NOAA Atlas 14

Precipitation-Frequency Atlas of the United States

Volume 1 Version 5.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah)

Geoffrey M. Bonnin, Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, David Riley

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Weather Service

Silver Spring, Maryland, 2004
revised 2006
revised 2011

NOAA Atlas 14

Precipitation-Frequency Atlas of the United States

Volume 1 Version 5.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah)

Geoffrey M. Bonnin, Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, David Riley

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Weather Service

Silver Spring, Maryland, 2004
revised 2006
revised 2011

Library of Congress Classification Number
GC
1046
.C8
U6
no.14
v.1
(2011)

Table of Contents

1. Abstract

NOAA Atlas 14 contains precipitation frequency estimates with associated confidence limits for the United States and is accompanied by additional information such as temporal distributions and seasonality. The Atlas is divided into volumes based on geographic sections of the country. The Atlas is intended as the official documentation of precipitation frequency estimates and associated information for the United States. It includes discussion of the development methodology and intermediate results. The Precipitation Frequency Data Server (PFDS) was developed and published in tandem with this Atlas to allow delivery of the results and supporting information in multiple forms via the Internet.

2. Preface to Volume 1

NOAA Atlas 14 Volume 1 contains precipitation frequency estimates for Arizona, Nevada, New Mexico, Utah, and southeastern California (Imperial, Inyo, Eastern Kern, Eastern Los Angeles, Riverside, San Bernardino and Eastern San Diego counties). These areas were addressed together in a single project focused on the semiarid southwestern United States. The Atlas supercedes precipitation frequency estimates contained in Technical Paper No. 49 “Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States” (Miller et al., 1964), NOAA Atlas 2 “Precipitation-Frequency Atlas of the Western United States” (Miller et al., 1973), “Short Duration Rainfall Frequency Relations for California” (Frederick and Miller, 1979) and “Short Duration Rainfall Relations for the Western United States” (Arkell and Richards, 1986). The updates are based on more recent and extended data sets, currently accepted statistical approaches, and improved spatial interpolation and mapping techniques.

The work was performed by the Hydrometeorological Design Studies Center within the Office of Hydrologic Development of the National Oceanic and Atmospheric Administration’s National Weather Service. Funding for the work was provided by the National Weather Service, U.S. Army Corps of Engineers, Natural Resources Conservation Service, Bureau of Reclamation, Arizona Department of Transportation, and Riverside County, California. Any use of trade names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Citation and Version History. This documentation and associated artifacts such as maps, grids, and point-and-click results from the PFDS, are part of a whole with a single version number and can be referenced as: “Precipitation-Frequency Atlas of the United States” NOAA Atlas 14, Volume 1, Version 5.0, G. M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley, NOAA, National Weather Service, Silver Spring, Maryland, 2011.

The version number has the format P.S where:

P is an integer representing successive releases of primary information. Primary information is essentially the data – the values of precipitation frequencies (in ASCII grids of the precipitation frequency estimates and output from the PFDS), shapefiles, cartographic maps, temporal distributions, and seasonality.

S is an integer representing successive releases of secondary information. S reverts to zero (or nothing; i.e., Version 2 and Version 2.0 are equivalent) when P is incremented. Secondary information includes documentation and metadata.

When new information is completed and added, such as draft documentation, *without changing any prior information*, the version number is not incremented.

The primary version number is stamped on the artifact or is included as part of the filename where the format does not allow for a version stamp (for example, the grids). An examination of any of the artifacts available through the Precipitation Frequency Data Server (PFDS) provides an immediate indication of the primary version number associated with all artifacts. All output from the PFDS is stamped with the version number and date of download.

Several versions of the project have been released. Table 2.1 lists the version history associated with the NOAA Atlas 14 Volume 1, the semiarid southwestern United States precipitation frequency project and indicates the nature of changes made. If major discrepancies are observed or identified by users, a new release may be warranted.

Volume Update (3/31/2011). Precipitation frequency estimates for the semiarid area of California were updated with the release of Volume 6, California. Volume 6 information supercedes Volume 1 information for that area.

Since the grid cell alignment for Volume 1 was different from subsequent volumes, it was necessary to shift grid-cell centers of the Volume 1 grids. This shift was coupled with interpolation; as a result, there was no real change in the estimates at a given geographic location in flat terrain and minimal change in mountainous areas. More information can be found in the Volume 1 Version 5.0 Addendum.

Table 2.1. Version History of the NOAA Atlas 14 Volume 1.

Version no.	**Date**	**Notes**
Version 1	October 30, 2002	Draft data used in peer review
Version 2	July 14, 2003	Final released data
Version 3	January 7, 2004	Updated final data
Version 3.0	October 22, 2004	Draft documentation released
Version 3.1	December 3, 2004	Final documentation released
Version 3.2	June 2, 2005	Edited final documentation released
Version 4	June 19, 2006	Updated final data (includes 1-year ARI)
Version 4.0	October 4, 2006	Updated final documentation released
Version 5.0	March 31, 2011	Updated estimates for semiarid California, as part of Volume 6. Volume 6 information supercedes Volume 1 information for that area.

3. Introduction

3.1. Objective

NOAA Atlas 14 Volume 1 provides precipitation frequency estimates for the semiarid southwestern United States which includes Arizona, Nevada, New Mexico, Utah, and southeastern California (Imperial, Inyo, Eastern Kern, Eastern Los Angeles, Riverside, San Bernardino and Eastern San Diego counties). Figures 4.1.1 and 4.1.2 show the project core area where estimates are available (enclosed in the bold line) and also include all stations used in the analysis, even those outside the core area. The Atlas provides precipitation frequency estimates for 5-minute through 60-day durations at average recurrence intervals of 1-year through 1,000-year. The estimates are based on the analysis of annual maximum series and then converted to partial duration series results. The information in NOAA Atlas 14 Volume 1 supercedes precipitation frequency estimates contained in Technical Paper No. 49 "Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States" (Miller, 1964), NOAA Atlas 2 "Precipitation-Frequency Atlas of the Western United States" (Miller et al., 1973), "Short Duration Rainfall Frequency Relations for California" (Frederick and Miller, 1979) and "Short Duration Rainfall Relations for the Western United States" (Arkell and Richards, 1986). The results are provided at high spatial resolution and include confidence limits for the estimates. The Atlas includes temporal distributions designed for use with the precipitation frequency estimates (Appendix A.1) and seasonal information for heavy precipitation (Appendix A.2). In addition, the potential effects of climate change were examined (Appendix A.3).

The new estimates are based on improvements in three primary areas: denser data networks with a greater period of record, the application of regional frequency analysis using L-moments for selecting and parameterizing probability distributions and new techniques for spatial interpolation and mapping. The new techniques for spatial interpolation and mapping account for topography and have allowed significant improvements in areas of complex terrain.

NOAA Atlas 14 Volume 1 precipitation frequency estimates for the semiarid southwestern United States are available via the Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds which provides the additional ability to download digital files. The types of results and information found there include:

- point estimates (via a point-and-click interface)
- ArcInfo© ASCII grids
- ESRI shapefiles
- color cartographic maps for each state
- associated Federal Geographic Data Committee-compliant metadata
- data series used in the analyses: annual maximum series and partial duration series
- temporal distributions of heavy precipitation (6-hour, 12-hour, 24-hour and 96-hour)
- seasonal exceedance graphs: counts of events that exceed the 1 in 2, 5, 10, 25, 50 and 100 annual exceedance probabilities for the 60-minute, 24-hour, 48-hour, and 10-day durations.

As discussed in Sections 4.8.4 and 4.8.5, the color cartographic maps and ESRI shapefiles were created to serve as visual aids and, unlike NOAA Atlas 2, are not recommended for interpolating final point or area precipitation frequency estimates. Users are urged to take advantage of the Precipitation Frequency Data Server or the underlying ArcInfo© ASCII grids for accessing estimates.

3.2. Terminology; Partial Duration and Annual Maximum Series

This publication adopts the terminology "average recurrence interval" (ARI) and "annual exceedance probability" (AEP) presented in Australian Rainfall and Runoff (Institute of Engineers, Australia, 1987) which in turn is based on Laurenson (1987). NOAA Atlas 14 is based on the analysis of annual maximum series data with the results converted to represent estimates based on partial duration series. The results for these two types of series differ at shorter average recurrence intervals and have different meanings. Factors for converting between these results are provided in Section 4.6.4.

An annual maximum series is constructed by taking the highest accumulated precipitation for a particular duration in each successive year of record, whether the year is defined as a calendar year or using some other arbitrary boundary such as a water year. Calendar years are used in this Atlas. An annual maximum series inherently excludes other extreme cases that occur in the same year as a more extreme case. In other words, the second highest case on record at an observing station may occur in the same year as the highest case on record but will not be included in the annual maximum series. A partial duration series is constructed by taking all of the highest cases above a threshold regardless of the year in which the case occurred. In this Atlas, partial duration series consist of the N largest cases in the period of record, where N is the number of years in the period of record at the particular observing station.

Analysis of annual maximum series produces estimates of the average period between *years when a particular value is exceeded*. On the other hand, analysis of partial duration series gives the average period between *cases of a particular magnitude*. The two results are numerically similar at rarer average recurrence intervals but differ at shorter average recurrence intervals (below about 20 years). The difference can be important depending on the application.

Typically, the use of AEP and ARI reflects the analysis of the different series. However, in some cases, average recurrence interval is used as a general term for ease of reference.

3.3. Approach

The approach used in this project largely follows the regional frequency analysis using the method of L-moments described in Hosking and Wallis (1997). This section provides an overview of the approach. Greater detail on the approach is provided in Section 4.2.

This Atlas introduces a change from past NWS publications by its use of regional frequency analysis using L-moments for selecting and parameterizing probability distributions. Both annual maximum series and partial duration series were extracted at each observing station from quality controlled data sets. Because of the greater reliability of the analysis of annual maximum series, an average ratio of partial duration series to annual maximum series precipitation frequency estimates (quantiles) was computed and then applied to the annual maximum series quantiles to obtain the final equivalent partial duration series quantiles.

Quality control was performed on the initial observed data sets (see Section 4.3) and it continued throughout the process as an inherent result of the performance parameters of intermediate steps.

To support the regional approach, potential regions were initially determined based on climatology. They were then tested statistically for homogeneity. Individual stations in each region were also tested statistically for discordancy. Adjustments were made in the definition of regions based on underlying climatology in cases where homogeneity and discordancy criteria were not met.

A variety of probability distributions were examined and the most appropriate distribution for each region and duration was selected using several different performance measures. The final determination of the appropriate distributions for each region and duration was made based on sensitivity tests and a desire for a relatively smooth transition between distributions from region to region. Probability distributions selected for annual maximum series were not necessarily the same as those selected for partial duration series.

Quantiles at each station were determined based on the mean of the data series at the station and the regionally determined higher order moments of the selected probability distribution. There were a number of stations where the regional approach did not provide the most effective choice of probability distribution. In these cases the most appropriate probability distribution was chosen and parameterized based solely on data at that station. Quantiles for durations below 60-minutes (n-minute durations) were computed using an average ratio between the n-minute and 60-minute quantiles due to the small number of stations recording data at less than 60-minute intervals.

For the first time, the National Weather Service is providing confidence limits for the precipitation frequency estimates in the area covered by NOAA Atlas 14. Monte Carlo Simulation was used to produce upper and lower bounds at the 90% confidence level.

In the regional approach, the second and higher order moments are constant for each region resulting in a potential for discontinuities in the quantiles at regional boundaries. In order to avoid potential discontinuities and to achieve an effective spatial interpolation of quantiles between observing stations, the data series means at each station for each duration were spatially interpolated using PRISM technology by the Spatial Climate Analysis Service (SCAS) at Oregon State University (Appendix A.4). Because the mean was derived directly at each observing station from the data series and independently of the regional computations, it was not subject to the same discontinuities. The grid of quantiles for each successive average recurrence interval was then derived in an iterative process using a strong linear relationship between a particular duration and average recurrence interval and the next rarer average recurrence interval of the same duration (see Section 4.8.2). The resulting set of grids were tested and adjusted in cases where inconsistencies occurred between durations and frequencies. Computations were made over a geographic domain that was larger than the published domain to ensure continuity at the edges of the published domain.

Both the spatial interpolation and the point estimates were subject to external peer reviews (see Section 6 and Appendices A.5 and A.6). Based on the results of the peer review, adjustments were made where necessary by the addition of new observations or removal of questionable ones. Adjustments were also made in the definition of regions.

Temporal precipitation patterns were extracted for use with the precipitation frequency estimates presented in the Atlas (Appendix A.1). The temporal patterns are presented in probabilistic terms and can be used in Monte Carlo development of ensembles of possible scenarios. They were specifically designed to be consistent with the definition of duration used for the precipitation frequency estimates.

The seasonality of heavy precipitation is represented in seasonal exceedance graphs that are available through the Precipitation Frequency Data Server. The graphs were developed for each region by tabulating the number of events exceeding the precipitation frequency estimate at each station for a given annual exceedance probability (Appendix A.2).

The 1-day annual maximum series were analyzed for linear trends in mean and variance and shifts in mean to determine whether climate change during the period of record was an issue in the production of this Atlas (Appendix A.3). The results showed little observable or geographically consistent impact of climate change on the annual maximum series during the period of record and so the entire period of record was used. The estimates presented in this Atlas make the necessary assumption that there is no effect of climate change in future years on precipitation frequency estimates. The estimates will need to be modified if that assumption proves quantifiably incorrect.

4. Method

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

4.1. Data

4.1.1. Properties

Sources. Daily, hourly, and n-minute (defined below) measurements of precipitation from various sources were used for this project (Table 4.1.1). Figure 4.1.1 shows the locations of daily stations, including SNOTEL (defined below), in the project area. Figure 4.1.2 shows the hourly and n-minute stations.

The National Weather Service (NWS) Cooperative Observer Program's (COOP) daily and hourly stations were the primary source of precipitation gauge records. The following data sets of COOP data were obtained from National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC):

- Hourly data set: TD3240
- Daily data set: TD3200 and TD3206
- N-minute data set: TD9649 and an additional dataset covering 1973-1979

Other sources were NRCS (USDA) and local datasets, which included data from:

- San Bernardino County Flood Control District, CA
- Riverside County Flood Control and Water Conservation District, CA
- NWS's California-Nevada River Forecast Center at Sacramento, CA
- California Department of Water Resources (CDWR) Automated Local Evaluation in Real Time (ALERT) precipitation gauges
- ALERT hourly data from Maricopa County Flood Control District, AZ
- U.S. Geological Survey (USGS) dense precipitation gauge network from the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

Various supplementary stations provided information where no or limited data were previously available – in high elevations and south of the United States border. SNOTEL (SNOpack TELemetry) provided information in high elevations of the project area. The SNOTEL network of stations at high elevations (6000 - 11,000 feet) is operated by the United State's Department of Agriculture's (USDA) National Resources Conservation Service (NRCS). Additional daily data south of the United States border were obtained through the cooperation of Mr. Jorge Sanchez-Sesma, Instituto Mexicano de Technologia del Agua, Mexico City, Mexico.

Table 4.1.1. Number of stations in each state in the project area.

State	Daily	SNOTEL	Hourly	N-min
Arizona	270	13	68	5
Southeastern California	129	1	75	7
Nevada	114	26	39	5
New Mexico	239	11	76	3
Utah	212	67	42	4
Border states*	477	64	181	3
Baja, Mexico	31	n/a	n/a	n/a
Chihuahua, Mexico	10	n/a	n/a	n/a
Sonora, Mexico	22	n/a	n/a	n/a
Total	**1504**	**182**	**481**	**27**

*Border states include parts of California, Colorado, Idaho, Oklahoma, Oregon, Texas and Wyoming that are directly adjacent to the project core area.

Figure 4.1.1. Map of daily and SNOTEL stations for NOAA Atlas 14 Volume 1.

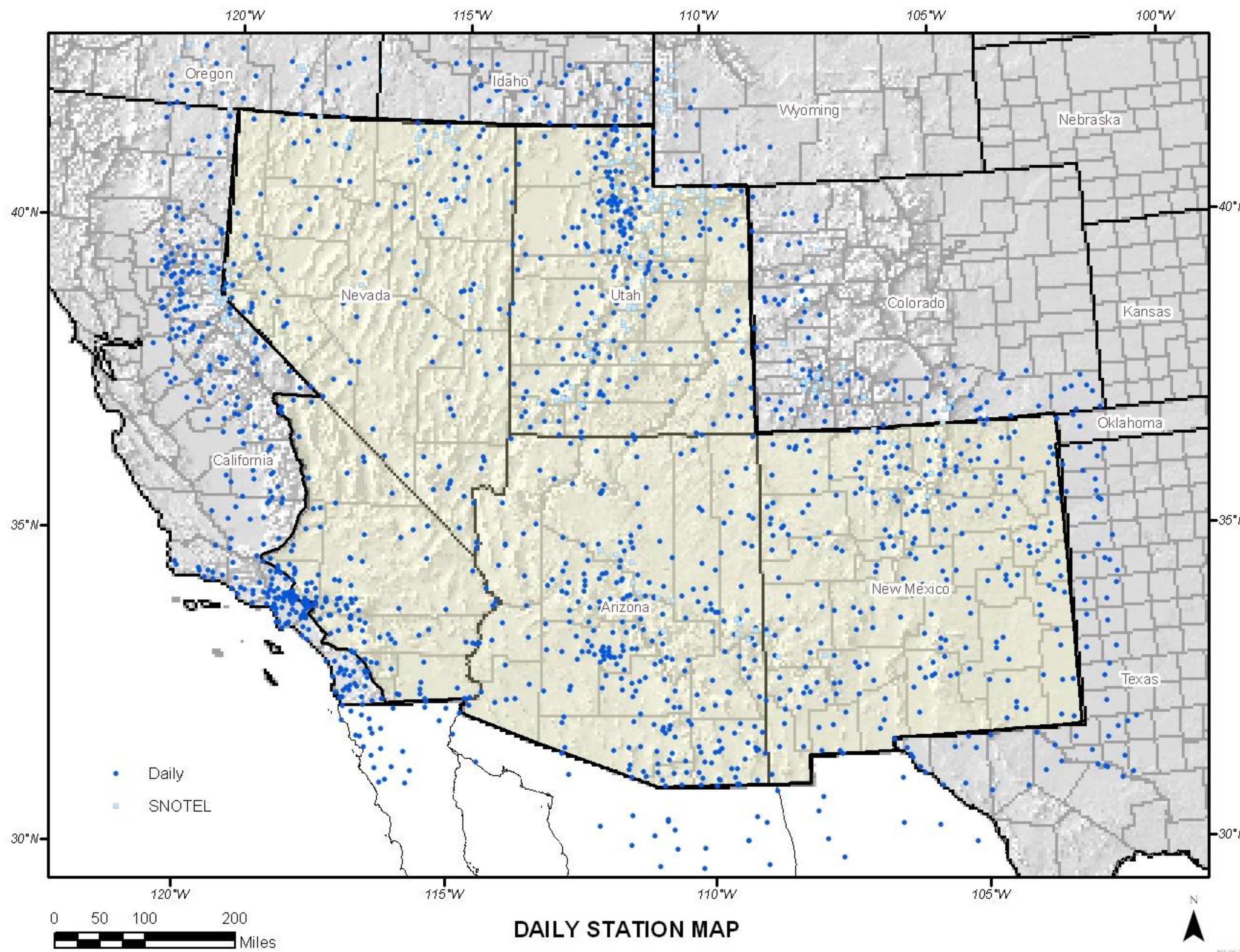
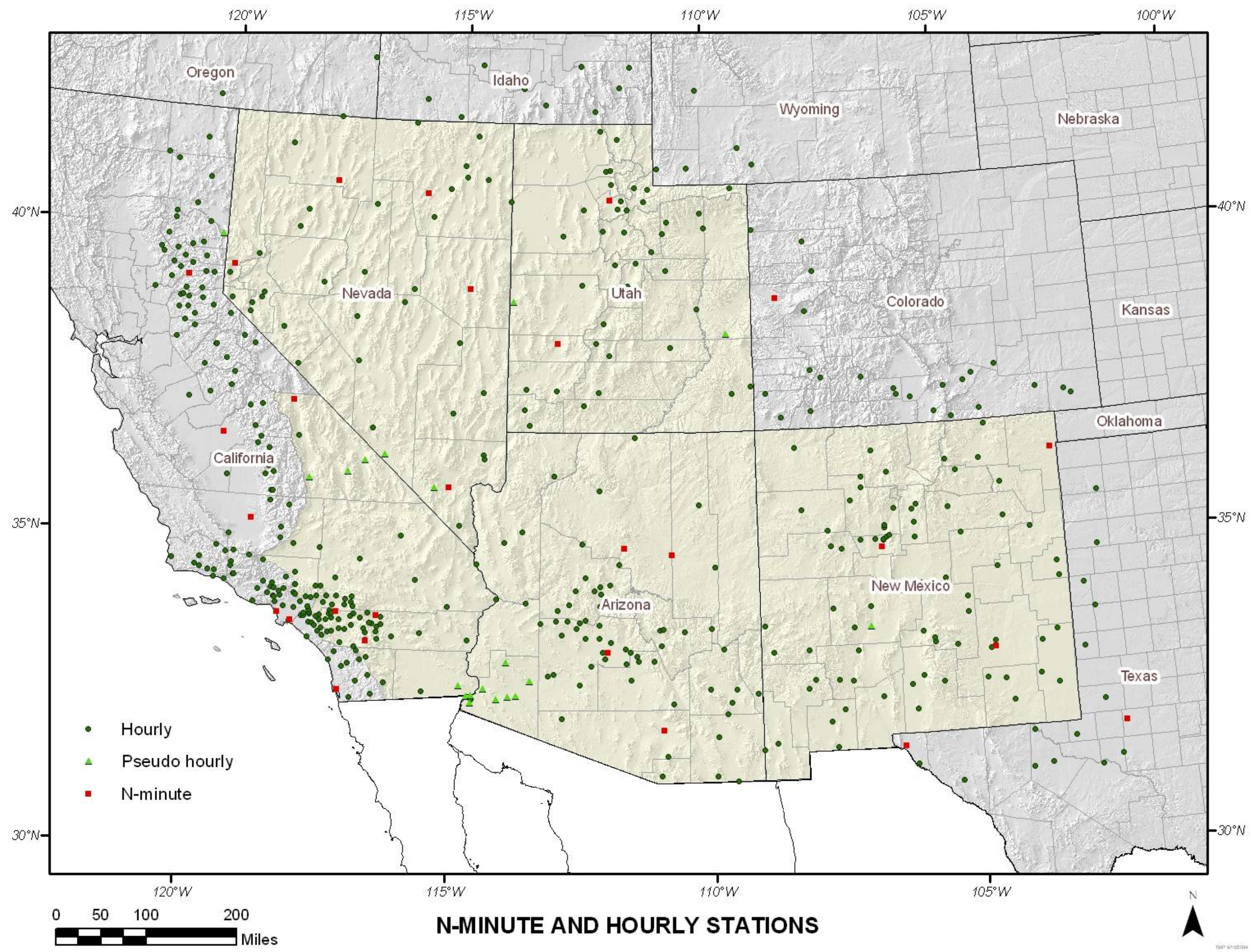


Figure 4.1.2. Map of hourly and n-minute stations for NOAA Atlas 14 Volume 1.



Record length. Record length may be characterized by the entire period of record or by the number of years of useable data within the total period of record (data years). For this project, only daily stations with 20 or more data years and hourly stations with 15 or more data years were used in the analysis. (Although, Mexico data were limited, so a threshold of 13 data years was used.) The records of these stations extend through December 2000 and average 54 data years in length for daily stations and 37 data years for hourly (Table 4.1.2). Figures 4.1.3 and 4.1.4 show the number of data years by percent of stations for the daily and hourly data. N-minute records used in the analysis had 14 to nearly 100 years of data with records extending through May 1997. At the time of this project the n-minute data at NCDC had not been updated beyond 1997. Eight n-minute stations had more than 80 years of data. (See Appendix A.7 for a complete list of stations or http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_data.html for downloadable comma-delimited station lists.)

Table 4.1.2. Information for daily and hourly datasets through 12/2000 and n-minute datasets through 5/1997.

	Daily	**Hourly**	**N-minute**
No. of stations	1441 (+182 SNOTEL) (+63 Mexico)	481	27
Longest record length (data yrs) (Station ID)	108 (29-8535)	62 (04-4211)	88 (02-6481)
Average record length (data yrs)	54*	37	36

*not including SNOTEL or Mexico stations

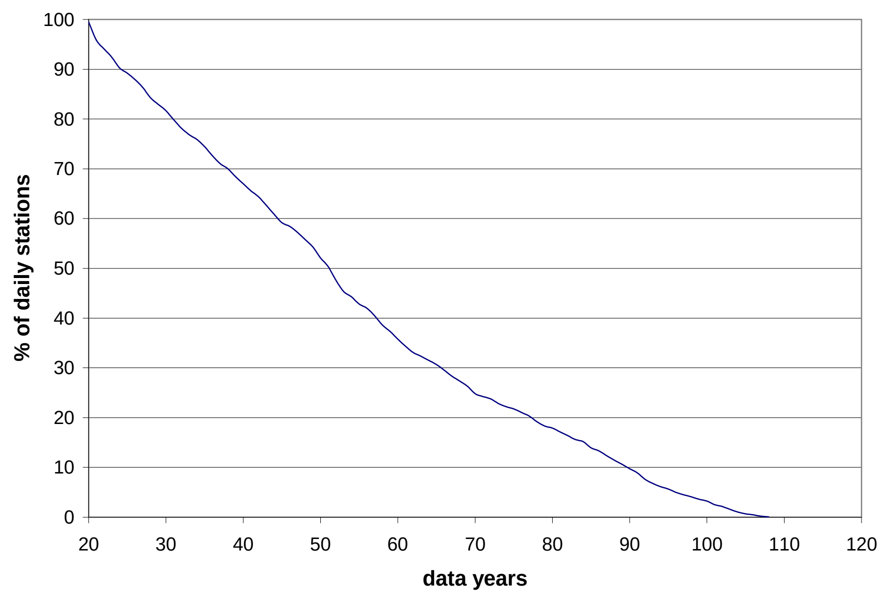


Figure 4.1.3. Plot of percentage of total number of daily stations used in NOAA Atlas 14 Volume 1 versus data years.

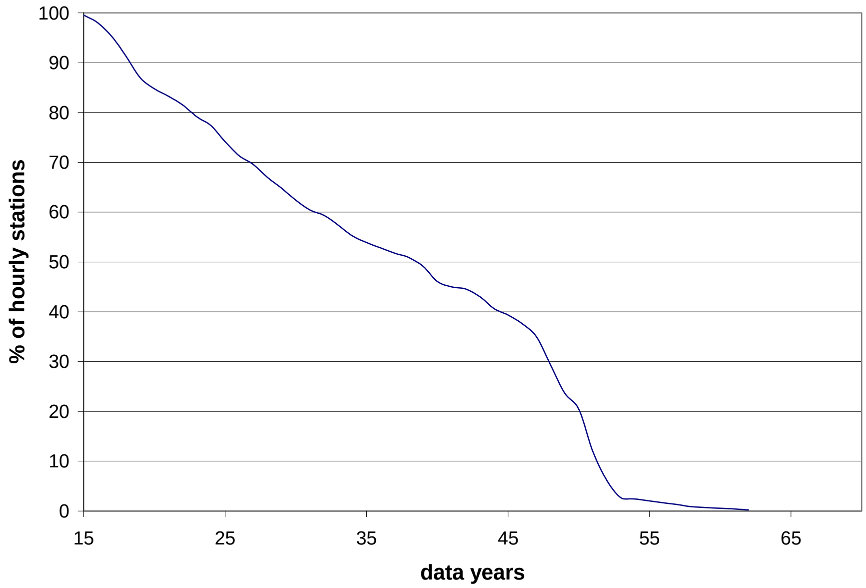


Figure 4.1.4. Plot of percentage of hourly stations used in NOAA Atlas 14 Volume 1 versus data years.

N-minute data. N-minute data are precipitation data measured at a temporal resolution of 5-minutes that can be summed to various "n-minute" durations (10-minute, 15-minute, 30-minute, and 60-minute). Because of the small number of n-minute data available, n-minute precipitation frequencies were estimated by applying a linear scaling to 60-minute data. The linear scaling factors were developed using ratios of n-minute quantiles to 60-minute quantiles from 27 co-located n-minute and hourly stations divided into 6 regions (Figure 4.1.5). The ratios were calculated and averaged for each region. Since they were found to be essentially the same regardless of region and frequency, the ratios for each duration were averaged over the 6 regions and all annual exceedance probabilities and then applied to the entire project area.

The ratios are consistent with other studies. Table 4.1.3 shows the n-minute ratios (n-min/60-min) computed for NOAA Atlas 14 Volume 1 and those reported in NOAA Atlas 2 (Miller et al., 1973) (herein after referred to as NOAA Atlas 2) for 5, 10, 15, and 30 minutes. Also shown in Table 4.1.3 are the ratios used by Arkell and Richards (1986), who computed values for a comparable geographic area, but did not include California.

Figure 4.1.5. Regional groupings for n-minute data for NOAA Atlas 14 Volume 1.

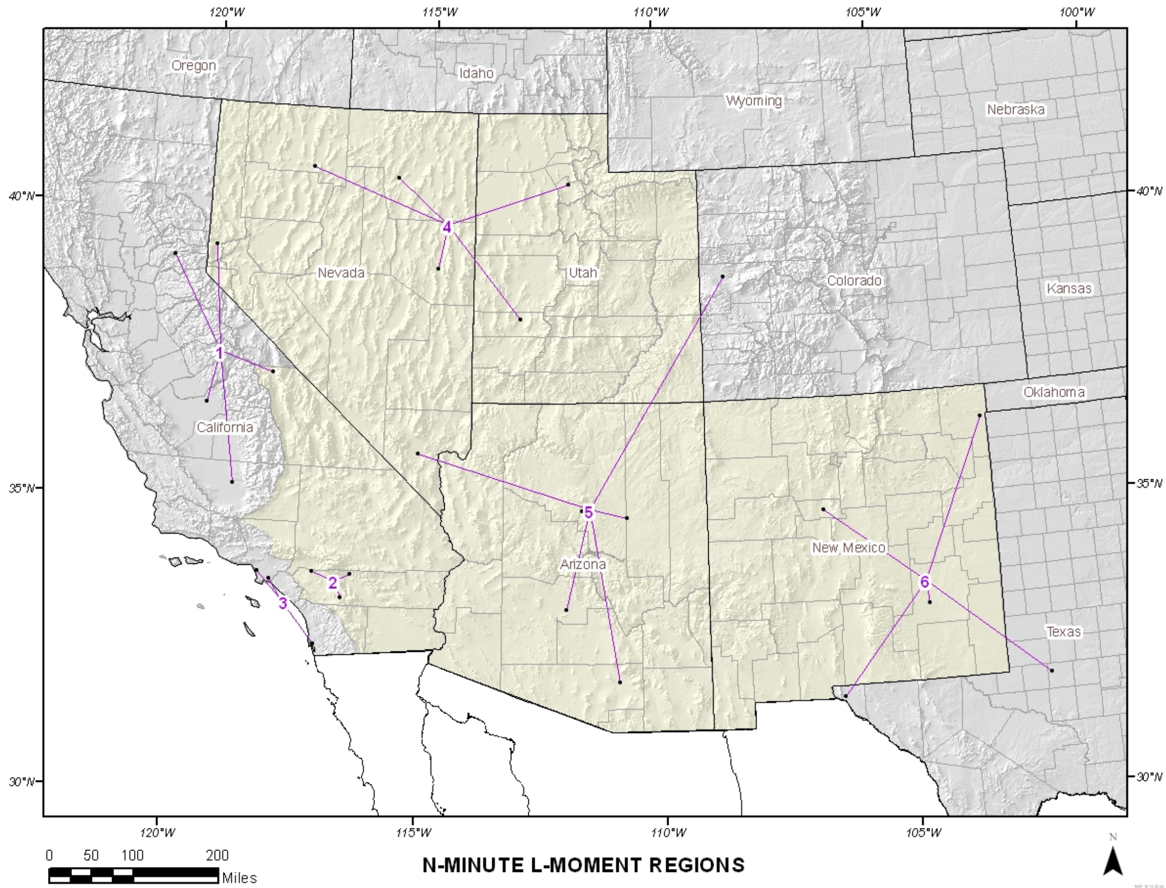


Table 4.1.3. N-minute ratios: 5-, 10-, 15- and 30-Minute to 60-Minute.

	5-min	10-min	15-min	30-min
NOAA Atlas 14 Volume 1	**0.318**	**0.484**	**0.600**	**0.808**
NOAA Atlas 2	*0.29*	*0.45*	*0.57*	*0.79*
Arkell and Richards, 1986	*0.34*	*0.52*	*0.62*	*0.82*

SNOTEL data. SNOTEL stations provide precipitation data in the higher elevations where in NOAA Atlas 2 there was no information. The number and quality of the data were insufficient for computing higher order statistical moments directly and so the data were not used in the calculation of regional parameters. Rather, mean annual maxima for the 24-hour through 60-day durations at each location were computed for use in analysis and spatial interpolation processes. Precipitation frequency estimates for SNOTEL stations were calculated using the regional growth factors (RGFs), a dimensionless regional frequency distribution parameter derived from the regions in which they resided (Section 4.6.1), combined with the mean of their annual maximum series at the SNOTEL station. The estimates were then used to anchor the spatial distribution of precipitation frequency residuals that were the basis of the precipitation frequency grids (Section 4.8) to provide better accuracy at higher elevations.

Mexico data. Mexico data were included to provide spatial continuity across the southern border of the project area. The maximum record length of these daily data was 15 years. Annual maximum series were extracted from the data using 13 years as the minimum years of record so that a reasonable number of stations could be included. The data were not directly used in L-moment computations for the project area. The mean annual precipitation and mean annual maxima for the 24-hour through 60-day durations were computed and used in the spatial interpolation of the mean annual maxima values, but not the precipitation frequency estimates.

Multi-day/hour durations. Maxima for durations greater than 24-hour were generated by accumulating daily data. The multi-day maxima, 2-day through 60-day, were extracted in an iterative process where 1-day observations were summed and compared with the value of the previous summation shifted by 1 day. Multi-hour durations, 2-hour through 48-hour, were generated by accumulating hourly data. (See Section 4.1.3 for additional details on the annual maximum series and partial duration series extraction process.)

NOAA Atlas 2 data comparison. NOAA Atlas 14 Volume 1 used a total of 2,194 stations, which includes substantially more stations, 76% more, than were available to NOAA Atlas 2 (southeastern California could not be directly compared). Table 4.1.4 shows a comparison between the total number of stations used in each Atlas for the 4 complete core states, Arizona, Nevada, New Mexico, and Utah. Many new stations also provided information in critical areas, where no data were available to NOAA Atlas 2, including 182 SNOTEL stations and 63 stations in Mexico. NOAA Atlas 2 used data through 1970, whereas NOAA Atlas 14 Volume 1 used data through 2000, vastly increasing the amount of data available. Some stations available for NOAA Atlas 14 Volume 1 had up to 30 more years of record than those used in NOAA Atlas 2. This allowed for the exclusion of shorter, less reliable data records. NOAA Atlas 2 used a minimum of 15 data years, whereas for NOAA Atlas 14 Volume 1 the minimum was increased to 20 data years. Figure 4.1.6 shows the number of years of record for daily stations used in each Atlas for the 4 core states, Arizona, Nevada, New Mexico, and Utah, (southeastern California could not be directly compared).

Table 4.1.4. Comparison of the total number of stations in Arizona, Nevada, New Mexico, and Utah (southeastern California could not be directly compared) that were used in NOAA Atlas 2 and NOAA Atlas 14 Volume 1.

Data type	**NOAA Atlas 2**	**NOAA Atlas 14 Volume 1**	**Increase**	**% increase**
Hourly	180	225	45	25%
Daily	563	835	272	48%
SNOTEL	0	182	182	
Mexico	0	63	63	
Total	**743**	**1305**	**562**	**76%**

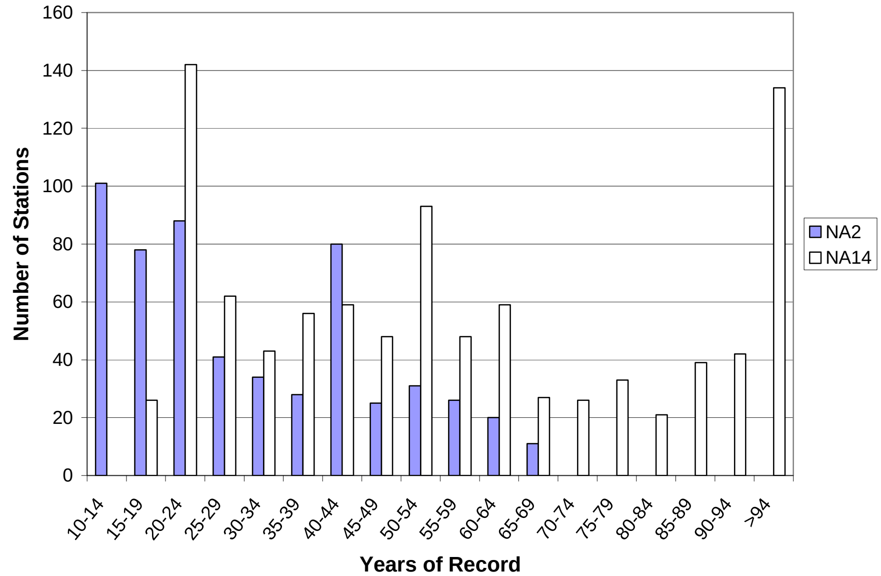


Figure 4.1.6. Comparison of the years of record at stations used in Arizona, Nevada, New Mexico, and Utah (southeastern California could not be directly compared) in NOAA Atlas 2 (NA2) and NOAA Atlas 14 Volume 1 (NA14) [Note: Mexico and SNOTEL stations are not included in chart.]

4.1.2. Conversions of data

Daily. Daily data have varying observation times. Maximum 24-hour amounts seldom fall within a single daily observation period. In order to make the daily and hourly data comparable, a conversion was necessary from 'observation day' (constrained observation) to 24 hours (unconstrained observation). Both NOAA Atlas 2 and Technical Paper 40 (Hershfield, 1961) used the empirically derived value of 1.13 to convert daily data to 24-hour data. Conversion factors for this project were computed using ratios of the 2-year quantiles computed from annual maxima series at 32 stations with concurrent hourly and daily data in the project area (note: at least 10 of these were first order stations). Time series for concurrent time periods were generated for 24-hour precipitation values summed from hourly observations and co-located daily precipitation observations. The series were analyzed separately using L-moments. Ratios of 2-year 24-hour to 2-year 1-day quantiles were then generated and averaged. The resulting conversion factor was comparable to results from a regression of daily-hourly annual maxima that occurred on the same day. The regression was not directly used since there were not enough data to produce a reliable result. The conversion factor used in this project was 1.14, which is in close agreement with the conversion factor used in NOAA Atlas 2 and Technical Paper 40 (see Table 4.1.5). Similarly, a 2-day to 48-hour conversion factor of 1.03 was generated for NOAA Atlas 14 Volume 1. This factor had not been previously calculated in the other studies. All daily and 2-day data, including SNOTEL data, were converted to equivalent 24-hour and 48-hour unconstrained values, respectively.

Hourly. In order to make hourly and 60-minute data comparable, a conversion was necessary from the constrained ‘clock hour' to unconstrained 60-minute and from 2 hours to 120-minute. Conversion factors were computed using ratios of the 2-year quantiles computed from annual maxima series at 12 stations with co-located hourly and n-minute stations in the project area. Time series from concurrent time periods were generated for 60-minute precipitation values summed from n-minute observations and co-located hourly precipitation observations. The series were analyzed separately using L-moments. Ratios of 2-year 60-minute to 2-year 1-hour quantiles were generated and averaged. The resulting conversion factor was 1.12 for 1-hour to 60-minute and 1.03 for 2-hour to 120-minute. This is in close agreement with NOAA Atlas 2 and Technical Paper 40 which used 1.13 for the 1-hour to 60-minute conversion (no conversion was provided for 2-hour to 120-minutes in those studies) (see Table 4.1.5).

Table 4.1.5. Conversion factors for constrained to unconstrained observations.

	Conversion Factors			
Project	**1-day to 24-hour**	**2-day to 48-hour**	**1-hour to 60-minute**	**2-hour to 60-minute**
NOAA Atlas 14 Vol. 1 (Semiarid Southwestern United States)	**1.14**	**1.03**	**1.12**	**1.03**
NOAA Atlas 2 (Miller et al., 1973)	1.13	N/A		N/A
Technical Paper 40	1.13	N/A	1.13	N/A

4.1.3. Extraction of series

Two methods were used for extracting series of data at a station for the analysis of precipitation frequency: **Annual Maximum Series (AMS)** and **Partial Duration Series (PDS)**.

The AMS method selected the largest single case that occurred in each calendar year of record. If a large case was not the largest in a particular year, it was not included in the series.

The PDS method recognized that more than one large case may occur during a single calendar year. For this Atlas, the largest N cases in the entire period of record, where N is the number of years of data, were selected to create the partial duration series. More than one case could be selected from any particular year and a large case that is not the largest in a particular year could appear in the series. Such a series is also called an annual exceedance series (AES) (Chow et al., 1988).

Differences in the meaning of the results of analysis using these two different types of series are discussed in Section 3.2. Average empirical conversion factors were developed to provide PDS-based results from the AMS-based results (see Section 4.6.4). The data series used in the analysis (and associated documentation) are provided through the Precipitation Frequency Data Server which can be found at http://hdsc.nws.noaa.gov/hdsc.

The procedure for extracting maxima from the dataset used specific criteria. The criteria, described below, ensured that each year had a sufficient number of data, particularly in the assigned “wet season”, to accurately extract statistically meaningful values. The “wet season” for each location was defined as the months in which extreme cases were mostly likely to occur and was assigned by assessing histograms of annual maximum precipitation for each homogeneous region (Tables 4.1.5 and 4.1.6). [The development and verification of the homogeneous regions are discussed in Section 4.4 and shown in Figures 4.4.1 and 4.4.2.]

Criteria for hourly annual maximum series. For all hourly durations (1-hour through 48-hours), the highest value in each year was extracted as the annual maximum for that particular year. Cases that spanned January 1st were assigned to the date on which the greatest hourly precipitation occurred during the corresponding duration.

A month was invalid and the maximum precipitation for that month was set to missing:

- if the hours of available data in a month were less than the duration hours
- if 240 hours or more in a month were missing and the maximum precipitation for the month <= 0.01 inches
- if 360 or more hours in a month were missing and the maximum precipitation for the month was less than 33% of the average precipitation for that month at that station
- if 50% or more hours (for a specific duration) were missing

Also, if more than 50% of the months in the wet season for a given region were missing, then the maximum precipitation for the year was set to missing.

Table 4.1.5. “Wet season” months for daily regions of NOAA Atlas 14 Volume 1.

Region	start month	end month
Daily Regions		
1	10	6
2	10	6
3	10	6
4	4	10
5	9	6
6	4	10
7	4	10
8	10	3
9	10	3
10	10	6
11	8	6
12	3	11
13	3	11
14	8	6
15	4	10
16	11	3
17	11	3
18	11	3
19	7	3
20	7	3
21	7	3
22	3	11
23	7	3
24	7	11
25	7	11
26	7	11
27	11	3
28	11	3
29	11	3
30	11	3
31	11	3
32	11	3
33	7	3
34	7	3
35	7	3
36	7	3
37	7	12
38	7	12
39	5	10
40	7	3
41	7	3
42	7	3
43	7	3
44	7	12
45	6	10
46	5	10
47	5	10
48	5	10
49	5	10
50	5	10
51	7	12
52	7	12
53	7	12
54	7	12
55	6	10
56	5	10
57	6	10
58	11	3
59	6	10
A1	7	12
A2	7	12
A3	6	10
A4	6	10
A5	7	11
A6	10	6

Table 4.1.6. “Wet season” months for hourly regions NOAA Atlas 14 Volume 1.

region	start month	end month
Hourly Regions		
1	10	6
2	4	10
3	10	6
4	8	6
5	4	10
6	7	11
7	7	3
8	7	12
9	5	10
10E	7	3
10W	7	3
11	7	3
12	7	12
13	6	10
14	5	10
15	11	3
16	10	3
17	10	3
18	9	6
19	4	10
20	11	3
21	3	11
22	11	3
23	8	6
24	11	3

Criteria for daily annual maximum series. An annual maximum was extracted for daily durations (1-day through 60-day), if at least 50% of the months in the assigned wet season and at least 50% of the data for the accumulated period were present. The highest value in each year was extracted as the annual maximum for that particular year. Cases that spanned January 1st were assigned to the date on which the greatest daily precipitation occurred during the corresponding duration.

In addition, the following criteria applied:

<u>1-day</u>:
If all the days in the month were missing, or if more than 10 days of the month were missing and the maximum precipitation for the month was 0.00", or if more than 15 days were missing and the maximum for the month was less than 30% of the average 1-day maximum precipitation for that month over the period of record at that station, then that month was set to missing.

<u>2-day</u>:
If there was only 1 day of data for the month and the rest of the days were missing, or if more than 10 days of the month were missing and the maximum precipitation for the month was 0.00", or if more than 15 days were missing and the maximum for the month was less than 30% of the average 2-day maximum precipitation for that month over the period of record at that station, then that month was set to missing.

<u>4-day</u>:
If more than 96% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.3" or less, then that year was set to missing.

<u>7-day</u>:
If more than 93% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.3" or less, then that year was set to missing.

<u>10-day</u>:
If more than 93% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.35" or less, then that year was set to missing.

<u>20-day</u>:
If more than 88% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.35" or less, then that year was set to missing.

<u>30-day</u>:
If more than 82% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.45" or less, then that year was set to missing.

<u>45-day</u>:
If more than 73% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.45" or less, then that year was set to missing.

<u>60-day</u>:
If more than 64% of the days in a given year were missing, or if 50% of the days of the year were missing and the maximum precipitation for the year was 0.45" or less, then that year was set to missing.

Criteria for partial duration series. The criteria listed above also apply for deciding whether a month or year has enough data to be included in the extraction process for a partial duration series. Cases that spanned January 1st were assigned to the date on which the greatest precipitation observation occurred during the corresponding duration.

Precipitation accumulations for each duration were extracted and then sorted in descending order. The highest N accumulations for each duration were retained where N is the number of actual data years for each station.

4.2. Regional approach based on L-moments

4.2.1. Overview

Hosking and Wallis (1997) describe regional frequency analysis using the method of L-moments. This approach, which stems from work in the early 1970s but which only began seeing full implementation in the 1990s, is now accepted as the state of the practice. The National Weather Service has used Hosking and Wallis, 1997, as its primary reference for the statistical method for this Atlas.

The method of L-moments (or linear combinations of probability weighted moments) provides great utility in choosing the most appropriate probability distribution to describe the precipitation frequency estimates. The method provides tools for estimating the shape of the distribution and the uncertainty associated with the estimates, as well as tools for assessing whether the data are likely to belong to a homogeneous region (e.g., climatic regime).

The regional approach employs data from many stations in a region to estimate frequency distribution curves for the underlying population at each station. The approach assumes that the frequency distributions of the data from many stations in a homogeneous region are identical apart from a site-specific scaling factor. This assumption allows estimation of shape parameters from the combination of data from all stations in a homogeneous region rather than from each station individually, vastly increasing the amount of information used to produce the estimate, and thereby increasing the accuracy. Weighted averages that are proportional to the number of data years at each station in the region are used in the analysis.

The regional frequency analysis using the method of L-moments assists in selecting the appropriate probability distribution and the shape of the distribution, but precipitation frequency estimates (quantiles) are estimated uniquely at each individual station by using a scaling factor, which, in this project, is the mean of the annual maximum series, at each station. The resulting quantiles are more reliable than estimates obtained based on single at-site analysis (Hosking and Wallis, 1997).

4.2.2. L-moment description

Regional frequency analysis using the method of L-moments provided tools to test the quality of the dataset, test the assumptions of regional homogeneity, select a frequency distribution, estimate precipitation frequencies, and estimate confidence limits for this Atlas. Details and equations for the analysis may be found in other sources (Hosking and Wallis, 1997; Lin et al., 2004). What follows here is a brief description.

By necessity, precipitation frequency analysis employs a limited data sample to estimate the characteristics of the underlying population by selecting and parameterizing a probability distribution. The distribution is uniquely characterized by a finite set of parameters. In previous NWS publications such as NOAA Atlas 2, the parameters of a probability distribution have been estimated using the Moments of Product or the Conventional Moments Method (CMM). However, sample moment estimates based on the CMM have some undesirable properties. The higher order sample moments such as the third and fourth moments associated with skewness and kurtosis, respectively, can be severely biased by limited data length. The higher order sample moments also can be very sensitive or unstable to the presence of outliers in the data (Hosking and Wallis, 1997; Lin et al., 2004).

L-moments are expectations of certain linear combinations of order statistics (Hosking, 1989). They are expressed as linear functions of the data and hence are less affected by the sampling variability and, in particular, the presence of outliers in the data compared to CMM (Hosking and Wallis, 1997). The regional application of L-moments further increases the robustness of the estimates by deriving the shape parameters from all stations in a homogeneous region rather than from each station individually.

Probability distributions can be described using coefficient of L-variation, L-skewness, and L-kurtosis, which are analogous to their CMM counterparts. Coefficient of L-variation provides a measure of dispersion. L-skewness is a measure of symmetry. L-kurtosis is a measure of peakedness. L-moment ratios of these measures are normalized by the scale measure to estimate the parameters of the distribution shape independent of its scale. Unbiased estimators of L-moments were derived as described by Hosking and Wallis (1997).

Since these scale-free frequency distribution parameters are estimated from regionalized groups of observed data, the result is a dimensionless frequency distribution common to the N stations in the region. By applying the site-specific scaling factor (the mean) to the dimensionless distribution (regional growth factors), site-specific quantiles for each frequency and duration can be computed (Section 4.6.1).

Regional frequency analysis using the method of L-moments also provides tools for determining whether the data likely belong to similar homogeneous regions (e.g., climatic regimes) and for detecting potential problems in the quality of the data record. A measure of heterogeneity in a region, H1, uses coefficient of L-variation to test between-site variations in sample L-moments for a group of stations compared with what would be expected for a homogeneous region (Hosking and Wallis, 1997) (Section 4.4). A discordancy measure is used to determine if a station's data are consistent with the set of stations in a region based on coefficient of L-variation, L-skewness, and L-kurtosis (Section 4.3).

4.3. Dataset preparation

Rigorous quality control is a major and integral part of dataset preparation. The methods used in this project for ensuring data quality included a check of extreme values above thresholds, L-moment discordancy tests, and a real-data-check (RDC) of quantiles, among others. Also, analyses such as a trend analysis of annual maximum series, a study of cross-correlation between stations, and testing of data series with large gaps in record provided additional data quality assurance. An interesting and valuable aspect of the analysis process, including spatial interpolation, is that throughout the process there are interim results and measures which allow additional evaluation of data quality. At each step, these measures indicate whether the data conform to the procedural assumptions. Measures indicating a lack of conformance were used as flags for data quality.

Quality control and data assembly methods. Initial quality control included a check of extreme values above thresholds, merging appropriate nearby stations, and checking for large gaps in records. Erroneous observations were eliminated from the daily, hourly, and n-minute datasets through a check of extreme values above thresholds. The thresholds were established for 1-hour and 24-hour values based on climatological factors and previous precipitation frequency estimates in a given region. Observations above these thresholds were checked against nearby stations, original records and other climatological bulletins.

Daily stations in the project area within 5 miles in horizontal distance and 300 feet in elevation with non-concurrent records were considered for merging to increase record length and reduce spatial overlaps. The 24-hour annual maximum series of candidate stations were tested using a statistical t-test (at the 90% confidence level) to ensure the samples were from the same population and appropriate to be merged. In this project, hourly stations did not meet these criteria and so were not merged.

Discordancy. The L-moment discordancy measure (Hosking and Wallis, 1997) was used for data quality control. In evaluating regions, it was also used to determine if a station had been inappropriately assigned to a region. The measure is based on coefficient of L-variation, L-skewness and L-kurtosis, which represent a point in 3-dimensional space for each station. Discordancy is a measure of the distance of each point from the cluster center of the points for all stations in a region. The cluster center is defined as the unweighted mean of the three L-moments for the stations within the region being tested. Stations at which the discordancy value was 3.0 or greater were scrutinized for suspicious or unusual data or to consider if they belonged in another region or as an at-site (Section 4.4). Some stations that captured a single high event or had a short data record were discordant but were accepted in a homogeneous region since no climatological or physical reason was found to justify their exclusion. Discordancy was checked at stations for n-minute, 1-hour, 24-hour, and some longer durations (typically the 10-day). Appendix A.7 which provides a list of stations used in the project also provides the L-statistics and discordancy measure for the 24-hour data or 60-minute data for each station in its region.

Annual maximum series screening. The 1-day annual maximum series (AMS) data were thoroughly scrutinized. For instance, large gaps (i.e., sequential missing years) in the annual maximum series of stations were screened since it was not possible to guarantee that the two given data segments were from the same population (i.e., same climatology, same rain gauge, same physical environment). The screening process assured data series consistency before the data were used. Station records with large gaps were flagged and examined on a case-by-case basis. Nearby stations were inspected for concurrent data years to fill in the gap if they passed a statistical test for consistency. If there were a sufficient number of years (at least 10 years of data) in each data segment, a t-test (at the 90% confidence level) was conducted to assess the statistical integrity of the data record. To produce more congruent data records for analysis, station record lengths were adjusted where appropriate.

The 1-day AMS data were also checked for linear trends in mean, linear trends in variance, and shifts in mean. Overall, the data were statistically free from trends and shifts. See Appendix A.3 for more details.

And finally, the 1-day AMS data were investigated for cross correlation between stations to assess intersite dependence, since it is necessarily assumed for precipitation frequency analysis that events are independent. Cases where annual maxima overlapped (+/- 1 day) at stations within 50 miles and with more than 20 years of data were analyzed using a t-test for correlation coefficients that were statistically significant at the 90% confidence level. It was found that the degree of cross correlation between stations in the project area was very low. Only 7% of the data in the entire project area showed strong correlation (correlation coefficient $\rho \geq 0.7$ at the 90% confidence level). The impact of cross correlation on the daily quantiles was very small. Relative errors were calculated by looking at the 8 regions where the percentage of cross-correlated stations was greater than 20%. For these 8 regions, the results of an analysis using all stations versus an analysis using only stations that were not cross-correlated were compared. The average relative errors in quantile estimation were minimal, 1.6% and 3.7% for 100-year and 1,000-year, respectively. Therefore, since the final quantiles were only minimally affected, it was concluded that it was not necessary to embed any measures to address dependence structures in the data.

4.4. Development and verification of homogeneous regions

The underlying assumption of the regional approach is that stations can be grouped in sets or "regions" in which stations have similar frequency distribution statistics except for a site-specific scale factor. Regions which satisfy this assumption are referred to as "homogeneous." The key to the regional approach is to construct a set of homogeneous regions for the entire project area. Hosking and Wallis (1997) make the case that homogeneous regions should be identified based on factors other than the statistics used to test the assumption of homogeneity. Regions in this project were first delineated subjectively based on climate, season(s) of highest precipitation, type of precipitation (e.g., general storm, convective, tropical storms or hurricanes, or a combination), topography and the homogeneity of such characteristics in a given geographic area.

The regions were then investigated using statistical homogeneity tests and other checks. As suggested in Hosking and Wallis (1997), adjustments of regions, such as moving stations from one region to another or subdividing a region, were made to reduce heterogeneity. The heterogeneity measure, H1, tests between-site variations in sample L-moments for a group of sites with what would be expected for a homogeneous region based on coefficient of L-variation (Hosking and Wallis, 1997). Earlier studies (Hosking and Wallis, 1997; also, personal discussion with Hosking at NWS, 2001) indicated that a threshold of 2 is conservative and reasonable. Therefore, an H1 measure greater than 2 (H1>2) indicated heterogeneity and H1<2 indicated homogeneity.

The regions for daily durations (24-hour through 60-day), Figure 4.4.1, were based on the 24-hour duration. Long duration (48-hour through 60-day) L-moment results where H1 was greater than 2 were closely examined to validate data quality. In most of these cases, one or several stations were driving the H1 measure due to the nature of their data sampling. Omitting the offending station(s) would decrease H1 significantly and the 100-year precipitation frequency estimates and regional growth factors would change by 5% or less. Once identified and checked, the high H1 values in these regions were sometimes accepted without modifying the regions themselves.

Similarly, the hourly regions, Figure 4.4.2, were based on the 60-minute data. The other short durations (2-hour through 24-hour) where H1 was greater than 2 were also closely examined to validate data quality. Given the lack of station density and the nature of precipitation in the semiarid southwest, it was particularly difficult to adhere to a threshold of 2, which was proposed as a conservative guideline, for the hourly data. In each case where the H1 measure was greater than 2, after validating data quality, tests were conducted where 1 to 3 stations were omitted. In each case, omitting the offending station(s) would decrease H1 significantly and the 100-year precipitation frequency estimates and regional growth factors would change by 5% or less. Given the geographic locations of the stations and the validity of their data, the suspect stations were often retained in the region and the region was accepted as is, regardless of its high H1.

Ideally, coefficient of L-variation is sufficient to assess regional homogeneity. However, in practice, the National Weather Service found that sole use of H1 was not optimum for defining a homogenous region. The effect of L-skewness on the formation of a homogenous region was also considered, particularly since coefficient of L-variation and L-skewness do not necessarily correlate, and to take into account effects on longer average recurrence intervals (ARI). L-skewness and L-kurtosis were accounted for using a so-called "real-data-check" process. Real-data-check flags occurred where a maximum observation in the real (observed) data series at a station exceeded a given frequency estimate, in this case the 100-year estimate. These stations were carefully investigated for data quality and appropriate regionalization. "Real-data-check" is used to refer to any check or test that compares the real observations or empirical frequencies with the calculated quantiles. The term is also used regarding a test for best-fitting distributions (Section 4.5).

Overall, effort was made during the subdivision process to mitigate discrepancies that could be caused by (1) sample error due to small sample sizes, or (2) regionalization that does not reflect a local situation. The purpose of the regionalization process was to obtain optimal quantiles to reflect local conditions and reduce the relative error. The final groups of stations in the project area are illustrated in Figures 4.4.1 for daily regions and 4.4.2 for hourly regions. Appendix A.8 lists the H1 values and regionally-averaged L-moment statistics for all regions for the 24-hour and 60-minute durations. The heterogeneity measures (H1) for each region and all durations are provided in Appendices A.9.

Figure 4.4.1. Regional groupings for daily data used to prepare NOAA Atlas 14 Volume 1.

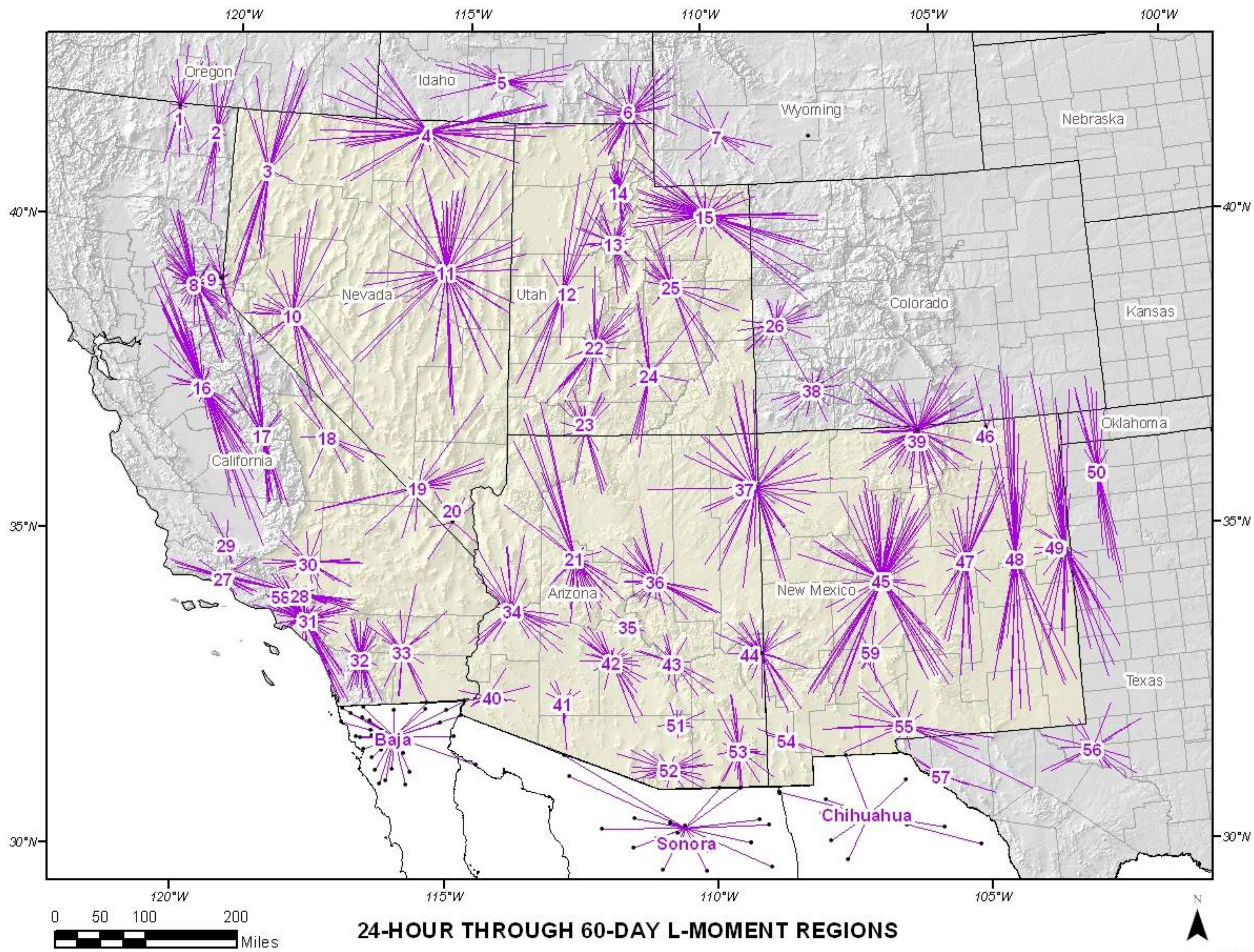
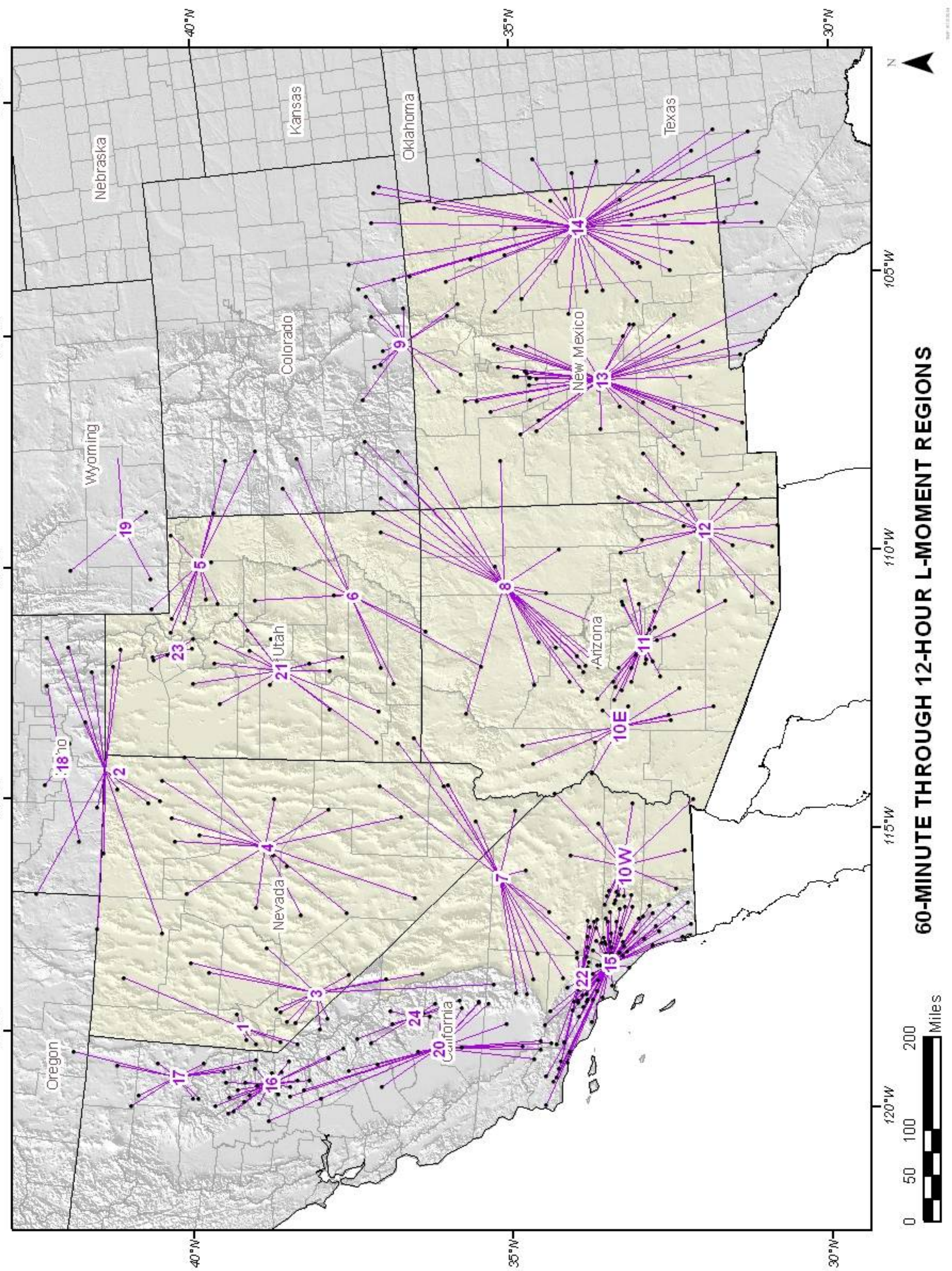


Figure 4.4.2. Regional groupings for hourly data used to prepare NOAA Atlas 14 Volume 1.



At-site stations. At some daily stations an at-site, instead of a regional, frequency analysis was a better approach to estimating the precipitation frequency quantiles. There were no hourly at-sites in the project. At-site stations were used because:

- They accounted for observed extreme precipitation regimes that the regional method could not resolve;
- They had more than 50 data years to produce reasonable estimates independent of a region;
- The spatial interpolation process was able to accommodate them;
- Error in the estimate was reduced compared to when included in a region.

Although at-sites have advantages in some cases, their use was considered a last-resort option because their precipitation frequency estimates sometimes caused irregularities in the spatial interpolation. All attempts to include a station in a region were considered before it was analyzed as an at-site. In fact, at-site stations had to meet at least 4 of the following criteria:

- Observed station data were markedly atypical and did not conform to adjacent regions;
- The at-site station caused adjacent regions that it would otherwise belong to be heterogeneous;
- The root mean-square-error (RMSE) of L-moments for a region was lower when the station was excluded in the region;
- The at-site station was flagged during the discordancy check or the "real-data-check;"
- The at-site station had at least 50 data years (in most cases they actually had more than 80 data years);
- The absence of the at-site station in an adjacent region did not greatly impact final regional precipitation frequency estimates;
- There was a compelling local climatological or topographical reason to support an at-site analysis.

Empirical frequency plots provided a tool for assessing the accuracy of chosen distributions at a given station. In the case of at-sites, the difference between the empirical frequencies and the theoretical precipitation frequency estimates, effectively the root-mean-square-error (RMSE), was much smaller from the at-site analysis than if the station was included in a region. For instance, figure 4.4.3 shows the empirical distribution for Bosque Del Apache, NM as an at-site.

Because at-site stations are often statistical exceptions and they ultimately influence the spatial pattern in an area, they were carefully investigated. However, the spatial impact of the at-site stations, if any, was mitigated by spatial smoothing. The smoothing helped to spatially blend the at-site precipitation frequency estimates with those derived from the regional-approach.

For NOAA Atlas 14 Volume 1, 5 daily stations and one pair of stations were analyzed using at-site analyses (Table 4.4.1). They are labeled A1 through A6. A1 and A6 are outside of the core domain and therefore are not specifically addressed in this documentation.

Table 4.4.1. Stations analyzed using an at-site analysis.

At-site	Station ID	Station Name	Data years
A1	05-6524	Placerville, CO	53
A2	29-0818	Beaverhead, NM	56
A3	29-1138	Bosque del Apache, NM	102
A4	29-8535	State University, NM	109
A5	42-5733	Moab Radio, UT	108
A6	04-2504 & 04-2506	Doyle & Doyle 4 SSE, CA	74 & 44

The following is a brief discussion of the core area at-site stations:

- A2. Beaverhead, NM (29-0818):
  Observed precipitation at 29-0818 was not consistent with its vicinity. The heterogeneity was -0.06 for Region 44 without 29-0818, but worse (1.73) for Region 44 with 29-0818. The precipitation frequency estimates in Region 44 remained nearly the same with and without 29-0818. The empirical frequencies verses the theoretical precipitation frequency estimates suggested that an at-site resulted in reduced RMSE. And finally, the resulting spatial pattern when using an at-site analysis was consistent with the surrounding area at this location.
- A3. Bosque Del Apache, NM (29-1138):
  This at-site station was analyzed more than any other station in the project. Several attempts to include it in nearby regions, including region 59, failed. Climatological evidence suggests the area around Bosque Del Apache is prone to extreme events, with Bosque Del Apache being the epicenter of the risk. To mitigate the spatial bulls eye associated with the high 24-hour and longer precipitation frequency estimates at Bosque Del Apache, region 59 was formed out of the stations around Bosque Del Apache. The at-site and region 59 are prone to two moisture sources which are consistent with Figure 7 in NOAA Atlas 2 and evaluation of synoptic maps during extreme events: Monsoonal flow from the south and Gulf of Mexico moisture from the southeast. Most of region 59 and Bosque Del Apache reside in the Jornada Del Muerto of New Mexico, which is a large, flat basin between two northeast-southwest oriented mountain ranges. The terrain is such that moisture is funneled into this area from the south or southeast, subjected to orographic lifting contributing to extreme precipitation and trapped by the higher terrain to the north. Regardless of the moisture source, the extreme precipitation events are primarily associated with localized thunderstorms. This unique climate and topography climatologically justified region 59 and the Bosque Del Apache at-site. The empirical frequencies versus the theoretical precipitation frequency estimates suggested that an at-site analysis resulted in lower RMSE. Figure 4.4.3 shows the empirical distribution for Bosque Del Apache, NM
- A4. State University, NM (29-8535):
  With 109 data years and unique precipitation characteristics, this station was analyzed as an at-site. One advantage of this at-site is that it accounts for the unique extreme precipitation data while conforming to a consistent spatial pattern. In other words, the at-site estimates are consistent with the surroundings.
- A5. Moab Radio, UT (42-5733):
  Moab, UT is an isolated valley at an elevation of around 4000 feet. Some of the surrounding mountains surpass 12,000 feet on its east and southeast sides. This relatively sheltered location creates the possibility for unique extreme precipitation climate conditions that are different from the surrounding region. Differential heating of mountain slopes leading to intense local convection, other orographic effects, and advection of Monsoonal moisture into the Moab Valley may all contribute to the enhancement of extreme precipitation at this location. Indeed, Moab has observed at least 3 cases of localized extreme precipitation causing high variation in the data at Moab. This unique climate and topography justified computing precipitation frequency estimates for the station in an at-site analysis.

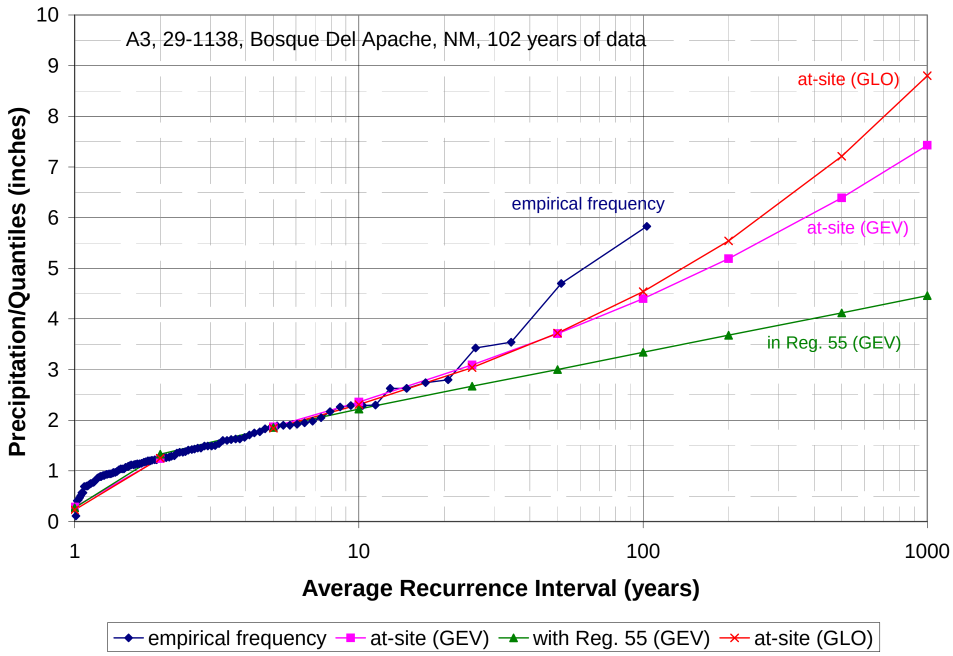


Figure 4.4.3. Empirical frequency plot of Bosque Del Apache, NM comparing at-site and regional analyses.

Since at-site stations accounted for localized 24-hour or longer duration extreme precipitation regimes, their precipitation frequency estimates sometimes did not relate well to the spatially interpolated hourly precipitation frequency estimates. In other words, the hourly interpolated estimates were lower than the at-site elevated estimates, therefore causing a “jump” from 12-hours to 24-hours. To make the precipitation frequency estimates temporally consistent, hourly pseudo data (Section 4.8.3) was created for Bosque Del Apache, NM; Moab Radio, UT and Doyle 4 SSE, CA.

4.5. Choice of frequency distribution

It was assumed that the stations within a region shared the same shape but not scale of their precipitation frequency distribution curves. It was not assumed that these factors or the distribution itself were common from region to region. In other words, a probability distribution was selected and its parameters were calculated for each region separately. Later during the sensitivity testing stage of the process, the selected distributions and their parameters were examined to ensure that they varied reasonably across the project domain. The goal was to select the distribution that best described the underlying precipitation frequencies. This goal was not necessarily achieved by a best fit to the sample data. Since a three-parameter distribution, which behaves both relatively reliably and flexibly, is more often selected to represent the underlying population, candidate theoretical distributions included: Generalized Logistic (GLO), Generalized Extreme Value (GEV), Generalized Normal (GNO), Generalized Pareto (GPA), and Pearson Type III (PE3). The five-parameter Wakeby distribution would have been considered only if the three-parameter distributions were found unsuitable for a region, but this did not happen. Three goodness-of-fit measures were used in this project to select the most appropriate distribution for the region. These were the Monte Carlo Simulation test, real-data-check test, and RMSE of the sample L-moments.

The Monte Carlo Simulation test. 1,000 synthetic data sets with the same record length and sample L-moments at each station in a region were generated using Monte Carlo simulation. Tests showed that 1,000 simulations were sufficient since means converged. Regional means of L-skewness and L-kurtosis were calculated for each simulation weighted by station data length. The regional means of all simulations were then calculated and plotted in an L-skewness versus L-kurtosis diagram and considered against candidate theoretical distributions (Figure 4.5.1). Assuming the distribution has L-skewness equal to the regional average L-skewness, the goodness-of-fit was then judged by the deviation from the simulated mean point to the theoretical distributions in the L-skewness dimension. To account for sampling variability, the deviation was standardized, (denoted as GZ) by assuming a Standardized Normal distribution Z. For the 90% confidence level, a distribution was acceptable if | GZ | ≤ 1.64. Among accepted distributions, the distribution with the smallest GZ was identified as the most appropriate distribution (Hosking, 1991).

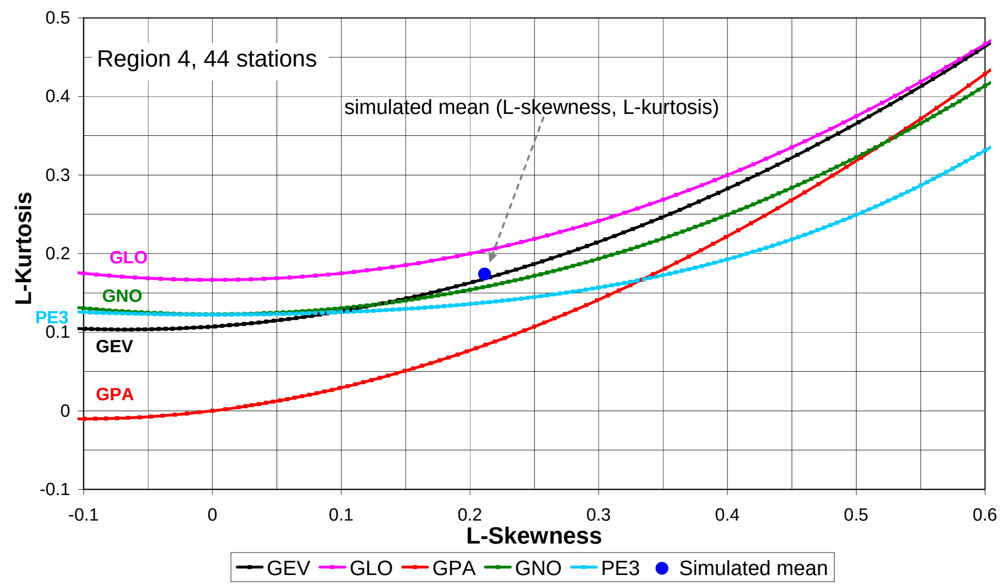


Figure 4.5.1. Plot of mean point from Monte Carlo simulations and theoretical distributions in L-skewness versus L-kurtosis diagram.

Real-data-check test. Similar to the practical application of a real-data-check in the construction of homogeneous regions, the real-data-check as a goodness-of-fit measure compared each theoretical distribution with empirical frequencies of the real (observed) data series at all stations in a region for recurrence intervals from 2-year to 100-year (Lin and Vogel, 1993). The relative error (or relative bias) of each distribution was calculated by comparing the quantiles that resulted from each fitted distribution to the empirical frequencies at each station. These were then averaged over all quantiles and stations in the region. This provided an indication of the degree of consistency between the empirical frequencies and the theoretical probabilities for the region. A smaller relative error indicated a better fit for that distribution. Although, relative error for a single station, or a few stations, is less meaningful in terms of goodness-of-fit due to sampling error, a relative error that is calculated over a number of stations to get a regional average is of statistical significance and was used as an index for the most appropriate distribution. For the ease of ranking distributions based on this test, the relative error was converted to an index in which the higher index indicated a smaller error.

RMSE of the sample L-moments. Unlike the Monte Carlo simulation test that emphasizes the effect of a simulated regional mean, the L-skewness and L-kurtosis of the real data were used in this test to assess the distribution. The deviation from the sample point (L- skewness, L- kurtosis) at each station against a given theoretical distribution in L- kurtosis scale was calculated. Then, the root-mean-square-error (RMSE) over the total set of deviations at all stations was obtained. The computation of the RMSE was done for each of the candidate distributions. The distribution with the smallest RMSE was identified as the most appropriate distribution based on this test.

Selecting the most appropriate distribution. A final decision of the most appropriate distribution for a region was primarily based upon a summary of the three tests. The goodness-of-fit tests were done on a region-by-region basis. Table 4.5.1 shows the results of the three tests for the 24-hour data in each of the 84 daily regions and 2 at-sites. Table 4.5.2 shows the results for the 60-minute data in each of the 26 hourly regions. The results from the three tests provide a strong statistical basis for selecting the most appropriate distribution. However, the goodness-of-fit results were then weighed against climatologic and geographic consistency considerations. To reduce bull's eyes and/or gradients in precipitation frequency estimates between regions, the distribution identified by the three methods was sometimes changed during a review of results on a macro-scale. An effort was made to maintain consistency of selected distribution from region to region. The use of an alternate distribution other than that suggested by the statistical tests was supported with sensitivity testing to ensure that results using the selected distribution were acceptable (i.e., changes in 100-year quantiles were less than 5%). For example, in daily region 13, GEV was not ranked first statistically, but using the statistically best-fitting distribution, GLO, would have created a climatologically unreasonable high bull's eye in the estimates amidst other regions where GEV was the statistically best-fitting distribution. Sensitivity tests showed that the 100-year 24-hour estimates in region 13 decreased by only 4.7% when using GEV rather than GLO. Therefore, GEV was selected for this region.

Based on the goodness-of-fit results, climatological considerations and sensitivity testing for all regions in the project area, GEV was selected to best represent the underlying distributions of all daily and hourly annual maximum data. GEV was also selected for the 5-, 10-, and 15-minute data and GNO was selected for the 30-minute annual maximum data that were used in the calculation of the n-minute ratios.

The at-site stations were extensively tested for the most appropriate distribution for all durations, since by their nature they were not consistent with the regional approach and required special treatment. It was found that for one at-site station within the core project area, A3, different distributions were most appropriate for different durations. GLO was selected for the 24-hour through 30-day durations for at-site A3 (29-1138) and GEV was selected for 45-day and 60-day.

Table 4.5.1. Goodness-of-fit test results for 24-hour annual maximum series data in each daily region calculated for NOAA Atlas 14 Volume 1.

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
1	1st	GEV	-0.42	GLO	22.5	GEV	0.12795	GEV
	2nd	GNO	-0.92	GEV	18.0	GNO	0.13153	
	3rd	GLO	1.72	GNO	16.0	GLO	0.13598	
2	1st	GLO	0.90	GEV	19.0	GEV	0.13807	GEV
	2nd	GEV	-1.13	GNO	17.0	GLO	0.13956	
	3rd	GNO	-2.11	GLO	16.0	GNO	0.14005	
3	1st	GEV	-0.33	GEV	21.5	GNO	0.10771	GEV
	2nd	GNO	-1.09	GNO	20.5	GEV	0.10842	
	3rd	GLO	2.41	PE3	13.0	PE3	0.11205	

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
4	1st	GEV	-1.02	GNO	18.5	GEV	0.09502	GEV
	2nd	GNO	-1.97	GEV	18.5	GNO	0.09689	
	3rd	PE3	-3.93	PE3	17.0	GLO	0.10194	
5	1st	GEV	-0.85	GEV	21.0	GEV	0.11629	GEV
	2nd	GNO	-1.67	GNO	20.5	GNO	0.11698	
	3rd	GLO	2.46	PE3	16.0	PE3	0.12256	
6	1st	GEV	-1.93	GEV	20.5	GLO	0.10816	GEV
	2nd	GLO	1.93	GLO	18.5	GEV	0.10836	
	3rd	GNO	-2.91	GNO	17.5	GNO	0.11044	
7	1st	GNO	-0.21	PE3	17.5	GNO	0.17183	GEV
	2nd	GEV	0.42	GNO	16.5	GEV	0.17281	
	3rd	PE3	-1.41	GEV	14.5	PE3	0.17348	
8	1st	GEV	0.09	PE3	20.0	GNO	0.08923	GEV
	2nd	GNO	-0.92	GEV	18.5	GEV	0.08975	
	3rd	PE3	-3.29	GNO	17.5	PE3	0.09234	
9	1st	GEV	-0.22	GEV	20.5	GNO	0.12301	GEV
	2nd	GNO	-0.98	GNO	18.5	GEV	0.12350	
	3rd	GLO	2.07	GLO	17.0	PE3	0.12672	
10	1st	GEV	-1.54	GEV	20.0	GEV	0.08236	GEV
	2nd	GLO	1.73	GNO	19.0	GNO	0.08428	
	3rd	GNO	-2.33	GLO	16.0	GLO	0.08663	
11	1st	GEV	-1.24	GEV	22.0	GEV	0.08419	GEV
	2nd	GNO	-2.42	GNO	18.0	GNO	0.08519	
	3rd	GLO	3.28	GLO	16.0	PE3	0.09176	
12	1st	GEV	-1.01	PE3	18.0	GEV	0.14403	GEV
	2nd	GNO	-1.47	GEV	17.5	GNO	0.14504	
	3rd	GLO	1.96	GNO	16.0	GLO	0.14907	
13	1st	GLO	1.67	GLO	22.5	GEV	0.06946	GEV
	2nd	GEV	-2.48	GEV	20.0	GLO	0.07001	
	3rd	GNO	-3.00	GNO	17.0	GNO	0.07188	
14	1st	GEV	0.08	GNO	19.5	GEV	0.08189	GEV
	2nd	GNO	-0.64	PE3	19.0	GNO	0.08267	
	3rd	PE3	-2.32	GEV	15.5	PE3	0.08631	
15	1st	GEV	-1.27	GEV	21.0	GEV	0.06844	GEV
	2nd	GNO	-2.63	GNO	20.0	GNO	0.07128	
	3rd	GLO	2.64	PE3	16.0	GLO	0.07612	
16	1st	GEV	-2.52	GEV	24.5	GEV	0.06716	GEV
	2nd	GLO	3.17	GNO	18.0	GNO	0.07304	
	3rd	GNO	-3.62	GLO	15.0	GLO	0.07467	
17	1st	GLO	0.81	GNO	18.5	GEV	0.09861	GEV
	2nd	GEV	-1.86	GEV	18.5	GLO	0.09909	

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
	3rd	GNO	-3.17	GLO	18.0	GNO	0.10213	
18	1st	GNO	0.02	PE3	19.5	GNO	0.15977	GEV
	2nd	GEV	0.82	GNO	19.5	PE3	0.16119	
	3rd	PE3	-1.41	GPA	14.5	GPA	0.16197	
19	1st	GEV	-1.51	GLO	19.5	GEV	0.08115	GEV
	2nd	GNO	-1.60	GNO	16.5	GNO	0.08257	
	3rd	GLO	1.65	GEV	16.5	GLO	0.08803	
20	1st	GLO	0.02	GNO	19.5	GEV	0.19198	GEV
	2nd	GEV	-0.99	GEV	19.5	GLO	0.19285	
	3rd	GNO	-1.62	PE3	14.5	GNO	0.19447	
21	1st	GEV	-1.49	GEV	19.5	GEV	0.06105	GEV
	2nd	GNO	-2.30	GNO	17.5	GNO	0.06697	
	3rd	GLO	2.95	GLO	17.5	GLO	0.07256	
22	1st	GLO	1.77	PE3	19.0	GEV	0.05648	GEV
	2nd	GEV	-1.89	GNO	19.0	GNO	0.05958	
	3rd	GNO	-2.71	GEV	18.0	GLO	0.06004	
23	1st	GEV	-0.08	GEV	20.5	GEV	0.12292	GEV
	2nd	GNO	-0.78	GNO	18.5	GNO	0.12502	
	3rd	PE3	-2.21	GLO	16.0	GLO	0.12971	
24	1st	GEV	-0.80	GEV	20.0	GEV	0.15892	GEV
	2nd	GLO	1.23	GLO	17.0	GNO	0.16155	
	3rd	GNO	-1.50	GNO	16.5	GLO	0.16249	
25	1st	GEV	0.10	GNO	18.0	GEV	0.09318	GEV
	2nd	GNO	-0.24	PE3	17.0	GNO	0.09472	
	3rd	PE3	-1.22	GEV	17.0	PE3	0.10036	
26	1st	GEV	-0.79	GEV	19.5	GEV	0.10688	GEV
	2nd	GNO	-1.61	GLO	18.0	GNO	0.10735	
	3rd	GLO	1.87	GNO	17.0	PE3	0.11193	
27	1st	PE3	0.36	PE3	22.0	PE3	0.11129	GEV
	2nd	GNO	1.54	GNO	18.0	GNO	0.11312	
	3rd	GEV	1.92	GEV	17.0	GEV	0.11405	
28	1st	GEV	-0.41	GNO	21.0	GEV	0.09215	GEV
	2nd	GNO	-1.59	GEV	21.0	GNO	0.09349	
	3rd	GLO	3.04	PE3	14.0	PE3	0.10130	
29	1st	GLO	-0.06	GEV	19.5	GEV	0.17908	GEV
	2nd	GEV	-1.40	GNO	18.5	GLO	0.18107	
	3rd	GNO	-2.02	PE3	15.0	GNO	0.18131	
30	1st	PE3	-0.53	PE3	22.0	PE3	0.09627	GEV
	2nd	GNO	1.04	GNO	17.0	GNO	0.09635	
	3rd	GEV	1.76	GPA	13.0	GEV	0.09733	
31	1st	PE3	0.05	PE3	18.5	PE3	0.06318	GEV

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
	2nd	GNO	3.51	GNO	16.5	GNO	0.06446	
	3rd	GEV	5.00	GEV	16.0	GEV	0.06612	
32	1st	GNO	0.09	PE3	20.5	GNO	0.08061	GEV
	2nd	GEV	1.47	GNO	18.5	GEV	0.08254	
	3rd	PE3	-2.49	GEV	15.5	PE3	0.08370	
33	1st	GLO	0.59	GEV	20.0	GLO	0.11650	GEV
	2nd	GEV	-1.65	GLO	19.5	GEV	0.11676	
	3rd	GNO	-2.73	GNO	16.5	GNO	0.11872	
34	1st	GLO	0.97	GEV	22.0	GEV	0.11298	GEV
	2nd	GEV	-1.68	GLO	18.0	GLO	0.11380	
	3rd	GNO	-2.49	GNO	16.5	GNO	0.11702	
35	1st	GEV	0.01	GNO	18.5	GNO	0.21691	GEV
	2nd	GNO	-0.53	GEV	18.5	GEV	0.21803	
	3rd	GLO	1.18	GLO	17.0	PE3	0.21869	
36	1st	GEV	-0.32	GEV	20.5	GEV	0.09814	GEV
	2nd	GNO	-1.22	GLO	18.5	GNO	0.10126	
	3rd	PE3	-3.10	GNO	17.5	GLO	0.10746	
37	1st	GEV	-0.63	GLO	18.5	GEV	0.09089	GEV
	2nd	GNO	-1.84	GEV	18.0	GNO	0.09312	
	3rd	GLO	3.61	GNO	16.0	PE3	0.09986	
38	1st	GEV	-0.78	GEV	20.0	GEV	0.11280	GEV
	2nd	GNO	-1.30	GLO	17.5	GNO	0.11447	
	3rd	PE3	-2.59	GNO	16.5	GLO	0.11937	
39	1st	GEV	-0.33	GNO	19.0	GEV	0.07051	GEV
	2nd	GNO	-1.66	PE3	18.0	GNO	0.07422	
	3rd	PE3	-4.36	GEV	17.0	PE3	0.08397	
40	1st	GEV	0.04	GEV	19.0	GEV	0.14036	GEV
	2nd	GNO	-0.73	GNO	18.0	GNO	0.14086	
	3rd	GLO	1.63	GLO	15.5	PE3	0.14594	
41	1st	GLO	0.47	GLO	22.5	GEV	0.16359	GEV
	2nd	GEV	-1.21	GEV	18.0	GLO	0.16651	
	3rd	GNO	-1.61	GNO	14.5	GNO	0.16677	
42	1st	GNO	-0.36	GEV	20.5	GEV	0.08687	GEV
	2nd	GEV	0.75	GNO	17.5	GNO	0.08715	
	3rd	PE3	-2.63	PE3	16.0	PE3	0.09243	
43	1st	GEV	-0.55	GNO	21.0	GEV	0.10722	GEV
	2nd	GNO	-1.22	GEV	19.0	GNO	0.10763	
	3rd	GLO	2.26	PE3	17.0	PE3	0.11140	
44	1st	GEV	-1.03	GEV	23.5	GEV	0.09660	GEV
	2nd	GNO	-1.61	GNO	18.5	GNO	0.09779	
	3rd	GEV	2.57	GLO	15.0	GLO	0.10121	

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
45	1st	GEV	-2.20	GEV	21.5	GEV	0.07639	GEV
	2nd	GNO	-3.15	GNO	18.5	GNO	0.07899	
	3rd	GLO	3.74	GLO	18.0	GLO	0.08315	
46	1st	GEV	0.01	GLO	19.5	GEV	0.23419	GEV
	2nd	GNO	-0.66	GNO	16.5	GNO	0.23598	
	3rd	GLO	0.86	GEV	16.0	GLO	0.23700	
47	1st	GEV	-1.17	GEV	23.0	GEV	0.08716	GEV
	2nd	GLO	2.15	GNO	19.0	GNO	0.08908	
	3rd	GNO	-2.24	GLO	15.0	GLO	0.09399	
48	1st	GNO	1.00	GNO	22.5	GNO	0.08534	GEV
	2nd	PE3	-1.54	PE3	19.0	GEV	0.08638	
	3rd	GEV	2.34	GEV	18.5	PE3	0.08843	
49	1st	GNO	-0.68	GEV	20.5	GNO	0.08092	GEV
	2nd	GEV	0.74	GNO	19.5	GEV	0.08095	
	3rd	PE3	-3.38	PE3	16.5	PE3	0.08639	
50	1st	GLO	0.88	GEV	19.0	GEV	0.09805	GEV
	2nd	GEV	-1.66	GNO	17.0	GLO	0.10052	
	3rd	GNO	-2.50	GLO	17.0	GNO	0.10112	
51	1st	GLO	0.66	GLO	18.0	GEV	0.14030	GEV
	2nd	GEV	-1.62	GEV	18.0	GLO	0.14130	
	3rd	GNO	-2.18	GNO	16.5	GNO	0.14219	
52	1st	GNO	0.44	GNO	21.5	GEV	0.10154	GEV
	2nd	PE3	-1.04	GEV	20.5	GNO	0.10186	
	3rd	GEV	1.06	PE3	18.0	PE3	0.10338	
53	1st	GNO	0.50	PE3	24.0	GNO	0.08635	GEV
	2nd	PE3	-0.81	GNO	18.5	GEV	0.08681	
	3rd	GEV	0.93	GEV	14.5	PE3	0.08700	
54	1st	GNO	-0.36	GLO	19.5	GNO	0.20462	GEV
	2nd	GEV	0.43	GEV	18.0	GEV	0.20488	
	3rd	GLO	1.69	GNO	16.5	PE3	0.20908	
55	1st	PE3	-0.13	PE3	21.0	GEV	0.11877	GEV
	2nd	GNO	1.09	GNO	20.5	GNO	0.11969	
	3rd	GEV	1.47	GEV	14.0	PE3	0.12137	
56	1st	GLO	0.37	GEV	19.5	GEV	0.10186	GEV
	2nd	GEV	-1.82	GLO	18.0	GLO	0.10287	
	3rd	GNO	-2.80	GNO	16.5	GNO	0.10627	
57	1st	GEV	-0.32	GEV	17.0	GNO	0.15977	GEV
	2nd	GLO	0.76	GNO	16.5	GEV	0.16049	
	3rd	GNO	-0.94	PE3	15.0	GLO	0.16424	
58	1st	GPA	-0.61	GPA	21.0	GPA	0.21246	GEV
	2nd	PE3	1.16	PE3	18.0	PE3	0.21341	

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
	3rd	GNO	2.14	GNO	14.5	GNO	0.21686	
59	1st	GEV	-0.56	PE3	17.5	GEV	0.14145	GLO
	2nd	GNO	-0.88	GLO	16.5	GNO	0.14312	
	3rd	PE3	-1.71	GEV	16.5	GLO	0.14701	
A1	1st	GEV	-0.09	PE3	18.5	GEV	0.58763	GEV
	2nd	GLO	0.15	GPA	18.5	GNO	0.58811	
	3rd	GNO	-0.39	GNO	13.5	GLO	0.58817	
A2	1st	GNO	0.08	GNO	18.5	GNO	0.36387	GNO
	2nd	GEV	0.47	GEV	18.5	PE3	0.36430	
	3rd	PE3	-0.60	GLO	13.5	GEV	0.36499	
A3	1st	GLO	-1.00	GLO	18.0	GLO	0.53849	GLO
	2nd	GEV	-1.40	GEV	17.0	GEV	0.54077	
	3rd	GNO	-1.68	GNO	15.0	GNO	0.54337	
A4	1st	GLO	0.19	GNO	19.5	GEV	0.55521	GEV
	2nd	GEV	-0.22	PE3	16.0	GLO	0.55544	
	3rd	GNO	-0.57	GEV	15.5	GNO	0.55600	
A5	1st	GLO	-0.63	GNO	18.5	GLO	0.58584	GEV
	2nd	GEV	-0.91	GEV	17.5	GEV	0.58701	
	3rd	GNO	-1.24	GLO	14.0	GNO	0.58958	
A6	1st	GNO	0.25	GPA	19.0	GNO	0.39431	GNO
	2nd	PE3	-0.47	PE3	18.0	PE3	0.39445	
	3rd	GEV	0.66	GNO	15.5	GEV	0.39518	

Table 4.5.2. Goodness-of-fit test results for 60-minute annual maximum series data in each hourly region calculated for NOAA Atlas 14 Volume 1.

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
1	1st	GLO	-0.42	GPA	17.5	GEV	0.26435	GEV
	2nd	GEV	-0.89	PE3	15.5	GLO	0.26451	
	3rd	GNO	-1.51	GNO	15.5	GNO	0.26654	
2	1st	GNO	0.07	PE3	22.0	GNO	0.14997	GEV
	2nd	GEV	1.13	GPA	22.0	PE3	0.15201	
	3rd	PE3	-1.75	GNO	14.5	GEV	0.15353	
3	1st	GLO	0.09	GNO	19.0	GEV	0.13290	GEV
	2nd	GEV	-0.82	GEV	17.0	GNO	0.13398	
	3rd	GNO	-1.68	PE3	13.5	GLO	0.13657	
4	1st	GLO	0.29	GPA	16.5	GEV	0.09848	GEV
	2nd	GEV	-0.70	PE3	15.5	GNO	0.10085	

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
	3rd	GNO	-1.60	GNO	15.0	GLO	0.10527	
5	1st	GEV	-0.17	GEV	17.0	GEV	0.19905	GEV
	2nd	GLO	0.70	GNO	16.5	GPA	0.20164	
	3rd	GNO	-1.00	GLO	16.5	GNO	0.20212	
6	1st	GEV	-0.12	GEV	19.0	GEV	0.12998	GEV
	2nd	GLO	0.73	GLO	18.0	GNO	0.13211	
	3rd	GNO	-0.92	GNO	16.0	GPA	0.13467	
7	1st	GEV	0.48	PE3	18.5	GNO	0.17481	GEV
	2nd	GNO	-0.51	GEV	18.5	GEV	0.17537	
	3rd	GLO	1.85	GNO	17.5	PE3	0.18091	
8	1st	GEV	0.42	GNO	19.0	GEV	0.10531	GEV
	2nd	GNO	-0.49	PE3	18.0	GNO	0.10642	
	3rd	PE3	-2.16	GEV	14.0	PE3	0.11274	
9	1st	GEV	0.10	GEV	17.0	GNO	0.15911	GEV
	2nd	GNO	-0.58	PE3	16.5	GEV	0.15918	
	3rd	GLO	1.62	GNO	16.0	PE3	0.16294	
10E	1st	PE3	0.89	PE3	17.5	GPA	0.13788	GEV
	2nd	GNO	1.55	GPA	17.0	PE3	0.14033	
	3rd	GEV	1.77	GNO	14.0	GNO	0.14229	
10W	1st	GNO	-0.25	GNO	19.0	GNO	0.18046	GEV
	2nd	GEV	0.83	GEV	17.5	PE3	0.18299	
	3rd	GLO	1.98	PE3	15.0	GEV	0.18374	
11	1st	GEV	-0.18	GLO	22.5	GEV	0.11029	GEV
	2nd	GNO	-0.75	GEV	18.0	GNO	0.11413	
	3rd	GLO	1.79	GNO	16.0	GLO	0.12386	
12	1st	GNO	0.04	GLO	18.5	GEV	0.11718	GEV
	2nd	GEV	0.37	GEV	18.0	GNO	0.11769	
	3rd	PE3	-0.81	PE3	17.5	PE3	0.12000	
13	1st	PE3	0.39	PE3	18.5	PE3	0.07046	GEV
	2nd	GNO	1.98	GNO	18.0	GNO	0.07110	
	3rd	GEV	2.62	GEV	17.0	GEV	0.07178	
14	1st	GEV	0.33	GEV	23.0	GNO	0.10488	GEV
	2nd	GNO	-0.38	GNO	20.0	PE3	0.10526	
	3rd	PE3	-2.04	PE3	14.0	GEV	0.10668	
15	1st	GLO	1.31	GEV	20.0	GEV	0.09094	GEV
	2nd	GEV	-2.60	GNO	18.0	GNO	0.09615	
	3rd	GNO	-4.11	GLO	16.0	GLO	0.09653	
16	1st	GLO	-1.67	GLO	20.0	GEV	0.13951	GEV
	2nd	GEV	-2.64	GEV	20.0	GLO	0.14120	
	3rd	GNO	-3.73	GNO	18.0	GNO	0.14662	
17	1st	GLO	0.09	GNO	18.0	GLO	0.18737	GEV

region	rank	Monte Carlo Simulation		Real-data-check test		RMSE test		selected
		distribution	test value	distribution	test value	distribution	RMSE	
	2nd	GEV	-0.48	GEV	18.0	GEV	0.18750	
	3rd	GNO	-1.49	GPA	15.0	GNO	0.18944	
18	1st	PE3	-0.08	GNO	17.5	GPA	0.34593	GEV
	2nd	GPA	-0.68	GEV	17.5	PE3	0.34705	
	3rd	GNO	0.90	PE3	15.0	GNO	0.35029	
19	1st	GNO	-0.13	PE3	17.0	PE3	0.21012	GEV
	2nd	GEV	0.30	GLO	15.5	GNO	0.21183	
	3rd	PE3	-0.89	GEV	15.5	GEV	0.21522	
20	1st	GEV	-0.47	GNO	18.0	GEV	0.14207	GEV
	2nd	GLO	1.23	GEV	17.5	GNO	0.14653	
	3rd	GNO	-1.49	PE3	15.0	GLO	0.14908	
21	1st	GEV	0.32	GLO	19.5	GEV	0.16714	GEV
	2nd	GNO	-0.69	GEV	17.0	GNO	0.16908	
	3rd	GLO	1.55	GNO	14.5	GPA	0.17343	
22	1st	GEV	-0.38	GNO	17.0	GNO	0.12547	GEV
	2nd	GNO	-1.04	GEV	16.0	GEV	0.12816	
	3rd	GLO	1.58	PE3	15.5	PE3	0.12854	
23	1st	GNO	-0.11	GNO	20.5	GNO	0.22287	GEV
	2nd	GEV	0.64	GLO	15.0	GEV	0.22490	
	3rd	GLO	1.36	GEV	13.5	GPA	0.22550	
24	1st	GLO	-0.38	GEV	19.5	GEV	0.20494	GEV
	2nd	GEV	-1.27	GLO	18.5	GNO	0.20698	
	3rd	GNO	-2.06	GNO	17.0	GLO	0.20763	

4.6. Estimation of quantiles

4.6.1. Regional growth factors

In the index-flood based regional analysis approach, the regional growth factors (RGFs) are defined as the quantiles of a regional dimensionless distribution. Regional growth factors are obtained by fitting the selected dimensionless distribution function with the weighted average L-moment ratios (or parameters) for a region that were computed using data re-scaled by the mean of the annual maximum series (Hosking and Wallis, 1997). Because the parameters are constant for each region, there is a single RGF for each region that varies only with frequency and duration. A table of RGFs for all durations for each region is provided in Appendix A.9. The RGFs are then multiplied by the site-specific scaling factor to produce the quantiles at each frequency and duration for each site. The site-specific scaling factor used in this project was the mean of the annual maximum series at each site. This scaling factor is often referred to as the “Index Flood” because the genesis of the statistical approach was in flood frequency analysis.

In this project, the scaling factors for each duration were first spatially interpolated to fine scale grids (Section 4.8.1) to take advantage of the RGFs at each frequency and obtain grids of the quantiles. A unique spatial interpolation procedure (Section 4.8.2) was developed to maintain differences between regions but generate spatially smooth quantiles across regional boundaries.

4.6.2. 1-year computation

The 1-year average recurrence interval (ARI) precipitation frequency estimates were computed for this project. ARI is the average period between exceedances (at a particular location and duration) and is associated with the partial duration series (PDS). Annual exceedance probability (AEP) is the probability that a particular level of rainfall will be exceeded in any particular year (at a particular location and duration) and is derived using the annual maximum series (AMS). An AEP depth or intensity may be exceeded once or more than once in a year. (Section 3.2 provides additional discussion on this topic.)

A 1-year AEP estimate, associated with AMS, has little meaning statistically or physically. However, the 1-year ARI, associated with PDS does have meaning and is used in several practical applications. The equation $T_{PDS} = [\ln(\frac{T_{AMS}}{T_{AMS}-1})]^{-1}$ (Chow et al., 1988), which is distribution free, provided a mathematical base for converting between frequencies for the AMS data and the PDS data. Here, T_{AMS} and T_{PDS} stand for the frequency associated with the AMS data and the frequency associated with the PDS data, respectively. The equation can be transformed into the following:

$$T_{AMS} = \frac{1}{1 - e^{-\frac{1}{T_{PDS}}}}$$

Therefore, T_{AMS} = 1.58-year when T_{PDS} = 1-year from the equation. This means that a PDS 1-year event is equivalent to an AMS 1.58-year event. This relationship was used to calculate the 1-year ARI from AMS data for this project. Appendix A.9 provides the regional growth factors computed for the 1.58-year AMS results. However, for all ARIs other than 1-year, the results were obtained by analyzing both AMS and PDS data separately, averaging ratios of PDS to AMS quantiles and then applying the average ratio to the AMS results (Section 4.6.4).

4.6.3. Practical consistency adjustments

In reality, data do not always behave ideally. Nor are datasets always collected perfectly through time or in dense spatial networks. Since quantiles for each duration and station in this project were computed independently, the practical adjustments described below were applied to produce realistic final results that are consistent in duration, frequency and space.

Annual maximum consistency adjustment. At some daily stations, there were inconsistencies in the annual maximum time series from one duration to the next. Specifically, a shorter duration observation in a given year may have sometimes been greater than the subsequent longer duration. Often this occurred because there were a significant number of missing data surrounding that particular case. A longer duration for the case could not be accumulated if the data immediately adjacent the relevant observations were not available. It also occurred in some cases when the average conversion factors that account for different sampling intervals were applied (e.g., 1-day data to 24-hour data; Section 4.1.2). If left unadjusted, these inconsistencies could result in a negative bias of longer duration precipitation frequency estimates relative to reality. Therefore, large inconsistencies in the annual maxima of a given year from one duration to the next were investigated and data added or corrected where possible. If missing data could not be found and/or the difference between the 2 durations was small (<10%), then the longer duration was set equal to the shorter duration. This adjustment ensured consistency from one duration to the next longer duration for each given year at a station.

Co-located hourly and daily station adjustment. Since hourly and daily durations were computed separately and from different data sets, it was necessary to explicitly ensure consistency of precipitation frequency estimates through the durations at co-located daily and hourly stations. At co-located daily and hourly stations the 24-hour estimates from the daily data were retained since they were based on more stations, generally had longer record lengths, and were less prone to under-catch precipitation. The quantiles of co-located stations were adjusted for consistency particularly across the 12-hour and 24-hour durations where disparities could occur. There are a number of possible reasons for such disparities, such as gage differences or different recording periods. The adjustment preserved the daily 24-hour quantiles and the hourly distribution for the 120-minute (2-hour) through 12-hour quantiles at the given hourly station. The 24-hour through 2-hour quantiles for co-located hourly stations were adjusted using *station-specific* ratios of the station daily and hourly 24-hour means and ratios of the daily and hourly 24-hour regional growth factors (RGFs) at all frequencies (1.58-yr, 2-yr, 5-yr, …, 1,000-yr).

Lessons learned in NOAA Atlas 14 Volume 2 suggested additional consideration of the adjustment to the 60-minute quantile to accommodate different hourly and daily regions, close spatial proximity of most stations, the average 1-hour to 60-minute conversion factor, and application of n-minute ratios. A process was developed to ultimately avoid discontinuities at the 60-minute quantile relative to adjusted 2-hour through 24-hour quantiles and n-minute quantiles and reduce spatial bull's eyes in the final maps.

In some cases, the station-specific ratios of daily region versus hourly region RGFs at co-located stations were less than 1.0. This was not common but did occur. When the daily 100-year 24-hour RGF/hourly 100-year 24-hour RGF, which was used as an index, was *less* than 1.0, the station-specific adjustment ratios were applied from 24-hour through 60-minute to maintain consistency over all hourly durations and avoid over-adjusting. However, when the station-specific 100-year 24-hour RGF ratio was *greater* than 1.0, the 60-minute quantile was adjusted using regionally averaged RGF and 24-hour mean ratios calculated from all co-located stations in the hourly region to achieve a more spatially consistent result.

The final result using the station-specific adjustment of the 60-minute quantile may not be as spatially smooth as the regionally averaged adjustment. However, the station-specific adjustment is more representative of the station data and mitigates the risk of over-adjusting.

In addition, the co-located adjustment was modified slightly for lessons learned in Volume 3 to accommodate unique cases. The unique data characteristics at a few stations coupled with the different daily and hourly regional characteristics created discontinuities relative to nearby stations. At these few stations, the daily to hourly RGF ratios at each frequency were unusually low. The data of two or more hourly durations at the stations shared the same annual maximum or had a very close values which created a very flat slope for quantiles from 5-year through 1,000-year. To ensure the consistency of precipitation frequency estimates in such a case, the regional RGF ratio and station-specific mean ratio were used to adjust the 60-minute duration at a station when the following criteria were met: (1) the station-specific daily/hourly 100-year RGF ratio was less than 1.0, and (2) the difference (range) of the 100-year RGF ratios of all hourly stations in the hourly region was greater than 0.2, and (3) the range divided by the lowest 100-year RGF ratio was equal to or greater than 0.4. These criteria were empirically determined and tested in Volume 3. The adjustment results in precipitation frequency estimates at such a co-located station that are more reasonable and consistent throughout the durations (60-minute through 24-hour) and with respect to other stations in that hourly region. However, no such cases occurred in the Volume 1 data.

Hourly-only station consistency adjustment. To ensure that hourly-only stations were consistent with nearby co-located hourly/daily stations that occur in different regions and reduce spatial bull's eyes observed in hourly results, an adjustment was applied to hourly-only stations. Specifically, the

48-hour through 60-minute quantiles for hourly-only stations were adjusted using a regionally averaged ratio of the daily and hourly 24-hour means and a set of regionally averaged RGF ratios at all frequencies (1.58-yr, 2-yr, 5-yr, …, 1,000-yr) calculated from all co-located stations within the hourly region.

Internal consistency adjustment. Since the quantiles of each duration at a given station were calculated separately, inconsistencies could occur where a shorter duration had a quantile that was higher than the next longer duration at a given average recurrence interval. For example, it could happen that a 100-year 2-hour quantile was greater than a 100-year 3-hour quantile at a station. This result, although based on sound statistical analysis, is physically unreasonable. Such results primarily occurred where durations had similar mean annual maxima but the shorter duration had higher regional parameters, such as coefficient of L-variation and L-skewness that produced a quantile higher than the longer duration quantile. The underlying causes of such an anomaly were primarily discontinuities in selection and parameterization of distribution functions between durations, data sampling variability, and the application of average conversion factors to convert 1-hour data to 60-minute and to convert 1-day data to 24-hour.

Such inconsistencies were identified when the ratio of the longer duration to the next shorter duration quantiles was less than 1.0 for a given average recurrence interval. If the inconsistency occurred in the higher frequencies, it was mitigated by distributing the surplus of the ratio, which was greater than 1.0, of the previous frequency for those durations at a constant slope to the ratios of the inconsistent frequency and higher through 1,000-year, until it converged at 1.0 after 1,000-year (Table 4.6.1). If the inconsistency occurred in the lower frequencies, it was mitigated by distributing the surplus of the ratio, which was greater than 1.0, of the following frequency for those durations at a constant slope to the ratios of the inconsistent frequency and lower through 1.58-year, until it converged at 1.0 before 1.58-year. The adjusted ratios were then, appropriately, greater than or equal to 1.0. Table 4.6.1 shows an example from the Ohio River basin and surrounding states of the 3-hour to 2-hour ratios for average recurrence intervals from 1.58-year to 1,000-year at a station before and after the internal consistency adjustment. Figure 4.6.1 shows the associated 3-hour quantiles before and after adjustment.

In most cases, applying the adjustment from 1.58-year through 1,000-year was sufficient. However, in some cases where the inconsistency occurred only for some frequencies, such as between 50-year and 500-year only, adjustments were still required from 1.58-year through 1,000-year to ensure consistency without changing the existing compliant quantiles.

Table 4.6.1. Example of the internal consistency adjustment of quantiles showing the ratios of 3-hour to 2-hour quantiles for 1.58-year to 1,000-year at station 15-3709, Hazard, Kentucky.

3-hour to 2-hour ratios	1.58-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1,000-yr
Before adjustment	1.025	1.022	1.017	1.009	1.004	0.997	0.994	0.990	0.983	0.979
After adjustment	1.025	1.022	1.017	1.009	1.004	1.003	1.003	1.002	1.002	1.001

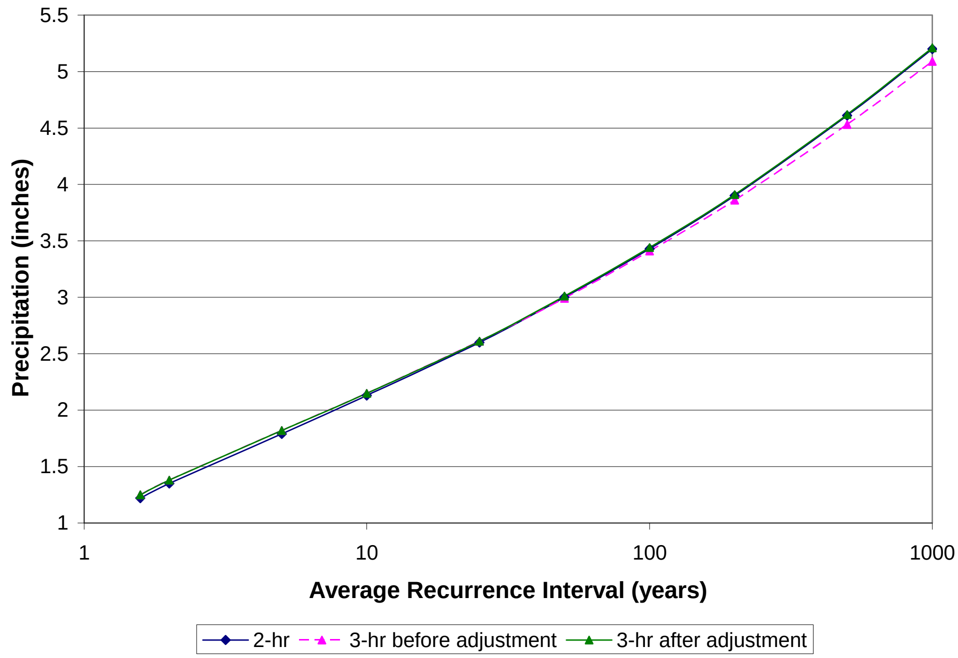


Figure 4.6.1. Example of internal consistency adjustment between the 3-hour and 2-hour quantiles at station 15-3709, Hazard, Kentucky.

4.6.4. Conversion factors for AMS to PDS

Annual maximum series (AMS) data consist of the largest case in each year, regardless of whether the second largest case in a year exceeds the largest cases of other years. In this project, the partial duration series (PDS) data is a subset of the complete data series where highest N cases are selected and N equals the number of years in the record. Such a series is also called an annual exceedance series (AES) (Chow et al., 1988). In this Atlas, the use of PDS refers to AES.

AMS data were used for all durations from 5-minute to 60-day and for annual exceedance probabilities of 1 in 2 to 1 in 1,000. The use of the AMS data is consistent with the concept of frequency analysis and the manipulation of annual probabilities of exceedance, and is consistent with the basis of development of the statistics used in this project. The statistical approach is less well demonstrated for PDS data. However, to remain consistent with the previous studies (e.g., NOAA Atlas 2) and to meet today's needs at lower return periods, NOAA Atlas 14 is also presented in terms of PDS results. The differences in meaning between AMS-based results and PDS-based results are discussed in Section 3.2.

PDS results were obtained by analyzing both AMS and PDS data separately, averaging ratios of PDS to AMS quantiles and then applying the average ratio to the AMS results. The PDS-AMS ratios were developed by independently fitting distributions to AMS and PDS data separately for each region before averaging. Figure 4.6.2 shows the average results of the PDS-AMS ratios for 24-hour data over the 59 homogenous regions in the project area. To account for sampling variability and to generate a smooth consistent curve, an asymptote of 1.004 was applied for 50-year and above.

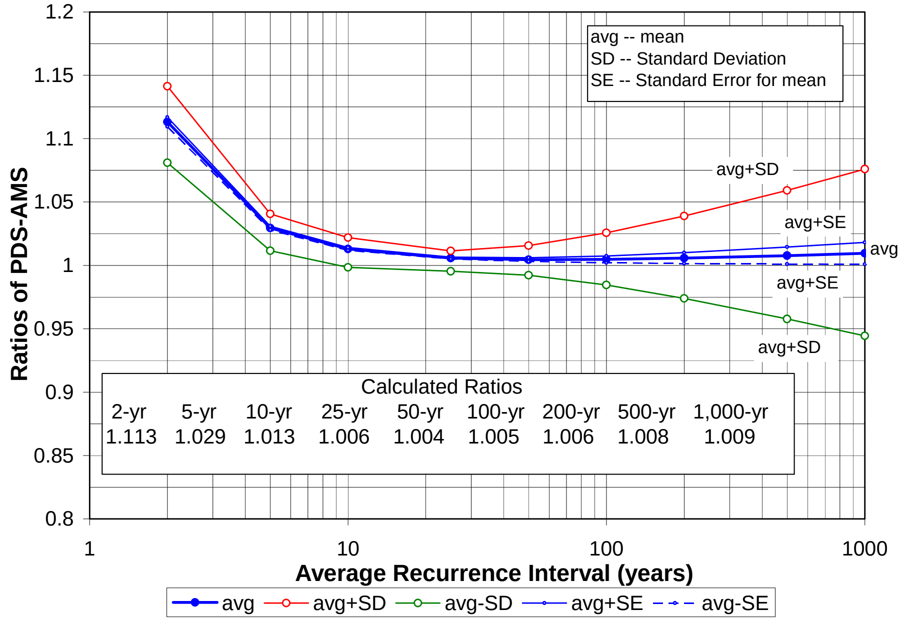


Figure 4.6.2. PDS-AMS ratio results for average recurrence intervals for the 24-hour duration over the 59 homogeneous regions used to prepare NOAA Atlas 14 Volume 1.

The ratios for this Atlas (Table 4.6.2) are consistent with NOAA Atlas 2 and theoretical computations. For example, Chow (1988) proposed a mathematical relation in terms of recurrence interval (T) between PDS (or AES) and AMS:

$$T_{AES} = [\ln(\frac{T_{AMS}}{T_{AMS} - 1})]^{-1}$$

According to this relation, a 2-year AMS value is equivalent to a 1.44-year AES value. Results were consistent with this relation. The ratios are also consistent with results from the recently released Ohio River Basin and surrounding states precipitation frequency project (Bonnin et al., 2004). The consistency of these PDS to AMS ratios with other derivations lends strong support to the validity of the results of this project because the PDS and AMS quantiles were derived independently using different probability distributions. To derive the PDS to AMS ratios, regional data, excluding at-site stations were used. Generalized Pareto (GPA) was selected as the most appropriate distribution for the PDS data in all but 9 regions. For regions 9, 24, 29, 33, 35, 50, 55, 56 and 59, Generalized Normal (GNO) was the best-fitting distribution.

Table 4.6.2. NOAA Atlas 14 Volume 1 PDS to AMS ratios for all durations with asymptote applied after 50-year.

2-year	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1.113	1.029	1.013	1.006	1.004	1.004	1.004	1.004	1.004

4.7. Estimation of confidence limits

For the first time, the National Weather Service is providing confidence limits for the estimates to quantify uncertainty. This will allow users a greater understanding of the uncertainty and will thus improve the utility of the estimates in engineering and environmental design practice. The quantiles per se are statistical variables that vary within an unknown range following an unknown distribution. To quantitatively assess the uncertainty, a Monte Carlo simulation technique was used to generate 1,000 synthetic data sets having the same statistical features.

Upper and lower confidence limits at the 90% confidence level were computed for each station's precipitation frequency estimate using Monte Carlo simulations coupled with the regional L-moments method, as suggested by Hosking and Wallis (1997). The sample parameters at each station were used in 1,000 Monte Carlo simulations to produce 1,000 samples with the same data length and same average regional parameters as the actual data. 1,000 quantiles were calculated for each station and then the upper 5% and lower 5% were delineated to produce the upper and lower confidence bounds. For n-minute data, the n-minute ratios (n-minute to 60-minute mean precipitation frequency estimates) were applied to the 60-minute upper/lower grids to compute the upper and lower bounds for n-minute estimates.

Confidence limits were adjusted to be consistent with their corresponding quantiles by applying ratios of the unadjusted quantiles and the adjusted quantiles in a manner comparable to the co-located hourly and daily station and hourly-only station consistency adjustments. 24-hour confidence limits at co-located or daily-only stations were derived from the station in the daily region analysis.

The estimation of confidence limits provides error bounds on the quantiles themselves under the assumption that the data have been well quality controlled and does not include error associated with rainfall measurement and the spatial interpolation procedure.

4.8. Spatial interpolation

4.8.1. Mean annual maximum (or “Index flood”) grids

As explained in Section 4.6.1, mean annual maximum values were used as the site-specific scaling factor to generate precipitation frequency estimates from regional growth factors (RGFs). The station mean annual maximum values were spatially interpolated to produce mean annual maximum, or “index flood”, grids using technology developed by Oregon State University’s Spatial Climate Analysis Service (SCAS). SCAS has developed PRISM (Parameter-elevation Regressions on Independent Slopes Model), a hybrid statistical-geographic approach to mapping climate data (Daly and Neilson, 1992; Daly et al., 1994; Daly et al., 1997; Daly et al., 2002). PRISM spatially interpolated the HDSC-calculated mean annual maximum values by using a naturally strong relationship with mean annual precipitation.

SCAS adapted PRISM to use their existing mean annual precipitation grids (USDA-NRCS, 1998), transformed using the square-root, as the predictor grid for interpolating mean annual maximum precipitation to a uniformly spaced grid. Mean annual precipitation was used as the predictor because it is based on a large data set, accounts for spatial variation of climatic information and is consistent with methods used in previous projects, including NOAA Atlas 2. PRISM uses a unique regression function for each target grid cell and has the ability to account for: user knowledge, the distance of an observing station to the target cell, if the station is in a cluster of stations grouped together, the difference between station and target cell mean annual precipitation, topographic facet, and coastal proximity. Other parameters include radius of influence, minimum number of stations on a facet, and total number of stations required for the regression to estimate the mean annual maximum precipitation at a given grid cell. PRISM cross-validation statistics were computed where each observing station was deleted from the data set one at a time and a prediction made in its absence. Results indicated that any overall bias was less than 2 percent and mean standard error was about 10 percent for this Atlas. Appendix A.4 provides additional information regarding the details of the work done by SCAS for HDSC.

Table 4.8.1 lists the mean annual maximum (a.k.a. “index flood”) grids, one for each duration of the project, that were interpolated by PRISM. The resulting high-resolution (30-second, or about 0.5 mile x 0.5 mile) mean annual maximum grids then served as the basis for deriving precipitation frequency estimates at different recurrence intervals using a unique HDSC-developed spatial interpolation procedure, the Cascade, Residual Add-Back (CRAB) derivation procedure (described in detail in Section 4.8.2).

Deviations may occur between the observed point mean annual maximum values in the HDSC database and the resulting grid cell value due to spatial interpolating and smoothing techniques employed by PRISM. The “HDSC database” consists of precipitation frequency estimates, mean annual maximum values and metadata (longitude, latitude, period of record, etc.) for each station. These deviations occur because PRISM produces interpolated values that mitigate differences between the observed point estimates and surrounding stations with similar climate, mean annual precipitation, elevation, aspect, distance from large water bodies and rain-shadow influences. See Appendix A.4 for more details.

Table 4.8.1. Mean annual maximum grids interpolated by PRISM.

Duration
60-minute
120-minute
3-hour
6-hour
12-hour
24-hour
48-hour
4-day
7-day
10-day
20-day
30-day
45-day
60-day
Total 14

4.8.2. Derivation of precipitation frequency grids

The Cascade, Residual Add-Back (CRAB) grid derivation procedure is a unique spatial interpolation technique, developed by HDSC, to convert mean annual maximum grids into grids of precipitation frequency estimates (see Figure 4.8.1). The CRAB philosophy was first used in the derivation of several of the National Climatic Data Center's Climate Atlas of the United States maps (Plantico et al., 2000).

CRAB accommodates spatial smoothing and interpolating across "region" boundaries to eliminate potential discontinuities due to different RGFs as a result of the regional L-moment analysis. The CRAB process, as the term cascade implies, uses the previously derived grid to derive the next grid in a cascading fashion. The technique derives grids along the frequency dimension with quantile estimates for different durations being separately interpolated. Hence, duration-dependent spatial patterns evolve independently of other durations. The CRAB process utilizes the inherently strong relationship between different frequencies for the same duration. In reality, this linear relationship is equivalent to the ratio of RGFs (e.g., 100-year 24-hour RGF over the 50-year 24-hour RGF) and is a constant for each region. CRAB initially makes a generalization that all regions have the same RGF ratios, thereby causing the linearly-predicted precipitation frequency estimates in some regions to be over predicted, while others under predicted. To account for these regional differences, CRAB utilizes residuals – the differences between the precipitation frequency estimates from the generalized all-region RGF ratios and the actual precipitation frequency estimates at each station. As a by-product of the generalization, the residuals (at each station) within each individual region are either all positive, negative or close to zero thereby supporting spatial autocorrelation and skill in interpolating the residuals. This combined with the inherently strong linear predictability from one frequency to the next makes CRAB an effective and accurate method for deriving the suite of precipitation frequency grids.

As mentioned above, the CRAB derivation process utilizes the strong, linear relationship between a particular duration and frequency, the *predictor* estimates, and the next rarer frequency of the same duration. Figure 4.8.2 shows the relationship between the *predictor* precipitation frequency estimates, 50-year 24-hour in this example, and the subsequent precipitation frequency estimates, 100-year 24-hour. The R-squared value here of 0.9986 is very close to 1.0 which was common throughout all of the regressions. Since this was calculated using all stations in the project area, the slope of this relationship (1.1345) can be thought of as an average domain-wide RGF ratio. Regional differences are then accounted for using residuals.

A summary of the complete CRAB derivation procedure is illustrated in Figure 4.8.1 and can be summarized in a series of steps. In this description, the term *predictor* refers to the previous grid upon which the subsequent grid is based.

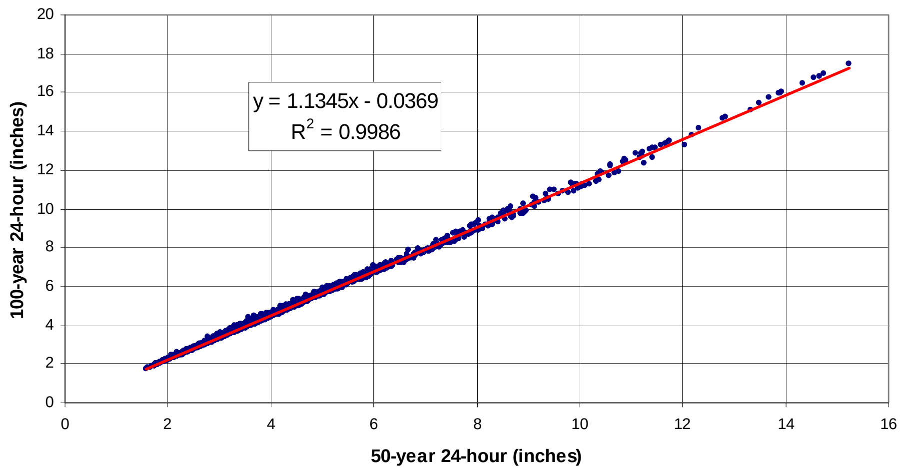


Figure 4.8.2. A scatter plot of 100-year 24-hour vs. 50-year 24-hour precipitation frequency estimates and the linear regression line from NOAA Atlas 14 Volume 1.

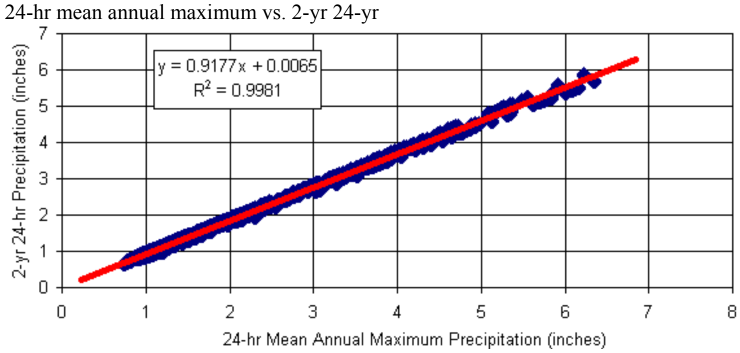
Step 1: Development of regression. The cascade began with the mean annual maximum grid derived by SCAS using PRISM for a given duration as the initial *predictor grid* (e.g., 24-hour mean annual maximum) and the 2-year frequency as the subsequent grid (e.g., 2-year 24-hour). All precipitation frequency estimates in the HDSC database were adjusted to accommodate the spatial smoothing of the PRISM mean annual maximum grids. An adjustment factor was calculated based on the difference between the mean annual maximum PRISM grid cell value and the point mean annual maximum as computed from observed data as listed in the HDSC database. The adjustment factor was a station-unique value applied to the precipitation frequency estimates and was independent of frequency. For example, a station has an observed mean annual maximum 60-minute value (from the database) of 0.82 inches, but the PRISM grid cell at this station has a value of 0.861 inches. This results in an adjustment factor of 1.05 which is applied to each of the 60-minute precipitation frequencies (2-years through 1,000-years) before constructing the regression equation. These adjusted precipitation frequency estimates are equivalent to the *actual estimates*. In most cases, this adjustment was ±5% (See Appendix A.4 for more details). A global (all-region) relationship for each duration/frequency pair was developed at the beginning of each iteration based on station precipitation frequency estimates, adjusted for spatial smoothing, at all stations.

To develop the global relationship, an x-y data file was built where initially x was the mean annual maximum for a given duration and y the 2-year precipitation frequency estimate for that duration for each observing station. The slope and y-intercept of a least-square fit linear regression line using x and y for all stations in the domain was calculated. For each individual region, the slope of such a line is equivalent to the 2-year RGF in the initial run and equivalent to the RGF ratio in subsequent runs.

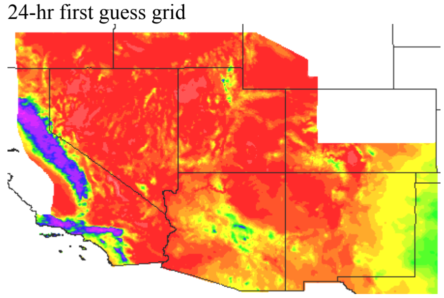
Figure 4.8.1. Flowchart of the cascade residual add-back (CRAB) grid derivation procedure beginning with the mean annual maximum grid of the x-duration and deriving the 2-year x-duration grid as an example.

Using PRISM, produce mean annual maximum grid for duration x (see accompanying documentation for details)

Build an x-y data file where initially **x is mean annual maximum** (for duration x) and **y the 2-year x-duration precipitation frequency estimate**. Calculate slope and y-intercept of a least-square fit linear regression line using x and y for ALL stations in the domain. Example: Semiarid Southwest 24-hr mean annual maximum vs. 2-yr 24-yr

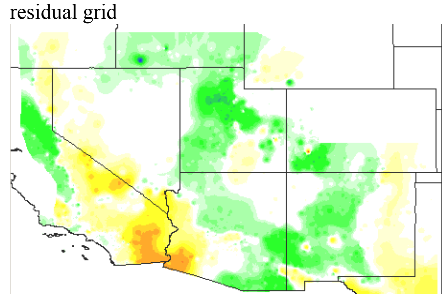


Based on slope, y-intercept and PRISM mean annual maximum grid, calculate a **first guess y grid**. Example:2-yr 24-hr first guess grid



Using the actual y value and the predicted y value, calculate the residual (actual minus predicted). Normalize the residual by dividing by the mean annual maximum, regardless of iteration.

Spatially interpolate the **normalized residual** values using inverse-distance weighting. Example:2-yr 24-hr normalized residual grid

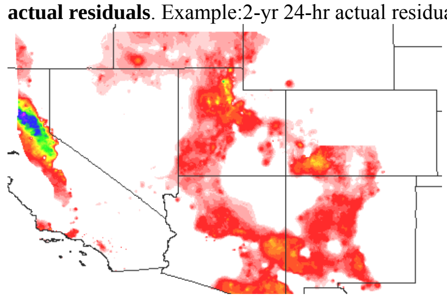


Iteration: Repeat for each frequency (e.g., mean annual maximum becomes 2yr, 2yr becomes 5yr, etc.). Then repeat for each duration (e.g., after the first mean annual maximum iteration, the duration starts at 60-minute, then 2-hour, etc.)

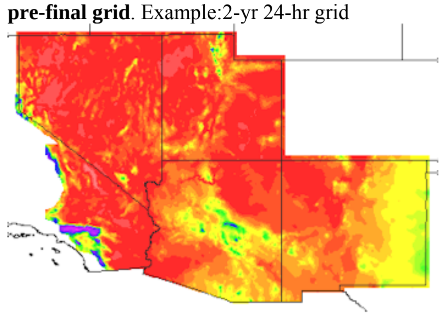
Continued on next page.

Figure 4.8.1. cont'd

Multiply the **normalized residual grid** by the mean annual maximum grid, regardless of iteration, to obtain a grid of **actual residuals**. Example:2-yr 24-hr actual residual grid



Add the actual residual grid to the first guess grid to obtain **pre-final grid**. Example:2-yr 24-hr grid



Apply small (3x3 grid cell) center-weighted, block filter to the pre-final grid to eliminate noise & promote smooth contour lines. This unmasked, unfiltered, unadjusted (for internal consistency (IC) violations) grid is saved as the next **predictor grid**.

In cases where x is not mean annual maximum (*Note: mean annual maximum is only used in the first iteration)*, check the **pre-final, filtered grid** for duration-based IC violations by making sure y is greater than the next lower duration final grid at the same frequency (e.g., 5y24h>5y12h). For grid cells that violate this rule, adjust y by setting the grid cell equal to the next lower duration plus 1%.

In cases where x is not mean annual maximum (*Note: mean annual maximum is only used in the first iteration.)*, check the **pre-final, filtered grid** for frequency-based IC violations by making sure y is greater than x (the next higher frequency final grid, e.g. 5y24h>2y24h). For grid cells that violate this rule, adjust y by setting the grid cell equal to the next higher frequency plus 1%. The result is the **final grid**.

If x & y represent upper and/or lower precipitation frequency bounds, then subject the grids to additional IC checks (e.g., make sure 5y24h upper > 5y24h).

If duration equals 60-minutes, calculate the n-minute (5-, 10-, 15- and 30-min) grids by applying the domain-wide 60-min to n-min ratios to the final grid.

Step 2: Development of *first guess grids*. The global linear regression relationship was then applied, using a Geographic Information System (GIS), to the *predictor grid* (e.g., 24-hour mean annual maximum) to establish a *first guess grid* (e.g., 2-year 24-hour) that was not necessarily equivalent to the *actual* estimates which were based on the unique RGF for each region.

Step 3: Development of spatially interpolated *residual grids*. To account for the regional differences, residuals (*actual* estimates minus *predicted* estimates) at each station were calculated. Here, *predicted* estimates (e.g., 2-year 24-hour) were those derived in the *first guess grid*. The residuals were normalized by the mean annual maximum to facilitate the interpolation of residuals to ungauged locations.

The normalized residuals at each station were then spatially interpolated to a grid using a modified version of the Geographic Resources Analysis Support System or GRASS© (GRASS, 2002) GIS inverse-distance-weighting (IDW) algorithm to produce a *normalized residual grid*. To achieve a smoothed result, the spatial resolution was reduced from 30-seconds to 1-minute before spatially interpolating the normalized residuals with the IDW algorithm. Sensitivity tests were conducted to determine the optimum resolution to avoid "over-smoothing" the normalized residuals which would cause the maps to deviate from the quantile estimates achieved through the L-moment analysis. The results were then re-sampled back to a 30-second resolution for the remainder of the process. The IDW method assumes the value at an unsampled point can be estimated as a weighted average of points within a certain distance or from a given number of m closest points; CRAB used the 12 closest points (i.e., m = 12). Weights are inversely proportional to the power of the distance in meters which at an unsampled point r = (x,y) is:

$$F(r) = \frac{\sum_{i=1}^{m} z(r_i) / |r - r_i|^p}{\sum_{j=1}^{m} 1 / |r - r_j|^p} \quad \text{(E.8, Neteler and Mitasova, 2002)}$$

where

$F(r)$ = interpolated precipitation at unsampled grid cell
z = precipitation at sample point
m = 12
p = 2
$r_{i,j}$ = location of sample point
r = location of unsampled grid cell.

The IDW was conducted in a geographic (i.e., latitude-longitude) projection with the distance between r and $r_{i,j}$ being computed in true distance (meters) units. IDW was used because by definition it is an exact interpolator and remained faithful to the *normalized residuals* at stations; this is important so that when the *normalized residuals* were converted back to *actual residuals* they were equal to the original *actual residual* at each station. Since there is a great deal of spatial autocorrelation of the *normalized residuals*, i.e. the *normalized residuals* tend to be spatially consistent within the regions, IDW was an adequate and appropriate interpolation scheme (see embedded map of normalized residuals in Figure 4.8.1).

The *normalized residual grid* was de-normalized by multiplying it by the original spatially interpolated mean annual maximum grid to obtain a spatially interpolated grid of *actual residuals* for the entire project area. Figure 4.8.3 shows the relationship between the 100-year 24-hour *actual* *residuals* and the 24-hour mean annual maximum estimates. Each linear cluster shown on this scatter plot represents stations within the same region that have varying 100-year 24-hour precipitation depths.

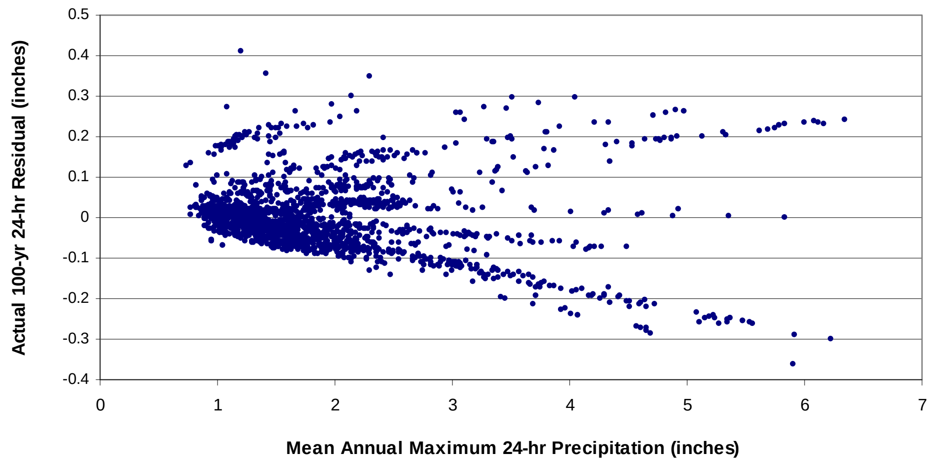


Figure 4.8.3. The relationship between the 100-year 24-hour *actual residuals* and the mean annual maximum precipitation from NOAA Atlas 14 Volume 1.

Step 4: Development of *pre-final grids*. The spatially interpolated grid of *actual residuals* was added to the *first guess grid* to create a spatially interpolated *pre-final* grid (e.g., 2-year 24-hour). To remove extraneous noise in the *pre-final grid* and encourage smooth contour lines, a 3x3 grid cell block average filter was applied. To prevent error propagation potentially introduced in the internal consistency adjustment steps (described in Step 5), the *pre-final grid* was archived and became the *predictor grid* for the next precipitation frequency grid derivation. For example, the *pre-final* 2-year 24-hour grid was used as the predictor for the 5-year 24-hour grid rather than the *final* 2-year 24-hour grid to remain faithful to the data and allow patterns to develop without any differences that may be introduced by adjustments and filters.

Step 5: Internal consistency check. To ensure internal consistency in the *pre-final* grid cell values, duration-based and frequency-based internal consistency checks were conducted. Frequency-based internal consistency violations (e.g., 100-year < 50-year) were very rare and when they did exist, they were small violations relative to the precipitation frequency estimates involved. Duration-based internal consistency violations (e.g., 24-hour < 12-hour) were more common, particularly between 120-minute and 3-hour, but again were small violations relative to the magnitude of precipitation frequency estimates. To mitigate internal consistency violations, the longer duration or rarer frequency grid cell value was adjusted by multiplying the shorter duration or lower frequency grid cell value by 1.01 to provide a 1% difference between the grid cells. One percent was chosen over a fixed factor to allow the difference to change according to the grid cell magnitudes while at the same time providing a minimal, but sufficient, adjustment without changing otherwise compliant data in the process. The duration-based check and adjustment was conducted first, resulting in a new pre-final grid, which was then subjected to the frequency-based check and adjustment. The resulting grid became the *final grid* for the particular frequency and duration (e.g., 2-year 24-hour).

Development of n-minute grids. Durations shorter than 60-minute (i.e., n-minute precipitation frequency estimates) were calculated using linear scaling factors applied to *final grids* of spatially interpolated 60-minute precipitation frequency estimates. Because there were so few n-minute stations in the project area, global ratios of n-minute to 60-minute estimates were averaged over the entire study area (Section 4.1.1). Using these ratios (listed again in Table 4.8.2), the *final* 60-minute *grids* were multiplied by the appropriate ratio to compute the appropriate n-minute grid. These ratios were used for all frequencies as well as both the n-minute upper- and lower- confidence limit grids.

Table 4.8.2. NOAA Atlas 14 Volume 1 n-minute ratios: 5-, 10-, 15- and 30-minute to 60-minute.

Duration	**5-minute**	**10-minute**	**15-minute**	**30-minute**
Ratio	0.318	0.484	0.600	0.808

Validation. The initial draft mean annual maximum, "index flood", grids for this Atlas, as well as the CRAB-derived 100-year 24-hour and 100-year 60-minute precipitation frequency grids were subjected to a peer-review (Appendix A.6). After considering and resolving all reviewer comments, final mean annual maximum grids were created by PRISM and the CRAB procedure re-run.

In addition, jackknife cross-validation allowed further, objective evaluation and validation of the precipitation frequency grids. The jackknife cross-validation exercise entailed running the CRAB procedure with a station in the dataset, storing the target grid cell value (at the station), then running CRAB without the station and comparing the target grid cell values. It was cost prohibitive to re-create the PRISM mean annual maximum grids for each cross-validation iteration. For this reason, the cross-validation results reflect the accuracy of the CRAB procedure based on the same mean annual maximum grids. The comparison was used to test the robustness and accuracy of the CRAB interpolation. A perfect validation would result in equal values – with and without the station. 100-year 60-minute results, which required the most interpolation to ungaged locations because of the low number of hourly stations, indicated that the CRAB process performed well (Figure 4.8.4). The primary message that Figure 4.8.4 conveys is the fact that, overall, CRAB did a good job reproducing the values in the absence of station data. The figure also indicates that there was a greater tendency for CRAB to slightly under-predict the precipitation frequency value at a location in a station's absence.

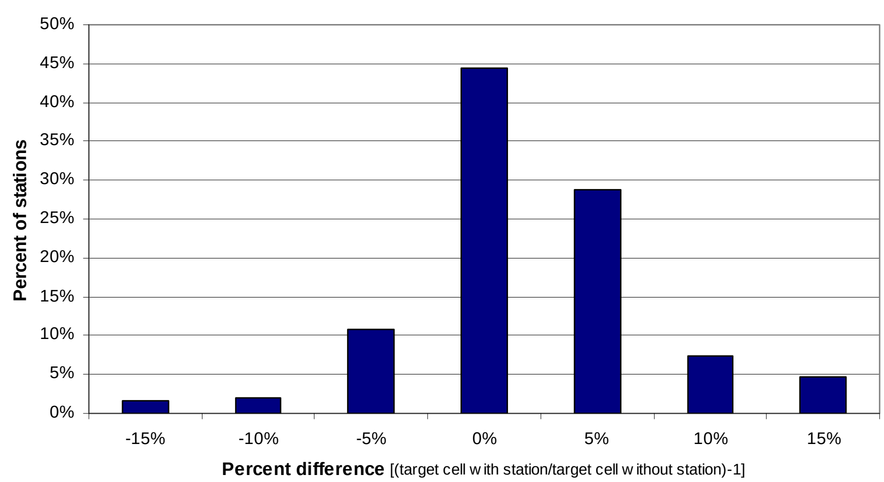


Figure 4.8.4. NOAA Atlas 14 Volume 1 100-year 60-minute jackknife cross-validation results.

Derivation of upper/lower limit precipitation frequency grids

The upper and lower limit precipitation frequency grids were also derived using the CRAB procedure. Testing suggested that the best method by which to derive the upper/lower limit grids was to use the preceding upper (or lower) grid as the *predictor grid* and *normalizing grid* for the upper/lower limit grid being derived, as opposed to using the corresponding mean precipitation frequency grid. Although the upper (lower) limit precipitation frequency estimates were slightly less stable than the mean grids, they still exhibited strong linear relationships with the previous (*predictor*) grid. The appropriate (i.e., same duration) mean annual maximum grid (PRISM-produced "index flood") was used as the initial *predictor grid* for the 2-year upper and lower limit precipitation frequency estimate grids. Figure 4.8.5 shows a scatter plot of the 24-hour mean values versus the 2-year 24-hour upper limit precipitation frequency estimates.

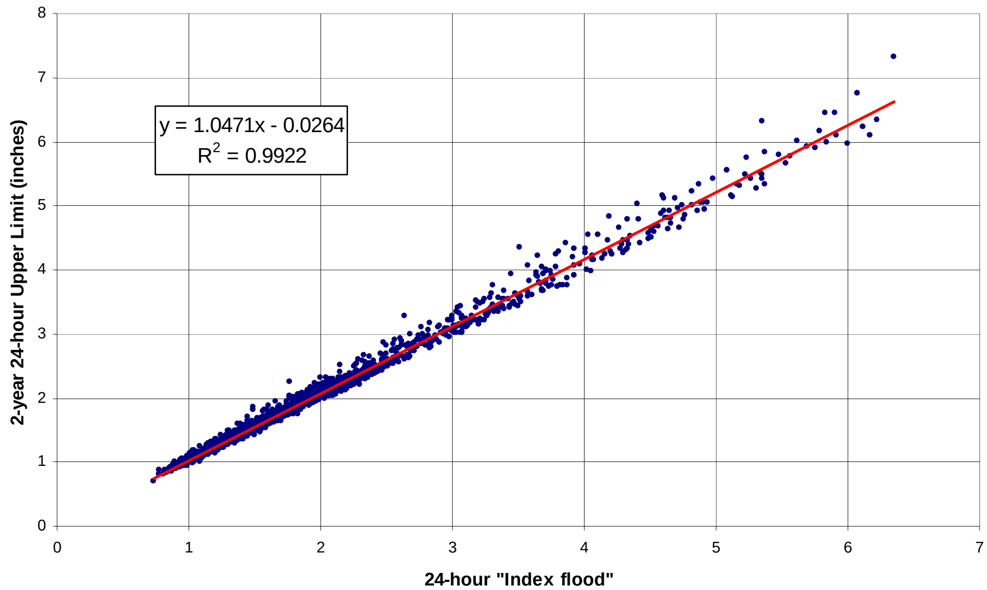


Figure 4.8.5. Scatter plot of the 24-hour mean precipitation frequency estimates vs. the 2-year 24-hour upper limit showing a coefficient of determination of 0.9922 in NOAA Atlas 14 Volume 1.

Similar to the precipitation frequency estimate grids, the upper and lower limit grids were evaluated and adjusted for internal consistency. Although very rare, duration-based adjustments were made to ensure the upper (lower) limit grid cell values were larger (smaller) than the mean values. In the event of a violation (e.g., 100-year 60-minute < 100-year 60-minute lower limit) the upper (lower) limit grid was adjusted up (down) by 1% of the mean grid. Like the precipitation grids, frequency-based or duration-based adjustments were made when needed. To mitigate any internal consistency violations, the longer duration or rarer frequency grid cell value was adjusted by multiplying the shorter duration or lower frequency grid cell value by 1.01 to provide a 1% difference between the grid cells.

4.8.3. Pseudo data

Since each duration was computed independently, it was possible for inconsistencies from duration to duration at a given location to occur. In the spatial interpolation, this was a particular concern at hourly-only and daily-only station locations. However, such inconsistencies were rare.

At hourly-only station locations, inconsistencies could occur because calculated 60-minute through 48-hour estimates anchored the interpolation while 4-day through 60-day estimates at those locations were computed during the spatial interpolation process that was based on estimates at nearby daily stations. During the evaluation phase of the grids, HDSC discovered 6 cases where inconsistencies in the precipitation frequency estimates from 48-hour to 4-day were identified. Each of the cases was resolved after reviewing the observed data and the behavior of nearby stations. In some cases it was clear that the 48-hour data derived from the hourly observations was less reliable than that derived from the daily observations. In these cases, the 48-hour point estimates were removed and instead estimated by spatial interpolation. In the remaining cases, the patterns were not inconsistent with possible climatologies in the area and thus were retained.

Likewise, there were 21 cases where inconsistencies arose at daily-only station locations because calculated 24-hour through 60-day estimates anchored the interpolation while 60-minute through 12-hour estimates at those locations were computed during the spatial interpolation process that was based on estimates at nearby hourly stations. In these 21 cases, the ≤ 12-hour interpolated precipitation frequency estimates were considerably lower and inconsistent with the surrounding calculated ≥ 24-hour precipitation frequency estimates. This caused unreasonable changes in the precipitation frequency estimates from 12-hours to 24-hours at those locations.

These cases were objectively identified using grids that indicated the difference between the 100-year 12-hour and 100-year 24-hour precipitation frequency estimates. By using these grids, spatial artifacts were differentiated from climatologically-driven patterns. In general, if the difference between the 100-year 12-hour and 100-year 24-hour grid cell value was ≥ 1.40”, the daily-only stations in that area were scrutinized. The 21 locations with such inconsistencies were identified and verified for data accuracy. These locations were primarily in desert locations, particularly in southwestern Arizona.

Table 4.8.3. Hourly pseudo stations used in the preparation of NOAA Atlas 14 Volume 1.

Station ID	Station Name	State
02-2434	DATELAND WHITEWING RCH	AZ
02-4702	KOFA MINE	AZ
02-5627	MOHAWK	AZ
02-8396	TACNA 3 NE	AZ
02-9211	WELLTON	AZ
02-9652	YUMA CITRUS STATION	AZ
02-9654	YUMA PROVING GROUND	AZ
02-9656	YUMA QUARTERMASTER DEPOT	AZ
02-9657	YUMA VALLEY	AZ
02-9662	YUMA WB CITY	AZ
04-2319	DEATH VALLEY	CA
04-2504	DOYLE	CA
04-2506	DOYLE 4 SSE	CA
04-3489	GOLD ROCK RANCH	CA
04-3710	HAIWEE	CA
04-9671	WILDROSE R S	CA
26-0150	AMARGOSA FARMS GAREY	NV
26-6691	RED ROCK CANYON ST PK	NV
29-1138	BOSQUE DEL APACHE	NM
42-2607	ESKDALE PSEUDO	UT
42-5733	MOAB RADIO	UT

So-called pseudo data were used to mitigate the inconsistencies at these 21 locations. Table 4.8.3 lists the hourly pseudo stations generated for this Atlas. The creation of pseudo hourly precipitation frequency estimates was similar to the approach used to alleviate 12-hour to 24-hour inconsistencies at co-located stations (Section 4.6.3). The pseudo precipitation frequency estimates were generated by applying a ratio of x-hour estimates to 24-hour estimates that was spatially interpolated using GRASS©'s inverse-distance-weighting algorithm (GRASS, 2002), which is shown in Section 4.8.2, based on only co-located daily/hourly stations. The ratio at each co-located station was calculated using the station's 24-hour precipitation frequency estimate to its x-hour precipitation frequency estimate. The interpolated ratio was then applied to the daily-only 24-hour precipitation frequency estimates to generate the pseudo hourly data at that station location. The mitigation provided a smoother, more meteorologically-sound transition from hourly to daily precipitation frequency estimates.

Tests showed that creating pseudo hourly data for daily-only stations that did not exhibit a large difference from 12-hour to 24-hour resulted in nearly identical precipitation frequency estimates before and after the inclusion of pseudo data. Pseudo data were not added to stations that did not need it or at ungauged locations. Locations where an inconsistency between 12-hour and 24-hour estimates could not be expressly proved were assumed accurate based on climate and not mitigated. Pseudo data were used only where deemed absolutely necessary to produce consistent results.

4.8.4. Derivation of isohyetals of precipitation frequency estimates

Isohyetal (contour) GIS files were created from the grids of partial duration series based precipitation frequency estimates for users with geographical information systems (GISs). The isohyetals are provided as Environmental Systems Research Institute, Inc. line shapefiles (ESRI, 2003). The isohyetals were created by contouring the grid files with GRASS©'s r.contour command (GRASS, 2002). The resulting files were when exported as shapefiles with GRASS©'s v.out.shapefile command (GRASS, 2002). In order to keep the isohyets and grids consistent, no line generalization or smoothing was conducted. The precision and resolution of the grids were sufficiently high to result in smooth contour lines.

The choice of contour intervals was determined by an algorithm which used the maximum, minimum and range of grid cell values. The number of individual contour intervals was constrained between 10 and 30; however, some of the n-minute grids did not exhibit the range necessary to meet the 10 interval threshold and therefore have fewer than 10. All of the intervals are evenly divisible by 0.10 inches – the finest interval. A script that computed the appropriate contour intervals and shapefiles also generated Federal Geographic Data Committee compliant metadata for the shapefiles and a "fact" file. The HTML-formatted fact file provides details of the shapefile and also includes a list of the contour intervals. To simplify the downloading of the isohyetal shapefiles from the Precipitation Frequency Data Server (PFDS), all of the shapefile components (*.shp, *.dbf, and *.shx, *.prj), metadata and fact file were compiled and compressed into a single archive file containing many files (*.tar). For projection, resolution and other details of the shapefiles, please refer to the metadata and/or fact file.

The isohyetal shapefiles were created to serve as visual aids and are not recommended for interpolating final point or area precipitation frequency estimates for design criteria. Users are urged to take advantage of the grids or the Precipitation Frequency Data Server user interface for accessing final estimates.

4.8.5. Creation of color cartographic maps

The isohyetal shapefiles were used to create color cartographic maps of the partial duration series-based precipitation frequency grids. The maps were created using Environmental Systems Research Institute, ArcGIS© 8.3 software, in particular ArcMap© (ESRI, 2003). Although in appearance the cartographic maps look to be comprised of polygons, enclosed two-dimensional cells, they are not. Instead, color shading of the grids combined with the line shapefiles provides the clean look of polygons. The cartographic maps are provided in an Adobe Portable Document format (PDF) format for easy viewing and printing. The scale of the maps is 1:2,000,000 when printed in their native size, 15.5” x 21.5” (same size as the NOAA Atlas 2 maps), however the maps can be printed at any size. Users should be mindful that future maps and/or other projects may be in different scales or print sizes.

The color cartographic maps were created to serve as visual aids and, unlike NOAA Atlas 2, are not recommended for interpolating final point or area precipitation frequency estimates for design criteria. Users are urged to take advantage of the Precipitation Frequency Data Server user interface for accessing estimates.

5. Precipitation Frequency Data Server

5.1. Introduction

NWS precipitation frequency estimates have traditionally been delivered in the form of Weather Bureau Technical Papers and Memoranda as well as NOAA Atlases. These are hard copy (i.e., paper) documents.

NOAA Atlas 14 precipitation frequency estimates are now delivered entirely in digital form rather than hard copy form in order to make the estimates more widely available and to provide the data in a broader and more accessible range of formats. The National Weather Service specifically developed the Precipitation Frequency Data Server (PFDS) as the primary web portal for precipitation frequency estimates and associated information (Parzybok and Yekta, 2003). The PFDS is an easy to use, point-and-click interface for official NOAA/NWS precipitation frequency estimates and intensities. It is based on work done for the Alabama Rainfall Atlas (Durrans and Brown, 2002). The PFDS can be found at http://hdsc.nws.noaa.gov/hdsc/pfds/.

5.2. Underlying data

The PFDS operates from a large set of ASCII grids of precipitation frequency estimates. There are a total of 540 grids for NOAA Atlas 14 Volume 1: 180 for the precipitation frequency estimates and 180 each for the lower and upper bounds of the 90% confidence limits of the estimates. Table 5.2.1 shows the complete table of average recurrence intervals (1-year to 1,000-year) and durations (5-minutes to 60-days) available from the PFDS for any particular location.

Table 5.2.1. Average recurrence intervals (ARI) (1-year to 1,000-year) and durations (5-minutes to 60-days) available from the PFDS for any particular location for estimated precipitation frequency estimates as well as upper (and lower) limit precipitation frequency estimates.

Duration \ ARI	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1,000-yr
5-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
120-minute	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
24-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
48-hour	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
45-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60-day	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The PFDS operates directly from ArcInfo© (ESRI, 2003) ASCII Grids. The same grids can be downloaded from the website and imported into a Geographical Information System (GIS). The

ASCII grids, which represent the official precipitation frequency estimates, have the following pertinent metadata:

- Resolution: 30-seconds (about 0.5 mile x 0.5 mile)
- Units: inches*1000 (integer)
- Projection: Geographic (longitude/latitude)
- Datum: WGS 1972
- No data value: -9999

The PFDS operates with conventional web-tools, including cgi-bin (Perl) scripts, JAVAScript and one C program. The main cgi-bin script is activated when a user selects a location, either by manually entering a longitude/latitude coordinates, selecting a station, or clicking a location on the state map. The cgi-bin script develops a comprehensive output web page on the fly.

5.3. Methods

Since the PFDS is not an Internet Map Server (IMS), a so-called "information" function had to be coded so that when provided a longitude/latitude coordinate, the PFDS could return the appropriate precipitation frequency estimates. "Getcell," a fast-running, C-compiled program, was written to accomplish this simple, yet crucial function. "Getcell" uses the header information provided in the ArcInfo© ASCII Grid and the supplied longitude-latitude coordinate to calculate the x and y location of the desired grid cell within the grid matrix. The output is the grid cell value.

The 30-second (about 0.5 mile by 0.5 mile) resolution of the underlying grids is more than adequate to provide accurate point estimates. Using the PFDS, a point can be selected by a number of ways:

- Clicking on the map
- Manually entering a longitude/latitude coordinate
- Selecting a station from a pull-down list
- Entering an area.

5.4. Output

After the web server has successfully extracted all 486 precipitation frequency and confidence limit estimates from the underlying grids, an output web page is built and displayed on-the-fly. There are two basic types of output: Depth-Duration-Frequency (DDF) and the Intensity-Duration-Frequency (IDF). Both outputs are based on the same data, but presented differently. The PFDS provides DDF graphs in two formats to provide a complete perspective of the data (Figure 5.4.1, 5.4.2). An example of the classic IDF graph, which is widely used in engineering applications, is shown in Figure 5.4.3.

The output pages also consist of data tables of the precipitation frequency depths (or intensities) and tables of the lower and upper bounds of the 90% confidence limits. These can also be downloaded as text via a button on the output page. In addition, location maps and helpful links are provided. Embedded maps on the output page are provided by a hyperlink to the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server (http://tiger.census.gov/cgi-bin/mapbrowse-tbl). The graphs (portable network graphics or ".png" format) are produced using gnuplot (http://www.gnuplot.info), while the remainder of the page is basic HTML.

Additionally, seasonal exceedance graphs are provided via a button on the output page. Exceedance graphs indicate the percentage of events exceeding the corresponding annual exceedance probability for the specified duration (Appendix A.2). The purpose of the graphs is to portray the monthly seasonality of extreme precipitation events. See Figure 5.4.4 for an example. The percentages are based on regional statistics and the seasonal graphs are unique for each region. The number of stations and cumulative years of record are provided in the graph title to provide the user a sense of the amount of data used and therefore the reliability of the results. Durations include:

- 60-minute
- 24-hour
- 48-hour
- 10-day

Volume Update (3/31/2011). With the release of NOAA Atlas 14 Volume 6, the PFDS web interface was enhanced. Enhancements include the addition of functionality with Google Maps, improved format and increased download speed.

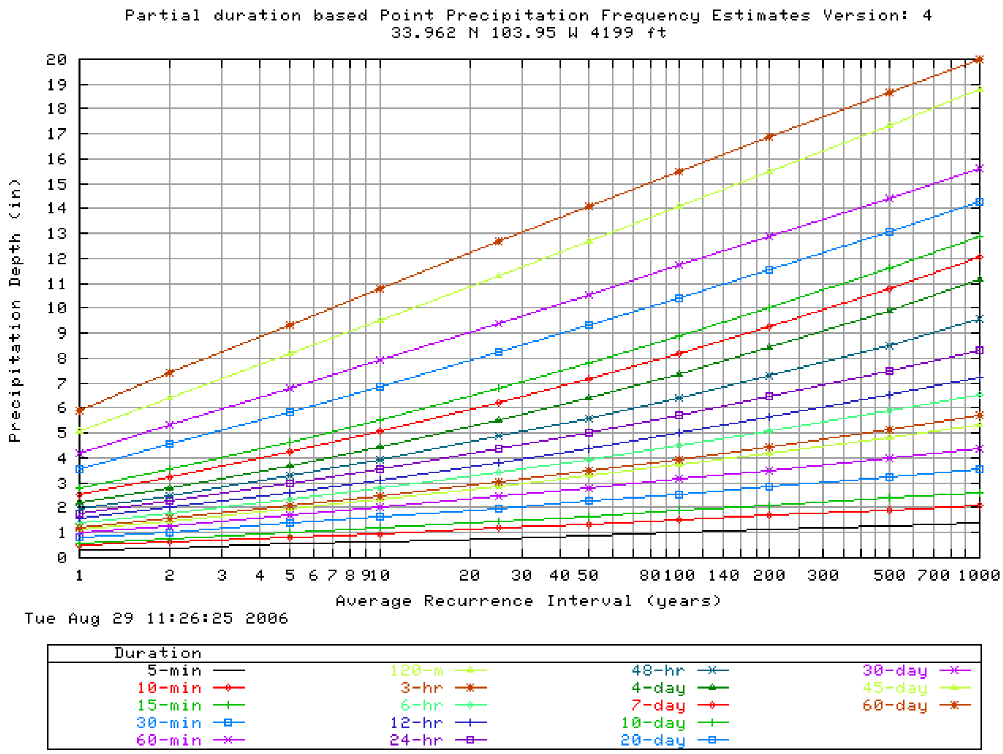


Figure 5.4.1. Sample depth-duration frequency plot with average recurrence interval on the x-axis.

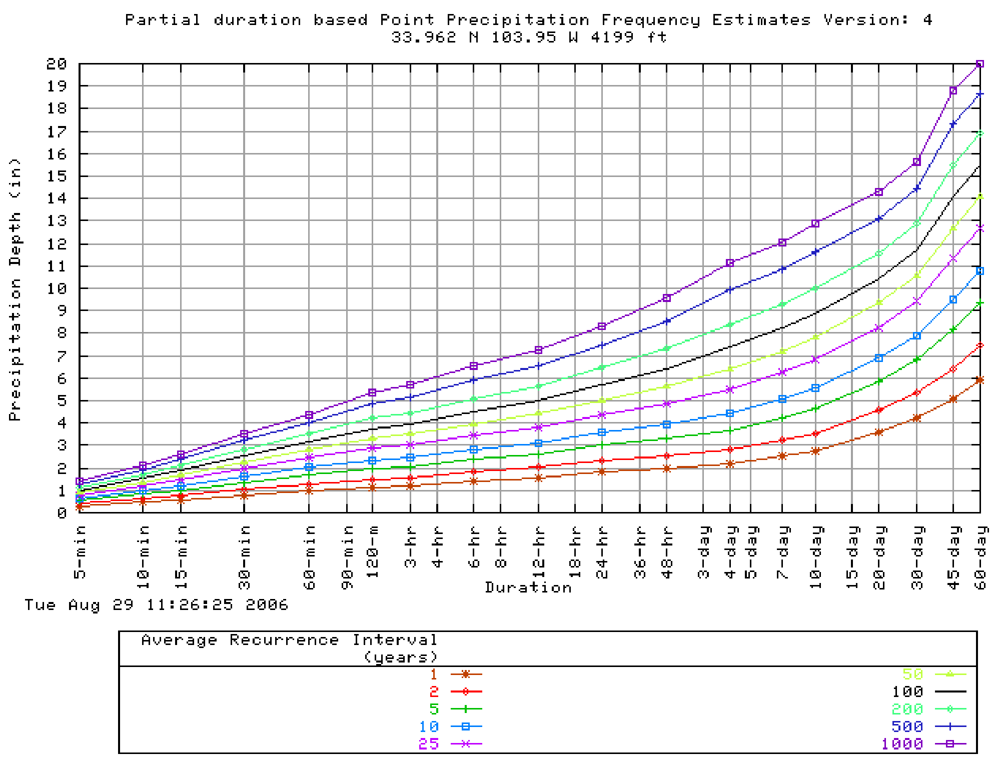


Figure 5.4.2. Sample depth-duration frequency plot with duration on the x-axis.

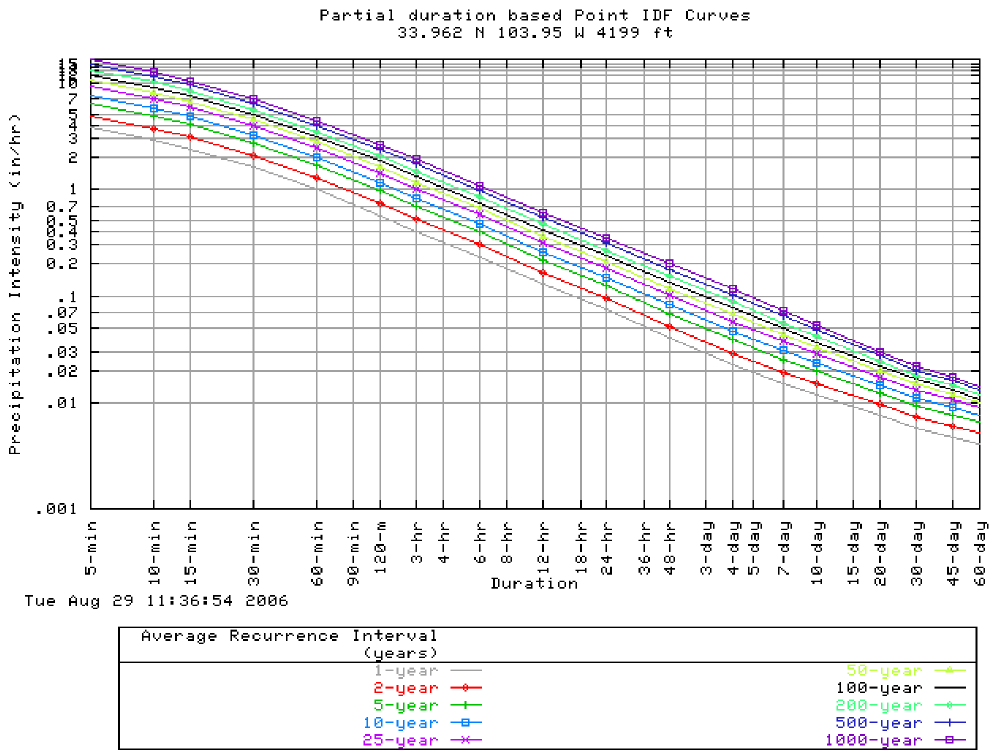


Figure 5.4.3. Sample intensity-duration-frequency (IDF) plot.

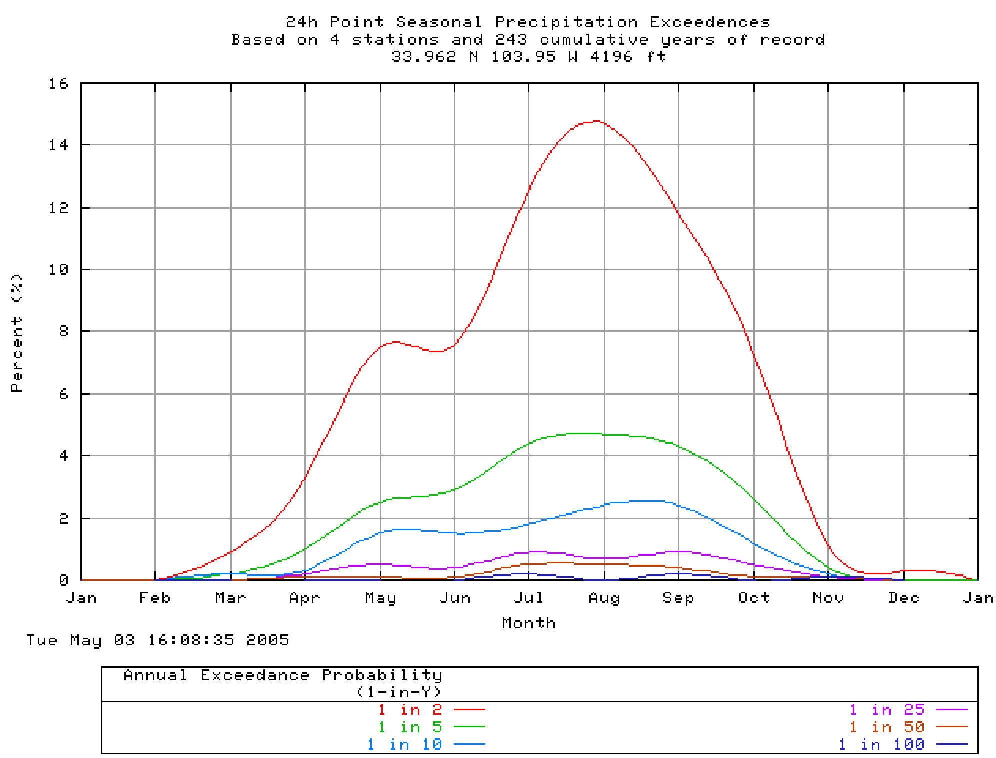


Figure 5.4.4. Sample 24-hour seasonal exceedance graph.

5.5. Using the Precipitation Frequency Data Server

The PFDS homepage (http://hdsc.nws.noaa.gov/hdsc/pfds/) has a clickable map of the United States. States with available precipitation frequency updates are indicated. Upon clicking on a state, a state-specific web page appears. From this page the user selects the desired location, units, and output via a web form.

The PFDS is also the portal for all NOAA Atlas 14 data formats, including:

- **Cartographic maps**
  These color maps were created to serve as visual aids and are not recommended for interpolating final point or area precipitation frequency estimates for design criteria. It is strongly recommended that point and areal values be obtained from the PFDS interface which accesses its data directly from the grids. These maps were based on contour lines (available as shapefiles from the PFDS) created from the final precipitation frequency estimate grids (Section 4.8.5). Figure 5.5.1 shows an excerpt from a cartographic map.

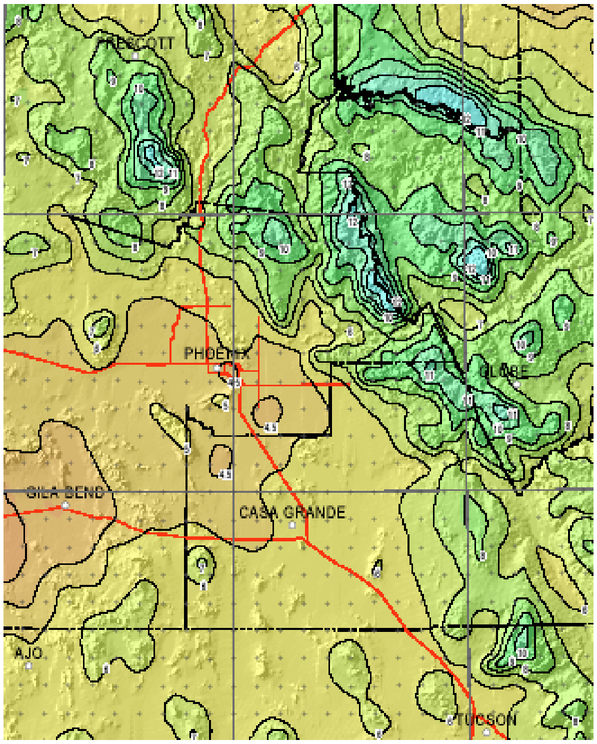


Figure 5.5.1. An excerpt of a cartographic map available from the PFDS.

- **GIS data**
  - Shapefiles (lines, vectors)
    These are the same files used to create the cartographic maps and are recommended for visual aids only.

- ArcInfo© ASCII grids
  These grids represent the highest resolution precipitation frequency estimates from which all other formats are derived.

- **Time Series (annual maximum and partial duration series)**
  The final high quality annual maximum series (AMS) and partial duration series (PDS) datasets used in the preparation of NOAA Atlas 14 Volume 1 are available at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_series.html. Information regarding their extraction can be found in Section 4.1.3.

- **Temporal distributions of heavy rainfall**
  This report is available via a link (http://hdsc.nws.noaa.gov/hdsc/pfds/docs/NA14Vol1_A1.pdf) on the PFDS web site and in Appendix A.1 of this document. The report provides information about the temporal distribution of heavy precipitation for use with precipitation frequency estimates in NOAA Atlas 14 Volume 1. Temporal distributions for 6-, 12-, 24- and 96-hour durations are available.

- **Documentation**
  The complete NOAA Atlas 14 Volume 1 documentation is available via links on the PFDS web site.

It is strongly advised that users review the Federal Geographic Data Committee (FGDC) compliant metadata before using any of the GIS datasets. On-line help and frequently-asked questions (FAQ) are also available via links on the PFDS web site.

Questions regarding the use of the PFDS or its data can be addressed by emailing HDSC.Questions@noaa.gov or visiting the inquiry web site, http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_contact.html.

6. Peer Reviews

Peer Reviews were conducted for the preliminary point precipitation frequency estimates, preliminary spatially interpolated estimates and the Precipitation Frequency Data Server (PFDS). Nearly 100 users, project sponsors and other interested parties were contacted via email for the reviews. The reviews provided critical feedback that HDSC used to create a better product.

The point precipitation frequency estimates were reviewed along with the newly deployed PFDS (Section 5) during a one month period. The majority of comments pertained to the PFDS, which were easily resolved software with changes or fixes. The most significant data-related issues included: unusual steps or changes in slope in the depth-duration-frequency curves and significant differences between precipitation frequency estimates and observed storm events. Similar issues/comments were grouped together and were accompanied by a single HDSC response. Reviewer comments and HDSC responses can be found in Appendix A.5. Further investigation and modification occurred subsequent to the initial responses.

A 6-week peer review of the spatial distribution focused on a subset of maps. For review purposes, draft 60-minute and 24-hour mean annual maximum grids were produced using PRISM. CRAB was then used to derive 100-year 60-minute and 100-year 24-hour grids from the PRISM grids. Both sets of grids were converted into cartographic maps in a PDF format for review. Reviewer comments and HDSC responses to the spatial review can be found in Appendix A.6. Further investigation and modification occurred subsequent to the initial responses.

During the reviews, some reviewers indicated the availability of additional data for the project, particularly in cases where it justified a reviewer-requested change in either the magnitude or spatial patterns of the draft precipitation frequency estimates. Several reviewers supplied additional quality-controlled precipitation datasets to the database. They include:

- Hourly data in the Albuquerque, New Mexico area provided by the USGS.
- Hourly ALERT data for Maricopa County, Arizona provided by the Flood Control District of Maricopa County.
- Hourly data for Riverside County, California provided by the Riverside County Flood Control District.

7. Interpretation

Point and areal estimates. The precipitation frequency estimates in this Atlas are point estimates, that is, estimates of precipitation frequency at a point location, not for an area. The conversion of point to areal estimates must take into account that, all other things being equal, as the area increases, the intensity decreases. This is done by applying an areal reduction factor (ARF) to the point estimates that are provided in this Atlas. Precipitation frequency estimates for areas can be computed by obtaining an average of the point values at all locations within the subject area and then multiplying that average by the appropriate areal reduction factor. Areal reduction factors have been published in previous publications: Technical Report 24 (Meyers and Zehr, 1980), Technical Memorandum HYDRO-40 (Zehr and Meyers, 1984), NOAA Atlas 2, etc. At the time of this publication there is a companion project to update previously developed areal reduction factors.

Independence. Precipitation is highly variable both spatially and temporally, however within any particular storm event, point observations have a degree of correlation. The methods used to develop the point precipitation frequency estimates for this Atlas assume independence between the annual maxima analyzed and so the individual estimates in this Atlas express independent, point probabilities. That a point within a particular watershed may receive an amount equal to or greater than its 1 in 50 or 1 in 100 values at a particular time does not affect probabilities for any other point within that watershed.

Annual Exceedance Probability (AEP) and Average Recurrence Interval (ARI).
As discussed in Section 3.2 and throughout this document, AEP is the probability that a particular level of rainfall will be exceeded in any particular year (at a particular location and duration) and is derived using the annual maximum series. An AEP depth or intensity may be exceeded once or more than once in a year. ARI is the average period between each exceedance and is derived for the partial duration series. As a result, the inverse of AEP is not ARI as is commonly assumed. Rather, the inverse of AEP is the average period between years with exceedances (Laurenson, 1987). One can convert between annual maximum and partial duration series results by using the ratio between partial duration and annual maximum results discussed in Section 4.6.4. This ratio approaches 1.0 for ARIs greater than about 25 years and so becomes significant only for values with ARIs less than about 25 years.

Exceedances. A certain number of exceedances can be statistically expected at a given station. For example, a rainfall with an AEP of 1 in 100 has a 1% chance of being exceeded approximately once in any given year at a particular station. When considering multiple stations that are sufficiently far apart to satisfy independence, the chance of observing such an event is directly proportional to the number of stations. For example, in the case of the 1 in 100 rainfall one can expect to observe approximately 10 such events each year in a network of 1,000 independent observing stations.

Use of confidence limits. Confidence limits provide users with an estimate of the uncertainty or potential error associated the precipitation frequency estimates. The error bounds about the precipitation frequency estimates and the probabilistic temporal distributions (Appendix A.1) enable designers to include estimations of error in the calculations by using Monte Carlo based ensemble modeling to estimate flow, rather than just applying a single value estimate.

Spatially interpolated confidence limits are provided with this Atlas. They were derived using the CRAB spatial derivation procedure (Section 4.8.2). The confidence limits are a function only of the error associated with the point precipitation frequency estimation and do not include error that may be associated with the spatial interpolation process.

Climate change. The current practice of precipitation (and river height and flow) frequency analysis makes the implicit assumption that past is prologue for the future. Rainfall frequency distribution characteristics are extracted from the historical record and the estimates are applied in the design of future projects assuming the climate will remain the same as it was during the period of the analyzed record. If the climate changed in the past, then the characteristics extracted are an "average" for the analyzed period, not specifically representing the period before the change or after the change. Furthermore, if the climate changes in the future, there is no guarantee that the characteristics extracted are suitable for representing climate during the future lifecycle of projects being designed. There has been considerable research done regarding climate change and precipitation. NOAA's National Weather Service conducted an analysis of shifts and trends in the NOAA Atlas 14 Volume 1 1-day annual maximum series data (Appendix A.3). Results suggested little consistent observable effects of climate change on the annual maximum series and therefore on parameters used for this Atlas. As such, NOAA's National Weather Service has assumed that the full period of the available historical record derived from rain gauges was suitable for use in this analysis even though there were some local instances of linear trends and shifts in mean in the data.

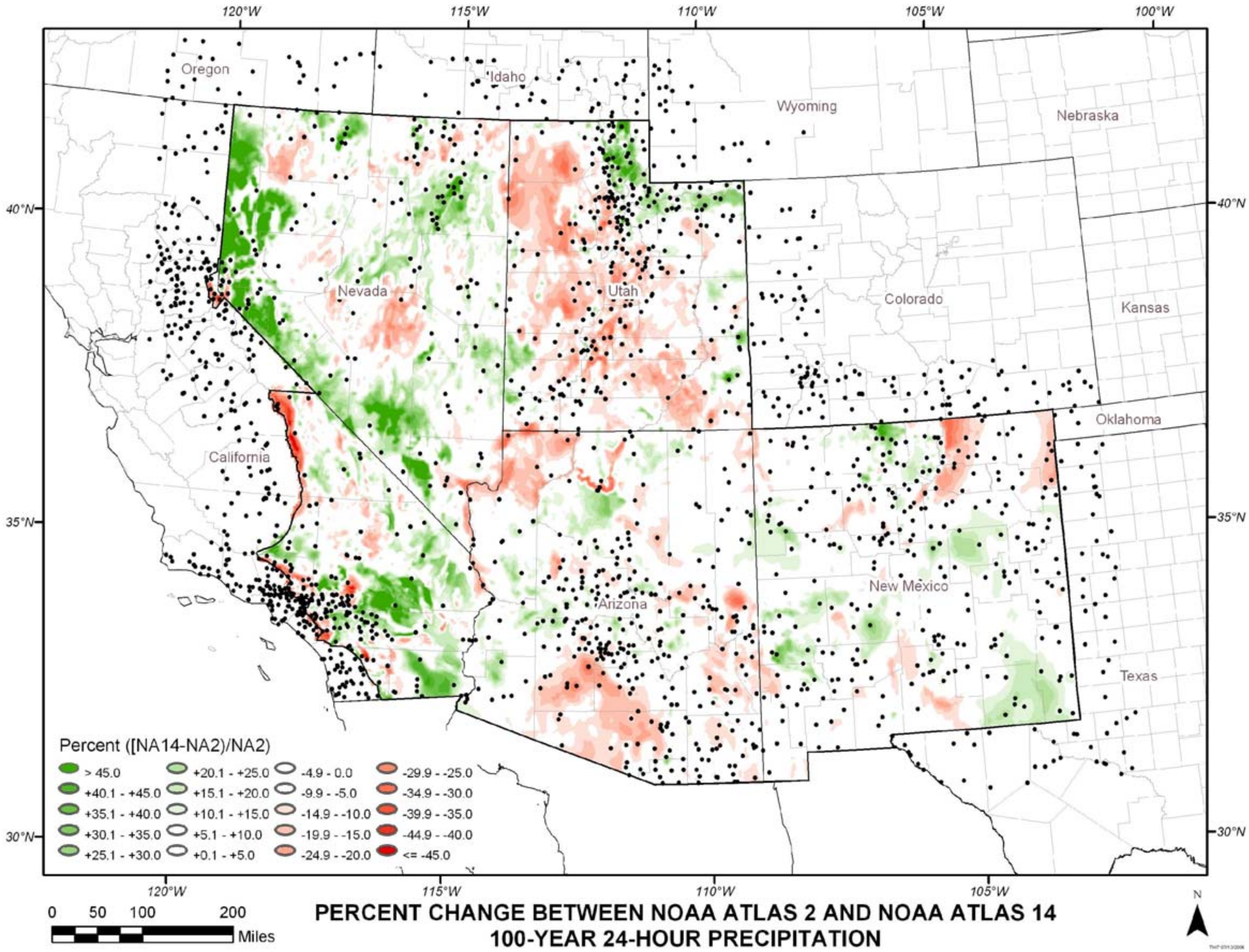
Comparison with NOAA Atlas 2. In general, reasons for differences between the NOAA Atlas 14 precipitation frequency estimates and NOAA Atlas 2 estimates include longer records of data, more stations and greater effectiveness of new statistical procedures, including an objective spatial analysis. Figure 7.1 shows the percent differences between NOAA Atlas 14 Volume 1 and NOAA Atlas 2 for 100-year 24-hour estimates. The largest differences are in mountain areas where the NOAA Atlas 2 analysis did not have data.

Differences between NOAA Atlas 14 and NOAA Atlas 2 results have been carefully considered. Areas of difference that were greater than 30% were investigated and found justified by the increased data availability, sound regionalization and statistical robustness used in these areas. "Differences" in this context refers to differences in the mean of the estimates. Because NOAA Atlas 14 is the first NWS publication to include confidence limits, a comparison of the confidence limits with previous publications was not possible. It should be noted from the width of the confidence limits that the errors associated with the estimates are not insignificant. It should also be noted that the confidence limits associated with NOAA Atlas 14 estimates are likely much narrower than in previous publications because of improvements in estimating techniques. In many cases, the mean estimates from previous publications, while different from NOAA Atlas 14, still fall within the confidence limits of NOAA Atlas 14.

Estimates were peer reviewed and careful consideration was given to reviewer comments. Often the analysis was modified to accommodate reviewer suggestions or additionally provided data. Appendices A.5 and A.6 provide reviewer comments and NWS initial responses to those comments. Further investigation was conducted subsequent to the initial responses to satisfactorily resolve reviewer concerns.

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California. The Volume 1 Version 5.0 Addendum illustrates differences between Version 4.0 and Version 5.0 for published areas.

Figure 7.1. Differences between NOAA Atlas 14 and NOAA Atlas 2 estimates.



Appendix A.1. Temporal distributions of heavy precipitation associated with NOAA Atlas 14 Volume 1

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

1. Introduction

Temporal distributions of heavy precipitation are provided for use with precipitation frequency estimates from NOAA Atlas 14 Volume 1 for 6-, 12-, 24- and 96-hour durations covering the semiarid southwestern United States. The temporal distributions are expressed in probabilistic terms as cumulative percentages of precipitation and duration at various percentiles. The starting time of precipitation accumulation was defined in the same fashion as it was for precipitation frequency estimates for consistency.

The project area was divided into two sub-regions based on the seasonality of observed heavy precipitation events. Figure A.1.1 shows the areal divisions for the temporal distribution regions.

Temporal distributions for each duration are presented in Figures A.1.2 and A.1.3. The data were also subdivided into quartiles based on where in the distribution the most precipitation occurred in order to provide more specific information on the varying distributions that were observed. Figures A.1.4 through A.1.11 depict temporal distributions for each quartile for the four durations. Digital data to generate all temporal distribution curves are available at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_temporal.html. Table A.1.1 lists the number and proportion of cases in each quartile for each duration and region.

2. Methodology. This project largely followed the methodology used by the Illinois State Water Survey (Huff, 1990) except in the definition of the precipitation accumulation. This project computed precipitation accumulations for specific (6-, 12-, 24- and 96-hour) time periods as opposed to single events or storms in order to be consistent with the way duration was defined in the associated precipitation frequency project. As a result, the accumulation cases may contain parts of one, or more than one precipitation event. Accumulation computations were made moving from earlier to later in time resulting in an expected bias towards front loaded distributions when compared with distributions for single storm events.

The General and Convective Precipitation Areas (Figure A.1.1) were established using factors set forth in previous work (Gifford *et al.*, 1967; NOAA, 1989), including the seasonality of maximum precipitation and event types. Maximum events in the General Precipitation Area were dominated by cool season precipitation while maximum events in the Convective Precipitation Area occurred in the warm season.

For every precipitation observing station in the project area that recorded precipitation at least once an hour, the three largest precipitation accumulations were selected for each month in the entire period of record and for each of the four durations. A minimum threshold was applied to make sure only heavier precipitation cases were being captured. The precipitation with an average recurrence interval (ARI) of 2 years at each observing station for each duration was used as the minimum threshold at that station.

A minimum threshold of 25-year ARI was tested. It was found to produce results similar to using a 2-year ARI minimum threshold. The 25-year ARI threshold was rejected because it reduced the number of samples sufficiently to cause concern for the stability of the estimates.

Each of the accumulations was converted into a ratio of the cumulative hourly precipitation to the total precipitation for that duration, and a ratio of the cumulative time to the total time. Thus, the last value of the summation ratios always had a value of 100%. Within the General Area, and separately within the Convective Precipitation Area, the data were combined, cumulative deciles of precipitation were computed at each time step, and then results were plotted to provide the graphs presented in Figures A.1.2 and A.1.3. The data were also separated into categories by the quartile in which the greatest percentage of the total precipitation occurred and the procedure was repeated for each quartile category to produce the graphs shown in Figures A.1.4 through A.1.11. A moving window weighted average smoothing technique was performed on each curve.

3. Interpreting the Results

Figures A.1.2 and A.1.3 present cumulative probability plots of temporal distributions for the 6-, 12-, 24- and 96-hour durations for the General and the Convective Precipitation Areas. Figures A.1.4 through A.1.11 present the same information but for categories based on the quartile of most precipitation. The x-axis is the cumulative percentage of the time period. The y-axis is the cumulative percentage of total precipitation.

The data on the graph represent the average of many events illustrating the cumulative probability of occurrence at 10% increments. For example, the 10% of cases in which precipitation is concentrated closest to the beginning of the time period will have distributions that fall above and to the left of the 10% curve. At the other end of the spectrum, only 10% of cases are likely to have a temporal distribution falling to the right and below the 90% curve. In these latter cases the bulk of the precipitation falls toward the end of the time period. The 50% curve represents the median temporal distribution on each graph.

First-quartile graphs consist of cases where the greatest percentage of the total precipitation fell during the first quarter of the time period, i.e., the first 1.5 hours of a 6-hour period, the first 3 hours of a 12-hour period, etc. The second, third and fourth quartile plots, similarly are for cases where the most precipitation fell in the second, third or fourth quarter of the time period.

The time distributions consistently show a greater spread, and therefore greater variation, between the 10% and 90% probabilities as the duration increases. Longer durations are more likely to have captured more than one event separated by drier periods; however, this has not been objectively tested as the cause of the greater variation at longer durations. The median of the distributions gradually becomes steeper at longer durations. The cases of the Convective Precipitation Area had steeper gradients than the cases of the General Precipitation Area for all durations and quartiles.

The following is an example of how to interpret the results using Figure A.1.8a and Table A.1.1. Of the 1,728 cases in the General Precipitation Area, 630 of them were first-quartile events:

- In 10% of these cases, 50% of the total rainfall (y-axis) fell in the first 1.8 hours of event time (7.5% on the x-axis). By the 12th hour (50% on the x-axis), all of the precipitation (100% on the y-axis) had fallen.
- A median case of this type will drop half of its total rain (50% on the y-axis) in 5.4 hours (22.5% on the x-axis).
- In 90 percent of these events, 50% of the total precipitation fell by 10.2 hours (42.5% on the x-axis).

4. Application of Results

Care should be taken in the use of these data. The data are presented in order to show the range of possibilities and to show that the range can be broad. The data should be used in a way that reflects the goals of the user. For example while all cases represented in the data will preserve volume, there will be a broad range of peak flow that could be computed. In those instances where peak flow is a critical design criterion, users should consider temporal distributions likely to produce higher peaks rather than the 50^{th} percentile or median cases, for example. In addition, users should consider whether using results from one of the quartiles rather than from the "all cases" sample might achieve more appropriate results for their situation.

5. Summary and General Findings

The results presented here can be used for determining temporal distributions of heavy precipitation at particular durations and amounts and at particular levels of probability. The results are designed for use with precipitation frequency estimates and may not be the same as the temporal distributions of single storms or single precipitation events. A majority of the cases analyzed were first-quartile cases regardless of precipitation area or duration (Table A.1.1). Fewer and fewer cases fell into each of the subsequent quartile categories with the fourth quartile containing the fewest number of cases. The time distributions show a greater spread between the percentiles with increasing duration. The median of the distributions becomes steeper with increasing duration. Overall, the Convective Precipitation Area distributions showed a steeper gradient and therefore depicted more initially intense precipitation than the General Precipitation Area distributions regardless of duration.

Table A.1.1. Numbers and proportion of cases in each quartile for each duration and temporal distribution region associated with NOAA Atlas 14 Volume 1.

Convective Precipitation Area					
	1st Quartile	**2nd Quartile**	**3rd Quartile**	**4th Quartile**	**Total number of cases**
6-hour	1679 (52%)	744 (23%)	509 (16%)	284 (9%)	3216
12-hour	1753 (51%)	769 (22%)	567 (17%)	354 (10%)	3443
24-hour	1751 (50%)	645 (19%)	571 (17%)	492 (14%)	3459
96-hour	1952 (63%)	707 (19%)	530 (14%)	527 (14%)	3716

General Precipitation Area					
	1st Quartile	**2nd Quartile**	**3rd Quartile**	**4th Quartile**	**Total number of cases**
6-hour	669 (36%)	471 (26%)	468 (25%)	243 (13%)	1851
12-hour	596 (33%)	465 (26%)	469 (26%)	277 (15%)	1807
24-hour	630 (36%)	442 (26%)	380 (22%)	276 (16%)	1728
96-hour	841 (46%)	376 (21%)	292 (16%)	320 (17%)	1829

Figure A.1.1. Regional division for temporal distributions associated with NOAA Atlas 14 Volume 1.

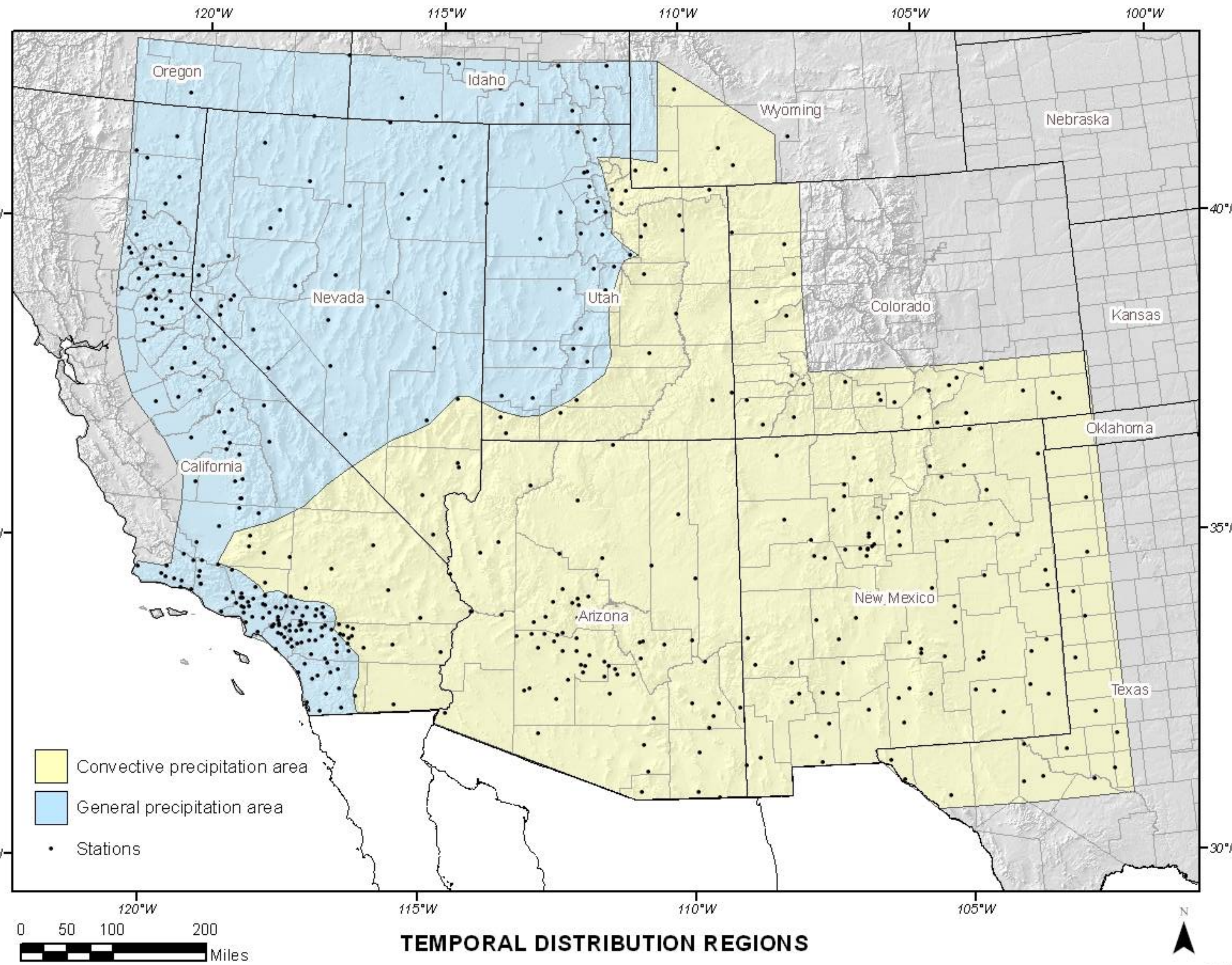


FIGURE A.1.2
TEMPORAL DISTRIBUTION: ALL CASES
GENERAL PRECIPITATION AREA

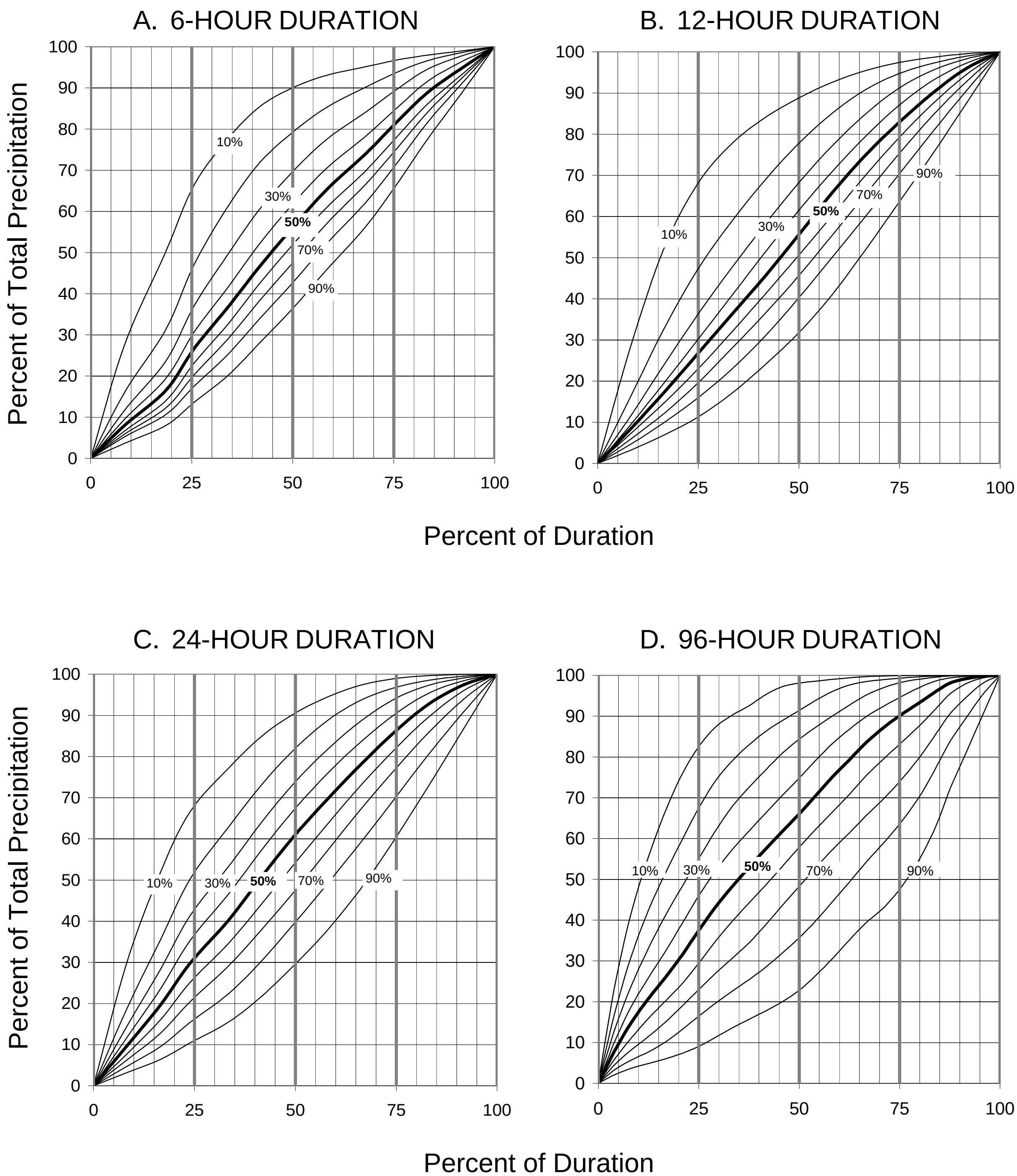


FIGURE A.1.3
TEMPORAL DISTRIBUTION: ALL CASES
CONVECTIVE PRECIPITATION AREA

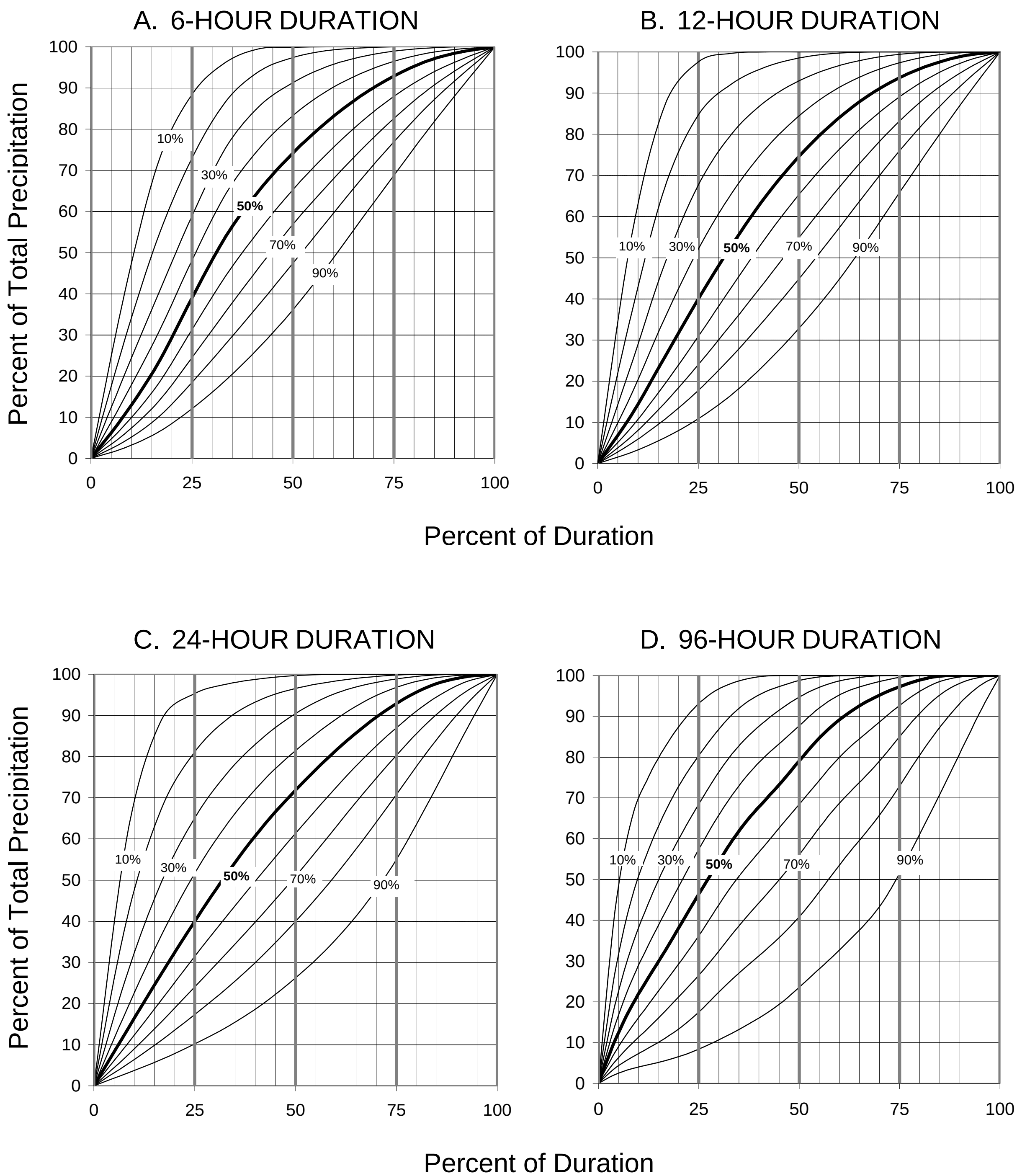


FIGURE A.1.4
TEMPORAL DISTRIBUTION: 6-HOUR DURATION
GENERAL PRECIPITATION AREA

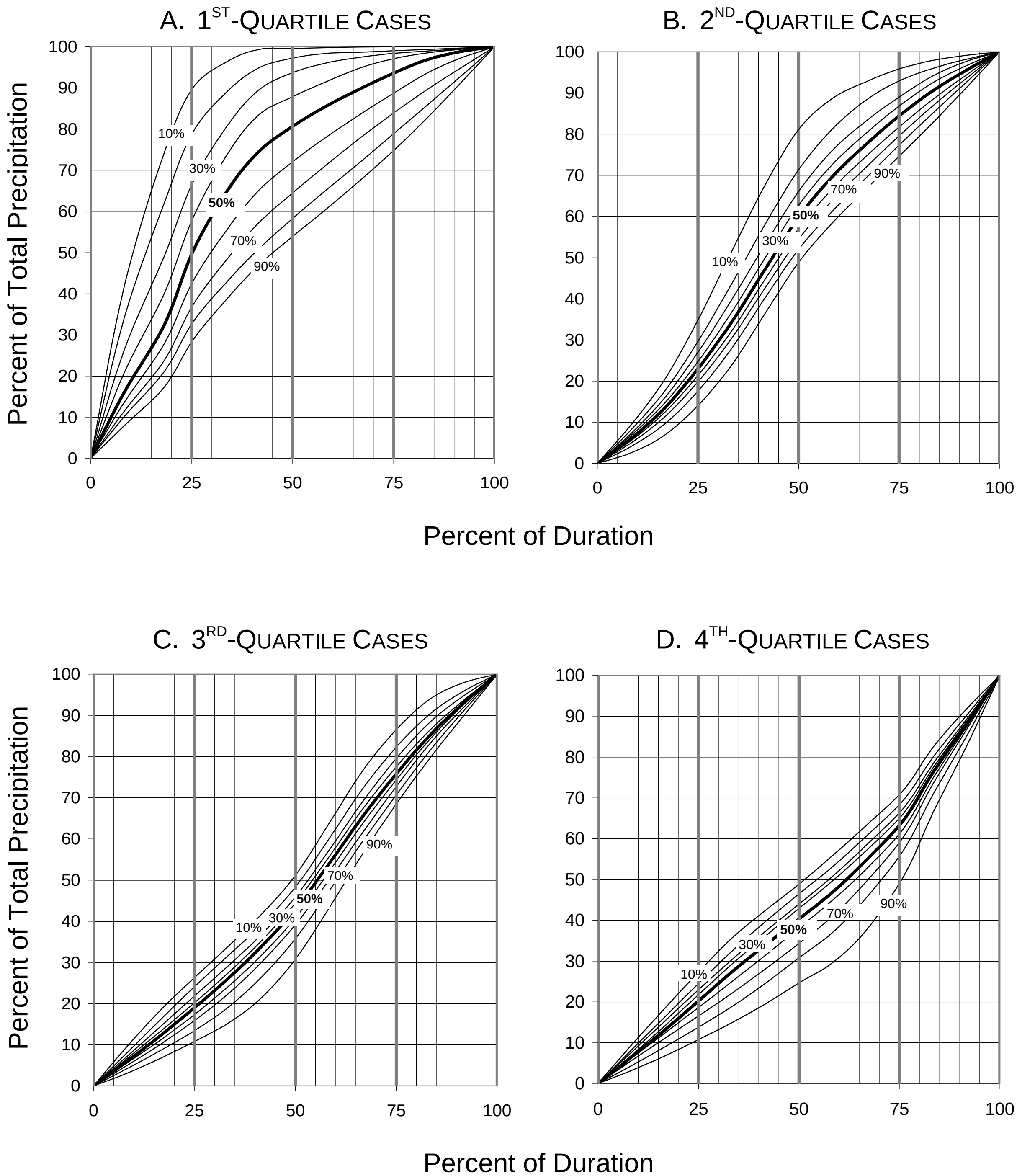


FIGURE A.1.5
TEMPORAL DISTRIBUTION: 6-HOUR DURATION
CONVECTIVE PRECIPITATION AREA

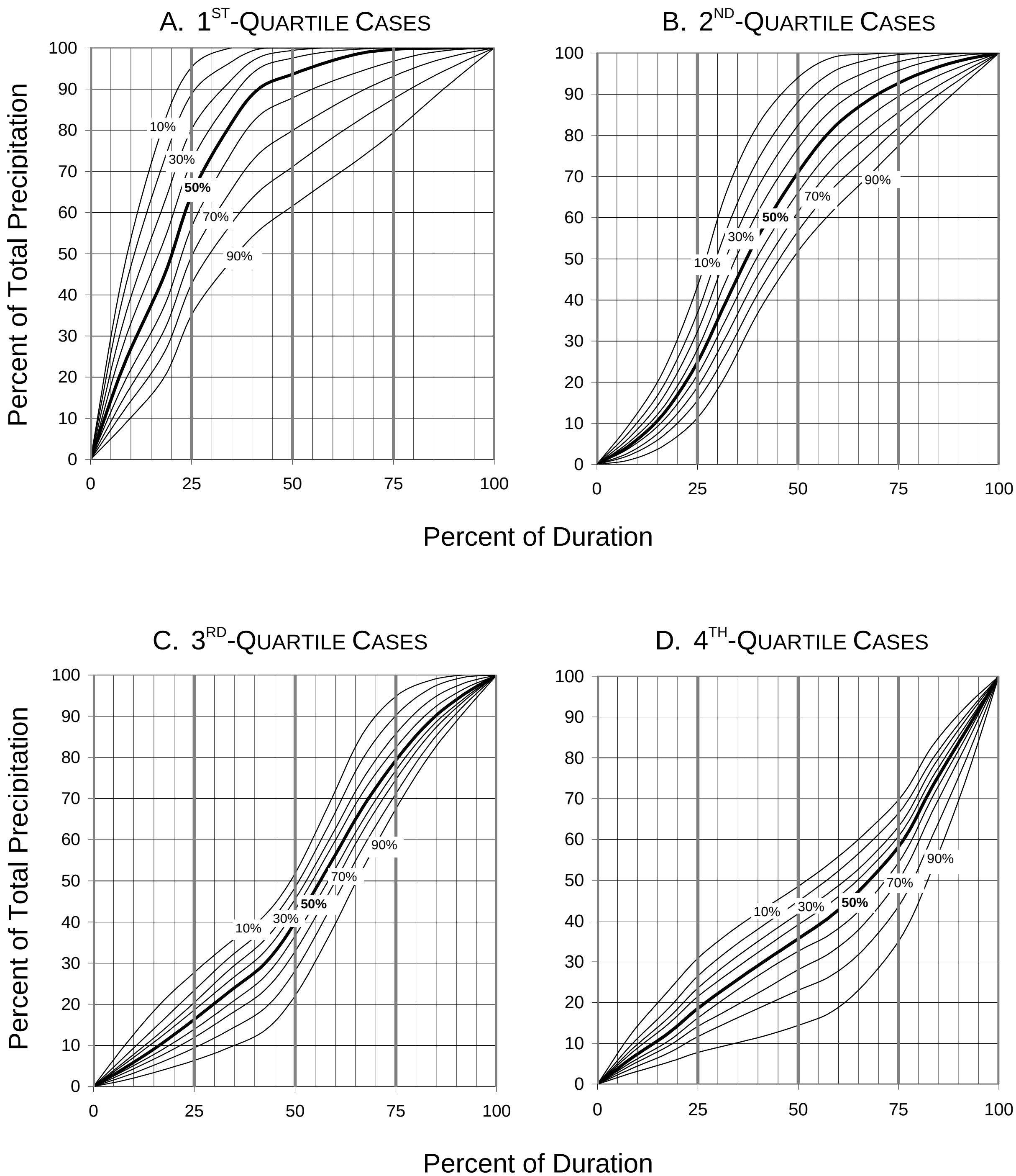


FIGURE A.1.6
TEMPORAL DISTRIBUTION: 12-HOUR DURATION
GENERAL PRECIPITATION AREA

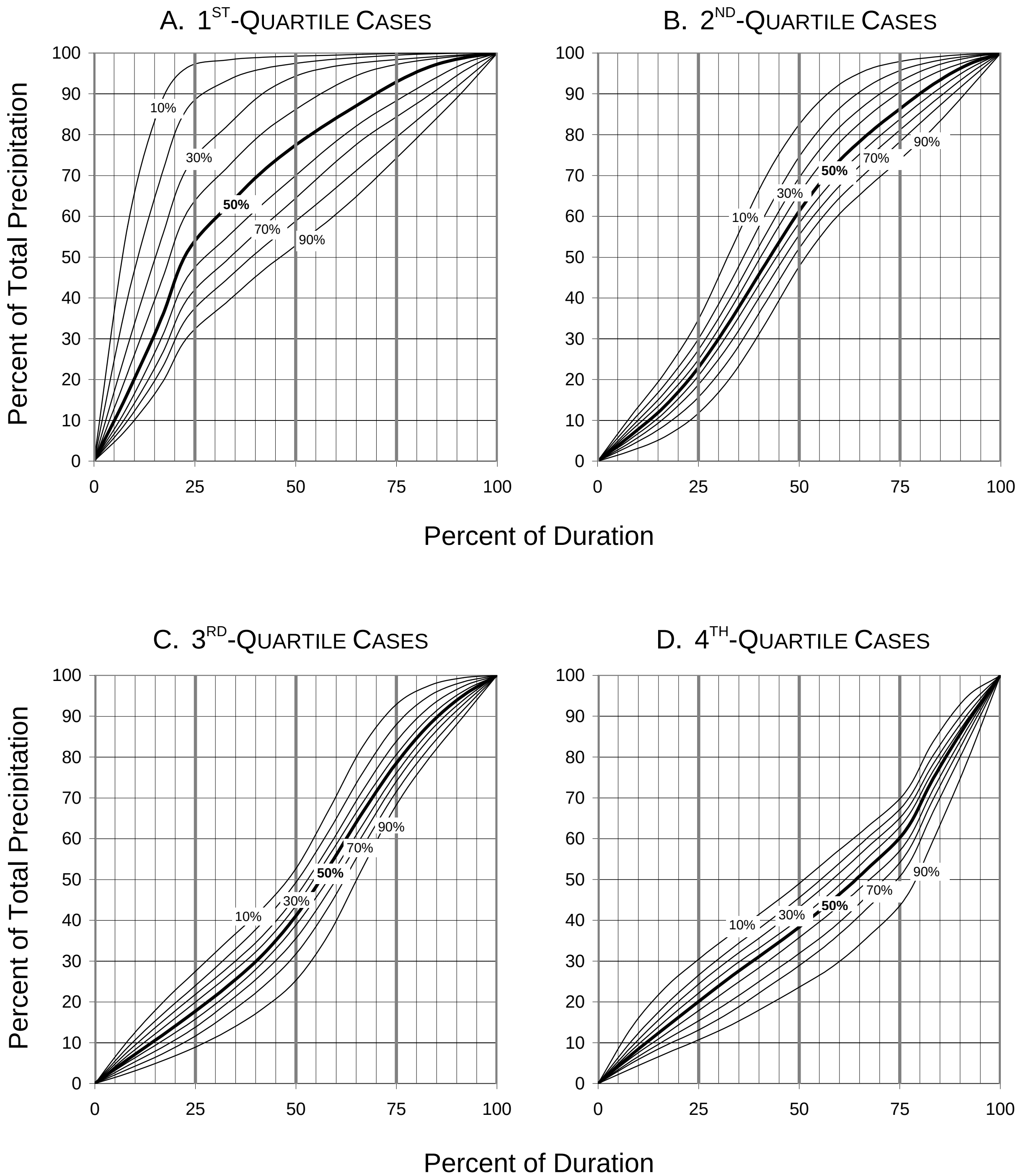


FIGURE A.1.7
TEMPORAL DISTRIBUTION: 12-HOUR DURATION
CONVECTIVE PRECIPITATION AREA

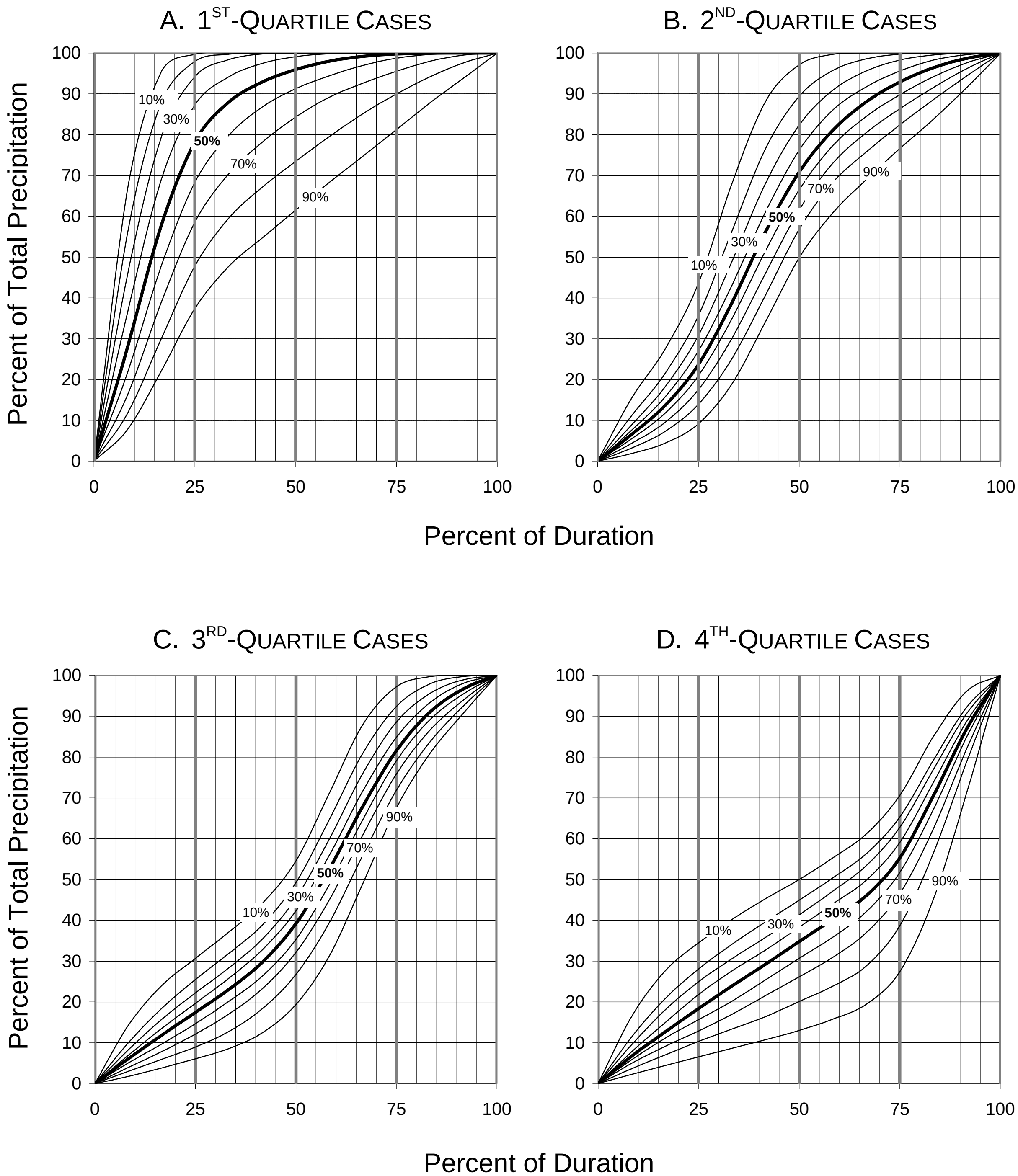


FIGURE A.1.8
TEMPORAL DISTRIBUTION: 24-HOUR DURATION
GENERAL PRECIPITATION AREA

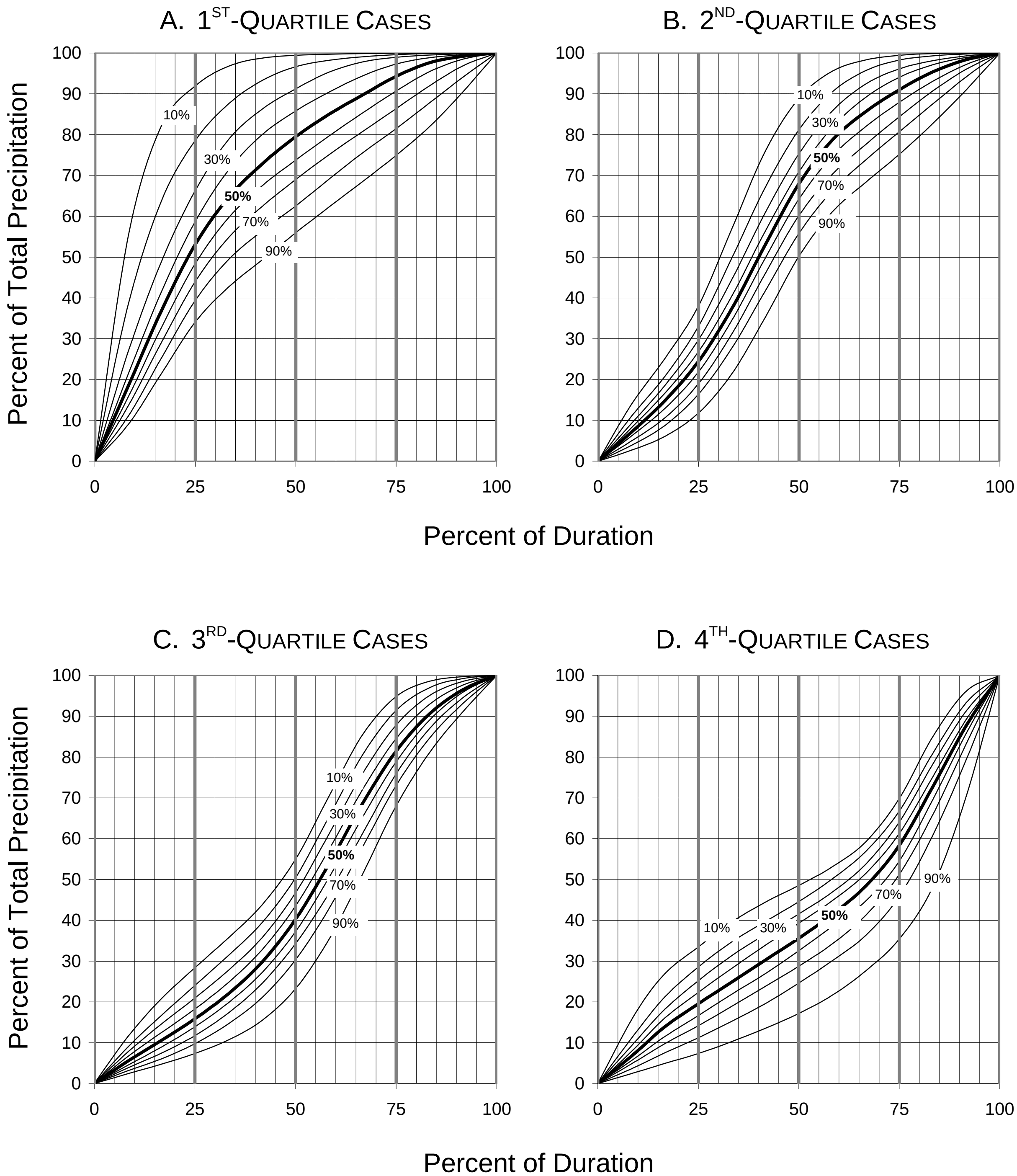


FIGURE A.1.9
TEMPORAL DISTRIBUTION: 24-HOUR DURATION
CONVECTIVE PRECIPITATION AREA

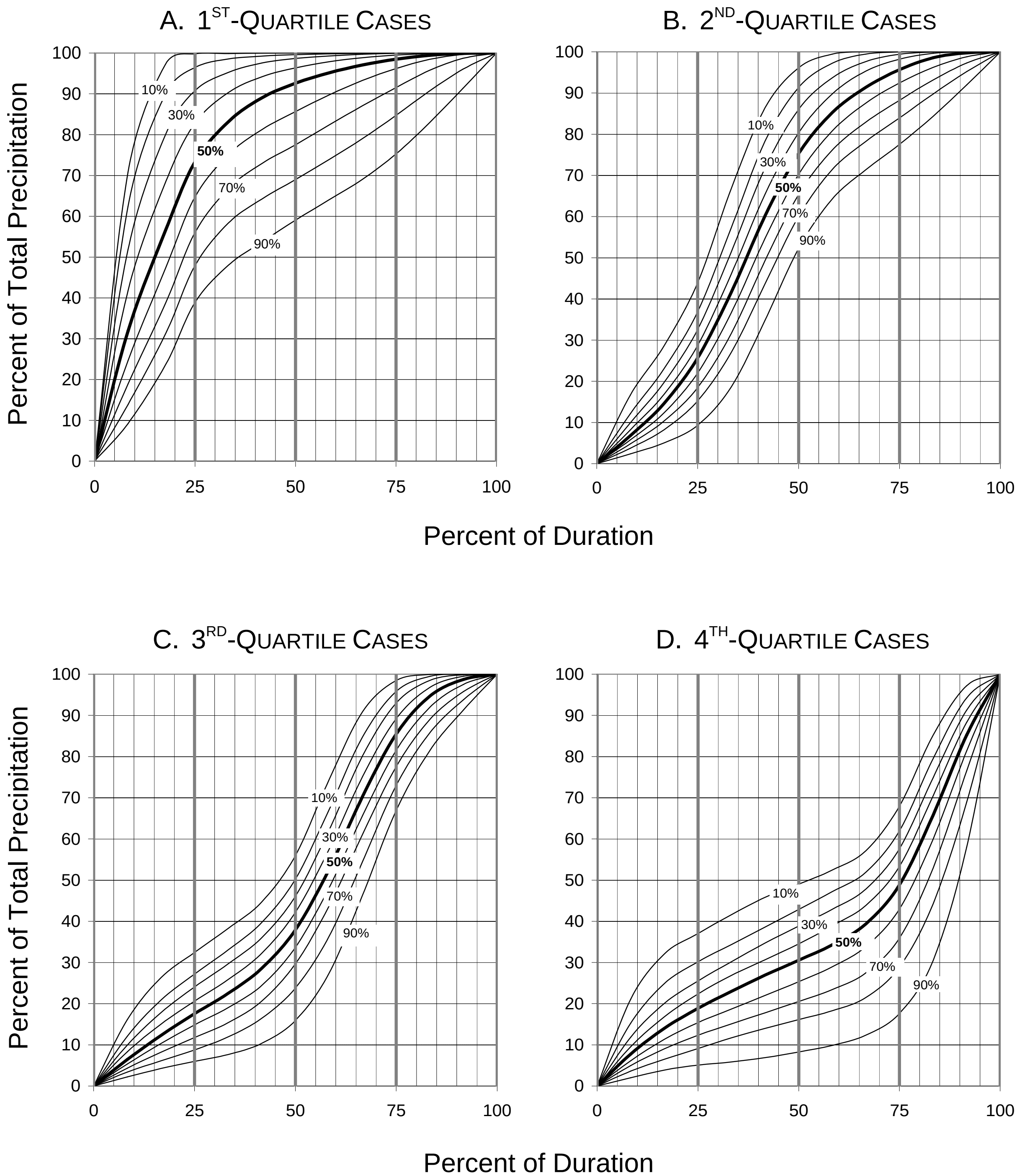


FIGURE A.1.10
TEMPORAL DISTRIBUTION: 96-HOUR DURATION
GENERAL PRECIPITATION AREA

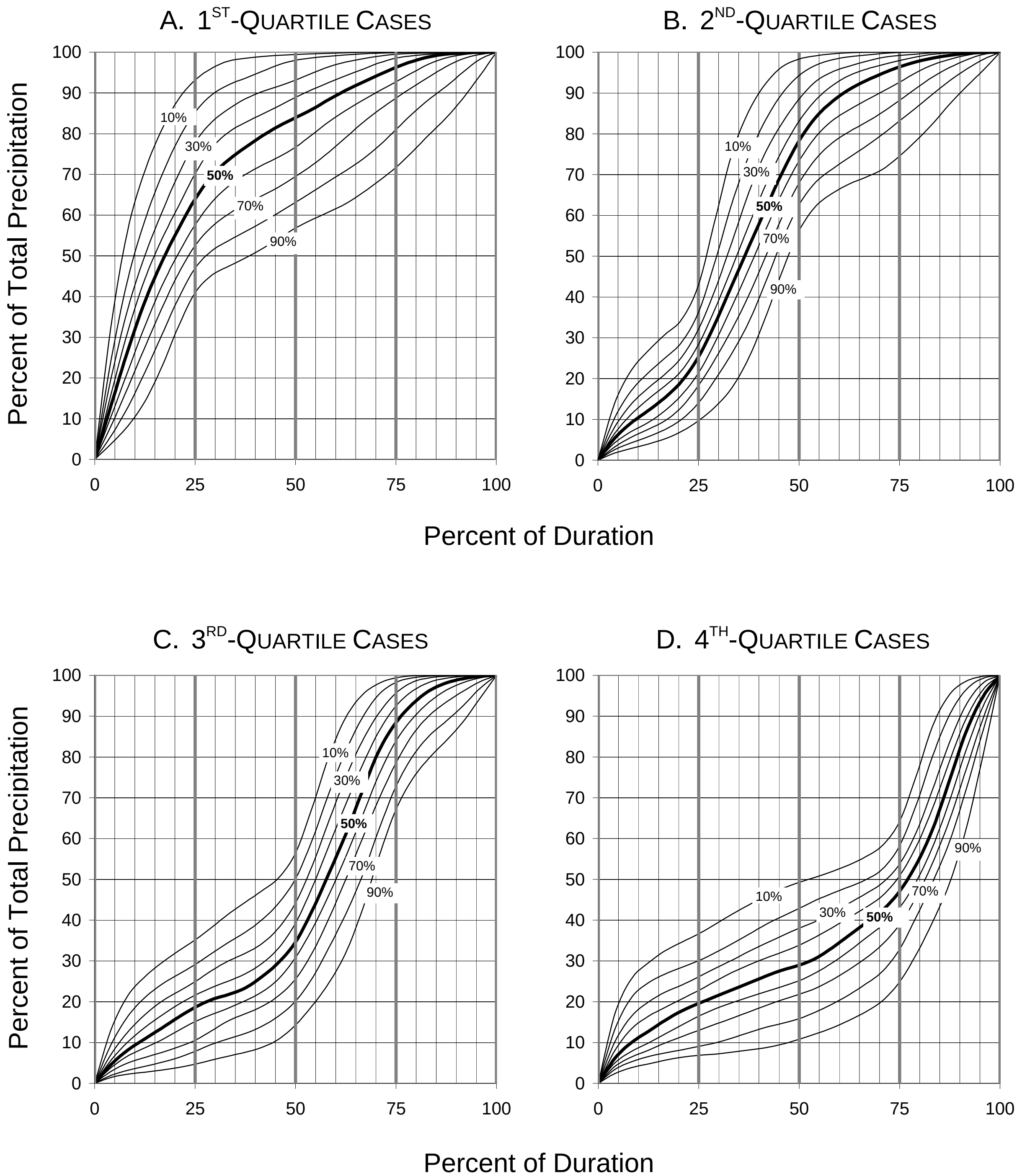
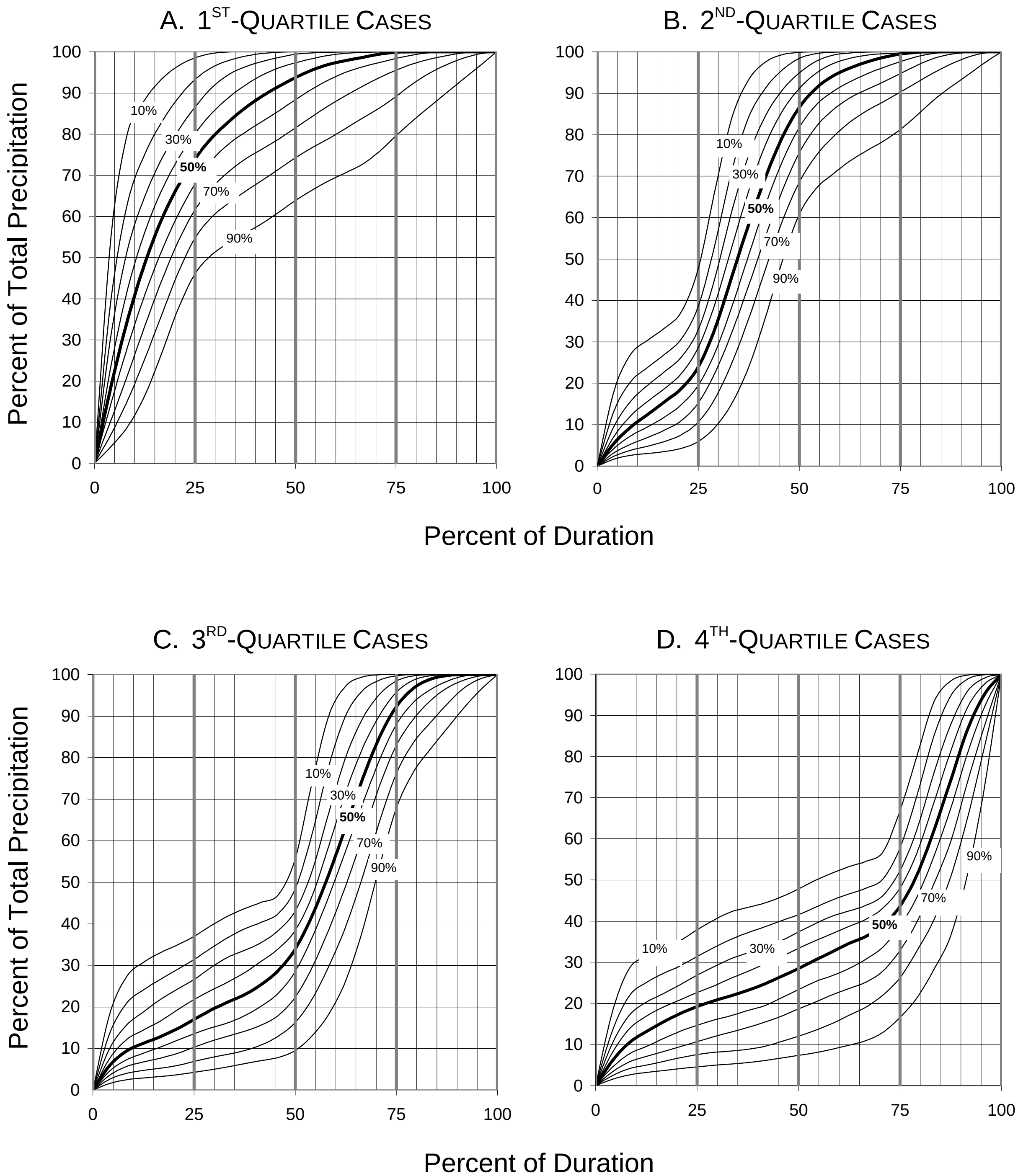


FIGURE A.1.11
TEMPORAL DISTRIBUTION: 96-HOUR DURATION
CONVECTIVE PRECIPITATION AREA



Appendix A.2. Seasonality

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

1. Introduction

Extreme precipitation over the semiarid southwestern United States project area can vary seasonally. In general, the western portion of the project area (western Nevada and into Southeastern California) receives maximum precipitation in the winter months of November through February. This climatology transitions to springtime dominated precipitation, March through May, across the northern portion of the project area, which includes much of Nevada and part of Utah. The southern portion of the project area, consisting of all of Arizona and New Mexico and parts of Southeastern California, Nevada, and Utah generally receives maximum precipitation in the summer months June through August which is associated with the monsoon.

To portray the seasonality of extreme precipitation throughout the project area, precipitation observations that exceeded given annual exceedance probabilities were examined for each region used in the analysis (Figures 4.4.1 and 4.4.2). Exceedance graphs showing this information on a monthly basis are provided as part of the Precipitation Frequency Data Server (PFDS).

2. Method

Exceedance graphs were prepared showing the percentage of events that exceeded selected annual exceedance probabilities (AEPs) in each month for each region. The quantiles were derived from annual maximum series at each station in the region as described in Section 4.2, Regional approach based on L-moments. Each graph shows the exceedances of the 1 in 2, 5, 10, 25, 50 and 100 AEPs.

Results for the 60-minute, 24-hour, 48-hour and 10-day durations are each provided in separate graphs. The results were compiled for each hourly region for the 60-minute (Figure 4.4.2) and each daily region for the 24-hour, 48-hour and 10-day (Figure 4.4.1).

To prepare the graphs, the number of events exceeding the precipitation frequency estimate at a station for a given AEP was tabulated for the selected durations. Cases were extracted in the same manner as for the generation of the annual maximum series (Section 4.1.3). The output for all stations in a given region was then combined, sorted by month, normalized by the total number of data years in the region and plotted via the PFDS.

3. Results

Seasonal exceedance graphs are available via the PFDS (http://hdsc.nws.noaa.gov/hdsc/pfds/). When a point is selected, a user can view the seasonal exceedance graphs by clicking the “Seasonality” button. The exceedance graphs (see Figure A.2.1 for an example) indicate a measure of events exceeding the corresponding AEP for the specified duration. The percentages are based on regional statistics. The total number of stations and the total number of cumulative data years for a given region are provided in the graph title.

The AEPs represent the probability of an event occurring that exceeds the quantile in any given year (i.e., 1 in 100 or 0.01 probability). Theoretically, 50% of the total number of events could exceed the 1 in 2 AEP, 4% could exceed the 1 in 25 AEP, 2% could exceed the 1 in 50 AEP and only 1% could exceed the 1 in 100 AEP. In other words, the sum of the 1 in 2 AEP percentages for each month in the graph roughly equals 50%.

The graphs also show how the seasonality of precipitation may differ between shorter duration and longer duration events in a region.

Seasonal precipitation frequency estimates cannot be derived from the graphs.

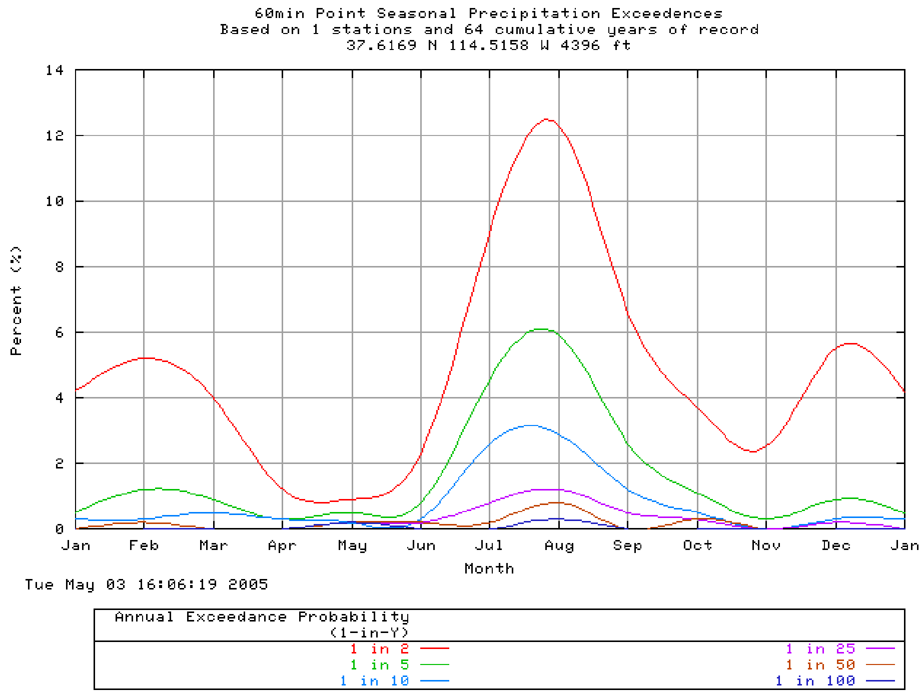


Figure A.2.1. Example of seasonal exceedance graph for the 60-minute duration.

Appendix A.3. Time series trend analysis associated with NOAA Atlas 14 Volume 1

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

1. Introduction

Precipitation frequency studies make the implicit assumption that the past is prologue for the future, i.e. that climate is stationary. Tests for linear trends in means and variance and shifts in mean were conducted on the 1-day annual maximum time series to verify the suitability of the data for this Atlas. The results of each test are provided and two specific examples of stations with linear trends and shifts are presented here. It was concluded that while there are some local instances of linear trends and shifts in mean in the data, it could be assumed that there was no consistent observed impact of climate change on the annual maximum series used for this Atlas. In particular, the impact upon the L-moment statistics and results of this Atlas would be small. Therefore, since it is beneficial to retain as much data as possible and thereby increase the robustness of the results, the entire period of record was used.

2. Linear Trend Tests

2.1. Methods

Linear trend tests were conducted to determine if there were any general increasing or decreasing patterns in the 1-day annual maximum series at a station through time. Data were tested for a linear trend in annual maximum series using the linear regression model and t-test of the correlation coefficient (Maidment, 1993, p17.30) at the 90% confidence level. Linear trends in variance were also tested by constructing a variance-related variable, an index of the square of deviation, or $v_i = (x_i - \bar{x})^2$ where, x_i is the annual maximum series data for i = 1, 2, …, n - the data year at a station, and $\bar{x}$ is the mean of the data. The index was then applied as a simple variable in the linear trend model. It was necessary for there to be a continuous time series to be eligible for the linear trend test. A minimum length of 50 years was chosen because it was sufficient to give reliable results and was close to the average data length of available stations. 52 of the eligible stations were not used because they were not continuous (i.e., they had a gap in record of 5 years or longer). The 5-year gap criterion was chosen to maximize the use of limited data while still maintaining the integrity of the time series for the tests.

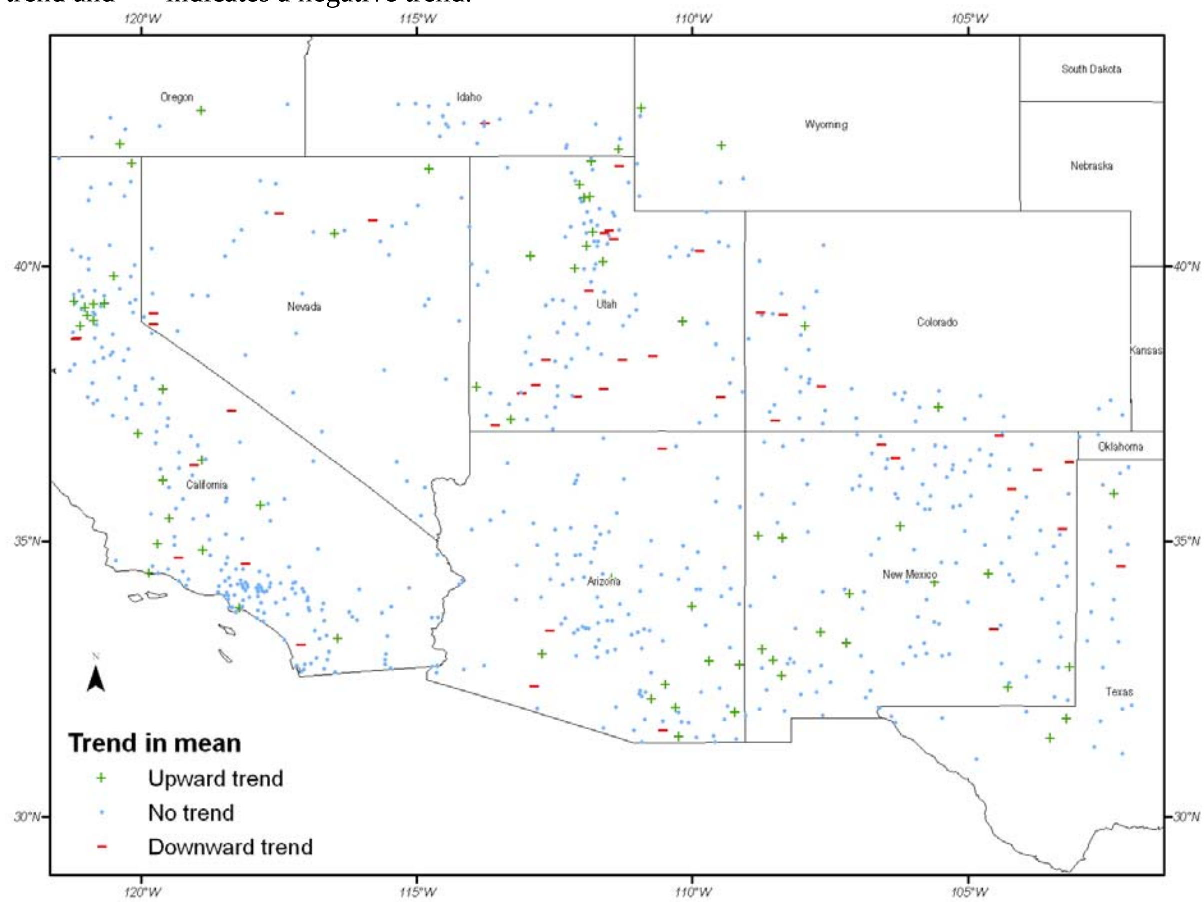
2.2. Linear Trend Results

Of 1,449 stations, 735 (or 50.7%) were eligible for the test. Of those tested stations, 15.2% exhibited a linear trend in their annual maximum series (9.1% in a positive direction, 6.1% in a negative direction). Table A.3.1 lists the linear trend results by state in the project area including the border areas. Figure A.3.1 shows the spatial distribution of stations with linear trends.

Table A.3.1. Number of stations tested and linear trend test results by state.

State	# Tested	# No Trend	# Trend	# Pos. Trend	# Neg. Trend	% tested with Trend
Arizona	125	111	14	10	4	11.2
California	219	192	27	20	7	12.3
Colorado	40	34	6	2	4	15.0
Idaho	23	21	2	1	1	8.7
Nevada	40	34	6	2	4	15.0
New Mexico	136	115	21	13	8	15.4
Oklahoma	3	3	0	0	0	0.0
Oregon	7	5	2	2	0	28.6
Texas	28	24	4	3	1	14.3
Utah	107	79	28	12	16	26.2
Wyoming	7	5	2	2	0	28.6
Total	**735**	**623**	**112**	**67**	**45**	**15.2%**

Figure A.3.1. Spatial distribution of linear trend results, where "+" indicates a station with a positive trend and "-" indicates a negative trend.



Two interesting clusters of upward trending stations were 8 stations in northern California, which may extend through southern California, and a string of 10 stations in northern Utah. These are mountainous areas. There were also numerous upward trending stations in southeast Arizona and south New Mexico, which is an area influenced by monsoonal rain. Negative trending stations seem to be more concentrated centrally in southern Utah southeastward through the northern part of New Mexico.

Overall, there appeared to be no definitive linear trend in the tested annual maximum time series and no obvious preference for geographic location.

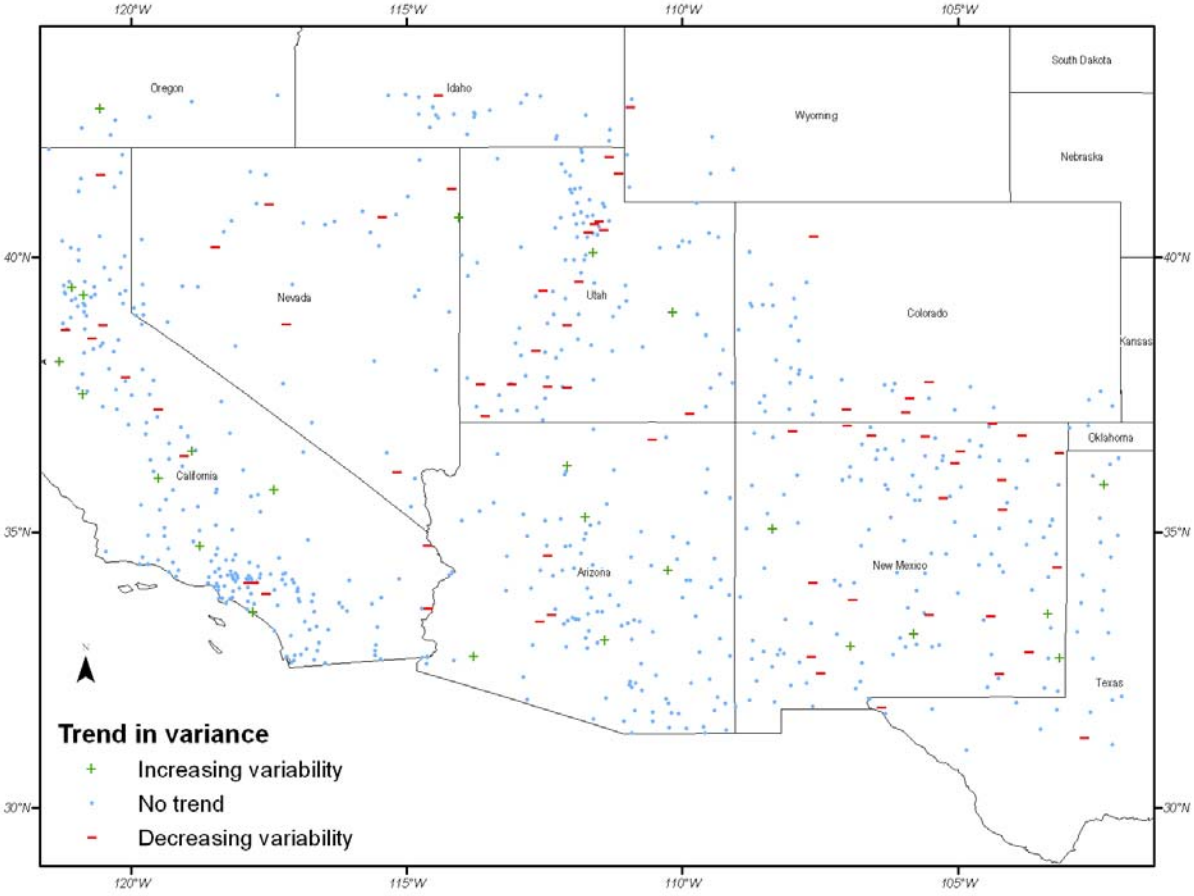
2.3. Linear Trend in Variance Results

Of the 735 stations tested, 12.7% exhibited a trend in the variance of annual maximums (3.3% in a positive direction, 9.4% in a negative direction). In other words, most stations that exhibited such a trend showed a decrease in variance. Table A.3.2 lists the trend in variance results by state in the project area. Figure A.3.2 shows the spatial distribution of those stations that had a trend in variance.

Table A.3.2. Number of stations tested and linear trend in variance test results by state.

State	# Tested	# No Trend	# Trend	# Pos. Trend	# Neg. Trend	% tested with Trend
Arizona	125	116	9	5	4	7.2
California	219	198	21	9	12	9.6
Colorado	40	35	5	0	5	12.5
Idaho	23	22	1	0	1	4.3
Nevada	40	34	6	0	6	15.0
New Mexico	136	110	26	5	21	19.1
Oklahoma	3	3	0	0	0	0.0
Oregon	7	6	1	1	0	14.3
Texas	28	25	3	1	2	10.7
Utah	107	87	20	3	17	18.7
Wyoming	7	6	1	0	1	14.3
Total	**735**	**642**	**93**	**24**	**69**	**12.7%**

Figure A.3.2. Spatial distribution of trend in variance results, where “+” indicates a station with a positive trend and “-“ indicates a negative trend.



There was an area of negative trend in variance that was roughly consistent with the area of negative linear trend through southern Utah and northern New Mexico.

Overall, there appeared to be no definitive linear trend in variance in the tested annual maximum time series and no obvious preference for geographic location.

3. Shift in Mean Tests

3.1. Methods

A shift test was conducted to compare the means of 1-day annual maximum series for two consecutive time periods at a station. The data were tested for shifts in mean using Mann Whitney non-parametric test (Newbold, 1988, p403) and the t-test (Lin, 1980, p160) at the 90% confidence levels. The Mann Whitney is a qualitative test that indicated if a shift occurred but not the direction of the shift. The t-test provided a quantitative measurement of the percentage that the mean shifted from one time period to the next. Both tests gave consistent results suggesting that the parametric t-test results can be used with assurance to assign quantitative values to observed shifts. Two dates were used to divide the data into two sets of consecutive time periods. First, a division of 1958 was tested because 1958 was the final year for which Technical Paper 40 (Hershfield, 1961) had data;

second, a division of 1970 was tested because 1970 was the final year of data for NOAA Atlas 2 (Miller et al., 1973). The results using these divisions would indicate whether a shift has occurred since the publication of earlier precipitation frequency estimates. A minimum of 30 years of data in each data segment were required at a station to test for shifts in mean. More stations were included using the 1970 split because the dataset has more data in recent years.

Since the Mann Whitney test uses ranks, it was better to have similar sizes between the two subsamples. A threshold of 30 years difference was set based on testing and used to screen the stations eligible for that test. However, since the t-test is a parametric test following the t-distribution or Normal distribution, the test is less sensitive to the difference between the sample sizes. In this project, stations were screened out (not eligible) for the Mann Whitney test that were included for the t-test.

3.2. Shift in mean results

The results when using 1958 as the division were:

- T-test: 242 of 1449 (16.7%) were eligible. 14.1% of those tested had a shift in mean (8.7% increased in mean, 5.4% decreased in mean).
- Mann Whitney test: 243 of 1449 (16.8%) were eligible. 15.2% of those tested had a shift in mean.

The results when using 1970 as the division were:

- T-test: 288 of 1449 (19.9%) were eligible. 13.2% of those tested had a shift in mean (7.0% increased in mean, 6.2% decreased in mean).
- Mann Whitney test: 193 of 1449 (13.3%) were eligible. 10.4% of those tested had a shift in mean.

Tables A.3.3 and A.3.4 list the shift in mean results by state in the project area including the border areas. Table A.3.3 shows the results comparing pre-1958 data and post-1958 data. Table A.3.4 shows the results comparing pre-1970 data and post-1970 data. The last column in each table shows the average percent change in mean for each state. Overall, the shifts in mean showed no preference toward increasing or decreasing shifts regardless of what time period was used.

Table A.3.3. Number of stations tested and test for shift in mean results (1958 split) by state.

State	# Tested	# No Shift	# Shift	# Pos. Shift	# Neg. Shift	% Change in Mean
Arizona	42	38	4	3	1	6.6
California	59	50	9	7	2	9.3
Colorado	12	10	2	0	2	-15.0
Idaho	10	9	1	1	0	13.9
Nevada	19	15	4	1	3	-6.9
New Mexico	44	38	6	4	2	5.3
Oklahoma	1	1	0	0	0	0
Oregon	1	0	1	1	0	17.3
Texas	3	2	1	1	0	20.1
Utah	47	41	6	3	3	1.0
Wyoming	4	4	0	0	0	0
Total	**242**	**208**	**34**	**21**	**13**	**4.2 (avg)**

Table A.3.4. Number of stations tested and test for shift in mean results (1970 split) by state.

State	# Tested	# No Shift	# Shift	# Pos. Shift	# Neg. Shift	% Change in Mean
Arizona	49	44	5	2	3	-4.8
California	79	70	9	3	6	-4.2
Colorado	11	11	0	0	0	0
Idaho	12	11	1	1	0	27.9
Nevada	19	14	5	2	3	-8.3
New Mexico	53	45	8	6	2	9.7
Oklahoma	1	1	0	0	0	0
Oregon	3	3	0	0	0	0
Texas	12	11	1	1	0	25.0
Utah	49	40	9	5	4	1.3
Wyoming	0	0	0	0	0	0
Total	288	250	38	20	18	1.0 (avg)

Figures A.3.3 and A.3.4 show the spatial distribution of the stations that have a shift in mean. The numbers by the station location indicate the percentage of change in mean at each station. In general, the results are consistent with the results of the linear trend results. However, given the sparsity of stations tested, it is difficult to draw any conclusions.

Figure A.3.3. Spatial distribution of shift in mean results, where "+" indicates a station with a positive trend, "-" indicates a negative trend and the number indicates the percentage of change (1958 split).

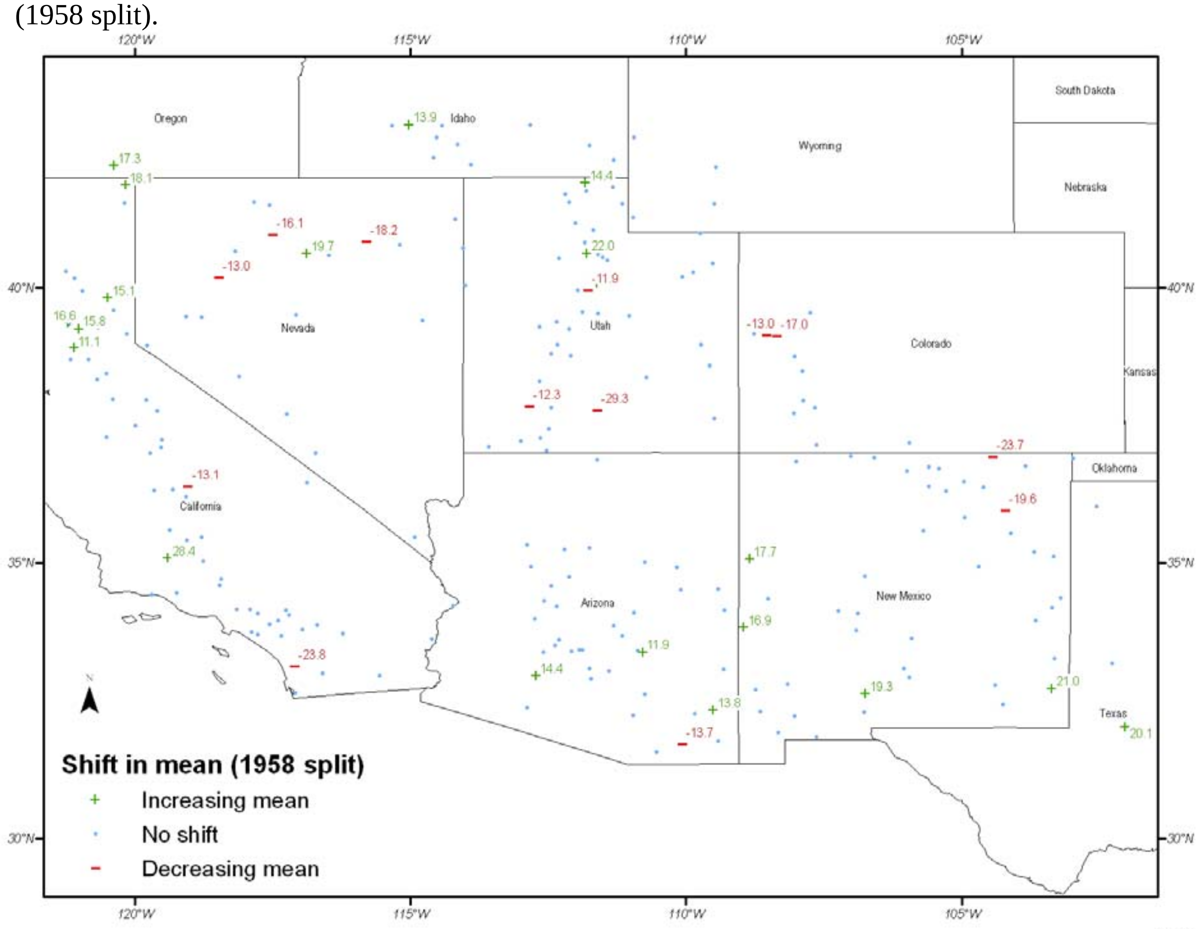
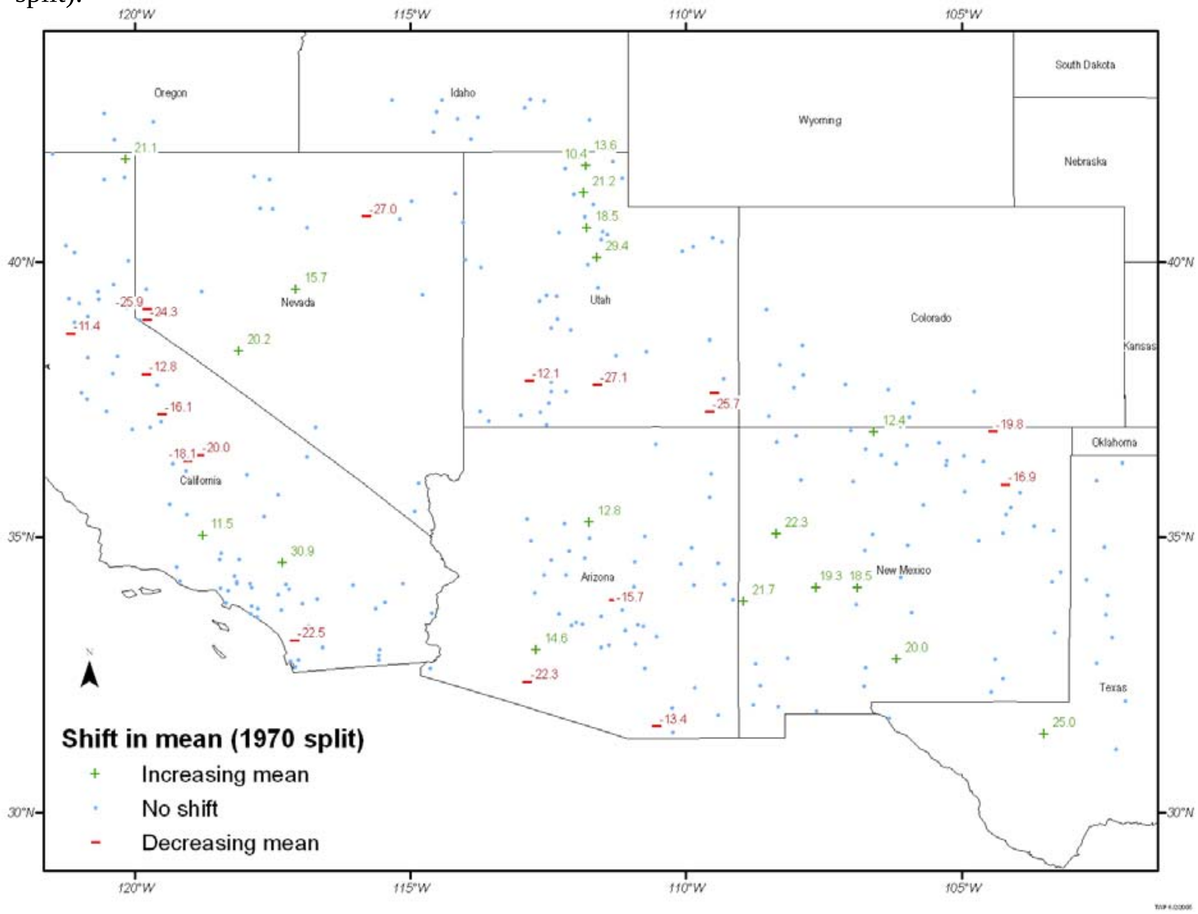


Figure A.3.4. Spatial distribution of shift in mean results, where "+" indicates a station with a positive trend, "-" indicates a negative trend and the number indicates the percentage of change (1970 split).



4. Specific Examples

In many cases, stations that showed a linear increase or decrease had a similar shift in mean. Figure A.3.5 shows a combined upward linear trend with an upward shift in mean (1958 split) at Dobbins 1 S, CA (04-2456). The time series for the station (1904 - 2000) is plotted and a solid straight line represents the linear trend. There was an accompanying increasing shift in mean (+16.6%) from the 1904 -1958 time period (3.01") to the 1959-2000 time period (3.51"). The means of each time period are represented as separate horizontal lines. There were not enough data in the latter part of the record for this station to be tested for a shift in mean with the 1971 split. This station did not exhibit a linear trend in the variance of the mean.

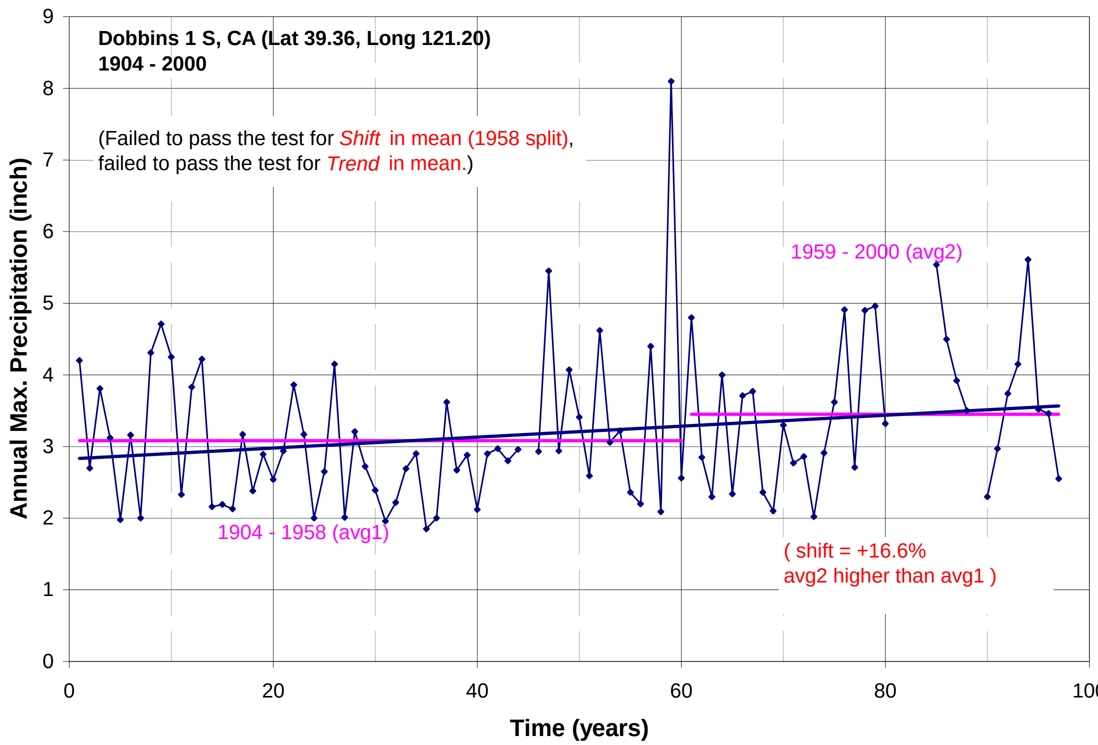


Figure A.3.5. Plot of increasing linear trend and shift (split 1958) tests for annual maximum time series at Dobbins 1 S, CA (04-2456).

Figure A.3.6 shows a combined downward linear trend with a downward shift in mean (1971 split) at Lemon Cove, CA (04-4890). The data record, 1899 - 2000, provided enough data to run all tests. A decreasing linear trend and a decreasing shift in mean for both the 1958 and 1971 splits were observed. The 1899-1958 mean, 1.69", decreased by 13.1% to 1.47" in 1959-2000. The 1971 split showed that the 1899-1971 mean, 1.69", decreased by 18.1% to 1.39" in 1972-2000, which is depicted in the Figure. The linear trend in variance was also decreasing through time. This indicates that there were less extreme events with time. The decrease in variance is shown in the Figure by the dashed lines outward of the linear trend line.

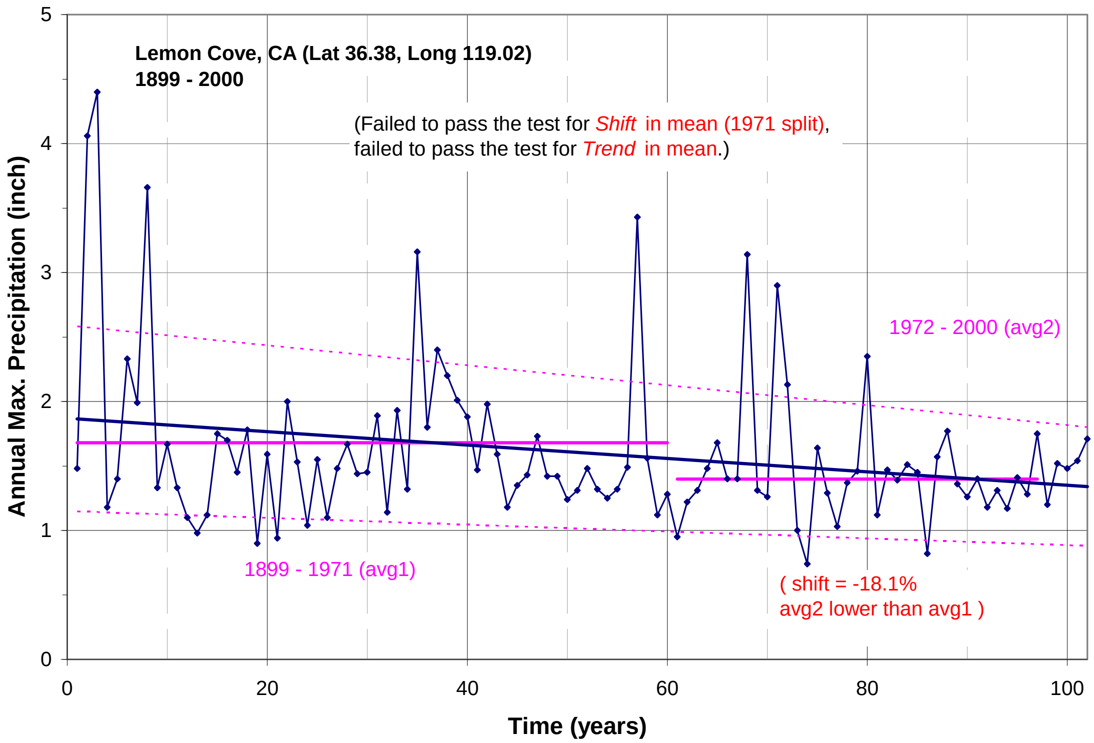


Figure A.3.6. Plot of decreasing linear trend and shift (split 1971) tests and decreasing linear variance for annual maximum time series at Lemon Cove, CA (04-4890).

5. Conclusions

1-day precipitation annual maximum series for stations used in NOAA Atlas 14 Volume 1 were examined for linear trends, linear trends in variance, and shifts in mean. The following conclusions about the stations tested can be made:

1. Overall, the annual maximum time series were free from linear trends and from shifts in mean for most of the stations in the project area.
2. Aside from 2 possible clusters, there appeared to be no definite preference in geographical location for stations exhibiting trends or shifts for those stations tested.

Therefore, since the results showed little observable or geographically consistent impact of change in the statistics used to estimate precipitation frequency, the entire historical time series was used in this Atlas.

Appendix A.4 (report was formatted by HDSC)

Final Report

Production of Rainfall Frequency Grids for the Semiarid Southwest And Ohio River Basin Using an Optimized PRISM System

Prepared for
National Weather Service, Hydrologic Design Service Center
Silver Spring, Maryland

Prepared by
Christopher Daly and George Taylor
Spatial Climate Analysis Service
Oregon State University
Corvallis, Oregon

July 2004

Overall Project Goal

The contractor, Spatial Climate Analysis Service (SCAS) at Oregon State University (OSU), will produce a series of grids for rainfall frequency estimation using an optimized system based on the Parameter-elevation Regressions on Independent Slopes Model (PRISM) and HDSC-calculated point estimates for the Semiarid Southwest (SA) and Ohio River Basin (ORB) study domains. It is anticipated that successful progress on this task will lead to additional work of the same nature for the remainder of the United States including Puerto Rico and the Virgin Islands.

This Report

This report describes work performed to produce final index flood grids for 14 precipitation durations, ranging from 60 minutes to 60 days, for the SA and ORB regions.

Adapting the PRISM system

The PRISM modeling system was adapted for use in this project after an investigation was performed for the SA region. The same PRISM system was applied to the ORB region.

PRISM (Parameter-elevation Regressions on Independent Slopes Model) is a knowledge-based system that uses point data, a digital elevation model (DEM), and many other geographic data sets to generate gridded estimates of climatic parameters (Daly et al. ,1994; Daly et al., 2001; Daly et al., 2002) at monthly to daily time scales. Originally developed for precipitation estimation, PRISM has been generalized and applied successfully to temperature, among other parameters. PRISM has been used extensively to map precipitation, dew point, and minimum and maximum temperature over the

United States, Canada, China, and other countries. Details on PRISM formulation can be found in Daly et al. (2002) and Daly (2002).

Examples of PRISM products already produced for the United States include: (1) a new US climate atlas that includes monthly and annual average climate maps for precipitation, temperature, snowfall, degree days, and other parameters for the 1961-1990 period (Plantico et al., 2000); (2) sequential monthly maps for precipitation and mean maximum and minimum temperature for the period 1895-1997 (Daly et al., 2001); (3) peer-reviewed 1961-1990 mean monthly precipitation maps, certified as the official maps of the USDA (USDA-NRCS, 1998; Daly and Johnson, 1999); and (4) an update of the 1961-1990 maps to the 1971-2000 climatological period.

Adapting the PRISM system for mapping precipitation frequencies required an approach slightly different than the standard modeling procedure. The amount of station data available to HDSC for precipitation frequency was much less than that available for high-quality precipitation maps, such as the peer-reviewed PRISM 1961-1990 mean precipitation maps (USDA-NRCS, 1998). Data sources suitable for long-term mean precipitation but not for precipitation frequency included snow courses, short-term COOP stations, remote storage gauges, and others. In addition, data for precipitation durations of less than 24 hours are available from hourly rainfall stations only. This meant that mapping precipitation frequency using HDSC stations would sacrifice a significant amount of the spatial detail present in the 1961-1990 mean precipitation maps.

A pilot project to identify ways of capturing more spatial detail in the precipitation frequency maps was undertaken. Early tests showed that mean annual precipitation (MAP) was an excellent predictor of precipitation frequency in a local area, much better than elevation, which is typically used as the underlying, gridded predictor variable in PRISM applications. In these tests, the DEM, the predictor grid in PRISM, was replaced by the official USDA digital map of MAP for the lower 48 states (USDA-NRCS, 1998; Daly et al., 2001; Figure 1). Detailed information on the creation of the USDA PRISM precipitation grids is available from Daly and Johnson (1999). Figures 2 and 3 illustrate the superior predictive capability of MAP over the DEM for locations in the southwestern US. The relationships between MAP and precipitation frequency were strong because much of the incorporation of the effects of various physiographic features on mean precipitation patterns had already been accomplished with the creation of the MAP grid from PRISM. Now, it was only a matter of relating precipitation frequency to mean total precipitation. Preliminary PRISM maps of 2-year and 100-year, 24-hour precipitation were made for the Semiarid Southwest and compared to hand-drawn HDSC maps of the same statistics. Differences were minimal, and mostly related to differences in station data used.

Further investigation found that the square-root transformation of MAP produced somewhat more linear, tighter and cleaner regression functions, and hence, more stable predictions, than the untransformed values; this transformation was incorporated into subsequent model applications. Square-root MAP was a good local predictor of not only for longer-duration precipitation frequency statistics, but for short-duration statistics, as well (Figures 4 and 5). Therefore, it was determined that a modified PRISM system that used square-root MAP as the predictive grid was suitable for producing high-quality precipitation frequency maps for this project.

PRISM Configuration and Operation

For application to the SA and ORB regions, PRISM consisted of a local moving-window, index flood vs. MAP regression function that interacts with an encoded knowledge base and inference engine (Daly et al., 2002). This knowledge base/inference engine is a series of rules, decisions and calculations that set weights for the station data points entering the regression function. In general, a weighting function contains knowledge about an important relationship between the climate field and a geographic or meteorological factor. The inference engine sets values for input parameters by using default values, or it may use the regression function to infer grid cell-specific parameter settings for the situation at hand. PRISM acquires knowledge through assimilation of station data, spatial data sets such as MAP and others, and a control file containing parameter settings.

The other center of knowledge and inference is that of the user. The user accesses literature, previously published maps, spatial data sets, and a graphical user interface to guide the model application. One of the most important roles of the user is to form expectations for the modeled climatic patterns, i.e., what is deemed "reasonable." Based on knowledgeable expectations, the user selects the station weighting algorithms to be used and determines whether any parameters should be changed from their default values. Through the graphical user interface, the user can click on any grid cell, run the model with a given set of algorithms and parameter settings, view the results graphically, and access a traceback of the decisions and calculations leading to the model prediction.

The moving-window regression function for index flood vs. MAP took the form

$$\text{Index flood value} = \beta_1 * \text{sqrt(MAP)} + \beta_0 \qquad (1)$$

where β_1 is the slope and β_0 is the intercept of the regression equation, and MAP is the grid cell value of 1961-90 mean annual precipitation

Upon entering the regression function for a given pixel, each station is assigned a weight that is based on several factors. In applications using a climate grid such as MAP as the predictor, the combined weight of a station is typically a function of distance, MAP, cluster, topographic facet, and coastal proximity, respectively. The combined weight W of a station is a function of the following:

$$W = f\{ W_d, W_z, W_c, W_f, W_p \} \qquad (2)$$

where W_d, W_z, W_c, $W_{f,}$ and W_p are the distance, MAP, cluster, topographic facet, and coastal proximity, respectively. Distance, MAP, and cluster weighting are relatively straightforward in concept. A station is down-weighted when it is relatively distant or has a much different MAP value than the target grid cell, or when it is clustered with other stations (which leads to over-representation). Facet weighting effectively groups stations into individual hillslopes (or facets), at a variety of scales, to account for sharp changes in climate regime that can occur across facet boundaries. Coastal proximity weighting is used to define gradients in precipitation that may occur due to proximity to large water bodies (Daly et al., 1997; Daly and Johnson, 1999; Daly et al., 2002, 2003). No coastal areas were present in the SA region, precluding the need for coastal proximity. However, coastal proximity weighting was implemented in the ORB, which encompasses a large section of the eastern coastline. Shown in Figure 6, the coastal proximity grid is a measure of the distance from each pixel to the coastline, expressed in 10-km bands out to 90 km. The "coastline" is defined as the boundary between land and the ocean or Great Lakes. It does not include bays and inlets, such as Chesapeake Bay.

An example of the usefulness of coastal proximity weighting is shown in Figure 7. In this example of the 1-hour index flood precipitation vs mean annual precipitation (sqrt(MAP)) near Charleston, SC, coastal proximity weighting allowed the regression function to preserve higher 1-hour precipitation values along the immediate coastline by producing different regression functions at coastal and inland pixels. In contrast, lack of coastal proximity weighting would produce similar regression functions for both pixels and would not recognize the coastal precipitation maximum.

Relevant PRISM parameters for the applications to 1- and 24-hour index flood statistics are listed in Tables 1 and 2. Further explanations of these parameters and associated equations are available in Daly (2002) and Daly et al. (2002). The difference to note between the parameter set in Tables 1 and 2 and that in Daly et al. (2002) is that the elevation weighting parameters in Daly et al. (2002) are now referred to here as MAP weighting parameters. This is because MAP, rather than elevation, is used as the predictor variable. The input parameters used for the 1-hour index flood application were generally applied to durations of 1-12 hours. The 24-hour input parameters were generally applied to durations of 24 hours and greater.

The values of radius of influence (*R)*, the minimum number of on-facet (s_f) and total (s_t) stations required in the regression were based on information from user assessment via the PRISM graphical user interface, and on a jackknife cross-validation exercise, in which each station was deleted from the data set one at a time, a prediction made in its absence, and mean absolute error statistics compiled. One parameter that was varied significantly between the 1-hour (and up through 12 hours) and 24-hour (and up through 60 days) index flood applications was the minimum number of on-facet stations required in the regression (s_f; Tables 1 and2). PRISM has access to topographic facet grids at six different scales, from small-scale to large-scale (Daly et al., 2002). When developing each pixel's regression function, PRISM preferentially searches for stations on the same topographic facet as that of the target pixel, starting with the smallest-scale facet grid. If it does not find the minimum number of on-facet stations required, it moves to the next-larger-scale grid, and accumulates more stations, until either s_f is reached, or the largest-scale grid is used. Because the number of stations available for 1-hour – 12-hour index flood mapping was so much smaller than that for 24-hour – 60-day mapping, a much lower s_f threshold for on-facet stations was used; this kept the applications for the two groups of durations using about the same scale of facet grids in station selection and promoted consistency among the two applications.

Input parameters that changed readily among the various durations were the minimum allowable slope (β_{1m}) and default slope (β_{1d}) of the regression function, with the maximum allowable slope (β_{1x}) varying less readily. Slopes are expressed in units that are normalized by the average observed value of the precipitation in the regression data set for the target cell. Evidence gathered during model development indicates that this method of expression is relatively stable in both space and time (Daly et al., 1994).

Bounds are put on the slopes to minimize unreasonable slopes that might occasionally be generated due to local station data patterns; if the slope is out of bounds and cannot be brought within bounds by the PRISM outlier deletion algorithm, the default slope is invoked (Daly et al., 2002). Slope bounds and default values were based on PRISM diagnostics that provided information on the distribution of slopes across the modeling region. The default value was set to approximate the average regression slope calculated by PRISM. The upper and lower bounds were set to approximately the 95th and 5th percentiles of the distribution of slopes, respectively, because many of the slopes outside this range are typically found to be questionable. For these applications, slope bounds typically increased with increasing duration (Table 3). In general, the longer the duration, the larger the slope bounds. This is primarily a result of higher precipitation amounts at the longer durations, and the tendency for longer-duration index flood statistics to bear a stronger and steeper relationship with MAP than shorter-durations statistics.

One relatively new PRISM input parameter not discussed in Daly et al. (2002) is D_m, the minimum allowable distance in the distance weighting function (Tables 1 and 2). Any station falling within D_m of the target pixel is set to a distance of D_m. D_m was implemented in the ORB (only) with a value of 50 km because it was recognized that many small-scale spatial features (bulls eyes) in the MAP grid, especially in flat terrain, may have not reflected actual climate features, but variations in station data completeness and period of record. The effect of implementing D_m was to spatially smooth the relationship between MAP and index flood over a larger area and produce more spatially homogeneous results. This restriction was applied to all parts of the ORB, except coastal areas, where a rapidly-changing relationship between MAP and index flood produced realistic small-scale features along the coastal strip. When such a smoothing effect is applied, the maps do not reflect the actual station precipitation values quite as closely. Figure 8 shows how well the interpolated grid cell values reproduced the actual station precipitation used in the mapping for 1-hour and 24-hour index flood statistics, with and without the 50-km distance limitation. The correlation coefficient between observed and gridded precipitation fell from 0.91 to 0.81 when the limitation was applied to the 1-hour statistic, and dropped from 0.95 to 0.91 when applied to the 24-hour statistic. The drop in correlation became progressively less pronounced at the longer durations.

After completion of the SA mapping and during the ORB mapping, updates of the 1961-1990 MAP grids to the 1971-2000 climatological period became available. The 1971-2000 grid was created using 1961-1990 MAP as the predictor grid. There are only subtle differences between the two MAP grids, but it was decided that the ORB mapping should use the latest MAP grid. Therefore, the SA maps reflect the 1961-1990 MAP predictor grid and the ORB maps reflect the 1971-2000 predictor grid.

Results

PRISM cross-validation statistics for 1- and 24-hour applications to the SA and ORB regions were compiled and summarized in Tables 4 and 5. In the SA, overall bias was less than 2 percent, and mean absolute error was about 10 percent. In the ORB, errors were lower (about 0.5% bias and 6% mean absolute error), owing to less terrain complexity and higher station density. One-hour errors were somewhat higher than those for the 24-hour run. Likely reasons for this are the much smaller number of stations available, and the somewhat weaker relationship between 1-hour index flood and MAP, compared to those for the 24-hour index flood. Errors for 2- to 12-hour durations were similar to those for the 1-hour duration, and errors for 2 to 60-day durations were similar to those for the 24-hour duration. Overall, these errors are quite low, and are likely comparable to errors associated with precipitation measurement and the calculation of index flood statistics.

Stations used in the SA modeling applications are shown in Figure 9. During the initial modeling process, three stations were found to be unusual: two in the 1-hour application and one in the 24-hour application. The two unusual 1-hour stations were Independence, CA (04-4235), and Raton WB Airport, NM (29-7283). Independence had a 1-hour value that was much lower than other stations in the region; it was also low when compared to its 24-hour value. Subsequent analysis showed that this station had a relatively short period of record. Conversely, Raton WB Airport seemed too high, compared to its neighbors. Both stations were omitted from the final 1-hour index flood application. [Note: The stations met the criteria for the original precipitation frequency analysis and so were retained in the analysis conducted by HDSC and only omitted from the mapping process. - comment added by HDSC] Red Rock Canyon, NV (26-6691) appeared unusual during the modeling of the 24-hour index flood. It is sited on the southern flank of the Spring Mountains, just northwest of Las Vegas. This is an area of steep elevation, and hence, precipitation, gradients. The Red Rock Canyon 24-hour index flood value seemed high compared to the underlying MAP grid-cell value; however, subsequent analysis showed that the underlying MAP grid value was higher than the stations' actual MAP, indicating that imprecision in either the station location or the 4-km grid cell resolution caused a misalignment between the grid MAP and station MAP. This problem was alleviated by substituting the station's MAP value for the grid MAP value when calculating the moving-window regression function.

Stations used in the ORB modeling applications are shown in Figure 10. During the review process, several bulls eyes were identified and questioned. One was found to be caused by a suspicious index flood station value, while the others were caused by unusual spots on the MAP predictor grid, which in turn were caused by unusual station averages used during the mapping of the 1961-1990 and 1971-2000 MAP grids. One suspicious station was Wateree Dam, SC (38-8979), which had an unusually low 1-hour index flood value. This was also noticed by the South Carolina State Climatologist after the original MAP mapping was completed (unfortunately). It was felt that because it is located at a dam, convective precipitation could be suppressed due to proximity to water. The MAP grid was altered to remove the effects of this station. Adding the 50-km minimum distance criterion mitigated its direct effect on the index flood grids, so the station was retained in the mapping process. Tangier Island, VA (44-8323), in Chesapeake Bay, produced a low area in the MAP grid, which was propagated to surrounding areas. It is possible that its location on an island suppressed convective precipitation, and thus lowered the MAP, but no conclusive evidence was presented. The MAP grid was altered to reduce the severity of the bulls eye. Manassas, VA (44-5213), and Middlebourne, OH (33-5199), also produced low spots in the MAP grid. The MAP grid was altered to reduce the severity of these bulls eyes.

After initial mapping of the ORB, three stations were found to have gridded index flood values that were significantly different than their station point values: Tuckasegee (31-8754), Mt. Mitchell (31-5921), and Parker (31-6565), NC. All three were located in the southern Appalachians, an area of steep elevation, and hence, precipitation, gradients, indicating that imprecisions in either the station location or the 4-km grid cell resolution caused a misalignment between the grid MAP and station MAP. This problem was alleviated by moving the station locations slightly.

Draft grids of 1- and 24-hour index flood statistics for the SA and ORB regions were produced by running PRISM at 2.5-minute (~4-km) resolution. These grids were reviewed by HDSC personnel, and found to be suitable for review by the larger user community, after some revision. A full set of maps for all index flood durations was then produced, including 1, 2, 3, 6, 12, and 24 hours; and 2, 4, 7, 10, 20, 30, 45, and 60 days. The maps were subjected to pixel-by-pixel tests to ensure that shorter duration values did not exceed those of longer duration values. To make the grids presentable for detailed contour plotting, SCAS used a Gaussian filter to resample the grids to 30-sec (~ 1km) resolution. Sample final filtered grids are shown in Figures 11-14. These grids were delivered electronically to HDSC via ftp.

References

Daly, C., 2002: Variable influence of terrain on precipitation patterns: Delineation and use of effective terrain height in PRISM. *World Wide Web document*. http://www.ocs.orst.edu/pub/prism/docs/effectiveterrain-daly.pdf

_______, E.H. Helmer, and M. Quinones, 2003: Mapping the climate of Puerto Rico, Vieques, and Culebra. *International Journal of Climatology*, **23**, 1359-1381.

_______ and G.L. Johnson, 1999: PRISM spatial climate layers: their development and use. *Short Course on Topics in Applied Climatology, 79th Annual Meeting of the American Meteorological Society,* 10-15 January, Dallas, TX. 49 pp. http://www.ocs.orst.edu/pub/prism/docs/prisguid.pdf

_______, R.P. Neilson, and D.L. Phillips, 1994: A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. *J. Appl. Meteor*. **33**, 140-158.

_______, G. Taylor, and W. Gibson, 1997: The PRISM Approach to Mapping Precipitation and Temperature, 10th Conf. on Applied Climatology, Reno,NV, *Amer. Meteor. Soc*., 10-12. http://www.ocs.orst.edu/pub/prism/docs/appclim97-prismapproach-daly.pdf

_______, G.H. Taylor, W. P. Gibson, T.W. Parzybok, G. L. Johnson, P. Pasteris, 2001: High-quality spatial climate data sets for the United States and beyond. *Transactions of the American Society of Agricultural Engineers* **43**, 1957-1962.

______, W. P. Gibson, G.H. Taylor, G. L. Johnson, and P. Pasteris, 2002: A knowledge-based approach to the statistical mapping of climate. *Clim. Res*., **22**, 99-113. http://www.ocs.orst.edu/pub/prism/docs/climres02-kb_approach_statistical_mapping-daly.pdf

Plantico, M.S., L.A. Goss, C. Daly, and G. Taylor, 2000: A new U.S. climate atlas. In: *Proc., 12th AMS Conf. on Applied Climatology, Amer. Meteorological Soc*., Asheville, NC, May 8-11, 247-248.

USDA-NRCS, 1998: PRISM Climate Mapping Project--Precipitation. Mean monthly and annual precipitation digital files for the continental U.S. *USDA-NRCS National Cartography and Geospatial Center*, Ft. Worth TX. December, CD-ROM.

Table 1. Values of relevant PRISM parameters for modeling of 1- and 24-hour index flood statistics for the SA (semiarid southwest region). See Daly et al. (2002) for details on PRISM parameters.

Name	Description	1-hour/24-hour Values
Regression Function		
R	Radius of influence	60/70 km*
s_f	Minimum number of on-facet stations desired in regression	2/12 stations*
s_t	Minimum number of total stations desired in regression	20/20 stations*
β_{1m}	Minimum valid regression slope	1.0/2.0+
β_{1x}	Maximum valid regression slope	30.0/30.0+
β_{1d}	Default valid regression slope	3.5/5.9+
Distance Weighting		
A	Distance weighting exponent	2.0/2.0
F_d	Importance factor for distance weighting	0.5/0.5
D_m	Minimum allowable distance	0 km
MAP Weighting**		
B	MAP weighting exponent	1.0/1.0
F_z	Importance factor for MAP weighting	0.5/0.5
Δ□z_m	Minimum station-grid cell MAP difference below which MAP weighting is maximum	50/50%
Δz_x	Maximum station-grid cell MAP difference above which MAP weight is zero	500/500%
Facet Weighting		
C	Facet weighting exponent	0.5/0.5 ‡
g_m	Minimum inter-cell elevation gradient, below which a cell is flat	1/1 m/cell
λ_x	Maximum DEM filtering wavelength for topographic facet determination	80/80 km
Coastal Proximity Weighting		
v	Coastal proximity weighting exponent	Not applied

* Optimized with cross-validation statistics (see Table 2).

\+ Slopes are expressed in units that are normalized by the average observed value of the precipitation in the regression data set for the target cell. Units here are 1/[sqrt(MAP(mm))*1000].

** Normally referred to as elevation weighting

‡ Maximum value; actual value varied dynamically by the model.

Table 2. Values of relevant PRISM parameters for modeling of 1- and 24-hour index flood statistics for the ORB (Ohio River Basin). See Daly et al. (2002) for details on PRISM parameters.

Name	Description	1-hour/24-hour Values
Regression Function		
R	Radius of influence	60/70 km*
s_f	Minimum number of on-facet stations desired in regression	2/12 stations*
s_t	Minimum number of total stations desired in regression	20/20 stations*
β_{1m}	Minimum valid regression slope	0.6/1.2$^+$
β_{1x}	Maximum valid regression slope	30.0/30.0$^+$
β_{1d}	Default valid regression slope	3.5/5.9$^+$
Distance Weighting		
A	Distance weighting exponent	2.0/2.0
F_d	Importance factor for distance weighting	0.5/0.5
D_m	Minimum allowable distance	50/50 km
MAP Weighting**		
B	MAP weighting exponent	1.0/1.0
F_z	Importance factor for MAP weighting	0.5/0.5
Δ□z_m	Minimum station-grid cell MAP difference below which MAP weighting is maximum	50/50%
Δz_x	Maximum station-grid cell MAP difference above which MAP weight is zero	500/500%
Facet Weighting		
C	Facet weighting exponent	0.5/0.5 ‡
g_m	Minimum inter-cell elevation gradient, below which a cell is flat	1/1 m/cell
λ_x	Maximum DEM filtering wavelength for topographic facet determination	80/80 km
Coastal Proximity Weighting		
v	Coastal proximity weighting exponent	1.0/1.0‡

* Optimized with cross-validation statistics (see Table 4).

\+ Slopes are expressed in units that are normalized by the average observed value of the precipitation in the regression data set for the target cell. Units here are 1/[sqrt(MAP(mm))*1000].

** Normally referred to as elevation weighting

‡ Maximum value; actual value varied dynamically by the model.

Table 3. Values of PRISM slope parameters for modeling of index flood statistics for the SA (Semiarid Southwest) and ORB (Ohio River Basin) for all durations. See Table 1 for definitions of parameters.

	Semiarid Southwest			Ohio River Basin		
Duration	β_{1m}	β_{1x}	β_{1d}	β_{1m}	β_{1x}	β_{1d}
1 hour	1.0	30.0	3.5	0.6	30.0	3.5
2 hour	1.2	30.0	3.8	0.7	30.0	3.8
3 hour	1.8	30.0	4.0	1.1	30.0	4.0
6 hour	2.0	30.0	4.5	1.2	30.0	4.5
12 hour	2.0	30.0	5.5	1.2	30.0	5.5
24 hour	2.0	30.0	5.9	1.2	30.0	5.9
48 hour	2.2	30.0	6.5	1.3	30.0	6.5
4 day	2.6	50.0	7.1	1.6	50.0	7.1
7 day	3.4	50.0	7.7	1.9	50.0	7.7
10 day	3.4	50.0	8.6	2.0	50.0	8.6
20 day	4.3	50.0	9.4	2.6	50.0	9.4
30 day	4.7	50.0	10.9	2.8	50.0	10.0
45 day	5.0	50.0	10.5	3.0	50.0	10.5
60 day	5.2	50.0	10.9	3.5	50.0	10.9

Table 4. PRISM cross-validation errors for 1- and 24-hour index flood applications to the SA (semiarid southwest) region.

Statistic	N	% Bias	% MAE
1-hour index flood	459	1.93	11.84
24-hour index flood	1822	1.56	8.99

Table 5. PRISM cross-validation errors for 1- and 24-hour index flood applications to the ORB (Ohio River Basin) region.

Statistic	N	% Bias	% MAE
1-hour index flood	946	0.48	5.77
24-hour index flood	2944	0.41	4.34

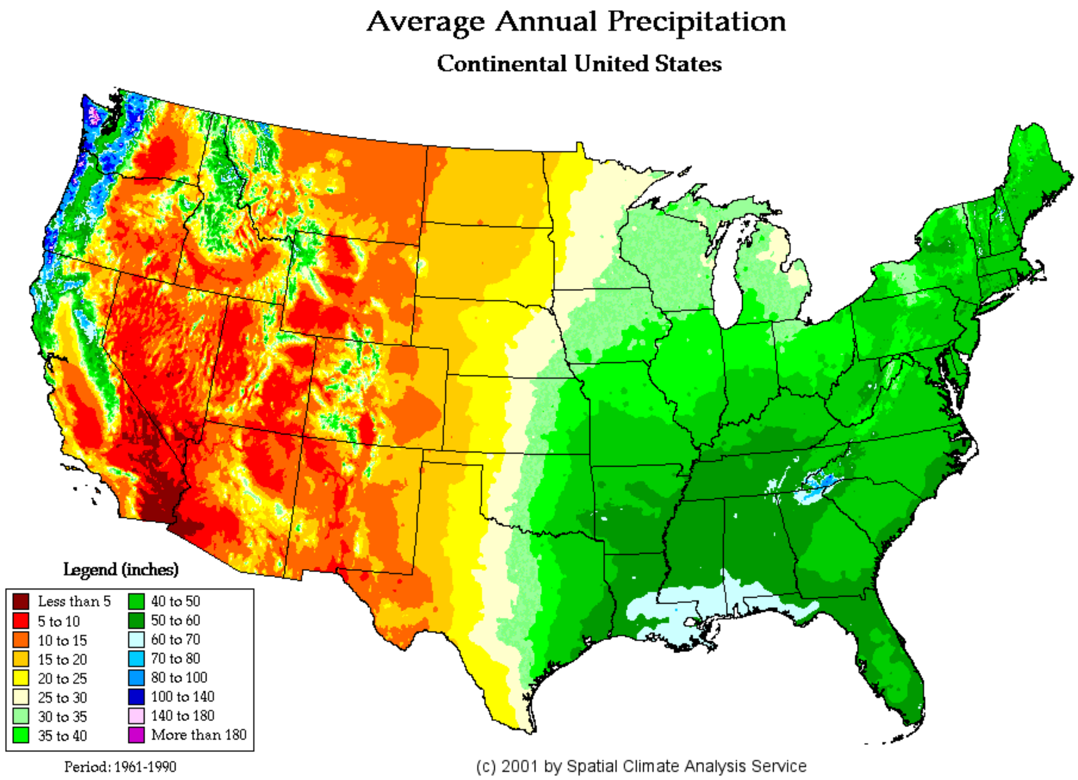
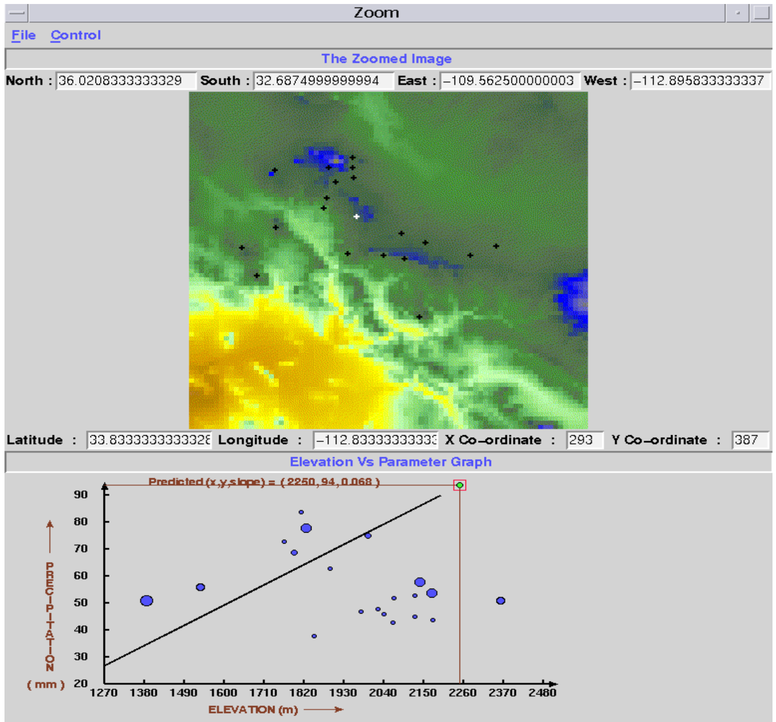


Figure 1. Grid of PRISM Mean Annual Precipitation for the United States (USDA-NRCS 1998, Daly and Johnson 1999), used as the spatial predictor of precipitation frequency.

(a)



(b)

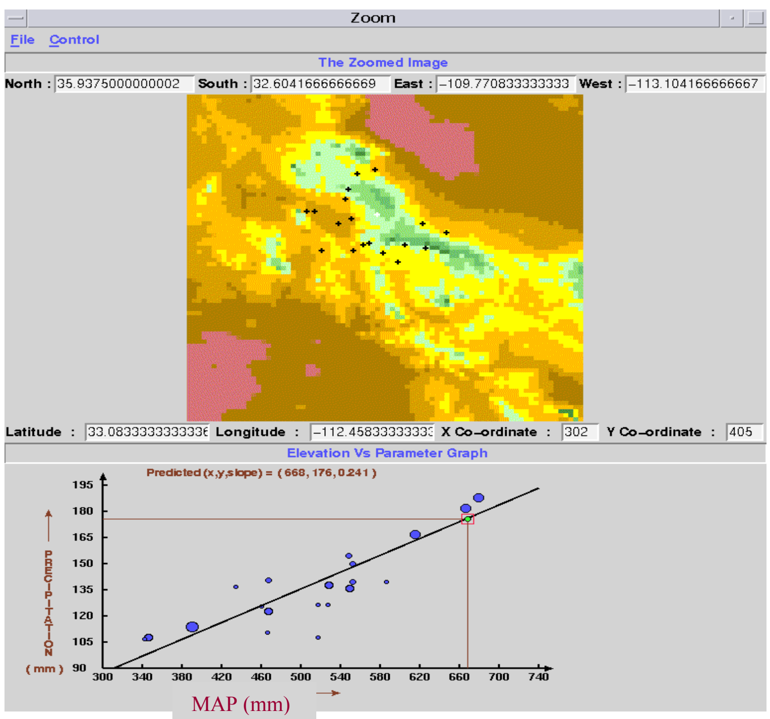


Figure 2. PRISM graphical user interface showing: (a) 100-yr 24-hour precipitation vs elevation; and (b) 100-yr 24-hour precipitation vs mean annual precipitation (MAP), Mogollon Rim, AZ. Size of dot indicates relative weight of station in regression function.

(a)

(b)

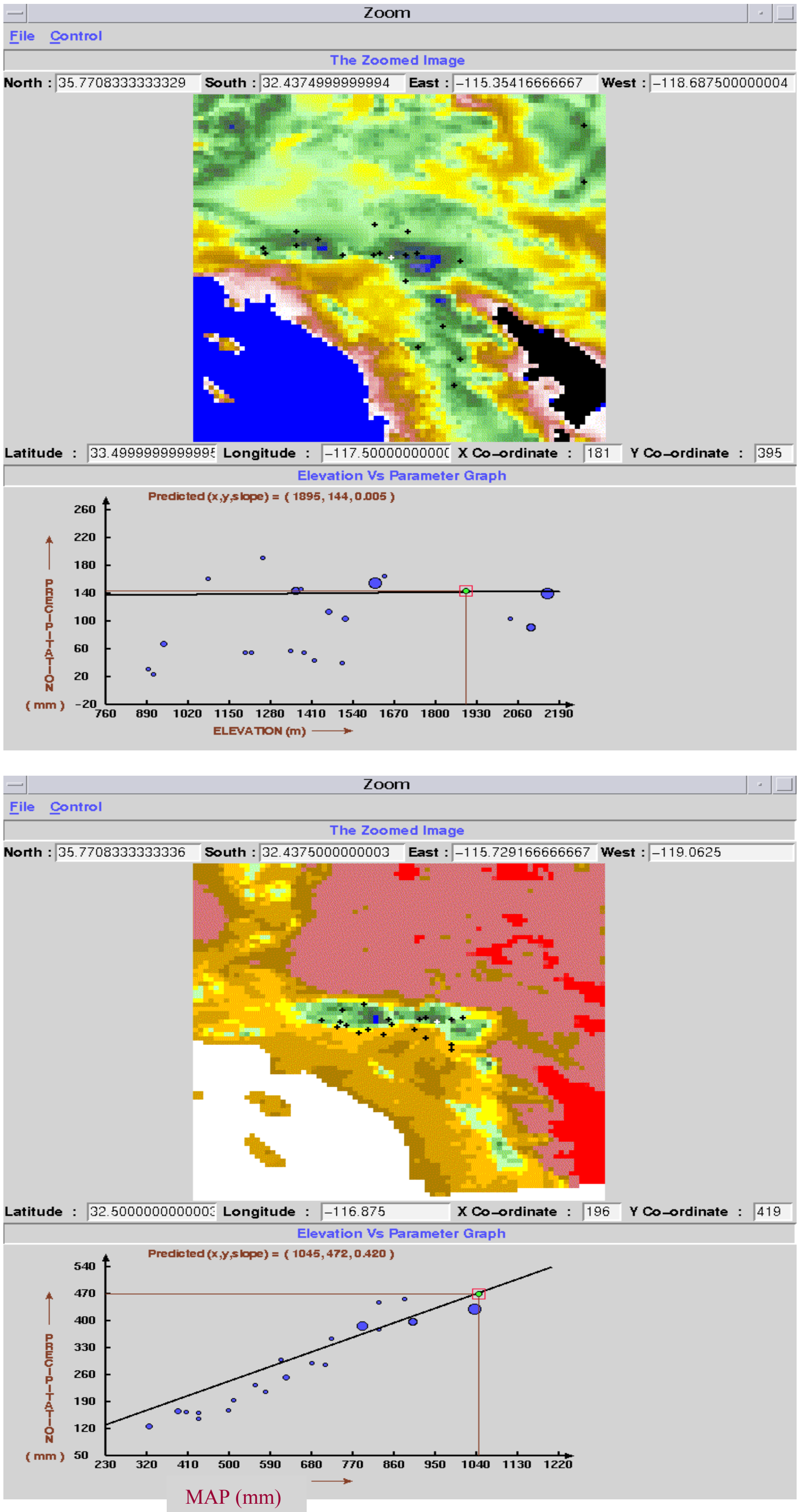
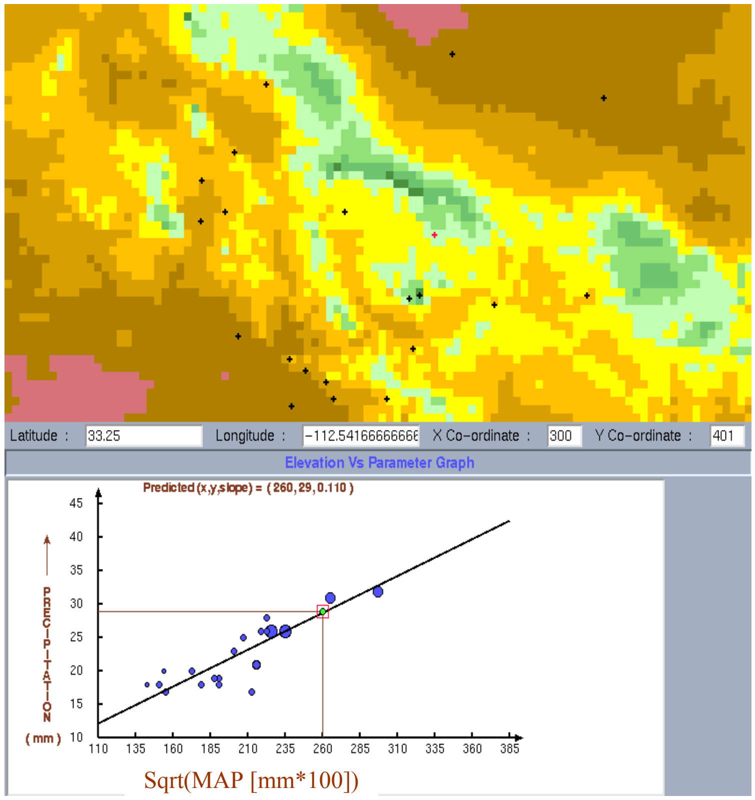


Figure 3. PRISM graphical user interface showing: (a) 100-yr 24-hour precipitation vs elevation; and (b) 100-yr 24-hour precipitation vs mean annual precipitation (MAP), San Bernardino Mountains, CA. Size of dot indicates relative weight of station in regression function.

(a)



(b)

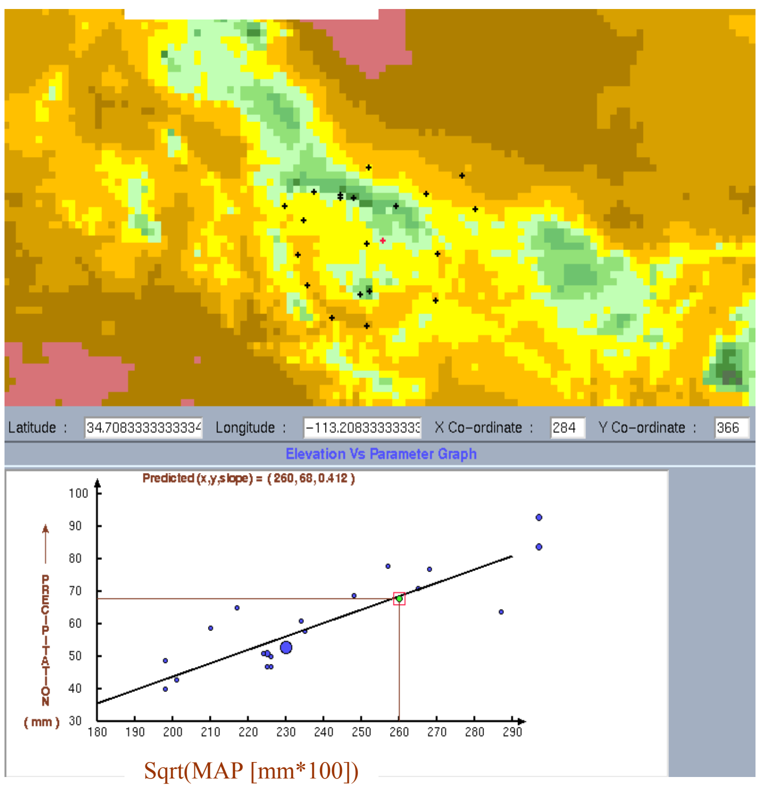
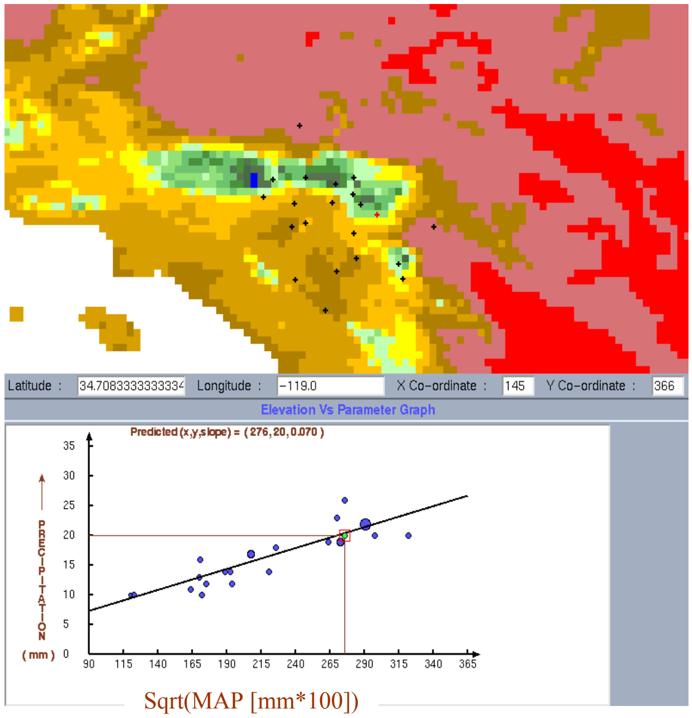


Figure 4. PRISM graphical user interface showing: (a) 1-hour index flood precipitation vs mean annual precipitation (sqrt(MAP)); and (b) 24-hour index flood precipitation vs sqrt(MAP), Mogollon Rim, AZ. Size of dot indicates relative weight of station in regression function.

(a)



(b)

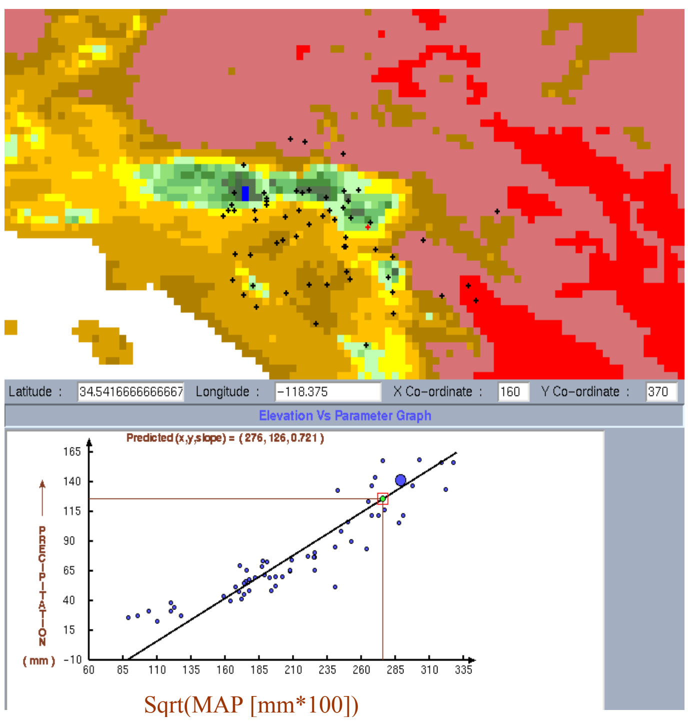


Figure 5. PRISM graphical user interface showing: (a) 1-hour index flood precipitation vs mean annual precipitation (sqrt(MAP)); and (b) 24-hour index flood precipitation vs sqrt(MAP), San Bernardino Mountains, CA. Size of dot indicates relative weight of station in regression function.

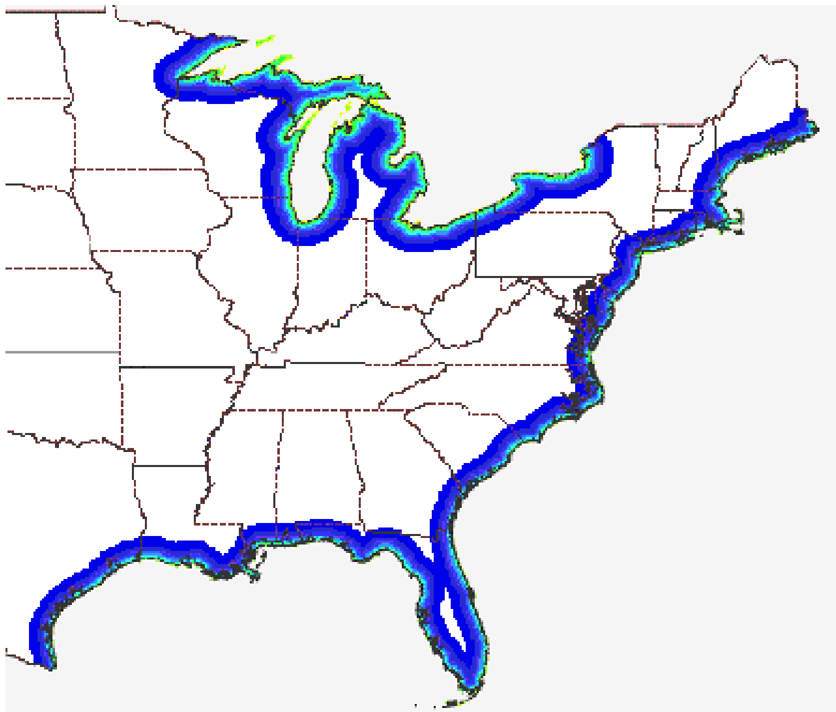
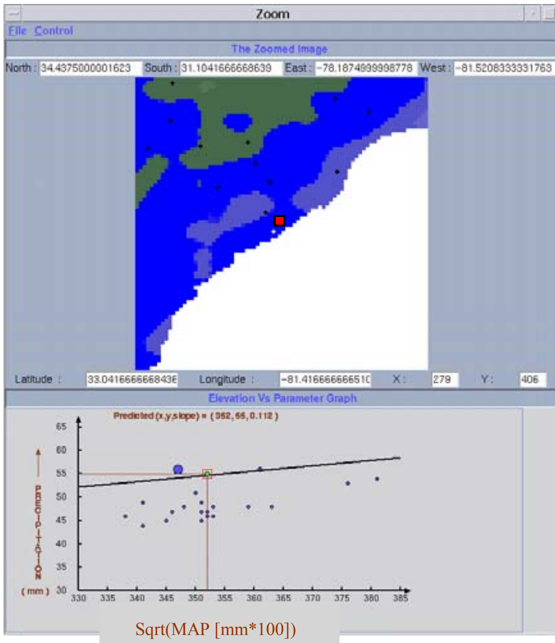
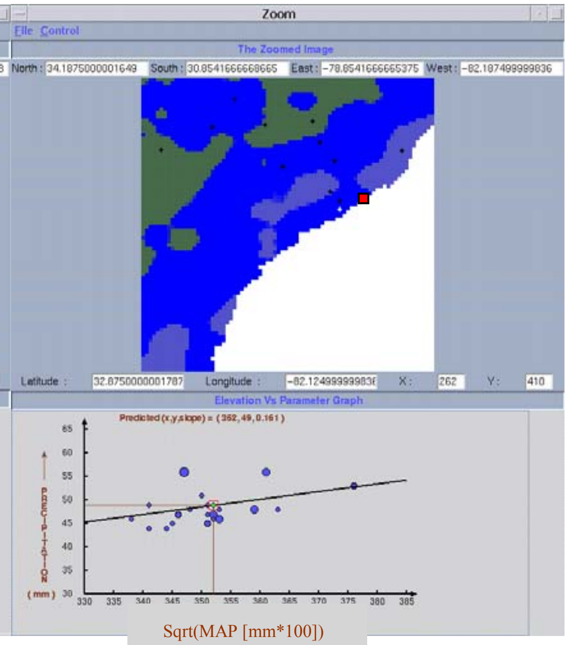


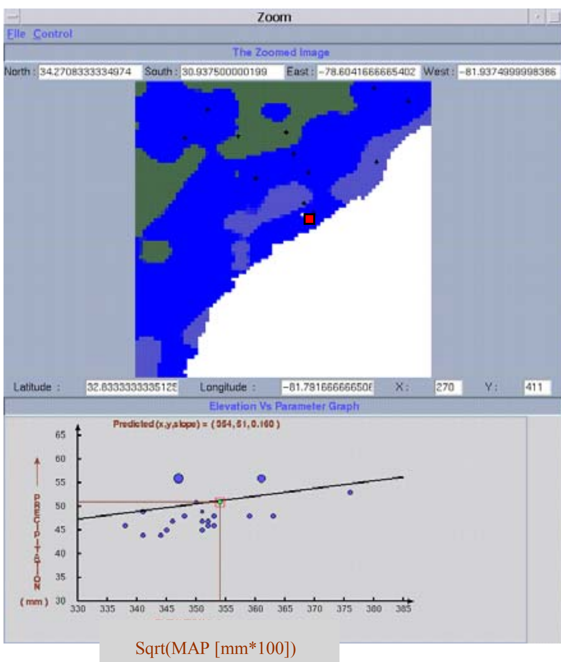
Figure 6. Coastal areas delineated in the eastern United States.



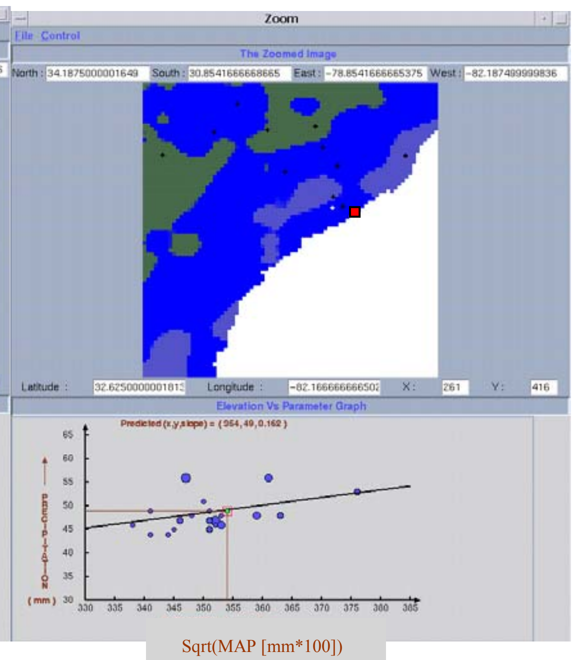
(a) Coastal pixel, coastal proximity enabled.



(b) Coastal pixel, coastal proximity disabled.

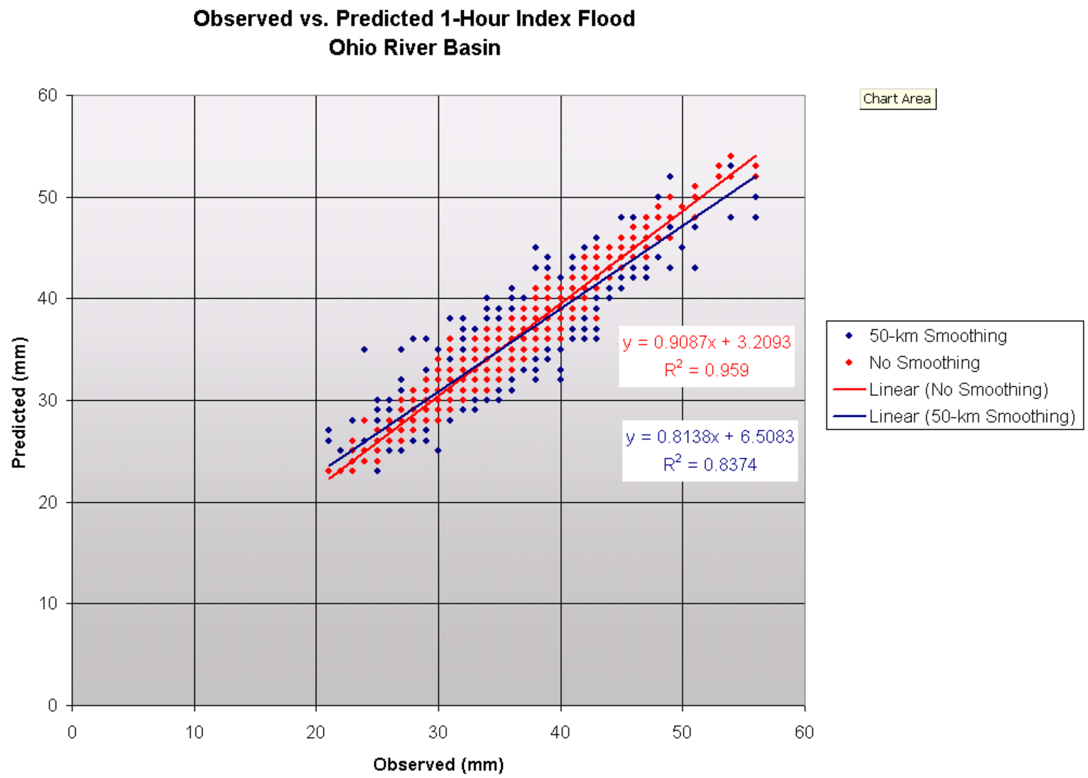


(c) Inland pixel, coastal proximity enabled.



(d) Inland pixel, coastal proximity disabled.

Figure 7. PRISM graphical user interface showing 1-hour index flood precipitation vs mean annual precipitation (sqrt(MAP)) near Charleston, SC. Coastal proximity weighting allows the regression function to preserve higher 1-hour precipitation values along the immediate coastline by producing different regression functions at coastal and inland pixels. In contrast, lack of coastal proximity weighting produces similar regression functions for both pixels and does not recognize the coastal precipitation maximum. Target pixel is shown as a red square. Size of dot on scatterplot indicates relative weight of station in regression function.



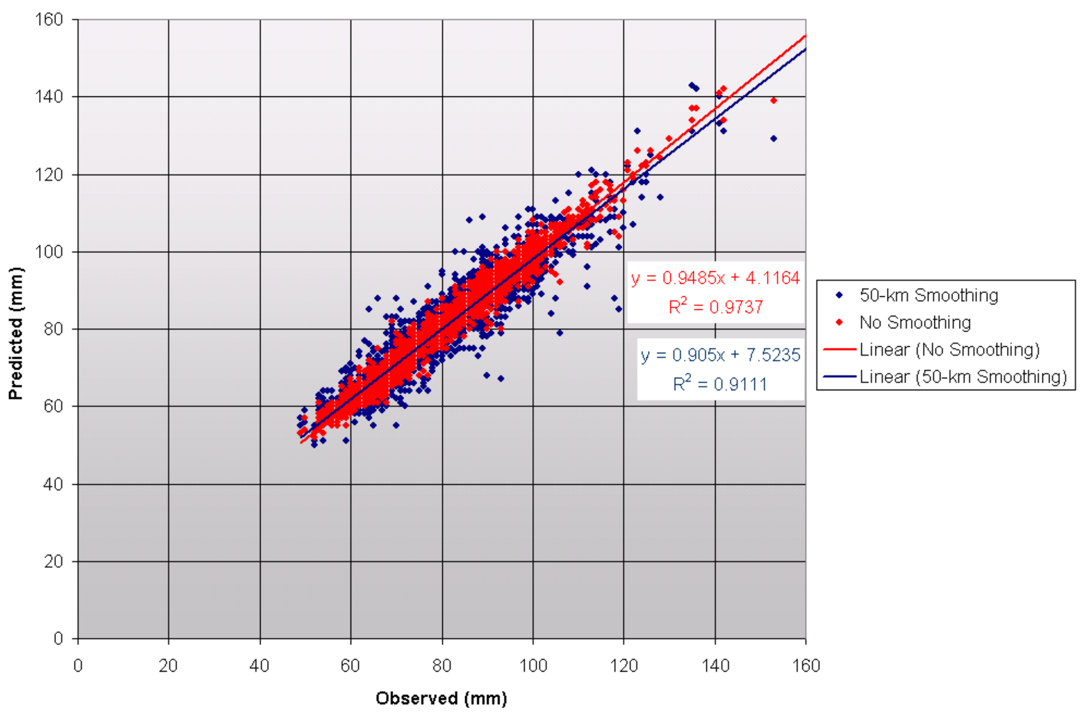
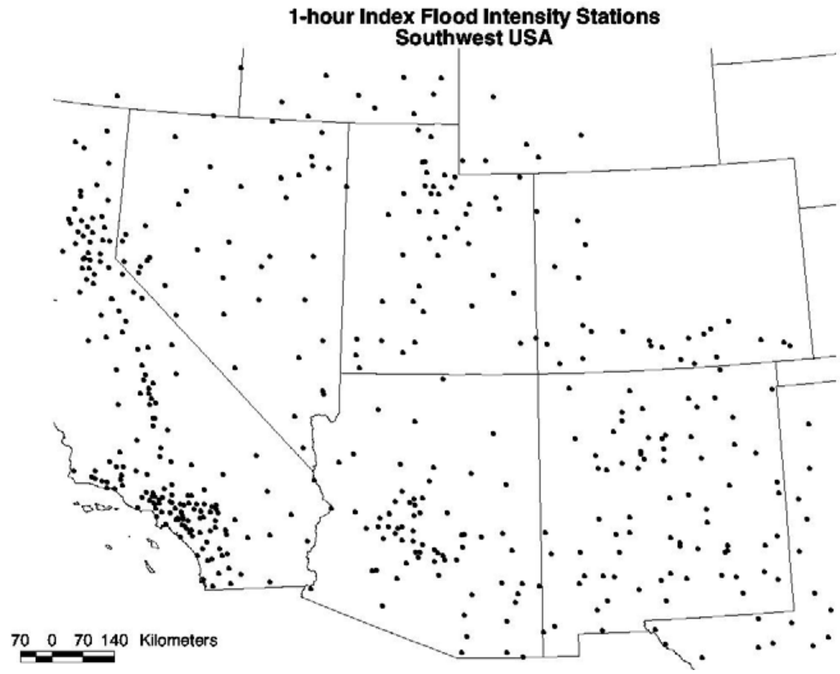


Figure 8. Relationships between station and gridded precipitation values for 1- and 24-hour index floods, with and without the 50-km distance weighting limitation (smoothing). See text for details.

(a)



(b)

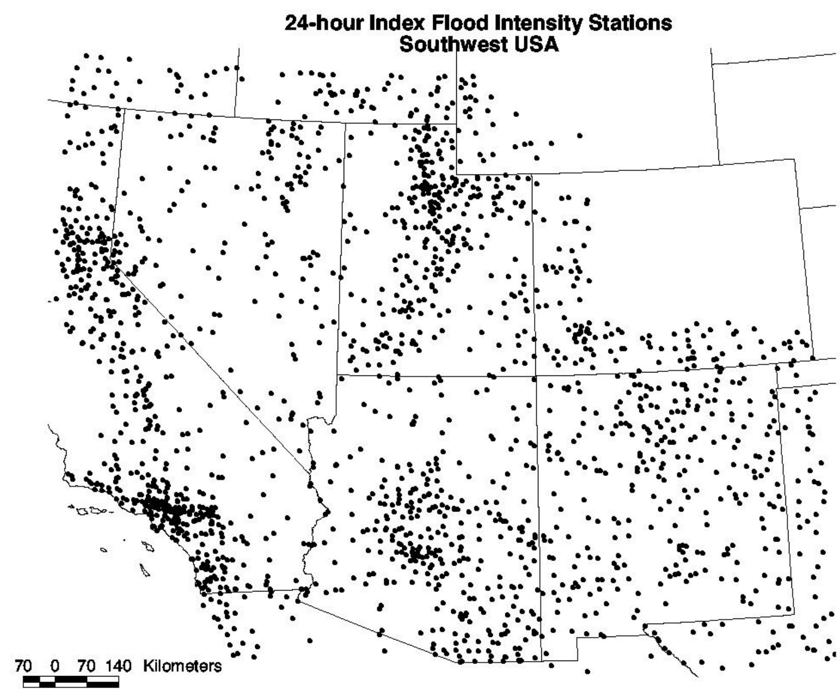
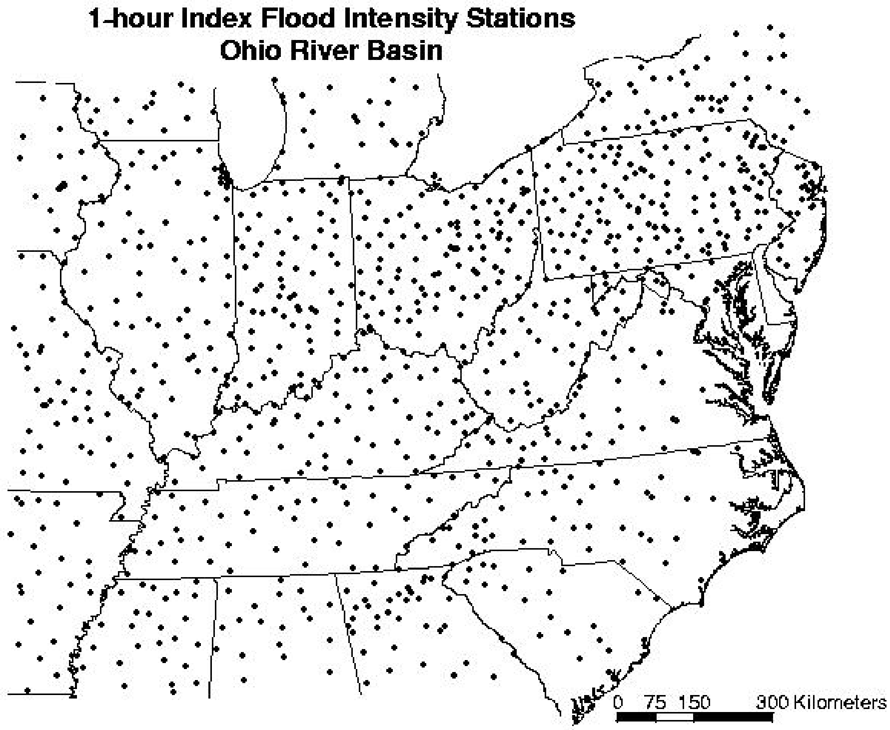


Figure 9. Distribution of station data in the Semiarid Southwest region for: (a) 1-hour; and (b) 24-hour index flood intensities.

(a)



(b)

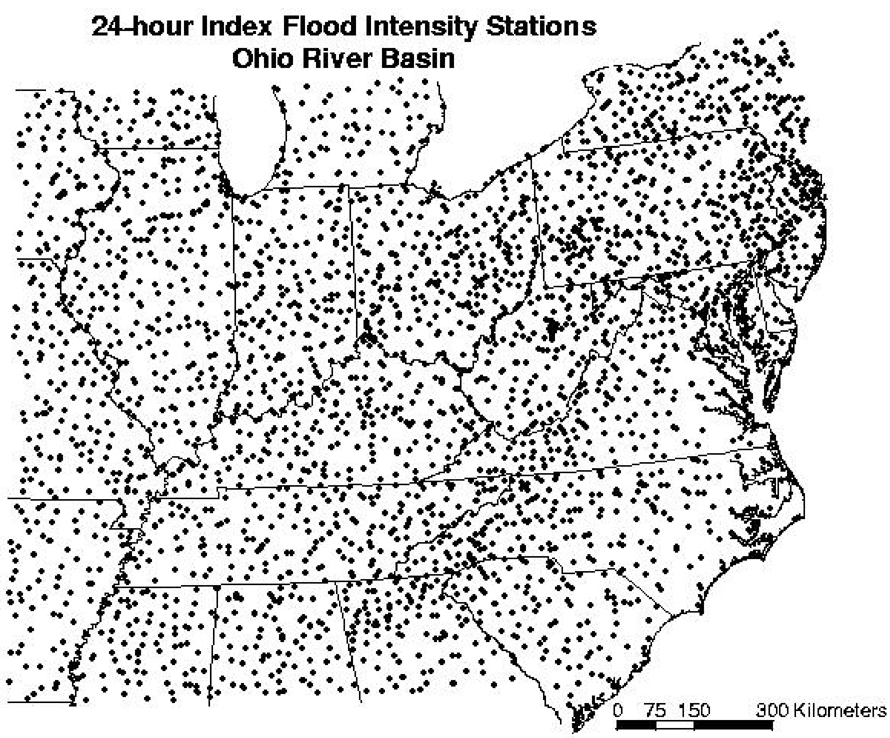


Figure 10. Distribution of station data in the Ohio River Basin for: (a) 1-hour; and (b) 24-hour index flood intensities.

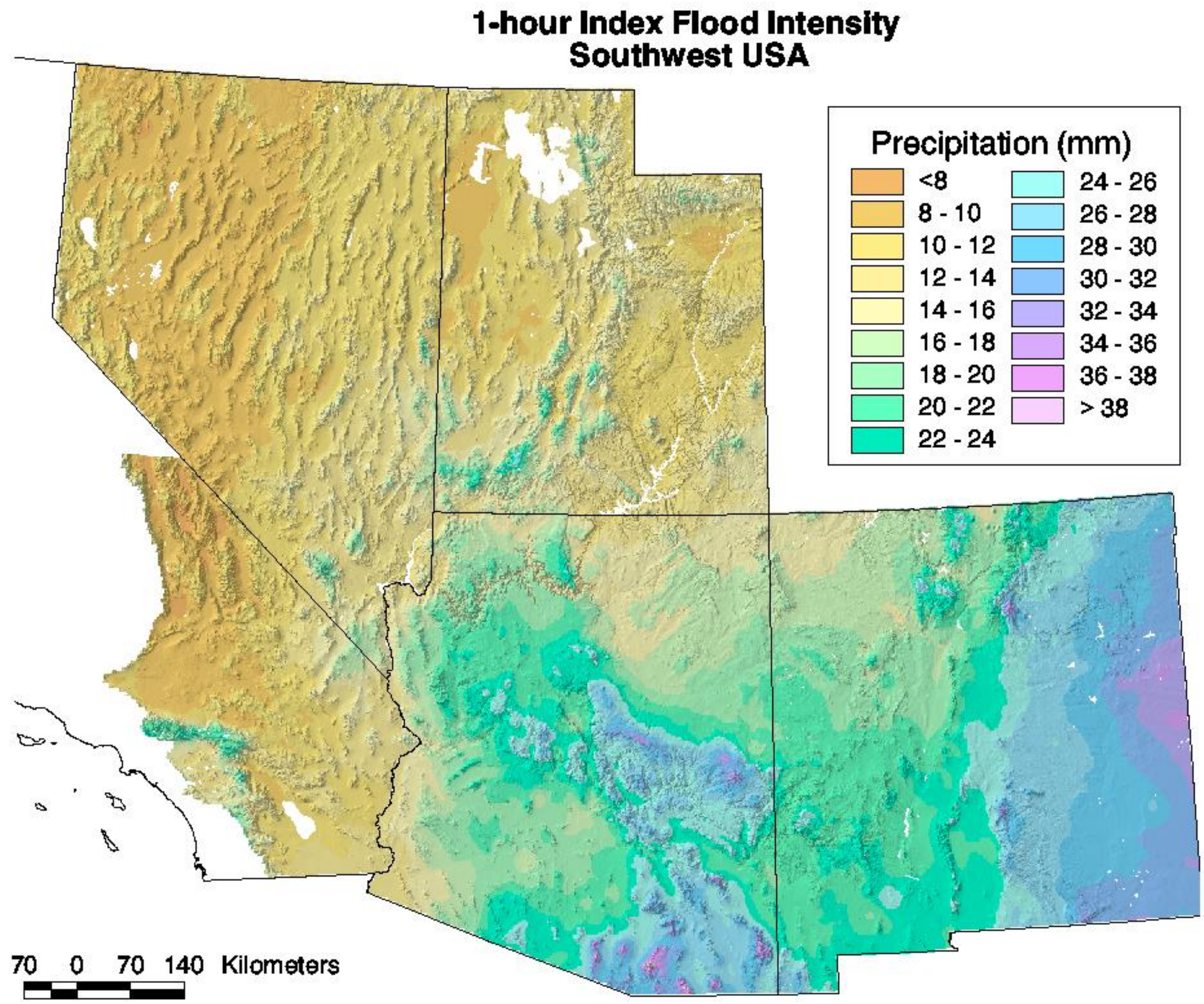


Figure 11. Final PRISM grid of 1-hour all-season, index flood intensity for the Semiarid Southwest region.

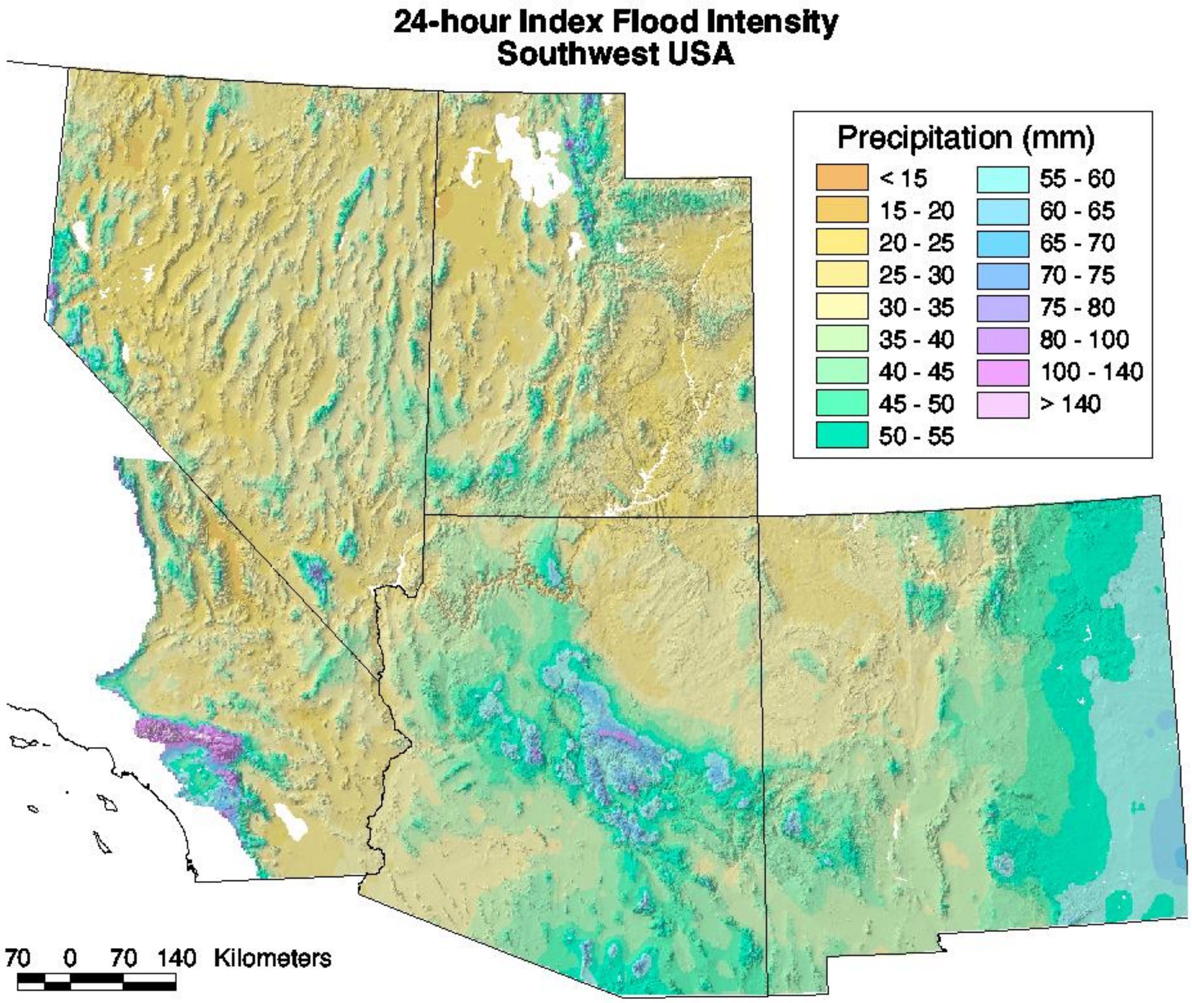


Figure 12. Final PRISM grid of 24-hour, all-season, index flood intensity for the Semiarid Southwest region.

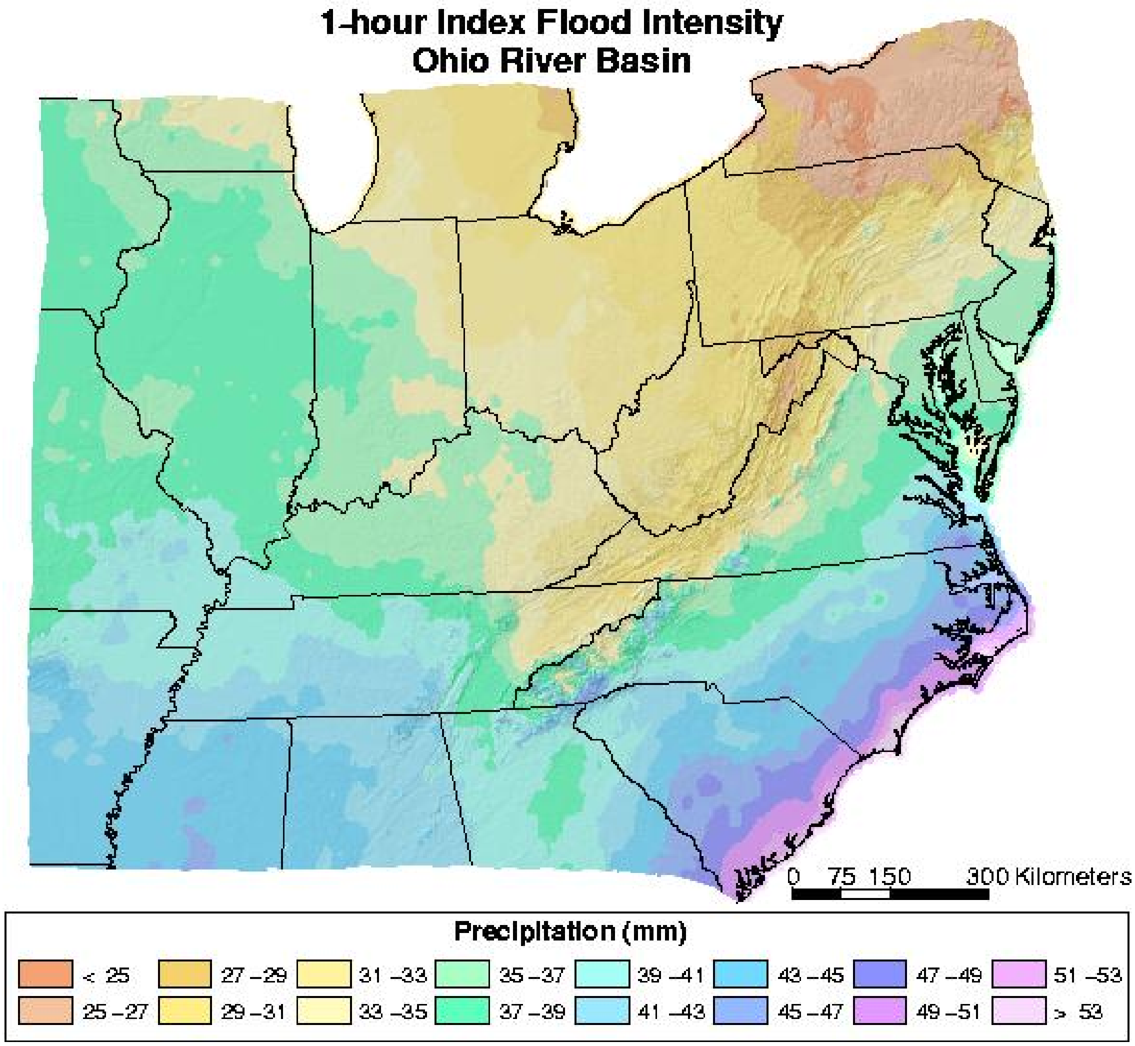


Figure 13. Final PRISM grid of 1-hour all-season, index flood intensity for the Ohio River Basin.

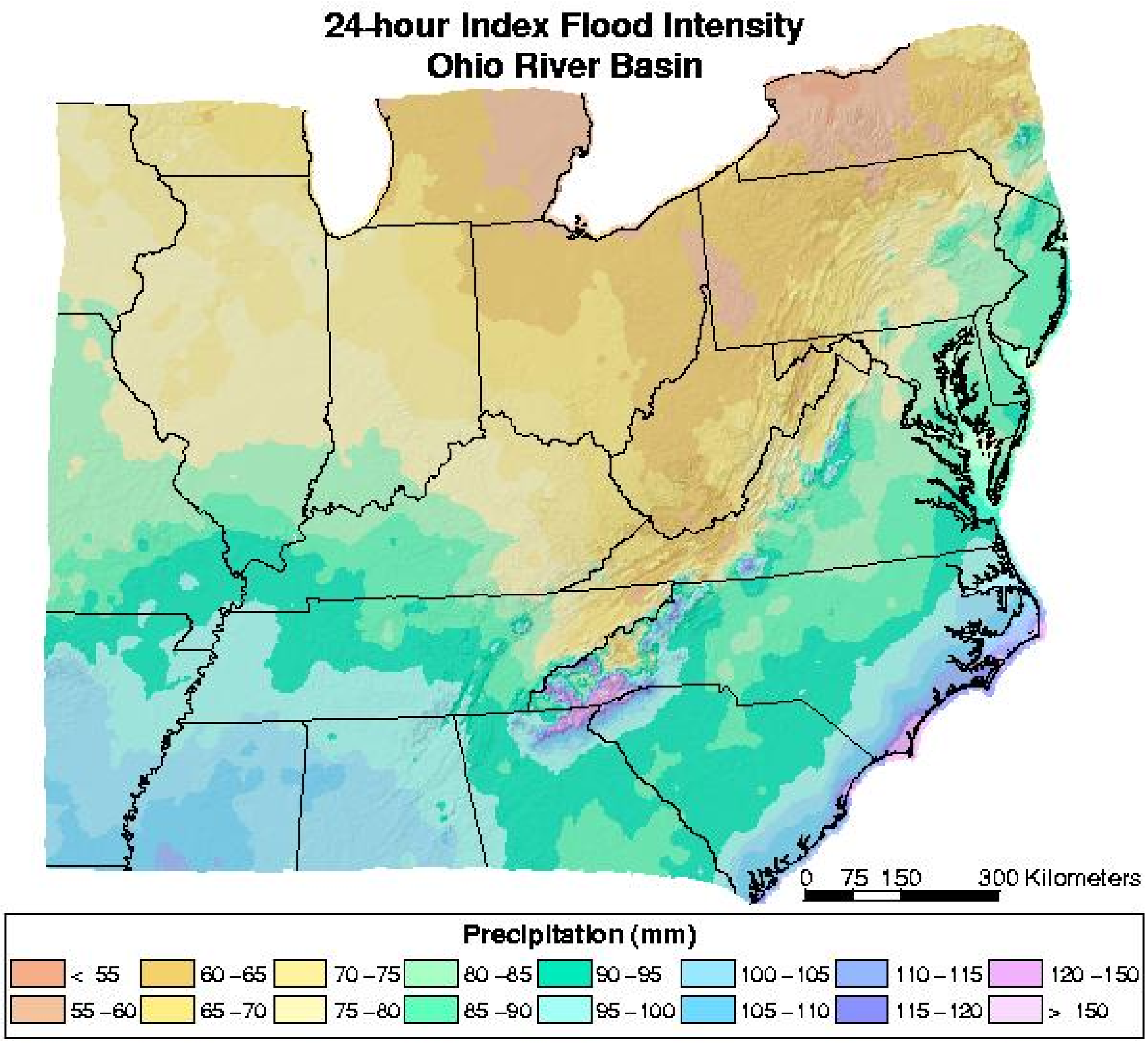


Figure 14. Final PRISM grid of 24-hour all-season, index flood intensity for the Ohio River Basin.

Appendix A.5

Observing Site Precipitation Frequency Review Comments and Responses

June 27-July 26, 2002
Semiarid Southwest

Tye Parzybok, Debbie Todd, Bingzhang Lin, Geoff Bonnin
August 15, 2002

Introduction

This document is a consolidated summary of all the review comments with our response. The wording of the comments was unchanged to make sure the meaning was not misconstrued and so individual reviewers could identify their comments. We've noted those cases where we don't have an immediate resolution.

The majority of the comments pertained to the PFDS (32), however the solution to these are easy software changes/fixes. The most significant data-related issues include: unusual steps or changes in slope in the IDF curves, and significant differences between our results and storm events in some locations. Similar issues/comments were grouped together and are accompanied by a single response. The comments and their respective responses have been divided into seven categories:

1 **Internal consistency and step functions**
2 **General data**
3 **Comparison with NOAA Atlas 2 and other sources/storms**
4 **Precipitation frequency estimates too high/low**
5 **Methodology**
6 **PFDS**
7 **General/miscellaneous**

Summary

Review period: June 27 – July 26, 2002
Number of reviewers notified: ~84
Number of reviewers that responded: 25 (30%)
Number of unique comments: 74

1 Internal consistency and step functions

1.1 For the station data at Las Vegas WSO Airport (26-4436), the plot of All Season Precipitation Frequency Estimates and that shown in the All Season Precipitation Frequency table indicates that the 1000-yr, 6 and 12 hour values are greater than the 24 and 48 hour amounts. How can this be? Examination of the "Intensity-Duration Frequency" curves shows a rather smooth transition but one has to examine carefully the slope of the curves shown and one can see that there is a problem with the 1000-yr, 6 and 12 hr values being greater than the 24 and 48 hr values. How many other places this occurs at I am not sure but I suggest this problem be seriously looked into at other sites if it should occur there also.

The point rainfall depths for the 24-hr and 48-hr 1000-yr frequency at Las Vegas WSO are LESS THAN the 12-hr depth for the same frequency event. For a given frequency, I would expect that the point rainfall depths would increase with longer duration events.

Viva Las Vegas. For the 1000 year rp, check Las Vegas at 6, 12, and 24 hours. rainfall goes down. Also a smaller decline from 12 to 24 hours for the 500 yr. Problems in extending curves? this is where some smoothing comes in?

Response: We are investigating this internal consistency issue (when 6 and 12 hour values are greater than 24 and 48 hour amounts), which occurs at more than one site but does not appear to be widespread. We do not currently know the cause. We will determine why this happens and how we can remedy it.

1.2 I looked at sites: Truckee RS (04-9043); Reno WSFO Airport (26-6779) "All Season Site-specific Precip. Freq. Estimates" plots and the information shown for the 2-year 5-min through 60-day duration curve looks great; however, that for return periods greater than the 10-yr look really odd (both internally; within the individual station data and when comparing both sets of data.) What is going on here? Do you have an explanation for why these curves don't look a bit more similar? I'd check this out for other locations.

Response: We are investigating these stations and will be checking all stations in the study area for similar problems. The results for Truckee RS clearly have a problem. The data for Reno WSFO Airport isn't as clearly flawed, and perhaps not flawed at all. The linear trend from 60-m to the 5,10,15 and 30-min durations is the result of a constant ratio to the 60-min estimate, thus probably okay.

1.3 At Truckee RS, I notice that the 1000-yr 12-hr precip value is 4.73 inches; yet the 1000-yr 12-hr incremental value for this station between the 12-hr and 24-hr 1000-yr depths indicates a magnitude of 4.9 inches. Is this possible? Something is wrong or I need an explanation as to why this is occurs.

Crystal Lake has another peculiarity in that for return periods between 10 and 200 years, the precipitation accumulation between 45 and 60 day periods is about 3 inches but for 500 years it is about 15 inches and for 1000 years it is about 19.5 inches.

Response: We are investigating any sharp differences or step-functions between sequential durations at all stations, between the 12 hour and 24 hour durations in particular. Any station with large differences between durations will be flagged and closely scrutinized to determine the cause and we will take appropriate action to resolve this problem globally or case by case. Currently we cannot say further how we will remedy this issue until we know the cause.

1.4 In a related matter, we examined the precipitation intensity tables at just one station—McNary 2N, AZ. We found that the 1000yr (0.28”/hr) intensity times the 24hr duration = 6.72”, which was different from the published 1000yr/24hr precipitation value (6.83”). Are these two values supposed to be the same, or should they be different. Please explain.

Response: Yes, they should be the same, but the difference is the result of rounding. The highest resolution 1000y/24h estimate the PFDS has for McNary 2N is 173.48 mm (you can get this by selecting Metric units). That equates to an intensity of 7.228 mm/hr, or 0.2845”/hr, which rounds to 0.28”/hr. I suggest using the metric units for the highest precision data.

1.5 I am used to seeing sets of pf curves where the precipitation intensity (1st derivative of precipitation with respect to a fixed time interval) continually decreases with increasing duration. This means for example that the precipitation plotted at the 6 hour point is the greatest precipitation for a 6 hour interval in the pf curve for a particular return period, and so on for every duration in the curve. While the data for many stations that I checked approximate this criterion, there were several other stations I found in my somewhat random search where the data presented deviate significantly from this, some so much so that I don't really know how to interpret those particular station data sets. What follows are examples of what I found in a random sampling of 30 or so stations.

Las Vegas WSO AP,NV: at 500 and 1000 years, the 24 hour precip is less than the 12 hour precip.

Searchlight, NV: At 1000 yr, only 0.02" of precip accumulates between 6 and 12 hours, yet 3.57" accumulates between 12 and 24 hours.

Arroyo Seco Ranger Station, CA:
The accumulation rate between 30 and 45 days greater than the accumulation rate between 20 and 30 days at all return periods.

Laguna, NM: The accumulation rate between 12 and 24 hours is greater than the rate between 6 and 12 hours and the 7-10 day accumulation is greater than the 4-7 day accumulation.

El Centro 2SSW, CA: At 1000 yr, only 0.13" precip accumulates between 2 and 12 hours, yet 1.71" accumulates between 12 and 24 hr and 1.05" between 24 and 48 hr, then only 0.11" between 48 hr and 7 days.

Bosque del Apache, NM: At 1000yr, we have only 3.00" for the 12 hour value, yet 4.43 accumulates between 12 and 24 hrs. The 3 days between 24hr and 4 days show an accumulation of 0.16" yet between 4 and 7 days, 1.88" accumulates. the 38 day period between 7 and 45 days shows an accumulation of 0.41" yet 2.36 accumulates between 45 and 60 days.

The examples cited above seem to be what one would expect to see for a cumulative mass curve of precipitation at a particular location for an actual series of events over a 60 day period of climatological record interspersed by dry periods of varying lengths.

Response: We are carefully investigating these specific examples as well as all other stations. We are developing software to screen and test output for all stations that behave like this.

1.6 Below are problems I have found with Texas stations appearing on the New Mexico map. Many stations in the Pecos and Rio Grande river areas have too little increase in precipitation totals between 10 days and 20 days at very long return periods, presumably due to a relative overabundance of excessive 10-day events during the period of record. These stations include:
Red Bluff Dam
Wink Airport
Penwell
Monahans
Pecos
Buenavista

Mentone
Imperial
Kent
Grandfalls
Socorro
Salt Flat
La Tuna

Four stations have too little increase between both 10-20 and 20-30 days at very long return periods:
Toyah
Van Horn
Fort Hancock
Fabens

Several stations near the Pecos river have too little increase in precipitation totals between 24 hours and 48 hours at the shortest return periods:
Muleshoe NWF
Salt Flat
Pecos
Buenavista
Imperial (48 hr 2-yr totals are less than 24 hr 2-yr totals)
Mentone (little change between 1 and 4 days)

Several stations have an unrealistic jump in precipitation totals between 12 and 24 hours at long return periods:
Andrews
Imperial
Red Bluff Dam
Sierra Blanca
Fabens (24 hr 1000-yr total is more than double 12 hr 1000-yr total)

Fort Hancock rainfall totals seem too high compared to nearby similarly-situated stations (Tornillo, Fabens, Socorro, Ysleta)

Kent totals seem too low for accumulation periods below 10 days.

Plains has an unrealistic near-peak at 45 days.

Coldwater totals seem too low at and around 20 days.

Romero totals are too high for long return frequencies compared to surrounding stations (Dalhart, Bunker Hill, Nara Visa NM).

Response: We are investigating stations showing “unrealistic jumps in precipitation totals” and developing tools to screen the data for this. Your insights into whether our values are too high or low are valued, however we need data we can use to objectively alter our results. Eastern NM and TX are particularly difficult areas because of the lack of good quality observations with a long period of record and a sufficient spatial density.

2 General data

2.1 We assume that there are no data available below 24 hr duration at many stations because these are daily observation stations. Correct?

At a few locations we clicked on there were no data for longer than 24 hour duration (for example, Camp Angelus CA (041369). Why?

I note that many of the sites do not have 5-min to 12-hour data. I assume that this is because these are 24-hour gage stations. Additionally I find a number of locations that do not have 48-hour to 60-day data. Will this data be obtained from other sources in the final product? If so, will there be any notation on how the data was obtained.

I have one suggestion - Make it clear that some locations only have data for 24 hour or longer durations, while other have data available for shorter durations. It may confuse some customers if they see data for 6 hour, for example, for one location but not another.

On the graph for stations with only 24-hr data, it is not necessary to draw a line from the base up to the amount for the 24-hr duration. That line has no meaning.

Unless I missed something, I could not get subdaily estimates of precipitation frequency. Will this functionality be available?

Short duration (less than 24 hour) data was not provided for any stations within Maricopa County except for three stations (Phoenix WSO, Phoenix City and Painted Rock Dam). Painted Rock Dam only had short duration data, and no data was provided for durations greater than 24 hours. In the absence of short duration data, FCDMC cannot complete its review and will provide additional comments when all data becomes available.

Response: Stations that only had data for <24 hours are hourly stations, while those with >=24 hr data are daily stations. Once the complete spatial data is available for all durations/frequencies, there will be no gaps in the data. We are using PRISM based spatial interpolation techniques which will not only result is estimates between observing sites but also at observing sites in the cases noted in the opening sentence. An hourly station location will be populated with a complete series of data (out to 60-days), likewise the daily stations will be populated with data down to 5-minutes. In other words, in the future if you desire data for a specific station, it will be transparent whether it is an hourly or daily (or SNOTEL) station, but if you'd like to know more details about the station, our final report will contain station lists for this information. For a subset of stations, a software bug prevented the 48-hour to 60-day data from appearing. This particular issue has been resolved.

2.2 Did the short duration rainfall data we sent you get included in the Riverside County SW Arid Study?

Response: Most n-minute data is used indirectly due to the sparsity of n-minute stations. N-minute ratios were calculated from n-minute data. The ratios were used to convert 60-minute hourly values to shorter durations. We had neglected to sum n-minute stations and use the hourly and longer period sums directly. Your question has prompted us to do this.

2.3 The inclusion of confidence intervals is a much needed and appreciated addition. I would suggest that you also include the period and/or number of years of record used for the statistical analysis for each site.

Response: Yes, we will provide station information on all daily, hourly and n-minute stations used in our study including the record period and years of record. We would also note that the confidence interval itself gives a more objective measure of the reliability of the estimates than the period of record.

2.4 Results: Depth-Duration-Frequency (DDF) curves or tables and confidence intervals for individual rainfall gage stations, isopluvials for typical durations and frequencies. It looks like that most of the gage stations have DDF curves with 12-our or longer time durations only. The confidence intervals seem to be very high. For example, for the 100-year 24-hour rainfall depth, the 90% confidence intervals are 3.39-4.00 in, 3.31-4.20 in, 3.35-3.98 in, 3.52-4.46 in, and 3.29-3.96 in for gage stations Granite Reef Dam, Griggs 3W, Buckeye, Wittman 4SW, and Litchfield Park, respectively.

Response: The confidence intervals at each site were computed through Monte Carlo simulation based on the original data and their statistical characteristics (data length, L-moments statistics) for the fitted distribution at a reasonable confidence level (90% was used for the study). The number of repeated simulations was set to 1000, which is acceptable in terms of simulation convergence and accuracy. In a brief look at the period of record for these stations, we found Granite Reef Dam, Griggs 3W, Buckeye, Wittman 4SW, and Litchfield Park with 82, 40, 105, 37 and 83 years of data, respectively, so one wouldn't expect the confidence intervals to by "very high." However, the confidence interval is also a function of the variance in the recorded data. On the other hand, we are concerned that because confidence intervals are generally not provided with precipitation frequency estimates, the estimates have taken on a aura of precision that is unwarranted. We expect some initial surprise when users become aware of the objectively determined confidence intervals we have computed.

2.5 Is there really no longer term data for El Paso WSO?

Response: There is, in fact we have 54 years of usable data for El Paso WSO, for all durations, including >24 hr which didn't show up on the PFDS – but has been fully used in our study. The reason for it not appearing has been identified and the problem has been fixed.

2.6 It would be nice to go all the way to "365-day" durations. Such would show the continuity of concept, and include another valuable piece of information in compact form. To get annuals I have to go to PRISM maps on another site.

Response: From a design point of view a 365-day event has limited or no use. The estimates we provide are for storms of varying durations, not climate normals for those periods. The PRISM maps and National Climatic Data Center products are a much better source for this information.

2.7 For the Siverbell station (02-7915), is the elevation correct? Nothing aberrant in the data from it, but the stated elevation (2613) looks low from my understandings of the local topography. No I've not checked it on the quad sheets.

Response: he PFDS will be providing data for 30-second grid cells rather than explicit points.

The grid cell elevation is based on a DEM. The elevation for the grid cell containing Silverbell is 2613 feet. The NCDC records indicate the Silverbell gage at 2740 feet.

3 Comparison with NOAA Atlas 2 and other sources/storms

3.1 Because the local agencies require development to use the NOAA Atlas, they need to buy off on it. If they have doubts on its validity, they may hold private developers to a higher standard than in the past for example, increase NOAA depth by 20%.

Response: n our initial comparisons, the new estimates, as you'd expect, are coming in relatively close to NOAA Atlas 2. However, there are a number of areas that are going to change, and some substantially. We have a more extensive set of data to work with and a variety of more effective analytical techniques than those available when NOAA Atlas 2 was developed. The provision of confidence intervals will also provide new information on the reliability of the quantiles themselves.

3.2 It's difficult to comment without the benefit of good data to support our initial thought. However, most locations away from the Albuquerque metro area looked reasonable. Unfortunately, the only Albuquerque site we could access was Netherwood Park. To us, the values look rather low, and generally 10-15 percent lower than the 1973 NOAA atlas (which we thought was already on the low side). We don't have much to go by, except the experience of being here during a number of events in which sections of Albuquerque received 2-3 inches of rain in less than 12 hours. Some of our worst flash floods have involved amounts of 3 inches or more in less than 3 hours. Some fairly recent examples includes a 1961 case with 4.07 inches of rain in less than 12 hours, 1963 case of 3.25 inches in one hour, 1980 case of 5-6 inches in 12 hours, 1988 case of 4-6 inches in less than six hours. A lot of our problem is that some flash floods have occurred as a result of heavy rainfall at higher elevations of the city, or even areas outside the city (western slopes of the Sandia Mountains). Of course, any precipitation that falls along the western slopes of the peaks east of the city is going to make its way toward the Rio Grande...coming through the city in the process. Perhaps the data just do not exist to support calculations for other elevations of the city. The foothills station (ABFN5) is at my house, but we only have about 11+ years of published data for that site.

Based on data which the Clark County Regional Flood Control District (RFCD) has collected over the past 14 years, the point rainfall depths provided in the All Season Precipitation Frequency table for Las Vegas WSO Airport (and perhaps other sites) appear to underestimate rainfall depths for durations less than 6 hours. During a single rainfall event on July 8, 1999, six RFCD gages reported depths which exceeded the 2.12" 6-hr 100-yr depth presented in the Precipitation Frequency table mentioned above (see the attached Flood Event Report). According to that table, the rainfall depths at those gages exceeded the 200-yr return interval depths, and the depths at two of the gages approached or exceeded to 1000-yr return interval depths. Similar "extremely rare" rainfall depths were recorded for durations of 15-60 minutes during this and other rainfall events. I am not suggesting that rare events do not occur or should not be expected, but rather that they DO occur more frequently than your results would indicate.

A more comprehensive research of the FCDMC network of gages with 8 to 20 years of data close to the Phoenix WSO gage reveals that in the past few years, 40% of our gages have already recorded precipitation that has equaled or exceeded the 100-year return frequency at least once. The summary of severe rainfall events for FCDMC gages can also be viewed at the following web site: http://156.42.96.39/alert/Rain/stormsdb.html. Our data indicates that NOAA 14 analysis may be severely under estimating short duration precipitation totals, possibly due to limited number of gages used.

In the limited time available, FCDMC researched a few flood reports from recent floodings in the Phoenix Metro area dating back to 1963 (less than 30 years). A plot of the rainfall totals for these few select storms vs. IDF curve for the Phoenix WSO (one of the only two stations with short duration data as per PFDS Web site) shows that all these storms were well above a 1000 year return interval (see attachment #5 and #6). Is this statistically significant and how can this be explained? The latest event on attachment 6 happened just two weeks ago, and was included as an example only. By no means this was considered an unusual event and yet plotted above the 100-year line.

Generally speaking, the rainfall depths were reduced from Atlas 2 and because of our short duration storms here in the semiarid southwest, I would find it more interesting to see the shorter duration short event data, which were not included in the review. I am concerned that they may be exceptionally lower yet and that concerns me because we see storm events with much higher rainfall depths than those shown on your PFDS tables for 100-year, 24-hour storm events.

Response: The short period of record is the most constraining factor in using the vast number of “new” rain gage networks. These networks are revealing extreme events that we’d expect and that are commonly confused as being directly comparable to our results. This is because our statistics are based on individual, non-moving rain gages. It is rare for any single location in an area to get a cloud burst during any given year, but it is very likely that somewhere in the area will receive a heavy rainfall from a cloud burst. Our results indicate rainfall estimates **for points**, not what nature can produce within an area. This means that 100-year storms are occurring all the time. If talking about the “24-hour 100-year event,” this really means the maximum 24-hour point rainfall that has a 1% chance of being exceeded in any given year at a specific site. On the other hand, if we did a study that represented the Albuquerque (or Las Vegas or Phoenix) metro area as a “site”, we’d end up pulling in all of the extreme rainfall events from the area, regardless of where and what gage the rain fell in, and end up with a much higher 24-hour 100-year precipitation estimates. This is much different than the 100-year 24-hour rainfall amounts for specific points, which we are publishing and that NOAA Atlas 2 indicate. The term “100-year storm” has a very precise meaning and definition which overtime has become more and more misinterpreted. Even with that said, it’s alarming that the Phoenix network has measured rainfall amounts exceeding the 1000-year return period and we will investigate.

3.3 Comparison with NOAA Atlas 2. This is also a policy issue for local government agencies. Generally speaking, the rainfall depths are lower on the NOAA 14 than those on the NOAA Atlas 2 for the majority of Maricopa County. Specifically, two areas were compared: White Tanks and Spook Hill. The 100-year 24-hour rainfall used in the ADMP study of White Tanks was 4.03 in. while the NOAA 14 gives 3.77 in (Griggs 3W); the peak flows estimated by HEC-1 model are reduced by about 10%. The difference in Spook Hill ADMP is much smaller, both rainfall and runoff have about 3% reduction. However, we did examine selected locations throughout the five state area, and compared these values to the NOAA Atlas 2 values, as best we could. In some locations there are significant gradients, so this made the determination of the NOAA Atlas 2 value a bit difficult, since we did not have access to the Atlas 2 point data. We found some differences from the NOAA Atlas 2 values, with largest ones at higher elevations and at the 100 year return level, as might be expected. In the San Bernardino Mtns. east of Los Angeles the new values are considerable smaller than the old ones, although exactly determining the value off of the NOAA Atlas 2 map was a bit difficult. At South Fork Cabin, for instance, the 100yr/24hr value is now 3 or more inches less than previously. In other locations the new values are higher, including more than 1.5" higher at Grant Grove in the central Sierra. An area of significant difference appears to be on the west slope of the Spring Mtns. west of Las Vegas, where Red Rock Canyon is a relatively new station (since 1977) that obviously was not included in NOAA Atlas 2 (NA2). The highest values (100yr/24hr) in these mountains was just 4.4" in NA2, but the value for Red Rock Canyon is now 6.15". Undoubtedly, when new maps are produced the spring mountain maximum will be even higher than this—perhaps 7 or 8". With data where there was none before, it seems likely the new values are correct.

Response: Knowing how hard it is to make point comparisons from NOAA Atlas 2, we used the NOAA Atlas 2 interface at "http://www.nws.noaa.gov/oh/hdsc/noaaatlas2.htm" to get estimates for South Fork Cabin, CA. It turns out the new NOAA new values are 3" (24%) HIGHER than NOAA Atlas 2 for 100yr24hr; 12.50" vs. 15.47". Other areas of the complex California mountains have shown decreases of this magnitude, but these difference are understandable given the lack of data during the NOAA Atlas 2 development. Just as you say; Red Rock Canyon, NV is a classic case of this. Based on your comment, we critically investigated the data at this station and deemed it accurate. As a result the Spring Mountains will have higher precipitation frequency estimates. Based on your comments about Maricopa County, along with other feedback from that county itself, we are carefully evaluating the NOAA Atlas 2 vs. Semiarid preicpitation frequency study differences there.

3.4 Both Phoenix and Safford AZ, at relatively lower elevations, saw their values drop. The 100yr/6hr value went down nearly an inch at Phoenix (3.2 to 2.3"). This is quite significant. We did not investigate whether such a drop was region-wide, even in the Phoenix area, but this should be done.

Response: The Flood Control District of Maricopa County, AZ did an comprehensive evaluation of the Phoenix area, so we have a lot of good feedback about this area to consider. When looking at the PHOENIX CITY, ARIZONA (02-6486) station, the plotted data looks well behaved, so initially we can't turn to bad data for explaining this drop. Perhaps the driving reason for this difference, particularly at the lower frequencies (<50-yr), can be explained by differences in the statistical procedure, but regardless we will look into this. Obviously we can't "cook the data," and there is a chance the values are lower.

3.5 It would be very useful to have a difference map constructed (New-NA2). Perhaps this has been done. You infer that you have done this, but we would be interested to see what your analysis has revealed. As you know, maps are a terrific quality control tool.

Response: We prepared such a map, but we explicitly chose not to distribute it. We are hoping that comments on the new estimates are based on their reasonableness rather than on whether they are changed or on how they were computed. The map we prepared is solely based on station data and not spatially interpolated data, the spatial representation of the differences is biased towards station density. In other words we used a 2-dimentional inverse distance weighting scheme to spatially distribute the 100yr24hr differences, but a more accurate approach would entail doing a spatial map calculation that uses the NOAA Atlas 2 100yr24hr grid and the updated 100yr24hr grid. At this stage the updated 100yr24hr grid is not available.

3.6 We have no basis to take issue with any of the new values. Except for the differences noted above, most of the values that we have examined are well within the range of normal expectation and noise. It was a bit surprising to us that the values, in general, had changed so little. Again, when new spatial coverages are completed using PRISM, the more significant differences may appear, due to the ability of new technology and data to depict more of the small scale variabilities and topographic forcings that were not possible when NA2 was produced.

Response: If just looking at the 100yr24hr results, you are right; for the most part they have changed very little from NOAA Atlas 2, but that isn't to say some areas are seeing substantial differences. We've carefully investigated and substantiated the areas with significant 100yr24hr differences. For a number of reasons we expect differences, but most importantly we strongly believe the new estimates are more accurate than NOAA Atlas 2. Certainly the computer power, statistical estimation procedure (L-moments) and spatial interpolation schemes are much better than was available back in the 1960s and 1970s for NOAA Atlas 2 and we also have additional data to work with.

3.7 In general the 6 and 24 hour rp depths for the Tucson city area are eye-catching less that the values currently used by the City in its design manual. FYI I'll send that to you next in a separate email (below):

The following are the return period duration rainfall depths used for hydrologic design by the City of Tucson, and by default, for much of Pima County as well.

--inches--		
rp(yr)	3hr	24hr
2	1.30	1.83
5	1.80	2.50
10	2.30	3.17
25	2.80	3.83
50	3.20	4.50
100	3.60	5.00
500	4.60	6.33

Response: It is not unusual to find differences between our estimates and those published by others. We expect to find these cases with our new data as well. Differences from a variety of sources including, data used in the study, quality control, whether annual maximum or partial duration results are being compared (they have different meanings but are often incorrectly compared), the statistical methods used for finding the distribution parameters, the distribution chosen, the nature and influence of regional considerations, and etc. These types of estimates are statistically expected values and the variability associated with them is not generally published. The confidence intervals we are providing should give a more objective representation of the variability. We are confident in our approach, however we are interested in any information you might have that would result in different estimates.

4 Precipitation frequency estimates too high/low

4.1 The frequency tables presented for the Logandale, NV and Overton, NV sites demonstrate the problem with statistical analysis of precipitation frequency analysis in the semi-arid Southwest. These two sites are less than 5 miles apart and are both located in a broad flat valley without any significant topographic features to distinguish between the two sites. And yet the point rainfall depths for short duration events (less than 12-hrs) for the 100-yr return interval storms vary by 32-63%, depending on the duration of the storm. If you look at the point depths for the 24-hr 100-yr event, the rainfall depths are 2.73" at Logandale, 2.16" at Overton, and 3.28" at Valley of Fire. Geographically, Overton is located between Logandale and Valley of Fire. I would guess that this large difference is due to differences in the period of record used for the analysis at these sites rather than a reflection of reality. I do not believe that the precipitation gradient between these sites is as steep as your statistics indicate.

Response: For Overton we have 38 and 29 years of data for the daily and hourly station respectively. For Logandale we have 24 and 23 years of record for the daily and hourly station respectively, substantially less than Overton. Valley of Fire is only a daily station with 28 years of data. You are probably right in your assessment, that the differences in these stations are partially related to their period of record. If taking the 100yr3hr as an example, the difference between the estimates at Overton and Logandale is 0.61" – a significant difference at this duration. From a quick assessment, it looks like although Overton has more data, its estimates seem too low. Valley of Fire has higher estimates, presumably due to more orographic factors associated with its location and higher elevation. We will investigate further.

4.2 Data Review Observations for Cochise County, Arizona. Many data readings are less than the 1973 (NOAA Atlas 2) readings. Nearly all of the sites do not have data for events less than the 24-hr frequency. The most useful precipitation frequencies are for the 1-hr, 2-hr, 3-hr, 6-hr, 12-hr and 24-hr storms. There are no data above the 5548-ft elevation, even though there are many areas around Cochise County that are above it. There seems to be remote areas that have many data sites (ie San Simon, Portal), while other locations don't have any data sites given (Ft Huachuca, Huachuca City, Elfrida) while there is only one data site for the Willcox/Northern Sulphur Springs Valley area, which has the most flooding events of all the local communities. Does this imply that for these areas without data readings, the isopluvials for the updated atlas will be interpolated?

Response: You have identified one of the difficulties with this region of the country, i.e., the lack of long term observations at sufficient spatial density. It is interesting to note that the sum of the actual catch area of all the rainfall gages in the U.S. is roughly equal to a tennis court – in others words we're all working with very small samples! The estimates for Cochise County, along with all other areas of the study domain, will be spatially interpolated at high resolution for all durations and frequencies. The spatial interpolation for Cochise County will be largely driven by the stations you noted, as well as other representative stations in nearby counties. And yes, isopluvials will be provided.

4.3 I have looked at a number of locations where the gages are in close proximity. In some cases the differences are minimal or can be easily explained by topographic features. But in other areas, the differences are substantial and more problematic. For example:
Netherwood Park, NM 2-y,24-h=1.13 and 100-y,24-hr=2.62
Albuquerque WSFO Airport, NM 2-y,24-hr=1.05 and 100-y,24-hr=2.22
(There are some old timers who say that the airport was located to be in an area with minimal weather problems, not too near the Rio Grand or too near the mountains... a zone of better

conditions)
Santa Fe, NM 2-y,5-m=0.25 and 100-y,5-m=0.69
Santa Fe 2, NM 2-y,5-m=0.22 and 100-y,5-m=0.60
Carlsbad FAA Airport,NM 2-y,24-h=1.99 and 100-y,24-hr=5.79
Carlsbad,NM 2-y,24-h=2.10 and 100-y,24-hr=6.11
Two Rivers Reservoir,NM 2-y,24-h=2.02 and 100-y,24-hr=5.88
Roswell WSO Airport,NM 2-y,24-h=1.84 and 100-y,24-hr=5.37
Roswell FAA ARPT,NM 2-y,24-h=1.98 and 100-y,24-hr=5.76 (I'm not sure where this third gage really is. If the word "APRT" means "airport" then the last two gages may be in nearly the same location.)
Roswell WSO Airport,NM 2-y,5-m=0.27 and 100-y,5-m=0.75
Roswell FAA ARPT,NM 2-y,5-m=0.37 and 100-y,5-m=1.01 (Wow!)
Clovis 3 SSW,NM 2-y,24-h=2.33 100-y,24-hr=6.26
Clovis 13 N,NM 2-y,24-h=2.07and 100-y,24-hr=5.54
Tucson WBO, AZ 2-y,24-h=1.63 and 100-y,24-hr=3.95
Tucson NWSO, AZ 2-y,24-h=1.54 and 100-y,24-hr=3.75
Tucson Camp Ave Exp Fm, AZ 2-y,24-h=1.55 and 100-y,24-hr=4.21
El Paso WSO Ap, TX 2-y,24-h=1.30 and 100-y,24-hr=3.18
Ysleta, TX 2-y,24-h=1.24 and 100-y,24-hr=4.29
Socorro, TX 2-y,24-h=1.27 and 100-y,24-hr=4.38

Response: Eastern NM is a particularly difficult area because of the lack of data. Hit and miss extreme rain storms (from thunderstorms) drive all of the short duration data, so we expect to have variability. The variability should be reflected in the associated confidence intervals. Our spatial mapping procedure mitigates the statistical variability when interpolating and at the same time allowing for topographic variability. We will evaluate and address your concerns from a spatial standpoint once we have the draft maps.

5 Methodology

Hosking and Wallis, 1997 describe regional frequency analysis using the method of L-moments. This approach, which stems from work in the early 1970s but which only began seeing full implementation in the 1990s, is now accepted as the state of the practice. The National Weather Service is using Hosking and Wallis, 1997 as its primary reference for the statistical method in its current studies. The method of L-moments (or linear combinations of probability weighted moments), provides great utility in choosing the most appropriate probability distribution function to describe the rainfall frequency distribution. It also provides tools for estimating the shape of the distribution and the uncertainty associated with the estimates, as well as tools for determining whether the data are likely to belong to similar climatic regimes. The so-called “regional approach” recognizes that different observing stations can be assembled into groupings of similar climatic regimes (regions). It takes advantage of the similarity by assuming that stations within similar regions have in common the shape (not scale) of their rainfall frequency distribution curves. This assumption allows estimation of the shape parameters from the combination of the data from all sites in a climatic region rather than from each site individually, vastly increasing the sample data set used in the estimate (reducing the sampling error).

Hosking, J. R. M., and Wallis, J. R. (1997) Regional frequency analysis, an approach based on L-moments. Cambridge University Press, Cambridge.

5.1 The precipitation frequency estimates for each site seem to come from the single site data. Do they include any adjustment for regional factors, nearby sites...or is this just the site data evaluated by the appropriate methodology. If that is what they are, this should be clarified. This may also reduce the applicability of any single site data in areas where information from multiple gages and topographic conditions should be applied to obtain an appropriate precipitation frequency.

Response: The data for all but 8 stations were computed using a regional approach; 8 stations were computed as "at-site" rather than using the regional approach because we believe that an at site approach for these 8 stations is more appropriate. For details, see the progress reports available on line at http://www.nws.noaa.gov/oh/hdsc/current-projects/project.html. A complete report of the methodology used will accompany the final data.

5.2 A concise summary of the methodology used to develop the data sets would be useful.

Methodology: L-Moments were used in the statistical analysis of the rainfall data series. One advantage over conventional statistical methods is that L-Moments are less influenced by extreme events. It seems to me that it is too late to evaluate the method itself now.

Obviously I couldn't review your data or your statistical methodology so I can't make any comment on those. But I am concerned that the statistical method disregards outliers and that is what the semiarid regions experience many times. Now on the other hand, I as a drainage engineer for developers would find it hard to defend designing for the outlier storm events but regardless, they happen.

Response: Since the focus of this review was the reasonableness of the point estimates themselves, the details of the methodology were intentionally not provided. Our methodology was evaluated, scrutinized and accepted by a team of experts last year. In frequency studies, the outliers appearing in a limited time series data play a very important role in estimation of quantiles, especially for estimating the rare events with probabilities such as 100-y, 500-y, 1000-y and up. In our QC processes we have paid great attention to outliers. However, the tough point is still how to reasonably determine the underlying frequency distribution when there are outliers in a finite data series. The method of L-moments we have used has been demonstrated in peer reviewed literature to be particularly adept at handling this situation when compared to other methods.

5.3 Spatial Distribution of Rainfall Gage Stations: Are there adequate gage stations for spatial interpolation?

Response: We believe that Oregon State University's PRISM (Parameter-elevation Regressions on independent Slopes Model) technology, will provide us much better spatial interpolations than would otherwise be available. Samples of the maps to review are forthcoming.

5.4 Software Used: Is the computer software used in the study good?

Response: As you might expect, there are a number of software programs utilized. We have tested the software and believe it is robust and free of defects. The core statistical computations are performed by a modified version of publicly available code developed by the Mathematical Science Dept., IBM Research Division: FORTRAN CODE WRITTEN FOR

INCLUSION IN IBM RESEARCH REPORT RC20525, 'FORTRAN ROUTINES FOR USE WITH THE METHOD OF L-MOMENTS, VERSION 3'

J. R. M. HOSKING
IBM RESEARCH DIVISION
T. J. WATSON RESEARCH CENTER
YORKTOWN HEIGHTS, NEW YORK 10598, U.S.A.

5.5 It is impossible for the Flood Control District to do a comprehensive review of the results without a report that explains the basis at which they were derived. Review of the progress reports alone is not sufficient, since final data and methodology may have changed ever since this project started. Additionally, a graphical representation of the differences between the NOAA Atlas 2 vs. NOAA 14 will greatly facilitate ones review. FCDMC has developed such maps for Maricopa County from the data provided at the PFDS (see attachments 1-4).

Response: We prepared such a map, but we explicitly chose not to distribute it. We are hoping that comments on the new estimates are based on their reasonableness rather than on whether they are changed or on how they were computed.

5.6 I presume there will be some "smoothing" and coordination of data within regions and to be consistent with adjacent stations etc?

Response: This is a key part of the regional approach we have used, and yes, these factors have been incorporated into the results.

6 PFDS

6.1 The borders of state maps should include latitude/longitude tick marks. That would help users position themselves in selecting points on the map other than climate stations.

Response: Nice suggestion. We will add tick marks in the final version. In addition, the lat/lon of the mouse pointer is shown as it pans across the map.

6.2 The vertical axes on the IDF and DDF curves displayed by the server should be relabeled. The vertical axis on IDF curves should be labeled "Precipitation Intensity," not "Precipitation." It might also be more clear if the vertical axis on DDF curves were labeled "Precipitation Depth" instead of "Precipitation."

Response: Good idea. We'll make those changes.

6.3 The ranges of durations for which IDF curves and DDF curves are displayed vary from one station to another. I understand that some stations are daily stations, some are hourly stations, etc., but it was initially surprising to be getting different types of results. It seems that HDSC has a choice to be made here: When a station is chosen, should results for only the durations greater than or equal to the measurement interval be displayed? Alternatively, should all durations be displayed, with spatial smoothing or interpolation used to "fill in" the durations shorter than the station measurement interval? Perhaps both options should be considered. How does this relate to the methods planned to be used for generation of estimates for arbitrary locations? What does a user do if he needs a 5-min intensity, but the station is a daily one? Whatever decisions are ultimately made here, it is imperative that it be made crystal clear to the user what he or he is getting.

Response: We agree, this is confusing. When spatially interpolated data is prepared for all durations/frequencies, there will be no gaps in the data.

6.4 HDSC requested reviews for durations from 60-min to 60-days, but IDF and DDF curves displayed for many sites include durations as short as 5-min. I have some concerns about statistical methods for such short-duration data, and have communicated them to Geoff Bonnin.

Response: You're right… at one point we said reviewers would only see 60-min through 60-days, because we weren't sure we could pull off getting the n-min data ready…but the final review letter dated June 27, 2002, read "5-minute through 60-day.

6.5 Noticed on the "MAP" section "Tiger Map Server" that the legend indicates two different depictions of county lines. Not sure why this is so. Please check into it and delete one or the other or further explain.

Response: Initial indications are that this is a bug in the U.S. Census Bureau's Tiger Map Server software. We will do our best to circumvent their software so it appears correctly, but it may be something we can't fix without removing the entire small map altogether.

6.6 I will raise a concern that the server offers far too much in the way of options for deriving precipitation frequency values. I personally do not like a dual presentation of values for any given location. Given the vagarities of sampling and problems of finite record at a given rain gage, I favor regionalized estimates in all circumstances. I am concerned that a user will go searching for the site values that produce depths most "useful" if not applicable for their purposes. The great feature of showing only regionalized estimates is that both liberal and conservative designers have the same depth.

Response: Our estimates are computed at point observing locations using a regional approach that accounts for both at-site and regional characteristics. The estimates are then spatially interpolated to provide a high resolution spatial coverage. In other words we only provide a single estimate at each location.

6.7 I note that the fixed location (lat/long) function and the area estimate functions were not working, so I could not test out any consistency with the observing site data, or get any information away from observing sites. This has limited my review extensively.

Response: For purposes of the review the functionality of entering a fixed location (lat/lon) was not available. The only two ways to get observing site data were via the map (clicking on site) or selecting it some the pull-down list. When spatial interpolations are complete, the fixed location functionality will be available. The review focused on the point estimates at observing locations. Spatially interpolated estimates we're not provided in this review cycle. Neither were depth area reduction curves.

6.8 The plots of the graphs of the tables with no data should be improved in the final presentation so that the curves do not go down to zero at the end.

Response: Since the final estimates will include ALL durations (5-min through 60-day), ALL frequencies (2-yr through 1000-yr) and high resolution spatial interpolation, the graphs will be completely populated with data and so this problem will disappear.

6.9 I believe that you should add a statement to your web-application indicating that the results of your study, while based on an expanded data set over what has been previously available, and the application of current statistical theory, are still limited by a relatively sparse amount of data; and the application of a higher standard of care by local regulatory agencies is prudent.

Response: Our final product will be marked with appropriate usage caveats and disclaimers and be accompanied with complete documentation.

6.10 It's unclear where the data reading station is located (ie street address/building location, etc). The location maps provided do not indicate major road names. The Station List is not friendly to retrieve. The chart only names the city, county, and/or country and you must continue to search for station data.

Response: For the protection and privacy of volunteer observers, and to avoid vandalism at automated observing locations, specific addresses are often confidential. Our final maps and grids will have a spatial resolution of 30 arc-seconds.

6.11 I had only one "hiccup" after first logging in. After looking at data for a station the State Button would not return me to the State Map. I clicked on the US Button and then returned to NM but only 1/3 of my screen was usable because I had 2 PFDS Screens. I had to logout and try again. This problem did not return.

Response: We will make sure the "back" and "return to…" buttons do no spawn windows inside of windows.

6.12 I used the links to USGS Maps and EPA Watershed Map. It was cumbersome to use the BACK button to return to the Precipitation Frequency Web Page.

Response: We'll modify the behaviour to spawn new web browser sessions when users click on these links and leave the PFDS output page intact.

6.13 The tables and numbers are easy to read. We think this will be a very valuable interface. Printing values was no problem, and the location map that is shown with each table is useful. There will still be need for some people to print maps. Of course, when the PRISM coverages are finished, pulling these into GIS will hopefully be easy to do, for conducting watershed studies, etc. This functionality with the gridded coverages must be provided.

Response: Absolutely, all of the ASCII GIS grids will be made available via a Spatial (GIS) Download web page on the PFDS. They will also be accessible via anonymous ftp. FGDC-compliant metadata will accompany the maps, as well as brief directions for downloading/importing the grids into a GIS.

6.14 It sometimes takes quite awhile for the "hand" to appear over a station location. It was faster to use the pull down menu on the right, but often we wanted to know the station name in a given location, without knowing ahead of time what it was.

Response: We apologize for this wait. The wait time is a function of Internet traffic. The state-specific web pages are rather large because they contain the coordinates for all of the displayed observing sites. We don't think there isn't a lot we can do about this.

6.15 In one visit we clicked on Goldstone Echo 2 CA, and the tables for a station in Wyoming were given.

Response: This indicates a hole in the error trapping. This also tells me that a station was not selected and a default location in Wyoming is chosen. Data for Goldstone Echo 2 CA does exist and was accessible during my tests. We will add code to prevent this from happening.

6.16 Is it possible to just show the stations in the state that is selected off the map, rather than always list all stations for all states in the box at the right?

Response: Yes, and this change will not only occur based on your feedback, but by shear necessity. As we publish more data the station list will obviously become too big and cumbersome to use effectively.

6.17 There are stations in states outside the Semiarid domain (TX, OK, CO, WY, ID, OR, coastal CA) that are included in the pull down menu, and their data tables and graphs do appear if selected. However, if we click on one of those states (like WY) and request data these stations do not show up there, and we are given a message that no data for that state are yet available. Can this be changed?

Response: This could be changed, but stations in these areas are outside of the study domain and therefore will not appear in the final results. Although from a review standpoint we encouraged feedback regarding these stations, their purpose is to provide a smooth spatial transition across state boundaries. From this point forward, the data from these outer areas will only be used internally.

6.18 Just to be grammatically correct, data <u>are</u> always plural. Thus, it should be "Data are preliminary" in the heading, not "Data is."

Response: Thank you, we will make that change.

6.19 Will the information with the future fixed location (lat/long) data entry agree with the numbers obtained with the selected site information? Or will there be two sets of data that don't agree.

Response: The spatial interpolation scheme (PRISM) we are using is faithful to the observing site data so the datasets will agree.

6.20 The most useful parts for me to see are the all season frequency tables, the frequency graph, and the two location maps. The +/- 90 percent tables will be of interest to a few, but I suspect most users won't regulate based in the +/- 90 percent values. That means that page 1 and 3 will be often printed. Page 2 less often. But sometimes the formatting for printing is different... when there is no data for longer than 24 hours, the frequency table takes all of one page. The graph goes to page 2, and the maps to pages 3 and 4. This can be fixed and made more efficient.

Response: Good point. We will consider re-organizing the output pages to make them more print friendly. However we are also hoping that the provision of the confidence interval data will provide a greater insight into the "real" accuracy of the estimates.

6.21 The latitude and longitude values on the two maps only display and print out the top 80% of the numbers. You can usually figure it out, but it looks bad.

Response: Unfortunately this is a bug in the U.S. Census Tiger Mapping software and out of our control to fix/change. I know it looks bad, but it's better than nothing. {We should take responsibility for everything we provide!}

6.22 The state maps are sometimes pretty small, when trying to select a specific location. Consider a zoom in feature, perhaps by county or a zoom area. This would also help with point selection, which is sometimes difficult.

Response: This would be an excellent feature to add, but since the PFDS does not have the functionality of an Internet Map Server (IMS), such a change would require resources beyond those available. Once data is available at all locations, this may become less of an issue because you'll have the liberty of picking a location (whether its at an observing site or not) with the mouse or by entering a long/lat.

6.23 It would be nice if the individual state pages and data display pages could be made to fit in a 1024x768 window without having to scroll left to right, perhaps by making the dark blue frame on the left compressible or narrower.

Response: Agree. We will make this change.

6.24 I missed the 'submit' button until someone pointed it out to me - perhaps one could be placed next to or just below each line where submit is appropriate.

Response: This has been reported by others as well. We will make this change.

6.25 Under "Climate Data Sources", the user has the ability of listing all gages within 30 minutes or 1 degree. However, when the data are listed, it is unclear what the group of gages represents. Presumably it is not the gages on which the study is based; many of them have periods of record far shorter than the 40-year criterion. It is not a comprehensive group of coverage; Maricopa County alone has more than 240 gage sites. Please clarify and consider adding additional gages to the database or links to local agencies so the user has a more accurate picture of available data.

Response: You've made a good point and we will clarify that the station lists one receives via NCDC's web site are NOT necessarily the stations used in this study. However this is were the vast majority of our data came from and therefore we provide a link to that data source. A complete station list – along with dots on the base state maps -- will be made available for the final product. Due to severely limited data (both spatially and temporally) in the Semiarid Southwest, we used a 20-year period of record criterion for selecting stations to be used.

6.26 FCDMC requests that the final NOAA 14 isopluvial maps also be provided in GIS format.

Response: 30-sec grids will definitely be provided for all statistics as well as isopluvial maps (in a GIS format such as shapefile).

6.27 The type of gage at each site is not indicated, e.g., SNOTEL, weighing type rain gage, tipping bucket rain gage, other types, etc. On your colored state maps showing rain gage locations, you might use different symbols or colors to indicate station type.

Response: Your suggestion of adding the station locations and types to the colored state maps is one we will implement However, our delineation of gage types will be: hourly, daily, SNOTEL or other (Mesonets, etc). More detailed gage information (i.e weighing type rain gage, tipping bucket rain gage, should be obtained from NCDC). Distinguishing the type of station on the output page will not be necessary once the maps are complete because the underlying maps will represent data from all sources.

6.28 The period-of-record used for each study site, e.g., number of years of record, period of record, etc.

Would like to see the years of record shown for the stations used (hourly and daily).

Response: We assume your desire to have this information is to gage the reliability of the estimates. Instead of displaying the period of record (or data years), we're providing the confidence limits, which are a much better assessment of the reliability.

6.29 I know it is apparent that -9.99 means no data for a given duration. However, all the 9s clutter up the tables. Either a blank or a dash - would be acceptable.

Response: Once the underlying maps are complete, the data in the tables and graphs will be completely populated for all locations. This problem will dissappear in the final deliverable.

6.30 At certain wet stations in California, precipitation at longer durations and return periods can exceed 100 inches but the data tables and plots can't handle this. An example of this is Strawberry Valley,CA Another example is Crystal Lake FC 283-C,CA.

For any stations that have >100" precipitation in the tables the leading "1" is lopped off the value in the table (example 107.66 is shown as 7.66"). Surprisingly, this is then translated into the graphs, as well (graph of Camp Angelus drops from near 100 inches to just over 7" going up to 1000 yr return period).

Response: This is a formatting error in the software which will be fixed.

6.31 When I did the page printouts... it would be nice to have the station name on each page somewhere, however small. If I floor-sorted the pile it would be a mess to re-connect. As it was I found myself doing flip-backs anyway.

Response: Excellent idea. We will try to address this.

6.32 The map locating showing the Campbell Avenue Farm (02-0796) seems to have the red dot in the wrong place. close but no cigar. It should be south of the Rillito River. On my map printout, about a quarter inch south of the shown red dot.

Response: The red dots on the maps show the exact location of the rain gage, and this may or may not be directly within the town which the station is named after. In this particular case I can't find 02-0796!?

7 General/Miscellaneous

7.1 I would also like to see relevant reports from recent authors on precipitation frequency since TP-40 and HYDRO-35 referenced. A subordinate section for each state would a nice location to show these. This is especially true for Washington, Montana, Oklahoma, and Texas since you all do not appear to be serving updated information for these states. Just a thought, but your server makes a good location for serving broader information regarding rainfall frequency values available from outside NOAA sources.

-- Schaefer, M.G., 1993, Dam safety guidelines, Technical note 3—Design storm construction: Olympia, Washington State Department of Ecology, Dam Safety Section, [variously paged].
-- Parrett, C.P., 1997, Regional analysis of annual precipitation maxima in Montana: U.S. Geological Survey Water Resources Investigations Report 97-4004, 51 p.
--Asquith, W.H., 1998, Depth-duration frequency of precipitation for Texas: U.S. Geological Survey Water Resources Investigations Report 98-4044, 107p.
--Tortorelli, R.L., Rea, A., Asquith, W.H., 2000, Depth-duration frequency of precipitation for Oklahoma: U.S. Geological Survey Water Resources Investigations Report 99-4232, 113 p.

Response: That is a good idea, but if we list relevant reports it would imply we endorse them and we can't do that.

7.2 I anticipate the much of this data will have legal standing in court cases and official reports. The problem with any WWW site is that it can be changed over time, sometimes without any indication of the change or official date of publication. A data of publication is important... even for a web site. Additional reference information as a reference document is also essential. The information produced by Netscape or Explorer at the top or bottom of the page is not enough.

I agree with your decision to publish the results of your study in PDF format on the internet. In the past we usually published only a few hundred or thousand copies of hydromet reports. For many studies, we soon ran out, which ran up our reproduction costs. The only problem you will have will be maintenance of the website.

All along, there was discussion about how to publish the document. Traditional hard copy, or CD. Has this been abandoned to go with the web site only? I hope not!

Response: We're glad you concur with our plans to publish the new estimates on the web. Although this presents regulators with a more virtual source for precipitation frequency standards, we will assure online documents/data are stable, constant, referenceable and accessible. The PFDS and its accompanying web pages will be maintained and a point-of-contact will be made available for future inquires. {Tye, we probably should embed a version number or date of some type in each product we produce whether it be a grid, web page or pdf}

7.3 Rainfall Data: Both the amount and quality of the rainfall time series are important, such as the length of the time series, number of outliers and missing data, and how they are dealt with. Should the data collected by FCD be included into the database?

Response: Most of these details will be provided in the final documentation.

7.4 A didn't find any of the data that USGS in Albuquerque sent to you for the Albuquerque area. This was several years ago. Now there is much more data available in computer format. (see Jack Veenhuis, veenhuis@usgs.com). AMAFCA and USGS spent some considerable money to get this data into a format that NWS could use and now it is used for.....nothing? I also understand that Maricopa County and Pima County in Arizona now have Alert data that has been collected for many years. I didn't find anything that looked like that data.

Response: Thank you for the follow up contact for this data. We will investigate this and be contacting Jack Veenhuis. There is even potential in using this dataset as part of our Depth-Area-Duration study.

7.5 Back when this project started, a large number of local government agencies contributed public funds to NWS to get the arid west project started. Some of these agencies seem to be on the e-mail list, but others are not. As things go forward, now would be a good time to keep them informed.

The data provided by NOAA 14 will be used by various agencies and others, and will become the basis for the design of infrastructure in the years to come. It is imperative that the review process be open to ALL agencies and parties who will be affected by this study, and that they should be given ample time for their review.

Response: We would greatly appreciate help from people like you, to make sure we have the appropriate people on our mailing list.

7.6 Somewhere it should be made clear that 1000-yr values really represent a probability of 0.001 based on your frequency analyses. If we truly are experiencing climate change, the 1000-yr values may have little meaning.

Response: Good idea. The true meaning and definition of precipitation frequency estimates is often misconstrued.

7.7 Have you found any evidence that metropolitan areas such as Salt Lake City, Phoenix, Tucson, and Las Vegas, have any effect on precipitation intensities in their areas?

Response: We haven't explored the effect of urban areas on precipitation intensities specifically. As you probably already know, a number of papers have focused on the effects of precipitation (in general) down-wind of urban areas.

7.8 Is there a significant relationship between rainfall intensities and mean precipitation (MAP)? Or, have you not looked at MAP for the stations in the study area?

Response: There is a significant relationship between the mean annual maximum precipitation and MAP. In fact, it is so strong that MAP spatial patterns are being used in spatially interpolating the precipitation frequency estimates.

7.9 Are there any plans to extend the study area in the western United States?

Response: The National Weather Service receives no funds from Congress for these studies.

We have performed them for over 50 years on a reimbursable basis using funds from other interested parties. Several parties have shown great interest in initiating a nation-wide study, however funds have not been forthcoming.

7.10 At the time of the publication of that Atlas (1973), I was the Science Advisor in the Office of Hydrology. Unfortunately, we did a poor job of drawing the rainfall intensity-duration-frequency lines for much of the west. I was interested in your comments on spatial interpolation in your Twenty-first Progress Report concerning the SCAS, Oregon State University, use of a program called PRISM. Although I am not familiar with that program, I assume it does a better job than we did. Assuming a linear relationship of precipitation intensity increasing with elevation and not considering exposure, etc., can produce excessive values.

Response: These issues will be come important during the review of the spatial interpolation. Your point about exaggerated extrapolation is one that many feared, but in initial tests, PRISM is doing a nice job of handling the situation. The use of SNOTEL data also provides a constraint at higher elevations. To learn more about PRISM visit this web page: http://www.ocs.orst.edu/prism/gen_toc.html.

7.11 Although seven of twelve study areas being used in the DAD studies are in the central or eastern United States, an area subject primarily to frontal and cyclonic-type precipitation, the desert --southwest is occasionally subjected to heavy rainfall from tropical systems augmented by orographic controls. You may find the twelve study areas produce similar DAD results.

Response: We are engaged in a national DAD update study, which will contain study areas from all areas of the US, including for example Walnut Gulch, Arizona. For more information, visit the Semiarid Precipitation Frequency progress reports at: http://www.nws.noaa.gov/oh/hdsc/current-projects/project.html

7.12 Maps, maps, MAPS... The point data is useful, but so are the traditional maps. So far, there is no way to see maps.

Loved the site and access to Atlas 2 and the rest of the data and publications. What's the future on relapsing to the public and additional data massaging and presentation? Like the smoothings, if there is to be any. Or will it remain in it's current "raw" form? Will there be maps with iso-lines eventually?

Response: There will be 162 different maps and GIS grids available from the PFDS when the Semiarid project is complete.

7.13 Are there independent statements on the effects of elevation in short distances? We have alot of that in Arizona. A local legend/folklore is that there is no effect to the top of Mt Lemmon: elev 9000 ft in back of town. At least no adjustments made in city and county design at last check. A noticeable relationship does emerge from the 16 stations I down-printed, Includes the Kitt Peak station at 6718ft.

Response: The effect of elevation will become apparent when you see the spatial interpolations.

7.14 Do you know of the prior paper on short duration rainfall in Arizona by Paul Kangieser? Out of Salt Lake City ca 1967 or so. operates from Atlas 2, which apparently gives partial duration information. Thus my prior query about annual series from the current site pages. Would be interested in your understandings on the relevance and applicability of it. Also, a similar paper by Arlo Richardson some years following about Utah short duration rp depths.

Response: We are not familiar with those papers. The results we provided for review are based on annual maximum series. Our final product will include conversions to partial duration series.

Appendix A.6

HDSC Spatial Precipitation Frequency Review Comments and Responses Semiarid Southwest

Tye Parzybok, Debbie Todd, Bingzhang Lin, Geoff Bonnin

December 27, 2002 (updated January 2, 2003)

Introduction

The Hydrometeorological Design Studies Center (HDSC) conducted a peer review of the spatially interpolated precipitation frequency estimates for the Semiarid Southwest United States from October 25, to December 6, 2002. This document presents a consolidation of all the spatial review comments with HDSC's response. For the most part, the wording of the comments was unchanged to make sure the meaning was not misconstrued and so individual reviewers can identify their comments. HDSC requested comments from roughly 84 people or agencies, we received comments from only 12. After parsing all of the comments, we found 34 unique comments and they are included in this document.

Similar issues/comments were grouped together and are accompanied by a single response. The comments and their respective responses have been divided into seven categories:

1. **Cartographic comments**
2. **General comments**
3. **Are estimates and patterns reasonable when compared to your local or regional knowledge?**
4. **Are stations located correctly on the map?**
5. **Are extremes (high and low) reasonable and located properly?**

1 Cartographic comments

1.1 There seems to be less isopluvials than NOAA 2.

Response: Although it was not explicitly stated, the review maps were designed to provide maximum "reviewability" and do not necessarily portray how the final maps will look. The final published maps (as PDFs) will include more contours at the lower levels and fewer at the higher levels. We will try to provide as many contours as possible.

1.2 I was also unable to identify the county lines for either state on both the black and white and colored maps.

On the PDF version of the Maps the County lines are barely visible on most plots of the map at any scale. The Highways are very faint at a sheet of 11 X 17.

Response: Thank you…we will increase the line size of the county lines and perhaps the highways.

1.3 The units being used (tenths of inch) need to be very obviously displayed so people don't go and use 52 inches for 0.52 inches.

Response: Our hope was that if we use the same standard used in NOAA Atlas 2 (tenths of inches) that we would actually avoid confusion. An added advantage (in using tenths of inches) is the omission of the decimal point, which allows for more room. Regardless, we will try to make the units obvious.

1.4 On several contiguous sheets although the isolines look identical the little labels (38, 36, and so on) are in different locations. An example is California NW of the intersection of 35 N and 115 W on the mountains trending NE up towards Nevada, where there are labels 52 and 44 for those lines, but they are not on the corresponding part of the Nevada map. (Am I making any sense?) Another example is on the Arizona map, west of the 37 N and 114 W intersection, where the isoline labels for 34 and 32 are placed differently on the isolines than they are on the Utah map. I realize that as long as the labels are on the right isolines they are OK, but I don't know how much you want the overlapping map parts to match each other.

Response: The labels are placed according to a complex algorithm in ESRI's ArcMap (part of the ArcGIS suite). We are not overly concerned with identically overlapping map labels. As you pointed out, as long as the labels are on the right lines, then things are okay.

1.5 Utah, 100-year, 24-hour analysis: I see on all the maps provided that the observing site is noted by a red dot with the station name shown. However, looking in the vicinity of Logan, Utah, I see several stations indicated by a red dot but no station name supplied. Does this have some significance to how individual station data was handled or analyzed? I ask this because I noted that just south of this location that the current Precipitation Frequency (PF) analysis provides depths much higher than NOAA Atlas 2. It seems that on all the other maps provided me to review, wherever you had a red dot, a station name was indicated.

Response: The labeling anomalies you raise are associated with the mapping software and will be corrected. They do not reflect a station's importance, weighting or treatment

1.6 The station name for "Tijeras Ranger Station" appears to obscure the name for "Albuquerque WSFO Airpo". Can this title be relocated?

Response: The final, published maps will only contain about the same number of city/town labels as NOAA Atlas 2, so over-lapping labels will become a non-issue. Labels were provided on the review maps for review purposes only.

1.7 Mean Annual - 60-Minute NM : At approx 35.6 deg N and 106.8 deg W there is a small "7" with a very small associated precip. contour. Some larger isolated zones are located between 36 and 37 N at 105 to 106 W.

Response: The very smallest contour areas will disappear in the final maps. The contour must meet a certain threshold to be maintained. Hopefully this will tidy up the map, but without loosing an appropriate level of detail.

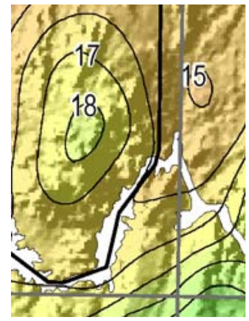
2 General comments

2.1 Most of my previous concerns are still the same, but would the NWS be installing new/updated gages at more locations (now/soon), so that there will be ample data for the next cycle update?

Response: NOAA's National Weather Service performs precipitation frequency studies at the request of and with funding provided by others. While we agree with the need to improve the resolution of the observing network, we have no mandate to make observations for this purpose.

2.2 Also, the isopluvials were hard to read on the state map due to color and scale, so I enlarged the area I was interested in but it was extremely difficult to print out at the larger scale (it took about an hour to download) and then I still didn't get the area I wanted...maybe it's just my computer.

Response: HDSC will try making some adjustments to the labels so they are clearer. You may also want to try using the Adobe Acrobat Reader "Graphic Select Tool," which allows you to select a portion of the map, copy it, and paste it into another document (word processor, web page, etc.). This is a nice way of showing the detail of an area that you've zoomed into. (See example on previous page)



Keep in mind, the final maps will be at the same scale (1:2,000,000) and projection (Lambert Conformal Conic) as those in NOAA Atlas 2, which means the paper size will be about that of the review maps (17"x22").

2.3 I note that Albuquerque, NM is not included on the list of Dense Area Rain Gauge Networks for the Depth-Area-Duration (DAD-Spatial Relations) study. Several years ago, I had the impression that the Albuquerque data was one of the primary sources for the DAD study.

The precipitation data collected by the USGS for the Albuquerque area is not yet on any of the maps. I understand that at least some of this data has sufficient time for inclusion in the 60 minute and 24-hour maps.

Response: By agreement with the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), we did not include these in the review maps, however in the final maps/grids, six additional stations/gauges in/around Albuquerque will be included. However, initial results indicate the pattern and magnitude of the precipitation frequency will not change appreciably.

2.4 I have not seen any recent information on n-minute factors since the Thirteenth Progress Report. Recent discussions with Mr. Tye Parzybok have indicated that the maps and precipitation-frequency tables on the web site will incorporate the n-minute factors (with maps available at 5-minutes, 10-minutes, etc). If there are primary maps and tabular values, with n-minute and other time or frequency (ie: 2-hour or 5 year data) data some mathematical function of the primary maps (ie: 5-minute at 33 percent of one hour), then information to identify the primary maps and the mathematical relations would be very useful. Ultimately, the new precipitation map data will be used in numerical models that predict runoff, plant growth, groundwater infiltration and similar physical conditions. Some models will use point precipitation and others will need to review extensive areas. If the mathematical relations are published in an accessible document, then this information can be utilized in future model procedures. The USGS PERFRE program is an example of a program that uses selected precipitation data to obtain a wide range of precipitation frequency values. There are many hydrologic models that use selected precipitation values (ie: 1-hour, 6-hour, 24-hour) to derive design distributions. If there are no unique relationships that can be applied, that is also useful information.

Response: The final report will provide the ratios we used to convert the 60-minute maps to the 5-, 10-, 15- and 30-minute grids/maps. Furthermore, maps/grids of these durations will be available. The Precipitation Frequency Data Server (PFDS) will have the ability to provide either point or areal estimates, depending on your needs. And just to reiterate, the final deliverables for this study will include complete (point and area) precipitation frequency estimates, at all locations, for all study durations at all study frequencies, regardless of station type.

2.5 Is it possible to produce a PDF copy of the maps that clearly prints in black and white? In many cases, the maps will be reproduced in reports and legal documents. The use of color in OK for some applications, but in many cases provides no particularly useful information. The black line format of the old maps may be better that color PDF maps in many applications. Additionally, they will download faster. PDF and TIF are good common use formats because many users will not have access to Arc-Info.

Response: Printing in black and white is easy, but making it clear is another issue. Although our tests have shown that black and white versions of the review maps are hard to read, they are still readable. We recognize the dilemma you raise and we will do what we can to address this. If cartographic maps weren't so labor/time intensive to create, the solution would be to create simple, black and white maps (without topography and interval shading) as well as color maps.

2.6 Will the documentation that comes out with these maps include methods to obtain values for other durations and frequencies that are not actually mapped?

We have need of rainfall data for specific frequencies: 1, 5, 10, 25, 50 100 year, and so forth. How do we get those figures from the new maps?

Response: All point values at the following durations and frequencies will be available through the online Precipitation Frequency Data Server (PFDS); see table below. For those with GIS capabilities, shapefiles of all the maps (5-min through 60-day, 2-year through 1000-yr) will be available through the PFDS. Additionally, GIS ArcInfo ASCII grid files will be available for all frequencies and durations. Cartographic maps will eventually be available for all states in the Semiarid Study area, all frequencies/durations, however at the time of initial delivery only a sub-set of cartographic maps will be available. The "index flood" grids will not be a final deliverable.

Initial (base) grids	Mean ("index Flood")
60-min	*
120-min	*
3-hr	*
6-hr	*
12-hr	*
24-hr	*
48-hr	*

4-day	*
7-day	*
10-day	*
20-day	*
30-day	*
45-day	*
60-day	*

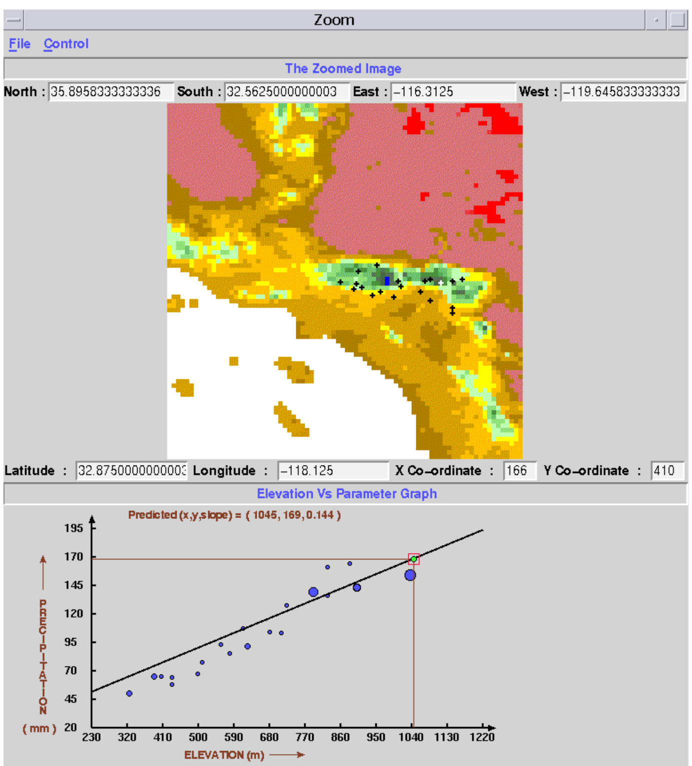
Precipitation frequency grids	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	500-yr	1000-yr
5-min	*	*	*	*	*	*	*	*	*
10-min	*	*	*	*	*	*	*	*	*
15-min	*	*	*	*	*	*	*	*	*
30-min	*	*	*	*	*	*	*	*	*
60-min	*	*	*	*	*	*	*	*	*
120-min	*	*	*	*	*	*	*	*	*
3-hr	*	*	*	*	*	*	*	*	*
6-hr	*	*	*	*	*	*	*	*	*
12-hr	*	*	*	*	*	*	*	*	*
24-hr	*	*	*	*	*	*	*	*	*
48-hr	*	*	*	*	*	*	*	*	*
4-day	*	*	*	*	*	*	*	*	*
7-day	*	*	*	*	*	*	*	*	*
10-day	*	*	*	*	*	*	*	*	*
20-day	*	*	*	*	*	*	*	*	*
30-day	*	*	*	*	*	*	*	*	*
45-day	*	*	*	*	*	*	*	*	*
60-day	*	*	*	*	*	*	*	*	*

2.7 We rarely use the 2.3 year frequency. Is this present for geomorphologic studies?

Response: No. The 2.3-year frequency map, also known as the “index flood” map represents the mean of the annual maximums and is the mean of the probability distribution at each location. It was sent out for review because the PRISM process of determining the spatial interpolation is applied at this frequency. That grid is then used to derive the spatial grids for all other frequencies and as a result needs to be critically evaluated. This map will not be part of the final deliverable.

2.8 In general, this current spatial analysis is by far a more consistent methodology applied to distribute precipitation frequency estimates throughout the mountainous western States. As I expressed at meetings held at the office of the National Weather Service some time ago, use of mean annual precipitation to distribute precipitation frequency estimates would likely result in precipitation frequency values increasing in magnitude in the higher elevation orographic regions, compared to what is currently provided in NOAA Atlas 2, and in most cases (not all) this comment has been validated by the review I just completed. This fact is especially noted when comparing 100- year, 24-hour precipitation frequency values with tentatively revised versus NOAA Atlas 2 results. The reason I gave as to why this would happen is that in the derivation of a mean annual analysis much precipitation at high elevations can be an accumulation of very light rain/snowfall that over time becomes unrepresentative of storm events defining precipitation occurrences lasting only hours to a few days/weeks. As far as the concerns that I have and what are the true causes or how they might be addressed

Response: You've pointed out perhaps the biggest concern people have expressed about using mean annual precipitation as a "predictor" layer for precipitation frequency maps. However HDSC is now satisfied with the approach. We are only relating mean annual precipitation (MAP) to mean annual maximums, which are both statistically stable and have a strong local correlation. By locally, we mean in a particular area, because if you related MAP to mean annual maximum precipitation over the entire Southwest, the relationship would be poor, justifying your concern. However, at a local level, the relationship is quite strong. The graphic at the left shows the relationship of MAP (y) to the 2-year 24-hour precipitation (x). In fact, we found the square-root of MAP relates even better to the 2-year (and/or 2.3-year "index flood") precipitation frequency estimates, so the relationship is even stronger than shown in graphic to the left. As you can see, there is only limited scatter around the linear regression line. We are utilizing SNOTEL data at the higher elevations where it is available and have found that the relationships between mean annual precipitation and



mean annual maximum precipitation remain sound at those elevations as well. The availability of the SNOTEL data also puts a “cap” on the need to extrapolate in many cases. PRISM allows us to examine the specific regressions at each pixel and by doing so we have become quite confident in the relationship throughout a broad spectrum of elevations and climates.

2.9 I found the colored maps somewhat easier to use than when I printed he maps out in black and white. However, I was unable to download some of the maps in color. Evidently the files must be too large for my system - particularly the 100-yr 24-hr maps.

Response: Downloading problems could be the result of several factors. As part of the final download web page we will provide a “troubleshooting” section for resolving this kind of issue.

2.10 Was it impossible to obtain more data from the Hopi, Navajo, and Apache Reservations? I recall that a number of years ago the NWS state office in Phoenix, Arizona, turned over a number of raingages to those reservations to operate. What happened to the gages and gage data I do not know. The only area on the Navajo Reservation that appeared a little low was the Chuska Mountain area northeast of Lukachokai. The 24-hr values look o.k., but the annual maximum and 100-yr 60-min values may be low. However, I realize that recording gage data are apparently not available for that area.

Response: We have contacted the Arizona State Climate office about this. Depending on the availability, quality, format, and relevance of the data, we will make a judgment as its applicability and usability in the study. However, we are fairly comfortable that with the existing data, coupled with our spatial interpolation process, we are producing appropriate spatial results in this area. Regardless, we will examine any additional data we find in the Chuska Mountains.

2.11 Use of District (Riverside County, California) Station Data over NWS Station Data for stations already incorporated into the NA14 Study. The District maintains 5 NWS Stations that have been included in the NA14 precipitation study (Idyllwild Fire Dept, Cabazon, Temecula, Beaumont, Winchester). The District provides the raw tapes from these District maintained stations to NWS. However, the District also performs corrections and quality control of the NWS station data. These corrections include reconstruction of missing events and removal of erroneous data. These corrected data sets are not routinely provided to NWS nor are they available through NCDC. The corrected sets have been transmitted to you by Steve Clark of our staff. The District strongly recommends the incorporation of these revised data sets into the NA14 model - for both 24-hour and 60-minute duration analyses.

example 1: Beaumont Station was malfunctioning from 2/19/98 to 4/8/98. For this reason approximately 9.8" of rainfall that occurred during the "March Miracle" does not appear in the NCDC Station Data. The "March Miracle" rainfall events have been reconstructed by the District and are included in the District's internal Beaumont Station data sets. The other stations have corrections of similar magnitudes for various events between 1981-2002.

example 2: Winchester Station - The NCDC Station Data extends from Dec 1947 - Feb 1971. At that point NWS discontinued this station. The District however has continued record keeping for this location and with an n-minute station and has an additional 26 years of n-minute record that has not been incorporated into the NA14 study. Comparisons of District and NA14 station analysis indicate that the NA14 analysis is 20-30% low for both 100-year and 2-year frequencies. It should be noted that the Cabazon Station is similar to Winchester - NWS ceased station operation in 1974, the District replaced it with a n-minute station in 1975. Addition of these data sets would also add more data points for the short duration (60-minute) analysis.

It should be noted that the District's data sets for Beaumont, Cabazon, Idyllwild and Temecula do not include the NWS records before January 1981 (or 1975 for Cabazon), when the District accepted maintenance of the stations. This will require that the District and NWS data sets be merged. The Winchester station was taken over in 1975 and it is my understanding that this data set does include the pre-1975 NWS data.

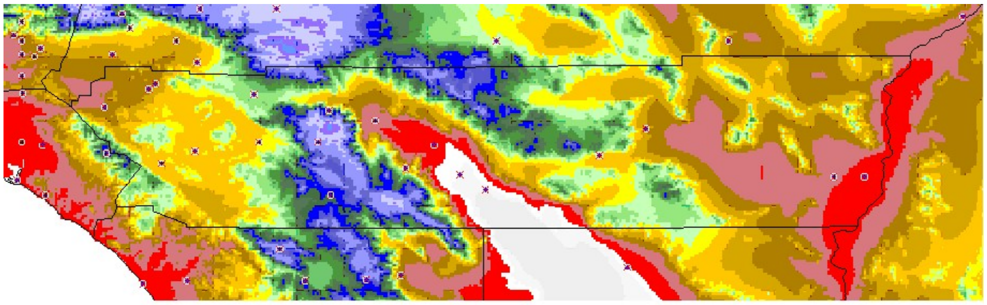
The Anza, Riverside Fire Station #3 and Sun City NWS stations (daily records only in NA14) have a District n-minute station at the same site. Incorporation of the District Station Data would allow for these stations to be used for the 60-minute duration frequency maps. The equivalent District Stations are Anza (Station # 005), Riverside South (Station #179), and Sun City (Station #212), respectively.

Response: We are considering the inclusion of additional data supplied by Riverside County.

2.12 The District (Riverside County, California) has significant concerns with the use of the mean annual precipitation map as a parameter in the solution of regression equations for determining mean precipitation for any given duration. Our concern is that very few (we understand 6 or 7) data points were used in Riverside County to develop the MAP. This may not be nearly enough data points to define a MAP in this hydrometeorologically complex region. Since the mean 24-hour and shorter duration precipitation estimates were developed from the MAP for the NA14 study, we also have concerns regarding their validity. We understand and appreciate that the MAP was peer reviewed, and that your regression analysis of 24-hour, 2 year data to MAP demonstrated a strong correlation, but we remain concerned because of the limited number of station data points used in the regression analysis. Particularly since about a year ago the District provided NOAA with annual series n-minute data files for 38 stations, all with relatively long records. It was reported back to us that with the exception of four "flier" events at four stations, that the data sets were found to be of high quality. The District feels that all of this information should have been used, and question if the inclusion of this information in the regression analysis would not have demonstrated a problem with the methodology.

The District believes that all its high quality n-minute data sets should have been incorporated in the NA14 study. At a minimum, we believe the 24-hour mean to MAP relationship should be validated against all District n-minute data not previously used, and that the regional L-moment statistics adopted for NA14 over Riverside County also be validated against the District's data sets.

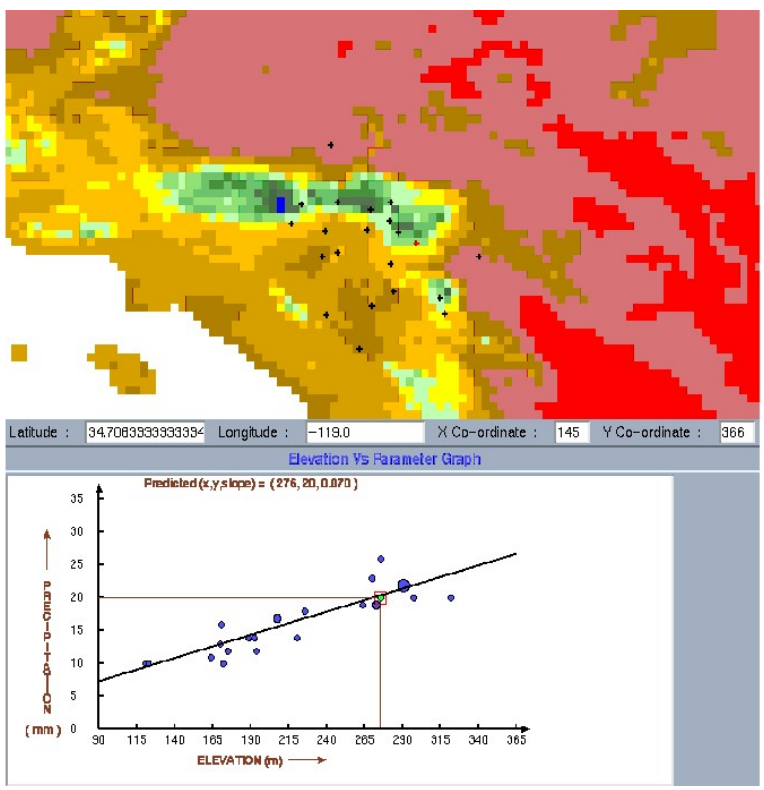
Response: Actually there were 19 stations within Riverside County that were used in the development of the PRISM MAP. See graphic below:



Locations of Riverside County stations used in development of the PRISM 1961-1990 mean annual precipitation (MAP) grids. Background is 1-km elevation grid.

To help address your concerns with using MAP as the predictor for the mean annual maximum (a.k.a. "index flood") values (particularly at the short durations), see the graphic below (next page). This is a screen snap shot from the PRISM graphical user interface (GUI). Notice that we are not actually using MAP, but the square-root of MAP regressed against the "index flood." Although the PRISM GUI has the x-axis labeled as "ELEVATION," this is actually the square root of MAP, while the y-axis is the 1-hour "index flood." The background color map (grid) is MAP at a resolution of 4-km (2.5-min).

PRISM scatterplot of sqrt(MAP) vs. 1-hr index flood values for the San Bernardino Mtns. Background is 4-km MAP. Red plus sign is pixel being estimated, black plus signs are stations. Size of scatterplot symbols denotes station weights. R2 of linear regression is 0.83.



Regardless, we are considering adding additional data supplied by Riverside.

3 Are estimates and patterns reasonable when compared to your local or regional knowledge?

3.1 Utah, 100-year, 24-hour analysis: Just east of 38N and 111W and about at 37.80N and 109.30W there are two centers of precipitation identified. The former center has a central value of 36 whereas the latter has a value of 52. Why would the precipitation values at these two locations be that different in magnitude? I see that at the latter center that there are several stations (one also unnamed) available to help describe the point frequency in that area but at the other location, none to limited data are observed. To me the terrain features look similar and I wonder why one location analysis provided such a larger central value than at the other location.

Response: The center (3.6”) atop the Henry Mountains is lower than the center (5.4”) atop the Abajo Mountains largely because the mean annual precipitation is lower in the Henry Mountains than the Abajo Mountains (27” vs. 37”). In fact, the mean annual precipitation in the Henry’s is lower than in the Lasal Mountains (32”) to the northeast. Although the PF maps don’t have a gage in the Henry Mountains, the lower mean annual precipitation is justified by a gage in the southern portion of the range. The relationship PRISM develops between the mean annual precipitation and the 2.3-year precipitation for the Henry Mountains uses information from the Abajo and Lasal Mountains as well.

3.2 New Mexico, 100-year, 24-hour analysis: At a location located just south of the center of the State, at Bosque Del Apache, a high precipitation center is indicated that looks suspicious when compared to surrounding topography (especially in relationship to another center located immediately to the northwest). I assume that the data obtained at Bosque Del Apache is the driving force behind the current analysis for this location. Please recheck the station precipitation for this station to verify if the analysis is good. Would think that if this station data is valid than one would have to greatly increase the general level of nonorographic precipitation throughout the majority of the State. I notice that there is no center as such that shows up on the mean annual, 24-hour map for Bosque Del Apache.

Looking at the NM draft 100 yr 60 min precip map: The 2.7 "bullseye" over Beaverhead (Gila) should be less of a concentric circle and more terrain oriented (higher elev gets bigger precip...SW slopes get more precip than valleys and E slopes...)

Response: These stations have been the focus of much attention. Bosque Del Apache and Beaverhead RS are being treated as “at-site” stations. In other words their annual maximum precipitation series were markedly different from other stations in the area. We have extensively checked the data and have eliminated that as a source of this discordancy. The result is that neither station could be used for estimating “regional” shape factors for the probability distributions and each has been treated individually. i.e., each of them has their own unique “at-site” probability distribution function. We are reluctant to simply discard these sites and have followed the convention of including them despite their discordant nature, but based on your comments we will experiment with ways to mitigate the “bullseyes.”

3.3 Nevada, 100-year, 24-hour analysis: One of the driving forces for Reclamation to do a re-analysis of precipitation frequency for the southwest States were comments from Reclamation Regional staff located in Boulder City, NV. They really felt that the magnitude of various return period precipitation was too low, especially around the Las Vegas area and for short durations. I see on the re-analysis that the 100-year, 24-hour estimate has gone from a level of about 30 in NOAA Atlas 2 to a 24 for the current analysis. This would be in the opposite sense from what my Regional people have indicated. I haven't run any short duration comparisons but I hope that the new analysis would be at least somewhat higher than what NOAA Atlas 2 provided for various return periods in the Las Vegas region.

Arizona, 100-year, 24-hour analysis: the Reclamation's Regional people also thought that the short duration precipitation in and around Phoenix was too low and analyzed in NOAA Atlas 2. However, the new analysis for 100-year, 24-hour indicates even a lesser value now than what is given in NOAA Atlas 2. There appears to be abundant station data available so I'd only ask that you check and make sure what you are going to provide for short duration precipitation frequency estimates for PHX is reasonable.

I noted that in general, precipitation analyzed in valleys of larger areal extent appear to be usually lower than that provided in the current NOAA Atlas 2 publication. The reasons for this in general are not obvious to me for I thought the addition of many more stations and increased years of record might help verify what was originally provided in NOAA Atlas 2 and the revised precipitation frequency analysis would be even closer than what is currently indicated. As far as the concerns that I have and what are the true causes or how they might be addressed?

Response: Based on the station data, two-thirds of the Semiarid results are within +/- 10% of NA2 (for 100-year 24-hour), which is remarkable considering all of technological changes/advances we have implemented. This gives us confidence that we are in fact homing in on the "real" point probabilities. Regardless of more stations, more data, more observed extreme events, the point precipitation probabilities are staying about the same. However, there are areas where the estimates have changed.

Greater numbers of rain gages generally lead to more observed extreme events and we now have reasonably dense rain gage networks in the area of concern. This can lead to a false impression that point precipitation frequency estimates have increased. We looked for climatic trends in the data for the Semiarid Study area and found no obvious linear trend or shift in mean or variance for the majority (~87%) of stations. We had already carefully examined these data and our results because of the changes you have noted, and are confident in our estimates. Your observation that large (areal extent) valley's tend to be lower than NOAA Atlas 2 is interesting. It was once feared that PRISM's linear regressions would drag the interpolated precipitation frequency estimates too low in climatologically dry, open valleys. From what we have seen thus far this is not happening, but your comment warrants further investigation. Another possible reason for this is the lack of topography for the NOAA Atlas 2 analyzers to use while drawing contour lines. In effect, this would lead to generalizations in valley's where now we have more detail.

3.4 The following comments regarding the draft precipitation maps are based on comparisons of the NA14 isohyets to point depths from regional station analysis of 38 District (Riverside County, California) n-minute stations. Thirty-three of these stations were not incorporated into the NA14 study. The District's station analysis was performed using the regional methods described in the California Department of Water Resources Bulletin 195. We have found reasonable correlation between the results of District's station analysis and station analysis performed using the techniques adopted for NA14 on comparable data sets. The District therefore believes that the comparison provides a reasonable indicator of regional accuracy of the Draft Precipitation Maps. Nearly all 38 n-minute District stations used for this review had lengths of record exceeding 20 years. Unfortunately, we found major variations between the

District's station analysis and the NA14 isohyets where the District's data was not incorporated into NA14. The District also discovered what we believe to be some data quality issues with data sets incorporated into the NA14 study.

The District (Riverside County, California) has identified four major regions of concern from its review of the preliminary NA14 Mean Annual and 100-Year Precipitation maps. The District feels that addition of District n-minute Station data within these areas would provide the additional detail necessary to accurately model the precipitation variation within these regions. For each region of concern, the District would recommend that the subsequently listed stations be added to the study. The District provided NOAA with data for these stations in July 2001. The corresponding District Station Number and years of record are listed in parenthesis.

1) The Easterly (leeward) side of the San Jacinto Mountains shows 60-minute storm isohyet values 30% to 40% lower than the District's analysis. The 24-hour storm values are also consistently low. Please add the following Station Data Sets to your model:

-Tachevah Dam (#216, 34)
-Tramway Valley Station (#224, 24)
-Whitewater North (#233, 24)
-Thousand Palms (#222, 43)
-Cathedral City (#034, 34)
-Haystack Mountain (#081, 22)
-Pinyon Flat (#157, 24)
-Snow Creek (#207, 13)
-Wide Canyon Dam (#243, 26)

2) The Northwest corner of the County shows isohyet values 25% to 30% higher than District analysis. Recommended stations to add:

-Norco (#131, 19)
-Lake Mathews (#102, 40)
-Woodcrest (#250, 46)
-Chase and Taylor (#035, 34)
-Mira Loma (#120, 30)

3) The District believes the Anza Valley area is a significantly different region than the Hurkey Creek and Idyllwild areas to the north, which are dominated by significant orographic influences. We believe this is why the Anza record (Station #005, 43 years in length) was found discordant with respect to other stations within the region. The isohyet values for Anza and Aguanga Valley, an adjacent District n-minute station within the same orographic region but not included in the study, appear significantly higher than District station analysis would indicate for the 24hour duration. Agaunga Valley station analysis also indicates that the 60-minute isohyets may be 40% higher than necessary. Recommended stations to add:

-Aguanga Valley (#002, 22)

4) Isohyets in the area surrounding Santa Rosa Plateau appear consistently low, often by as much as 40%. Recommended stations to add:

-El Cariso Station (#062, 23)

-Wildomar La Cresta (#274, 12)
-Santa Rosa Plateau (#199, 12)
-Murrieta Creek at Tenaja (#128, 15)

The District has identified two additional stations that may need to be considered in the study. Isohyet values for the 100-year frequency durations at Banning Bench appeared approximately 20% low. Isohyet values at the 60-minute San Jacinto Valley Station appeared approximately 25% low.

-Banning Bench (#011, 27)
-San Jacinto Valley (#186, 12)

Response: The data sets form Riverside County we have been analyzing were those agreed on with County staff late last year. As a result of further discussions during the last few weeks we are adding additional Riverside County data to the analysis.

3.5 The 3.6 Red Bluff "bullseye" seems a bit artificial.

Response: This is an artifact of the contour interval interacting with the low gradient in the estimates and does not appear in the underlying gridded data. We will try to mitigate the artifact by modifying some of our map derivation steps.

3.6 Regarding the NM 100-year 1-hour map…Higher terrain from north of Chama to east of Tierra Amarilla (N - NE of El Vado Dam) should show some sort of maximum contouring...not unlike what is already depicted N of Abiquiu Dam.

Response: In order to justify higher values in this area, we would need data to support it. The spatial patterns in the current estimates are consistent with those of NOAA Atlas 2 100-yr 6-hr map for the are of concern and yet they were arrived at using quite different methods. We suspect the maps are depicting the area north of Chama less than the area north of Abiquiu Dam because extreme short-duration events are confined to the upper eastern slopes of the mountains due to moisture inflows from the southeast. That being said, if you have data to support your suggestion, we'd be more than happy to take a look at it.

3.7 When I look at the NM 100-year 60-minute map, I see several areas with concentric circles at the precipitation contours. Many of them seem strange because terrain and ground elevations in many areas are not particularly unique. When I look at the Arizona 100-year 60-minute maps, I don't see the same patterns. Areas of special concern are at "Beaverhead RS" and "Florida" in SW New Mexico. Additionally remarkable are the differences between "Red Bluff Dam, TX" at 3.6 inches and "Caprock 4 SE" at 2.8 inches. I wonder of there is not something unusual about the data from one or both of these stations. Overall, the problem seems to be associated with rare events in areas with very sparse gauge spacing.

Response: For a response to the Beaverhead RS comment please see 3.2. As for Red Bluff Dam, TX, Florida, NM and Caprock 4 SE, we agree, however this is largely an artifact of the contour interval used on the maps interacting with low gradients in the values and it does not appear in the underlying grids. We will try to mitigate the bullseyes by modifying some of our map derivation steps, but we certainly don't want to over generalize the results and lose spatial detail in the process.

3.8 The only comment we have relates to the isopluvials around Wickenburg, Arizona where it appears that the Vulture Mine Gage may have overly influenced the pattern. I have attached our recommended correction on the file attached (changes in red). Please contact Steve Waters (602-506-4694) if you need any clarification on this recommended change.

Response: The values in this area are what the data are telling us. If you have additional data to support your suggestion please let us know.

3.9 On the Nevada 100-year 24-hour isohyet map, there is an interesting "loop" in the 2.8" isohyet along I-15 NE of Las Vegas. Also regarding this same map, there appears to be a significant increase in the total rainfall for high elevations (e.g., the Spring Mtns west of Las Vegas) and only a very moderate increase in the rainfall totals for the lower elevations. Inasmuch as there are no gages located at the higher elevations, I'm curious as to how this is justified.

Response: The “loop” is an artifact of contouring the grid. This type of situation will likely be mitigated by a minor change made to the Cascade, Residual Add-back (CRAB) precipitation frequency grid derivation procedure.

The “significant” increase in rainfall for the high elevations is due to extrapolation along the strong linear relationship of “index flood” and the square-root of mean annual precipitation (MAP). In other words, with increasing MAP comes higher precipitation frequency estimates in this area. Lower elevations have fewer undulations in the MAP field, thus fewer significant rises/falls in the precipitation frequency estimates. Furthermore, the estimates in the Spring Mountains (which were carefully evaluated) are being influenced by Red Rock Canyon State Park (26-6691) that reported a remarkably high, but validated annual maximum rainfall of 5.38” in March 1986.

3.10 Regarding the Nevada 100-year 1-hour isohyet map, it would appear that the rainfall depth for Las Vegas is something slightly less than 1.6". This is to be compared with the 1.44" depth from NOAA Atlas II, and the 2.06" which the Regional Flood Control District uses. While we agree with the direction of the change, we disagree with the magnitude of the change. As we have briefly discussed in the past, we believe that the rainfall data which the District has collected throughout Clark County over the past 15 years justifies higher design rainfall values; however we recognize that the length of record for our gages is not sufficient to have that data included in your study. Once again, I encourage you to include a statement (or two) in your final report which recognizes and encourages the use of design rainfall values based on local knowledge and data not included in your study.

Response: We have paid particular attention to the estimates in the Las Vegas area and are confident in our current results. (See response for 3.3 for more information)

4 Are stations located correctly on the map?

4.1 The Idyllwild Fire Department Station identified on the Draft Precipitation Maps appears to be incorrectly located. Our understanding of the current location is Latitude 33° 44’50”; Longitude 116° 42’52”; elevation 5,397’. It is our understanding that this station is located on the southeast corner of Highway 243 and Pine Crest Road, across the street from the Fire Station since approximately June 18, 1952. The District began maintenance of this station for NWS on December 1979.

Response: Thank you for the correct longitude and latitude coordinates for this station. We will make this adjustment.

4.2 The station labeled "Carlsbad Caverns" is not located correctly on the Mean Annual - 24-Hour-NM and 100-Year - 24-Hour – NM map. Carlsbad caverns is located SE of the City of Carlsbad, NM

Response: Thank you so much for noticing this. According to NCDC records this station moved from 32.18, -104.45 (lat,lon) to 32.53472,-103.93666 in June 1996; this is a distance of about 38 miles. We used the newest location on our maps, but the prior location was the location since the station was established and is obviously inline with where it should be, as you note. We will adopt the old location for this station and assume a station move of 38 miles (in the West) indicates a metadata error and not a real station move. However we will also investigate to determine if this is merely a metadata error or if in fact we are looking at a time series from different locations.

4.3 Chamita located just NW of Chama is a SNOTEL location, but not a town. However, there is a community named Chamita in NM...located just NW of Espanola. Either drop the Chamita from the draft map, or re-label as Chamita SNOTEL.

Otto FAA Airport is not an airport, but may be a FAA NAVAID.

Raton WB Airport should be Raton Municipal Airport

Dawson is an abandoned mining town. (USGS river gaging site with raingage is 1N.)

Response: The final maps will not contain the station names for the stations, but rather a representative set of towns/cities for reference. Regardless, we identify SNOTEL stations by their ID number and not their name in our calculations. As for Raton WB and Dawson, we want to be consistent with the stations names NCDC uses, even if they aren't technically right. In our published time series, we will provide both ID and name so that you can accurately identify the location we used.

4.4 Panchuela was a SNOTEL site, but precip recording equipment has been removed. Either remove it, or re-label as Panchuela Snow Course site (NRCS)

Response: We used the SNOTEL data from this site before it was converted to a Snow Course, so the review map label for this site is indicating what we want. For reasons described in 4.3, this label will not appear on the final maps.

4.5 I continue to have some concern about the relative location of "Roswell WSO Airport" and "Roswell FAA Arpt". Perhaps Charlie Liles can provide some information about the location.

Response: We have contacted Charlie Liles and will research the station location carefully.

5 Are extremes (high and low) reasonable and located properly?

5.1 New Mexico, 100-year, 24-hour analysis: There is a terrain feature located at about 33.6N and 105.4W that I would have thought might have a small 46 center drawn over it. This feature is located just north of Hondo 1SE and Fort Stanton.

Response: According to the mean annual precipitation and NOAA Atlas 2, this terrain feature (Capitan Mtns) should have more of a maximum, but for some reason it doesn't on our map. The maximum grid value in these mountains is a 4.53" (or 45), which is a smidgen higher than the contours portrayed. Prompted by this comment, a change to the CRAB mapping procedure was made such that it maintains more spatial detail throughout the evolution of the maps. This change resulted in a small maximum on the terrain feature you mention.

5.2 100-Year - 60-Minute – NM: At approx 35.6 deg N and 106.7 deg W precipitation contour at 1.8 inches has a very strange shape.

Response: This jagged contour is the result of a contour traversing the grid in an area with a very gentle precipitation gradient. We've seen other contours like this and we will resolve this by increasing the size (5x5 to a 7x7 grid cell) of the weighted filter used to smooth the grids.

Appendix A.7. Daily, hourly, SNOTEL, and Mexico station lists for NOAA Atlas 14 Volume 1 showing station ID, station name and state, daily region in which the station resides, longitude, latitude, elevation (feet), begin date of record, end date of record, number of data years (i.e., years for which a reliable annual maximum was extracted), station coefficient of L-variation (L-CV), L-skewness (L-CS), L-kurtosis (L-CK), and discordancy of the station within its region (Disc.).

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

Table A.7.1. Daily stations (statistical values for the 24-hour duration)

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-0060	AGUILA	AZ	34	-113.1875	33.9433	2165	05/1924	11/2000	70	0.2740	0.3136	0.1837	0.88
02-0080	AJO	AZ	41	-112.8619	32.3683	1800	05/1914	12/2000	87	0.2321	0.2261	0.2730	0.68
02-0088	AJO WELL	AZ	41	-112.8333	32.4500	1430	02/1940	04/1975	35	0.2402	0.2851	0.2057	1.13
02-0100	ALAMO DAM	AZ	34	-113.5767	34.2303	1290	07/1975	12/2000	26	0.2305	0.0837	0.0898	1.40
02-0104	ALHAMBRA	AZ	42	-112.1167	33.5167	1142	01/1946	09/1976	31	0.2589	0.1939	0.1236	0.47
02-0159	ALPINE	AZ	44	-109.1469	33.8492	8050	10/1904	12/2000	84	0.1763	0.1420	0.1440	0.11
02-0204	AMADO 1 SE	AZ	52	-111.0500	31.7000	3123	07/1941	07/1976	33	0.2405	0.2202	0.1791	1.73
02-0287	ANVIL RANCH	AZ	52	-111.3822	31.9800	2750	12/1942	12/2000	57	0.2298	0.1429	0.0964	1.09
02-0380	ARIVACA	AZ	52	-111.3350	31.5722	3620	01/1956	12/2000	45	0.1588	0.1795	0.1176	1.49
02-0406	ARIZONA FALLS 1 WNW	AZ	42	-111.9833	33.5000	1250	05/1922	02/1968	40	0.2455	0.1478	0.1539	0.66
02-0482	ASH FORK	AZ	21	-112.4833	35.2167	5213	04/1902	09/1987	67	0.1833	0.0246	0.1501	1.92
02-0498	ASHURST HAYDEN DAM	AZ	42	-111.2864	33.0869	1550	01/1956	12/2000	44	0.1665	0.1348	0.1615	1.08
02-0586	BAGDAD	AZ	21	-113.1778	34.5672	3705	05/1925	12/2000	68	0.2178	0.1571	0.1675	0.25
02-0590	BAGDAD 8 NE	AZ	21	-113.0833	34.6500	4242	04/1950	04/1975	25	0.2333	0.2005	0.1676	0.43
02-0625	BAR T BAR RANCH	AZ	35	-111.3667	34.0333	3104	01/1952	11/1979	23	0.2798	0.3032	0.0603	1.67
02-0632	BARTLETT DAM	AZ	35	-111.6494	33.8092	1650	09/1939	12/2000	61	0.2360	0.2431	0.1582	0.13
02-0660	BEARDSLEY	AZ	42	-112.3833	33.6667	1270	01/1950	05/1978	28	0.2729	0.2735	0.2402	1.16
02-0670	BEAVER CREEK RANGER STN	AZ	36	-111.7136	34.6719	3820	02/1957	12/2000	44	0.1820	0.2621	0.2461	0.74
02-0672	BEAVER DAM	AZ	21	-113.9333	36.9167	1875	10/1951	12/2000	38	0.1834	0.2313	0.1750	0.73
02-0675	BEAVERHEAD LODGE	AZ	44	-109.2167	33.6833	8094	07/1948	12/1969	22	0.2362	0.1120	0.1951	3.90
02-0680	BENSON	AZ	52	-110.2833	31.9667	3586	06/1894	05/1975	74	0.1799	0.1504	0.1282	0.24
02-0683	BENSON 6 SE	AZ	52	-110.2403	31.8803	3690	07/1923	12/2000	78	0.1695	-0.0102	0.0577	3.98
02-0750	BETATAKIN	AZ	37	-110.5411	36.6778	7286	03/1939	12/2000	62	0.2402	0.3178	0.1500	1.65

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-0768	BISBEE	AZ	53	-109.9167	31.4333	5307	12/1892	12/1961	65	0.1701	0.1469	0.1582	0.54
02-0773	BISBEE 2	AZ	53	-109.8950	31.4269	5050	06/1961	06/1997	24	0.2200	0.3511	0.2279	2.98
02-0808	BLACK RIVER PUMPS	AZ	44	-109.7517	33.4783	6065	07/1948	12/2000	53	0.1662	0.1777	0.1102	0.60
02-0855	BLUE	AZ	44	-109.1667	33.5833	5420	11/1903	08/1989	54	0.1916	0.2238	0.1454	0.25
02-0871	BLUE RIDGE RANGER STN	AZ	36	-111.1892	34.6103	6880	07/1965	12/2000	36	0.1562	0.0331	-0.0092	2.13
02-0923	BOSLEY RANCH	AZ	51	-110.2000	32.5667	4803	07/1941	05/1966	25	0.1847	0.2415	0.1676	0.72
02-0949	BOUSE	AZ	34	-114.0242	33.9431	925	01/1952	12/2000	49	0.2475	0.1691	0.1589	0.25
02-0958	BOWIE	AZ	53	-109.4908	32.3236	3760	01/1899	12/2000	95	0.1814	0.0559	0.1295	1.43
02-1001	BRIGHT ANGEL RANGER STN	AZ	23	-112.0667	36.2000	8400	05/1925	11/2000	71	0.2024	0.2504	0.2270	0.27
02-1026	BUCKEYE	AZ	42	-112.5828	33.3761	890	03/1893	12/2000	105	0.2358	0.2753	0.2273	0.27
02-1050	BULLHEAD CITY	AZ	34	-114.5678	35.1411	540	11/1977	12/2000	23	0.2587	0.3775	0.3358	1.25
02-1059	BUMBLE BEE	AZ	21	-112.1500	34.2000	2503	12/1952	09/1979	27	0.2708	0.3351	0.1195	4.20
02-1101	BURRUS RANCH	AZ	36	-111.5333	35.2667	6804	10/1943	10/1968	25	0.1856	0.3204	0.2185	1.77
02-1169	CAMERON 1 NNE	AZ	36	-111.4000	35.8833	4164	05/1962	09/1992	31	0.2710	0.3424	0.2937	3.62
02-1216	CAMP WOOD	AZ	21	-112.8667	34.8000	5715	07/1948	10/1979	29	0.2084	0.1696	0.1703	0.05
02-1231	CANELO 1 NW	AZ	52	-110.5294	31.5589	5010	01/1910	12/2000	89	0.1961	0.2600	0.1987	0.59
02-1248	CANYON DE CHELLY	AZ	37	-109.5394	36.1533	5610	12/1908	12/2000	84	0.2320	0.2880	0.2756	0.85
02-1282	CAREFREE	AZ	35	-111.9019	33.8161	2530	11/1961	12/2000	32	0.1843	0.1453	0.1774	1.44
02-1306	CASA GRANDE	AZ	42	-111.7142	32.8889	1403	06/1898	12/2000	95	0.2620	0.2483	0.1846	0.48
02-1314	CASA GRANDE NATL MONUMENT	AZ	42	-111.5367	32.9947	1419	03/1906	12/2000	77	0.2227	0.2628	0.2590	0.55
02-1330	CASCABEL	AZ	51	-110.4131	32.3208	3145	06/1965	12/2000	36	0.2267	0.4255	0.3175	1.86
02-1353	CASTLE HOT SPRINGS HOTEL	AZ	21	-112.3667	33.9833	1972	01/1916	12/2000	51	0.2411	0.0991	0.1019	1.53
02-1511	CHANDLER	AZ	42	-111.8333	33.3000	1220	11/1912	11/1980	53	0.2322	0.2061	0.1141	0.18
02-1514	CHANDLER HEIGHTS	AZ	42	-111.6819	33.2058	1425	01/1941	12/2000	58	0.1841	0.0752	0.0693	1.03
02-1574	CHEVELON R S	AZ	36	-110.9194	34.5472	7006	05/1916	12/2000	72	0.1846	0.1558	0.1099	0.25
02-1614	CHILDS	AZ	21	-111.6981	34.3494	2650	09/1915	12/2000	85	0.1970	0.1709	0.2050	0.28
02-1654	CHINO VALLEY	AZ	21	-112.4567	34.7569	4750	06/1941	12/2000	60	0.2296	0.2446	0.1794	0.36
02-1664	CHIRICAHUA NATL MONUMENT	AZ	53	-109.3572	32.0061	5300	01/1909	12/2000	63	0.1954	0.2057	0.1717	0.20
02-1749	CIBECUE	AZ	36	-110.4875	34.0375	4980	06/1927	01/1979	48	0.2180	0.1405	0.1162	1.00
02-1849	CLIFTON	AZ	44	-109.3072	33.0561	3520	01/1893	12/2000	104	0.1765	0.1964	0.1421	0.25

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-1870	COCHISE 4 SSE	AZ	53	-109.8908	32.0589	4180	02/1899	12/1954	37	0.2020	0.1046	0.1765	1.47
02-1920	COLORADO CITY	AZ	23	-112.9719	36.9939	5010	07/1950	12/2000	49	0.2271	0.3725	0.3082	1.94
02-2099	COPPER MINE TRADING POST	AZ	24	-111.4167	36.6333	6385	03/1939	12/1976	37	0.2815	0.3454	0.2880	0.82
02-2109	CORDES	AZ	21	-112.1678	34.3053	3771	12/1925	12/2000	75	0.2210	0.2288	0.1562	0.28
02-2140	CORONADO N M HDQTRS	AZ	52	-110.2542	31.3456	5242	02/1960	12/2000	41	0.1896	0.1527	0.1726	0.58
02-2159	CORTARO 3 SW	AZ	51	-111.1167	32.3333	2270	03/1945	09/1976	30	0.2607	0.3923	0.3515	2.07
02-2329	CROWN KING	AZ	21	-112.3453	34.2097	5920	12/1914	01/1995	79	0.2079	0.2065	0.1464	0.18
02-2434	DATELAND WHITEWING RCH	AZ	40	-113.4967	32.9719	520	06/1972	05/2000	28	0.3587	0.2216	0.1512	0.42
02-2462	DEER VALLEY	AZ	42	-112.0833	33.5833	1257	01/1950	01/1985	35	0.2305	0.1358	0.0515	0.63
02-2648	DOS CABEZAS 1 SE	AZ	53	-109.6000	32.1667	5105	10/1951	04/1975	23	0.1655	0.1678	0.0723	2.10
02-2659	DOUGLAS	AZ	53	-109.5333	31.3500	4040	07/1948	02/1994	32	0.1790	0.1652	0.0766	1.11
02-2664	DOUGLAS FCWOS	AZ	53	-109.6036	31.4692	4098	07/1948	12/2000	53	0.1827	0.0611	0.0654	1.13
02-2669	DOUGLAS SMELTER	AZ	53	-109.5833	31.3500	3973	12/1903	03/1973	69	0.2007	0.1985	0.1846	0.25
02-2705	DRAKE RANGER STN	AZ	21	-112.3833	34.9667	4652	02/1915	04/1962	47	0.2015	0.1587	0.1790	0.13
02-2742	DUGAS 2 SE	AZ	21	-111.9500	34.3500	4042	07/1919	12/1972	52	0.2143	0.2203	0.1597	0.16
02-2754	DUNCAN	AZ	44	-109.1214	32.7481	3660	05/1901	12/2000	66	0.1624	0.1086	0.0950	0.58
02-2779	EAGLE CREEK	AZ	44	-109.4833	33.4000	5105	01/1928	07/1973	45	0.1758	0.1397	0.2190	0.50
02-2787	EHRENBERG	AZ	34	-114.5333	33.6000	322	10/1941	01/1977	35	0.3083	0.1622	0.1658	0.80
02-2790	EHRENBERG 2 E	AZ	34	-114.4706	33.6133	465	02/1977	12/2000	24	0.2664	0.3775	0.3465	1.39
02-2797	ELGIN 5 N	AZ	52	-110.5333	31.7333	4905	10/1912	01/1970	56	0.2022	0.2055	0.1196	0.26
02-2807	ELOY 4 NE	AZ	42	-111.5186	32.7858	1545	05/1951	12/2000	47	0.1857	0.2911	0.2196	0.97
02-2902	FAIRBANK 1 S	AZ	52	-110.1833	31.7167	3852	07/1909	03/1973	60	0.2157	0.1499	0.0559	0.88
02-2927	FALCON FIELD	AZ	42	-111.7500	33.4333	1322	06/1940	09/1976	32	0.2021	0.1787	0.1047	0.35
02-3010	FLAGSTAFF WSO AP	AZ	36	-111.6667	35.1333	7004	01/1924	12/2000	70	0.2068	0.1447	0.1641	0.74
02-3027	FLORENCE	AZ	42	-111.3942	33.0311	1505	12/1892	12/2000	90	0.2160	0.1798	0.1269	0.08
02-3082	FORESTDALE	AZ	36	-110.1000	34.1500	6106	10/1947	05/1971	21	0.2210	0.3400	0.2961	1.03
02-3110	FORT GRANT	AZ	53	-109.9500	32.6167	4833	01/1900	09/1974	53	0.2159	0.2065	0.1221	0.27
02-3150	FORT THOMAS 2 SW	AZ	43	-110.0019	33.0192	2800	06/1966	12/2000	35	0.2195	0.1573	0.1707	0.70
02-3160	FORT VALLEY	AZ	36	-111.7428	35.2681	7347	01/1909	12/2000	92	0.1758	0.1539	0.1362	0.24
02-3185	FOSSIL SPRINGS	AZ	36	-111.5667	34.4167	4272	01/1951	10/1970	20	0.1762	0.0529	0.0467	1.00
02-3190	FOUNTAIN HILLS	AZ	42	-111.7133	33.6003	1575	10/1979	12/2000	21	0.1539	0.1511	0.1950	1.61
02-3250	FREDONIA	AZ	23	-112.5333	36.9500	4682	01/1937	10/1975	39	0.1973	0.1072	0.1259	0.71

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-3258	FRITZ RANCH	AZ	44	-109.1833	33.3333	4324	07/1948	05/1980	30	0.1554	0.1399	0.2676	1.89
02-3303	GANADO	AZ	37	-109.5661	35.7164	6340	02/1929	12/2000	71	0.2149	0.2784	0.1971	0.37
02-3393	GILA BEND	AZ	41	-112.7131	32.9481	735	12/1892	12/2000	98	0.2115	0.1821	0.1432	0.15
02-3398	GILA BEND FAA AIRPORT	AZ	41	-112.7167	32.8833	853	01/1944	12/1966	23	0.2662	0.2300	0.2347	0.50
02-3505	GLOBE	AZ	43	-110.7711	33.3767	3650	01/1894	12/2000	98	0.1639	0.1937	0.2073	0.83
02-3595	GRAND CANYON NATL PARK	AZ	23	-112.1333	36.0500	6955	09/1903	07/1977	71	0.1822	0.2613	0.2519	0.99
02-3596	GRAND CANYON N P 2	AZ	23	-112.1500	36.0500	6785	05/1976	12/2000	24	0.2034	0.1821	0.2392	1.44
02-3621	GRANITE REEF DAM	AZ	42	-111.7000	33.5167	1322	01/1893	09/1979	82	0.2340	0.1443	0.0471	0.71
02-3635	GRANVILLE	AZ	44	-109.3833	33.2000	6804	04/1955	08/1975	20	0.1915	0.1995	0.1086	0.39
02-3683	GREER	AZ	44	-109.4625	34.0017	8490	07/1904	12/2000	72	0.1833	0.1933	0.1453	0.10
02-3702	GRIGGS 3 W	AZ	42	-112.4833	33.5000	1160	01/1950	03/1990	40	0.2316	0.1821	0.1911	0.38
02-3713	GROOM CREEK	AZ	21	-112.4500	34.4833	6106	01/1942	04/1976	34	0.2263	0.1812	0.2254	0.95
02-3828	HAPPY JACK RANGER STN	AZ	36	-111.4139	34.7433	7480	05/1969	12/2000	32	0.1891	0.1565	0.0611	0.95
02-3852	HARQUAHALA PLAINS 1	AZ	34	-113.1667	33.5333	1220	04/1952	12/1979	25	0.2595	0.0309	0.2172	4.05
02-3926	HAWLEY LAKE	AZ	44	-109.7500	33.9833	8180	11/1967	08/1988	20	0.2125	0.3500	0.2958	1.94
02-3961	HEBER RANGER STN	AZ	36	-110.5581	34.3925	6590	06/1915	12/2000	67	0.1826	0.2789	0.2007	1.08
02-3981	HELVETIA SANTA RITA RANGE	AZ	52	-110.7833	31.8667	4304	06/1916	04/1950	32	0.1573	0.0995	0.0436	2.50
02-4053	HILLSIDE 4 NNE	AZ	21	-112.8881	34.4700	3320	01/1955	12/1997	43	0.2025	0.2554	0.2208	0.24
02-4089	HOLBROOK	AZ	37	-110.1544	34.9094	5085	01/1893	12/2000	103	0.2260	0.2590	0.1630	0.34
02-4182	HORSESHOE DAM	AZ	35	-111.7125	33.9831	2020	07/1948	12/2000	53	0.2732	0.3215	0.2059	0.79
02-4345	INTAKE	AZ	43	-110.9333	33.6167	2221	07/1906	04/1952	44	0.1971	0.2217	0.1472	0.13
02-4391	IRVING	AZ	36	-111.6181	34.4025	3795	01/1951	12/2000	50	0.1845	0.0542	0.1100	1.30
02-4418	JACOB LAKE	AZ	23	-112.2167	36.7333	7825	01/1950	10/1987	24	0.1727	0.1494	0.2765	2.76
02-4438	JEDDITO	AZ	37	-110.1333	35.7667	6706	12/1931	10/1955	23	0.1856	0.2064	0.1664	0.41
02-4453	JEROME	AZ	21	-112.1114	34.7522	4950	09/1897	12/2000	102	0.1986	0.1631	0.1618	0.05
02-4558	KATHERINE RANGER STN	AZ	20	-114.5667	35.2333	670	01/1958	02/1978	20	0.3442	0.2759	0.2174	1.55
02-4578	KAYENTA	AZ	37	-110.2833	36.7333	5705	06/1915	03/1978	56	0.2539	0.1987	0.1549	1.10
02-4586	KEAMS CANYON	AZ	37	-110.1917	35.8111	6205	01/1949	12/2000	43	0.2156	0.2306	0.1789	0.05
02-4590	KEARNY	AZ	43	-110.9078	33.0519	1830	12/1922	10/2000	62	0.1883	0.1565	0.0885	0.59
02-4639	KINGMAN CAA AP	AZ	34	-114.0000	35.2167	-999	05/1901	07/1967	66	0.2234	0.1428	0.0805	1.31
02-4645	KINGMAN NO 2	AZ	34	-114.0167	35.2000	3539	09/1967	09/1993	26	0.2026	0.2800	0.1371	2.05
02-4675	KITT PEAK	AZ	52	-111.5978	31.9597	6790	09/1960	12/2000	40	0.2091	0.2546	0.0756	2.75

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-4686	KLAGETOH 12 WNW	AZ	37	-109.7000	35.5500	6500	11/1959	04/1993	33	0.1678	0.0617	0.0643	1.11
02-4698	KLONDYKE 3 SE	AZ	43	-110.3000	32.8000	3612	01/1952	04/1978	23	0.2349	0.0488	-0.0494	3.72
02-4702	KOFA MINE	AZ	40	-113.9653	33.2742	1775	05/1952	12/2000	46	0.3335	0.2997	0.2005	1.96
02-4761	LAKE HAVASU CITY	AZ	34	-114.3600	34.5028	468	09/1967	09/2000	33	0.2327	0.1103	0.1488	1.01
02-4770	LAKE PLEASANT	AZ	42	-112.2667	33.8500	1505	11/1949	12/1977	28	0.2667	0.3662	0.3494	2.43
02-4779	LAKESIDE RANGER STN	AZ	36	-109.9833	34.1667	6706	05/1911	06/1975	45	0.1898	0.2207	0.1393	0.45
02-4829	LAVEEN 3 SSE	AZ	42	-112.1472	33.3369	1135	07/1948	12/2000	53	0.2418	0.1348	0.0939	0.49
02-4849	LEES FERRY	AZ	24	-111.6033	36.8633	3210	04/1916	12/2000	75	0.2442	0.2204	0.1447	0.19
02-4864	LESLIE CANYON	AZ	53	-109.5667	31.6000	4462	05/1916	01/1960	44	0.2089	0.1955	0.1546	0.11
02-4872	LEUPP	AZ	36	-110.9667	35.2833	4705	10/1914	04/1981	54	0.2456	0.3590	0.2375	1.52
02-4977	LITCHFIELD PARK	AZ	42	-112.3667	33.5000	1030	08/1917	02/2000	83	0.2526	0.1629	0.1151	0.48
02-5129	LUKACHUKAI	AZ	37	-109.2289	36.4183	6520	08/1951	12/2000	47	0.2047	0.0352	0.1145	1.98
02-5204	MANY FARMS SCHOOL	AZ	37	-109.6167	36.3667	5315	08/1951	07/1975	24	0.2220	0.1148	0.0420	1.40
02-5270	MARICOPA 4 N	AZ	42	-112.0303	33.1139	1160	02/1960	12/2000	41	0.2276	0.1386	0.0911	0.31
02-5274	MARICOPA 9 SSW	AZ	42	-112.1000	32.9167	1401	06/1898	12/1958	56	0.2979	0.2939	0.1748	1.66
02-5312	MAVERICK	AZ	44	-109.5500	33.7500	7805	07/1948	07/1967	19	0.1858	0.2172	0.3206	1.65
02-5412	MC NARY 2 N	AZ	36	-109.8500	34.1167	7340	08/1933	12/2000	67	0.1918	0.1869	0.1395	0.08
02-5418	MC NEAL	AZ	53	-109.6686	31.6031	4170	03/1960	12/2000	41	0.2103	0.2124	0.0928	0.67
02-5467	MESA EXPERIMENT FARM	AZ	42	-111.8667	33.4167	1230	03/1896	12/2000	103	0.2032	0.2024	0.1669	0.13
02-5512	MIAMI	AZ	43	-110.8700	33.4044	3560	02/1914	12/2000	87	0.1978	0.1627	0.1735	0.25
02-5627	MOHAWK	AZ	40	-113.7667	32.7333	541	07/1900	05/1951	51	0.3122	0.2103	0.1763	0.57
02-5635	MONTEZUMA CASTLE N M	AZ	21	-111.8333	34.6167	3179	10/1938	12/2000	62	0.2286	0.1568	0.0894	0.73
02-5665	MONUMENT VALLEY	AZ	37	-110.1111	36.9819	5564	10/1980	12/2000	20	0.1751	-0.0127	0.1059	2.91
02-5700	MORMON FLAT	AZ	43	-111.4456	33.5553	1705	08/1923	12/2000	75	0.2279	0.2233	0.2139	0.75
02-5744	MOUNT TRUMBULL	AZ	21	-113.3500	36.4167	5604	10/1919	12/1977	55	0.2048	0.3050	0.2544	0.63
02-5825	NATURAL BRIDGE	AZ	36	-111.4500	34.3167	4613	01/1893	11/1972	78	0.1993	0.2006	0.1201	0.31
02-5921	NOGALES	AZ	52	-110.9167	31.3500	3812	12/1892	06/1983	75	0.1699	0.2363	0.2082	0.91
02-5924	NOGALES 6 N	AZ	52	-110.9650	31.4444	3560	10/1952	12/2000	48	0.2205	0.1841	0.1515	0.57
02-6037	OAK CREEK CANYON	AZ	36	-111.7500	34.9667	5075	03/1935	12/2000	66	0.2288	0.2345	0.1474	0.72
02-6119	ORACLE 2 SE	AZ	51	-110.7344	32.6025	4510	01/1893	12/2000	99	0.1781	0.1019	0.1850	0.70
02-6132	ORGAN PIPE CACTUS N M	AZ	41	-112.8008	31.9550	1678	01/1944	12/2000	57	0.2070	0.1572	0.0797	0.72
02-6180	PAGE	AZ	24	-111.4500	36.9167	4272	10/1957	12/2000	42	0.2335	0.2484	0.2337	0.30

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-6190	PAINTED DESERT NATL PARK	AZ	37	-109.7833	35.0667	5760	10/1973	12/2000	27	0.1751	0.1763	0.1220	0.66
02-6242	PARADISE	AZ	53	-109.2167	31.9333	5433	01/1906	08/1937	29	0.1905	0.1739	0.0798	0.72
02-6246	PARADISE VALLEY NO 2	AZ	42	-111.9667	33.5667	1381	06/1955	09/1976	22	0.2513	0.5505	0.3975	4.89
02-6250	PARKER 6 NE	AZ	34	-114.2167	34.2167	410	10/1893	05/2000	105	0.2908	0.1963	0.1868	0.29
02-6282	PATAGONIA #2	AZ	52	-110.7517	31.5481	4190	01/1978	12/2000	23	0.2346	0.1282	0.0190	2.08
02-6315	PAYSON 12 NNE	AZ	36	-111.2667	34.4000	5505	10/1952	09/1976	24	0.2030	0.2458	0.2066	0.10
02-6323	PAYSON	AZ	36	-111.3333	34.2333	4913	01/1893	12/2000	96	0.1959	0.2597	0.2327	0.29
02-6328	PEACH SPRINGS	AZ	21	-113.4103	35.5436	4970	07/1948	12/2000	53	0.1808	0.1512	0.1831	0.45
02-6353	PEARCE SUNSITES	AZ	53	-109.8383	31.9356	4350	03/1950	12/2000	43	0.1773	0.1452	0.0970	0.58
02-6358	PEARCE 5 W	AZ	53	-109.9000	31.8833	4925	02/1922	02/1950	24	0.2116	0.1357	0.0752	0.48
02-6468	PETRIFIED FOREST N P	AZ	37	-109.8883	34.7969	5446	01/1931	12/2000	70	0.2195	0.1561	0.1522	0.29
02-6471	PHANTOM RANCH	AZ	23	-112.1000	36.1000	2570	07/1935	12/2000	63	0.2043	0.1589	0.1041	0.34
02-6476	PHOENIX INDIAN SCHOOL	AZ	42	-112.0667	33.5000	1122	02/1921	04/1975	43	0.2618	0.3019	0.1804	0.64
02-6481	PHOENIX WSO AP	AZ	42	-111.9903	33.4431	1107	07/1933	12/2000	62	0.2435	0.2717	0.1665	0.26
02-6486	PHOENIX CITY	AZ	42	-112.0825	33.4489	1098	07/1948	10/1998	47	0.2588	0.2281	0.0893	0.79
02-6506	PICACHO RESERVOIR	AZ	42	-111.4667	32.8667	1512	01/1956	08/1983	28	0.2103	0.1515	0.1546	0.25
02-6538	PIERCE FERRY 17 SSW	AZ	21	-114.0833	35.8833	3858	06/1963	07/1984	21	0.1694	0.2035	0.1435	1.43
02-6561	PINAL RANCH	AZ	43	-110.9833	33.3500	4524	03/1895	05/1973	78	0.2122	0.2089	0.1443	0.06
02-6581	PINEDALE	AZ	36	-110.2500	34.3000	6506	06/1912	12/1968	56	0.2033	0.2581	0.2679	0.65
02-6601	PINETOP FISH HATCHERY	AZ	36	-109.9222	34.1242	7200	11/1943	12/2000	57	0.1857	0.1577	0.1783	0.25
02-6616	PIPE SPRINGS NATL MONUMEN	AZ	23	-112.7386	36.8586	4920	06/1963	12/2000	38	0.1967	0.1740	0.0988	0.51
02-6653	PLEASANT VALLEY R S	AZ	36	-110.9333	34.1000	5050	07/1903	12/2000	87	0.1944	0.1926	0.1430	0.07
02-6706	PORTAL	AZ	53	-109.1667	31.9000	5003	01/1914	03/1955	37	0.1897	0.0755	0.0609	0.95
02-6716	PORTAL 4 SW	AZ	53	-109.2058	31.8828	5390	01/1951	12/2000	50	0.1915	0.2313	0.2173	0.80
02-6796	PRESCOTT	AZ	21	-112.4322	34.5706	5205	05/1898	12/2000	102	0.1939	0.1960	0.1709	0.14
02-6801	PRESCOTT WBO	AZ	21	-112.4333	34.6500	5020	01/1948	12/1969	22	0.2349	0.3508	0.3326	1.78
02-6840	PUNKIN CENTER	AZ	35	-111.3064	33.8556	2325	11/1915	12/2000	81	0.2290	0.2122	0.1711	0.06
02-6865	QUARTZSITE	AZ	34	-114.2272	33.6650	875	05/1908	12/2000	58	0.2537	0.1997	0.2127	0.17
02-7036	REDINGTON	AZ	51	-110.4667	32.3903	2940	07/1941	12/2000	59	0.2465	0.3699	0.2286	1.29
02-7058	RED ROCK 6 SW	AZ	42	-111.3667	32.5000	1860	01/1893	10/1973	49	0.1990	0.0465	0.0306	1.29
02-7131	RIMROCK	AZ	36	-111.7333	34.6500	3602	06/1941	05/1962	20	0.2324	0.1272	0.1059	2.23
02-7281	ROOSEVELT 1 WNW	AZ	43	-111.1500	33.6667	2205	07/1905	12/2000	96	0.1804	0.2168	0.1818	0.31

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-7326	RUBY 4 NW	AZ	52	-111.2833	31.5000	3983	04/1895	12/1955	33	0.2039	0.2913	0.2112	1.11
02-7334	RUCKER CANYON	AZ	53	-109.4136	31.7564	5370	01/1893	12/2000	88	0.1956	0.2138	0.1400	0.34
02-7355	SABINO CANYON	AZ	51	-110.8139	32.3083	2640	07/1941	09/1982	41	0.2021	0.1865	0.1601	0.20
02-7370	SACATON	AZ	42	-111.7411	33.0800	1285	04/1908	12/2000	90	0.2358	0.2282	0.2137	0.29
02-7388	SAFFORD	AZ	53	-109.7167	32.8333	2904	08/1898	06/1973	51	0.2388	0.1685	0.0843	1.23
02-7390	SAFFORD AGRICULTRL CTR	AZ	53	-109.6811	32.8153	2954	08/1948	12/2000	53	0.2129	0.1295	0.1331	0.61
02-7419	SAHUARITA 8 W	AZ	52	-111.0667	31.9000	3560	02/1950	03/1988	37	0.1640	0.1809	0.1643	0.68
02-7435	SAINT JOHNS	AZ	37	-109.4028	34.5172	5790	08/1901	12/2000	93	0.1976	0.2090	0.1321	0.28
02-7440	ST MICHAELS 6 WNW	AZ	37	-109.2000	35.6667	7644	01/1906	12/1927	22	0.2258	0.3478	0.2311	1.19
02-7445	SALA RANCH	AZ	53	-109.9833	31.8667	5164	08/1947	08/1978	32	0.2084	0.1683	0.1034	0.15
02-7460	SALOME 6 SE	AZ	34	-113.5333	33.7333	1703	12/1907	04/1957	49	0.2327	0.1793	0.0918	1.05
02-7475	SAN CARLOS	AZ	43	-110.4500	33.3500	2641	10/1912	04/1977	40	0.1862	0.1401	0.2155	1.00
02-7480	SAN CARLOS RESERVOIR	AZ	43	-110.5269	33.1825	2532	10/1900	12/2000	89	0.1940	0.1543	0.1524	0.21
02-7488	SANDERS	AZ	37	-109.3222	35.2239	5853	07/1949	12/2000	43	0.2011	0.1912	0.1506	0.04
02-7496	SANDERS 11 ESE	AZ	37	-109.1667	35.1667	6250	05/1961	07/1986	25	0.1950	0.3006	0.2899	1.81
02-7530	SAN MANUEL	AZ	51	-110.6339	32.6014	3460	06/1954	12/2000	46	0.1823	0.1890	0.1062	0.65
02-7555	SAN RAFAEL RANCH	AZ	52	-110.6167	31.3500	4744	12/1892	03/1968	49	0.1752	0.1787	0.2025	0.75
02-7560	SAN SIMON	AZ	54	-109.2256	32.2714	3610	03/1898	12/2000	66	0.2399	0.2854	0.1729	0.19
02-7567	SAN SIMON 9 ESE	AZ	54	-109.0833	32.1667	3880	07/1962	07/1986	24	0.2259	0.3860	0.2399	1.69
02-7583	SANTA MARGARITA	AZ	52	-111.5833	31.6833	3934	06/1917	11/1950	33	0.1867	0.1923	0.1511	0.08
02-7593	SANTA RITA EXP RANGE	AZ	52	-110.8464	31.7625	4300	05/1950	12/2000	51	0.2065	0.2283	0.1463	0.27
02-7619	SASABE	AZ	52	-111.5447	31.4833	3590	02/1959	12/2000	41	0.2188	0.2410	0.1583	0.50
02-7622	SASABE 7 NW	AZ	52	-111.6028	31.6039	3825	12/1950	12/2000	50	0.1794	0.1823	0.2166	1.00
02-7708	SEDONA RANGER STN	AZ	36	-111.7667	34.8667	4220	10/1943	12/2000	56	0.1931	0.3041	0.2500	0.83
02-7716	SELIGMAN	AZ	21	-112.8797	35.3322	5250	12/1904	12/2000	92	0.2336	0.2786	0.2001	0.58
02-7726	SELLS	AZ	52	-111.8858	31.9142	2345	01/1911	12/2000	45	0.1816	0.2611	0.2437	1.16
02-7751	SENTINEL	AZ	41	-113.2167	32.8667	689	01/1899	03/1960	28	0.2894	0.1447	0.1422	2.31
02-7855	SHOW LOW AIRPORT	AZ	36	-110.0075	34.2639	6411	01/1893	12/2000	68	0.1573	0.0391	0.0687	1.19
02-7876	SIERRA ANCHA	AZ	43	-110.9714	33.7986	5100	11/1913	09/1979	47	0.1975	0.2503	0.1496	0.36
02-7880	SIERRA VISTA	AZ	52	-110.2847	31.5553	4600	02/1900	12/2000	65	0.1748	0.1597	0.1947	0.88
02-7915	SILVER BELL	AZ	42	-111.5000	32.3833	2740	02/1906	04/1974	35	0.2200	0.1974	0.2702	1.42
02-8012	SNOWFLAKE	AZ	36	-110.0833	34.5000	5642	06/1897	12/2000	100	0.2187	0.1842	0.1330	0.54

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-8018	SNOWFLAKE 15 W	AZ	36	-110.3333	34.5000	6080	05/1965	02/1998	33	0.1877	0.3189	0.3284	1.84
02-8112	SOUTH PHOENIX	AZ	42	-112.0694	33.3814	1155	01/1915	12/2000	85	0.2260	0.1477	0.1052	0.22
02-8162	SPRINGERVILLE	AZ	44	-109.3000	34.1333	7037	04/1911	12/2000	90	0.1905	0.2613	0.1680	0.56
02-8184	STANTON	AZ	21	-112.7333	34.1667	3481	03/1944	12/1969	26	0.2218	0.1860	0.3309	4.05
02-8206	STEPHENS RANCH	AZ	53	-109.2000	31.4000	3999	12/1928	03/1982	52	0.1844	0.1496	0.1380	0.13
02-8214	STEWART MOUNTAIN	AZ	43	-111.5358	33.5575	1422	06/1939	12/2000	62	0.2140	0.2938	0.2511	0.67
02-8273	SUNFLOWER 3 NNW	AZ	35	-111.4856	33.9119	3720	07/1916	11/1984	38	0.2570	0.3650	0.3070	1.39
02-8329	SUNSET CRATER NATL MONUME	AZ	36	-111.5436	35.3694	6980	12/1969	12/2000	31	0.1744	0.1529	0.1404	0.26
02-8343	SUPAI	AZ	23	-112.7000	36.2000	3204	09/1899	02/1987	55	0.2382	0.2624	0.1829	1.28
02-8348	SUPERIOR	AZ	43	-111.0967	33.3008	2860	07/1920	12/2000	81	0.1715	0.2184	0.1713	0.66
02-8396	TACNA 3 NE	AZ	40	-113.9183	32.7217	324	02/1969	12/2000	32	0.3402	0.2394	0.1827	0.06
02-8468	TEEC NOS POS	AZ	37	-109.0900	36.9233	5290	06/1962	12/2000	37	0.2236	0.1802	0.1160	0.33
02-8489	TEMPE 1 SE	AZ	42	-111.9333	33.4333	1161	01/1926	09/1984	59	0.2192	0.2008	0.1630	0.02
02-8499	TEMPE A S U	AZ	42	-111.9294	33.4197	1170	01/1905	12/2000	94	0.2285	0.2515	0.2275	0.26
02-8598	TOLLESON 1 E	AZ	42	-112.2433	33.4536	1025	10/1951	12/2000	49	0.2307	0.2268	0.1465	0.06
02-8619	TOMBSTONE	AZ	52	-110.0575	31.7053	4610	07/1893	12/2000	101	0.1941	0.1787	0.1047	0.26
02-8641	TONOPAH 5 NE	AZ	34	-112.8833	33.5000	1150	09/1951	01/1994	23	0.3080	0.2450	0.1702	0.78
02-8649	TONTO CREEK FISH HATCHERY	AZ	36	-111.1000	34.3667	6283	06/1944	07/1975	30	0.1637	0.1932	0.3166	3.16
02-8650	TONTO CREEK FISH HAT 2	AZ	36	-111.1000	34.3833	6390	08/1975	12/2000	26	0.1592	0.0517	0.1126	1.16
02-8657	TONTO SPRINGS RS	AZ	21	-112.7500	34.6167	4593	09/1914	10/1966	40	0.2050	0.1541	0.0844	0.59
02-8778	TRUXTON CANYON	AZ	34	-113.6594	35.3881	3820	05/1901	03/1980	62	0.2472	0.2155	0.1796	0.09
02-8792	TUBA CITY	AZ	37	-111.2392	36.1375	5030	03/1897	12/2000	84	0.2557	0.2928	0.2262	0.87
02-8796	TUCSON CAMP AVE EXP FM	AZ	51	-110.9436	32.2817	2330	02/1949	12/2000	51	0.2043	0.2213	0.1843	0.03
02-8800	TUCSON MAGNETIC OBSY	AZ	51	-110.8333	32.2500	2526	01/1912	03/1994	63	0.1904	0.1339	0.1810	0.39
02-8815	TUCSON NWSO	AZ	51	-110.9539	32.2297	2478	09/1894	12/2000	106	0.2087	0.1332	0.1722	1.28
02-8820	TUCSON WBO	AZ	51	-110.9167	32.1833	2559	02/1930	12/2000	58	0.2124	0.2831	0.1844	0.28
02-8865	TUMACACORI NATL MONUMENT	AZ	52	-111.0517	31.5664	3267	04/1946	12/2000	55	0.2226	0.2139	0.1672	0.60
02-8895	TUWEEP	AZ	21	-113.0636	36.2861	4775	06/1941	12/1985	45	0.2035	0.1883	0.1466	0.09
02-8904	TUZIGOOT	AZ	21	-112.0333	34.7667	3470	11/1911	12/2000	69	0.2094	0.2635	0.1114	1.79
02-8998	VAIL 7 N	AZ	51	-110.7247	32.1264	2980	03/1941	12/2000	58	0.1637	0.1609	0.1491	1.10

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-9114	WAHWEAP	AZ	24	-111.4914	36.9953	3730	05/1961	12/2000	40	0.2935	0.4269	0.4013	2.63
02-9156	WALNUT CANYON NATL MONUME	AZ	36	-111.5067	35.1706	6685	10/1950	12/2000	50	0.2016	0.2853	0.2156	0.41
02-9158	WALNUT CREEK	AZ	21	-112.8097	34.9281	5090	12/1915	12/2000	85	0.1925	0.2242	0.2418	0.44
02-9166	WALNUT GROVE	AZ	21	-112.5619	34.3117	3764	01/1893	12/2000	105	0.1872	0.1461	0.1275	0.32
02-9211	WELLTON	AZ	40	-114.1333	32.6667	259	03/1922	12/1980	55	0.3292	0.2056	0.1333	0.32
02-9271	WHITERIVER 1 SW	AZ	44	-109.9833	33.8169	5120	02/1900	12/2000	91	0.2030	0.1931	0.2211	0.35
02-9287	WICKENBURG	AZ	21	-112.7403	33.9792	2095	03/1908	12/2000	91	0.1845	0.0868	0.1134	0.53
02-9309	WIKIEUP	AZ	34	-113.6136	34.7061	2010	07/1925	12/2000	68	0.2487	0.2283	0.2013	0.05
02-9334	WILLCOX	AZ	53	-109.8406	32.2578	4175	06/1898	12/2000	99	0.2108	0.2269	0.1371	0.36
02-9359	WILLIAMS	AZ	36	-112.1906	35.2411	6750	03/1897	12/2000	97	0.1503	0.1001	0.1564	1.24
02-9376	WILLOW BEACH	AZ	20	-114.6611	35.8686	740	10/1967	12/2000	33	0.2581	0.2030	0.1414	1.20
02-9382	WILLOW SPRINGS RANCH	AZ	51	-110.8667	32.7167	3691	03/1943	12/1978	30	0.1807	0.1355	0.3032	2.54
02-9410	WINDOW ROCK 4 SW	AZ	37	-109.1244	35.6169	6920	03/1937	09/1999	60	0.2117	0.2190	0.1055	0.62
02-9420	WINKELMAN 9 S	AZ	43	-110.7167	32.8667	2123	01/1893	05/1980	58	0.1889	0.0929	0.0706	0.99
02-9439	WINSLOW WSO AP	AZ	36	-110.7333	35.0167	4890	10/1898	12/2000	91	0.2205	0.2639	0.1688	0.46
02-9464	WITTMANN 4 SW	AZ	42	-112.5983	33.7478	1670	12/1923	11/1966	37	0.2213	0.1619	0.1340	0.11
02-9542	WUPATKI NATL MONUMENT	AZ	36	-111.3667	35.5167	4908	01/1940	12/2000	60	0.2044	0.2352	0.1316	0.53
02-9562	Y LIGHTNING RANCH	AZ	52	-110.2267	31.4517	4590	01/1939	12/2000	62	0.1956	0.1890	0.1315	0.04
02-9572	YAEGER CANYON	AZ	21	-112.1667	34.6833	6004	12/1917	08/1948	30	0.1770	-0.0307	0.0878	2.31
02-9601	YAVA 6 ESE	AZ	21	-112.8000	34.4500	3783	07/1948	04/1975	27	0.1643	0.2351	0.2942	2.08
02-9634	YOUNGTOWN	AZ	42	-112.3014	33.5950	1135	07/1913	12/2000	78	0.2293	0.1928	0.1631	0.07
02-9645	YUCCA 1 NNE	AZ	34	-114.1344	34.8775	1950	01/1950	12/2000	48	0.2398	0.2592	0.2307	0.18
02-9652	YUMA CITRUS STATION	AZ	40	-114.6350	32.6114	191	09/1920	12/2000	80	0.3855	0.2570	0.1617	0.68
02-9654	YUMA PROVING GROUND	AZ	40	-114.3942	32.8356	324	01/1955	12/2000	46	0.3064	0.2112	0.2196	2.04
02-9656	YUMA QUARTERMASTER DEPOT	AZ	40	-114.6233	32.7278	140	09/1948	12/2000	51	0.3828	0.2724	0.1636	0.62
02-9657	YUMA VALLEY	AZ	40	-114.7167	32.7167	120	11/1930	12/1992	58	0.3773	0.3610	0.3070	2.32
02-9662	YUMA WB CITY	AZ	40	-114.6167	32.7333	240	01/1893	04/1974	81	0.3429	0.2676	0.2051	0.13
04-0010	ACAMPO 5 NE	CA	16	-121.2031	38.2189	87	07/1926	12/2000	73	0.1408	0.1428	0.1684	1.47
04-0014	ACTON ESCONDIDO FC261	CA	31	-118.2714	34.4947	2970	07/1948	08/2000	50	0.2760	0.1761	0.1239	0.37
04-0029	ADIN RS	CA	1	-120.9447	41.1939	4195	01/1944	12/2000	56	0.1772	0.1938	0.1521	0.30

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-0046	AGUANGA BERGMAN RANCH	CA	32	-116.9167	33.4167	3104	05/1928	11/1948	19	0.2227	0.2137	0.0889	0.85
04-0115	ALISO CANYON OAT MTN FC44	CA	31	-118.5500	34.3167	2367	07/1948	10/1990	40	0.2252	0.2428	0.1706	1.13
04-0136	ALPINE	CA	32	-116.7753	32.8389	1735	10/1952	12/2000	48	0.2580	0.1996	0.0736	0.69
04-0144	ALTADENA	CA	31	-118.1394	34.1814	1127	01/1922	08/2000	76	0.2707	0.2188	0.1463	0.17
04-0161	ALTURAS RANGER STATION	CA	2	-120.5500	41.5000	4400	04/1905	12/2000	85	0.2099	0.3029	0.2473	0.45
04-0204	ANGIOLA	CA	16	-119.4833	35.9833	210	08/1899	03/1982	80	0.2101	0.1185	0.1194	1.01
04-0235	ANZA	CA	32	-116.6739	33.5558	3915	09/1943	12/2000	53	0.2569	0.1989	0.1739	0.18
04-0244	APPLE VALLEY	CA	30	-117.2167	34.5167	2934	06/1959	03/1987	28	0.3375	0.2030	0.0118	2.60
04-0327	ARROYO SECO RANGER STN	CA	28	-118.1667	34.2167	1220	10/1916	04/1974	57	0.3185	0.2945	0.1722	1.11
04-0343	ASH MOUNTAIN	CA	17	-118.8253	36.4914	1708	01/1927	12/2000	73	0.2290	0.3480	0.2464	0.65
04-0355	ASSOC OIL ANAHEIM 1	CA	31	-117.8833	33.9000	341	05/1906	05/1966	24	0.2516	0.3221	0.2412	2.02
04-0379	AUBERRY 2 NW	CA	16	-119.5128	37.0919	2090	07/1915	12/2000	84	0.2011	0.1861	0.1014	0.92
04-0383	AUBURN	CA	16	-121.0839	38.9072	1292	01/1905	12/2000	94	0.1627	0.1133	0.1451	0.64
04-0410	AZUSA CITY PARK FC 143	CA	31	-117.9000	34.1333	610	12/1901	10/1972	43	0.2775	0.3047	0.2656	2.08
04-0418	BACKUS RANCH	CA	30	-118.1833	34.9500	2651	06/1936	02/1963	25	0.2958	0.2640	0.2141	0.99
04-0436	BAKER	CA	19	-116.0736	35.2658	940	12/1971	12/2000	21	0.2460	0.0927	0.2036	0.79
04-0442	BAKERSFIELD WSO ARPT	CA	16	-119.0500	35.4167	495	01/1893	12/2000	98	0.1928	0.1942	0.1833	0.03
04-0449	BALCH POWER HOUSE	CA	17	-119.0883	36.9092	1720	02/1950	12/2000	51	0.2232	0.2976	0.1678	0.92
04-0509	BARNESON PARK	CA	31	-117.8500	33.9333	581	11/1941	03/1966	22	0.3443	0.4154	0.2091	5.19
04-0514	BARRETT DAM	CA	32	-116.6667	32.6833	1621	12/1913	12/1980	65	0.2494	0.3047	0.1643	0.43
04-0519	BARSTOW	CA	30	-117.0333	34.9000	2162	01/1903	03/1980	55	0.2787	0.2121	0.1250	0.53
04-0521	BARSTOW FIRE STATION	CA	30	-117.0228	34.8878	2320	05/1980	11/2000	20	0.2468	0.0933	0.0998	1.20
04-0606	BEAUMONT	CA	32	-116.9750	33.9292	2613	03/1906	10/1971	64	0.2232	0.2721	0.1988	0.36
04-0607	BEAUMONT PUMPING PLANT	CA	32	-116.9667	33.9833	3051	01/1911	10/1975	64	0.2442	0.3424	0.2421	0.87
04-0609	BEAUMONT 1 E	CA	32	-116.9650	33.9297	2600	08/1939	12/2000	61	0.2110	0.2431	0.1423	0.58
04-0619	BEL AIR FC 10A	CA	31	-118.4500	34.0833	541	07/1948	11/1980	32	0.2409	0.1639	0.0318	1.43
04-0678	BENNETT RANCH	CA	28	-117.4500	34.1667	1850	01/1918	04/1953	34	0.3046	0.4084	0.3588	2.68
04-0684	BENTON INSPECTION STN	CA	18	-118.4783	37.8428	5460	10/1964	12/2000	36	0.3438	0.2480	0.1742	0.16
04-0741	BIG BEAR LAKE	CA	28	-116.8878	34.2469	6790	07/1960	12/2000	40	0.2852	0.3886	0.2968	1.59
04-0742	BIG BEAR LAKE DAM	CA	28	-116.9764	34.2417	6815	12/1914	09/1971	39	0.3035	0.2815	0.2282	0.65
04-0747	BIG BEN RANGER STN	CA	8	-120.5167	39.3000	5745	10/1943	04/1972	27	0.2232	0.3496	0.2068	1.29
04-0755	BIG CREEK PH 1	CA	17	-119.2500	37.2000	4882	09/1915	12/2000	48	0.1894	0.1733	0.1413	0.73

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-0758	BIG DALTON DAM FC223C	CA	28	-117.8167	34.1667	1591	01/1930	12/1980	50	0.2575	0.2404	0.2089	0.21
04-0779	BIG PINES PARK FC83B	CA	28	-117.6833	34.3833	6845	01/1926	09/1996	68	0.2547	0.2528	0.2296	0.42
04-0798	BIG TUJUNGA DAM FC46DE	CA	28	-118.1872	34.2942	2317	01/1932	08/2000	68	0.3238	0.2564	0.1472	1.53
04-0819	BISHOP CREEK INTAKE 2	CA	17	-118.5814	37.2481	8154	10/1959	12/2000	41	0.2906	0.2183	0.1780	1.74
04-0822	BISHOP WSO AIRPORT	CA	18	-118.3581	37.3711	4102	01/1948	12/2000	53	0.3194	0.2861	0.1759	0.06
04-0897	BLUE CANYON	CA	8	-120.7103	39.2775	5280	03/1940	12/2000	52	0.2202	0.2505	0.1205	0.71
04-0924	BLYTHE	CA	34	-114.5972	33.6131	268	01/1913	12/2000	87	0.3260	0.1978	0.1534	1.25
04-0927	BLYTHE FCWOS	CA	34	-114.7142	33.6186	395	07/1948	12/2000	53	0.2744	0.2184	0.2071	0.07
04-0931	BOCA	CA	9	-120.0936	39.3886	5575	04/1906	12/2000	70	0.1826	0.2378	0.2271	1.32
04-0943	BODIE	CA	10	-119.0142	38.2119	8370	02/1895	12/2000	47	0.2316	0.1547	0.0786	1.07
04-0968	BONITA	CA	31	-117.0333	32.6667	112	11/1915	12/1970	53	0.2286	0.2455	0.1721	1.03
04-0983	BORREGO DESERT PARK	CA	32	-116.4144	33.2314	805	07/1942	12/2000	53	0.2707	0.1554	0.1540	0.57
04-1009	BOULEVARD 2	CA	32	-116.2833	32.6667	3353	12/1924	12/1967	39	0.2819	0.2407	0.0806	0.94
04-1010	BOULEVARD 2	CA	32	-116.3000	32.6667	3600	10/1969	12/1994	25	0.2409	0.1658	0.1110	0.20
04-1013	BOUQUET CANYON	CA	31	-118.3667	34.5833	3061	07/1940	03/1978	37	0.2808	0.3142	0.1479	1.46
04-1018	BOWMAN DAM	CA	8	-120.6556	39.4539	5385	06/1896	12/2000	87	0.1847	0.1405	0.1266	0.10
04-1048	BRAWLEY 2 SW	CA	33	-115.5581	32.9544	-100	06/1910	12/2000	89	0.3917	0.3154	0.2737	1.76
04-1056	BREA CITY SHAFFER TOOL WR	CA	31	-117.9000	33.9333	381	07/1948	04/1970	21	0.2749	0.2395	0.0514	1.93
04-1072	BRIDGEPORT	CA	10	-119.2286	38.2575	6470	01/1958	12/2000	43	0.2345	0.1654	0.1430	0.14
04-1075	BRIDGEPORT DAM	CA	10	-119.2167	38.3167	6424	04/1925	06/1957	30	0.2987	0.2323	0.0542	3.15
04-1130	BRUSH CREEK RANGER STN	CA	8	-121.3333	39.6833	3560	12/1937	05/1983	45	0.2252	0.2045	0.1863	0.92
04-1159	BUCKS CREEK P H	CA	8	-121.3511	39.9178	1850	07/1959	09/1999	39	0.2065	0.2281	0.2198	0.45
04-1180	BULLARDS BAR PH	CA	8	-121.1500	39.4167	1781	02/1941	07/1968	26	0.2120	0.1914	0.1352	0.35
04-1192	BURBANK FIRE DEP FC226	CA	58	-118.3000	34.1833	679	01/1930	10/1972	43	0.3300	0.2196	0.1261	1.33
04-1194	BURBANK-GLEN-PASS AP	CA	58	-118.3667	34.2000	725	12/1939	12/2000	61	0.2969	0.2321	0.1026	0.15
04-1244	BUTTONWILLOW	CA	29	-119.4731	35.4047	269	01/1940	12/2000	60	0.2539	0.3157	0.2907	0.89
04-1250	CABAZON	CA	32	-116.7833	33.9167	1801	03/1906	03/1974	43	0.2864	0.2427	0.2200	1.00
04-1253	CACHUMA LAKE	CA	27	-119.9833	34.5667	781	03/1952	12/2000	49	0.2576	0.2204	0.0885	0.65
04-1277	CALAVERAS BIG TREES	CA	8	-120.3114	38.2769	4695	10/1929	12/2000	70	0.1848	0.1962	0.1491	0.08
04-1280	CALAVERAS RANGER STN	CA	16	-120.3667	38.2000	3360	08/1914	02/1986	21	0.1867	0.3960	0.3657	2.57
04-1288	CALEXICO 2 NE	CA	33	-115.4636	32.6881	12	08/1904	12/2000	79	0.3443	0.2641	0.1894	0.27
04-1300	CALIF HOT SPRINGS	CA	17	-118.6833	35.8833	2953	01/1907	09/1951	38	0.2318	0.3043	0.2025	0.35

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-1404	CAMP HILL OPIDS 57B	CA	28	-118.1000	34.2500	4252	01/1917	12/1978	59	0.3023	0.1949	0.1369	0.94
04-1424	CAMPO	CA	32	-116.4728	32.6233	2630	07/1948	12/2000	51	0.2568	0.2503	0.1448	0.11
04-1428	CAMP PARDEE	CA	16	-120.8433	38.2486	658	07/1926	12/2000	72	0.1825	0.1832	0.1738	0.02
04-1462	CAMPTONVILLE RANGER STN	CA	8	-121.0500	39.4500	2755	02/1907	03/1973	55	0.2023	0.3124	0.2016	0.85
04-1476	CANBY 3 SW	CA	1	-120.9017	41.4219	4310	09/1943	12/2000	53	0.2092	0.2514	0.1836	0.34
04-1484	CANOGA PARK PIERCE COLLEG	CA	31	-118.5744	34.1819	790	07/1948	12/2000	52	0.2728	0.1370	0.0698	0.79
04-1488	CANTIL 2 E	CA	30	-117.9333	35.3167	1962	03/1955	07/1974	20	0.3003	0.1367	0.1140	0.78
04-1497	CANYON DAM	CA	8	-121.0886	40.1706	4560	01/1914	12/2000	86	0.1686	0.1382	0.1042	0.45
04-1588	CATHEYS VALLEY BULL R RAN	CA	16	-120.0500	37.4000	1430	07/1948	05/1977	26	0.2473	0.4515	0.3794	3.98
04-1614	CEDARVILLE	CA	2	-120.1736	41.5336	4670	05/1894	12/2000	106	0.2347	0.3212	0.1799	1.09
04-1630	CENTRAL CAMP	CA	17	-119.4833	37.3500	5364	12/1923	12/1947	24	0.2079	0.2156	0.2589	1.29
04-1653	CHALLENGE RANGER STN	CA	8	-121.2167	39.4833	2570	12/1937	04/1994	55	0.2038	0.1945	0.1227	0.21
04-1680	CHATSWORTH FC 24 F	CA	31	-118.6000	34.2500	950	01/1949	10/1988	39	0.2410	0.2347	0.1194	0.72
04-1697	CHERRY VALLEY DAM	CA	8	-119.9161	37.9747	4765	10/1955	12/2000	45	0.2194	0.2471	0.2023	0.58
04-1700	CHESTER	CA	8	-121.2356	40.3000	4525	05/1910	12/2000	89	0.1782	0.1485	0.1482	0.10
04-1733	CHINA LAKE ARMITAGE	CA	19	-117.6833	35.6833	2220	02/1944	12/2000	57	0.3213	0.1838	0.1682	1.32
04-1758	CHULA VISTA	CA	31	-117.0858	32.6400	56	09/1918	12/2000	82	0.2381	0.1836	0.1504	0.17
04-1779	CLAREMONT POMONA COLLEGE	CA	31	-117.7167	34.1000	1201	02/1893	12/1980	86	0.2820	0.2475	0.1557	0.48
04-1805	CLEAR LAKE DAM	CA	1	-121.0667	41.9333	4573	05/1907	09/1954	38	0.1894	0.1515	0.1693	1.12
04-1878	COARSEGOLD 1 SW	CA	16	-119.7053	37.2503	2230	08/1977	12/2000	23	0.2091	0.2678	0.1755	0.87
04-1896	COLBYS FC53D	CA	28	-118.1167	34.3000	3681	01/1955	12/1978	24	0.3011	0.2189	0.1367	0.69
04-1912	COLFAX	CA	8	-120.9544	39.0997	2400	01/1905	12/2000	93	0.1812	0.1853	0.1662	0.10
04-1916	COLGATE POWER HOUSE	CA	8	-121.1833	39.3333	595	11/1906	12/2000	93	0.1857	0.2203	0.1530	0.20
04-2012	CORCORAN IRRIG DIST	CA	16	-119.5817	36.0975	200	01/1945	12/2000	55	0.2206	0.1195	0.1297	1.61
04-2031	CORONA	CA	31	-117.5500	33.8833	610	07/1908	07/1988	79	0.2749	0.2990	0.1952	0.96
04-2090	COVINA NIGG FC193B	CA	31	-117.8667	34.0833	575	10/1929	08/2000	71	0.2534	0.2273	0.2397	1.38
04-2092	COW CREEK	CA	18	-116.8833	36.5333	-999	12/1934	04/1961	26	0.3229	0.1034	0.0921	0.86
04-2111	COYOTE WELLS	CA	33	-115.9667	32.7333	249	07/1948	02/1970	21	0.3966	0.2918	0.2232	0.62
04-2198	CRYSTAL LAKE FC 283-C	CA	28	-117.8333	34.3167	5370	11/1959	08/2000	41	0.2750	0.1450	0.1258	0.60
04-2199	CRYSTAL LAKE EAST PINE FL	CA	28	-117.8333	34.3333	5774	02/1931	10/1959	24	0.2906	0.3088	0.3279	2.06
04-2214	CULVER CITY	CA	31	-118.4128	34.0050	55	01/1935	12/2000	64	0.2555	0.1556	0.1016	0.12

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-2239	CUYAMACA	CA	32	-116.5872	32.9897	4640	01/1899	12/2000	101	0.2298	0.3377	0.2605	1.14
04-2257	DAGGETT FCWOS	CA	30	-116.7858	34.8536	1917	07/1948	12/2000	52	0.2649	0.2211	0.1861	0.40
04-2319	DEATH VALLEY	CA	18	-116.8636	36.4622	-999	06/1911	12/2000	87	0.3165	0.1110	0.1121	0.86
04-2327	DEEP CANYON LABORATORY	CA	33	-116.3764	33.6514	1200	01/1963	12/2000	38	0.3480	0.2929	0.2212	0.16
04-2331	DEEP SPRINGS COLLEGE	CA	10	-117.9803	37.3739	5225	07/1948	12/2000	48	0.2408	0.1642	0.1802	0.16
04-2334	DEER CREEK PH	CA	8	-120.8500	39.3000	3704	01/1907	04/1970	57	0.1966	0.1882	0.0939	0.39
04-2338	DEER CREEK FOREBAY	CA	8	-120.8333	39.3000	4455	11/1969	04/1994	23	0.2150	0.2523	0.2927	1.86
04-2346	DELANO	CA	16	-119.2367	35.7700	323	03/1906	12/2000	65	0.2190	0.1403	0.1168	1.20
04-2389	DENAIR 3 NNE	CA	16	-120.7833	37.5667	141	06/1899	06/1984	84	0.1691	0.1540	0.1473	0.24
04-2406	DESCANSO RANGER STN	CA	32	-116.6167	32.8500	3500	01/1896	03/1998	65	0.2245	0.2466	0.1804	0.20
04-2456	DOBBINS 1 S	CA	8	-121.2022	39.3583	1640	10/1903	12/2000	92	0.1780	0.2119	0.1326	0.42
04-2467	DONNER MEMORIAL ST PK	CA	9	-120.2331	39.3239	5937	10/1953	12/2000	47	0.1787	0.2860	0.2141	1.14
04-2494	DOWNEY FIRE STN FC107C	CA	31	-118.1456	33.9297	110	03/1906	08/2000	64	0.2614	0.1738	0.1275	0.07
04-2500	DOWNIEVILLE	CA	8	-120.8239	39.5633	2915	09/1908	12/2000	79	0.1785	0.1712	0.1488	0.10
04-2516	DRY CANYON RESERVOIR	CA	31	-118.5333	34.4833	1455	11/1921	01/1990	64	0.2836	0.1918	0.1738	0.89
04-2539	DUDLEYS	CA	16	-120.1000	37.7500	3002	08/1908	01/1976	65	0.1706	0.2139	0.2277	0.47
04-2598	EAGLE MOUNTAIN	CA	33	-115.4508	33.8089	973	10/1933	12/2000	67	0.3017	0.1792	0.2104	0.40
04-2705	EL CAJON YALE RANCH	CA	32	-116.9167	32.7833	531	02/1899	10/1959	60	0.2840	0.3151	0.2373	0.98
04-2706	EL CAJON	CA	32	-116.9750	32.8144	405	11/1959	12/2000	41	0.2199	0.0441	0.0967	1.33
04-2709	EL CAPITAN DAM	CA	32	-116.8164	32.8839	600	07/1948	12/2000	52	0.2222	0.2661	0.2186	0.46
04-2713	EL CENTRO 2 SSW	CA	33	-115.5617	32.7669	-30	03/1932	12/2000	69	0.3381	0.2123	0.1363	1.44
04-2728	ELECTRA P H	CA	16	-120.6706	38.3306	715	01/1904	07/1997	92	0.1650	0.2508	0.2185	0.77
04-2735	ELIZABETH LAKE CN FC12	CA	31	-118.5667	34.6000	2080	01/1949	10/1972	24	0.2835	0.1539	0.0931	0.87
04-2756	ELLERY LAKE	CA	17	-119.2306	37.9356	9645	11/1924	12/2000	69	0.2376	0.1582	0.1053	1.35
04-2771	EL MIRAGE FIELD	CA	30	-117.6311	34.5897	2950	05/1971	12/2000	28	0.3072	0.1763	0.0693	0.55
04-2805	ELSINORE	CA	31	-117.3319	33.6692	1285	03/1897	12/2000	100	0.2757	0.1781	0.1449	0.44
04-2863	ESCONDIDO NO 2	CA	31	-117.0969	33.1186	600	01/1900	12/2000	100	0.2507	0.2610	0.1833	0.61
04-2871	ESCONDIDO CHURCH RANCH	CA	31	-117.0833	33.1000	722	12/1893	05/1958	46	0.2779	0.3234	0.1876	1.37
04-2920	EXCHEQUER RESERVOIR	CA	16	-120.2667	37.5833	442	12/1950	12/2000	50	0.1648	0.2278	0.2530	0.94
04-2941	FAIRMONT	CA	30	-118.4275	34.7042	3060	02/1909	12/2000	92	0.2899	0.2076	0.1345	0.08
04-2964	FALL RIVER MILLS INTAKE	CA	1	-121.4667	41.0167	3343	05/1923	12/2000	48	0.1835	0.2046	0.1874	0.16
04-3038	FIDDLETOWN DEXTER RANCH	CA	16	-120.7061	38.5236	2160	01/1938	12/2000	60	0.1946	0.2232	0.1284	0.89

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-3111	FOLSOM	CA	16	-121.1833	38.6833	249	01/1893	10/1955	62	0.1847	0.0754	0.1307	1.17
04-3113	FOLSOM DAM	CA	16	-121.1667	38.7000	350	10/1955	04/1993	38	0.1667	0.2634	0.1284	2.87
04-3118	FONTANA 5 N	CA	28	-117.4500	34.1833	1972	04/1953	09/1984	31	0.2890	0.3191	0.3138	1.55
04-3120	FONTANA KAISER	CA	31	-117.5167	34.0833	1102	03/1951	08/1984	34	0.2644	0.2004	0.1891	0.52
04-3134	FORESTHILL RANGER STN	CA	8	-120.8450	39.0097	3015	12/1937	12/2000	62	0.2008	0.2253	0.1019	0.49
04-3157	FORT BIDWELL	CA	2	-120.1514	41.8594	4500	05/1911	12/2000	89	0.2031	0.2785	0.1973	0.76
04-3257	FRESNO YOSEMITE INTL	CA	16	-119.7194	36.7800	333	01/1948	12/2000	52	0.1802	0.2023	0.1033	1.23
04-3261	FRIANT GOVERNMENT CAMP	CA	16	-119.7092	36.9933	410	10/1912	12/2000	86	0.1781	0.1098	0.1491	0.60
04-3288	FULLERTON HILLCREST RE	CA	31	-117.9167	33.8833	331	03/1933	12/1976	40	0.2870	0.2207	0.0730	1.25
04-3369	GEM LAKE	CA	17	-119.1403	37.7519	8970	11/1924	12/2000	70	0.2227	0.2121	0.2760	1.71
04-3381	GEORGETOWN	CA	8	-120.8333	38.9167	2723	01/1893	11/1967	49	0.1893	0.0845	0.0408	1.28
04-3384	GEORGETOWN RANGER STN	CA	8	-120.8000	38.9333	3001	11/1946	12/2000	53	0.2245	0.2120	0.1360	0.76
04-3397	GIANT FOREST	CA	17	-118.7667	36.5667	6414	06/1921	11/1968	47	0.2523	0.2195	0.1735	0.42
04-3402	GIBRALTAR DAM 2	CA	28	-119.6822	34.5228	1550	01/1958	12/2000	41	0.2541	0.1462	0.0121	2.18
04-3450	GLENDALE KENNEDY	CA	58	-118.2667	34.1500	531	01/1929	08/1971	31	0.2911	0.2356	0.1532	1.23
04-3452	GLENDORA WEST FC 185	CA	31	-117.8667	34.1333	822	01/1895	08/2000	71	0.2437	0.1223	0.1913	1.51
04-3463	GLENNVILLE	CA	17	-118.7006	35.7269	3140	06/1951	12/2000	49	0.2022	0.2568	0.1516	0.88
04-3468	GLENNVILLE MORROW RANCH	CA	17	-118.7333	35.7000	3271	09/1909	06/1951	41	0.2182	0.2661	0.2180	0.12
04-3489	GOLD ROCK RANCH	CA	40	-114.8667	32.8833	485	02/1964	04/1996	32	0.3023	0.1854	0.0949	1.75
04-3491	GOLD RUN 2 SW	CA	8	-120.8567	39.1650	3320	01/1905	12/2000	74	0.1933	0.2153	0.1355	0.14
04-3498	GOLDSTONE ECHO NO 2	CA	19	-116.7844	35.2814	2950	12/1973	12/2000	27	0.2355	0.0476	0.0681	1.18
04-3551	GRANT GROVE	CA	17	-118.9631	36.7394	6600	07/1940	12/2000	59	0.2268	0.1774	0.1743	0.37
04-3571	GRASS VALLEY	CA	8	-121.0667	39.2167	2641	01/1893	09/1966	68	0.1687	0.1719	0.1300	0.43
04-3573	GRASS VALLEY NO 2	CA	8	-121.0681	39.2042	2400	10/1966	12/2000	34	0.1485	0.0029	0.2052	2.59
04-3621	GREENVILLE R S	CA	8	-120.9428	40.1406	3560	03/1894	12/2000	76	0.1965	0.1119	0.1928	0.87
04-3672	GROVELAND R S	CA	16	-120.0983	37.8231	3144	01/1944	12/2000	56	0.2028	0.1948	0.1345	0.43
04-3703	HAINES CAN LWR FC 364	CA	31	-118.2667	34.2667	2451	01/1949	06/1970	22	0.2989	0.2839	0.2226	1.65
04-3704	HAINES CAN UPR FC 367	CA	31	-118.2500	34.2667	3442	01/1949	01/1979	30	0.2720	0.2126	0.1806	0.45
04-3710	HAIWEE	CA	18	-117.9528	36.1389	3825	06/1923	12/2000	76	0.2539	0.2182	0.1769	1.63
04-3747	HANFORD 1 S	CA	16	-119.6356	36.3219	245	09/1899	12/2000	94	0.1773	0.1879	0.1846	0.09
04-3800	HARRY ENGLEBRIGHT DAM	CA	16	-121.2667	39.2372	800	07/1955	12/2000	44	0.1600	0.2575	0.2725	1.37
04-3855	HAYFIELD PUMPING PLANT	CA	33	-115.6289	33.7044	1370	07/1933	12/2000	67	0.3384	0.2562	0.1915	0.22

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-3896	HEMET	CA	32	-116.9406	33.7458	1655	07/1942	12/2000	57	0.2279	0.1360	0.1030	0.40
04-3914	HENSHAW DAM	CA	32	-116.7614	33.2367	2700	09/1942	12/2000	57	0.2479	0.2192	0.1924	0.18
04-3939	HETCH HETCHY	CA	8	-119.7831	37.9614	3870	10/1910	12/2000	89	0.1925	0.2282	0.1764	0.13
04-4014	HODGES DAM	CA	31	-117.1333	33.0500	390	09/1940	05/1962	22	0.1980	0.1261	0.0798	1.62
04-4017	HOEGEES FC 60 A	CA	28	-118.0333	34.2167	2762	01/1949	06/1978	29	0.2754	0.1915	0.1031	0.43
04-4176	HUNTINGTON LAKE	CA	17	-119.2206	37.2275	7020	09/1915	12/2000	71	0.2002	0.1967	0.1660	0.38
04-4211	IDYLLWILD FIRE DEPT	CA	32	-116.7144	33.7472	5397	10/1943	12/2000	56	0.2301	0.2840	0.1637	0.42
04-4223	IMPERIAL	CA	33	-115.5661	32.8497	-64	12/1901	12/2000	80	0.3593	0.2943	0.2354	0.22
04-4232	INDEPENDENCE	CA	18	-118.2000	36.8000	3944	01/1925	12/2000	73	0.3790	0.3344	0.2357	1.03
04-4259	INDIO FIRE STATION	CA	33	-116.2153	33.7086	-21	03/1894	12/2000	89	0.4063	0.3162	0.2587	1.60
04-4278	INYOKERN	CA	19	-117.8183	35.6492	2440	07/1948	12/2000	52	0.3151	0.2515	0.2252	1.44
04-4283	IONE	CA	16	-120.9333	38.3500	279	03/1906	06/1977	31	0.1879	0.2442	0.3049	1.60
04-4288	IOWA HILL	CA	8	-120.8350	39.1181	3100	01/1893	12/2000	72	0.1612	0.1315	0.1181	0.58
04-4297	IRON MOUNTAIN	CA	33	-115.1219	34.1472	922	01/1935	12/2000	66	0.2727	0.1696	0.2456	1.61
04-4374	JESS VALLEY	CA	2	-120.2947	41.2683	5400	08/1948	12/2000	52	0.2028	0.1986	0.1553	0.59
04-4389	JOHNSONDALE	CA	17	-118.5333	35.9667	4682	12/1954	04/1979	25	0.3390	0.4818	0.4014	5.07
04-4412	JULIAN CDF	CA	32	-116.5925	33.0764	4215	01/1893	12/2000	36	0.2973	0.3320	0.2025	0.96
04-4415	JULIAN MANZANITA RANCH	CA	32	-116.6333	33.0667	4222	01/1929	03/1949	21	0.2820	0.2298	0.0527	1.44
04-4418	JULIAN WYNOLA	CA	32	-116.6500	33.1000	3650	09/1949	08/1988	39	0.2003	0.3399	0.1992	1.63
04-4422	JUNCAL DAM	CA	28	-119.5069	34.4908	2227	06/1941	12/2000	58	0.3015	0.3070	0.2011	0.53
04-4484	KELSEY 1 N	CA	8	-120.8208	38.8089	2000	11/1946	12/2000	44	0.1605	0.2015	0.1827	0.98
04-4520	KERN RIVER PH 1	CA	16	-118.7833	35.4667	970	12/1906	08/1991	84	0.1746	0.1357	0.1417	0.22
04-4523	KERN RIVER PH 3	CA	17	-118.4389	35.7831	2703	10/1946	12/2000	53	0.2260	0.1535	0.1560	0.63
04-4628	LA CRESCENTA FC 251C	CA	31	-118.2425	34.2222	1565	01/1918	08/2000	64	0.2782	0.1867	0.1100	0.41
04-4647	LAGUNA BEACH	CA	31	-117.7803	33.5472	35	03/1928	12/2000	73	0.2351	0.1334	0.1413	0.36
04-4671	LAKE ARROWHEAD	CA	28	-117.1883	34.2467	5205	08/1941	12/2000	58	0.2437	0.1582	0.1670	0.45
04-4675	LAKE CITY	CA	2	-120.2167	41.6333	4613	03/1929	10/1960	28	0.3164	0.3769	0.1852	2.09
04-4679	LAKE ELEANOR	CA	8	-119.8833	37.9667	4662	10/1909	10/1957	45	0.1966	0.3019	0.2386	1.03
04-4705	LAKE SABRINA	CA	17	-118.6136	37.2131	9065	01/1925	12/2000	55	0.2626	0.2083	0.1521	0.98
04-4710	LAKESIDE 2 E	CA	32	-116.8992	32.8542	690	05/1967	12/2000	33	0.1876	0.0296	0.1157	1.94
04-4713	LAKE SPAULDING	CA	8	-120.6392	39.3183	5155	01/1902	12/2000	96	0.1937	0.2047	0.1669	0.03
04-4735	LA MESA	CA	31	-117.0242	32.7664	530	03/1934	12/2000	66	0.2201	0.1780	0.1641	0.71

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-4747	LANCASTER	CA	30	-118.1167	34.6833	2402	01/1945	10/1972	27	0.2430	0.0592	0.0488	2.54
04-4749	LANCASTER FSS	CA	30	-118.2167	34.7333	2339	04/1974	12/2000	26	0.2706	0.1277	0.1236	0.44
04-4773	LA PORTE	CA	8	-120.9833	39.6833	4984	04/1894	12/1928	32	0.1771	0.1833	0.1815	0.22
04-4838	LAVA BEDS NAT MONUMENT	CA	1	-121.5067	41.7400	4770	10/1959	12/2000	40	0.2424	0.2106	0.1448	1.54
04-4863	LEBEC	CA	27	-118.8650	34.8328	3585	07/1948	11/2000	52	0.2552	0.1722	0.1420	0.22
04-4867	LECHUZA PTRL ST FC352B	CA	31	-118.8803	34.0764	1600	07/1948	10/1997	49	0.2620	0.2691	0.1110	1.11
04-4884	LE GRAND	CA	16	-120.2500	37.2333	259	06/1899	12/1980	80	0.1901	0.2342	0.1304	1.11
04-4890	LEMON COVE	CA	16	-119.0264	36.3817	513	03/1899	12/2000	102	0.1835	0.3617	0.3249	1.79
04-4957	LINDSAY	CA	16	-119.0581	36.2033	420	12/1913	12/2000	86	0.1718	0.1813	0.2360	0.95
04-5002	LLANO EBERLE RANCH	CA	30	-117.7500	34.4667	3822	10/1945	10/1965	19	0.2263	0.1125	0.1871	1.80
04-5023	LOCKWOOD MESA	CA	31	-117.2500	32.9833	210	09/1940	07/1965	25	0.2333	0.2410	0.1599	0.78
04-5026	LODGEPOLE	CA	17	-118.7389	36.6033	6735	11/1968	12/2000	32	0.2455	0.2006	0.1366	0.81
04-5032	LODI	CA	16	-121.2878	38.1061	40	01/1893	12/2000	93	0.1780	0.2301	0.1889	0.25
04-5064	LOMPOC	CA	27	-120.4483	34.6519	95	07/1950	12/2000	50	0.1896	0.0390	0.1162	1.91
04-5080	LONG BEACH PUB SVC	CA	31	-118.2000	33.7833	10	03/1906	04/1973	62	0.2854	0.2799	0.1542	0.82
04-5085	LONG BEACH WSCMO	CA	31	-118.1500	33.8167	25	01/1949	12/2000	51	0.2469	0.1954	0.2038	0.73
04-5114	LOS ANGELES WSO ARPT	CA	31	-118.4056	33.9381	100	08/1944	12/2000	56	0.2618	0.2386	0.1618	0.22
04-5115	LOS ANGELES DOWNTOWN	CA	31	-118.2958	34.0278	185	04/1906	12/2000	88	0.2690	0.1962	0.1391	0.14
04-5147	LOS PRIETOS RANGER STN	CA	28	-119.7900	34.5436	1024	07/1943	12/2000	55	0.2718	0.1726	0.1675	0.36
04-5182	LUCERNE VALLEY 2 W	CA	30	-116.9833	34.4500	2982	03/1949	09/1973	25	0.2954	0.1757	0.1473	0.36
04-5215	LYTLE CREEK PH	CA	28	-117.4500	34.2000	2251	04/1906	08/1967	53	0.2683	0.1634	0.1319	0.27
04-5218	LYTLE CREEK RANGER STN	CA	28	-117.4667	34.2333	2730	01/1931	12/2000	67	0.2766	0.2594	0.2312	0.28
04-5231	MADELINE	CA	2	-120.4833	41.0667	5262	09/1908	02/1975	33	0.3041	0.3276	0.2609	2.02
04-5233	MADERA	CA	16	-120.0378	36.9539	270	01/1928	12/2000	72	0.1677	0.0697	0.0797	0.82
04-5338	MARICOPA	CA	29	-119.3833	35.0833	675	09/1911	07/1993	78	0.2732	0.2332	0.2039	0.08
04-5352	MARIPOSA R S	CA	16	-119.9858	37.4950	2100	01/1893	12/2000	91	0.1921	0.2695	0.2003	0.47
04-5356	MARKLEEVILLE	CA	9	-119.7803	38.6919	5530	08/1909	12/2000	34	0.1916	0.1413	0.1394	0.36
04-5400	MATHER	CA	8	-119.8561	37.8811	4510	10/1947	12/2000	47	0.1942	0.2800	0.2030	0.60
04-5496	MEADOW LAKE	CA	16	-119.4333	37.0833	4482	07/1948	12/1975	27	0.2351	0.2724	0.1929	1.57
04-5502	MECCA FIRE STATION	CA	33	-116.0767	33.5714	-999	09/1905	10/2000	80	0.4014	0.2145	0.1213	2.25
04-5532	MERCED	CA	16	-120.5117	37.2858	153	06/1899	12/2000	100	0.1636	0.1413	0.1408	0.39
04-5541	MERCED FALLS	CA	16	-120.3333	37.5333	322	12/1906	06/1950	29	0.1626	0.2481	0.2204	0.85

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-5602	MIDDLEWATER	CA	29	-119.8167	35.5000	801	09/1911	03/1962	51	0.2355	0.0312	0.0891	2.26
04-5629	MILL CREEK 2	CA	31	-117.0333	34.0833	2943	01/1904	08/1967	63	0.2137	0.2157	0.1342	1.38
04-5721	MITCHELL CAVERNS	CA	20	-115.5469	34.9436	4350	03/1958	12/2000	43	0.3174	0.3107	0.2178	0.44
04-5738	MODESTO CITY-COUNTY AP	CA	16	-120.9506	37.6242	73	03/1906	12/2000	86	0.1853	0.2276	0.1461	0.65
04-5756	MOJAVE	CA	30	-118.1619	35.0492	2735	01/1941	12/2000	59	0.3265	0.1951	0.1127	0.68
04-5779	MONO LAKE	CA	17	-119.1500	38.0000	6449	10/1950	02/1988	37	0.2832	0.4277	0.3344	1.96
04-5790	MONTEBELLO	CA	31	-118.1039	34.0192	240	01/1979	12/2000	22	0.2567	0.0741	0.0912	1.20
04-5823	MOORPARK 1 SSE	CA	27	-118.8833	34.2833	581	01/1956	06/1977	22	0.2806	0.2310	0.1996	2.22
04-5890	MOUNTAIN PASS	CA	20	-115.5439	35.4706	4730	02/1955	12/2000	45	0.2754	0.3173	0.1663	1.52
04-5900	MT BALDY FC85E	CA	28	-117.6500	34.2333	4281	01/1916	09/1976	57	0.2948	0.2373	0.1924	0.40
04-5909	MOUNT DANAHER	CA	8	-120.6667	38.7500	3412	10/1943	05/1973	27	0.1935	0.1228	0.0421	1.13
04-6006	MT WILSON NO 2	CA	28	-118.0647	34.2264	5709	07/1948	12/2000	51	0.2560	0.1372	0.1141	0.42
04-6118	NEEDLES FCWOS	CA	34	-114.6233	34.7661	887	07/1948	12/2000	53	0.2655	0.2450	0.1792	0.11
04-6122	NEENACH	CA	30	-118.5833	34.8000	2890	01/1939	12/1963	24	0.3143	0.1705	0.0591	0.69
04-6136	NEVADA CITY	CA	8	-121.0006	39.2467	2781	02/1893	12/2000	108	0.1678	0.1384	0.1770	0.40
04-6154	NEW CUYAMA FIRE STN	CA	29	-119.6811	34.9458	2160	11/1944	12/2000	55	0.2744	0.1924	0.1390	0.42
04-6162	NEWHALL S FC32CE	CA	31	-118.5336	34.3894	1243	03/1906	08/2000	63	0.2592	0.1372	0.0560	0.66
04-6175	NEWPORT BEACH HARBOR	CA	31	-117.8803	33.6025	10	01/1921	12/2000	79	0.2586	0.2163	0.1335	0.10
04-6197	NILAND	CA	33	-115.5239	33.2775	-60	10/1914	12/2000	59	0.3534	0.2383	0.2199	0.17
04-6252	NORTH FORK R S	CA	16	-119.5067	37.2311	2630	03/1904	12/2000	96	0.2042	0.2825	0.2263	0.43
04-6256	NORTH HOLLYWOOD	CA	58	-118.3833	34.1667	620	01/1936	07/1962	26	0.3476	0.3033	0.1734	1.32
04-6305	OAKDALE WOODWARD DAM	CA	16	-120.8667	37.8667	220	03/1906	12/1967	61	0.2305	0.3837	0.3222	2.10
04-6377	OCEANSIDE MARINA	CA	31	-117.3950	33.2097	10	10/1909	12/2000	70	0.2154	0.1009	0.0917	0.76
04-6383	OCOTILLO	CA	33	-116.1333	33.1500	180	03/1932	06/1975	29	0.3497	0.2622	0.2347	0.25
04-6390	OCOTILLO 2	CA	33	-115.9992	32.7453	410	06/1971	12/2000	30	0.3832	0.3127	0.2054	0.33
04-6399	OJAI	CA	28	-119.2292	34.4481	750	05/1905	12/2000	95	0.2516	0.2124	0.1583	0.18
04-6476	ORANGE COVE	CA	16	-119.3000	36.6167	430	06/1931	11/1990	58	0.2014	0.1474	0.0946	0.70
04-6523	OROVILLE 7 SE	CA	16	-121.4833	39.4333	531	11/1919	02/1961	40	0.1797	0.1707	0.1041	0.62
04-6569	OXNARD	CA	27	-119.1753	34.1981	49	08/1923	12/2000	76	0.2433	0.2518	0.1252	0.93
04-6576	OZENA	CA	29	-119.3167	34.7000	3714	02/1904	07/1964	59	0.2891	0.2801	0.2323	0.10
04-6597	PACIFIC HOUSE	CA	8	-120.5033	38.7581	3440	11/1941	12/2000	58	0.1956	0.2246	0.2022	0.21
04-6602	PACOIMA DAM FC 33 A-E	CA	31	-118.3994	34.3325	1500	05/1943	08/2000	57	0.2641	0.1814	0.1070	0.14

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-6624	PALMDALE	CA	30	-118.1000	34.5833	2596	01/1930	12/2000	69	0.2364	0.1005	0.1325	1.25
04-6627	PALMDALE CAA AIRPORT	CA	30	-118.0833	34.6333	2517	07/1948	03/1974	26	0.2685	0.1556	0.1386	0.18
04-6657	PALOMAR MOUNTAIN OBSERVAT	CA	32	-116.8400	33.3781	5550	07/1938	12/2000	61	0.2533	0.2931	0.1809	0.24
04-6663	PALOS VERDES EST FC43D	CA	31	-118.3900	33.8000	216	01/1949	08/2000	52	0.2848	0.2291	0.0809	1.13
04-6699	PARKER RESERVOIR	CA	34	-114.1708	34.2903	738	01/1934	12/2000	62	0.2562	0.2058	0.2114	0.11
04-6719	PASADENA	CA	31	-118.1447	34.1483	864	01/1908	12/2000	93	0.2693	0.1765	0.1293	0.20
04-6754	PATTIWAY	CA	29	-119.3833	34.9333	3868	12/1915	11/1987	71	0.2290	0.2210	0.2054	0.85
04-6857	PIEDRA	CA	16	-119.3833	36.8000	581	03/1912	10/1964	48	0.1938	0.2067	0.2626	1.13
04-6891	PINE CANYON PS FC321E	CA	30	-118.4333	34.6667	3291	01/1949	10/1972	24	0.3243	0.2807	0.1094	1.77
04-6896	PINE FLAT DAM	CA	16	-119.3361	36.8239	610	01/1965	12/2000	36	0.1975	0.1703	0.1207	0.36
04-6940	PIRU 2 ESE	CA	27	-118.7564	34.4056	730	06/1959	12/2000	41	0.2667	0.1506	0.0740	0.35
04-6960	PLACERVILLE	CA	16	-120.8244	38.6956	1850	01/1900	12/2000	98	0.1642	0.0965	0.1156	0.62
04-6962	PLACERVILLE IFG	CA	8	-120.7333	38.7333	2755	02/1955	12/1991	37	0.1679	0.1286	0.0805	0.69
04-7050	POMONA FAIRPLEX	CA	31	-117.7656	34.0811	1040	11/1893	05/1995	93	0.2594	0.2487	0.1735	0.34
04-7077	PORTERVILLE	CA	16	-119.0197	36.0678	393	06/1902	12/2000	97	0.1793	0.1542	0.1932	0.48
04-7085	PORTOLA	CA	9	-120.4719	39.8053	4850	03/1915	12/2000	82	0.1829	0.2046	0.1645	0.35
04-7096	POSEY 3 E	CA	17	-118.6333	35.8000	4958	09/1954	03/1987	31	0.1881	0.2280	0.1865	0.62
04-7111	POWAY VALLEY	CA	31	-117.0292	33.0175	648	01/1893	10/2000	60	0.2025	0.1439	0.1191	1.22
04-7195	QUINCY	CA	8	-120.9475	39.9367	3420	04/1895	12/2000	96	0.1595	0.1192	0.1591	0.59
04-7228	RAMONA FIRE DEPT	CA	32	-116.9086	33.0117	1470	02/1974	12/2000	27	0.2738	0.2770	0.2807	1.86
04-7231	RAMONA SPAULDING	CA	32	-116.8500	33.0667	1480	01/1928	09/1973	36	0.2318	0.2318	0.0601	1.57
04-7244	RANCHITA	CA	32	-116.5333	33.2333	4114	07/1948	12/1970	21	0.2166	0.1194	0.1563	0.64
04-7253	RANDSBURG	CA	30	-117.6525	35.3692	3570	09/1937	12/2000	62	0.2855	0.1793	0.1435	0.06
04-7306	REDLANDS	CA	31	-117.1894	34.0528	1318	04/1898	12/2000	102	0.2134	0.1700	0.1088	0.94
04-7370	REPRESA	CA	16	-121.1611	38.6944	295	03/1893	12/2000	107	0.1835	0.1558	0.1580	0.10
04-7470	RIVERSIDE FIRE STA 3	CA	31	-117.3881	33.9511	840	01/1893	12/2000	101	0.2306	0.2238	0.1343	0.73
04-7473	RIVERSIDE CITRUS EXP STN	CA	31	-117.3500	33.9667	986	07/1948	12/2000	48	0.2295	0.1436	0.1069	0.27
04-7516	ROCKLIN	CA	16	-121.2333	38.8000	249	09/1904	06/1976	71	0.1416	0.1080	0.1630	1.68
04-7641	SAGEHEN CREEK	CA	9	-120.2406	39.4317	6337	06/1953	10/2000	47	0.2208	0.0761	0.1021	1.47
04-7681	SALSIPUEDES GAGING STN	CA	27	-120.4069	34.5858	250	07/1948	12/2000	43	0.1961	0.1973	0.1856	1.30
04-7689	SALT SPRINGS PWR HOUSE	CA	8	-120.2189	38.5006	3700	01/1943	11/1998	54	0.1717	0.1735	0.2172	0.65

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-7702	SAN ANDREAS 3 S	CA	16	-120.6667	38.1667	830	07/1948	06/1977	29	0.2211	0.1151	0.0934	1.67
04-7711	SAN ANTONIO CN MOUTH	CA	28	-117.6667	34.1667	2392	03/1917	08/1967	50	0.2825	0.2571	0.1623	0.17
04-7723	SAN BERNARDINO F S 226	CA	31	-117.2539	34.1344	1140	01/1893	11/2000	107	0.2374	0.2375	0.1720	0.60
04-7735	SANDBERG WSMO	CA	30	-118.7333	34.7500	4517	01/1948	12/2000	50	0.3280	0.2412	0.1708	1.33
04-7740	SAN DIEGO WSO AIRPORT	CA	31	-117.1686	32.7347	13	01/1927	12/2000	74	0.1925	0.0985	0.1139	1.69
04-7749	SAN DIMAS FIRE FC95	CA	31	-117.8053	34.1072	955	01/1949	08/2000	52	0.2266	0.1743	0.1780	0.67
04-7759	SAN FERNANDO	CA	31	-118.4667	34.2833	971	03/1906	03/1974	68	0.2654	0.2567	0.1807	0.42
04-7776	SAN GABRIEL CANYON P H	CA	31	-117.9078	34.1553	744	01/1917	12/2000	82	0.2510	0.2057	0.2082	0.75
04-7779	SAN GABRIEL DAM FC425B	CA	28	-117.8608	34.2053	1481	07/1948	08/2000	52	0.2580	0.1931	0.1433	0.10
04-7785	SAN GABRIEL FIRE DEPT	CA	31	-118.0989	34.1031	450	05/1939	12/2000	60	0.2457	0.1949	0.1553	0.10
04-7813	SAN JACINTO R S	CA	32	-116.9592	33.7869	1560	01/1893	12/2000	107	0.2049	0.1613	0.0695	1.25
04-7874	SAN PASQUAL ANIMAL PK	CA	32	-116.9983	33.0936	420	07/1979	12/2000	21	0.1961	-0.0592	0.1535	4.64
04-7876	SAN PEDRO	CA	31	-118.2667	33.7167	10	03/1906	08/1964	57	0.2705	0.3209	0.1967	1.35
04-7888	SANTA ANA FIRE STATION	CA	31	-117.8667	33.7442	135	04/1906	12/2000	91	0.2359	0.2141	0.1802	0.50
04-7894	SANTA ANA RIVER PH 1	CA	31	-117.0667	34.1333	2772	12/1903	04/1967	62	0.2190	0.2217	0.1985	1.34
04-7897	SANTA ANITA F L FC 432	CA	28	-118.0167	34.2167	2041	01/1949	10/1972	24	0.2992	0.1789	0.1280	0.99
04-7902	SANTA BARBARA	CA	27	-119.6853	34.4167	5	01/1893	12/2000	107	0.2323	0.2488	0.1846	1.04
04-7905	SANTA BARBARA MUNI AP	CA	27	-119.8425	34.4258	9	01/1941	12/2000	55	0.2028	0.1136	0.1355	0.70
04-7909	SANTA BARBARA TV PEAK	CA	27	-119.9500	34.5333	4003	12/1953	12/1973	20	0.2368	0.1551	0.1128	0.03
04-7950	SANTA MONICA CITY	CA	31	-118.4833	34.0167	59	11/1900	12/1979	65	0.2711	0.1751	0.1329	0.27
04-7957	SANTA PAULA	CA	27	-119.1333	34.3086	237	05/1894	12/2000	67	0.2314	0.1769	0.0890	0.47
04-8014	SAUGUS POWER PLANT 1	CA	31	-118.4536	34.5903	2105	07/1918	12/2000	81	0.2500	0.1554	0.0896	0.18
04-8105	SEVEN OAKS	CA	28	-116.9500	34.1833	5082	12/1909	03/1955	41	0.3118	0.2961	0.1484	1.14
04-8173	SHINGLE SPRINGS	CA	16	-120.9167	38.6667	1381	03/1906	11/1972	40	0.1819	0.0234	0.0857	1.88
04-8200	SHOSHONE	CA	19	-116.2700	35.9719	1570	12/1972	12/2000	28	0.2381	0.1167	0.1129	0.58
04-8207	SIERRA CITY	CA	8	-120.6228	39.5678	4240	07/1948	05/2000	40	0.2027	0.3137	0.1252	1.33
04-8210	SIERRA MADRE HENSZEY	CA	31	-118.0500	34.1667	1132	01/1897	06/1958	61	0.2556	0.1206	0.1229	0.49
04-8218	SIERRAVILLE R S	CA	9	-120.3706	39.5833	4975	12/1909	12/2000	90	0.2087	0.2528	0.1732	0.14
04-8230	SIGNAL HILL FC 415	CA	31	-118.1675	33.7967	100	07/1948	10/1972	24	0.2963	0.1969	0.1124	1.05
04-8317	SNOW CREEK UPPER	CA	33	-116.6814	33.8739	1940	03/1919	12/2000	82	0.3192	0.3543	0.2245	1.98
04-8331	SODA SPRINGS	CA	8	-120.3833	39.3167	6755	02/1914	01/1959	28	0.2134	0.1881	0.1413	0.39
04-8349	SOMIS 3 NW	CA	27	-119.0500	34.2833	502	01/1956	01/1977	21	0.2088	0.1208	0.1144	0.58

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-8353	SONORA RS	CA	16	-120.3872	37.9672	1675	12/1903	12/2000	94	0.1845	0.2565	0.1963	0.40
04-8380	SOUTH ENTR YOSEMITE NP	CA	17	-119.6489	37.5072	5120	07/1941	12/2000	55	0.2445	0.2239	0.1743	0.26
04-8390	SOUTH FORK CABIN	CA	28	-116.8167	34.0667	7126	01/1919	12/1963	43	0.2704	0.2697	0.2139	0.15
04-8406	SOUTH LAKE	CA	17	-118.5706	37.1683	9580	12/1924	12/2000	50	0.2234	0.1176	0.1723	1.37
04-8436	SPADRA PAC COL FC356C	CA	31	-117.8167	34.0500	676	03/1906	10/1972	49	0.2505	0.1564	0.1039	0.08
04-8455	SPRINGVILLE 7 ENE	CA	17	-118.7000	36.1667	2470	10/1953	10/1974	21	0.2667	0.3456	0.2252	0.79
04-8463	SPRINGVILLE TULE HD	CA	17	-118.6567	36.1933	4070	01/1896	10/1955	51	0.2601	0.3257	0.2367	0.37
04-8479	SQUIRREL INN 2	CA	28	-117.2333	34.2333	5682	11/1909	12/1971	61	0.2459	0.2713	0.2341	0.79
04-8606	STRAWBERRY VALLEY	CA	8	-121.1078	39.5631	3808	11/1948	12/2000	52	0.1885	0.2529	0.1843	0.39
04-8655	SUN CITY	CA	31	-117.1906	33.7183	1420	05/1973	12/2000	27	0.2197	0.1464	0.1937	1.33
04-8700	SUSANA KNOLLS	CA	31	-118.6667	34.2667	1089	11/1945	06/1977	31	0.2537	0.1706	0.1731	0.40
04-8702	SUSANVILLE AP	CA	2	-120.5667	40.3833	4145	01/1893	12/2000	94	0.2508	0.2924	0.2077	0.12
04-8713	SUTTER HILL CDF	CA	16	-120.8008	38.3772	1586	10/1943	12/2000	36	0.2099	0.1895	0.1442	0.48
04-8758	TAHOE CITY	CA	8	-120.1428	39.1678	6230	09/1903	12/2000	92	0.2100	0.1983	0.1499	0.24
04-8781	TAMARACK	CA	8	-119.9333	38.6000	8064	10/1903	11/1948	37	0.1839	0.3239	0.2367	1.79
04-8826	TEHACHAPI	CA	30	-118.4500	35.1333	4017	01/1906	06/1997	74	0.2521	0.2622	0.1515	3.28
04-8839	TEJON RANCHO	CA	16	-118.7497	35.0233	1425	01/1895	12/2000	93	0.1656	0.1708	0.1083	0.86
04-8873	TERMO 1 E	CA	2	-120.4333	40.8667	5300	08/1948	03/1999	40	0.2175	0.3936	0.3339	1.87
04-8892	THERMAL FCWOS	CA	33	-116.1600	33.6278	-999	05/1950	12/2000	51	0.3834	0.3169	0.1852	0.73
04-8905	THOUSAND OAKS	CA	27	-118.8667	34.2167	810	01/1956	06/1977	22	0.2998	0.1761	0.0338	1.67
04-8914	THREE RIVERS ED PH 2	CA	17	-118.8833	36.4667	951	08/1909	06/1971	61	0.2549	0.4032	0.2949	1.24
04-8917	THREE RIVERS EDISON PH 1	CA	17	-118.8619	36.4650	1140	07/1948	12/2000	32	0.2106	0.2162	0.1473	0.45
04-8928	TIGER CREEK PH	CA	8	-120.4992	38.4461	2355	12/1906	11/1998	91	0.1840	0.2413	0.1275	0.61
04-8967	TOPANGA PATROL STN FC6	CA	31	-118.5989	34.0842	745	01/1949	08/2000	52	0.2648	0.1655	0.1634	0.49
04-8973	TORRANCE	CA	31	-118.3411	33.8017	110	01/1932	12/2000	69	0.2593	0.2300	0.1481	0.16
04-9035	TRONA	CA	19	-117.3908	35.7636	1695	01/1920	12/2000	80	0.2819	0.0318	0.0807	1.00
04-9043	TRUCKEE RS	CA	9	-120.1892	39.3311	6020	09/1904	12/2000	79	0.1816	0.1834	0.1630	0.36
04-9047	TUJUNGA	CA	31	-118.2833	34.2667	1819	07/1966	03/1987	21	0.3475	0.2474	0.1166	4.49
04-9053	TULELAKE	CA	1	-121.4744	41.9600	4035	01/1932	12/2000	69	0.1854	0.1471	0.0986	0.66
04-9073	TURLOCK #2	CA	16	-120.8550	37.5006	115	01/1893	12/2000	93	0.1878	0.1262	0.0977	0.41
04-9087	TUSTIN IRVINE RANCH	CA	31	-117.7539	33.7025	235	01/1902	12/2000	99	0.2614	0.2589	0.1781	0.44
04-9099	TWENTYNINE PALMS	CA	33	-116.0369	34.1281	1975	05/1935	12/2000	66	0.3368	0.2326	0.1647	0.63

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-9138	UNION OIL STEARNS ABS	CA	31	-117.8667	33.9333	712	07/1948	03/1970	22	0.2595	0.1352	0.0829	0.37
04-9152	U C L A	CA	31	-118.4428	34.0697	430	03/1933	12/2000	67	0.2611	0.1432	0.0890	0.31
04-9157	UPLAND	CA	31	-117.6833	34.1333	1841	01/1903	09/1959	35	0.2270	0.1395	0.1938	1.28
04-9158	UPLAND 3 N	CA	31	-117.6500	34.1333	1611	09/1959	05/1980	21	0.2247	0.2201	0.2308	1.68
04-9228	VALLEY CENTER 6 N	CA	32	-117.0333	33.3000	1680	08/1941	09/1968	26	0.3135	0.2271	0.0648	1.69
04-9251	VALYERMO RANGER STN	CA	28	-117.8500	34.4500	3704	05/1915	12/1971	53	0.2401	0.1688	0.1180	0.51
04-9260	VAN NUYS FC15A	CA	31	-118.4500	34.1833	695	01/1949	11/1995	47	0.2829	0.1898	0.0800	0.83
04-9285	VENTURA	CA	27	-119.2958	34.2806	105	01/1900	12/2000	83	0.2398	0.1600	0.1546	0.18
04-9325	VICTORVILLE PUMP PLANT	CA	30	-117.3058	34.5350	2858	01/1939	12/2000	61	0.2932	0.2143	0.1220	0.26
04-9345	VINCENT FS FC 120	CA	30	-118.1411	34.4883	3135	10/1927	08/2000	72	0.2587	0.2261	0.1912	0.61
04-9351	VINTON	CA	9	-120.1858	39.8056	4950	03/1950	12/2000	51	0.2484	0.2666	0.1608	0.67
04-9367	VISALIA	CA	16	-119.2992	36.3283	325	02/1895	12/2000	100	0.2011	0.2791	0.2252	0.38
04-9378	VISTA 2 NNE	CA	31	-117.2269	33.2294	510	08/1957	12/2000	37	0.2202	0.1644	0.0767	0.99
04-9418	WALLACE	CA	16	-120.9667	38.2000	331	08/1926	06/1977	47	0.1936	0.0783	0.1338	1.37
04-9431	WALNUT NI FC102C	CA	31	-117.8658	34.0017	488	12/1927	06/2000	64	0.2607	0.1854	0.0795	0.43
04-9447	WARNER SPRINGS	CA	32	-116.6333	33.2833	3182	04/1906	03/1977	68	0.2711	0.3681	0.2209	1.00
04-9452	WASCO	CA	16	-119.3531	35.5975	345	01/1901	12/2000	98	0.2421	0.2449	0.2380	2.11
04-9582	WEST POINT	CA	16	-120.5453	38.3775	2775	02/1894	12/2000	84	0.1709	0.1474	0.1335	0.24
04-9583	WEST POINT 3 SW	CA	16	-120.5667	38.3833	2372	12/1949	02/1969	19	0.1840	0.2746	0.2098	0.57
04-9600	WESTWOOD 3 WSW	CA	8	-121.0500	40.3000	4993	01/1921	06/1957	35	0.2071	0.1318	0.1460	0.63
04-9633	WHITE MOUNTAIN 2	CA	18	-118.2333	37.5833	12470	10/1955	10/1980	24	0.3009	0.5225	0.3784	2.43
04-9639	WHITE ROCK	CA	16	-121.0833	38.5667	351	03/1943	03/1968	25	0.1543	0.1222	0.0902	1.02
04-9660	WHITTIER CITY YD FC106C	CA	31	-118.0211	33.9761	420	01/1949	08/2000	52	0.2341	0.1469	0.1748	0.69
04-9671	WILDROSE R S	CA	18	-117.1853	36.2656	4100	01/1969	01/2000	31	0.3289	0.3440	0.2306	0.19
04-9754	WOFFORD HEIGHTS KERNVILLE	CA	17	-118.4500	35.7167	2733	01/1894	07/1983	89	0.2661	0.2486	0.1927	0.52
04-9775	WOODFORDS	CA	9	-119.8000	38.7833	5650	11/1909	08/1990	59	0.2370	0.2619	0.2271	0.78
04-9847	YORBA LINDA	CA	31	-117.8167	33.8833	350	10/1912	11/1982	69	0.2463	0.1486	0.1110	0.08
04-9855	YOSEMITE PARK HDQTRS	CA	17	-119.5883	37.7567	3966	08/1906	12/2000	94	0.1767	0.2818	0.1864	1.54
04-9881	YUCCA GROVE	CA	19	-115.8167	35.4000	3953	08/1931	11/1954	22	0.2642	0.2268	0.1109	1.35
05-0102	AGUILAR 1 SE	CO	39	-104.6547	37.4011	6400	01/1980	12/2000	21	0.2302	0.1215	-0.0140	2.58
05-0130	ALAMOSA WSO AP	CO	39	-105.8656	37.4361	7533	01/1932	12/2000	69	0.2150	0.1930	0.1610	0.25

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
05-0214	ALTENBERN	CO	15	-108.3794	39.5008	5678	07/1947	12/2000	53	0.1752	0.1373	0.0419	1.77
05-0228	AMES	CO	38	-107.8833	37.8667	8700	12/1914	03/1986	71	0.1913	0.2430	0.1727	0.51
05-0776	BLANCA	CO	39	-105.5167	37.4333	7750	01/1909	12/2000	66	0.1645	0.1317	0.2071	1.53
05-0784	BLOOM	CO	48	-103.9500	37.6833	4472	02/1927	01/1954	19	0.2626	0.1740	0.1197	0.34
05-0825	BONHAM RESERVOIR	CO	15	-107.8978	39.1036	9850	07/1963	02/1994	30	0.2465	0.3161	0.1862	1.40
05-0898	BRANSON	CO	48	-103.8833	37.0167	6293	01/1940	04/1974	30	0.2698	0.2969	0.2149	0.46
05-1017	BROWNS PARK REFUGE	CO	15	-108.9172	40.8008	5354	04/1966	07/1997	32	0.2028	0.3843	0.2766	1.63
05-1268	CAMPO 7 S	CO	50	-102.5544	37.0156	4118	04/1954	12/2000	45	0.2126	0.1638	0.1702	0.33
05-1384	CASCADE	CO	38	-107.8000	37.6667	8855	09/1906	10/1958	49	0.1572	0.0976	0.1130	0.41
05-1440	CEDAREDGE	CO	26	-107.9333	38.9000	6244	01/1898	05/1994	87	0.1990	0.1875	0.1947	0.50
05-1458	CENTER 4 SSW	CO	39	-106.1439	37.7067	7673	08/1941	12/2000	57	0.1946	0.2223	0.2205	0.25
05-1741	COLLBRAN	CO	15	-107.9631	39.2425	5980	01/1893	12/1999	101	0.1683	0.2034	0.1868	0.37
05-1772	COLORADO NATL MONUMENT	CO	26	-108.7333	39.1014	5780	03/1940	12/2000	61	0.2132	0.3063	0.1842	1.28
05-1886	CORTEZ	CO	38	-108.5931	37.3444	6153	08/1929	12/2000	70	0.1588	0.0497	0.1429	1.48
05-1932	CRAIG 4 SW	CO	15	-107.5894	40.4506	6440	05/1977	12/2000	24	0.1733	0.2828	0.2617	0.89
05-1939	CREEDE	CO	39	-106.9253	37.8531	8852	06/1978	12/2000	21	0.2753	0.4030	0.3615	4.29
05-2000	CROWDER RANCH	CO	48	-103.8833	37.3833	5131	09/1939	03/1983	42	0.2339	0.2268	0.1345	0.25
05-2048	CUMBRES	CO	39	-106.4500	37.0167	10026	01/1910	08/1951	40	0.1781	0.1504	0.1098	0.31
05-2178	DELHI	CO	48	-104.0167	37.6333	5092	02/1954	09/1980	25	0.2467	0.1473	0.0984	0.36
05-2184	DEL NORTE 2 E	CO	39	-106.3242	37.6739	7870	01/1920	12/2000	79	0.1736	0.1724	0.1384	0.31
05-2196	DELTA 3 E	CO	26	-108.0278	38.7539	5010	02/1893	12/2000	104	0.2271	0.2108	0.2025	1.21
05-2286	DINOSAUR NATL MONUMNT	CO	15	-108.9719	40.2442	5920	08/1948	12/2000	41	0.1794	0.2462	0.1511	0.49
05-2326	DOLORES	CO	38	-108.4992	37.4708	6940	10/1908	12/2000	68	0.1576	0.0010	0.0824	1.68
05-2803	EVERSOLL RANCH	CO	50	-102.0667	37.0333	3583	09/1943	11/1966	22	0.2356	0.3287	0.2103	0.58
05-3016	FORT LEWIS	CO	38	-108.0497	37.2342	7600	01/1915	12/2000	78	0.1769	0.1342	0.1362	0.23
05-3146	FRUITA 1 W	CO	26	-108.7556	39.1636	4480	01/1903	12/2000	97	0.2147	0.1787	0.1845	0.98
05-3222	GARDNER	CO	39	-105.1833	37.7667	6965	06/1939	07/1971	29	0.2367	0.2758	0.2316	0.86
05-3246	GATEWAY 1 SE	CO	26	-108.9722	38.6825	4550	09/1947	12/2000	54	0.1989	0.2843	0.2433	1.11
05-3488	GRAND JUNCTION WSO AP	CO	26	-108.5375	39.1342	4840	01/1900	12/2000	101	0.1906	0.2368	0.1738	0.08
05-3489	GRAND JUNCTION 6 ESE	CO	26	-108.4658	39.0422	4760	03/1962	12/2000	39	0.1603	0.1397	0.1387	0.89
05-3541	GREAT SAND DUNES N M	CO	39	-105.5189	37.7250	8120	09/1950	12/2000	50	0.2046	0.1093	0.0979	0.79
05-3738	HAMILTON	CO	15	-107.6117	40.3722	6230	07/1947	12/2000	53	0.1761	0.2699	0.1444	1.08

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
05-3951	HERMIT 7 ESE	CO	39	-107.1097	37.7717	9048	01/1920	12/2000	81	0.2091	0.2991	0.1907	0.72
05-4250	IGNACIO 1 N	CO	38	-107.6264	37.1364	6460	07/1909	07/1993	79	0.1898	0.1736	0.1583	0.40
05-4726	LA JUNTA 20 S	CO	49	-103.4833	37.7167	4240	01/1942	12/2000	31	0.1753	0.2082	0.1445	1.10
05-4870	LA VETA PASS	CO	39	-105.1667	37.4667	9245	03/1909	01/1954	43	0.2025	0.1697	0.1275	0.13
05-5048	LITTLE HILLS	CO	15	-108.2000	40.0000	6140	07/1946	09/1991	44	0.1555	0.2051	0.2981	2.84
05-5322	MANASSA	CO	39	-105.9394	37.1739	7690	01/1893	12/2000	93	0.2012	0.1443	0.1430	0.42
05-5327	MANCOS	CO	38	-108.2947	37.3425	6980	11/1898	12/2000	68	0.1485	0.1421	0.1691	0.87
05-5446	MAYBELL	CO	15	-108.0947	40.5117	5908	06/1958	12/2000	38	0.2210	0.1913	0.1796	0.69
05-5484	MEEKER 3 W	CO	15	-107.9608	40.0236	6180	01/1893	12/2000	71	0.1980	0.3549	0.2496	1.12
05-5531	MESA VERDE NP	CO	38	-108.4883	37.1986	7115	02/1922	12/2000	78	0.1612	0.2061	0.1975	0.54
05-5706	MONTE VISTA 2 W	CO	39	-106.1861	37.5806	7650	01/1939	12/2000	58	0.1636	0.0832	0.0699	1.00
05-5722	MONTROSE NO 2	CO	26	-107.8792	38.4858	5785	10/1895	12/2000	104	0.1942	0.2573	0.2401	0.85
05-5990	NORTH LAKE	CO	39	-105.0500	37.2167	8806	09/1909	10/1980	66	0.1931	0.2351	0.2040	0.11
05-6012	NORWOOD	CO	26	-108.2864	38.1317	7020	04/1924	12/2000	73	0.2002	0.2296	0.1585	0.15
05-6203	OURAY	CO	38	-107.6686	38.0206	7840	01/1953	12/2000	47	0.1623	0.1210	0.1757	0.76
05-6258	PAGOSA SPRINGS	CO	39	-107.0167	37.2425	7250	12/1906	11/1998	76	0.2161	0.2316	0.1894	0.18
05-6266	PALISADE	CO	26	-108.3506	39.1136	4810	05/1911	12/2000	84	0.2011	0.2723	0.1606	0.68
05-6271	PALISADE LAKES 6 SSE	CO	38	-107.1500	37.4333	8094	07/1947	01/1971	24	0.1554	0.3294	0.2527	3.10
05-6306	PAONIA 1 SW	CO	26	-107.6236	38.8522	5580	02/1905	12/2000	69	0.1536	0.1469	0.1354	0.97
05-6311	PARACHUTE	CO	15	-108.0500	39.4500	5090	05/1965	05/1992	24	0.2497	0.3645	0.1991	2.13
05-6315	PARADOX 2 SE	CO	26	-108.9500	38.3667	5282	08/1948	10/1977	29	0.1866	0.2389	0.1762	0.11
05-6832	RANGELY 1 E	CO	15	-108.7717	40.0894	5290	07/1894	12/2000	66	0.2006	0.2444	0.1556	0.19
05-7017	RICO	CO	38	-108.0386	37.7131	8800	01/1893	12/2000	97	0.1900	0.2567	0.1620	0.88
05-7031	RIFLE 2 ENE	CO	15	-107.7333	39.5500	5319	10/1910	12/2000	83	0.2109	0.1696	0.1469	0.55
05-7050	RIO GRANDE RESERVOIR	CO	38	-107.2678	37.7256	9455	09/1977	12/2000	24	0.1450	0.0584	0.0321	2.46
05-7315	RYE	CO	39	-104.9333	37.9000	6850	12/1940	01/1992	44	0.2458	0.3071	0.2310	1.18
05-7428	SAN LUIS 3 SE	CO	39	-105.4064	37.1783	8017	01/1893	12/1923	30	0.2126	0.2859	0.1739	0.64
05-7656	SILVERTON	CO	38	-107.6614	37.8117	9272	03/1899	12/2000	91	0.1954	0.2125	0.1696	0.53
05-7862	SPRINGFIELD	CO	50	-102.6167	37.4000	4411	04/1893	07/1985	69	0.2504	0.3036	0.2460	0.48
05-7866	SPRINGFIELD 7 WSW	CO	49	-102.7431	37.3692	4622	09/1956	12/2000	44	0.2218	0.3461	0.2440	1.13
05-7992	STONINGTON	CO	50	-102.1864	37.2931	3802	01/1941	07/1999	56	0.2043	0.2551	0.1413	0.83
05-8100	SUNBEAM 7 SW	CO	15	-108.2667	40.5000	5863	04/1927	10/1951	24	0.1702	0.2735	0.1458	1.33

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
05-8154	TACOMA	CO	38	-107.7833	37.5167	7300	01/1908	08/1987	61	0.1763	0.1679	0.1130	0.67
05-8204	TELLURIDE 4 WNW	CO	38	-107.8733	37.9492	8672	12/1900	12/2000	92	0.1927	0.2725	0.1902	0.64
05-8429	TRINIDAD	CO	39	-104.4867	37.1789	6030	07/1898	12/2000	96	0.2179	0.2421	0.1887	0.19
05-8434	TRINIDAD AP	CO	48	-104.3378	37.2622	5746	01/1948	12/2000	53	0.2339	0.2721	0.2312	0.50
05-8436	TRINIDAD LAKE	CO	39	-104.5569	37.1506	6120	05/1978	12/2000	23	0.1853	0.1852	0.1377	0.12
05-8454	TROUT LAKE	CO	38	-107.8833	37.8333	9699	04/1914	03/1986	53	0.1726	0.2139	0.1737	0.10
05-8468	TROY 1 SE	CO	49	-103.3000	37.1333	5607	08/1941	09/1987	45	0.2319	0.2686	0.1631	0.25
05-8510	TWO BUTTES 1 NW	CO	50	-102.4000	37.5667	4081	09/1900	03/1972	59	0.2920	0.4495	0.3615	2.40
05-8560	URAVAN	CO	26	-108.7422	38.3761	5010	11/1960	12/2000	40	0.1594	0.2654	0.1850	1.18
05-8574	UTLEYVILLE	CO	49	-103.0333	37.2667	5003	04/1920	07/1956	34	0.2310	0.2715	0.2010	0.20
05-8582	VALLECITO DAM	CO	38	-107.5833	37.3833	7648	01/1942	12/2000	59	0.1422	0.1989	0.1502	1.64
05-8742	WAGON WHEEL GAP 3 N	CO	39	-106.8333	37.8000	8507	08/1948	03/1972	23	0.2900	0.2880	0.1668	4.06
05-8781	WALSENBURG	CO	39	-104.7681	37.6464	6150	04/1934	12/2000	65	0.2304	0.1908	0.1618	0.81
05-8793	WALSH 1 W	CO	50	-102.2978	37.3822	3978	01/1968	12/2000	32	0.2004	0.2172	0.0985	0.91
05-9181	WOLF CREEK PASS 1 E	CO	39	-106.7906	37.4744	10640	12/1957	12/2000	41	0.1703	0.1493	0.1352	0.40
05-9183	WOLF CREEK PASS 4 W	CO	39	-106.8667	37.4833	9436	08/1939	08/1971	29	0.1818	0.1943	0.2182	0.51
05-9216	WOOTTON RANCH	CO	46	-104.4886	37.0181	7580	05/1978	12/2000	23	0.1849	0.2994	0.1109	1.48
05-9275	YELLOW JACKET 2 W	CO	38	-108.7561	37.5206	6860	05/1962	12/2000	39	0.2044	0.2634	0.2064	0.91
10-0010	ABERDEEN EXPERIMNT STN	ID	5	-112.8253	42.9536	4405	04/1914	12/2000	87	0.2113	0.3038	0.1840	0.53
10-0149	ALBION COLLEGE OF EDUC	ID	5	-113.5833	42.4167	4754	11/1899	07/1953	22	0.2278	0.1772	0.0568	2.14
10-0227	AMERICAN FALLS 3 NW	ID	5	-112.9214	42.7914	4405	12/1892	12/2000	96	0.1782	0.1163	0.1776	0.70
10-0347	ARBON 2 NW	ID	6	-112.5758	42.5031	5210	07/1962	12/2000	38	0.2142	0.3763	0.2549	2.28
10-1002	BLISS 4 NW	ID	5	-115.0131	42.9544	3275	01/1917	01/2000	80	0.1695	0.1688	0.1515	0.35
10-1195	BRUNEAU	ID	5	-115.8000	42.8833	3002	06/1962	12/2000	38	0.2379	0.3298	0.2300	0.99
10-1217	BUHL	ID	5	-114.7667	42.6000	3763	05/1906	04/1963	55	0.2383	0.2103	0.1579	1.50
10-1220	BUHL NO 2	ID	5	-114.7453	42.6008	3800	01/1978	12/2000	23	0.1757	0.1367	0.0641	0.79
10-1288	BURLEY	ID	5	-113.7833	42.5333	4183	07/1917	06/1967	49	0.2164	0.2571	0.2193	0.31
10-1298	BURLEY FACTORY	ID	5	-113.8000	42.5500	4144	01/1925	04/1955	26	0.1756	0.1648	0.2104	0.62
10-1303	BURLEY MUNICIPAL AP	ID	5	-113.7717	42.5425	4157	08/1948	12/2000	52	0.1736	0.2707	0.2775	1.67
10-1551	CASTLEFORD 2 N	ID	5	-114.8661	42.5500	3825	06/1963	12/2000	37	0.2573	0.3843	0.2627	2.09
10-2071	CONDA	ID	6	-111.5500	42.7167	6204	01/1939	04/1978	38	0.1760	0.1315	0.1758	0.60
10-3631	GLENNS FERRY	ID	5	-115.3192	42.9433	2510	01/1909	12/2000	90	0.2165	0.3571	0.2902	1.25

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
10-3682	GOODING FAA AIRPORT	ID	5	-114.7667	42.9167	3698	09/1909	02/1997	62	0.1725	0.1313	0.0933	0.47
10-3732	GRACE	ID	6	-111.7447	42.5864	5550	01/1907	12/2000	94	0.1664	0.1177	0.1435	0.65
10-4140	HAZELTON	ID	5	-114.1375	42.5972	4060	05/1917	12/2000	84	0.1722	0.1906	0.1696	0.34
10-4295	HOLLISTER	ID	5	-114.5750	42.3531	4525	03/1912	12/2000	89	0.1907	0.1895	0.1647	0.02
10-4670	JEROME	ID	5	-114.5197	42.7333	3740	09/1915	12/2000	85	0.1783	0.1588	0.1682	0.21
10-5275	LIFTON PUMPING STN	ID	6	-111.3139	42.1231	5926	10/1919	12/2000	81	0.2098	0.2363	0.2011	0.44
10-5544	MALAD	ID	6	-112.2667	42.2000	4581	02/1904	03/1982	69	0.1713	0.2428	0.1718	0.55
10-5559	MALAD CITY AIRPORT	ID	6	-112.2872	42.1492	4470	08/1948	12/2000	52	0.2037	0.2747	0.1820	0.58
10-5563	MALTA 4 ESE	ID	4	-113.3042	42.2917	4590	09/1963	12/2000	36	0.2201	0.2555	0.2142	0.28
10-5678	MASSACRE ROCKS ST PARK	ID	5	-112.9981	42.6681	4195	05/1973	12/2000	28	0.2341	0.3993	0.3506	2.45
10-5716	MCCAMMON	ID	6	-112.2000	42.6500	4774	08/1949	12/2000	31	0.1369	0.1848	0.2288	1.60
10-5980	MINIDOKA DAM	ID	5	-113.4833	42.6667	4210	05/1947	12/2000	51	0.1792	0.2273	0.1727	0.34
10-6053	MONTPELIER RANGER STN	ID	6	-111.3000	42.3167	5960	06/1914	06/1991	77	0.1866	0.2808	0.2064	0.56
10-6542	OAKLEY	ID	4	-113.8919	42.2333	4560	07/1893	12/2000	108	0.1552	0.0740	0.0896	1.48
10-6877	PAUL 1 ENE	ID	5	-113.7622	42.6283	4150	01/1925	12/2000	65	0.1850	0.2470	0.1540	0.47
10-7211	POCATELLO WSO AP	ID	6	-112.5711	42.9203	4454	01/1939	12/2000	62	0.1684	0.0959	0.1548	1.09
10-7346	PRESTON KACH	ID	6	-111.8333	42.1333	4820	10/1964	12/2000	28	0.1867	0.1587	0.2220	0.90
10-7353	PRESTON SUGAR FACTORY	ID	6	-111.8500	42.0667	4724	11/1921	01/1980	48	0.1852	0.2562	0.1500	0.83
10-7968	RUPERT 3 WSW	ID	5	-113.7575	42.6042	4200	11/1906	12/2000	79	0.2000	0.1765	0.1305	0.18
10-8380	SHOSHONE 1 WNW	ID	5	-114.4169	42.9383	3950	03/1908	12/2000	92	0.1925	0.2016	0.1469	0.04
10-8535	SODA SPRINGS AIRPORT	ID	6	-111.5833	42.6514	5842	06/1978	12/2000	21	0.2138	0.2805	0.1771	0.88
10-8786	STREVELL	ID	4	-113.2500	42.0167	5280	08/1948	09/1986	36	0.1566	0.0670	0.1284	1.55
10-9119	THREE CREEK	ID	4	-115.1500	42.0833	5458	07/1940	08/1987	47	0.2240	0.2636	0.1371	0.67
10-9293	TWIN FALLS KMVT	ID	5	-114.4586	42.5803	3670	02/1980	11/2000	21	0.1872	0.2366	0.0525	2.14
10-9294	TWIN FALLS 2 NNE	ID	5	-114.4667	42.5833	3691	09/1905	05/1974	68	0.1902	0.0986	0.0926	0.74
10-9299	TWIN FALLS 3 SE	ID	5	-114.4167	42.5333	3773	01/1925	07/1977	53	0.1975	0.1811	0.1582	0.07
10-9303	TWIN FALLS WSO	ID	5	-114.3500	42.5500	3960	04/1963	12/2000	38	0.1907	0.1213	0.1524	0.53
26-0046	ADAVEN	NV	11	-115.5833	38.1167	6250	04/1914	02/1982	64	0.2103	0.1967	0.1621	0.01
26-0099	ALAMO	NV	11	-115.1667	37.3667	-999	10/1921	09/1962	39	0.2685	0.3410	0.3403	2.21
26-0150	AMARGOSA FARMS GAREY	NV	18	-116.4619	36.5717	2450	12/1965	12/2000	26	0.3208	0.2154	0.1290	0.10
26-0438	ARTHUR 4 NW	NV	11	-115.1858	40.7811	6300	09/1910	12/2000	86	0.1857	0.2306	0.1929	0.74
26-0507	AUSTIN	NV	11	-117.0719	39.4961	6605	12/1887	12/2000	107	0.1926	0.2176	0.1332	0.53

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-0691	BATTLE MOUNTAIN AP	NV	11	-116.8667	40.6167	4531	02/1893	12/2000	107	0.2261	0.1803	0.1986	0.27
26-0718	BEATTY 8 N	NV	10	-116.7183	36.9950	3550	11/1917	12/2000	79	0.2642	0.2255	0.1964	0.24
26-0795	BEOWAWE	NV	11	-116.4747	40.5903	4700	01/1893	12/2000	101	0.2177	0.1358	0.1410	0.27
26-0800	BEOWAWE U OF N RANCH	NV	11	-116.5875	39.9003	5740	09/1972	12/2000	28	0.1922	0.3292	0.1894	1.92
26-0955	BLUE EAGLE RANCH HANKS	NV	11	-115.5442	38.5208	4780	04/1978	12/2000	23	0.1821	0.0728	0.0183	1.35
26-1071	BOULDER CITY	NV	20	-114.8458	35.9714	2450	09/1931	12/2000	69	0.2766	0.3049	0.3031	0.90
26-1415	CARLIN NEWMONT MINE	NV	4	-116.3175	40.9150	6520	11/1966	12/2000	33	0.2144	0.1536	0.2482	2.48
26-1485	CARSON CITY	NV	3	-119.7678	39.1464	4651	01/1893	12/2000	90	0.2436	0.1985	0.1179	0.55
26-1740	CLOVER VALLEY	NV	11	-115.0333	40.7333	5804	10/1896	12/2000	70	0.2558	0.2864	0.1729	0.70
26-1905	CONTACT	NV	4	-114.7528	41.7706	5350	07/1948	10/1999	51	0.2116	0.1490	0.1138	0.59
26-2189	DEETH	NV	4	-115.2711	41.0661	5340	12/1951	12/2000	48	0.1938	0.2741	0.1850	0.65
26-2229	DENIO	NV	3	-118.6339	41.9897	4190	10/1951	12/2000	47	0.1959	0.2316	0.1427	0.33
26-2243	DESERT NATL WL RANGE	NV	19	-115.3597	36.4378	2920	04/1940	12/2000	61	0.2591	0.1165	0.1402	0.06
26-2296	DIAMOND VALLEY USDA	NV	11	-116.0494	39.7086	5970	08/1979	12/2000	21	0.2183	0.2354	0.0301	1.98
26-2390	DUCKWATER	NV	11	-115.7158	38.9322	5610	09/1966	09/2000	31	0.2250	0.1576	0.1322	0.28
26-2394	DUFURRENA	NV	3	-119.0144	41.8681	4800	10/1951	11/1999	44	0.2426	0.1337	0.0852	1.14
26-2431	DYER 4 SE	NV	10	-118.0333	37.6167	4979	02/1903	12/2000	63	0.2486	0.2044	0.1125	0.60
26-2573	ELKO FCWOS	NV	11	-115.7917	40.8250	5050	02/1888	12/2000	104	0.2730	0.3683	0.2564	1.43
26-2631	ELY WSO AIRPORT	NV	11	-114.8453	39.2950	6253	01/1893	12/2000	69	0.2150	0.2213	0.1821	0.03
26-2656	EMIGRANT PASS HWY STN	NV	11	-116.3000	40.6500	5760	06/1944	12/2000	53	0.2110	0.2462	0.1568	0.24
26-2708	EUREKA	NV	11	-115.9619	39.5178	6540	05/1888	12/2000	77	0.2063	0.2648	0.2164	0.43
26-2780	FALLON EXPERIMENT STN	NV	10	-118.7811	39.4572	3965	06/1903	12/2000	96	0.2186	0.1768	0.1735	0.17
26-2840	FERNLEY	NV	3	-119.2500	39.6167	4163	09/1944	05/1974	22	0.2190	0.1374	0.2069	0.54
26-2860	FISH CREEK RANCH	NV	11	-116.0000	39.2667	6053	05/1943	12/1964	21	0.1992	0.1501	0.1632	0.12
26-3090	GERLACH	NV	3	-119.3619	40.6506	3950	01/1948	12/2000	29	0.2138	0.4010	0.2896	2.37
26-3101	GEYSER RANCH	NV	11	-114.6361	38.6683	6020	02/1904	12/2000	36	0.2474	0.1951	0.2564	1.35
26-3114	GIBBS RANCH	NV	4	-115.2122	41.5697	6000	11/1952	12/2000	47	0.1450	0.2001	0.1909	2.05
26-3205	GLENBROOK	NV	9	-119.9411	39.0753	6350	01/1901	12/2000	62	0.2046	0.2320	0.1434	0.47
26-3245	GOLCONDA	NV	4	-117.4881	40.9536	4415	02/1893	12/2000	104	0.2329	0.2122	0.1539	0.74
26-3285	GOLDFIELD	NV	10	-117.2331	37.7081	5690	02/1906	12/2000	85	0.2746	0.1811	0.1484	0.41
26-3340	GREAT BASIN NATL PARK	NV	11	-114.2267	39.0092	6830	10/1937	12/2000	61	0.1763	0.1694	0.1525	0.65
26-3515	HAWTHORNE AIRPORT	NV	10	-118.6667	38.5500	4220	02/1888	08/1991	63	0.2508	0.2650	0.2544	0.71

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-3671	HIKO	NV	11	-115.2236	37.5581	3900	03/1964	12/2000	37	0.2692	0.3121	0.1532	1.41
26-3957	IMLAY	NV	10	-118.1631	40.6564	4260	03/1914	12/2000	82	0.2118	0.2327	0.2307	0.48
26-3980	INDIAN SPRINGS	NV	19	-115.6833	36.5833	3123	01/1939	06/1964	25	0.2881	0.1956	0.2309	0.99
26-4038	JARBRIDGE 4 N	NV	4	-115.4333	41.9333	6168	11/1916	06/1995	40	0.1755	0.0781	-0.0029	2.19
26-4086	JIGGS	NV	11	-115.6500	40.4500	5423	07/1910	03/1972	57	0.2016	0.1746	0.1058	0.28
26-4095	JIGGS 8 SSE ZAGA	NV	11	-115.6206	40.3450	5800	10/1978	12/2000	22	0.2271	0.2626	0.1973	0.14
26-4199	KIMBERLY	NV	11	-115.0333	39.2667	7234	02/1928	05/1958	29	0.1591	0.1725	0.1546	1.50
26-4236	KINGS RIVER VALLEY	NV	4	-118.2253	41.7456	4240	11/1956	12/2000	40	0.1951	0.2113	0.2085	0.12
26-4349	LAHONTAN DAM	NV	10	-119.0644	39.4689	4150	04/1911	12/2000	88	0.2432	0.2702	0.2364	0.48
26-4384	LAKE VALLEY STEWARD	NV	11	-114.6500	38.3167	6350	01/1971	11/1998	28	0.2067	0.1803	0.1300	0.09
26-4392	LAMOILLE 3 E	NV	11	-115.4333	40.7333	6306	07/1916	08/1975	54	0.1872	0.1540	0.1745	0.33
26-4394	LAMOILLE YOST	NV	11	-115.5231	40.7178	5840	10/1975	12/2000	25	0.2096	0.3603	0.3041	1.99
26-4429	LAS VEGAS	NV	19	-115.1333	36.1667	2011	06/1895	08/1956	53	0.2538	0.0598	0.1638	0.56
26-4436	LAS VEGAS WSO AIRPORT	NV	19	-115.1667	36.0833	2162	09/1948	12/2000	52	0.2366	0.1585	0.2068	0.43
26-4527	LEONARD CREEK RANCH	NV	3	-118.7192	41.5172	4224	12/1954	12/2000	46	0.1555	0.2242	0.1411	1.51
26-4651	LOGANDALE	NV	19	-114.4833	36.6167	1410	02/1968	01/1992	24	0.2426	0.3229	0.2365	1.58
26-4698	LOVELOCK	NV	10	-118.4667	40.1833	3975	01/1895	12/2000	97	0.2162	0.1543	0.1582	0.30
26-4700	LOVELOCK FCWOS	NV	10	-118.5653	40.0664	3900	07/1948	11/2000	49	0.2229	0.1363	0.1228	0.48
26-4745	LUND	NV	11	-115.0092	38.8625	5560	08/1957	12/2000	43	0.1858	0.1010	0.2745	2.21
26-4824	MALA VISTA RANCH	NV	4	-115.2500	41.3167	5594	05/1939	06/1965	26	0.2028	0.2138	0.0381	2.11
26-4858	MARLETTE LAKE	NV	9	-119.9167	39.1667	8005	12/1913	07/1952	25	0.1703	0.0683	0.1381	1.42
26-4935	MCDERMITT	NV	4	-117.7200	41.9961	4527	01/1971	12/2000	29	0.2331	0.2689	0.1993	0.56
26-4950	MCGILL	NV	11	-114.7764	39.4014	6270	01/1892	12/2000	93	0.2137	0.2757	0.2237	0.38
26-5092	METROPOLIS	NV	4	-115.0167	41.2833	5800	08/1965	09/1995	27	0.1802	0.1917	0.1719	0.22
26-5168	MINA	NV	10	-118.1058	38.3867	4550	03/1896	12/2000	104	0.2500	0.1608	0.1994	0.43
26-5191	MINDEN	NV	3	-119.7758	38.9547	4709	06/1906	12/2000	90	0.2432	0.2565	0.1907	0.26
26-5352	MONTELLO 2 SE	NV	11	-114.1728	41.2428	4900	04/1895	12/2000	103	0.1990	0.2284	0.2555	0.76
26-5392	MOUNTAIN CITY R S	NV	4	-115.9653	41.8375	5650	02/1955	11/1999	45	0.2152	0.2594	0.1048	1.15
26-5605	NIXON	NV	3	-119.3500	39.8333	3904	05/1928	11/1974	36	0.2506	0.2714	0.2645	0.95
26-5691	NORTH FORK MNTC STN	NV	4	-115.8167	41.4833	6204	11/1909	10/1970	49	0.1931	0.1736	0.2145	0.53
26-5705	NORTH LAS VEGAS	NV	19	-115.1231	36.2108	1880	02/1951	12/2000	49	0.1900	-0.0505	0.1423	2.50
26-5818	OROVADA 4 WSW	NV	4	-117.8333	41.5500	4290	08/1911	12/2000	85	0.1788	0.1489	0.1596	0.33

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-5846	OVERTON	NV	19	-114.4583	36.5489	1250	05/1939	12/2000	38	0.2690	0.1783	0.1596	0.04
26-5869	OWYHEE	NV	4	-116.1000	41.9500	5397	07/1948	01/1985	37	0.1986	0.4194	0.3889	4.10
26-5880	PAHRANAGAT W L REFUGE	NV	11	-115.1197	37.2692	3400	03/1964	10/2000	36	0.1934	0.1395	0.0366	1.10
26-5890	PAHRUMP	NV	19	-116.0031	36.2786	2674	03/1914	12/2000	52	0.2968	0.3085	0.2083	0.91
26-5931	PALMETTO	NV	10	-117.7667	37.4667	5906	03/1890	09/1951	22	0.2794	0.0945	0.0800	1.56
26-6005	PARADISE VALLEY 1 NW	NV	4	-117.5478	41.5022	4675	02/1894	12/2000	89	0.1963	0.1902	0.1268	0.17
26-6055	PARIS RANCH	NV	10	-117.6833	40.2167	4140	07/1966	10/1991	25	0.1865	0.1872	0.1178	1.52
26-6148	PEQUOP	NV	11	-114.5333	41.0667	6033	07/1948	07/1985	30	0.1981	0.1339	0.0846	0.41
26-6242	PINE VALLEY BAILEY RANCH	NV	11	-116.1200	40.4294	5047	10/1956	12/2000	43	0.2245	0.2863	0.2104	0.29
26-6252	PIOCHE	NV	11	-114.4661	37.9444	6180	01/1888	11/2000	71	0.2225	0.2368	0.1517	0.13
26-6504	QUINN RIVER CROSSING	NV	4	-118.4333	41.5667	4091	02/1901	03/1951	28	0.2374	0.3038	0.2644	1.11
26-6691	RED ROCK CANYON ST PK	NV	20	-115.4603	36.0686	3780	05/1977	12/2000	24	0.2882	0.3578	0.3060	1.05
26-6746	REESE RIVER RANGER STN	NV	11	-117.4667	38.9833	6649	04/1972	12/2000	27	0.1683	0.1142	0.0265	1.70
26-6779	RENO WSFO AIRPORT	NV	3	-119.7833	39.5000	4404	03/1937	12/2000	64	0.2440	0.2616	0.1633	0.34
26-7123	RUBY LAKE	NV	11	-115.4928	40.2028	6010	01/1940	12/2000	60	0.1964	0.2611	0.1264	1.01
26-7175	RUTH	NV	11	-114.9875	39.2800	6840	06/1958	11/2000	36	0.1958	0.1410	0.0966	0.33
26-7192	RYE PATCH DAM	NV	10	-118.3047	40.4661	4135	05/1935	12/2000	64	0.1847	0.2516	0.1508	1.78
26-7261	SAND PASS	NV	3	-119.8000	40.3167	3904	10/1913	09/1971	52	0.2186	0.1820	0.1734	0.05
26-7284	SAN JACINTO	NV	4	-114.6833	41.8833	5203	09/1904	09/1948	43	0.1914	0.2079	0.2556	0.73
26-7358	SCHURZ	NV	10	-118.8167	38.9500	4124	01/1920	04/1957	36	0.2144	0.3116	0.2764	1.42
26-7369	SEARCHLIGHT	NV	20	-114.9217	35.4661	3540	12/1913	12/2000	85	0.2746	0.2347	0.2352	0.83
26-7443	SHELDON	NV	3	-119.6333	41.8500	6506	07/1933	02/1972	38	0.1721	0.1547	0.1787	0.66
26-7463	SILVERPEAK	NV	10	-117.5653	37.7619	4260	10/1967	12/2000	33	0.2676	0.3763	0.2596	2.42
26-7609	SMITH 1 N	NV	10	-119.3333	38.8167	4754	07/1908	09/1966	57	0.3041	0.3134	0.2066	2.01
26-7612	SMITH 6 N	NV	10	-119.3511	38.8822	5000	07/1973	12/2000	27	0.2245	0.2034	0.1611	0.14
26-2840	FERNLEY	NV	3	-119.2500	39.6167	4163	09/1944	05/1974	22	0.2190	0.1374	0.2069	0.54
26-2860	FISH CREEK RANCH	NV	11	-116.0000	39.2667	6053	05/1943	12/1964	21	0.1992	0.1501	0.1632	0.12
26-3090	GERLACH	NV	3	-119.3619	40.6506	3950	01/1948	12/2000	29	0.2138	0.4010	0.2896	2.37
26-3101	GEYSER RANCH	NV	11	-114.6361	38.6683	6020	02/1904	12/2000	36	0.2474	0.1951	0.2564	1.35
26-3114	GIBBS RANCH	NV	4	-115.2122	41.5697	6000	11/1952	12/2000	47	0.1450	0.2001	0.1909	2.05
26-3205	GLENBROOK	NV	9	-119.9411	39.0753	6350	01/1901	12/2000	62	0.2046	0.2320	0.1434	0.47
26-3245	GOLCONDA	NV	4	-117.4881	40.9536	4415	02/1893	12/2000	104	0.2329	0.2122	0.1539	0.74

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-3285	GOLDFIELD	NV	10	-117.2331	37.7081	5690	02/1906	12/2000	85	0.2746	0.1811	0.1484	0.41
26-3340	GREAT BASIN NATL PARK	NV	11	-114.2267	39.0092	6830	10/1937	12/2000	61	0.1763	0.1694	0.1525	0.65
26-3515	HAWTHORNE AIRPORT	NV	10	-118.6667	38.5500	4220	02/1888	08/1991	63	0.2508	0.2650	0.2544	0.71
26-3671	HIKO	NV	11	-115.2236	37.5581	3900	03/1964	12/2000	37	0.2692	0.3121	0.1532	1.41
26-3957	IMLAY	NV	10	-118.1631	40.6564	4260	03/1914	12/2000	82	0.2118	0.2327	0.2307	0.48
26-3980	INDIAN SPRINGS	NV	19	-115.6833	36.5833	3123	01/1939	06/1964	25	0.2881	0.1956	0.2309	0.99
26-4038	JARBRIDGE 4 N	NV	4	-115.4333	41.9333	6168	11/1916	06/1995	40	0.1755	0.0781	-0.0029	2.19
26-4086	JIGGS	NV	11	-115.6500	40.4500	5423	07/1910	03/1972	57	0.2016	0.1746	0.1058	0.28
26-4095	JIGGS 8 SSE ZAGA	NV	11	-115.6206	40.3450	5800	10/1978	12/2000	22	0.2271	0.2626	0.1973	0.14
26-4199	KIMBERLY	NV	11	-115.0333	39.2667	7234	02/1928	05/1958	29	0.1591	0.1725	0.1546	1.50
26-4236	KINGS RIVER VALLEY	NV	4	-118.2253	41.7456	4240	11/1956	12/2000	40	0.1951	0.2113	0.2085	0.12
26-4349	LAHONTAN DAM	NV	10	-119.0644	39.4689	4150	04/1911	12/2000	88	0.2432	0.2702	0.2364	0.48
26-4384	LAKE VALLEY STEWARD	NV	11	-114.6500	38.3167	6350	01/1971	11/1998	28	0.2067	0.1803	0.1300	0.09
26-4392	LAMOILLE 3 E	NV	11	-115.4333	40.7333	6306	07/1916	08/1975	54	0.1872	0.1540	0.1745	0.33
26-4394	LAMOILLE YOST	NV	11	-115.5231	40.7178	5840	10/1975	12/2000	25	0.2096	0.3603	0.3041	1.99
26-4429	LAS VEGAS	NV	19	-115.1333	36.1667	2011	06/1895	08/1956	53	0.2538	0.0598	0.1638	0.56
26-4436	LAS VEGAS WSO AIRPORT	NV	19	-115.1667	36.0833	2162	09/1948	12/2000	52	0.2366	0.1585	0.2068	0.43
26-4527	LEONARD CREEK RANCH	NV	3	-118.7192	41.5172	4224	12/1954	12/2000	46	0.1555	0.2242	0.1411	1.51
26-4651	LOGANDALE	NV	19	-114.4833	36.6167	1410	02/1968	01/1992	24	0.2426	0.3229	0.2365	1.58
26-4698	LOVELOCK	NV	10	-118.4667	40.1833	3975	01/1895	12/2000	97	0.2162	0.1543	0.1582	0.30
26-4700	LOVELOCK FCWOS	NV	10	-118.5653	40.0664	3900	07/1948	11/2000	49	0.2229	0.1363	0.1228	0.48
26-4745	LUND	NV	11	-115.0092	38.8625	5560	08/1957	12/2000	43	0.1858	0.1010	0.2745	2.21
26-4824	MALA VISTA RANCH	NV	4	-115.2500	41.3167	5594	05/1939	06/1965	26	0.2028	0.2138	0.0381	2.11
26-4858	MARLETTE LAKE	NV	9	-119.9167	39.1667	8005	12/1913	07/1952	25	0.1703	0.0683	0.1381	1.42
26-4935	MCDERMITT	NV	4	-117.7200	41.9961	4527	01/1971	12/2000	29	0.2331	0.2689	0.1993	0.56
26-4950	MCGILL	NV	11	-114.7764	39.4014	6270	01/1892	12/2000	93	0.2137	0.2757	0.2237	0.38
26-5092	METROPOLIS	NV	4	-115.0167	41.2833	5800	08/1965	09/1995	27	0.1802	0.1917	0.1719	0.22
26-5168	MINA	NV	10	-118.1058	38.3867	4550	03/1896	12/2000	104	0.2500	0.1608	0.1994	0.43
26-5191	MINDEN	NV	3	-119.7758	38.9547	4709	06/1906	12/2000	90	0.2432	0.2565	0.1907	0.26
26-5352	MONTELLO 2 SE	NV	11	-114.1728	41.2428	4900	04/1895	12/2000	103	0.1990	0.2284	0.2555	0.76
26-5392	MOUNTAIN CITY R S	NV	4	-115.9653	41.8375	5650	02/1955	11/1999	45	0.2152	0.2594	0.1048	1.15
26-5605	NIXON	NV	3	-119.3500	39.8333	3904	05/1928	11/1974	36	0.2506	0.2714	0.2645	0.95

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-5691	NORTH FORK MNTC STN	NV	4	-115.8167	41.4833	6204	11/1909	10/1970	49	0.1931	0.1736	0.2145	0.53
26-5705	NORTH LAS VEGAS	NV	19	-115.1231	36.2108	1880	02/1951	12/2000	49	0.1900	-0.0505	0.1423	2.50
26-5818	OROVADA 4 WSW	NV	4	-117.8333	41.5500	4290	08/1911	12/2000	85	0.1788	0.1489	0.1596	0.33
26-5846	OVERTON	NV	19	-114.4583	36.5489	1250	05/1939	12/2000	38	0.2690	0.1783	0.1596	0.04
26-5869	OWYHEE	NV	4	-116.1000	41.9500	5397	07/1948	01/1985	37	0.1986	0.4194	0.3889	4.10
26-5880	PAHRANAGAT W L REFUGE	NV	11	-115.1197	37.2692	3400	03/1964	10/2000	36	0.1934	0.1395	0.0366	1.10
26-5890	PAHRUMP	NV	19	-116.0031	36.2786	2674	03/1914	12/2000	52	0.2968	0.3085	0.2083	0.91
26-5931	PALMETTO	NV	10	-117.7667	37.4667	5906	03/1890	09/1951	22	0.2794	0.0945	0.0800	1.56
26-6005	PARADISE VALLEY 1 NW	NV	4	-117.5478	41.5022	4675	02/1894	12/2000	89	0.1963	0.1902	0.1268	0.17
26-6055	PARIS RANCH	NV	10	-117.6833	40.2167	4140	07/1966	10/1991	25	0.1865	0.1872	0.1178	1.52
26-6148	PEQUOP	NV	11	-114.5333	41.0667	6033	07/1948	07/1985	30	0.1981	0.1339	0.0846	0.41
26-6242	PINE VALLEY BAILEY RANCH	NV	11	-116.1200	40.4294	5047	10/1956	12/2000	43	0.2245	0.2863	0.2104	0.29
26-6252	PIOCHE	NV	11	-114.4661	37.9444	6180	01/1888	11/2000	71	0.2225	0.2368	0.1517	0.13
26-6504	QUINN RIVER CROSSING	NV	4	-118.4333	41.5667	4091	02/1901	03/1951	28	0.2374	0.3038	0.2644	1.11
26-6691	RED ROCK CANYON ST PK	NV	20	-115.4603	36.0686	3780	05/1977	12/2000	24	0.2882	0.3578	0.3060	1.05
26-6746	REESE RIVER RANGER STN	NV	11	-117.4667	38.9833	6649	04/1972	12/2000	27	0.1683	0.1142	0.0265	1.70
26-6779	RENO WSFO AIRPORT	NV	3	-119.7833	39.5000	4404	03/1937	12/2000	64	0.2440	0.2616	0.1633	0.34
26-7123	RUBY LAKE	NV	11	-115.4928	40.2028	6010	01/1940	12/2000	60	0.1964	0.2611	0.1264	1.01
26-7175	RUTH	NV	11	-114.9875	39.2800	6840	06/1958	11/2000	36	0.1958	0.1410	0.0966	0.33
26-7192	RYE PATCH DAM	NV	10	-118.3047	40.4661	4135	05/1935	12/2000	64	0.1847	0.2516	0.1508	1.78
26-7261	SAND PASS	NV	3	-119.8000	40.3167	3904	10/1913	09/1971	52	0.2186	0.1820	0.1734	0.05
26-7284	SAN JACINTO	NV	4	-114.6833	41.8833	5203	09/1904	09/1948	43	0.1914	0.2079	0.2556	0.73
26-7358	SCHURZ	NV	10	-118.8167	38.9500	4124	01/1920	04/1957	36	0.2144	0.3116	0.2764	1.42
26-7369	SEARCHLIGHT	NV	20	-114.9217	35.4661	3540	12/1913	12/2000	85	0.2746	0.2347	0.2352	0.83
26-7443	SHELDON	NV	3	-119.6333	41.8500	6506	07/1933	02/1972	38	0.1721	0.1547	0.1787	0.66
26-7463	SILVERPEAK	NV	10	-117.5653	37.7619	4260	10/1967	12/2000	33	0.2676	0.3763	0.2596	2.42
26-7609	SMITH 1 N	NV	10	-119.3333	38.8167	4754	07/1908	09/1966	57	0.3041	0.3134	0.2066	2.01
26-7612	SMITH 6 N	NV	10	-119.3511	38.8822	5000	07/1973	12/2000	27	0.2245	0.2034	0.1611	0.14
26-7620	SMOKEY VALLEY	NV	11	-117.1742	38.7839	5625	07/1949	12/2000	51	0.2208	0.1173	0.1158	0.52
26-7640	SNOWBALL RANCH	NV	11	-116.1989	39.0403	7160	09/1966	12/2000	34	0.1838	0.1262	0.0372	1.17
26-7750	SPRING VALLEY ST PK	NV	11	-114.1800	38.0406	5950	08/1974	12/2000	26	0.1791	0.1488	0.3013	2.47
26-7873	SULPHUR	NV	3	-118.6667	40.9000	4042	09/1914	01/1953	36	0.2646	0.1064	0.0666	2.42

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-7908	SUNNYSIDE	NV	11	-115.0228	38.4236	5300	07/1948	12/2000	37	0.1946	0.0412	0.0282	1.33
26-7953	SUTCLIFFE	NV	3	-119.5983	39.9503	3900	06/1967	12/2000	28	0.1911	0.2024	0.2138	0.41
26-8034	THORNE	NV	10	-118.6000	38.6000	4203	04/1914	05/1950	34	0.2425	0.1253	0.1061	0.59
26-8160	TONOPAH	NV	11	-117.2333	38.0667	6024	05/1902	06/1954	31	0.2205	0.1184	0.1288	0.48
26-8170	TONOPAH FCWOS	NV	11	-117.0872	38.0603	5430	06/1954	12/2000	47	0.2171	0.1170	0.0960	0.53
26-8186	TOPAZ LAKE 3 N	NV	10	-119.5100	38.7319	5105	07/1957	12/1985	26	0.1907	0.1708	0.2921	2.68
26-8346	TUSCARORA	NV	4	-116.2244	41.3161	6170	05/1957	12/2000	40	0.2201	0.2619	0.1835	0.25
26-8349	TUSCARORA WILLIAMS RANCH	NV	4	-116.0667	41.3500	6404	09/1888	11/1956	46	0.1771	0.1569	0.2538	1.48
26-8588	VALLEY OF FIRE ST PK	NV	19	-114.5142	36.4297	2000	12/1972	12/2000	28	0.2490	0.2165	0.1566	0.57
26-8761	VIRGINIA CITY	NV	3	-119.6483	39.3128	6340	04/1951	12/2000	46	0.1657	0.0368	0.1147	1.55
26-8822	WABUSKA 6 SE	NV	10	-119.1189	39.0747	4300	06/1972	12/2000	28	0.2243	0.1563	0.2144	0.62
26-8838	WADSWORTH 4 N	NV	3	-119.2903	39.6911	4200	08/1974	12/2000	26	0.1933	0.2041	0.1168	0.43
26-8977	WELLINGTON RANGER STN	NV	10	-119.3667	38.7500	4843	07/1942	04/1973	29	0.2566	0.2905	0.2243	0.67
26-8988	WELLS	NV	4	-114.9736	41.1006	5700	04/1895	12/2000	88	0.2144	0.2231	0.1840	0.12
26-9122	WILKINS	NV	4	-114.7500	41.4333	5643	07/1948	05/1980	21	0.1645	0.1109	0.0681	1.25
26-9171	WINNEMUCCA WB CITY	NV	4	-117.7167	40.9667	4295	01/1928	12/2000	73	0.1905	0.1941	0.1857	0.08
29-0022	ABBOTT 1 SE	NM	47	-104.2500	36.3000	6150	07/1909	12/2000	82	0.2047	0.1806	0.1924	0.27
29-0041	ABIQUIU DAM	NM	39	-106.4333	36.2333	6380	06/1957	12/2000	44	0.1603	0.0602	0.0706	1.31
29-0119	ADOBE RANCH	NM	45	-107.9000	33.5667	7418	12/1941	02/1994	38	0.2030	0.2564	0.2489	0.56
29-0125	AFTON 8 NE	NM	55	-106.8500	32.1500	4210	07/1942	05/1999	56	0.2430	0.2638	0.1971	0.90
29-0199	ALAMOGORDO	NM	45	-105.9467	32.9183	4350	07/1909	09/2000	91	0.1757	0.1734	0.2131	0.55
29-0234	ALBUQUERQUE WSFO AIRPORT	NM	45	-106.6064	35.0422	5310	03/1931	12/2000	70	0.1946	0.1483	0.1858	0.20
29-0268	ALEMAN RANCH	NM	59	-106.9333	32.9167	4521	06/1948	09/2000	52	0.1868	0.1656	0.1241	1.20
29-0377	AMISTAD 5 SSW	NM	49	-103.1667	35.8667	4445	04/1925	12/2000	74	0.1796	0.1533	0.2117	1.60
29-0394	ANCHO	NM	47	-105.7500	33.9333	6125	07/1909	12/1971	62	0.2302	0.3370	0.2326	0.72
29-0417	ANIMAS 3 ESE	NM	54	-108.7686	31.9378	4437	05/1923	12/2000	78	0.2381	0.2171	0.1347	0.70
29-0525	ARCH	NM	49	-103.1500	34.1000	3999	01/1929	12/2000	28	0.2047	0.0372	0.0480	2.12
29-0600	ARTESIA 6 S	NM	48	-104.3881	32.7747	3320	06/1905	12/2000	93	0.2639	0.2243	0.1639	0.15
29-0606	ASPEN GROVE RANCH	NM	39	-106.1833	36.6500	9708	07/1909	12/1948	40	0.1930	0.2525	0.1910	0.22
29-0640	AUGUSTINE 2 E	NM	45	-107.6211	34.0750	7000	04/1926	12/2000	70	0.1770	0.1583	0.1093	0.49
29-0646	AURORA	NM	39	-105.0500	36.2667	8136	07/1909	08/1960	52	0.2253	0.2488	0.1163	0.94
29-0692	AZTEC RUINS NATL	NM	37	-108.0000	36.8333	5643	01/1895	12/2000	96	0.1788	0.1400	0.0895	0.57

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
	MONUMENT												
29-0743	BANDELIER NATL MONUMENT	NM	45	-106.2667	35.7833	6063	05/1924	08/1976	51	0.2129	0.2402	0.2238	0.34
29-0795	BATEMAN RANCH	NM	39	-106.3167	36.5167	8907	09/1909	02/1970	60	0.1619	0.1849	0.1321	0.85
29-0846	BELEN	NM	45	-106.7667	34.6667	4803	11/1941	05/1976	30	0.2479	0.2561	0.2547	1.83
29-0858	BELL RANCH	NM	48	-104.1000	35.5333	4500	05/1899	12/2000	101	0.2230	0.2123	0.1243	0.48
29-0903	BERNALILLO 3 SW	NM	45	-106.5333	35.3333	5062	01/1939	08/1982	43	0.1896	0.1235	0.2437	1.44
29-0983	BINGHAM 2 NE	NM	59	-106.3500	33.9167	5551	09/1939	12/2000	55	0.2279	0.2828	0.1466	1.47
29-0992	BITTER LAKES WL REFUGE	NM	48	-104.4000	33.4667	3664	12/1950	12/2000	50	0.2466	0.1763	0.1733	0.56
29-1000	BLACK LAKE	NM	39	-105.2833	36.3000	8356	07/1909	12/2000	89	0.1960	0.2404	0.2639	0.73
29-1063	BLOOMFIELD 3 SE	NM	37	-107.9667	36.6667	5806	01/1904	12/1924	21	0.2086	0.2101	0.0292	2.52
29-1080	BLUEWATER 3 WSW	NM	45	-108.0333	35.2500	6804	07/1896	11/1959	50	0.1924	0.0722	0.0735	0.94
29-1180	BRAZOS LODGE	NM	39	-106.4444	36.7436	8005	03/1970	12/2000	31	0.1790	0.4176	0.4499	5.12
29-1252	BUCKHORN	NM	44	-108.7167	33.0333	4800	01/1948	12/2000	52	0.2087	0.1969	0.1591	0.39
29-1269	BUEYEROS 4 NW	NM	48	-103.7333	36.0167	4682	07/1929	01/1968	37	0.2255	0.3744	0.3448	2.79
29-1332	CAMERON	NM	49	-103.4428	34.9039	4580	01/1941	05/1998	57	0.2070	0.2317	0.1361	0.32
29-1389	CANJILON R S	NM	39	-106.4500	36.4833	7828	09/1938	12/2000	61	0.1741	0.1821	0.0711	1.31
29-1423	CANTON	NM	48	-104.1667	34.2833	4055	01/1942	12/2000	58	0.2679	0.2798	0.2224	0.50
29-1440	CAPITAN	NM	47	-105.6000	33.5333	6465	07/1909	12/2000	79	0.1876	0.1596	0.2224	1.06
29-1452	CAPULIN 6 SSE	NM	48	-103.9500	36.6667	7205	01/1930	12/1969	40	0.2052	0.1966	0.2151	1.07
29-1469	CARLSBAD	NM	48	-104.2456	32.4306	3120	02/1900	12/2000	100	0.2667	0.1422	0.1183	0.96
29-1475	CARLSBAD FAA AIRPORT	NM	48	-104.2633	32.3375	3232	06/1948	12/2000	52	0.2542	0.1120	0.0446	0.95
29-1480	CARLSBAD CAVERNS	NM	48	-104.4500	32.1800	4405	01/1935	12/2000	66	0.2553	0.2849	0.1991	0.25
29-1515	CARRIZOZO 1 SW	NM	45	-105.8964	33.6308	5405	06/1908	12/2000	92	0.2081	0.2691	0.2310	0.49
29-1630	CERRO	NM	39	-105.5956	36.7408	7650	05/1910	12/2000	87	0.1962	0.2399	0.1296	0.63
29-1647	CHACO CANYON NATL MON	NM	37	-107.9106	36.0286	6174	12/1909	12/2000	70	0.2089	0.2082	0.2336	0.61
29-1653	CHACON	NM	39	-105.3833	36.1667	8502	07/1909	08/1985	72	0.1932	0.2969	0.2327	0.64
29-1664	CHAMA	NM	39	-106.5781	36.9178	7850	01/1893	12/2000	97	0.1728	0.1439	0.1377	0.38
29-1813	CIMARRON 4 SW	NM	39	-104.9456	36.4661	6540	05/1904	12/2000	97	0.2227	0.2434	0.1623	0.33
29-1840	CIRCLE F RANCH	NM	47	-105.0000	33.9000	5400	01/1942	01/1995	52	0.2263	0.1315	0.0441	1.38
29-1881	CLAYTON 9 SSE	NM	49	-103.1000	36.3333	4905	01/1927	12/1959	33	0.2622	0.2799	0.1572	0.94
29-1887	CLAYTON WSO AIRPORT	NM	49	-103.1500	36.4500	4970	01/1948	12/2000	50	0.2280	0.2124	0.1691	0.03
29-1910	CLIFF 11 SE	NM	44	-108.5167	32.8333	4776	05/1944	12/2000	57	0.1754	0.1198	0.1899	0.40

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-1918	CLINES CORNERS 7 SE	NM	47	-105.5872	34.9319	6924	12/1968	09/2000	30	0.1870	0.1998	0.0998	1.24
29-1927	CLOUDCROFT RANGER STA	NM	45	-105.7500	32.9667	8835	12/1901	06/1987	78	0.1815	0.1880	0.1820	0.19
29-1939	CLOVIS 3 SSW	NM	49	-103.2000	34.3667	4280	11/1910	12/2000	90	0.2203	0.2475	0.1396	0.26
29-1963	CLOVIS 13 N	NM	49	-103.2161	34.5989	4435	06/1949	12/2000	52	0.2023	0.1046	0.0943	0.86
29-2024	COLUMBUS	NM	55	-107.6333	31.8333	4065	08/1909	12/2000	90	0.2135	0.1781	0.1392	0.28
29-2030	CONCHAS DAM	NM	48	-104.1906	35.4072	4244	11/1936	12/2000	64	0.2346	0.2507	0.1817	0.20
29-2093	CORONA 4 ENE	NM	47	-105.5833	34.2500	6654	07/1909	02/1977	68	0.1800	0.1590	0.1368	0.72
29-2139	COWLES	NM	39	-105.6667	35.8167	8107	07/1894	10/1964	60	0.1566	0.0868	0.0573	1.26
29-2207	CROSSROADS 2	NM	49	-103.3572	33.5128	4150	05/1929	12/2000	68	0.1968	0.1720	0.1899	0.61
29-2219	CROWNPOINT	NM	37	-108.1500	35.6833	6965	07/1914	11/1969	53	0.1981	0.2159	0.1578	0.17
29-2241	CUBA	NM	45	-106.9683	36.0106	7045	09/1938	12/2000	62	0.1628	0.2011	0.1750	0.91
29-2250	CUBERO	NM	45	-107.5178	35.0883	6195	01/1977	12/2000	23	0.1897	0.1438	0.0816	0.63
29-2321	CUNICO RANCH	NM	48	-104.1167	36.6833	6824	06/1940	08/1970	31	0.2201	0.2033	0.0369	2.39
29-2367	DATIL	NM	45	-107.8500	34.1500	7106	09/1905	08/1951	37	0.1934	0.1524	0.0749	0.78
29-2384	DAWSON	NM	39	-104.7833	36.6667	6404	06/1909	06/1961	52	0.2261	0.2742	0.2768	1.14
29-2436	DEMING	NM	55	-107.7333	32.2500	4300	10/1892	12/2000	80	0.2160	0.1530	0.0436	1.15
29-2453	DES MOINES	NM	48	-103.8333	36.7500	6620	04/1916	06/1994	78	0.2230	0.2102	0.0844	1.10
29-2468	DIAMOND A CATTLE CO	NM	44	-108.6333	32.5333	5199	11/1942	06/1989	43	0.2032	0.0984	0.0881	1.47
29-2510	DILIA	NM	47	-105.0500	35.1833	5150	11/1941	12/2000	57	0.2513	0.3202	0.2030	0.66
29-2608	DULCE	NM	39	-107.0000	36.9358	6793	06/1906	12/2000	90	0.1759	0.2808	0.2184	0.99
29-2665	DURAN	NM	47	-105.4000	34.4667	6285	07/1908	09/1951	33	0.2705	0.4234	0.2470	2.39
29-2700	EAGLE NEST	NM	39	-105.2628	36.3908	8280	04/1929	12/2000	71	0.2088	0.2491	0.1816	0.13
29-2757	EICKS RANCH	NM	53	-108.9333	31.4833	5305	02/1916	10/1961	36	0.1762	0.0678	0.1447	1.28
29-2785	EL MORRO NATL MONUMENT	NM	45	-108.3500	35.0500	7227	03/1938	12/2000	63	0.2012	0.2179	0.1651	0.12
29-2820	EL RITO	NM	39	-106.1833	36.3333	6870	01/1928	12/2000	71	0.1978	0.1794	0.2149	0.74
29-2837	EL VADO DAM	NM	39	-106.7333	36.6000	6740	01/1923	12/2000	67	0.1782	0.2152	0.1699	0.29
29-2848	ELEPHANT BUTTE DAM	NM	59	-107.1833	33.1500	4576	08/1908	12/2000	83	0.2016	0.1851	0.1551	0.48
29-2854	ELIDA	NM	49	-103.6553	33.9494	4354	01/1910	11/2000	86	0.2320	0.2938	0.2200	0.41
29-2860	ELIZABETHTOWN	NM	39	-105.2833	36.6167	8474	01/1905	02/1948	41	0.1826	0.1170	0.0656	0.59
29-2865	ELK 2 E	NM	47	-105.3342	32.9442	5750	01/1948	12/2000	52	0.1911	0.1459	0.1616	0.51
29-2945	ENGLE	NM	59	-107.0333	33.1833	4774	12/1894	05/1961	41	0.2450	0.2861	0.3197	1.78
29-3031	ESPANOLA	NM	39	-106.0667	35.9833	5590	04/1895	12/1947	37	0.1817	0.0204	0.0588	2.11

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-3060	ESTANCIA 7 NE	NM	45	-105.9692	34.8433	6120	11/1904	12/2000	80	0.2100	0.2017	0.1434	0.24
29-3128	FARMINGTON FAA AIRPORT	NM	37	-108.2333	36.7500	5535	01/1948	12/1969	22	0.1869	0.1571	0.1789	0.51
29-3142	FARMINGTON AG SCIENCE CNT	NM	37	-108.2500	36.7000	5625	05/1978	12/2000	23	0.1543	0.0222	-0.0033	2.20
29-3157	FAYWOOD	NM	45	-107.8667	32.6333	5191	06/1946	12/2000	53	0.2275	0.1875	0.1660	0.61
29-3180	FENCE LAKE	NM	37	-108.6667	34.6500	7073	11/1933	12/2000	42	0.1560	0.0659	0.0548	1.45
29-3225	FLORIDA	NM	55	-107.4833	32.4333	4450	06/1929	05/1992	56	0.2271	0.1492	0.1037	0.07
29-3237	FLYING H	NM	47	-105.1000	33.0000	5305	03/1917	09/1978	49	0.2615	0.2973	0.2613	0.96
29-3260	FORREST	NM	49	-103.6000	34.8000	5003	11/1939	02/1961	21	0.2075	0.1517	0.2169	1.22
29-3265	FORT BAYARD	NM	45	-108.1517	32.7939	6142	02/1897	12/2000	103	0.1877	0.1547	0.1452	0.08
29-3288	FORT STANTON	NM	47	-105.5167	33.5000	6224	11/1896	11/1974	74	0.2002	0.1608	0.2151	0.79
29-3294	FORT SUMNER	NM	48	-104.2500	34.4667	4025	01/1915	12/1943	28	0.2010	0.0769	0.0188	2.09
29-3296	FORT SUMNER 5 S	NM	48	-104.2503	34.3942	4050	01/1948	12/2000	53	0.2679	0.2086	0.1036	0.25
29-3305	FORT WINGATE	NM	37	-108.5333	35.4667	7005	03/1897	07/1966	40	0.1889	0.1019	0.1670	1.05
29-3340	FRUITLAND 3 E	NM	37	-108.3500	36.7333	5220	01/1893	12/2000	81	0.2096	0.2119	0.1578	0.03
29-3368	GAGE 4 ESE	NM	55	-108.0167	32.2167	4410	06/1899	08/2000	99	0.2347	0.1991	0.1400	0.14
29-3422	GALLUP FAA AP	NM	37	-108.7922	35.5111	6466	01/1973	12/2000	28	0.2217	0.1584	0.0421	1.48
29-3425	GALLUP RANGER STN	NM	37	-108.5667	35.4500	7106	08/1943	01/1975	29	0.1887	0.2458	0.2342	0.94
29-3431	GAMERCO	NM	37	-108.7667	35.6000	6745	07/1922	05/1951	29	0.2448	0.1623	0.0696	1.73
29-3488	GASCON	NM	39	-105.4481	35.8917	8250	11/1953	12/2000	47	0.1623	0.3066	0.1916	2.81
29-3505	GAVILAN	NM	39	-106.9667	36.4333	7425	07/1929	01/1970	41	0.1914	0.2156	0.1226	0.43
29-3511	GHOST RANCH	NM	39	-106.4747	36.3297	6460	01/1942	12/2000	58	0.2011	0.2449	0.1788	0.12
29-3530	GILA HOT SPRINGS	NM	44	-108.2167	33.2000	5600	05/1957	12/2000	44	0.2116	0.2426	0.1540	0.58
29-3586	GLORIETA	NM	45	-105.7667	35.5833	7518	01/1949	12/2000	52	0.1809	0.2204	0.1095	1.08
29-3592	GOLDEN	NM	45	-106.2144	35.2656	6700	01/1944	12/2000	56	0.1839	0.1611	0.1384	0.14
29-3626	GOWER	NM	37	-108.7500	35.3333	7306	04/1919	12/1948	20	0.2660	0.0959	0.1330	3.80
29-3649	GRAN QUIVIRA NATL MON	NM	45	-106.0931	34.2594	6600	01/1929	12/2000	70	0.1823	0.1439	0.0908	0.56
29-3682	GRANTS AIRPORT	NM	45	-107.9022	35.1653	6520	06/1945	12/2000	55	0.1870	0.0545	0.0935	0.96
29-3775	HACHITA	NM	54	-108.3219	31.9142	4507	07/1909	12/2000	90	0.2466	0.2791	0.1837	0.10
29-3792	HAGERMAN	NM	48	-104.3333	33.1167	3422	08/1920	03/1960	29	0.2240	0.1366	0.1995	1.76
29-3855	HATCH 5 NW	NM	55	-107.2167	32.7167	4040	03/1894	12/1947	36	0.2161	0.1433	0.0980	0.15
29-3946	HERMANAS	NM	54	-107.9833	31.8500	4544	07/1909	12/1959	45	0.2689	0.3260	0.2845	1.94
29-3969	HICKMAN	NM	45	-107.9333	34.5167	7805	09/1943	01/1985	40	0.2168	0.2469	0.1650	0.48

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-4009	HILLSBORO	NM	45	-107.5628	32.9236	5270	01/1893	12/1947	33	0.2400	0.2230	0.1764	1.10
29-4026	HOBBS	NM	48	-103.1372	32.7119	3615	12/1912	12/2000	80	0.2792	0.2517	0.1404	0.34
29-4030	HOBBS 13 W	NM	48	-103.3528	32.7103	3805	01/1906	12/2000	82	0.2431	0.2271	0.1329	0.12
29-4101	HOOD RANGER STN	NM	44	-108.7833	33.7167	5833	12/1906	03/1954	40	0.1432	0.1509	0.1920	1.66
29-4112	HOPE	NM	48	-104.7333	32.8167	4091	08/1905	12/1945	27	0.2249	0.2838	0.1743	0.93
29-4306	IONE	NM	49	-103.3000	35.7500	4705	09/1910	03/1961	49	0.2445	0.2377	0.1486	0.29
29-4346	JAL	NM	56	-103.1869	32.1111	3060	03/1919	12/2000	68	0.2400	0.2333	0.1632	0.56
29-4369	JEMEZ SPRINGS	NM	45	-106.6872	35.7783	6262	05/1910	12/1951	41	0.1988	0.2174	0.1108	0.73
29-4375	JEWETT WORK CENTER	NM	44	-108.6333	33.9833	7405	06/1923	09/1967	43	0.1701	0.0857	0.1249	0.53
29-4398	JOHNSON RANCH	NM	45	-107.0833	35.9500	7203	06/1944	12/2000	56	0.2005	0.2484	0.2147	0.29
29-4426	JORNADA EXP RANGE	NM	55	-106.7333	32.6167	4266	06/1914	12/2000	84	0.2247	0.1157	0.1259	0.55
29-4461	KELLY RANCH	NM	45	-107.1250	34.0311	6699	10/1945	12/2000	55	0.1687	0.1618	0.1135	0.71
29-4506	KINGSTON RANGER STN	NM	45	-107.6833	32.9167	6043	12/1915	07/1953	36	0.1986	0.2783	0.1720	0.81
29-4719	LAGUNA	NM	45	-107.4000	35.0333	5800	04/1905	12/1955	31	0.2135	0.1939	0.2264	0.49
29-4742	LAKE MALOYA	NM	46	-104.3667	36.9833	7400	09/1942	12/2000	58	0.2180	0.1960	0.1309	1.24
29-4786	LANEY RANCH	NM	45	-107.6500	32.7333	5643	05/1905	09/1978	70	0.2280	0.2202	0.2405	0.91
29-4850	LAS VEGAS 2 NW	NM	47	-105.2667	35.6167	6604	12/1892	05/1983	88	0.1964	0.1943	0.1779	0.24
29-4856	LAS VEGAS FAA AIRPORT	NM	47	-105.1425	35.6542	6866	11/1940	12/2000	60	0.1898	0.1415	0.1637	0.58
29-4936	LEVY	NM	47	-104.6833	36.0833	6253	11/1908	03/1961	48	0.1999	0.2004	0.1957	0.23
29-4960	LINDRITH 3 NNW	NM	39	-107.0500	36.3333	7716	08/1971	12/2000	29	0.2098	0.1561	0.0706	0.62
29-5079	LORDSBURG 4 SE	NM	54	-108.6500	32.3000	4250	10/1892	12/2000	108	0.2128	0.2754	0.1944	1.70
29-5084	LOS ALAMOS	NM	45	-106.3167	35.8667	7424	11/1910	12/2000	83	0.1797	0.1936	0.1291	0.48
29-5150	LOS LUNAS 3 SSW	NM	45	-106.7500	34.7667	4840	12/1892	12/2000	102	0.2099	0.1126	0.1495	0.61
29-5199	LOVING	NM	48	-104.0833	32.2833	3022	11/1917	09/1949	32	0.2529	0.2484	0.1449	0.12
29-5273	LUNA R S	NM	44	-108.9417	33.8225	7050	03/1903	12/2000	95	0.1933	0.2141	0.2019	0.10
29-5290	LYBROOK	NM	37	-107.5667	36.2333	7150	05/1951	11/2000	47	0.2132	0.1287	0.0343	1.32
29-5353	MAGDALENA	NM	45	-107.2333	34.1167	6540	04/1905	10/1993	79	0.2103	0.1844	0.1047	0.60
29-5370	MALJAMAR 4 SE	NM	48	-103.7047	32.8233	4000	09/1942	09/2000	56	0.2420	0.2436	0.1335	0.29
29-5490	MAXWELL 3 NW	NM	46	-104.5667	36.5667	6019	04/1905	12/2000	79	0.2008	0.2401	0.1872	0.56
29-5502	MAYHILL RANGER STN	NM	45	-105.4667	32.9167	6565	02/1917	08/1976	60	0.1801	0.0616	0.1435	0.95
29-5516	MC CARTY RANCH	NM	49	-103.3667	35.6000	4411	10/1968	12/2000	32	0.1844	0.1901	0.1193	0.82
29-5560	MCGAFFEY 5 SE	NM	37	-108.4500	35.3333	8000	01/1949	12/2000	52	0.1770	0.1525	0.1713	0.71

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-5583	MC INTOSH 4 NW	NM	45	-106.0833	34.9167	6253	01/1928	08/1976	49	0.2228	0.2279	0.1828	0.41
29-5617	MELROSE	NM	49	-103.6167	34.4333	4598	07/1908	12/1947	34	0.1833	0.1376	0.1427	0.89
29-5657	MESCALERO	NM	45	-105.7833	33.1500	6716	06/1911	09/1978	66	0.1505	0.0631	0.1361	1.55
29-5685	MEXICAN SPRINGS	NM	37	-108.8333	35.8000	6444	05/1934	03/1972	35	0.2583	0.2863	0.1230	2.13
29-5691	MIAMI	NM	39	-104.7667	36.3500	6306	11/1907	11/1959	49	0.2111	0.2122	0.2508	1.14
29-5725	MILLS	NM	47	-104.2000	36.0667	6053	07/1915	01/1951	21	0.1714	0.1778	0.1655	0.93
29-5754	MIMBRES RANGER STN	NM	45	-108.0142	32.9325	6238	05/1905	12/1947	33	0.1996	0.1551	0.1279	0.15
29-5800	MOGOLLON	NM	44	-108.8000	33.4000	6568	04/1916	09/1951	21	0.2179	0.3867	0.1120	4.16
29-5874	MONTOYA 10 SE	NM	48	-103.9333	35.0000	4344	07/1909	07/1957	36	0.2420	0.3847	0.3730	3.23
29-5937	MOSQUERO 1 NE	NM	48	-103.9333	35.8000	5465	08/1926	12/2000	72	0.1941	0.1903	0.1325	1.31
29-5960	MOUNTAIN PARK	NM	45	-105.8167	32.9500	6780	10/1894	12/1947	31	0.2160	0.1312	0.2014	0.98
29-5965	MOUNTAINAIR	NM	45	-106.2500	34.5333	6499	05/1902	12/1947	39	0.1933	0.1550	0.1742	0.08
29-6028	NAMBE 1	NM	45	-105.9833	35.9000	6053	01/1947	09/1974	28	0.2028	0.1931	0.1648	0.03
29-6040	NARA VISA	NM	49	-103.1000	35.6167	4193	08/1905	09/1966	37	0.2946	0.3021	0.1049	3.51
29-6079	NETHERWOOD PARK	NM	45	-106.6167	35.1000	5135	05/1935	04/1957	22	0.2356	0.0745	0.0523	2.93
29-6098	NEWCOMB	NM	37	-108.7167	36.3000	5584	06/1948	04/1971	22	0.2457	0.1937	0.2465	1.70
29-6115	NEWKIRK	NM	48	-104.2500	35.0667	4563	03/1926	12/2000	72	0.2805	0.3103	0.2170	0.70
29-6275	OCATE 2 NW	NM	39	-105.0667	36.2000	7655	08/1960	12/2000	40	0.2043	0.2711	0.1652	0.55
29-6281	OCHOA	NM	56	-103.4253	32.1669	3460	02/1942	12/2000	55	0.2727	0.2629	0.2731	1.23
29-6321	OJO CALIENTE	NM	39	-106.0500	36.3000	6296	06/1944	03/1982	35	0.1999	0.2321	0.1484	0.21
29-6435	OROGRANDE	NM	55	-106.0911	32.3789	4182	12/1904	12/1947	40	0.2606	0.3079	0.3142	2.92
29-6465	OTIS	NM	37	-107.8667	36.3167	6880	04/1957	12/2000	43	0.1788	0.1866	0.0541	1.72
29-6492	OTTO FAA AIRPORT	NM	45	-106.0167	35.0833	6234	03/1909	10/1954	41	0.1857	0.1986	0.1246	0.45
29-6532	PALMA 2 NE	NM	47	-105.4500	35.0000	6453	05/1905	11/1968	50	0.2632	0.2650	0.1863	0.61
29-6619	PASAMONTE	NM	48	-103.7333	36.3000	5650	01/1910	02/1965	54	0.2732	0.3464	0.2514	1.05
29-6676	PECOS RANGER STN	NM	45	-105.6833	35.5833	6940	01/1916	12/2000	81	0.1510	0.0886	0.0850	1.47
29-6687	PEDERNAL 9 E	NM	47	-105.4739	34.6153	6150	01/1948	12/2000	53	0.2191	0.1379	0.1457	0.44
29-6705	PENASCO RANGER STN	NM	39	-105.6833	36.1667	7927	01/1929	02/1976	45	0.1852	0.2009	0.1494	0.14
29-6854	PINOS ALTOS	NM	45	-108.2167	32.8667	7005	07/1911	02/1973	61	0.2030	0.1589	0.1382	0.13
29-6900	PITT RANCH	NM	37	-108.0167	35.8000	6463	11/1942	03/1968	21	0.2670	0.3348	0.2878	1.65
29-7008	PORTALES	NM	49	-103.3519	34.1742	4010	01/1905	12/2000	89	0.2258	0.2672	0.1679	0.20
29-7014	PORTALES 7 WNW	NM	49	-103.4333	34.2333	4203	04/1934	09/1960	26	0.2093	0.2494	0.0966	1.11

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-7026	PORTER 2 E	NM	49	-103.2833	35.2333	4078	06/1923	04/1984	57	0.2117	0.1826	0.1325	0.13
29-7094	PROGRESSO	NM	45	-105.8833	34.4167	6297	07/1929	12/2000	70	0.2454	0.2922	0.2438	1.60
29-7168	QUAY 2 S	NM	49	-103.7500	34.9000	4304	05/1923	05/1959	34	0.1860	0.3608	0.3511	4.06
29-7180	QUEMADO RANGER STN	NM	37	-108.5000	34.3500	6878	07/1915	12/2000	68	0.2158	0.2555	0.1884	0.17
29-7226	RAGLAND 3 SSW	NM	49	-103.7492	34.7800	5060	02/1935	12/2000	64	0.1874	0.2122	0.1409	0.65
29-7254	RAMON 8 SW	NM	47	-105.0000	34.1500	5327	03/1957	12/2000	42	0.2232	0.2174	0.1978	0.06
29-7279	RATON FILTER PLANT	NM	46	-104.4325	36.9194	6932	03/1894	12/2000	101	0.2437	0.3633	0.2365	0.78
29-7323	RED RIVER	NM	39	-105.4036	36.7058	8676	06/1906	12/2000	93	0.1818	0.2397	0.1498	0.69
29-7340	REDROCK 1 NNE	NM	44	-108.7333	32.7000	4050	03/1905	12/2000	92	0.2126	0.2419	0.2187	0.48
29-7346	REGINA	NM	45	-106.9500	36.1833	7454	08/1914	08/1969	55	0.2065	0.2182	0.1973	0.11
29-7380	RENCONA	NM	47	-105.6000	35.2833	7005	12/1923	08/1962	32	0.2085	0.2442	0.1713	0.23
29-7423	RIENHARDT RANCH	NM	59	-107.2167	33.7500	5450	09/1951	12/2000	49	0.2149	0.0305	0.1106	1.35
29-7534	RODEO	NM	53	-109.0333	31.8333	4114	07/1909	04/1978	66	0.2061	0.1624	0.1736	0.40
29-7609	ROSWELL WSO AIRPORT	NM	48	-104.5333	33.4000	3629	01/1893	12/1972	79	0.2714	0.2801	0.1962	0.33
29-7610	ROSWELL FAA ARPT	NM	48	-104.5411	33.3081	3649	12/1946	12/2000	46	0.2784	0.2086	0.1026	0.44
29-7638	ROY	NM	47	-104.2000	35.9500	5878	10/1905	12/2000	91	0.2221	0.2589	0.1785	0.14
29-7649	RUIDOSO 2 NNE	NM	45	-105.6167	33.3833	6840	12/1941	12/2000	52	0.2035	0.3471	0.2871	1.86
29-7867	SAN JON	NM	49	-103.3289	35.1086	4230	06/1907	12/2000	93	0.2121	0.1901	0.1209	0.19
29-7918	SAN MATEO	NM	45	-107.6500	35.3333	7242	01/1940	02/1988	33	0.2074	0.1672	0.1654	0.12
29-7987	SANCHEZ	NM	47	-104.4333	35.6167	4905	06/1940	12/1959	20	0.2540	0.2257	0.1078	0.91
29-8011	SANDIA CREST	NM	45	-106.4500	35.2167	10686	02/1953	04/1979	25	0.1394	0.1572	0.0843	2.66
29-8072	SANTA FE	NM	45	-105.9000	35.6833	7205	10/1867	03/1972	103	0.1888	0.2477	0.2608	0.85
29-8085	SANTA FE 2	NM	45	-105.9753	35.6194	6718	04/1972	12/2000	29	0.1485	0.0176	0.1332	2.29
29-8107	SANTA ROSA	NM	47	-104.6833	34.9333	4600	06/1913	12/2000	87	0.2122	0.1552	0.1368	0.24
29-8187	SEDAN 7 NW	NM	49	-103.2167	36.2000	4774	03/1911	04/1960	49	0.2454	0.2506	0.2427	0.83
29-8284	SHIPROCK	NM	37	-108.6833	36.8000	4972	07/1926	12/2000	70	0.2640	0.2359	0.2437	1.71
29-8324	SILVER CITY	NM	45	-108.2667	32.7833	5920	04/1901	10/1964	54	0.2065	0.1945	0.1704	0.06
29-8387	SOCORRO	NM	59	-106.8797	34.0783	4585	01/1893	12/2000	104	0.2157	0.2085	0.1953	0.21
29-8501	SPRINGER	NM	47	-104.5936	36.3661	5922	01/1892	12/2000	104	0.2344	0.3092	0.2384	0.40
29-8518	STANLEY 1 NNE	NM	45	-105.9608	35.1672	6380	11/1954	12/2000	46	0.1875	0.1345	0.1956	0.43
29-8524	STAR LAKE	NM	45	-107.4667	35.9333	6644	01/1944	12/2000	50	0.1852	0.1667	0.1648	0.08
29-8596	SUMNER LAKE	NM	48	-104.3833	34.6000	4306	01/1948	12/2000	53	0.2335	0.1520	0.1550	0.60

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-8639	TAIBAN	NM	48	-104.0167	34.4500	4134	01/1948	06/1977	29	0.3392	0.3132	0.1166	3.12
29-8668	TAOS	NM	39	-105.5864	36.3906	6965	12/1892	12/2000	100	0.1896	0.1926	0.1478	0.05
29-8713	TATUM	NM	49	-103.3167	33.2667	4100	06/1919	12/2000	76	0.2548	0.3067	0.2295	0.86
29-8845	TIERRA AMARILLA 4 NNW	NM	39	-106.5667	36.7500	7425	09/1927	12/2000	68	0.1843	0.2295	0.1800	0.22
29-8873	TIJERAS RANGER STN	NM	45	-106.3833	35.0667	6306	04/1910	05/1962	48	0.1791	0.2262	0.1378	0.79
29-8888	TINNIE	NM	47	-105.1333	33.3500	5043	05/1951	10/1979	28	0.2823	0.3640	0.3184	2.43
29-8919	TOHATCHI 1 ESE	NM	37	-108.7333	35.8500	6424	07/1914	04/1979	57	0.2213	0.1783	0.1599	0.16
29-9085	TRES PIEDRAS	NM	39	-105.9833	36.6667	8139	04/1905	12/2000	93	0.1994	0.1833	0.1352	0.05
29-9113	TRUCHAS	NM	39	-105.8167	36.0333	8035	04/1909	05/1962	53	0.2334	0.2011	0.0722	1.34
29-9125	TRUJILLO	NM	47	-104.7000	35.5333	6463	06/1915	04/1957	30	0.2602	0.3328	0.2947	1.34
29-9128	TRUTH OR CONSEQUENCES	NM	59	-107.2167	33.1500	4382	05/1949	12/2000	26	0.2617	0.0575	0.0624	1.67
29-9129	TRUTH OR CONSEQUENCES FAA	NM	59	-107.2667	33.2333	4826	05/1950	04/1990	30	0.2457	0.1414	0.2429	1.11
29-9153	TUCUMCARI FAA AIRPORT	NM	49	-103.6000	35.1833	4051	01/1948	09/1982	28	0.2179	0.1787	0.1230	0.16
29-9156	TUCUMCARI 4 NE	NM	49	-103.6833	35.2000	4086	12/1904	12/2000	96	0.2032	0.2459	0.1327	0.57
29-9165	TULAROSA	NM	45	-106.0417	33.0719	4430	07/1909	12/2000	86	0.2343	0.2915	0.2363	1.11
29-9193	TURQUOISE BONANZA CREEK	NM	45	-106.1000	35.5500	6124	01/1954	02/1996	42	0.2178	0.1963	0.1040	0.85
29-9245	UNION VALLEY	NM	49	-103.6333	33.7667	4505	06/1923	08/1958	33	0.2406	0.0672	0.1218	2.12
29-9330	VALMORA	NM	47	-104.9333	35.8167	6312	01/1917	12/2000	82	0.2223	0.3070	0.2090	0.48
29-9405	VAUGHN	NM	47	-105.2000	34.6000	5974	07/1909	08/1981	65	0.2213	0.3541	0.2443	1.07
29-9496	VILLANUEVA	NM	47	-105.3500	35.2667	5765	01/1942	12/2000	50	0.2685	0.0466	0.1598	5.07
29-9508	VIRDEN	NM	44	-108.9833	32.6833	3783	12/1940	09/1974	30	0.1562	0.1231	0.0936	0.78
29-9686	WHITE SANDS NATL MON	NM	55	-106.1747	32.7817	3995	01/1939	12/2000	62	0.2066	0.2120	0.2239	1.05
29-9691	WHITE SIGNAL	NM	44	-108.3667	32.5500	6068	11/1942	12/2000	53	0.1495	0.1077	0.0872	1.07
29-9697	WHITETAIL	NM	45	-105.5500	33.2333	7454	10/1914	02/1959	35	0.1991	0.2325	0.3778	4.16
29-9806	WINSTON	NM	45	-107.6500	33.3500	6196	05/1949	12/2000	52	0.1840	0.0386	0.0371	1.63
29-9820	WOLF CANYON	NM	45	-106.7469	35.9478	8220	06/1951	12/2000	50	0.1933	0.2395	0.1919	0.27
29-9851	YESO 2 S	NM	47	-104.6128	34.4031	4850	01/1942	12/2000	59	0.2584	0.1740	0.1527	0.94
29-9882	YORK RANCH	NM	44	-108.3333	33.8000	6804	01/1948	11/1974	24	0.2069	0.2232	0.2397	0.46
29-9897	ZUNI CAA	NM	37	-108.7833	35.1000	6440	06/1908	12/2000	89	0.2011	0.2027	0.1714	0.07
34-0908	BOISE CITY	OK	50	-102.5167	36.7333	4173	01/1908	12/2000	76	0.2071	0.2043	0.1186	0.42
34-4766	KENTON	OK	49	-102.9667	36.9000	4350	11/1900	12/2000	94	0.2367	0.2895	0.1895	0.35

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
34-7534	REGNIER	OK	50	-102.6333	36.9333	4020	01/1942	12/2000	59	0.2160	0.1727	0.1261	0.57
35-0036	ADEL	OR	3	-119.8961	42.1761	4583	03/1956	12/2000	34	0.1816	0.0435	0.2631	3.00
35-0118	ALKALI LAKE	OR	2	-119.9933	42.9694	4332	04/1961	12/2000	38	0.2599	0.1583	0.0818	1.49
35-0188	ANDREWS	OR	3	-118.6167	42.4333	4104	09/1915	11/1959	26	0.1834	0.1342	0.0897	0.75
35-0189	ANDREWS WESTON MINE	OR	3	-118.5500	42.5500	4779	08/1969	03/1993	23	0.2063	0.2764	0.0769	1.51
35-1174	BURNS JUNCTION	OR	4	-117.8525	42.7772	3930	11/1972	08/1999	26	0.2494	0.2645	0.1756	1.26
35-2018	DAIRY 4 NNE YONNA	OR	1	-121.4667	42.2667	4154	08/1907	02/1953	41	0.2137	0.3451	0.2436	1.29
35-2135	DANNER	OR	4	-117.3389	42.9467	4225	06/1929	12/2000	68	0.2080	0.2146	0.1737	0.04
35-3232	GERBER DAM	OR	1	-121.1314	42.2050	4850	11/1925	10/1956	30	0.1617	0.3498	0.3002	2.46
35-3692	HART MOUNTAIN REFUGE	OR	3	-119.6556	42.5483	5616	05/1939	12/2000	62	0.2307	0.2689	0.2120	0.24
35-4670	LAKEVIEW 2 NNW	OR	2	-120.3636	42.2139	4778	06/1887	12/2000	105	0.1776	0.2521	0.2282	0.95
35-5174	MALIN 5 E	OR	1	-121.3186	42.0078	4627	11/1968	12/2000	32	0.1773	0.1448	0.1400	0.24
35-5335	MC DERMITT 26 N	OR	4	-117.8631	42.4108	4464	11/1955	12/2000	44	0.2240	0.1972	0.1466	0.49
35-6426	PAISLEY	OR	2	-120.5403	42.6922	4360	01/1892	12/2000	91	0.2326	0.2446	0.1772	0.11
35-6853	P RANCH REFUGE	OR	3	-118.8875	42.8269	4195	01/1942	12/2000	57	0.2035	0.3227	0.2129	0.88
35-7310	ROME 2 NW	OR	4	-117.6578	42.8586	3405	12/1950	12/2000	48	0.2212	0.1654	0.1372	0.74
35-7354	ROUND GROVE	OR	1	-120.8894	42.3414	4888	03/1920	12/1998	67	0.1757	0.1496	0.1687	0.97
35-8007	SPRAGUE RIVER 2 SE	OR	1	-121.4892	42.4306	4483	05/1953	12/2000	47	0.1656	0.0126	0.0114	1.39
35-8173	SUMMER LAKE 1 S	OR	2	-120.7897	42.9592	4192	03/1957	12/2000	44	0.2547	0.2514	0.2018	0.15
35-8812	VALLEY FALLS	OR	2	-120.2822	42.4844	4325	05/1910	12/2000	70	0.2535	0.1296	0.1544	1.46
35-9290	WHITEHORSE RANCH	OR	4	-118.2297	42.3383	4380	04/1959	12/1998	38	0.2574	0.2607	0.1180	2.02
41-0248	ANDREWS	TX	56	-102.5500	32.3167	3412	01/1949	12/2000	42	0.2422	0.2410	0.1690	0.52
41-1000	BOYS RANCH	TX	50	-102.2556	35.5303	3191	07/1964	12/2000	23	0.1912	0.0976	0.2122	1.33
41-1128	BROWNFIELD 2	TX	49	-102.2608	33.1800	3300	03/1914	12/2000	84	0.2246	0.1608	0.1677	0.38
41-1185	BUENAVISTA 2 NNW	TX	56	-102.6667	31.2500	2513	06/1912	09/1951	23	0.2561	0.3882	0.2958	2.01
41-1224	BUNKER HILL	TX	49	-102.9333	36.1500	4348	01/1941	07/1990	45	0.2353	0.1575	0.0519	1.22
41-1649	CHANNING 2	TX	50	-102.3317	35.6867	3790	05/1967	12/2000	24	0.1823	0.1622	0.1743	0.60
41-1874	COLDWATER	TX	50	-102.5667	36.4000	4134	03/1941	10/1983	39	0.2321	0.3557	0.2336	1.06
41-1946	CONLEN	TX	50	-102.2333	36.2333	3820	01/1941	12/2000	58	0.2132	0.2393	0.1775	0.10
41-2012	CORNUDAS SERVICE STN	TX	55	-105.4667	31.7833	4480	06/1940	12/2000	59	0.2502	0.2193	0.2408	1.51
41-2082	CRANE 2 E	TX	56	-102.3122	31.4011	2630	05/1928	12/2000	46	0.2510	0.2625	0.2232	0.06
41-2240	DALHART FAA AIRPORT	TX	50	-102.5472	36.0233	3990	11/1905	12/2000	93	0.1918	0.2390	0.1891	1.00

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
41-2354	DELL CITY	TX	55	-105.2000	31.9333	3704	07/1979	12/2000	22	0.2336	0.1888	0.1086	0.25
41-2463	DIMMITT 6 E	TX	50	-102.2167	34.5500	3812	01/1923	06/1985	61	0.1889	0.0866	0.1259	0.79
41-2464	DIMMITT 2 N	TX	50	-102.3111	34.5925	3850	05/1959	12/2000	42	0.2202	0.2088	0.1740	0.13
41-2797	EL PASO WSO AP	TX	55	-106.3758	31.8111	3918	07/1947	12/2000	54	0.1951	0.0674	0.0528	1.04
41-3033	FABENS 1	TX	57	-106.1500	31.5000	3612	04/1939	09/1977	38	0.3061	0.2088	0.1380	0.44
41-3266	FORT HANCOCK 8 SSE	TX	57	-105.7414	31.1853	3905	07/1966	12/2000	32	0.3484	0.4498	0.2507	1.53
41-3368	FRIONA	TX	49	-102.7111	34.6425	4010	11/1927	12/2000	64	0.1964	0.1853	0.1180	0.46
41-3557	GIRVIN	TX	56	-102.4000	31.0667	2313	09/1947	04/1979	30	0.2428	0.3160	0.3217	1.50
41-3680	GRANDFALLS 3 SSE	TX	56	-102.8333	31.3000	2440	02/1909	07/1999	76	0.2270	0.1883	0.1675	0.49
41-3972	HART	TX	50	-102.0903	34.3653	3640	01/1947	12/2000	45	0.2183	0.1866	0.2095	0.32
41-3981	HARTLEY 4 ESE	TX	50	-102.3333	35.8667	3905	01/1941	12/2000	56	0.1860	0.1886	0.2180	0.92
41-4098	HEREFORD	TX	50	-102.4000	34.8167	3820	01/1937	12/2000	63	0.2129	0.1785	0.1964	0.22
41-4425	IMPERIAL	TX	56	-102.7000	31.2667	2400	06/1940	09/1993	50	0.2553	0.1617	0.1743	0.99
41-4767	KENT 5 E	TX	55	-104.1500	31.0667	4183	01/1893	04/1976	37	0.1967	0.1418	0.1078	0.82
41-4931	LA TUNA 1 S	TX	55	-106.6000	31.9667	3800	03/1943	12/2000	58	0.2236	0.2130	0.1079	1.09
41-5183	LEVELLAND	TX	49	-102.3828	33.5869	3550	02/1926	12/2000	61	0.2183	0.0526	0.0547	1.86
41-5265	LITTLEFIELD 2 NW	TX	49	-102.3447	33.9375	3505	01/1928	12/2000	71	0.2141	0.2902	0.1459	0.82
41-5351	LOOP	TX	49	-102.4167	32.9000	3245	01/1941	07/1995	47	0.2398	0.3213	0.2998	1.67
41-5707	MCCAMEY	TX	56	-102.1933	31.1367	2450	02/1932	12/2000	69	0.2637	0.4069	0.3557	2.43
41-5828	MENTONE 2 S	TX	56	-103.6000	31.6833	2703	08/1943	01/1974	26	0.2910	0.2214	0.1415	0.98
41-5890	MIDLAND WSO AP	TX	56	-102.1906	31.9431	2862	02/1948	12/2000	53	0.2323	0.1956	0.1878	0.35
41-5891	MIDLAND 4 ENE	TX	56	-102.0167	32.0167	2743	04/1894	12/2000	90	0.2491	0.3173	0.2970	0.87
41-5999	MONAHANS	TX	56	-102.9119	31.5414	2585	06/1959	09/2000	41	0.2276	0.1656	0.1454	0.66
41-6074	MORTON	TX	49	-102.7586	33.7186	3760	05/1935	12/2000	56	0.2224	0.2005	0.1142	0.23
41-6135	MULESHOE 1	TX	49	-102.7339	34.2286	3825	08/1921	09/2000	79	0.1966	0.2443	0.2128	0.56
41-6137	MULESHOE NATL WDLF REF	TX	49	-102.7783	33.9544	3740	02/1980	12/2000	21	0.2000	0.2222	0.0980	0.90
41-6502	ODESSA	TX	56	-102.3944	31.8797	2910	09/1950	12/2000	48	0.2334	0.2616	0.1401	2.53
41-6644	OLTON	TX	50	-102.1356	34.1861	3610	04/1928	12/2000	51	0.2372	0.3160	0.2949	0.61
41-6892	PECOS	TX	56	-103.5000	31.4167	2610	01/1934	08/2000	67	0.2664	0.2245	0.1336	0.73
41-6932	PENWELL	TX	56	-102.5892	31.7353	2940	09/1943	12/2000	55	0.2269	0.2171	0.1830	0.46
41-7044	PINE SPRINGS	TX	55	-104.7833	31.9167	5634	01/1939	12/2000	21	0.2126	0.1014	0.0648	0.44
41-7074	PLAINS	TX	49	-102.8286	33.1875	3675	01/1925	12/2000	64	0.2611	0.3329	0.2869	1.86

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
41-7481	RED BLUFF DAM	TX	56	-103.9294	31.9061	2800	10/1939	11/2000	53	0.3084	0.3207	0.2005	1.51
41-7730	ROMERO	TX	49	-102.9167	35.7167	4062	02/1910	04/1936	21	0.3052	0.2553	0.2053	3.36
41-7920	SALT FLAT	TX	55	-105.0803	31.7456	3722	10/1978	08/1998	20	0.2004	0.2166	0.2714	1.91
41-8201	SEMINOLE	TX	49	-102.5425	32.7139	3340	08/1922	12/2000	75	0.2364	0.2066	0.2154	0.59
41-8305	SIERRA BLANCA 2 E	TX	57	-105.3233	31.1850	4535	01/1962	12/2000	38	0.2440	0.1493	0.1493	0.51
41-8435	SOCORRO	TX	57	-106.2833	31.6500	3661	04/1918	10/1950	31	0.3060	0.2204	0.0878	1.20
41-8692	STRATFORD	TX	50	-102.0833	36.3500	3691	07/1911	12/2000	77	0.1862	0.1108	0.1399	0.48
41-8852	TASCOSA	TX	50	-102.3000	35.5667	3412	01/1941	07/1984	40	0.1749	0.0959	-0.0065	2.30
41-9088	TORNILLO 2 SSE	TX	57	-106.0581	31.4028	3525	01/1981	12/2000	20	0.2166	0.1890	0.2174	0.94
41-9106	TOYAH	TX	56	-103.8000	31.3000	2812	08/1943	02/1977	30	0.3196	0.2850	0.1811	1.88
41-9224	UMBARGER	TX	50	-102.1000	34.9500	3746	01/1941	12/2000	59	0.2473	0.2457	0.1095	2.16
41-9295	VAN HORN	TX	57	-104.8369	31.0417	3955	01/1939	12/2000	60	0.2837	0.3981	0.2944	1.08
41-9330	VEGA	TX	50	-102.4167	35.2500	4012	03/1923	04/1983	60	0.1880	0.2337	0.2532	1.74
41-9830	WINK FAA AIRPORT	TX	56	-103.2014	31.7797	2807	06/1938	12/2000	58	0.2645	0.1990	0.1999	0.68
41-9966	YSLETA	TX	57	-106.3167	31.7000	3670	02/1939	12/2000	62	0.2488	0.2622	0.1645	1.14
42-0050	ALLEN'S RANCH	UT	15	-109.1528	40.8997	5490	08/1962	12/2000	36	0.2323	0.2011	0.1440	0.95
42-0061	ALPINE	UT	14	-111.7708	40.4522	5070	05/1899	12/2000	94	0.1779	0.1722	0.1459	0.13
42-0072	ALTA	UT	14	-111.6367	40.5917	8730	01/1945	12/2000	47	0.1663	0.1650	0.0741	1.02
42-0074	ALTAMONT	UT	15	-110.2878	40.3561	6370	09/1948	09/1999	50	0.1835	0.1971	0.1700	0.11
42-0086	ALTON	UT	23	-112.4833	37.4333	7040	05/1915	12/2000	86	0.1936	0.2545	0.1731	0.78
42-0113	ALUNITE	UT	22	-112.2667	38.3667	6745	04/1917	07/1953	37	0.1728	0.0587	0.2105	3.69
42-0157	ANETH PLANT	UT	37	-109.3292	37.2558	4576	01/1961	12/2000	37	0.2107	0.2349	0.1757	0.09
42-0168	ANGLE	UT	22	-111.9603	38.2492	6400	07/1981	12/2000	20	0.1614	0.2055	0.1641	0.30
42-0194	ANTELOPE ISLAND	UT	12	-112.1667	40.9333	4232	09/1952	08/1972	20	0.2393	0.4079	0.3082	1.99
42-0336	ARCHES NP HQS	UT	25	-109.6192	38.6172	4130	06/1980	12/2000	21	0.1537	0.0936	0.1930	0.77
42-0449	BARTHOLOMEW POWERHOUSE	UT	13	-111.5000	40.1667	5139	09/1956	09/1994	38	0.1562	0.0721	0.1041	0.59
42-0490	BEAR RIVER BAY	UT	12	-112.2667	41.3000	4210	05/1969	04/1996	26	0.2411	0.4204	0.2881	2.00
42-0506	BEAR RIVER REFUGE	UT	6	-112.2667	41.4667	4213	08/1937	02/1984	46	0.1865	0.2424	0.2917	1.50
42-0519	BEAVER	UT	22	-112.6500	38.3000	5940	04/1893	05/1990	83	0.1992	0.2364	0.2179	0.40
42-0527	BEAVER CANYON PH	UT	22	-112.4814	38.2681	7275	08/1939	12/2000	61	0.1766	0.1915	0.1541	0.14
42-0617	BENMORE	UT	13	-112.4167	40.0333	5955	08/1911	08/1953	41	0.1939	0.0849	0.2046	1.67
42-0699	BINGHAM CANYON	UT	13	-112.1500	40.5333	6106	12/1940	10/1974	33	0.1643	0.0505	0.1075	0.76

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-0716	BIRDSEYE	UT	13	-111.5333	39.8667	5719	10/1933	04/1992	49	0.1787	0.2383	0.1855	0.26
42-0730	BLACK ROCK	UT	12	-112.9533	38.7086	4895	10/1900	12/2000	77	0.2007	0.2177	0.2373	0.88
42-0738	BLANDING	UT	37	-109.4794	37.6131	6040	12/1904	12/2000	94	0.2160	0.2968	0.2684	0.85
42-0757	BLOWHARD MTN RADAR	UT	22	-112.8639	37.5928	10694	08/1964	12/2000	36	0.1436	0.2116	0.1668	1.00
42-0788	BLUFF	UT	37	-109.5664	37.2839	4355	06/1911	12/2000	80	0.2498	0.3645	0.3015	1.53
42-0802	BONANZA	UT	15	-109.1833	40.0167	5450	03/1938	02/1993	49	0.1787	0.2085	0.1537	0.20
42-0820	BOUNTIFUL-VAL VERDA	UT	14	-111.8900	40.8544	4540	04/1981	12/2000	20	0.1591	0.1765	0.1953	0.45
42-0849	BOULDER	UT	24	-111.4197	37.9053	6680	06/1954	12/2000	47	0.2094	0.1899	0.0709	1.59
42-0924	BRIGHAM CITY	UT	6	-112.0333	41.4833	4344	03/1899	05/1974	61	0.1525	0.1592	0.0982	1.40
42-0928	BRIGHAM CITY WASTE PLT	UT	6	-112.0436	41.5239	4230	06/1974	12/2000	27	0.2026	0.2094	0.2527	1.10
42-1002	BRYCE CANYON FAA AIRPORT	UT	23	-112.1500	37.7000	7587	11/1948	05/1983	34	0.2202	0.1545	0.1192	1.00
42-1008	BRYCE CANYON NATL PK HDQ	UT	23	-112.1689	37.6411	7915	04/1933	12/2000	68	0.2307	0.2324	0.1514	0.91
42-1020	BULLFROG BASIN	UT	24	-110.7167	37.5333	3822	03/1967	12/2000	27	0.2326	0.2537	0.1935	0.17
42-1144	CALLAO	UT	11	-113.7117	39.8994	4330	01/1938	12/2000	61	0.2162	0.2313	0.1928	0.06
42-1163	CANYONLANDS THE NECK	UT	25	-109.8200	38.4469	5930	06/1965	12/2000	36	0.1739	0.2435	0.2260	0.28
42-1168	CANYONLANDS THE NEEDLE	UT	25	-109.7822	38.1506	4998	06/1965	12/2000	36	0.1507	0.0209	0.1376	1.14
42-1171	CAPITOL REEF NATL PARK	UT	24	-111.2622	38.2917	5500	08/1938	12/2000	63	0.2217	0.2197	0.1478	0.35
42-1214	CASTLE DALE	UT	25	-111.0122	39.2078	5620	03/1899	12/2000	95	0.1824	0.1654	0.1023	0.13
42-1216	CASTLEDALE HUNTER UP&L	UT	25	-111.0322	39.1761	5660	05/1980	12/2000	21	0.1904	0.1893	0.0719	0.51
42-1222	CASTLE ROCK	UT	15	-111.1667	41.1333	6453	05/1904	11/1961	30	0.1914	0.2659	0.1189	1.21
42-1241	CASTLE VALLEY INSTITUTE	UT	26	-109.3986	38.6514	4725	08/1978	12/2000	21	0.1589	0.2249	0.1278	1.16
42-1267	CEDAR CITY AP	UT	22	-113.0972	37.7017	5587	07/1948	12/2000	53	0.1900	0.1736	0.1797	0.18
42-1272	CEDAR CITY POWERHOUSE	UT	22	-113.0833	37.6833	5682	11/1905	12/1961	55	0.2022	0.2225	0.1729	0.49
42-1273	CEDAR CITY STEAM PLANT	UT	22	-113.0333	37.6667	6004	12/1961	02/1983	21	0.1441	0.1153	0.1685	1.54
42-1308	CEDAR POINT	UT	37	-109.0833	37.7167	6760	04/1946	12/2000	55	0.2258	0.2921	0.2172	0.41
42-1432	CIRCLEVILLE	UT	22	-112.2786	38.1706	6050	10/1941	12/2000	56	0.2064	0.3124	0.2644	1.46
42-1440	CISCO	UT	25	-109.3167	38.9667	4334	01/1893	06/1967	27	0.2040	0.1008	0.0826	0.68
42-1446	CITY CREEK WATER PLANT	UT	14	-111.8353	40.8164	5330	08/1915	12/2000	84	0.1534	0.1571	0.0748	1.00
42-1472	CLEAR CREEK	UT	25	-111.1500	39.6500	8307	01/1936	12/1967	32	0.1871	0.2591	0.0567	1.51
42-1500	CLEAR LAKE REFUGE	UT	12	-112.6167	39.1000	4603	10/1963	05/1984	20	0.2148	0.0502	0.1081	1.36
42-1588	COALVILLE	UT	15	-111.3983	40.9139	5550	01/1930	12/2000	71	0.1743	0.2239	0.2344	0.58
42-1590	COALVILLE 13 E	UT	15	-111.1492	40.9383	6510	10/1974	12/2000	20	0.1938	0.1725	0.1643	0.28

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-1685	CONRAD RANCH	UT	15	-111.5167	40.3333	5639	02/1963	11/1989	27	0.2163	0.2816	0.2149	0.25
42-1731	CORINNE	UT	6	-112.1064	41.5472	4220	03/1896	07/1998	99	0.1792	0.1995	0.1372	0.41
42-1759	COTTONWOOD WEIR	UT	14	-111.7833	40.6189	4960	05/1917	12/2000	83	0.1740	0.2061	0.2134	0.52
42-1792	COVE FORT	UT	22	-112.5833	38.6000	5994	10/1941	03/1980	37	0.2211	0.3387	0.2579	2.22
42-1918	CUTLER DAM UTAH P&L CO	UT	6	-112.0558	41.8328	4290	04/1980	12/2000	21	0.1560	0.1902	0.3164	3.43
42-2057	DEER CREEK DAM	UT	15	-111.5333	40.4000	5270	03/1939	12/2000	62	0.2388	0.3193	0.2737	1.25
42-2090	DELTA FAA AIRPORT	UT	12	-112.5167	39.3833	4764	06/1938	12/2000	61	0.2282	0.2792	0.1850	0.66
42-2101	DESERET	UT	12	-112.6517	39.2869	4590	01/1893	12/2000	104	0.1891	0.1786	0.1834	0.24
42-2116	DESERT EXP RANGE	UT	12	-113.7500	38.6000	5249	01/1950	09/1984	35	0.1874	0.1865	0.2129	0.78
42-2150	DEWEY	UT	26	-109.2997	38.8128	4120	10/1967	12/2000	33	0.1385	0.1497	0.2432	3.26
42-2173	DINOSAUR NM QUARRY AREA	UT	15	-109.3033	40.4356	4770	04/1958	12/2000	43	0.1995	0.1779	0.0777	1.03
42-2253	DUCHESNE	UT	15	-110.4000	40.1667	5520	04/1906	12/2000	88	0.1909	0.2164	0.1779	0.02
42-2257	DUGWAY	UT	12	-112.9192	40.1819	4340	09/1950	12/2000	50	0.1881	0.1377	0.1235	0.19
42-2385	ECHO DAM	UT	15	-111.4333	40.9667	5470	02/1940	12/2000	61	0.1570	0.1361	0.1395	0.92
42-2418	ELBERTA	UT	13	-111.9500	39.9500	4690	01/1902	08/1992	88	0.2006	0.1593	0.1720	0.73
42-2424	ELECTRIC LAKE U P & L	UT	25	-111.2167	39.6000	8380	05/1980	12/2000	20	0.1543	0.2916	0.0664	2.98
42-2429	ELKHORN ASHLEY RNGR STN	UT	15	-109.9500	40.5500	6810	01/1910	04/1956	44	0.2432	0.2584	0.1477	1.26
42-2484	EMERY	UT	24	-111.2500	38.9167	6253	01/1901	04/1978	72	0.2181	0.2638	0.2537	0.84
42-2558	ENTERPRISE	UT	12	-113.7089	37.5728	5320	07/1905	12/2000	63	0.1951	0.2215	0.1701	0.20
42-2561	ENTERPRISE AIRPORT	UT	12	-113.6500	37.6833	5203	09/1940	12/2000	53	0.2157	0.2082	0.2018	0.19
42-2578	EPHRAIM SORENSENS FLD	UT	13	-111.5858	39.3706	5510	09/1949	12/2000	51	0.1772	0.2553	0.2871	1.19
42-2592	ESCALANTE	UT	24	-111.5978	37.7683	5810	05/1901	12/2000	95	0.2238	0.2132	0.1847	0.20
42-2607	ESKDALE	UT	11	-113.9539	39.1089	4980	03/1966	12/2000	35	0.2571	0.2314	0.2352	1.07
42-2625	EUREKA	UT	13	-112.1167	39.9500	6480	03/1930	07/1984	52	0.2080	0.2614	0.2373	0.99
42-2696	FAIRFIELD	UT	13	-112.0906	40.2622	4880	10/1950	12/2000	47	0.1930	0.2337	0.1390	0.74
42-2702	FAIRVIEW 8 N	UT	13	-111.4139	39.7450	6750	05/1975	12/2000	26	0.1763	0.2915	0.1932	0.87
42-2721	FARMINGTON	UT	14	-111.9000	40.9833	4272	01/1893	05/1965	65	0.1713	0.2068	0.1478	0.12
42-2726	FARMINGTON USU FLD STN	UT	14	-111.9167	41.0167	4340	07/1948	12/2000	40	0.1458	0.2339	0.1725	0.75
42-2798	FERRON	UT	25	-111.1322	39.0872	5930	07/1948	12/2000	53	0.1935	0.2299	0.1680	0.21
42-2828	FILLMORE	UT	22	-112.3283	38.9661	5120	01/1893	12/2000	108	0.1610	0.1783	0.1466	0.37
42-2852	FISH SPRINGS REFUGE	UT	12	-113.3981	39.8397	4335	06/1960	12/2000	41	0.2114	0.1800	0.1931	0.25
42-2864	FLAMING GORGE	UT	15	-109.4117	40.9317	6270	12/1957	12/2000	43	0.2213	0.2635	0.1828	0.31

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-2996	FORT DUCHESNE	UT	15	-109.8611	40.2844	5050	01/1902	12/2000	98	0.2548	0.2713	0.2539	2.03
42-3056	FRUITLAND	UT	15	-110.8500	40.2167	6624	06/1910	02/1966	36	0.2322	0.2352	0.1211	1.12
42-3097	GARFIELD	UT	13	-112.1983	40.7231	4330	12/1950	12/2000	50	0.2079	0.2278	0.2318	1.00
42-3138	GARRISON	UT	11	-114.0333	38.9333	5260	01/1903	07/1990	53	0.1954	0.1240	0.1897	0.44
42-3260	GOLD HILL	UT	11	-113.8333	40.1667	5250	05/1966	07/1990	24	0.3004	0.3699	0.1906	2.88
42-3320	GOVERNMENT CREEK	UT	13	-112.6667	40.0500	5282	12/1900	05/1950	49	0.1631	0.1268	0.1207	0.29
42-3348	GRANTSVILLE 2 W	UT	13	-112.5056	40.6025	4480	01/1906	12/2000	70	0.1601	0.1883	0.2373	0.48
42-3418	GREEN RIVER AVIATION	UT	24	-110.1544	38.9906	4070	07/1948	12/2000	51	0.2609	0.2672	0.1959	0.18
42-3486	GROUSE CREEK	UT	4	-113.8844	41.7086	5320	04/1959	12/2000	40	0.2221	0.3410	0.2319	1.06
42-3506	GUNLOCK POWERHOUSE	UT	21	-113.7283	37.2806	4110	01/1930	12/2000	71	0.1717	0.1599	0.1400	0.84
42-3514	GUNNISON SUGAR FACTORY	UT	13	-111.8167	39.1167	5125	03/1956	04/1990	33	0.1760	-0.0430	0.1368	2.97
42-3600	HANS FLAT RANGER STN	UT	25	-110.1800	38.2553	6600	10/1980	12/2000	20	0.1721	0.0937	0.0892	0.24
42-3611	HANKSVILLE	UT	24	-110.7153	38.3706	4308	03/1910	12/2000	88	0.2176	0.1475	0.1363	0.66
42-3624	HANNA	UT	15	-110.7594	40.4000	6745	06/1952	05/1994	38	0.1623	0.1973	0.1300	0.74
42-3671	HARDWARE RANCH	UT	6	-111.5667	41.6000	5560	01/1956	02/1991	34	0.1872	0.1925	0.2022	0.15
42-3776	HATCH	UT	22	-112.4328	37.6475	6890	06/1915	12/2000	79	0.2030	0.1181	0.1002	1.83
42-3809	HEBER	UT	15	-111.4156	40.4922	5630	01/1893	12/2000	108	0.1806	0.2709	0.2359	0.42
42-3836	HELPER CARBON U P & L	UT	25	-110.8661	39.7272	6100	05/1980	12/2000	20	0.1813	0.1204	0.0908	0.16
42-3896	HIAWATHA	UT	25	-111.0167	39.4833	7282	11/1916	07/1992	72	0.1789	0.0933	0.1257	0.23
42-3976	HITE MARINA	UT	24	-110.4000	37.8667	3691	02/1900	01/1978	36	0.2937	0.1717	0.1764	2.79
42-4100	HOVENWEEP NM	UT	37	-109.0794	37.3867	5240	04/1957	12/2000	44	0.1771	0.3055	0.2225	2.16
42-4135	HUNTSVILLE MONASTERY	UT	14	-111.7114	41.2400	5140	11/1976	12/2000	24	0.1749	0.2692	0.1563	0.91
42-4174	IBAPAH	UT	11	-113.9883	40.0378	5280	01/1903	12/2000	87	0.2069	0.2609	0.2053	0.35
42-4342	JENSEN	UT	15	-109.3450	40.3642	4750	03/1925	12/2000	74	0.1965	0.1699	0.1736	0.40
42-4362	JOHNSON PASS	UT	13	-112.6114	40.3375	5630	11/1972	12/2000	28	0.1375	0.1910	0.0941	2.12
42-4467	KAMAS 3 NW	UT	15	-111.3167	40.6667	6410	10/1948	12/2000	50	0.2169	0.3369	0.3392	2.05
42-4508	KANAB	UT	23	-112.5247	37.0375	4940	12/1899	12/2000	92	0.1980	0.2155	0.1432	0.32
42-4527	KANOSH	UT	22	-112.4403	38.7961	4990	07/1907	12/2000	91	0.1741	0.2128	0.1634	0.14
42-4755	KODACHROME BASIN PARK	UT	23	-111.9872	37.5206	5810	05/1979	12/2000	22	0.1684	0.2427	0.2398	1.59
42-4764	KOOSHAREM	UT	22	-111.8842	38.5114	6930	01/1949	12/2000	52	0.1583	0.1106	0.1005	1.20
42-4856	LAKETOWN	UT	6	-111.3211	41.8256	5980	01/1900	12/2000	101	0.2162	0.2919	0.2328	0.80
42-4946	LA SAL	UT	26	-109.2500	38.3167	6985	04/1901	03/1978	65	0.1904	0.1611	0.1369	0.49

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-4947	LA SAL 2 SE	UT	26	-109.2336	38.2881	6720	04/1978	12/2000	23	0.1858	0.1428	0.0621	2.22
42-4968	LA VERKIN	UT	21	-113.2683	37.2036	3220	05/1950	12/2000	51	0.1669	0.2756	0.2201	1.90
42-5065	LEVAN	UT	13	-111.8669	39.5542	5290	01/1893	12/2000	107	0.1863	0.1889	0.1626	0.19
42-5082	LEWISTON	UT	6	-111.8333	41.9667	4482	09/1924	06/1976	51	0.1253	0.1269	0.1708	1.67
42-5138	LITTLE SAHARA DUNES	UT	22	-112.3089	39.7303	5240	06/1979	12/2000	22	0.1788	0.2298	0.1894	0.06
42-5148	LOA	UT	22	-111.6500	38.4000	7078	05/1893	10/1994	88	0.1957	0.1424	0.1768	0.61
42-5182	LOGAN RADIO KVNU	UT	6	-111.8561	41.7353	4470	11/1956	12/2000	44	0.1990	0.2228	0.1716	0.25
42-5186	LOGAN UTAH STATE UNIV	UT	6	-111.8033	41.7456	4790	01/1893	11/2000	108	0.1591	0.1452	0.1160	0.78
42-5190	LOGAN USU EXP STN	UT	6	-111.8167	41.7667	4613	09/1950	08/1978	28	0.2209	0.2618	0.2652	1.43
42-5194	LOGAN 5 SW EXP FARM	UT	6	-111.8906	41.6672	4490	01/1968	11/2000	33	0.2121	0.2335	0.1002	2.10
42-5219	LOWER AMERICAN FORK POWER	UT	14	-111.7500	40.4333	5043	01/1914	05/1957	44	0.1932	0.1927	0.1355	0.72
42-5229	LOWER MILL CREEK	UT	14	-111.7833	40.7000	4964	12/1913	08/1953	39	0.1466	0.2020	0.1094	0.93
42-5239	LUCIN	UT	4	-113.9000	41.3500	4469	04/1905	12/1990	47	0.2122	0.1881	0.1987	0.51
42-5247	LUND	UT	12	-113.4333	38.0000	5092	12/1900	11/1967	29	0.1764	0.0083	0.0685	1.14
42-5377	MANILA	UT	15	-109.7333	40.9833	6440	04/1910	02/1990	71	0.2121	0.2169	0.1109	0.72
42-5402	MANTI	UT	13	-111.6314	39.2581	5740	01/1893	12/2000	105	0.1520	0.1261	0.1352	0.29
42-5477	MARYSVALE	UT	22	-112.2292	38.4494	5910	07/1948	12/2000	45	0.1717	0.2042	0.2262	0.64
42-5582	MEXICAN HAT	UT	37	-109.8683	37.1447	4130	07/1940	12/2000	54	0.1838	0.1439	0.1363	0.33
42-5607	MIDLAKE	UT	12	-112.6333	41.2167	4222	03/1911	09/1981	32	0.2401	0.1811	0.1669	0.92
42-5610	MIDVALE	UT	14	-111.9167	40.6000	4344	10/1911	11/1971	59	0.1493	0.2498	0.2556	1.89
42-5654	MILFORD WSO AIRPORT	UT	12	-113.0167	38.4333	5028	01/1928	12/2000	69	0.1628	0.1700	0.1661	0.95
42-5723	MINERSVILLE	UT	22	-112.9211	38.2164	5280	02/1897	12/2000	77	0.1889	0.1706	0.1960	0.34
42-5752	MODENA WBO	UT	12	-113.9000	37.8000	5476	01/1948	12/2000	53	0.1662	0.1373	0.0751	1.57
42-5805	MONTICELLO	UT	37	-109.3069	37.8736	6820	04/1902	12/2000	84	0.2143	0.2372	0.2367	0.44
42-5812	MONUMENT VLY MISSION	UT	37	-110.2167	37.0167	5300	05/1956	12/1989	32	0.1854	0.1579	0.1316	0.27
42-5815	MOON LAKE	UT	15	-110.4925	40.5650	8150	07/1935	07/1969	28	0.1879	0.2383	0.2185	0.16
42-5826	MORGAN POWER AND LIGHT	UT	14	-111.6700	41.0428	5090	01/1903	12/2000	94	0.1650	0.2557	0.2474	1.22
42-5837	MORONI	UT	13	-111.5869	39.5261	5560	05/1908	12/2000	93	0.2169	0.2445	0.1456	1.51
42-5892	MOUNTAIN DELL DAM	UT	14	-111.7222	40.7497	5420	01/1920	12/2000	75	0.1686	0.1109	0.0755	0.84
42-5969	MYTON	UT	15	-110.0619	40.1961	5080	08/1915	12/2000	82	0.2105	0.2381	0.2137	0.21
42-6053	NATURAL BRIDGES NATL MON	UT	25	-109.9772	37.6094	6500	06/1965	12/2000	36	0.1269	0.0489	0.0720	1.97

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-6123	NEOLA	UT	15	-110.0511	40.4178	5950	04/1956	12/2000	44	0.2004	0.0565	0.0980	2.53
42-6135	NEPHI	UT	13	-111.8322	39.7125	5125	09/1941	12/2000	59	0.1590	0.2005	0.0973	1.31
42-6140	NEPHI 5 SSW	UT	13	-111.8667	39.6500	5243	02/1906	07/1948	35	0.1661	0.2244	0.3248	2.29
42-6181	NEW HARMONY	UT	22	-113.3131	37.4844	5265	06/1911	12/2000	71	0.1937	0.1606	0.0743	2.64
42-6340	NUTTERS RANCH	UT	15	-110.2500	39.8000	5788	08/1963	05/1986	22	0.1897	0.3969	0.3535	2.93
42-6357	OAK CITY	UT	22	-112.3400	39.3792	5070	03/1905	12/2000	91	0.1756	0.2004	0.2198	0.46
42-6404	OGDEN PIONEER P H	UT	14	-111.9475	41.2439	4350	01/1902	12/2000	71	0.1785	0.1923	0.1227	0.39
42-6414	OGDEN SUGAR FACTORY	UT	14	-112.0281	41.2319	4280	09/1924	12/2000	76	0.1502	0.1601	0.1354	0.24
42-6455	OLMSTEAD P H	UT	13	-111.6536	40.3172	4820	03/1977	12/2000	24	0.1336	0.1066	0.1006	1.17
42-6534	ORDERVILLE	UT	23	-112.6386	37.2717	5460	03/1910	12/2000	91	0.1947	0.2331	0.1473	0.69
42-6538	OREM TREATMENT PLANT	UT	13	-111.7386	40.2778	4510	01/1953	12/2000	48	0.1911	0.1742	0.1595	0.32
42-6568	OURAY 4 NE	UT	15	-109.6422	40.1342	4670	08/1955	12/2000	45	0.2024	0.1378	0.1310	0.79
42-6601	PANGUITCH	UT	22	-112.4314	37.8233	6610	05/1904	12/2000	90	0.2087	0.2218	0.1528	1.10
42-6648	PARK CITY RADIO	UT	14	-111.5000	40.6500	7140	03/1896	06/1991	59	0.2210	0.2235	0.1893	2.45
42-6658	PARK VALLEY	UT	4	-113.3500	41.8000	5440	04/1911	02/1990	75	0.1908	0.2159	0.1415	0.29
42-6686	PAROWAN POWER PLANT	UT	22	-112.8314	37.8389	6000	01/1893	12/2000	107	0.1744	0.2526	0.2256	0.40
42-6708	PARTOUN	UT	11	-113.8833	39.6500	4754	04/1950	12/2000	51	0.2139	0.1782	0.1193	0.15
42-6724	PAYSON	UT	13	-111.7481	40.0369	4630	04/1904	06/1999	78	0.1588	0.2324	0.2652	1.01
42-6869	PINE VIEW DAM	UT	14	-111.8378	41.2578	4940	01/1935	12/2000	65	0.1580	0.2483	0.2170	0.76
42-6897	PIUTE DAM	UT	22	-112.1833	38.3167	5906	10/1911	05/1971	59	0.2039	0.1887	0.1561	0.64
42-6919	PLEASANT GROVE	UT	13	-111.7219	40.3647	4760	09/1946	12/2000	55	0.1577	0.0442	0.1067	0.75
42-7015	PRICE GAME FARM	UT	25	-110.8333	39.6167	5584	01/1921	08/1968	47	0.2273	0.2604	0.1559	1.51
42-7026	PRICE WAREHOUSES	UT	25	-110.8000	39.6167	5700	09/1968	12/2000	33	0.2017	0.1807	0.1762	0.47
42-7064	PROVO BYU	UT	13	-111.6506	40.2436	4570	04/1916	12/2000	35	0.1141	0.0513	0.1327	1.72
42-7068	PROVO RADIO KOVO	UT	13	-111.6667	40.2167	4472	04/1952	02/1977	25	0.1792	0.3198	0.2877	1.58
42-7165	RANDOLPH	UT	6	-111.1867	41.6636	6270	05/1893	12/2000	43	0.2218	0.1893	0.2053	1.69
42-7260	RICHFIELD RADIO KSVC	UT	22	-112.0781	38.7619	5300	01/1893	12/2000	101	0.2007	0.1380	0.1804	0.86
42-7271	RICHMOND	UT	6	-111.8100	41.9064	4680	10/1911	12/2000	89	0.1617	0.2699	0.2074	1.21
42-7318	RIVERDALE POWERHOUSE	UT	14	-112.0000	41.1667	4403	01/1914	02/1991	77	0.1630	0.1191	0.1266	0.30
42-7395	ROOSEVELT	UT	15	-109.9833	40.3000	5106	07/1948	12/2000	53	0.2225	0.1856	0.2022	1.09
42-7516	ST GEORGE	UT	21	-113.5672	37.1061	2770	01/1893	12/2000	108	0.1999	0.2208	0.1738	0.17
42-7557	SALINA	UT	22	-111.8667	38.9667	5131	10/1923	06/1994	68	0.1912	0.1555	0.2091	0.84

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-7578	SALTAIR SALT PLANT	UT	12	-112.1167	40.7667	4210	05/1956	08/1991	36	0.2325	0.2272	0.1301	1.45
42-7598	SALT LAKE CITY NWSFO	UT	14	-111.9553	40.7725	4222	01/1948	12/2000	53	0.1768	0.2070	0.1334	0.33
42-7603	SALT LAKE CITY WB CITY	UT	14	-111.8833	40.7667	4304	01/1928	07/1954	27	0.1765	0.2047	0.1688	0.11
42-7608	SALT LAKE CITY SUBURBAN S	UT	14	-111.9167	40.7000	4242	01/1950	12/1978	29	0.2326	0.1906	0.2138	4.10
42-7655	SALT LAKE CITY ZOO	UT	14	-111.8211	40.7469	4890	12/1913	12/2000	63	0.1691	0.2588	0.1811	0.51
42-7686	SANTAQUIN CHLORINATOR	UT	13	-111.7794	39.9578	5160	01/1914	12/2000	87	0.1740	0.1502	0.1676	0.04
42-7714	SCIPIO	UT	22	-112.1067	39.2464	5315	06/1895	12/2000	100	0.1890	0.2573	0.1966	0.26
42-7720	SCOFIELD	UT	25	-111.1500	39.7167	7726	05/1893	05/1984	25	0.1980	0.3330	0.3500	2.19
42-7724	SCOFIELD DAM	UT	25	-111.1189	39.7858	7630	07/1948	03/1991	43	0.1849	0.1413	0.0881	0.18
42-7744	SEVERE RANCH	UT	13	-112.7333	40.3333	4403	01/1925	02/1951	26	0.1663	0.1578	0.1769	0.01
42-7846	SILVER LAKE BRIGHTON	UT	14	-111.5842	40.6008	8740	07/1915	12/2000	83	0.1752	0.2453	0.1807	0.35
42-7909	SNAKE CREEK POWERHOUSE	UT	14	-111.5000	40.5500	6010	12/1913	12/2000	87	0.1648	0.1949	0.1722	0.06
42-7931	SNOWVILLE	UT	4	-112.7167	41.9667	4560	03/1893	10/1991	76	0.1868	0.1904	0.2200	0.39
42-7959	SOLDIER SUMMIT	UT	15	-111.0792	39.9286	7470	05/1893	12/2000	58	0.2518	0.2834	0.2945	2.56
42-8119	SPANISH FORK PWR HOUSE	UT	13	-111.6044	40.0797	4720	07/1909	12/2000	91	0.1598	0.1742	0.2288	0.39
42-8456	SUMMIT	UT	22	-112.9328	37.8006	6000	11/1951	12/2000	48	0.1420	0.1831	0.1738	1.04
42-8478	SUNNYSIDE CITY CENTER	UT	25	-110.3869	39.5525	6530	02/1905	12/2000	59	0.1808	0.1653	0.1376	0.01
42-8631	TERMINAL	UT	14	-112.0000	40.7500	4232	06/1940	04/1972	30	0.1832	0.0298	0.0945	2.40
42-8668	THIOKOL PLANT 78	UT	6	-112.4264	41.7197	4600	06/1962	12/2000	39	0.1700	0.2816	0.2255	1.05
42-8705	THOMPSON	UT	25	-109.7167	38.9667	5099	05/1911	11/1994	80	0.1717	0.1583	0.2101	0.31
42-8733	TIMPANOGOS CAVE	UT	14	-111.7000	40.4500	5640	12/1946	12/2000	52	0.1373	0.1650	0.1506	0.75
42-8771	TOOELE	UT	13	-112.2972	40.5269	5070	03/1896	12/2000	105	0.1572	0.2116	0.1499	0.60
42-8817	TREMONTON	UT	6	-112.1833	41.7000	4324	04/1913	12/2000	86	0.2089	0.3141	0.2119	0.97
42-8828	TRENTON	UT	6	-111.9089	41.9194	4455	04/1944	12/2000	28	0.1823	0.1542	0.1562	0.35
42-8847	TROPIC	UT	23	-112.0811	37.6258	6280	01/1893	08/1999	87	0.1990	0.1603	0.1501	0.13
42-8939	UPPER AMERICAN FORK PH	UT	14	-111.7333	40.4333	5330	09/1957	05/1986	28	0.1384	0.1126	0.0760	1.21
42-8973	UTAH LAKE LEHI	UT	13	-111.8972	40.3597	4497	06/1904	12/2000	82	0.1816	0.1190	0.0849	0.98
42-9111	VERNAL AIRPORT	UT	15	-109.5092	40.4411	5260	12/1894	12/2000	100	0.1709	0.1482	0.1017	0.74
42-9133	VERNON	UT	13	-112.4550	40.0831	5485	08/1953	12/2000	38	0.1942	0.1043	0.1555	0.95
42-9136	VEYO POWERHOUSE	UT	21	-113.6667	37.3522	4600	08/1957	12/2000	43	0.1683	0.0703	0.0545	1.50
42-9152	WAH WAH RANCH	UT	12	-113.4264	38.4831	4880	08/1955	12/2000	45	0.1947	0.1723	0.1285	0.27
42-9165	WANSHIP DAM	UT	15	-111.4078	40.7906	5940	08/1955	12/2000	45	0.1686	0.1446	0.1125	0.70

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-9346	WEBER BASIN PUMP PL 3	UT	14	-111.9117	41.1164	4900	05/1962	12/2000	39	0.1420	0.2091	0.2125	1.19
42-9368	WELLINGTON 3 E	UT	25	-110.6858	39.5450	5400	06/1980	12/2000	21	0.1304	0.4112	0.4054	4.41
42-9382	WENDOVER AWOS	UT	11	-114.0356	40.7206	4237	05/1911	12/2000	89	0.2415	0.2111	0.1693	0.36
42-9514	WIDTSOE 3 NNE	UT	22	-111.9739	37.8747	7540	03/1912	12/2000	46	0.1852	0.3040	0.2251	0.74
42-9595	WOODRUFF	UT	6	-111.1494	41.5250	6315	01/1897	12/2000	92	0.2273	0.1958	0.1465	1.97
42-9717	ZION NATIONAL PARK	UT	23	-112.9842	37.2083	4050	01/1904	12/2000	96	0.1939	0.1758	0.1356	0.09
48-0027	AFTON	WY	6	-110.9342	42.7314	6210	03/1903	12/2000	92	0.1685	0.1929	0.1387	0.45
48-0603	BEDFORD 3 SE	WY	6	-110.9075	42.8733	6425	07/1899	12/2000	94	0.1569	0.1587	0.1886	0.39
48-0695	BIG PINEY	WY	7	-110.1167	42.5333	6821	08/1948	12/2000	46	0.2768	0.3580	0.1647	1.53
48-0761	BITTER CREEK 4 NE	WY	7	-108.5086	41.5894	6720	09/1962	12/2000	32	0.2650	0.3316	0.2561	1.20
48-1736	CHURCH BUTTES GAS PLT	WY	7	-110.0856	41.3975	7075	03/1891	12/2000	45	0.2329	0.1699	0.1714	0.97
48-3100	EVANSTON 1 E	WY	15	-110.9500	41.2650	6825	12/1890	12/2000	102	0.2005	0.2129	0.1902	0.10
48-3170	FARSON 5 N	WY	7	-109.4475	42.1872	6675	01/1915	12/2000	73	0.2214	0.1972	0.1824	0.24
48-3396	FONTENELLE DAM	WY	7	-110.0608	41.9861	6480	07/1963	12/2000	37	0.2004	0.2637	0.2368	2.43
48-3430	FORT BRIDGER CAA AIRPORT	WY	7	-110.4167	41.4000	7024	09/1940	03/1966	21	0.2414	0.1579	0.0590	1.14
48-4065	GREEN RIVER	WY	7	-109.4767	41.5314	6077	04/1897	12/2000	93	0.2293	0.2083	0.1262	0.46
48-5105	KEMMERER 2 N	WY	6	-110.5333	41.8167	6926	01/1933	12/2000	58	0.1656	0.0941	0.1525	1.07
48-5252	LA BARGE 4 WNW	WY	7	-110.2000	42.2667	6600	06/1958	12/2000	34	0.2534	0.2330	0.1548	0.18
48-6555	MOUNTAIN VIEW	WY	15	-110.3306	41.2708	6800	04/1966	12/2000	35	0.1626	0.1807	0.1994	0.73
48-7840	ROCK SPRINGS	WY	7	-109.2167	41.5833	6375	11/1898	05/1979	41	0.2969	0.3726	0.2241	1.52
48-7845	ROCK SPRINGS AP	WY	7	-109.0667	41.6000	6741	01/1948	12/2000	51	0.2343	0.2589	0.1921	0.23
48-7955	SAGE 4 NNW	WY	6	-111.0000	41.8667	6210	01/1923	12/2000	71	0.1881	0.1740	0.2003	0.36

Table A.7.2. Hourly stations (statistical values for the 60-minute duration)

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-0002	AGUANGA VALLEY	CA	15	-116.8797	33.4444	1920	6/1979	12/2000	20	0.3416	0.3375	0.2910	3.59
00-0011	BANNING BENCH	CA	15	-116.9117	33.9722	3600	6/1974	7/2000	26	0.1866	0.1823	0.1448	0.63
00-0034	CATHEDRAL CITY	CA	10W	-116.4575	33.7803	295	1/1969	2/1996	27	0.4805	0.5118	0.2915	1.68
00-0035	CHASE & TAYLOR	CA	15	-117.5756	33.8436	1055	6/1967	12/2000	33	0.1839	-0.0179	0.1250	2.73
00-0057	DES HOT SPR EAST	CA	10W	-116.4944	33.9675	1220	11/1949	7/2000	49	0.4118	0.2553	0.2083	1.04

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-0062	EL CARISO STATION	CA	15	-117.4119	33.6500	2260	6/1978	12/2000	22	0.2132	0.1460	0.1403	0.22
00-0081	HAYSTACK-MNT	CA	10W	-116.4789	33.7022	2800	7/1979	7/1999	20	0.3686	0.3926	0.2436	1.07
00-0102	LAKE MATHEWS	CA	15	-117.4542	33.8528	1400	12/1961	12/2000	39	0.2661	0.2575	0.1926	0.32
00-0131	NORCO	CA	15	-117.5778	33.9297	620	6/1982	5/1998	16	0.2224	0.0631	0.0535	1.13
00-0151	PERRIS RESERVOIR	CA	15	-117.1958	33.8644	1625	3/1964	12/1991	28	0.2599	0.3525	0.2563	0.51
00-0155	PIGEON PASS	CA	15	-117.2689	33.9878	1910	4/1956	3/1994	37	0.2181	0.3446	0.2883	0.89
00-0157	PINYON FLAT	CA	15	-116.4472	33.5856	4000	8/1977	5/2000	23	0.3197	0.2782	0.2122	2.28
00-0178	RIVERSIDE NORTH	CA	15	-117.3778	34.0028	840	5/1962	12/2000	38	0.2021	0.2262	0.1006	1.33
00-0216	TACHEVAH DAM	CA	10W	-116.5578	33.8319	580	8/1967	7/2000	32	0.3481	0.3007	0.1691	0.18
00-0222	THOUSAND PALMS	CA	10W	-116.3928	33.8200	2409	1/1980	7/2000	20	0.2931	0.1755	0.0952	1.02
00-0224	TRAMWAY VALLEY STA	CA	10W	-116.6125	33.8369	2700	8/1977	7/2000	23	0.3626	0.3172	0.1591	0.23
00-0233	WHITEWATER NORTH	CA	10W	-116.6556	33.9897	2200	8/1977	7/2000	23	0.2628	0.2765	0.0986	2.43
00-0243	WIDE CANYON DAM	CA	10W	-116.3908	33.9344	1530	10/1975	1/1997	21	0.3199	0.2443	0.1740	0.54
00-0250	WOODCREST	CA	15	-117.3503	33.8847	1557	10/1955	12/2000	45	0.2372	0.2836	0.1886	0.27
00-4630	THUNDERBIRD ACADEMY	AZ	11	-111.9228	33.6100	1450	10/1980	12/2000	19	0.2508	0.1995	0.1346	0.12
00-5000	MT. OATMAN	AZ	10E	-113.1375	33.0510	1720	10/1980	9/2001	19	0.2967	0.1341	-0.0423	1.26
00-5170	GLADDEN	AZ	10E	-113.2983	33.9020	2200	10/1980	9/2001	19	0.2992	0.2716	0.0681	1.19
00-5180	CENTENNIAL WASH	AZ	10E	-113.0008	33.9430	2415	10/1980	9/2001	19	0.2519	0.1650	0.0395	0.89
00-5215	JACKRABBIT WASH	AZ	10E	-112.8822	33.7150	2130	10/1980	9/2001	18	0.1802	0.0378	0.2182	2.11
00-5260	VULTURE MINE ROAD	AZ	11	-112.7686	33.9450	2310	10/1980	12/2000	20	0.3383	0.5401	0.4483	2.29
00-5275	SOLS WASH AT SR 71	AZ	10E	-112.9625	34.1180	2740	10/1980	9/2001	20	0.2256	0.1425	0.0878	1.25
00-5290	YARNELL HILL	AZ	11	-112.7400	34.2160	5130	10/1980	12/2000	17	0.2468	0.0556	0.0189	0.62
00-5365	WILHOIT	AZ	8	-112.6131	34.4430	5045	10/1980	12/2000	19	0.1832	0.1662	0.1642	1.68
00-5445	MCMICKEN DAM	AZ	11	-112.4231	33.6770	1360	10/1980	12/2000	18	0.3745	0.3780	0.1459	2.53
00-5475	CIRCLE CITY	AZ	11	-112.5903	33.8220	1890	10/1980	12/2000	18	0.2915	0.4675	0.3970	1.18
00-5490	CASTLE HOT SPRINGS	AZ	11	-112.5283	33.9280	2685	10/1980	12/2000	20	0.3046	0.3779	0.2146	0.76
00-5535	ADOBE DAM	AZ	11	-112.1533	33.6760	1415	10/1980	12/2000	19	0.2712	0.2613	0.3025	1.28
00-5625	SUNUP RANCH	AZ	11	-112.1500	33.8810	2140	10/1980	12/2000	19	0.2342	0.3506	0.3189	0.81
00-5670	GARFIAS MTN.	AZ	11	-112.4286	33.9650	2645	10/1980	12/2000	20	0.2305	0.0894	0.0441	0.56
00-5730	SUNSET POINT	AZ	8	-112.1344	34.1860	3380	10/1980	12/2000	18	0.2241	0.2753	0.2219	0.74
00-5745	HORSESHOE RANCH	AZ	8	-112.0000	34.2300	3805	10/1980	12/2000	18	0.2491	0.0931	-0.0177	1.66
00-5760	HORNER MTN. RANCH	AZ	8	-111.9456	34.5310	4405	10/1980	12/2000	20	0.2120	0.1253	0.1438	1.32

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-5775	ARIZONA HUNT CLUB	AZ	8	-112.1283	34.3900	3805	10/1980	12/2000	19	0.2290	0.2338	0.1921	0.29
00-5805	DEWEY	AZ	8	-112.1422	34.5050	4775	10/1980	12/2000	19	0.2903	0.1636	0.0348	1.18
00-6510	SOUTH MOUNTAIN PARK	AZ	11	-112.0331	33.3430	2135	10/1980	12/2000	19	0.2696	0.3385	0.2295	0.36
00-6610	QUEEN CREEK RD.	AZ	11	-111.6289	33.2610	1410	10/1980	12/2000	19	0.2374	0.2732	0.1500	1.08
00-6655	THUNDER MOUNTAIN	AZ	11	-111.6403	33.4960	2550	10/1980	12/2000	20	0.3561	0.4329	0.2764	1.44
00-6670	APACHE JUNCTION FRS	AZ	11	-111.5519	33.4410	1990	10/1980	12/2000	20	0.2150	0.1627	0.2154	0.77
00-6730	FLORENCE JUNCTION	AZ	11	-111.3953	33.2970	1840	10/1980	12/2000	19	0.3090	0.2640	0.1965	0.43
00-6745	KINGS RANCH	AZ	11	-111.4328	33.3850	2145	10/1980	12/2000	19	0.2079	0.4208	0.3855	2.26
00-6880	WATERMAN WASH	AZ	11	-112.3086	33.2200	1265	10/1980	12/2000	19	0.2348	0.0997	0.0563	0.44
00-6960	BENDER WASH	AZ	10E	-112.5322	32.9100	1245	10/1980	9/2001	20	0.2278	-0.0072	-0.0200	1.31
02-0080	AJO	AZ	10E	-112.8700	32.3700	1800	7/1948	12/2000	53	0.2717	0.1655	0.1649	0.39
02-0100	ALAMO DAM	AZ	10E	-113.5800	34.2300	1290	3/1965	12/2000	34	0.2185	0.0288	0.0695	0.63
02-0487	ASH FORK 2	AZ	8	-112.4886	35.1989	5075	7/1948	12/2000	49	0.2514	0.0703	0.0876	2.97
02-0768	BISBEE	AZ	12	-109.9167	31.4333	5307	7/1948	2/1985	33	0.2100	0.1184	0.2110	0.43
02-0808	BLACK RIVER PUMPS	AZ	12	-109.7517	33.4783	6065	7/1948	12/2000	50	0.2520	0.0945	0.0943	0.40
02-0966	BOWIE JUNCTION R15 ON	AZ	12	-109.7000	32.4333	4724	7/1948	2/1967	18	0.1595	0.1738	0.3560	2.63
02-1314	CASA GRANDE NATL MONUM	AZ	11	-111.5367	32.9947	1419	7/1948	12/2000	51	0.2913	0.1071	0.1004	0.98
02-1870	COCHISE 4 SSE	AZ	12	-109.8908	32.0589	4180	7/1948	12/2000	51	0.2609	0.2623	0.1250	0.59
02-2659	DOUGLAS	AZ	12	-109.5333	31.3500	4040	7/1948	3/1994	46	0.2267	0.1414	0.1001	0.23
02-2754	DUNCAN	AZ	12	-109.1214	32.7481	3660	8/1975	12/2000	23	0.3212	0.2641	0.2302	1.67
02-3010	FLAGSTAFF WSO AP	AZ	8	-111.6667	35.1333	7004	1/1950	12/2000	51	0.2444	0.2878	0.2738	0.56
02-3596	GRAND CANYON N P 2	AZ	6	-112.1500	36.0500	6785	5/1976	12/2000	20	0.2209	0.1392	0.0356	1.00
02-4586	KEAMS CANYON	AZ	8	-110.1917	35.8111	6205	7/1948	12/2000	47	0.3153	0.2524	0.1660	1.28
02-4645	KINGMAN NO 2	AZ	10E	-114.0200	35.2000	3540	8/1967	10/1993	27	0.2905	0.1779	0.0611	0.25
02-5325	MAYER	AZ	8	-112.2500	34.4333	4642	3/1969	11/1986	18	0.2632	0.2770	0.1428	0.49
02-5924	NOGALES 6 N	AZ	12	-110.9650	31.4444	3560	8/1983	12/2000	18	0.2530	0.0214	0.0431	1.32
02-6119	ORACLE 2 SE	AZ	12	-110.7344	32.6025	4510	2/1950	12/2000	46	0.2305	0.2751	0.1245	1.56
02-6180	PAGE	AZ	6	-111.4500	36.9167	4272	10/1957	12/1983	26	0.3770	0.5090	0.4096	1.47
02-6194	PAINTED ROCK DAM	AZ	10E	-113.0300	33.0800	550	1/1962	12/2000	37	0.2899	0.1771	0.1040	0.34
02-6323	PAYSON	AZ	8	-111.3333	34.2333	4913	5/1949	12/2000	49	0.3003	0.1931	0.0523	1.13
02-6468	PETRIFIED FOREST N P	AZ	8	-109.8883	34.7969	5446	7/1948	12/2000	47	0.2850	0.2986	0.2200	0.37
02-6481	PHOENIX WSFO AP	AZ	11	-111.9903	33.4431	1107	7/1948	12/2000	51	0.2978	0.1068	0.0797	0.99

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
02-6486	PHOENIX CITY	AZ	11	-112.0825	33.4489	1098	7/1948	8/1968	20	0.2733	0.1993	0.0647	0.78
02-6546	PIMA R4 ON W2	AZ	11	-110.0167	32.8333	3773	7/1948	2/1967	19	0.2243	-0.0142	0.0471	1.23
02-6801	PRESCOTT FAA AIRPORT	AZ	8	-112.4333	34.6500	5020	7/1948	11/1969	21	0.2300	0.2849	0.2490	0.65
02-7593	SANTA RITA EXP RANGE	AZ	12	-110.8464	31.7625	4300	5/1950	12/2000	48	0.1603	0.0492	0.1858	1.19
02-7708	SEDONA RANGER STN	AZ	8	-111.7667	34.8667	4220	4/1973	12/2000	26	0.2930	0.2998	0.0701	2.22
02-7741	SENECA 3 NW	AZ	11	-110.5000	33.7667	5003	7/1948	11/1965	18	0.2883	0.1344	0.0191	0.90
02-7876	SIERRA ANCHA	AZ	11	-110.9714	33.7986	5100	1/1976	12/2000	25	0.2478	0.1340	0.1146	0.16
02-8264	SUMMIT	AZ	11	-110.9500	33.5500	3652	10/1951	5/1977	25	0.2243	0.1178	0.0951	0.36
02-8348	SUPERIOR	AZ	11	-111.0967	33.3008	2860	6/1959	10/1978	20	0.2392	0.1038	0.2111	1.94
02-8409	TANQUE R9 ON W4	AZ	12	-109.6167	32.6167	3563	7/1948	2/1967	18	0.3027	0.2937	0.1361	0.73
02-8778	TRUXTON CANYON	AZ	10E	-113.6700	35.3800	3820	7/1970	12/2000	31	0.3170	0.3178	0.2927	2.02
02-8820	TUCSON WSO AP	AZ	11	-110.9167	32.1833	2559	7/1948	12/2000	53	0.2306	0.1844	0.1758	0.20
02-8895	TUWEEP	AZ	8	-113.0636	36.2861	4775	7/1948	12/2000	50	0.2883	0.2965	0.2116	0.39
02-9271	WHITERIVER 1 SW	AZ	12	-109.9833	33.8169	5120	7/1948	12/2000	50	0.2467	0.2153	0.1233	0.28
02-9279	WHITLOCK VALLEY R2 ON	AZ	12	-109.5167	32.8167	3291	7/1948	2/1967	19	0.2837	0.1942	0.2525	1.45
02-9439	WINSLOW WSO AP	AZ	8	-110.7333	35.0167	4890	7/1948	12/2000	53	0.2469	0.3188	0.2508	0.71
02-9534	WORKMAN CREEK 1	AZ	11	-110.9167	33.8167	6975	7/1948	2/1986	38	0.1915	0.2266	0.1714	1.53
02-9660	YUMA WSO AP	AZ	10W	-114.6000	32.6667	206	9/1948	7/1996	45	0.4162	0.3633	0.2409	0.14
04-0014	ACTON ESCONDIDO FC261	CA	15	-118.2714	34.4947	2970	7/1948	12/2000	43	0.2759	0.4084	0.3289	1.10
04-0115	ALISO CANYON OAT MTN F	CA	15	-118.5500	34.3167	2367	7/1948	10/1992	40	0.2122	0.1954	0.1471	0.18
04-0161	ALTURAS RANGER STATION	CA	17	-120.5500	41.5000	4400	7/1948	12/2000	52	0.2604	0.3477	0.2373	0.18
04-0176	AMBOY	CA	10W	-115.7500	34.5667	640	7/1948	11/1974	25	0.3978	0.2478	0.2402	1.35
04-0235	ANZA	CA	15	-116.6728	33.5550	3915	7/1958	7/2000	39	0.3347	0.2832	0.1649	3.07
04-0239	APACHE CAMP	CA	20	-119.3333	34.8667	4974	7/1948	11/1971	21	0.2701	0.3440	0.2621	0.41
04-0422	BADGER	CA	24	-119.0122	36.6328	3030	7/1948	12/2000	51	0.2268	0.3958	0.3578	0.47
04-0436	BAKER	CA	7	-116.0736	35.2658	940	11/1953	8/1990	34	0.4556	0.3942	0.1530	2.81
04-0442	BAKERSFIELD WSO ARPT	CA	20	-119.0500	35.4167	495	7/1948	12/2000	51	0.2612	0.3854	0.2488	0.55
04-0449	BALCH POWER HOUSE	CA	24	-119.0883	36.9092	1720	2/1950	12/2000	49	0.2488	0.5245	0.4684	1.81
04-0606	BEAUMONT	CA	15	-116.9750	33.9292	2613	4/1940	12/2000	60	0.2781	0.4929	0.3834	2.26
04-0619	BEL AIR FC 10	CA	15	-118.4500	34.0833	541	7/1948	2/1984	30	0.2174	0.2138	0.1151	0.56
04-0731	BIEBER	CA	17	-121.1347	41.1208	4125	7/1948	12/2000	47	0.2483	0.4358	0.3878	0.95
04-0742	BIG BEAR LAKE DAM	CA	22	-116.9764	34.2417	6815	7/1948	12/2000	46	0.2200	0.2483	0.1665	0.04

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-0779	BIG PINES PARK FC83B	CA	22	-117.6833	34.3833	6845	7/1948	10/1996	44	0.2360	0.2550	0.2175	0.15
04-0818	BIRMINGHAM GEN HOSP	CA	15	-118.5000	34.1833	722	7/1948	5/1977	28	0.2341	0.2756	0.3537	1.55
04-0822	BISHOP WSO AIRPORT	CA	3	-118.3581	37.3711	4102	7/1948	12/2000	45	0.1878	0.2001	0.2377	1.80
04-0883	BLODGETT EXP FOREST	CA	16	-120.6678	38.9092	4414	10/1969	12/2000	30	0.1662	0.3105	0.1343	0.62
04-0897	BLUE CANYON	CA	16	-120.7103	39.2775	5280	7/1948	12/2000	49	0.1624	0.3320	0.2105	0.37
04-0925	BLYTHE 7 W	CA	10W	-114.7167	33.6167	390	2/1953	12/1994	40	0.3991	0.3016	0.1926	0.15
04-0979	BORON	CA	7	-117.6503	35.0042	2455	12/1959	12/2000	41	0.2960	0.2815	0.0837	1.41
04-1018	BOWMAN DAM	CA	16	-120.6556	39.4539	5385	7/1948	12/2000	47	0.2141	0.3389	0.1955	0.48
04-1057	BREA DAM	CA	15	-117.9264	33.8906	275	7/1948	12/2000	49	0.2043	0.2084	0.1417	0.43
04-1072	BRIDGEPORT RANGER STN	CA	3	-119.2203	38.2472	6441	6/1950	12/2000	39	0.2819	0.3620	0.3070	0.31
04-1130	BRUSH CREEK R S	CA	16	-121.3333	39.6833	3560	7/1948	12/2000	41	0.1539	0.1145	0.1103	0.91
04-1161	BUCKS LAKE	CA	16	-121.2000	39.9000	5203	7/1948	11/1969	19	0.1944	0.1667	0.2414	1.09
04-1194	BURBANK VALLEY PUMP PL	CA	15	-118.3667	34.2000	725	7/1948	12/2000	52	0.1957	0.2416	0.1433	1.08
04-1250	CABAZON	CA	15	-116.7811	33.9092	1700	6/1975	12/2000	25	0.2509	0.3916	0.2830	0.95
04-1253	CACHUMA LAKE	CA	15	-119.9833	34.5667	781	10/1951	12/2000	49	0.1972	0.1230	0.1299	0.41
04-1272	CAJON WEST SUMMIT	CA	7	-117.5925	34.3900	4780	7/1948	12/2000	51	0.2951	0.2739	0.1948	0.04
04-1300	CALIF HOT SPRINGS	CA	20	-118.6833	35.8833	2953	7/1948	3/1965	17	0.1528	0.3711	0.3153	3.29
04-1369	CAMP ANGELUS	CA	22	-116.9803	34.1492	5770	7/1948	12/2000	51	0.2279	0.2188	0.1711	0.03
04-1404	OPIDS CAMP FC 57 BE	CA	22	-118.1000	34.2500	4252	7/1948	5/1969	18	0.1686	0.3111	0.1624	2.30
04-1428	CAMP PARDEE	CA	20	-120.8433	38.2486	658	7/1948	12/2000	52	0.2316	0.3843	0.2612	0.66
04-1462	CAMPTONVILLE RANGER ST	CA	16	-121.0500	39.4500	2755	7/1948	6/1994	37	0.1692	0.2089	0.1420	0.32
04-1497	CANYON DAM	CA	17	-121.0886	40.1706	4560	10/1975	12/2000	24	0.1908	0.2166	0.2674	1.92
04-1518	CARBON CANYON GILMAN	CA	15	-117.7778	33.9231	1624	6/1955	12/2000	40	0.2319	0.2059	0.1351	0.18
04-1520	CARBON CANYON WORKMAN	CA	15	-117.7792	33.9581	1180	9/1949	12/2000	47	0.2264	0.2531	0.1849	0.13
04-1540	CARPINTERIA RESERVOIR	CA	15	-119.4833	34.4000	385	11/1968	12/2000	31	0.2777	0.2461	0.1999	0.68
04-1588	CATHAY BULL RUN RANCH	CA	20	-120.0500	37.4000	1430	7/1948	5/1977	29	0.1792	0.1832	0.1595	0.37
04-1682	CHATSWORTH RESERVOIR	CA	15	-118.6178	34.2253	910	7/1948	12/2000	49	0.2199	0.1571	0.1119	0.27
04-1754	CHUCHUPATE RANGER STN	CA	15	-119.0114	34.8078	5260	7/1948	12/2000	50	0.2636	0.2413	0.1370	0.53
04-2012	CORCORAN IRRIG DIST	CA	20	-119.5817	36.0975	200	1/1956	12/2000	44	0.1604	0.0838	0.0286	1.01
04-2139	CRAWFORD RANCH	CA	10W	-116.2833	32.8833	1502	7/1948	7/1985	35	0.4963	0.4919	0.2665	1.69
04-2164	CRESTLINE FIRE STN 2	CA	22	-117.2708	34.2428	4560	4/1966	12/2000	31	0.1841	0.0669	0.1739	0.87
04-2239	CUYAMACA	CA	15	-116.5872	32.9897	4640	8/1967	12/2000	31	0.2207	0.2731	0.3098	0.74

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-2249	CUYAMA RANGER STN	CA	20	-119.4833	34.8500	2753	7/1948	3/1967	18	0.3417	0.5370	0.5742	4.20
04-2255	DAGGETT EDISON PLANT	CA	7	-116.8556	34.8611	1970	3/1953	12/2000	43	0.3160	0.2717	0.1998	0.12
04-2306	DAY	CA	17	-121.3742	41.2122	3650	7/1948	12/2000	48	0.2605	0.4385	0.2868	0.65
04-2432	DIAMOND BAR HORSE CAMP	CA	15	-117.8000	34.0000	879	7/1948	11/1985	31	0.1438	0.1731	0.1764	2.15
04-2500	DOWNIEVILLE	CA	16	-120.8239	39.5633	2915	7/1948	12/2000	51	0.1857	0.4173	0.3255	0.48
04-2709	EL CAPITAN DAM	CA	15	-116.8164	32.8839	600	5/1956	11/1992	32	0.2321	0.2933	0.1631	0.75
04-2713	EL CENTRO 2 SSW	CA	10W	-115.5617	32.7669	-30	7/1948	12/2000	51	0.4123	0.2792	0.0821	3.02
04-2775	EL MODENA	CA	15	-117.7833	33.8000	459	7/1948	10/1977	29	0.2278	0.1681	0.2088	0.47
04-2805	ELSINORE	CA	15	-117.3319	33.6692	1285	2/1966	12/2000	35	0.2175	0.0534	0.0344	1.26
04-2863	ESCONDIDO 2	CA	15	-117.0969	33.1186	600	11/1964	10/1992	24	0.1663	-0.0369	0.0993	2.76
04-2895	ETIWANDA 1 N	CA	15	-117.5239	34.1317	1390	7/1948	12/2000	49	0.1877	0.1128	0.1919	0.93
04-2922	EXETER FAUVER RANCH	CA	20	-119.0667	36.3500	439	7/1948	8/1988	40	0.2023	0.0870	0.0716	1.99
04-2958	FALLBROOK	CA	15	-117.2500	33.3500	660	7/1948	10/1992	40	0.2364	0.3787	0.2937	0.95
04-2994	FEATHER FALLS	CA	16	-121.2667	39.6000	2972	1/1958	6/1975	16	0.0950	0.2608	-0.0379	3.64
04-3038	FIDDLETOWN DEXTER RANC	CA	20	-120.7061	38.5236	2160	7/1948	12/2000	52	0.1735	0.1713	0.1047	0.34
04-3048	FIGUEROA MOUNTAIN	CA	15	-120.0000	34.7333	3200	7/1948	12/2000	48	0.2338	0.1804	0.2147	0.45
04-3093	FLORENCE LAKE	CA	24	-118.9733	37.2739	7325	7/1948	12/2000	49	0.2703	0.2639	0.2440	1.00
04-3257	FRESNO WSO AP	CA	20	-119.7194	36.7800	333	7/1948	12/2000	52	0.2574	0.3982	0.2622	0.62
04-3285	FULLERTON DAM	CA	15	-117.8881	33.8964	340	7/1948	12/2000	49	0.2089	0.1895	0.1905	0.14
04-3381	GEORGETOWN	CA	16	-120.8333	38.9167	2723	7/1948	12/1967	19	0.1467	0.0653	0.1672	1.94
04-3384	GEORGETOWN RANGER STN	CA	16	-120.8000	38.9333	3001	11/1967	12/2000	29	0.1853	0.4066	0.4362	1.55
04-3397	GIANT FOREST	CA	24	-118.7667	36.5667	6414	7/1948	12/1968	20	0.1874	0.2337	0.2152	0.28
04-3402	GIBRALTAR DAM # 2	CA	22	-119.6822	34.5228	1550	5/1970	12/2000	30	0.1931	0.0659	0.0889	0.67
04-3465	GLENNVILLE FULTON RNGR	CA	20	-118.6797	35.7250	3500	7/1948	12/2000	49	0.2554	0.3761	0.3986	1.29
04-3551	GRANT GROVE	CA	24	-118.9631	36.7394	6600	7/1948	9/1980	29	0.2134	0.2414	0.0384	1.65
04-3573	GRASS VALLEY NO 2	CA	16	-121.0681	39.2042	2400	9/1966	12/2000	33	0.2123	0.5226	0.5083	1.91
04-3649	GRIZZLY FLATS	CA	16	-120.5167	38.6333	3862	7/1948	11/1967	19	0.1609	0.1203	0.0724	0.97
04-3669	GROVELAND 2	CA	20	-120.2258	37.8444	2800	7/1948	12/2000	51	0.2101	0.2919	0.2586	0.17
04-3725	HAMILTON BRANCH FIRE D	CA	17	-121.0833	40.2667	4564	4/1953	10/1985	25	0.2258	0.3342	0.4055	1.53
04-3751	HANSEN DAM	CA	15	-118.3853	34.2608	1087	7/1948	12/2000	49	0.2871	0.3134	0.2797	0.99
04-3855	HAYFIELD RESERVOIR	CA	10W	-115.6289	33.7044	1370	7/1948	12/2000	51	0.3849	0.2949	0.1539	0.30
04-3891	HELL HOLE	CA	16	-120.4150	39.0583	4850	1/1954	12/2000	36	0.2742	0.3828	0.4161	1.35

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-3914	HENSHAW DAM	CA	15	-116.7614	33.2367	2700	7/1948	10/1992	40	0.2092	0.2752	0.2781	0.54
04-3939	HETCH HETCHY	CA	16	-119.7831	37.9614	3870	7/1948	12/2000	50	0.2453	0.4899	0.3498	0.69
04-4176	HUNTINGTON LAKE	CA	24	-119.2206	37.2275	7020	7/1948	12/2000	51	0.2346	0.3891	0.2774	0.30
04-4181	HURKEY CREEK PARK	CA	15	-116.6797	33.6764	4390	6/1961	12/2000	39	0.2814	0.2848	0.2192	0.63
04-4211	IDYLLWILD FIRE DEPT	CA	15	-116.7144	33.7472	5397	2/1937	12/2000	62	0.1971	0.2232	0.1132	1.20
04-4232	INDEPENDENCE	CA	3	-118.2000	36.8000	3944	7/1948	12/2000	52	0.2534	0.1523	0.1595	1.05
04-4297	IRON MOUNTAIN	CA	10W	-115.1219	34.1472	922	7/1948	12/2000	52	0.3593	0.2528	0.2150	0.63
04-4616	KYBURZ STRAWBERRY	CA	16	-120.1500	38.8000	5705	7/1948	4/1980	30	0.2570	0.3564	0.3057	0.84
04-4650	LAGUNA BEACH 2	CA	15	-117.8006	33.5567	210	7/1948	12/2000	50	0.2443	0.2904	0.2285	0.12
04-4726	LAKE WOHLFORD	CA	15	-117.0000	33.1667	1500	7/1948	10/1992	39	0.1654	0.2153	0.3163	2.26
04-4773	LA PORTE	CA	16	-120.9833	39.6833	4984	11/1958	9/1977	17	0.2157	0.2631	0.1802	0.59
04-4867	LECHUZA PTRL ST FC352B	CA	15	-118.8803	34.0764	1600	7/1948	11/1997	46	0.1943	0.1517	0.2100	0.62
04-4986	LITTLE TUJUNGA GLD CR	CA	15	-118.3000	34.3167	2753	7/1948	5/1970	17	0.2465	0.1396	-0.0460	3.11
04-5078	LONG BARN EXPERMENT ST	CA	16	-120.0167	38.1833	5203	7/1948	2/1964	15	0.1671	0.4648	0.2811	1.42
04-5098	LORAINE	CA	7	-118.4333	35.3000	2720	7/1948	4/1987	36	0.2222	0.3625	0.4092	2.08
04-5114	LOS ANGELES WSO ARPT	CA	15	-118.4056	33.9381	100	7/1948	12/2000	52	0.2472	0.2228	0.1949	0.12
04-5115	LOS ANGELES CIVIC CENT	CA	15	-118.2958	34.0278	185	7/1948	12/2000	52	0.2414	0.3004	0.2567	0.19
04-5162	LOWER OTAY RESERVOIR	CA	15	-116.9333	32.6167	540	7/1948	10/1992	40	0.1836	0.1583	0.1017	0.92
04-5212	LYTLE CREEK FOOTHILL B	CA	15	-117.3347	34.0950	1160	7/1948	12/2000	44	0.2395	0.3953	0.4800	3.62
04-5218	LYTLE CREEK RANGER STN	CA	22	-117.4667	34.2333	2730	1/1949	12/2000	50	0.1784	0.0533	0.1534	0.80
04-5356	MARKLEEVILLE	CA	1	-119.7803	38.6919	5530	7/1948	12/2000	38	0.2646	0.3980	0.2896	0.52
04-5417	MATILIJA DAM	CA	22	-119.3056	34.4839	1060	3/1969	12/2000	31	0.2620	0.2173	0.1482	0.82
04-5535	MERCED 2	CA	20	-120.4831	37.3061	170	7/1948	12/2000	52	0.2444	0.3023	0.2186	0.12
04-5586	MICHIGAN BLUFF	CA	16	-120.7333	39.0500	3481	7/1948	10/1985	32	0.2630	0.5461	0.5282	1.46
04-5623	MILFORD LAUFMAN RNGR S	CA	17	-120.3533	40.1414	4860	7/1948	12/2000	51	0.2759	0.4220	0.2999	0.12
04-5632	MILL CREEK INTAKE	CA	22	-116.9364	34.0914	4945	7/1948	12/2000	46	0.2549	0.3444	0.2257	0.27
04-5637	MILL CREEK SUMMIT R S	CA	22	-118.0753	34.3872	4990	1/1972	12/2000	29	0.2959	0.5057	0.3373	1.86
04-5669	MILO 5 NE	CA	24	-118.7675	36.2756	3100	1/1957	12/2000	44	0.2077	0.2333	0.2180	0.29
04-5756	MOJAVE	CA	7	-118.1619	35.0492	2735	11/1959	12/2000	40	0.3327	0.3633	0.2584	0.28
04-5840	MORENA DAM	CA	15	-116.5219	32.6856	3075	7/1948	12/2000	52	0.2530	0.2377	0.1528	0.26
04-5900	MT BALDY FC85E	CA	22	-117.6500	34.2333	4281	5/1958	9/1976	18	0.2368	0.2633	0.0377	2.19
04-5909	MOUNT DANAHER	CA	16	-120.6667	38.7500	3412	7/1948	4/1975	26	0.1816	0.3441	0.3217	0.37

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-6006	MT WILSON NO 2	CA	22	-118.0647	34.2264	5709	7/1948	6/1972	22	0.1919	0.0080	0.1854	2.02
04-6115	NEEDLES	CA	10W	-114.5667	34.8500	489	2/1953	12/2000	44	0.4517	0.4099	0.3319	1.44
04-6154	NEW CUYAMA FIRE STN	CA	20	-119.6811	34.9458	2160	12/1973	12/2000	24	0.2863	0.3449	0.0931	3.16
04-6162	NEWHALL S FC32CE	CA	15	-118.5336	34.3894	1243	10/1949	12/2000	50	0.1979	0.0306	0.0540	1.28
04-6232	NORTH BLOOMFIELD	CA	16	-120.9000	39.3667	3104	10/1969	12/2000	31	0.1802	0.2735	0.2744	0.27
04-6379	OCEANSIDE PUMPING PLAN	CA	15	-117.3536	33.2103	30	2/1952	12/2000	49	0.2578	0.2597	0.1285	0.67
04-6473	ORANGE COUNTY RESERVOI	CA	15	-117.8850	33.9378	660	7/1948	12/2000	49	0.1971	0.1958	0.2417	0.57
04-6577	OZENA GUARD STN	CA	20	-119.3539	34.6828	3590	11/1972	12/2000	26	0.2260	0.2502	0.1504	0.18
04-6624	PALMDALE	CA	7	-118.1000	34.5833	2596	2/1963	12/2000	38	0.2401	0.1113	0.1736	2.06
04-6657	PALOMAR MOUNTAIN OBSER	CA	15	-116.8400	33.3781	5550	7/1948	12/2000	50	0.2265	0.1651	0.1183	0.24
04-6699	PARKER RESERVOIR	CA	10E	-114.1700	34.2800	740	7/1948	12/2000	51	0.2961	0.2513	0.1504	0.35
04-6893	PINECREST SUMMIT R S	CA	16	-120.0000	38.1833	5600	11/1964	12/2000	34	0.2168	0.3838	0.3076	0.08
04-6910	PINE MOUNTAIN INN	CA	22	-119.3667	34.6103	4220	1/1965	12/2000	34	0.2567	0.2967	0.1513	0.45
04-6942	PIRU TELEMETERING	CA	15	-118.7000	34.4000	801	6/1971	12/2000	28	0.2182	0.1311	0.1746	0.53
04-6964	PLACERVILLE DISPOSAL P	CA	20	-120.8461	38.7311	1560	6/1963	12/2000	36	0.1541	0.1977	0.1733	0.69
04-6998	PLUMAS EUREKA STATE PA	CA	16	-120.6964	39.7578	5165	5/1964	12/2000	34	0.2839	0.4809	0.3008	2.15
04-7085	PORTOLA	CA	17	-120.4719	39.8053	4850	10/1954	12/2000	42	0.2815	0.4377	0.2198	0.71
04-7123	PRADO DAM	CA	15	-117.6453	33.8903	560	7/1948	12/2000	48	0.2246	0.2403	0.1934	0.05
04-7470	RIVERSIDE SOUTH	CA	15	-117.3875	33.9511	800	2/1976	12/2000	25	0.2216	0.4180	0.3021	2.08
04-7473	RIVERSIDE CITRUS EXP S	CA	15	-117.3500	33.9667	986	7/1948	12/2000	46	0.2340	0.2632	0.1939	0.10
04-7489	ROBBS PEAK P H	CA	16	-120.3833	38.9000	5125	2/1967	12/2000	34	0.2201	0.3662	0.2779	0.12
04-7600	RUNNING SPRINGS 1 E	CA	22	-117.0864	34.2067	5965	7/1948	12/2000	51	0.1814	0.1719	0.1134	0.39
04-7735	SANDBERG WSMO	CA	15	-118.7333	34.7500	4517	7/1948	5/1983	33	0.1969	0.0712	0.0062	1.49
04-7740	SAN DIEGO WSO AIRPORT	CA	15	-117.1686	32.7347	13	7/1948	12/2000	52	0.2228	0.2000	0.1480	0.10
04-7750	SAN DIMAS TANBARK FLAT	CA	22	-117.7667	34.2000	2801	7/1948	11/1985	35	0.1850	0.1658	0.1580	0.24
04-7762	SAN FERNANDO PH 3	CA	15	-118.5000	34.3167	1250	7/1948	12/2000	47	0.2323	0.3222	0.2816	0.42
04-7779	SAN GABRIEL DAM FC425B	CA	22	-117.8608	34.2053	1481	7/1948	12/2000	46	0.1959	0.3156	0.2926	2.06
04-7813	SAN JACINTO RANGER STN	CA	15	-116.9592	33.7869	1560	7/1948	12/2000	52	0.2730	0.3227	0.1607	1.06
04-7837	SAN JUAN GUARD STN	CA	15	-117.5144	33.5922	730	7/1948	12/2000	38	0.2498	0.3085	0.3786	1.87
04-7859	SAN MARCOS PASS	CA	22	-119.8167	34.5333	2303	12/1967	12/2000	33	0.2071	0.2204	0.1173	0.28
04-7891	SANTA ANA RIVER P H 3	CA	15	-117.1061	34.1017	1984	7/1948	12/2000	41	0.2368	0.4421	0.3501	1.94
04-7902	SANTA BARBARA	CA	15	-119.6853	34.4167	5	7/1948	12/2000	50	0.2141	0.2254	0.1681	0.19

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-7926	SANTA FE DAM	CA	15	-117.9686	34.1128	425	7/1948	12/2000	49	0.2082	0.0904	0.1579	0.92
04-7976	SANTA YNEZ	CA	15	-120.0692	34.6078	600	7/1948	12/2000	51	0.2357	0.2235	0.1565	0.10
04-7987	SANTIAGO DAM	CA	15	-117.7217	33.7869	855	7/1948	12/2000	49	0.2732	0.3247	0.1644	1.03
04-7993	SANTIAGO PEAK	CA	15	-117.5361	33.7108	5638	7/1971	12/2000	24	0.1574	0.0606	0.2445	3.19
04-8092	SEPULVEDA DAM	CA	15	-118.4728	34.1661	680	7/1948	12/2000	49	0.2332	0.2058	0.1999	0.09
04-8218	SIERRAVILLE RANGER STN	CA	17	-120.3706	39.5833	4975	7/1948	12/2000	48	0.2253	0.3505	0.2671	0.48
04-8230	SIGNAL HILL FC 415	CA	15	-118.1675	33.7967	100	7/1948	12/2000	47	0.2624	0.2652	0.3062	1.19
04-8243	SILVERADO RANGER STN	CA	15	-117.6600	33.7425	1095	7/1948	12/2000	46	0.2250	0.1886	0.1624	0.06
04-8261	SIMI SANITATION PLANT	CA	15	-118.8119	34.2839	660	10/1975	12/2000	25	0.2162	0.1429	0.1389	0.24
04-8332	SODA SPRINGS 1 E	CA	16	-120.3672	39.3256	6885	7/1961	12/2000	29	0.2335	0.3776	0.2435	0.57
04-8355	SONORA JUNCTION	CA	3	-119.4500	38.3511	6886	9/1959	12/2000	41	0.2434	0.2524	0.0953	1.34
04-8436	SPADRA PAC COL FC356C	CA	15	-117.8167	34.0500	676	1/1955	12/2000	42	0.2149	0.2877	0.2811	0.50
04-8460	SPRINGVILLE RANGER STN	CA	20	-118.8114	36.1422	1050	7/1948	12/2000	50	0.1948	0.1632	0.0828	0.45
04-8463	SPRINGVILLE TULE HD	CA	24	-118.6567	36.1933	4070	10/1956	12/2000	43	0.1646	0.1286	0.1705	1.31
04-8655	SUN CITY	CA	15	-117.1903	33.7153	1426	11/1970	12/2000	30	0.2727	0.3554	0.3236	0.89
04-8697	SURF 2 ENE	CA	15	-120.5364	34.6828	110	7/1948	12/2000	50	0.2448	0.2563	0.1901	0.07
04-8703	SUSANVILLE 1 WNW	CA	17	-120.6747	40.4239	4555	9/1952	12/2000	45	0.3382	0.4706	0.2632	1.61
04-8752	TAFT	CA	20	-119.4492	35.1400	987	7/1948	10/1989	41	0.2580	0.4236	0.2835	0.86
04-8832	TEHACHAPI RS	CA	7	-118.4408	35.1322	3960	7/1948	12/2000	52	0.2911	0.3180	0.2051	0.21
04-8844	TEMECULA	CA	15	-117.1508	33.4972	1020	1/1974	12/2000	27	0.2475	0.1138	0.1255	1.04
04-8873	TERMO 1 E	CA	17	-120.4333	40.8667	5300	7/1948	2/2000	48	0.3079	0.4301	0.3177	1.12
04-8892	THERMAL FIRE STN 39	CA	10W	-116.1639	33.6358	-115	6/1950	12/2000	50	0.3633	0.2952	0.1959	0.08
04-8912	THREE RIVERS 6 SE	CA	20	-118.8475	36.3711	1935	1/1957	12/2000	43	0.1882	0.2097	0.1495	0.14
04-8917	THREE RIVERS HAMMOND R	CA	20	-118.8619	36.4650	1140	7/1948	12/2000	51	0.2128	0.2561	0.2177	0.11
04-8928	TIGER CREEK PH	CA	16	-120.4992	38.4461	2355	7/1948	12/1998	46	0.1445	0.1722	0.1853	0.79
04-8992	TRABUCO OAKS	CA	15	-117.5894	33.6583	970	7/1948	12/2000	50	0.1853	0.1634	0.0758	1.30
04-9043	TRUCKEE RANGER STN	CA	17	-120.1892	39.3311	6020	7/1948	12/2000	49	0.2687	0.2999	0.0959	2.05
04-9049	TUJUNGA MILL FC 470	CA	22	-118.0833	34.3833	4652	7/1948	6/1976	22	0.3523	0.4877	0.3075	2.77
04-9120	UHL RANGER STN	CA	20	-118.6500	35.8833	3725	1/1965	12/2000	35	0.1317	0.1728	0.1446	1.18
04-9325	VICTORVILLE	CA	7	-117.3058	34.5350	2858	7/1948	12/2000	52	0.2973	0.1961	0.1398	0.48
04-9447	WARNER SPRINGS	CA	15	-116.6333	33.2833	3182	7/1948	5/1978	30	0.3306	0.2752	0.1402	2.98
04-9482	WAWONA RANGER STN	CA	24	-119.6417	37.5350	3985	7/1948	12/2000	50	0.1968	0.2446	0.1825	0.17

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
04-9512	WELDON	CA	3	-118.3000	35.6667	2680	7/1948	3/1986	37	0.3889	0.5736	0.3995	1.84
04-9605	WHEATLAND 2 NE	CA	20	-121.3908	39.0278	105	7/1948	12/2000	52	0.2200	0.2310	0.1365	0.21
04-9615	WHEELER SPRINGS 2 SW	CA	22	-119.3000	34.4833	879	7/1948	1/1969	20	0.1801	0.1295	0.0576	0.80
04-9666	WHITTIER NARROWS DAM	CA	15	-118.0858	34.0200	200	9/1972	12/2000	25	0.2375	0.1030	0.0970	0.86
04-9722	WINCHESTER	CA	15	-117.0833	33.7167	1480	12/1940	12/2000	54	0.2239	0.3063	0.2198	0.49
04-9855	YOSEMITE PARK HDQTRS	CA	24	-119.5883	37.7567	3966	7/1948	12/2000	50	0.1878	0.3457	0.2163	0.93
05-0130	ALAMOSA WSO AP	CO	9	-105.8656	37.4361	7533	9/1948	12/2000	49	0.2521	0.2337	0.2632	0.88
05-1440	CEDAREDGE	CO	6	-107.9333	38.9000	6244	8/1948	5/1994	46	0.3381	0.4734	0.3715	0.83
05-2040	CUCHARAS DAM	CO	14	-104.6000	37.7500	5845	8/1948	4/1988	36	0.3452	0.3365	0.0983	2.83
05-2286	DINOSAUR NATL MONUMENT	CO	5	-108.9719	40.2442	5920	6/1965	12/2000	36	0.2584	0.3807	0.3113	0.20
05-2432	DURANGO	CO	8	-107.8833	37.2833	6600	8/1948	9/1980	25	0.2278	0.1609	0.1331	0.50
05-3488	GRAND JUNCTION WSO AP	CO	6	-108.5375	39.1342	4840	8/1948	12/2000	52	0.2350	0.3542	0.2934	1.50
05-4538	KIM 15 NNE	CO	14	-103.3219	37.4533	5150	8/1948	12/2000	51	0.2741	0.1899	0.0995	0.33
05-5487	MEEKER NO 2	CO	5	-107.9167	40.0333	6347	10/1970	9/1992	19	0.2692	0.1045	-0.0985	2.19
05-5531	MESA VERDE NATL PARK	CO	8	-108.4883	37.1986	7115	8/1948	12/2000	52	0.2566	0.2388	0.1601	0.01
05-5706	MONTE VISTA	CO	9	-106.1861	37.5806	7650	8/1948	5/1965	16	0.2878	0.1481	-0.0374	1.86
05-5711	MONTE VISTA REFUGE	CO	9	-106.1500	37.4833	7675	5/1965	3/1999	31	0.3092	0.2253	0.1614	0.82
05-5819	MULE SHOE LODGE 1 SSE	CO	9	-105.1833	37.5833	8870	8/1948	2/1986	37	0.2323	0.2684	0.1549	0.72
05-6591	PLEASANT VIEW 2 W	CO	8	-108.7833	37.5875	6860	8/1950	12/2000	49	0.2296	0.2346	0.1997	0.29
05-7031	RIFLE	CO	5	-107.7333	39.5500	5319	8/1948	12/2000	47	0.3012	0.3662	0.2251	0.48
05-7428	SAN LUIS	CO	9	-105.4064	37.1783	8017	8/1948	12/2000	51	0.3216	0.3647	0.3637	1.89
05-7656	SILVERTON	CO	8	-107.6614	37.8117	9272	8/1948	4/1986	35	0.2384	0.1908	0.1834	0.43
05-7866	SPRINGFIELD 7 WSW	CO	14	-102.7431	37.3692	4622	5/1972	12/2000	28	0.2230	0.1375	0.0059	2.97
05-7867	SPRINGFIELD 8 S	CO	14	-102.6167	37.2833	4505	8/1948	5/1972	20	0.2658	0.1669	0.1680	0.31
05-8204	TELLURIDE	CO	8	-107.8733	37.9492	8672	8/1948	12/2000	53	0.2562	0.3085	0.3033	0.85
05-8220	TERCIO 4 NW	CO	9	-105.0572	37.0708	8270	8/1948	12/2000	52	0.2072	0.1480	0.1359	0.70
05-8429	TRINIDAD	CO	14	-104.4867	37.1789	6030	5/1973	12/2000	26	0.2839	0.2218	0.0996	0.45
05-8742	WAGON WHEEL GAP 3 N	CO	9	-106.8333	37.8000	8507	8/1948	2/1975	23	0.3168	0.3629	0.1788	0.97
05-8781	WALSENBURG	CO	9	-104.7681	37.6464	6150	8/1948	12/2000	50	0.2811	0.1904	0.1260	0.43
05-8997	WHITE ROCK	CO	14	-104.1139	37.8675	4730	8/1948	12/2000	50	0.2736	0.1695	0.1098	0.35
10-1298	BURLEY FACTORY	ID	18	-113.8000	42.5500	4144	7/1948	5/1978	24	0.3387	0.4545	0.1797	1.00
10-3677	GOODING 1 S	ID	18	-114.6964	42.9183	3560	9/1952	12/2000	48	0.3003	0.3783	0.2335	1.00

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
10-3732	GRACE	ID	2	-111.7447	42.5864	5550	11/1952	12/2000	46	0.2651	0.2372	0.1287	0.65
10-3811	GRASMERE 3 S	ID	18	-115.8833	42.3450	5140	4/1963	12/2000	38	0.2918	0.1564	-0.0127	1.00
10-4230	HENRY	ID	2	-111.5289	42.9092	6140	9/1971	12/2000	26	0.1981	0.2347	0.2502	2.10
10-5544	MALAD	ID	2	-112.2667	42.2000	4581	7/1948	5/1978	29	0.2981	0.2861	0.0901	0.80
10-5567	MALTA AVIATION	ID	2	-113.3350	42.3019	4540	11/1952	12/2000	42	0.2640	0.2523	0.0739	0.82
10-7211	POCATELLO WSO ARPT	ID	18	-112.5711	42.9203	4454	7/1948	12/2000	52	0.2170	0.2226	0.1909	1.00
10-9119	THREE CREEK	ID	2	-115.1500	42.0833	5458	4/1961	11/1987	24	0.2988	0.3205	0.0687	0.99
26-0507	AUSTIN	NV	4	-117.0719	39.4961	6605	7/1948	12/2000	52	0.2228	0.1366	0.1326	0.69
26-0691	BATTLE MOUNTAIN 4 SE	NV	4	-116.8667	40.6167	4531	7/1948	12/2000	52	0.2349	0.2797	0.1860	0.30
26-0718	BEATTY 8 N	NV	4	-116.7183	36.9950	3550	11/1972	12/2000	28	0.3539	0.4010	0.3477	1.29
26-1358	CALIENTE	NV	7	-114.5158	37.6169	4400	7/1948	11/1976	25	0.3143	0.2524	0.1582	0.11
26-1905	CONTACT	NV	2	-114.7528	41.7706	5350	7/1948	12/2000	45	0.2995	0.3231	0.1149	0.56
26-2477	EASTGATE	NV	3	-117.8833	39.3000	5023	7/1948	7/1969	19	0.3648	0.4128	0.2855	0.87
26-2573	ELKO WB AIRPORT	NV	4	-115.7917	40.8250	5050	7/1948	10/1999	51	0.3892	0.6084	0.5022	2.91
26-2631	ELY WBO	NV	4	-114.8453	39.2950	6253	7/1948	12/2000	52	0.2688	0.4587	0.3064	1.53
26-2860	FISH CREEK RANCH	NV	4	-116.0000	39.2667	6053	7/1948	8/1966	17	0.2476	0.2625	0.2179	0.15
26-3515	HAWTHORNE AIRPORT	NV	3	-118.6667	38.5500	4220	7/1948	9/1991	31	0.3386	0.2901	0.1323	1.29
26-4086	JIGGS	NV	4	-115.6500	40.4500	5423	7/1948	3/1972	22	0.2590	0.2867	0.1681	0.44
26-4436	LAS VEGAS WSO AIRPORT	NV	7	-115.1667	36.0833	2162	1/1949	12/2000	52	0.3685	0.3215	0.1346	0.50
26-4527	LEONARD CREEK RANCH	NV	1	-118.7192	41.5172	4224	12/1954	12/2000	44	0.2601	0.4136	0.3955	1.33
26-4651	LOGANDALE	NV	7	-114.4833	36.6167	1410	2/1968	1/1992	23	0.3349	0.1959	0.0531	0.86
26-4698	LOVELOCK	NV	3	-118.4667	40.1833	3975	9/1952	12/2000	44	0.2656	0.2372	0.1573	0.25
26-4935	MC DERMITT	NV	2	-117.7200	41.9961	4527	3/1950	12/2000	42	0.2882	0.3318	0.1725	0.26
26-5092	METROPOLIS	NV	2	-115.0167	41.2833	5800	3/1968	1/1996	23	0.2519	0.2361	0.2250	1.57
26-5191	MINDEN	NV	1	-119.7758	38.9547	4709	7/1948	12/2000	52	0.1992	0.2520	0.2532	1.57
26-5362	MONTGOMERY MNTC STN	NV	3	-118.3167	37.9667	7106	5/1960	8/1984	23	0.3102	0.3669	0.2563	0.07
26-5441	MOUNT ROSE CHRISTMAS T	NV	1	-119.8636	39.3422	7235	1/1971	12/2000	30	0.2421	0.3262	0.1926	0.91
26-5846	OVERTON	NV	7	-114.4583	36.5489	1250	7/1948	12/2000	29	0.3308	0.3829	0.3883	2.23
26-5869	OWYHEE	NV	2	-116.1000	41.9500	5397	7/1948	6/1985	31	0.2549	0.3687	0.2412	1.07
26-5880	PAHRANAGAT W L REFUGE	NV	4	-115.1197	37.2692	3400	4/1965	12/2000	36	0.3017	0.3899	0.2525	0.43
26-6148	PEQUOP	NV	4	-114.5333	41.0667	6033	7/1948	3/1989	39	0.2943	0.2627	0.1712	0.35
26-6779	RENO WSFO AIRPORT	NV	1	-119.7833	39.5000	4404	7/1948	12/2000	52	0.2926	0.3721	0.2334	0.16

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
26-7192	RYE PATCH DAM	NV	3	-118.3047	40.4661	4135	7/1948	12/2000	52	0.2840	0.4306	0.3386	0.62
26-7369	SEARCHLIGHT	NV	7	-114.9217	35.4661	3540	7/1948	12/2000	53	0.2916	0.2581	0.1349	0.34
26-7397	SEVENTY ONE RANCH	NV	4	-115.3167	40.9000	5453	12/1949	9/1978	20	0.2396	0.1835	0.1717	0.50
26-7612	SMITH 6 N	NV	3	-119.3511	38.8822	5000	7/1973	12/2000	26	0.2649	0.4798	0.2856	2.20
26-7620	SMOKEY VALLEY	NV	4	-117.1742	38.7839	5625	5/1953	12/2000	48	0.2843	0.3619	0.2493	0.19
26-7640	SNOWBALL RANCH	NV	4	-116.1989	39.0403	7160	9/1966	12/2000	34	0.2740	0.1674	0.0969	0.96
26-7908	SUNNYSIDE	NV	4	-115.0228	38.4236	5300	7/1948	12/2000	47	0.3715	0.3247	0.1690	2.39
26-8170	TONOPAH AP	NV	4	-117.0872	38.0603	5430	6/1954	3/1977	21	0.2142	0.1307	0.1758	1.71
26-8822	WABUSKA 5 SE	NV	3	-119.1189	39.0747	4300	2/1972	12/2000	27	0.3026	0.2945	0.2983	1.10
26-8838	WADSWORTH 4 N	NV	1	-119.2903	39.6911	4200	8/1974	12/2000	26	0.3726	0.3882	0.2096	1.51
26-8977	WELLINGTON RANGER STN	NV	3	-119.3667	38.7500	4843	7/1948	5/1973	24	0.2786	0.2251	0.0808	1.09
26-8988	WELLS	NV	2	-114.9736	41.1006	5700	7/1948	12/2000	53	0.2727	0.4174	0.2762	1.65
26-9171	WINNEMUCCA WSO AIRPORT	NV	2	-117.7167	40.9667	4295	7/1948	12/2000	53	0.2741	0.3588	0.2659	0.59
26-9234	YERINGTON SCS Y 1	NV	3	-119.1667	39.0000	4383	7/1948	12/1971	21	0.2645	0.3038	0.2509	0.15
29-0041	ABIQUIU DAM	NM	9	-106.4333	36.2333	6380	10/1963	12/2000	33	0.2027	0.1063	0.0679	0.92
29-0199	ALAMOGORDO	NM	13	-105.9467	32.9183	4350	9/1968	12/2000	30	0.2272	0.0196	0.0467	1.81
29-0234	ALBUQUERQUE WSFO AIRPO	NM	13	-106.6064	35.0422	5310	10/1947	12/2000	53	0.2408	0.1491	0.1147	0.14
29-0417	ANIMAS	NM	12	-108.7686	31.9378	4437	11/1969	12/2000	31	0.2644	0.1271	-0.0077	1.16
29-0600	ARTESIA 6 S	NM	14	-104.3881	32.7747	3320	10/1947	12/2000	52	0.2708	0.2064	0.1302	0.10
29-0640	AUGUSTINE 2 E	NM	13	-107.6211	34.0750	7000	10/1947	12/2000	51	0.2670	0.2373	0.1028	0.51
29-0818	BEAVERHEAD R S	NM	12	-108.1167	33.4167	6670	7/1948	12/2000	49	0.2451	0.2314	0.1798	0.16
29-0860	GRANT LINE ARROYO	MN	13	-106.5711	35.1344	5302	6/1976	9/1992	17	0.2713	0.0724	0.0646	0.84
29-0880	ACADEMY ACRES	MN	13	-106.5717	35.1506	5306	7/1976	9/1992	17	0.2161	0.3387	0.0947	3.45
29-0890	LA CUEVA ARROYO	MN	13	-106.4956	35.1906	6100	7/1977	9/1992	15	0.3113	0.2170	0.2496	1.63
29-0903	BERNALILLO 1 NNE	NM	13	-106.5333	35.3333	5062	10/1947	9/1982	35	0.2571	0.1553	0.1267	0.07
29-0935	ARROYO 19A	MN	13	-106.7296	35.1567	5328	6/1977	9/1992	16	0.2094	0.1099	-0.0499	2.44
29-1120	BONITO DAM	NM	13	-105.6833	33.4500	7055	10/1947	12/2000	51	0.2288	0.1633	0.0941	0.26
29-1286	CABALLO DAM	NM	13	-107.3000	32.9000	4190	10/1947	12/2000	52	0.2651	0.2574	0.2284	0.71
29-1446	CAPROCK 4 SE	NM	14	-103.6333	33.3500	4272	10/1947	12/1971	23	0.2062	0.2031	0.1864	1.20
29-1469	CARLSBAD	NM	14	-104.2456	32.4306	3120	10/1947	12/2000	51	0.2893	0.1653	0.0645	1.12
29-1515	CARRIZOZO	NM	13	-105.8964	33.6308	5405	10/1947	12/2000	53	0.2637	0.1911	0.1630	0.11
29-1840	FARNSWORTH RANCH	NM	14	-105.0000	33.9000	5400	5/1953	5/1980	27	0.3116	0.2946	0.1397	1.11

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-1887	CLAYTON WSO AIRPORT	NM	14	-103.1500	36.4500	4970	10/1947	12/2000	47	0.2410	0.1156	0.0635	1.03
29-1939	CLOVIS	NM	14	-103.2000	34.3667	4280	7/1949	12/2000	51	0.2131	0.2100	0.1555	1.12
29-1963	CLOVIS 13 N	NM	14	-103.2161	34.5989	4435	7/1949	12/2000	52	0.2411	0.2623	0.2068	0.83
29-1982	COCHITI DAM	NM	13	-106.3322	35.6414	5560	4/1967	12/2000	34	0.2401	0.2572	0.2541	1.31
29-2024	COLUMBUS	NM	13	-107.6333	31.8333	4065	10/1947	12/2000	51	0.2793	0.0988	0.0421	0.77
29-2030	CONCHAS DAM	NM	14	-104.1906	35.4072	4244	10/1947	12/2000	51	0.2962	0.3150	0.1321	1.21
29-2203	CROSSROADS	NM	14	-103.3333	33.5167	4150	3/1977	5/1993	16	0.2736	0.2890	0.1963	0.71
29-2219	CROWNPOINT	NM	8	-108.1500	35.6833	6965	7/1948	11/1969	21	0.3299	0.3688	0.3695	4.02
29-2241	CUBA	NM	13	-106.9683	36.0106	7045	7/1970	12/2000	31	0.3090	0.2234	0.1234	0.84
29-2436	DEMING	NM	13	-107.7333	32.2500	4300	7/1982	12/2000	18	0.3007	0.1132	0.1445	1.08
29-2510	DILIA 1 SSE	NM	14	-105.0500	35.1833	5150	10/1947	12/2000	50	0.2366	0.1860	0.2425	0.84
29-2665	DURAN	NM	14	-105.4000	34.4667	6285	10/1947	12/2000	52	0.2309	0.1061	0.1706	0.66
29-2700	EAGLE NEST	NM	9	-105.2628	36.3908	8280	10/1947	12/2000	51	0.1992	0.2092	0.1674	0.95
29-2837	EL VADO DAM	NM	9	-106.7333	36.6000	6740	10/1947	12/2000	53	0.3015	0.2733	0.1276	0.36
29-3142	FARMINGTON AG SCIENCE	NM	8	-108.2500	36.7000	5625	4/1978	12/2000	23	0.2500	0.2341	0.1439	0.09
29-3225	FLORIDA	NM	13	-107.4833	32.4333	4450	10/1947	7/1992	43	0.2793	0.1397	0.0697	0.39
29-3265	FORT BAYARD	NM	13	-108.1517	32.7939	6142	9/1968	12/2000	32	0.2406	0.0956	0.0407	0.62
29-3374	GALISTEO	NM	13	-105.9500	35.4000	6093	1/1958	12/1977	20	0.2657	0.1542	0.0261	0.81
29-4009	HILLSBORO	NM	13	-107.5628	32.9236	5270	10/1947	12/2000	51	0.2369	0.0536	0.0743	1.14
29-4089	HONDO 1 SE	NM	14	-105.2544	33.3803	5270	10/1947	12/2000	53	0.2297	0.0792	0.1473	0.96
29-4112	HOPE	NM	14	-104.7333	32.8167	4091	5/1965	12/2000	29	0.2490	0.2830	0.0835	2.27
29-4366	JEMEZ DAM	NM	13	-106.5333	35.3833	5388	10/1953	12/2000	47	0.2159	0.2109	0.1300	0.57
29-4426	JORNADA EXP RANGE	NM	13	-106.7333	32.6167	4266	11/1947	12/2000	52	0.2968	0.1585	0.1273	0.45
29-4719	LAGUNA	NM	13	-107.4000	35.0333	5800	10/1948	12/2000	51	0.2702	0.2253	0.2371	0.86
29-4850	LAS VEGAS 2 NW	NM	14	-105.2667	35.6167	6604	11/1954	6/1983	24	0.2189	0.2540	0.2779	2.13
29-5273	LUNA RANGER STN	NM	12	-108.9417	33.8225	7050	7/1948	1/1970	19	0.2078	-0.0389	0.0295	1.59
29-5370	MALJAMAR 4 SE	NM	14	-103.7047	32.8233	4000	2/1948	12/2000	51	0.2406	0.1962	0.1289	0.26
29-5754	MIMBRES RANGER STN	NM	13	-108.0142	32.9325	6238	11/1952	12/2000	45	0.2613	0.0982	-0.0026	1.13
29-5800	MOGOLLON	NM	12	-108.8000	33.4000	6568	7/1948	10/1973	25	0.2112	0.1814	0.1858	0.30
29-5834	MONTANO GRANT	NM	13	-107.0167	35.1667	5935	1/1948	10/1967	20	0.2443	0.1247	0.0268	0.65
29-6043	NARROWS	NM	13	-107.1667	33.3833	4403	1/1948	4/1969	21	0.2687	0.2003	0.1181	0.08
29-6138	NOGAL LAKE	NM	13	-105.6833	33.5167	7116	11/1947	5/1970	19	0.3261	0.2023	0.0875	1.58

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
29-6275	OCATE 1 N	NM	9	-105.0667	36.2000	7655	8/1960	12/2000	40	0.2881	0.4035	0.2438	1.49
29-6435	OROGRANDE 1 N	NM	13	-106.0911	32.3789	4182	11/1947	12/2000	50	0.2678	0.2763	0.2311	0.83
29-6659	PEARL	NM	14	-103.3833	32.6500	3800	11/1947	8/1996	48	0.2174	0.1389	0.1190	0.66
29-7094	PROGRESSO	NM	13	-105.8833	34.4167	6297	11/1947	12/2000	53	0.2457	0.1637	0.1335	0.10
29-7254	RAMON 8 SW	NM	14	-105.0000	34.1500	5327	6/1969	12/2000	31	0.2380	0.2279	0.2288	0.69
29-7279	RATON FILTER PLANT	NM	14	-104.4325	36.9194	6932	9/1953	12/2000	35	0.2946	0.3030	0.2187	1.24
29-7346	REGINA	NM	13	-106.9500	36.1833	7454	11/1947	9/1969	22	0.2504	0.2745	0.1463	0.68
29-7423	RIENHARDT RANCH	NM	13	-107.2167	33.7500	5450	10/1951	12/2000	49	0.2384	0.2738	0.1593	0.72
29-7534	RODEO	NM	12	-109.0333	31.8333	4114	1/1954	4/1978	23	0.3152	0.3511	0.2339	1.29
29-7609	ROSWELL WSO AIRPORT	NM	14	-104.5333	33.4000	3629	12/1947	12/1972	25	0.2075	0.1164	0.2283	1.30
29-7610	ROSWELL FAA ARPT	NM	14	-104.5411	33.3081	3649	1/1973	12/2000	26	0.2696	0.2405	0.1813	0.21
29-7638	ROY	NM	14	-104.2000	35.9500	5878	11/1947	12/2000	53	0.2121	0.1813	0.1917	0.74
29-7736	SACRAMENTO # 2	NM	13	-105.5667	32.8000	7550	11/1974	12/2000	26	0.1824	0.2543	0.1581	2.02
29-7827	SAN FIDEL 1 N	NM	13	-107.6000	35.0833	6135	11/1947	12/1976	28	0.2559	0.0966	0.1770	1.44
29-7918	SAN MATEO	NM	13	-107.6500	35.3333	7242	11/1947	3/1989	34	0.3118	0.2249	0.2583	1.75
29-8011	SANDIA CREST	NM	13	-106.4500	35.2167	10686	10/1953	7/1969	15	0.1640	0.2103	0.1141	2.48
29-8072	SANTA FE	NM	13	-105.9000	35.6833	7205	11/1947	3/1972	24	0.2411	0.2963	0.2639	1.59
29-8085	SANTA FE 2	NM	13	-105.9753	35.6194	6718	3/1972	12/2000	28	0.2146	0.1073	0.1512	1.34
29-8387	SOCORRO	NM	13	-106.8797	34.0783	4585	7/1948	12/2000	53	0.2966	0.2123	0.1418	0.41
29-8501	SPRINGER	NM	14	-104.5936	36.3661	5922	11/1947	12/2000	52	0.2363	0.1082	0.1558	0.57
29-8518	STANLEY 1 NNE	NM	13	-105.9608	35.1672	6380	12/1954	12/2000	44	0.3125	0.2762	0.1713	1.21
29-8596	SUMNER LAKE	NM	14	-104.3833	34.6000	4306	1/1975	12/2000	25	0.2860	0.3352	0.1371	1.65
29-9031	TORREON NAVAJO MISSION	NM	13	-107.1833	35.8000	6703	1/1961	12/2000	40	0.2829	0.2369	0.1143	0.53
29-9156	TUCUMCARI 4 NE	NM	14	-103.6833	35.2000	4086	11/1947	12/2000	53	0.2330	0.0940	0.1791	0.95
29-9265	TWO RIVERS RESERVOIR	NM	14	-104.6167	33.2833	4056	7/1963	8/1982	17	0.3002	0.2910	0.2234	1.37
29-9686	WHITE SANDS NATL MON	NM	13	-106.1747	32.7817	3995	11/1947	12/2000	53	0.2629	0.2108	0.1348	0.06
35-4321	JORDAN VALLEY	OR	2	-117.0536	42.9783	4390	10/1948	12/2000	51	0.2710	0.3484	0.3137	1.53
35-4670	LAKEVIEW 2 NNW	OR	17	-120.3636	42.2139	4778	10/1948	12/2000	52	0.2434	0.3986	0.2600	0.66
41-0248	ANDREWS	TX	14	-102.5500	32.3167	3412	7/1942	12/2000	58	0.2625	0.1642	0.0828	0.49
41-1646	CHANNING	TX	14	-102.3100	35.6853	3800	1/1941	12/2000	60	0.2287	0.1701	0.1662	0.23
41-2082	CRANE	TX	14	-102.3122	31.4011	2630	8/1943	12/2000	57	0.2286	0.1059	0.1149	0.62
41-2797	EL PASO WSO AP	TX	13	-106.3758	31.8111	3918	8/1942	12/2000	59	0.2414	0.1035	0.0860	0.43

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
41-3033	FABENS 1	TX	13	-106.1500	31.5000	3612	2/1953	9/1977	25	0.3284	0.2238	0.0785	2.02
41-4098	HEREFORD	TX	14	-102.4000	34.8167	3820	5/1955	12/2000	43	0.2323	0.1113	0.1788	0.66
41-4425	IMPERIAL 2 W	TX	14	-102.7000	31.2667	2400	9/1963	10/1993	30	0.2739	0.0830	0.0857	1.87
41-5890	MIDLAND WSO AP	TX	14	-102.1906	31.9431	2862	2/1941	12/2000	56	0.2915	0.1973	0.2064	1.27
41-6136	MULESHOE 2	TX	14	-102.7367	34.2208	3800	6/1941	12/2000	57	0.2429	0.1843	0.2593	1.23
41-6893	PECOS 8 W	TX	14	-103.6333	31.3783	2660	3/1960	12/2000	41	0.2512	0.1603	0.1512	0.09
41-6935	PEP	TX	14	-102.5578	33.8153	3660	8/1956	12/2000	44	0.2341	0.2111	0.2038	0.42
41-7074	PLAINS	TX	14	-102.8286	33.1875	3675	7/1942	12/2000	59	0.2757	0.2095	0.1692	0.21
41-7481	RED BLUFF DAM	TX	14	-103.9294	31.9061	2800	7/1942	12/2000	52	0.2902	0.1313	0.0738	1.52
41-8305	SIERRA BLANCA 2 E	TX	13	-105.3233	31.1850	4535	7/1942	12/2000	51	0.2304	0.1017	0.1515	1.13
41-9037	TINNIN RANCH	TX	14	-103.9833	31.3167	3232	7/1942	12/1969	27	0.3218	0.2368	0.1611	1.68
41-9829	WINK	TX	14	-103.1500	31.7667	2790	7/1942	4/1997	48	0.2372	0.1431	0.1842	0.35
42-0086	ALTON	UT	6	-112.4833	37.4333	7040	12/1971	12/2000	29	0.2396	0.2780	0.2049	0.48
42-0168	ANGLE	UT	21	-111.9603	38.2492	6400	7/1981	12/2000	19	0.2529	0.3297	0.2038	0.28
42-0738	BLANDING	UT	8	-109.4794	37.6131	6040	7/1948	12/2000	53	0.3028	0.2562	0.0693	1.21
42-1008	BRYCE CANYON NATL PK H	UT	6	-112.1689	37.6411	7915	6/1959	12/2000	42	0.2590	0.2655	0.2021	0.59
42-1273	CEDAR CITY STEAM PLANT	UT	21	-113.0333	37.6667	6004	12/1961	2/1984	22	0.1973	0.0674	-0.0037	1.51
42-1308	CEDAR POINT	UT	8	-109.0833	37.7167	6760	7/1974	12/2000	26	0.2710	0.3008	0.1738	0.50
42-1590	COALVILLE 13 E	UT	5	-111.1492	40.9383	6510	11/1974	12/2000	26	0.1749	0.2199	0.0653	1.55
42-1759	COTTONWOOD WEIR	UT	23	-111.7833	40.6189	4960	7/1948	12/2000	52	0.2693	0.3400	0.1525	1.81
42-2090	DELTA	UT	21	-112.5167	39.3833	4764	7/1948	12/2000	52	0.2585	0.2932	0.2199	0.03
42-2257	DUGWAY	UT	21	-112.9192	40.1819	4340	3/1951	12/2000	47	0.3132	0.2548	0.1257	0.71
42-2385	ECHO DAM	UT	5	-111.4333	40.9667	5470	11/1949	12/2000	51	0.2304	0.2733	0.2154	0.41
42-2561	ENTERPRISE BERYL JCT	UT	21	-113.6500	37.6833	5203	7/1948	12/2000	50	0.3674	0.3974	0.3489	1.93
42-2578	EPHRAIM SORENSENS FLD	UT	21	-111.5858	39.3706	5510	9/1949	12/2000	51	0.1961	0.3184	0.2259	1.20
42-2696	FAIRFIELD	UT	21	-112.0906	40.2622	4880	9/1950	12/2000	49	0.3305	0.4537	0.2765	0.86
42-2702	FAIRVIEW 8 N	UT	21	-111.4139	39.7450	6750	7/1974	12/2000	26	0.2711	0.3645	0.3546	0.88
42-2726	FARMINGTON USU FLD STN	UT	23	-111.9167	41.0167	4340	8/1948	2/1968	19	0.2872	0.4814	0.3223	1.25
42-2864	FLAMING GORGE	UT	5	-109.4117	40.9317	6270	2/1958	12/2000	39	0.3062	0.3467	0.2146	0.49
42-3056	FRUITLAND	UT	5	-110.8500	40.2167	6624	8/1948	7/1965	16	0.3372	0.5440	0.4979	1.86
42-3348	GRANTSVILLE	UT	21	-112.5056	40.6025	4480	6/1956	12/2000	45	0.2122	0.0614	-0.0024	1.63
42-3418	GREEN RIVER AVIATION	UT	6	-110.1544	38.9906	4070	11/1949	12/2000	49	0.2734	0.2863	0.1642	0.21

ID	Name	ST	Hourly Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
42-3611	HANKSVILLE	UT	6	-110.7153	38.3706	4308	7/1948	12/2000	53	0.2998	0.2791	0.1506	0.82
42-3624	HANNA	UT	5	-110.7594	40.4000	6745	7/1965	11/1995	28	0.2289	0.3019	0.3174	1.48
42-5186	LOGAN UTAH STATE UNIV	UT	2	-111.8033	41.7456	4790	7/1948	12/2000	51	0.2312	0.2697	0.2411	0.56
42-5477	MARYSVALE	UT	21	-112.2292	38.4494	5910	7/1948	12/2000	47	0.2559	0.3379	0.2800	0.24
42-5654	MILFORD	UT	21	-113.0167	38.4333	5028	7/1948	12/2000	51	0.2458	0.1880	0.1605	0.56
42-5892	MOUNTAIN DELL DAM	UT	23	-111.7222	40.7497	5420	10/1967	12/2000	33	0.2122	0.2899	0.1446	0.90
42-6127	NEOLA 8 N	UT	5	-110.0622	40.5367	6910	12/1971	12/2000	29	0.2735	0.2352	0.1398	0.44
42-6135	NEPHI	UT	21	-111.8322	39.7125	5125	8/1948	12/2000	52	0.2624	0.3215	0.1330	0.87
42-6374	OAKLEY 3 NE	UT	5	-111.2406	40.7403	6610	2/1971	12/2000	30	0.2186	0.4147	0.2267	2.27
42-6404	OGDEN PIONEER P H	UT	23	-111.9475	41.2439	4350	10/1971	12/2000	29	0.2265	0.2181	0.1447	0.88
42-6414	OGDEN SUGAR FACTORY	UT	23	-112.0281	41.2319	4280	6/1953	12/2000	47	0.2737	0.2919	0.2120	1.05
42-6938	PLYMOUTH	UT	2	-112.1475	41.8744	4470	7/1948	12/2000	53	0.2488	0.2658	0.1151	0.86
42-7026	PRICE WAREHOUSES	UT	6	-110.8000	39.6167	5700	7/1968	12/2000	32	0.2698	0.2382	0.1370	0.37
42-7064	PROVO BYU	UT	21	-111.6506	40.2436	4570	9/1980	12/2000	20	0.1770	0.2746	0.3253	2.02
42-7260	RICHFIELD RADIO KSVC	UT	21	-112.0781	38.7619	5300	8/1948	12/2000	52	0.2924	0.3777	0.1621	1.16
42-7395	ROOSEVELT RADIO	UT	5	-109.9833	40.3000	5106	7/1948	12/2000	53	0.2831	0.3303	0.2102	0.13
42-7516	ST GEORGE	UT	7	-113.5672	37.1061	2770	7/1948	12/2000	53	0.2835	0.2822	0.1945	0.14
42-7598	SALT LAKE CITY NWSFO	UT	23	-111.9553	40.7725	4222	7/1948	12/2000	52	0.2738	0.3870	0.2735	0.42
42-7846	SILVER LAKE BRIGHTON	UT	23	-111.5842	40.6008	8740	7/1948	12/2000	49	0.2225	0.3280	0.2061	0.70
42-7959	SOLDIER SUMMIT	UT	21	-111.0792	39.9286	7470	7/1948	12/2000	45	0.3715	0.4049	0.2512	1.13
42-9136	VEYO POWERHOUSE	UT	7	-113.6667	37.3522	4600	3/1974	12/2000	27	0.2971	0.4752	0.2935	2.32
42-9382	WENDOVER WSO AIRPORT	UT	4	-114.0356	40.7206	4237	7/1948	1/1977	29	0.2477	0.2801	0.2109	0.07
48-0695	BIG PINEY	WY	19	-110.1167	42.5333	6821	8/1948	8/1992	42	0.2080	0.2124	0.1814	1.12
48-2175	CRESTON	WY	19	-107.7333	41.7333	7116	8/1948	2/1984	29	0.2678	0.2377	0.1804	0.78
48-3100	EVANSTON 1 E	WY	5	-110.9500	41.2650	6825	8/1948	12/2000	49	0.2505	0.2973	0.2643	0.50
48-6555	MOUNTAIN VIEW	WY	19	-110.3306	41.2708	6800	3/1966	12/2000	35	0.2099	0.1840	0.1426	1.04
48-6597	MUD SPRINGS	WY	19	-108.9167	41.3167	6736	5/1953	12/2000	48	0.2848	0.2815	0.2025	0.74
48-7840	ROCK SPRINGS	WY	19	-109.2167	41.5833	6375	4/1954	5/1979	24	0.3590	0.3946	0.1417	1.32

Table A.7.3 SNOTEL data

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
02-0001	BAKER BUTTE	AZ	36	-111.4000	34.4500	7300	1/1982	12/2000	19
02-0002	BALDY	AZ	44	-109.5167	33.9833	9125	1/1982	12/2000	18
02-0005	CORONADO TRAIL	AZ	44	-109.1500	33.8000	8400	1/1982	12/2000	18
02-0006	FRY	AZ	36	-111.8500	35.0667	7200	1/1982	12/2000	18
02-0007	HANNAGAN MEADOWS	AZ	44	-109.3000	33.6500	9020	1/1982	12/2000	18
02-0008	HEBER	AZ	36	-110.7500	34.3167	7640	1/1982	12/2000	18
02-0009	MAVERICK FORK	AZ	44	-109.4500	33.9167	9200	1/1982	12/2000	19
02-0010	MORMON MOUNTAIN	AZ	36	-111.5167	34.9333	7500	1/1982	12/2000	18
02-0011	PROMONTORY	AZ	36	-111.0167	34.3667	7930	1/1982	12/2000	18
02-0012	SUGAR LOAF	AZ	36	-111.5167	34.6167	6120	1/1982	12/1999	16
02-0013	WHITE HORSE LAKE	AZ	21	-112.1500	35.1333	7180	1/1982	12/2000	18
02-0014	WILDCAT	AZ	44	-109.5000	33.7500	7850	1/1984	12/2000	17
04-0001	ADIN MTN	CA	2	-120.7667	41.2500	6200	1/1984	12/2000	16
04-0002	BLUE LAKES	CA	8	-119.9167	38.6000	8000	1/1980	12/2000	20
04-0003	CEDAR PASS	CA	2	-120.3000	41.5833	7100	1/1978	12/2000	22
04-0004	CSS LAB	CA	8	-120.3667	39.3333	6900	1/1981	12/2000	18
04-0005	DISMAL SWAMP	CA	2	-120.1667	41.9667	7000	1/1980	12/2000	20
04-0006	EBBETTS PASS	CA	8	-119.8000	38.5500	8700	1/1978	12/2000	22
04-0007	ECHO PEAK	CA	8	-120.0667	38.8500	7800	1/1980	12/2000	20
04-0008	FALLEN LEAF	CA	8	-120.0500	38.9333	6300	1/1979	12/2000	21
04-0009	HAGAN'S MEADOW	CA	8	-119.9333	38.8500	8000	1/1978	12/2000	22
04-0010	HEAVENLY VALLEY	CA	8	-119.9000	38.9333	8850	1/1978	12/2000	22
04-0011	INDEPENDENCE CAMP	CA	8	-120.2833	39.4500	7000	1/1978	12/2000	22
04-0012	INDEPENDENCE CREEK	CA	8	-120.2833	39.4833	6500	1/1980	12/2000	20
04-0013	INDEPENDENCE LAKE	CA	8	-120.3167	39.4167	8450	1/1978	12/2000	22
04-0015	LEAVITT MEADOWS	CA	17	-119.5500	38.3333	7200	1/1980	12/2000	20
04-0016	LOBDELL LAKE	CA	17	-119.3667	38.4333	9200	1/1978	12/2000	22
04-0018	POISON FLAT	CA	8	-119.6333	38.5000	7900	1/1980	12/2000	20
04-0019	RUBICON #2	CA	8	-120.1333	39.0000	7500	1/1980	12/2000	20
04-0020	SONORA PASS	CA	17	-119.6000	38.3167	8800	1/1978	12/2000	22
04-0021	SPRATT CREEK	CA	8	-119.8167	38.6667	6200	1/1980	12/2000	20
04-0022	SQUAW VALLEY G.C.	CA	8	-120.2500	39.1833	8200	1/1980	12/2000	20

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
04-0023	TAHOE CITY CROSS	CA	8	-120.1500	39.1667	6750	1/1980	12/2000	20
04-0024	TRUCKEE #2	CA	8	-120.2000	39.3000	6400	1/1980	12/2000	20
04-0025	VIRGINIA LAKES RIDGE	CA	17	-119.2500	38.0833	9200	1/1978	12/2000	21
04-0026	WARD CREEK #3	CA	8	-120.2333	39.1333	6750	1/1978	12/2000	22
05-0001	APISHAPA	CO	39	-105.0667	37.3333	10000	1/1980	12/2000	21
05-0004	BEARTOWN	CO	38	-107.5167	37.7167	11600	1/1982	12/2000	18
05-0010	BURRO MOUNTAIN	CO	15	-107.6000	39.8833	9400	1/1978	12/2000	20
05-0012	CASCADE	CO	38	-107.8000	37.6500	8880	1/1978	12/2000	23
05-0016	COLUMBINE PASS	CO	38	-108.3833	38.4167	9400	1/1986	12/2000	14
05-0021	CULEBRA #2	CO	39	-105.2000	37.2167	10500	1/1979	12/2000	21
05-0025	EL DIENTE PEAK	CO	38	-108.0167	37.7833	10200	1/1986	12/2000	14
05-0039	LIZARD HEAD PASS	CO	38	-107.9333	37.8000	10200	1/1980	12/2000	21
05-0040	LONE CONE	CO	38	-108.1833	37.9000	9600	1/1980	12/2000	21
05-0045	MESA LAKES	CO	26	-108.0833	39.0500	10000	1/1986	12/2000	14
05-0047	MINERAL CREEK	CO	38	-107.7333	37.8500	10040	1/1978	12/2000	22
05-0055	PARK RESERVOIR	CO	26	-107.8667	39.0333	9960	1/1978	12/2000	22
05-0060	RED MOUNTAIN PASS	CO	38	-107.7167	37.9000	11150	1/1980	12/2000	20
05-0064	SCOTCH CREEK	CO	38	-108.0167	37.6500	9100	1/1986	12/2000	15
05-0065	SLUMGULLION	CO	38	-107.2000	37.9833	11440	1/1980	12/2000	21
05-0067	SPUD MOUNTAIN	CO	38	-107.7833	37.7000	10660	1/1986	12/2000	14
05-0069	STUMP LAKES	CO	38	-107.6333	37.4833	11200	1/1986	12/2000	15
05-0075	UPPER SAN JUAN	CO	39	-106.8333	37.4833	10130	1/1986	12/2000	14
05-0079	WHISKEY CK	CO	39	-105.1167	37.2167	10220	1/1980	12/2000	20
05-0082	WOLF CREEK SUMMIT	CO	39	-106.8000	37.4833	11000	1/1986	12/2000	14
10-0021	EMIGRANT SUMMIT	ID	6	-111.5667	42.3667	7390	1/1980	12/2000	20
10-0026	GIVEOUT	ID	6	-111.1667	42.4167	6930	1/1981	12/2000	18
10-0030	HOWELL CANYON	ID	4	-113.6167	42.3167	7980	1/1980	12/2000	20
10-0039	MAGIC MOUNTAIN	ID	4	-114.3000	42.1833	6880	1/1980	12/2000	20
10-0051	OXFORD SPRING	ID	6	-112.1333	42.2667	6740	1/1980	12/2000	20
10-0064	SOMSEN RANCH	ID	6	-111.3667	42.9500	6800	1/1980	12/2000	20
10-0065	SOUTH MTN.	ID	4	-116.9000	42.7667	6500	1/1980	12/2000	20
26-0001	BEAR CREEK	NV	4	-115.4500	41.8333	7800	1/1978	12/2000	22

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
26-0002	BERRY CREEK	NV	11	-114.6500	39.3500	9100	1/1980	12/2000	20
26-0003	BIG BEND	NV	4	-115.7167	41.7667	6700	1/1978	12/2000	22
26-0004	BIG CREEK SUM	NV	11	-117.1167	39.3000	8700	1/1980	12/2000	20
26-0005	BIG MEADOW	NV	9	-119.9500	39.4500	8300	1/1983	12/2000	17
26-0006	BUCKSKIN LOWER	NV	4	-117.5333	41.7500	6700	1/1980	12/2000	20
26-0008	CORRAL CANYON	NV	11	-115.5333	40.2833	8500	1/1978	12/2000	22
26-0009	DIAMOND PEAK	NV	11	-115.8500	39.5667	8000	1/1983	12/2000	18
26-0010	DISASTER PEAK	NV	4	-118.2000	41.9667	6500	1/1980	12/2000	20
26-0011	DORSEY BASIN	NV	11	-115.2000	40.8833	8100	1/1978	12/2000	22
26-0012	DRAW CREEK	NV	4	-115.3167	41.6500	7200	1/1983	12/2000	18
26-0013	FAWN CREEK	NV	4	-116.1000	41.7000	7000	1/1980	12/2000	20
26-0015	GRANITE PEAK	NV	4	-117.5667	41.6500	7800	1/1980	12/2000	20
26-0016	GREEN MOUNTAIN	NV	11	-115.5333	40.3833	8000	1/1980	12/2000	20
26-0017	HOLE-IN-MOUNTAIN	NV	11	-115.0500	40.9667	7900	1/1981	12/2000	20
26-0018	JACK CREEK UPPER	NV	4	-116.0167	41.5500	7250	1/1978	12/2000	22
26-0019	JACKS PEAK	NV	4	-116.0167	41.5000	8420	1/1981	12/2000	20
26-0020	LAMANCE CREEK	NV	4	-117.6333	41.5167	6000	1/1980	12/2000	18
26-0021	LAMOILLE #3	NV	11	-115.4000	40.6333	7700	1/1980	12/2000	20
26-0022	LAUREL DRAW	NV	4	-116.0333	41.7833	6700	1/1979	12/2000	22
26-0023	MARLETTE LAKE	NV	8	-119.9000	39.1500	8000	1/1978	12/2000	22
26-0024	MT ROSE SKI AREA	NV	9	-119.8833	39.3167	8850	1/1980	12/2000	20
26-0026	POLE CREEK R.S.	NV	4	-115.2500	41.8667	8330	1/1980	12/2000	20
26-0027	SEVENTYSIX CREEK	NV	4	-115.4667	41.7000	7100	1/1978	12/2000	22
26-0032	TAYLOR CANYON	NV	11	-115.9833	41.2333	6200	1/1980	12/2000	20
26-0033	WARD MOUNTAIN	NV	11	-114.8167	39.1333	9200	1/1980	12/2000	20
29-0002	CHAMITA	NM	39	-106.6500	36.9500	8400	1/1979	12/2000	21
29-0003	FRISCO DIVIDE	NM	44	-108.9333	33.7333	8000	1/1980	12/2000	20
29-0004	GALLEGOS PEAK	NM	39	-105.5500	36.1833	9800	1/1980	12/2000	21
29-0005	HOPEWELL	NM	39	-106.2667	36.7167	10000	1/1979	12/2000	21
29-0006	LOOKOUT MOUNTAIN	NM	45	-107.8333	33.3667	8500	1/1981	12/2000	19
29-0007	NORTH COSTILLA	NM	39	-105.2500	37.0000	10600	1/1979	12/2000	21
29-0008	PANCHUELA	NM	45	-105.6667	35.8333	8400	1/1980	12/2000	21

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
29-0009	QUEMAZON	NM	45	-106.3833	35.9167	9500	1/1980	12/2000	21
29-0010	RED RIVER PASS #2	NM	39	-105.3333	36.7000	9850	1/1979	12/2000	21
29-0011	SENORITA DIVIDE #2	NM	45	-106.8333	36.0000	8600	1/1980	12/2000	20
29-0013	SILVER CREEK DIVIDE	NM	44	-108.7167	33.3667	9000	1/1980	12/2000	20
35-0022	FISH CREEK	OR	3	-118.6333	42.7000	7900	1/1978	12/2000	22
35-0059	SILVER CREEK	OR	1	-121.1833	42.9500	5720	1/1980	12/2000	20
35-0060	SILVIES	OR	3	-118.6833	42.7500	6900	10/1977	12/2000	21
35-0064	SUMMER RIM	OR	1	-120.8167	42.7000	7100	1/1978	12/2000	22
35-0066	TAYLOR BUTTE	OR	1	-121.4000	42.7000	5100	1/1978	12/2000	22
42-0003	BEAVER DAMS	UT	22	-111.5500	39.1333	8000	1/1980	12/2000	20
42-0004	BEAVER DIVIDE	UT	15	-111.0667	40.6167	8280	1/1978	12/2000	22
42-0005	BEN LOMOND PEAK	UT	14	-111.9500	41.3667	8000	1/1978	12/2000	22
42-0006	BEN LOMOND TRAIL	UT	14	-111.9167	41.3833	6000	1/1980	12/2000	20
42-0007	BIG FLAT	UT	22	-112.3500	38.3000	10290	1/1979	12/2000	21
42-0008	BLACK FLAT-U.M. CK	UT	22	-111.5833	38.6833	9400	1/1981	12/2000	19
42-0009	BOX CREEK	UT	22	-112.0167	38.5000	9800	1/1979	12/2000	21
42-0010	BRIGHTON	UT	13	-111.6167	40.6000	8750	1/1986	12/2000	14
42-0011	BROWN DUCK	UT	15	-110.5833	40.5833	10600	1/1978	12/2000	22
42-0012	BUCK FLAT	UT	24	-111.4333	39.1333	9800	1/1979	12/2000	21
42-0013	BUG LAKE	UT	15	-111.4167	41.6833	7950	1/1978	12/2000	22
42-0014	CAMP JACKSON	UT	37	-109.4833	37.8000	8600	1/1985	12/2000	15
42-0015	CASTLE VALLEY	UT	23	-112.7333	37.7500	9580	1/1980	12/2000	20
42-0016	CHALK CREEK #1	UT	15	-111.0667	40.8500	9100	1/1978	12/2000	22
42-0017	CHALK CREEK #2	UT	15	-111.0667	40.9000	8200	1/1978	12/2000	22
42-0018	CHEPETA	UT	15	-110.0000	40.7667	10300	1/1981	12/2000	19
42-0019	CLEAR CREEK #1	UT	25	-111.2833	39.8667	9200	1/1979	12/2000	21
42-0020	CLEAR CREEK #2	UT	25	-111.2667	39.8833	8300	1/1979	12/2000	21
42-0021	CURRANT CREEK	UT	25	-111.1000	40.3667	8000	1/1978	12/2000	22
42-0022	DANIELS-STRAWBERRY	UT	25	-111.2500	40.3000	8000	1/1978	12/2000	22
42-0024	DILL'S CAMP	UT	22	-111.4667	39.0333	9200	1/1978	12/2000	21
42-0025	DONKEY RESERVOIR	UT	24	-111.4667	38.2167	9800	1/1985	12/2000	15
42-0026	DRY BREAD POND	UT	14	-111.5333	41.4167	8350	1/1978	12/2000	22

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
42-0028	EAST WILLOW CREEK	UT	25	-109.5167	39.3167	8250	1/1986	12/2000	15
42-0029	FARMINGTON	UT	14	-111.8000	40.9667	8000	1/1978	12/2000	22
42-0030	FARNSWORTH LAKE	UT	22	-111.6833	38.7667	9600	1/1980	12/2000	20
42-0031	FIVE POINTS LAKE	UT	15	-110.4667	40.7167	10920	1/1981	12/2000	19
42-0032	GOOSEBERRY R.S.	UT	22	-111.6833	38.8000	7920	1/1979	12/2000	21
42-0034	HARRIS FLAT	UT	23	-112.5833	37.4833	7800	1/1979	12/2000	21
42-0035	HAYDEN FORK	UT	15	-110.8833	40.8000	9100	1/1978	12/2000	22
42-0036	HEWINTA	UT	15	-110.4833	40.9500	9500	1/1985	12/2000	15
42-0037	HICKERSON PARK	UT	15	-109.9667	40.9000	9100	1/1985	12/2000	15
42-0038	HOLE-IN-ROCK	UT	15	-110.2000	40.9167	9150	1/1985	12/2000	15
42-0039	HORSE RIDGE	UT	15	-111.4500	41.3167	8160	1/1978	12/2000	22
42-0040	INDIAN CANYON	UT	25	-110.7500	39.9000	9100	1/1979	12/2000	21
42-0041	KIMBERLY MINE	UT	22	-112.3833	38.4833	9300	1/1980	12/2000	20
42-0042	KING'S CABIN	UT	15	-109.5500	40.7167	8730	1/1979	12/2000	21
42-0043	KOLOB	UT	23	-113.0500	37.5333	9250	1/1979	12/2000	21
42-0044	LAKEFORK #1	UT	15	-110.4333	40.6000	10100	1/1979	12/2000	21
42-0045	LAKEFORK BASIN	UT	15	-110.6167	40.7500	10900	1/1980	12/2000	20
42-0046	LASAL MOUNTAIN	UT	26	-109.2667	38.4833	9850	1/1981	12/2000	19
42-0048	LILY LAKE	UT	15	-110.8000	40.8667	9050	1/1981	12/2000	19
42-0049	LITTLE BEAR	UT	14	-111.8167	41.4000	6550	1/1978	12/2000	22
42-0051	LONG FLAT	UT	21	-113.4000	37.5167	8000	1/1980	12/2000	20
42-0052	LONG VALLEY JCT	UT	23	-112.5167	37.4833	7360	1/1986	12/2000	15
42-0054	MAMMOTH-COTTONWOOD	UT	25	-111.3167	39.6833	8800	1/1979	12/2000	21
42-0055	MERCHANT VALLEY	UT	22	-112.4333	38.3000	8750	1/1980	12/2000	20
42-0056	MIDWAY VALLEY	UT	23	-112.8333	37.5667	9800	1/1981	12/2000	19
42-0059	MONTE CRISTO	UT	15	-111.5000	41.4667	8960	1/1978	12/2000	22
42-0060	MOSBY MTN.	UT	15	-109.8833	40.6167	9500	1/1978	12/2000	22
42-0061	PARLEY'S SUMMIT	UT	13	-111.6167	40.7667	7500	1/1978	12/2000	22
42-0062	PAYSON R.S.	UT	13	-111.6333	39.9333	8050	1/1980	12/2000	20
42-0063	PICKLE KEG	UT	22	-111.5833	39.0167	9600	1/1978	12/2000	22
42-0064	PINE CREEK	UT	22	-112.2500	38.8833	8800	1/1985	12/2000	15
42-0065	RED PINE RIDGE	UT	25	-111.2667	39.4667	9200	1/1979	12/2000	21

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs
42-0066	ROCK CREEK	UT	15	-110.6833	40.5500	7900	1/1980	12/2000	20
42-0067	ROCKY BASIN-SETTLEME	UT	13	-112.2167	40.4333	8900	1/1981	12/2000	19
42-0068	SEELEY CREEK	UT	24	-111.4333	39.3167	10000	1/1980	12/2000	20
42-0069	SMITH & MOREHOUSE	UT	15	-111.1000	40.7833	7600	1/1978	12/2000	22
42-0071	STEEL CREEK PARK	UT	15	-110.5000	40.9167	10100	1/1978	12/2000	22
42-0074	TIMPANOGOS DIVIDE	UT	13	-111.6167	40.4333	8140	1/1978	12/2000	22
42-0075	TONY GROVE LAKE	UT	14	-111.6333	41.9000	8400	1/1978	12/2000	22
42-0076	TRIAL LAKE	UT	15	-110.9500	40.6833	9960	1/1978	12/2000	22
42-0077	TROUT CREEK	UT	15	-109.6667	40.7333	9400	1/1979	12/2000	21
42-0078	VERNON CREEK	UT	12	-112.4167	39.9333	7500	1/1978	12/2000	22
42-0079	WEBSTER FLAT	UT	23	-112.9000	37.5833	9200	1/1980	12/2000	20
42-0080	WHITE RIVER #1	UT	25	-110.9833	39.9667	8550	1/1978	12/2000	21
48-0008	BLIND BULL SUM	WY	6	-110.6000	42.9500	8900	1/1980	12/2000	20
48-0018	COTTONWOOD CREEK	WY	6	-110.8167	42.5167	7600	1/1982	12/2000	17
48-0030	HAMS FORK	WY	7	-110.6833	42.1500	7840	1/1985	12/2000	15
48-0033	INDIAN CREEK	WY	6	-110.6833	42.3000	9425	1/1980	12/2000	20
48-0035	KELLEY R.S.	WY	6	-110.8000	42.2500	8180	1/1980	12/2000	20
48-0059	SNIDER BASIN	WY	6	-110.5333	42.4667	8060	1/1980	12/2000	20
48-0062	SPRING CREEK DIVIDE	WY	6	-110.6667	42.5333	9000	1/1980	12/2000	20
48-0073	TRIPLE PEAK	WY	6	-110.5833	42.7667	8500	1/1985	12/2000	15
48-0079	WILLOW CREEK	WY	6	-110.8167	42.8167	8450	1/1980	12/2000	20

Table A.7.4 Mexico data(statistical values for the 24-hour duration)

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-2001	MISSING	MX	Baja	-116.4500	32.1000	410	1969	1983	14	0.3042	0.4619	0.4605	1.41
00-2003	MISSING	MX	Baja	-115.0667	32.5500	70	1969	1983	14	0.4533	0.4619	0.2521	1.76
00-2004	MISSING	MX	Baja	-116.4833	32.1833	555	1969	1983	15	0.2915	0.3156	0.1873	0.11
00-2005	MISSING	MX	Baja	-116.7500	32.0667	40	1969	1983	15	0.3039	0.4253	0.3349	0.59
00-2011	MISSING	MX	Baja	-115.1833	32.3500	12	1969	1983	15	0.3854	0.1482	-0.0209	2.16
00-2014	MISSING	MX	Baja	-116.0500	31.5833	1115	1969	1983	15	0.2800	0.2552	0.1667	0.04

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-2017	MISSING	MX	Baja	-117.0333	32.3000	22	1969	1983	14	0.2200	0.3653	0.2235	1.63
00-2021	MISSING	MX	Baja	-116.2833	32.1833	1350	1969	1983	15	0.2700	0.3780	0.3427	0.68
00-2029	MISSING	MX	Baja	-116.1667	31.3833	15	1969	1983	14	0.2292	0.1696	0.0195	0.76
00-2030	MISSING	MX	Baja	-116.6500	32.5500	515	1969	1983	13	0.2424	0.1375	0.3240	4.00
00-2031	MISSING	MX	Baja	-116.0667	32.5167	1200	1969	1983	14	0.3331	0.3916	0.2921	0.24
00-2033	MISSING	MX	Baja	-115.4500	32.6500	45	1969	1983	15	0.3337	0.3193	0.0744	0.94
00-2034	MISSING	MX	Baja	-115.4667	32.5500	3	1969	1983	14	0.2927	0.0742	-0.0209	1.35
00-2035	MISSING	MX	Baja	-116.2667	31.8667	720	1969	1983	14	0.2707	0.2423	0.2722	0.77
00-2036	MISSING	MX	Baja	-116.6667	32.0500	351	1969	1983	14	0.2866	0.3061	0.1359	0.35
00-2037	MISSING	MX	Baja	-114.7333	32.7167	35	1969	1983	14	0.5171	0.5975	0.4953	3.90
00-2038	MISSING	MX	Baja	-116.8667	32.4333	140	1969	1983	15	0.2900	0.1889	0.0579	0.31
00-2045	MISSING	MX	Baja	-116.4333	31.7500	170	1969	1983	15	0.2433	0.1750	0.1685	0.60
00-2049	MISSING	MX	Baja	-116.5000	32.3333	0	1969	1983	15	0.2578	0.0740	-0.0177	1.07
00-2056	MISSING	MX	Baja	-116.2667	31.3333	150	1969	1983	15	0.2668	0.2078	-0.0129	1.05
00-2057	MISSING	MX	Baja	-115.7167	31.5333	0	1969	1983	15	0.2395	0.2643	0.2330	0.43
00-2065	MISSING	MX	Baja	-116.3667	31.5500	28	1969	1983	15	0.2539	0.2110	0.1444	0.21
00-2066	MISSING	MX	Baja	-115.8500	31.8333	1545	1969	1983	15	0.2685	0.2056	0.0492	0.39
00-2068	MISSING	MX	Baja	-117.0333	32.5167	55	1969	1983	14	0.2356	0.2956	0.2625	0.58
00-2069	MISSING	MX	Baja	-116.6500	32.3833	45	1969	1983	15	0.3381	0.5094	0.3886	1.20
00-2071	MISSING	MX	Baja	-115.7833	31.3333	0	1969	1983	15	0.2820	0.3335	0.1204	0.92
00-2072	MISSING	MX	Baja	-116.6000	31.8833	24	1969	1983	15	0.2690	0.2124	0.1001	0.17
00-6001	MISSING	MX	sonora	-109.5667	31.3333	1189	1969	1983	13	0.1736	-0.1180	0.1929	1.82
00-6005	MISSING	MX	sonora	-110.1833	30.3333	870	1969	1983	15	0.2029	0.0951	0.0441	0.30
00-6007	MISSING	MX	sonora	-110.7500	30.6333	0	1969	1983	15	0.1797	0.3102	0.5263	1.46
00-6008	MISSING	MX	sonora	-110.2167	30.0167	0	1969	1983	15	0.1845	0.1533	0.0508	0.36
00-6022	MISSING	MX	sonora	-109.2167	30.8167	1106	1969	1983	15	0.2193	0.4577	0.4049	0.97
00-6023	MISSING	MX	sonora	-109.0500	30.7333	0	1969	1983	15	0.2386	0.2474	0.1406	0.79
00-6025	MISSING	MX	sonora	-110.7000	30.3333	0	1969	1983	15	0.1458	0.0025	0.1487	0.78
00-6037	MISSING	MX	Baja	-114.4833	31.7000	0	1971	1983	13	0.4338	0.3276	0.1608	1.53
00-6041	MISSING	MX	sonora	-112.7333	31.5333	610	1969	1983	14	0.2662	0.3012	0.1268	1.90
00-6045	MISSING	MX	sonora	-110.8667	30.7833	826	1969	1983	14	0.1549	0.2491	0.1379	0.74
00-6057	MISSING	MX	sonora	-109.9500	31.3333	1340	1969	1983	15	0.1905	0.1824	0.1093	0.16

ID	Name	ST	Daily Region	LON	LAT	Elev (ft)	Begin	End	Data yrs	L-CV	L-CS	L-CK	Disc.
00-6069	MISSING	MX	sonora	-109.3833	30.4500	965	1969	1983	15	0.1741	0.4826	0.4851	1.24
00-6074	MISSING	MX	sonora	-111.0167	30.0500	657	1969	1983	14	0.1970	0.0515	0.0813	0.23
00-6076	MISSING	MX	Baja	-114.9167	32.1333	4	1969	1983	15	0.3378	0.3083	0.1798	0.11
00-6087	MISSING	MX	Baja	-114.8000	32.4833	40	1969	1983	14	0.3530	0.2984	0.2776	0.74
00-6089	MISSING	MX	sonora	-111.1333	30.5500	676	1969	1983	14	0.2227	0.1410	0.1166	0.39
00-6092	MISSING	MX	sonora	-111.5333	30.8667	590	1969	1983	14	0.1665	0.0886	0.3982	1.63
00-6093	MISSING	MX	sonora	-112.1333	30.7000	286	1969	1983	15	0.1320	0.1501	0.1064	1.08
00-6096	MISSING	MX	sonora	-112.8500	31.8667	398	1969	1983	14	0.2294	0.1744	0.2312	0.57
00-6103	MISSING	MX	sonora	-111.5500	30.4000	0	1969	1983	14	0.1939	0.0071	0.1133	0.40
00-6110	MISSING	MX	sonora	-109.0167	30.0500	0	1969	1983	13	0.2093	0.0347	0.0696	0.41
00-6115	MISSING	MX	sonora	-110.8667	30.8000	0	1969	1983	14	0.1281	-0.0070	-0.1361	2.39
00-6116	MISSING	MX	sonora	-109.4000	30.4500	965	1969	1983	14	0.1607	0.6063	0.5117	2.40
00-8001	MISSING	MX	chihuahua	-107.9833	31.1000	1287	1970	1982	13	0.2270	0.0961	-0.1305	1.10
00-8048	MISSING	MX	chihuahua	-105.1667	30.2500	1170	1969	1983	15	0.2392	0.2252	0.0551	0.29
00-8066	MISSING	MX	chihuahua	-107.6333	30.1167	1431	1969	1983	14	0.2554	0.2179	-0.0471	0.78
00-8080	MISSING	MX	chihuahua	-108.0833	30.8833	1357	1969	1983	15	0.2758	0.1531	0.1028	2.34
00-8110	MISSING	MX	chihuahua	-107.5833	31.7833	1995	1969	1983	15	0.2688	0.3289	0.2848	1.36
00-8118	MISSING	MX	chihuahua	-105.8333	30.5500	1500	1969	1983	15	0.2299	0.2280	0.2897	0.79
00-8121	MISSING	MX	chihuahua	-106.4833	31.3500	1275	1969	1983	15	0.2403	0.2278	0.0447	0.35
00-8129	MISSING	MX	chihuahua	-108.8333	31.2333	1468	1969	1983	15	0.1831	0.0715	0.1145	1.89
00-8155	MISSING	MX	chihuahua	-106.5167	30.6167	1205	1969	1983	15	0.2165	0.1715	0.0006	0.52
00-8184	MISSING	MX	chihuahua	-107.9167	30.4333	1473	1969	1983	15	0.2407	0.1974	0.2500	0.59

Appendix A.8. Average L-moment statistics and heterogeneity measures for regions used in NOAA Atlas 14 Volume 1.

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

Table A.8.1. Number of daily and hourly stations, H1 statistic, mean number of data years, and weighted L-statistics of 24-hour data for each daily region and at-site.

region	# daily stations	# hourly stations	H1	Mean number of data years*	Coeff. of L-variation Weighted Mean	L-Skewness Weighted Mean	L-Kurtosis Weighted Mean
1	11	2	1.39	47	0.193	0.202	0.168
2	13	5	1.72	62	0.228	0.252	0.201
3	20	4	1.77	44	0.219	0.211	0.169
4	35	9	0.94	49	0.199	0.203	0.171
5	25	3	1.01	56	0.193	0.204	0.172
6	34	6	1.86	56	0.181	0.206	0.181
7	10	3	0.93	45	0.236	0.222	0.163
8	45	27	0.40	49	0.188	0.185	0.155
9	11	6	1.74	53	0.211	0.224	0.174
10	25	11	1.11	47	0.239	0.203	0.178
11	48	15	1.17	48	0.215	0.208	0.173
12	17	4	1.33	48	0.198	0.181	0.166
13	31	6	1.74	54	0.173	0.173	0.173
14	28	7	0.31	54	0.167	0.187	0.155
15	45	14	1.63	49	0.197	0.227	0.183
16	57	11	1.65	64	0.186	0.191	0.174
17	27	17	0.33	47	0.230	0.254	0.205
18	9	3	1.23	46	0.328	0.254	0.169
19	16	5	0.56	40	0.265	0.142	0.159
20	7	1	-1.22	47	0.286	0.275	0.220
21	36	12	-0.67	50	0.203	0.189	0.170
22	28	4	-0.25	61	0.184	0.199	0.179
23	17	3	-0.52	55	0.200	0.204	0.164
24	12	3	0.38	53	0.238	0.227	0.185
25	20	2	0.38	39	0.180	0.168	0.147
26	17	2	1.06	62	0.194	0.218	0.179
27	14	9	0.65	48	0.239	0.166	0.127
28	29	19	-1.23	43	0.269	0.226	0.175
29	6	5	-0.58	46	0.268	0.248	0.211
30	22	9	0.43	43	0.286	0.195	0.140
31	80	51	0.35	51	0.252	0.186	0.134
32	32	23	2.15	44	0.242	0.231	0.161
33	17	9	0.86	55	0.349	0.253	0.206
34	21	11	0.21	43	0.265	0.218	0.189
35	6	1	0.54	44	0.238	0.251	0.183

region	# daily stations	# hourly stations	H1	Mean number of data years*	Coeff. of L-variation Weighted Mean	L-Skewness Weighted Mean	L-Kurtosis Weighted Mean
36	35	4	1.43	53	0.196	0.199	0.164
37	51	7	0.87	49	0.213	0.213	0.172
38	18	3	0.31	61	0.175	0.180	0.162
39	55	13	1.16	54	0.196	0.208	0.166
40	11	1	-0.61	51	0.349	0.255	0.183
41	6	4	-0.02	46	0.226	0.203	0.186
42	36	17	1.53	45	0.228	0.206	0.157
43	15	6	0.77	53	0.198	0.202	0.169
44	26	5	-0.06	49	0.186	0.183	0.165
45	59	26	0.15	49	0.196	0.182	0.168
46	4	2	-0.52	53	0.223	0.299	0.207
47	29	8	0.91	54	0.220	0.221	0.182
48	33	12	1.51	50	0.250	0.223	0.152
49	42	11	0.60	52	0.222	0.223	0.165
50	23	3	0.78	51	0.215	0.223	0.192
51	13	2	0.39	53	0.200	0.205	0.187
52	26	2	0.89	51	0.194	0.184	0.144
53	25	6	-0.25	47	0.198	0.166	0.139
54	6	1	-0.76	63	0.237	0.277	0.187
55	16	9	-0.62	51	0.224	0.163	0.132
56	19	8	-1.17	50	0.256	0.247	0.206
57	7	2	0.29	40	0.280	0.268	0.198
58	4	1	-0.15	43	0.307	0.235	0.113
59	8	2	-0.28	54	0.222	0.177	0.161
A1	1	0	N/A	53	0.323	0.345	0.241
A2	1	1	N/A	53	0.252	0.277	0.175
A3	1	0	N/A	102	0.276	0.289	0.267
A4	1	0	N/A	109	0.243	0.308	0.228
A5	1	0	N/A	108	0.256	0.343	0.285
A6	2	0	N/A	59	0.265	0.267	0.165
total	**1444**	**479**		**50**			

*includes both daily and hourly stations

Table A.8.2. Number of hourly stations, H1 statistic, mean number of data years, and weighted L-statistics of 60-minute data for each hourly region.

region	# hourly stations	H1	Mean number of data years	Coeff. of L-variation Weighted Mean	L-Skewness Weighted Mean	L-Kurtosis Weighted Mean
1	6	0.57	40	0.265	0.354	0.268
2	14	-1.20	41	0.266	0.309	0.190
3	14	0.82	34	0.281	0.318	0.233
4	16	2.12	35	0.281	0.316	0.229
5	12	0.07	35	0.261	0.318	0.219

region	# hourly stations	H1	Mean number of data years	Coeff. of L-variation Weighted Mean	L-Skewness Weighted Mean	L-Kurtosis Weighted Mean
6	10	1.08	37	0.275	0.319	0.220
7	16	1.79	41	0.308	0.292	0.194
8	27	-0.50	34	0.262	0.243	0.172
9	12	2.25	41	0.263	0.246	0.178
10E	12	1.00	29	0.269	0.167	0.115
10W	17	1.02	36	0.392	0.318	0.200
11	26	0.93	24	0.263	0.214	0.168
12	17	2.55	33	0.240	0.176	0.145
13	43	1.05	37	0.259	0.181	0.130
14	45	1.00	41	0.254	0.184	0.152
15	80	1.38	40	0.231	0.235	0.196
16	25	0.16	32	0.200	0.337	0.269
17	12	-0.64	44	0.265	0.390	0.270
18	4	1.97	41	0.277	0.288	0.154
19	5	2.39	36	0.259	0.254	0.174
20	22	2.59	40	0.217	0.273	0.200
21	15	3.49	42	0.274	0.304	0.203
22	19	2.50	35	0.219	0.225	0.176
23	7	-0.48	40	0.253	0.330	0.204
24	11	1.12	41	0.224	0.312	0.243
total	**487**		**37**			

Appendix A.9. Heterogeneity statistic, H1, for regions and durations used in NOAA Atlas 14 Volume 1.

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

Table A.9.1. H1 for daily regions (1-59) for durations 24-hour through 60-day.

Region	24-hr	2-day	4-day	7-day	10-day	20-day	30-day	45-day	60-day
1	1.39	-0.34	1.83	3.58	3.81	1.49	1.18	1.48	1.82
2	1.72	1.17	0.48	0.68	1.50	3.39	4.30	4.68	5.69
3	1.77	2.78	4.32	3.52	4.51	5.31	5.21	6.48	8.06
4	0.94	1.85	1.77	2.88	4.16	4.58	3.07	2.43	2.83
5	1.01	-0.18	-1.31	-2.82	-2.29	-1.74	-1.59	-1.27	-1.08
6	1.86	3.00	4.02	4.31	4.34	5.12	5.57	7.23	6.02
7	0.93	0.25	-0.42	-0.52	-0.75	-0.35	-0.60	-1.33	-1.53
8	0.40	-0.51	-1.04	-1.60	-0.95	-0.59	-1.73	-2.61	-1.81
9	1.74	0.02	-0.46	0.02	0.36	0.90	0.38	1.00	0.08
10	1.11	1.49	3.85	4.10	4.43	3.33	2.69	2.77	3.54
11	1.17	1.51	2.51	3.50	3.44	4.40	5.75	6.26	6.24
12	1.33	-1.42	-0.76	0.34	2.42	1.97	1.55	1.36	1.43
13	1.74	-0.13	-0.39	0.51	0.60	0.14	0.65	0.98	0.52
14	0.31	1.07	2.53	3.85	4.42	4.79	4.77	3.13	2.50
15	1.63	1.34	2.08	2.46	2.45	3.50	3.33	2.84	3.71
16	1.65	1.70	2.52	2.24	1.14	0.26	-0.34	-0.38	-1.53
17	0.33	0.69	1.46	1.00	0.40	1.44	1.55	0.49	0.96
18	1.23	0.64	-0.26	0.53	-0.09	0.55	0.14	0.72	0.18
19	0.56	1.65	2.53	2.55	1.95	1.47	1.86	1.80	0.97
20	-1.22	-0.34	0.54	1.56	1.20	1.20	1.17	1.27	0.88
21	-0.67	1.07	3.00	2.02	0.40	-0.83	0.14	-0.64	0.42
22	-0.25	0.17	0.04	2.07	3.65	3.94	4.88	4.66	4.05
23	-0.52	-1.19	-0.05	-1.04	-0.98	-0.47	-0.58	-1.89	-1.76
24	0.38	-0.62	-0.35	0.97	0.44	1.17	1.95	1.70	1.83
25	0.38	-0.43	1.40	1.77	2.64	2.75	3.44	3.82	3.45
26	1.06	1.48	1.37	1.87	2.61	2.61	2.89	3.60	3.18
27	0.65	-0.36	-0.65	-1.02	-1.14	-0.61	-0.92	-1.55	-1.45
28	-1.23	-1.40	-1.60	-2.04	-1.77	-1.97	-1.38	-2.29	-1.15
29	-0.58	-0.69	-0.32	-0.46	-0.14	0.72	0.40	0.49	0.42
30	0.43	0.56	0.90	1.02	1.14	1.22	1.29	1.57	1.45
31	0.35	0.10	2.51	3.59	3.03	0.42	1.31	-0.05	0.10
32	2.15	0.16	-0.80	-0.17	0.22	-0.58	0.30	-0.76	-0.35
33	0.86	-0.84	-0.40	0.28	0.72	-0.34	-0.71	-0.68	-0.66
34	0.21	-0.13	0.65	0.63	0.54	1.33	1.02	0.64	0.91
35	0.54	0.40	-0.07	-0.94	-0.87	-1.53	-1.22	-0.43	-0.42
36	1.43	1.76	0.99	0.56	1.07	1.94	1.68	1.67	2.46
37	0.87	1.77	0.98	1.56	1.73	1.81	2.65	2.53	2.70
38	0.31	-0.09	-0.03	0.63	0.90	-1.18	-1.01	-0.19	0.11
39	1.16	3.26	4.14	3.94	5.16	5.06	3.04	2.40	1.81
40	-0.61	-0.56	-0.59	-0.68	-0.45	-0.23	-0.27	-0.53	-0.94
41	-0.02	-0.34	0.59	0.51	1.14	1.59	2.26	2.20	2.06
42	1.53	0.51	-0.34	-0.49	-0.48	-0.24	0.93	0.24	-0.02
43	0.77	-1.59	-0.92	-3.19	-2.55	-1.59	-0.95	-0.92	-0.92

Region	24-hr	2-day	4-day	7-day	10-day	20-day	30-day	45-day	60-day
44	-0.06	-0.48	0.22	-0.77	-0.49	-0.22	0.78	0.40	0.50
45	0.15	2.05	2.74	3.22	3.50	3.43	3.77	4.38	5.45
46	-0.52	0.38	1.13	2.67	3.09	2.53	2.67	2.65	1.67
47	0.91	0.85	3.18	3.60	3.63	4.90	5.85	7.52	7.49
48	1.51	1.40	1.94	2.41	2.36	3.16	4.45	4.91	5.28
49	0.60	1.25	-0.17	-0.18	-0.49	0.30	0.80	0.13	0.28
50	0.78	1.55	1.92	2.26	1.71	1.86	1.61	1.86	0.95
51	0.39	-0.52	-0.65	-0.55	-0.35	-0.63	-0.97	-0.15	-0.57
52	0.89	-0.54	-0.30	0.07	0.93	1.53	1.09	1.19	1.60
53	-0.25	0.50	1.74	0.50	-0.30	-0.24	0.45	0.30	1.24
54	-0.76	0.03	-0.06	0.12	0.45	-0.06	-0.05	-0.44	-0.68
55	-0.62	-0.81	-1.43	-0.81	-0.50	-1.59	-1.95	-0.87	-0.33
56	-1.17	-0.21	-0.42	-0.60	-1.23	-1.57	-1.48	-0.70	0.05
57	0.29	-0.31	-0.29	-0.69	-1.12	-0.45	-0.19	-0.33	0.05
58	-0.15	-0.33	-0.31	-0.87	-1.04	-1.00	-0.90	-1.01	-0.42
59	-0.28	0.97	-0.06	-0.64	0.08	-0.28	-0.57	0.57	-0.45

Table A.9.2. Heterogeneity statistic, H1, for hourly regions (1-24) for durations 60-minute through 48-hour.

Region	60-min	2-hour	3-hour	6-hour	12-hour	24-hour	48-hour
1	0.57	1.85	3.85	3.93	1.32	0.15	0.76
2	-1.20	-0.61	-0.79	-0.94	-0.57	-0.02	0.36
3	0.82	0.40	0.30	0.88	2.88	4.19	3.50
4	2.12	2.13	2.60	3.04	2.12	0.63	0.68
5	0.07	-0.73	-0.20	0.67	1.07	0.94	1.31
6	1.08	0.33	0.62	2.15	3.17	3.28	2.16
7	1.79	2.16	1.96	0.88	1.89	1.89	1.89
8	-0.50	0.46	0.67	0.11	-0.35	-1.65	-0.37
9	2.25	2.39	1.32	0.22	-0.19	0.10	0.30
10E	1.00	0.02	-0.43	-0.16	0.27	0.07	-0.05
10W	1.02	1.46	0.92	0.38	0.69	0.77	0.97
11	0.93	0.77	0.50	0.45	0.72	0.28	-0.24
12	2.55	1.25	1.11	0.06	1.17	1.99	1.60
13	1.05	1.92	2.44	2.44	2.69	2.00	2.35
14	1.00	0.71	0.27	0.24	0.32	1.89	2.81
15	1.38	1.20	1.58	2.93	1.94	-0.08	-1.00
16	0.16	0.78	1.38	1.50	2.13	0.88	-0.50
17	-0.64	-0.09	1.03	2.31	0.47	1.25	1.13
18	1.97	1.54	1.27	1.38	2.48	0.96	0.79
19	2.39	0.53	0.95	0.51	2.21	1.60	0.94
20	2.59	2.91	1.98	2.74	2.07	1.72	0.85
21	3.49	3.28	4.31	3.87	2.81	2.65	2.12
22	2.50	0.44	-0.27	0.65	-0.19	-1.43	-1.07
23	-0.48	-0.83	-0.41	-0.10	-0.28	-1.13	-1.15
24	1.12	2.64	3.47	5.31	3.49	1.43	-0.11

Appendix A.10. Regional growth factors for regions used in NOAA Atlas 14 Volume 1.

Volume Update (3/31/2011). NOAA Atlas 14 Volume 6 supercedes Volume 1 for precipitation frequency estimates in southeastern California. Please see Volume 6 documentation for details regarding the data used and analysis approach for California.

Table A.10.1. Regional growth factors for daily regions and at-site analyses for each duration 24-hour to 60-day for the annual maximum series results. *Note that the 1.58-year was computed to equate the 1-year average recurrence interval (ARI) for partial duration series results (see Section 4.6.2) and the 1.58 year results were not released as annual exceedance probabilities (AEP).

24-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.833	0.931	1.247	1.466	1.754	1.977	2.206	2.442	2.765	3.020
2	0.793	0.902	1.269	1.543	1.927	2.242	2.584	2.955	3.496	3.948
3	0.809	0.919	1.277	1.528	1.862	2.124	2.395	2.677	3.069	3.380
4	0.828	0.929	1.254	1.479	1.777	2.007	2.244	2.489	2.825	3.090
5	0.833	0.931	1.246	1.465	1.755	1.980	2.211	2.450	2.779	3.038
6	0.843	0.934	1.230	1.437	1.710	1.923	2.142	2.369	2.682	2.930
7	0.792	0.909	1.292	1.566	1.937	2.230	2.539	2.863	3.320	3.688
8	0.840	0.938	1.246	1.454	1.723	1.927	2.132	2.340	2.620	2.835
9	0.814	0.918	1.261	1.506	1.839	2.102	2.380	2.672	3.084	3.416
10	0.793	0.915	1.305	1.577	1.934	2.211	2.495	2.788	3.191	3.508
11	0.813	0.922	1.273	1.518	1.844	2.098	2.360	2.632	3.008	3.306
12	0.833	0.936	1.260	1.478	1.758	1.969	2.180	2.394	2.679	2.898
13	0.856	0.947	1.229	1.417	1.655	1.833	2.010	2.186	2.420	2.597
14	0.858	0.944	1.218	1.403	1.643	1.825	2.009	2.196	2.448	2.643
15	0.825	0.922	1.243	1.473	1.786	2.035	2.298	2.576	2.969	3.288
16	0.841	0.937	1.241	1.448	1.718	1.923	2.132	2.344	2.632	2.856
17	0.790	0.900	1.272	1.549	1.940	2.262	2.612	2.992	3.549	4.015
18	0.701	0.857	1.387	1.783	2.339	2.798	3.295	3.836	4.627	5.288
19	0.787	0.931	1.364	1.640	1.975	2.214	2.445	2.668	2.953	3.160
20	0.735	0.866	1.325	1.678	2.186	2.616	3.092	3.621	4.414	5.093
21	0.827	0.932	1.264	1.490	1.782	2.005	2.230	2.458	2.767	3.006
22	0.842	0.936	1.235	1.443	1.714	1.924	2.138	2.359	2.660	2.896
23	0.827	0.928	1.254	1.481	1.780	2.012	2.251	2.498	2.837	3.105
24	0.789	0.906	1.293	1.571	1.950	2.252	2.570	2.908	3.385	3.773
25	0.850	0.946	1.240	1.435	1.680	1.861	2.041	2.220	2.456	2.633
26	0.830	0.926	1.242	1.466	1.768	2.006	2.254	2.515	2.880	3.173
27	0.802	0.929	1.319	1.576	1.899	2.137	2.372	2.605	2.910	3.140
28	0.762	0.895	1.332	1.646	2.072	2.411	2.768	3.145	3.677	4.109
29	0.757	0.885	1.320	1.641	2.089	2.456	2.852	3.280	3.902	4.419
30	0.755	0.901	1.369	1.689	2.108	2.429	2.756	3.091	3.547	3.903
31	0.786	0.917	1.329	1.608	1.969	2.242	2.518	2.798	3.175	3.465
32	0.784	0.903	1.297	1.581	1.970	2.281	2.612	2.963	3.462	3.868
33	0.683	0.849	1.412	1.831	2.421	2.906	3.433	4.005	4.841	5.541
34	0.767	0.899	1.331	1.637	2.049	2.374	2.713	3.069	3.568	3.968

24-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
35	0.784	0.898	1.282	1.568	1.969	2.297	2.652	3.037	3.598	4.065
36	0.831	0.931	1.251	1.472	1.763	1.986	2.215	2.450	2.772	3.025
37	0.814	0.920	1.268	1.513	1.840	2.097	2.364	2.642	3.029	3.338
38	0.852	0.944	1.230	1.423	1.669	1.855	2.041	2.228	2.478	2.669
39	0.830	0.929	1.249	1.472	1.769	2.000	2.239	2.487	2.829	3.100
40	0.682	0.847	1.411	1.832	2.426	2.916	3.447	4.026	4.874	5.584
41	0.805	0.919	1.288	1.544	1.882	2.142	2.411	2.688	3.068	3.367
42	0.802	0.918	1.290	1.549	1.892	2.158	2.433	2.717	3.109	3.419
43	0.829	0.930	1.252	1.477	1.772	2.000	2.235	2.477	2.809	3.071
44	0.843	0.940	1.244	1.449	1.713	1.912	2.112	2.314	2.586	2.794
45	0.834	0.936	1.258	1.474	1.752	1.961	2.172	2.384	2.669	2.888
46	0.790	0.889	1.242	1.521	1.937	2.298	2.708	3.174	3.892	4.525
47	0.806	0.915	1.273	1.528	1.872	2.145	2.431	2.732	3.155	3.495
48	0.779	0.903	1.309	1.600	1.993	2.305	2.633	2.978	3.465	3.858
49	0.804	0.914	1.275	1.532	1.882	2.158	2.449	2.756	3.188	3.537
50	0.810	0.916	1.266	1.516	1.854	2.122	2.404	2.702	3.121	3.459
51	0.827	0.928	1.255	1.482	1.782	2.015	2.255	2.503	2.844	3.113
52	0.835	0.937	1.254	1.469	1.745	1.954	2.164	2.377	2.662	2.881
53	0.836	0.941	1.265	1.478	1.746	1.944	2.140	2.334	2.589	2.781
54	0.780	0.889	1.269	1.561	1.984	2.343	2.741	3.184	3.849	4.421
55	0.815	0.934	1.301	1.541	1.842	2.063	2.281	2.496	2.777	2.988
56	0.769	0.891	1.305	1.611	2.038	2.386	2.761	3.165	3.752	4.239
57	0.742	0.872	1.322	1.664	2.153	2.563	3.015	3.514	4.255	4.886
58	0.726	0.875	1.373	1.735	2.233	2.634	3.060	3.515	4.166	4.699
59	0.828	0.936	1.267	1.502	1.835	2.116	2.430	2.783	3.320	3.787
A1	0.686	0.818	1.316	1.735	2.393	2.995	3.710	4.562	5.944	7.227
A2	0.759	0.878	1.299	1.615	2.055	2.408	2.784	3.184	3.753	4.215
A3	0.755	0.874	1.282	1.609	2.121	2.596	3.170	3.869	5.032	6.140
A4	0.769	0.875	1.258	1.565	2.027	2.432	2.896	3.429	4.259	4.998
A5	0.751	0.856	1.253	1.585	2.105	2.580	3.143	3.812	4.894	5.896
A6	0.749	0.876	1.319	1.647	2.098	2.458	2.838	3.241	3.810	4.270

48-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.836	0.936	1.251	1.465	1.741	1.951	2.164	2.380	2.671	2.896
2	0.783	0.890	1.264	1.552	1.969	2.322	2.715	3.153	3.812	4.379
3	0.805	0.916	1.278	1.534	1.879	2.150	2.433	2.730	3.145	3.478
4	0.838	0.937	1.250	1.462	1.735	1.942	2.150	2.361	2.645	2.864
5	0.832	0.932	1.251	1.471	1.759	1.979	2.205	2.436	2.751	2.997
6	0.847	0.936	1.224	1.425	1.692	1.899	2.114	2.335	2.642	2.884
7	0.783	0.898	1.285	1.572	1.972	2.300	2.653	3.035	3.590	4.051

48-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
8	0.817	0.918	1.254	1.495	1.824	2.087	2.364	2.657	3.074	3.411
9	0.796	0.906	1.273	1.542	1.915	2.217	2.541	2.888	3.388	3.801
10	0.794	0.917	1.309	1.578	1.931	2.202	2.478	2.761	3.147	3.448
11	0.816	0.923	1.269	1.510	1.829	2.078	2.334	2.600	2.966	3.256
12	0.826	0.929	1.259	1.487	1.788	2.019	2.257	2.501	2.836	3.099
13	0.851	0.940	1.225	1.420	1.673	1.867	2.065	2.267	2.541	2.755
14	0.859	0.946	1.220	1.405	1.642	1.819	1.998	2.178	2.419	2.603
15	0.828	0.926	1.246	1.473	1.777	2.016	2.265	2.526	2.890	3.181
16	0.830	0.930	1.251	1.473	1.766	1.991	2.223	2.461	2.788	3.045
17	0.770	0.885	1.286	1.591	2.029	2.397	2.803	3.253	3.922	4.493
18	0.700	0.857	1.390	1.787	2.344	2.801	3.297	3.835	4.620	5.276
19	0.787	0.935	1.372	1.646	1.976	2.209	2.431	2.643	2.910	3.102
20	0.737	0.868	1.325	1.675	2.178	2.601	3.070	3.589	4.365	5.029
21	0.825	0.930	1.264	1.492	1.790	2.018	2.250	2.488	2.811	3.062
22	0.840	0.931	1.230	1.440	1.722	1.943	2.174	2.414	2.749	3.017
23	0.826	0.928	1.255	1.484	1.786	2.021	2.262	2.513	2.857	3.130
24	0.788	0.900	1.279	1.560	1.953	2.274	2.620	2.995	3.539	3.992
25	0.850	0.945	1.239	1.434	1.681	1.864	2.047	2.228	2.468	2.649
26	0.836	0.932	1.240	1.454	1.739	1.960	2.188	2.424	2.750	3.008
27	0.788	0.916	1.322	1.599	1.958	2.233	2.511	2.795	3.180	3.479
28	0.739	0.879	1.350	1.695	2.174	2.562	2.978	3.425	4.069	4.599
29	0.760	0.884	1.307	1.624	2.075	2.448	2.855	3.301	3.956	4.508
30	0.749	0.898	1.376	1.705	2.136	2.467	2.805	3.153	3.628	3.999
31	0.770	0.905	1.338	1.640	2.039	2.348	2.666	2.995	3.448	3.806
32	0.762	0.883	1.300	1.615	2.064	2.438	2.847	3.298	3.964	4.528
33	0.667	0.831	1.403	1.845	2.487	3.032	3.638	4.315	5.336	6.215
34	0.772	0.905	1.332	1.630	2.027	2.335	2.654	2.985	3.442	3.805
35	0.788	0.904	1.290	1.570	1.954	2.264	2.593	2.943	3.444	3.854
36	0.831	0.931	1.251	1.473	1.765	1.990	2.221	2.460	2.787	3.044
37	0.821	0.927	1.265	1.499	1.807	2.044	2.287	2.538	2.881	3.150
38	0.852	0.942	1.227	1.421	1.672	1.862	2.055	2.251	2.514	2.718
39	0.835	0.932	1.245	1.461	1.747	1.968	2.195	2.429	2.751	3.004
40	0.691	0.857	1.414	1.822	2.388	2.848	3.340	3.869	4.631	5.259
41	0.797	0.910	1.282	1.549	1.912	2.201	2.505	2.828	3.284	3.653
42	0.793	0.911	1.296	1.569	1.935	2.222	2.522	2.836	3.274	3.624
43	0.824	0.926	1.256	1.486	1.792	2.031	2.277	2.533	2.887	3.168
44	0.841	0.938	1.244	1.451	1.718	1.920	2.124	2.330	2.608	2.822
45	0.837	0.938	1.255	1.467	1.738	1.942	2.145	2.351	2.624	2.834
46	0.797	0.898	1.247	1.516	1.906	2.235	2.601	3.008	3.619	4.145
47	0.803	0.912	1.273	1.533	1.888	2.171	2.471	2.789	3.240	3.606
48	0.772	0.894	1.306	1.608	2.025	2.364	2.727	3.116	3.677	4.140
49	0.803	0.912	1.272	1.532	1.886	2.170	2.470	2.789	3.241	3.608
50	0.818	0.923	1.263	1.502	1.819	2.067	2.324	2.591	2.961	3.254

48-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
51	0.824	0.927	1.259	1.490	1.794	2.030	2.272	2.523	2.867	3.138
52	0.835	0.932	1.244	1.460	1.746	1.967	2.194	2.428	2.751	3.004
53	0.840	0.942	1.258	1.466	1.728	1.921	2.112	2.302	2.552	2.740
54	0.791	0.900	1.270	1.547	1.937	2.259	2.609	2.989	3.547	4.014
55	0.811	0.927	1.292	1.538	1.855	2.094	2.335	2.578	2.905	3.156
56	0.769	0.891	1.304	1.610	2.037	2.387	2.765	3.173	3.767	4.261
57	0.729	0.853	1.301	1.662	2.206	2.686	3.237	3.872	4.864	5.751
58	0.696	0.851	1.384	1.787	2.360	2.838	3.361	3.936	4.786	5.505
59	0.828	0.935	1.262	1.496	1.829	2.112	2.429	2.786	3.332	3.810
A1	0.751	0.878	1.314	1.644	2.115	2.507	2.938	3.411	4.112	4.706
A2	0.792	0.908	1.290	1.559	1.915	2.190	2.473	2.766	3.170	3.490
A3	0.773	0.889	1.278	1.582	2.049	2.474	2.981	3.587	4.579	5.507
A4	0.779	0.887	1.268	1.562	1.990	2.353	2.757	3.209	3.890	4.478
A5	0.751	0.850	1.233	1.564	2.100	2.604	3.216	3.962	5.206	6.390
A6	0.726	0.863	1.344	1.703	2.197	2.593	3.013	3.457	4.087	4.598

4-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.820	0.919	1.248	1.485	1.811	2.072	2.348	2.643	3.061	3.403
2	0.774	0.886	1.275	1.575	2.009	2.377	2.786	3.242	3.926	4.515
3	0.801	0.913	1.281	1.543	1.897	2.177	2.470	2.779	3.213	3.562
4	0.843	0.942	1.249	1.453	1.714	1.908	2.101	2.295	2.551	2.747
5	0.830	0.933	1.258	1.480	1.768	1.988	2.211	2.438	2.746	2.985
6	0.845	0.936	1.227	1.430	1.698	1.906	2.120	2.342	2.647	2.888
7	0.791	0.904	1.284	1.560	1.940	2.246	2.573	2.921	3.420	3.829
8	0.800	0.911	1.279	1.542	1.900	2.185	2.484	2.801	3.249	3.610
9	0.770	0.887	1.292	1.597	2.032	2.393	2.789	3.223	3.865	4.407
10	0.793	0.917	1.312	1.582	1.935	2.206	2.481	2.763	3.146	3.445
11	0.818	0.925	1.269	1.508	1.823	2.067	2.317	2.576	2.931	3.211
12	0.822	0.925	1.258	1.492	1.803	2.045	2.296	2.558	2.919	3.206
13	0.843	0.934	1.228	1.434	1.709	1.924	2.146	2.377	2.698	2.953
14	0.853	0.941	1.222	1.415	1.665	1.857	2.052	2.251	2.521	2.732
15	0.831	0.930	1.249	1.470	1.761	1.987	2.218	2.457	2.786	3.044
16	0.824	0.930	1.268	1.499	1.798	2.027	2.258	2.494	2.813	3.061
17	0.761	0.884	1.305	1.621	2.069	2.441	2.846	3.289	3.941	4.491
18	0.695	0.851	1.389	1.794	2.369	2.846	3.367	3.939	4.781	5.491
19	0.784	0.933	1.377	1.655	1.991	2.228	2.454	2.671	2.945	3.142
20	0.749	0.885	1.339	1.671	2.129	2.498	2.893	3.315	3.921	4.418
21	0.825	0.931	1.268	1.497	1.794	2.019	2.247	2.479	2.792	3.034
22	0.837	0.927	1.226	1.441	1.734	1.967	2.214	2.476	2.846	3.147
23	0.823	0.925	1.257	1.490	1.799	2.040	2.290	2.550	2.910	3.196

4-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
24	0.793	0.905	1.279	1.552	1.929	2.235	2.561	2.911	3.413	3.827
25	0.848	0.943	1.239	1.437	1.689	1.877	2.065	2.254	2.504	2.695
26	0.829	0.926	1.245	1.471	1.772	2.009	2.256	2.514	2.873	3.160
27	0.778	0.918	1.351	1.640	2.007	2.280	2.554	2.827	3.190	3.465
28	0.720	0.869	1.371	1.741	2.256	2.675	3.126	3.612	4.315	4.898
29	0.756	0.882	1.314	1.637	2.093	2.471	2.881	3.329	3.986	4.538
30	0.730	0.883	1.382	1.737	2.215	2.593	2.988	3.403	3.985	4.453
31	0.756	0.899	1.359	1.679	2.102	2.430	2.768	3.117	3.598	3.977
32	0.750	0.875	1.309	1.641	2.118	2.519	2.962	3.453	4.186	4.812
33	0.670	0.835	1.408	1.846	2.476	3.005	3.590	4.238	5.205	6.031
34	0.776	0.908	1.333	1.627	2.014	2.312	2.619	2.934	3.366	3.705
35	0.776	0.891	1.285	1.582	2.003	2.354	2.737	3.157	3.776	4.299
36	0.825	0.925	1.250	1.480	1.788	2.031	2.283	2.548	2.917	3.213
37	0.827	0.933	1.265	1.490	1.782	2.003	2.226	2.453	2.759	2.994
38	0.856	0.946	1.226	1.414	1.652	1.831	2.009	2.188	2.427	2.608
39	0.835	0.933	1.247	1.463	1.746	1.964	2.187	2.415	2.727	2.971
40	0.699	0.863	1.408	1.805	2.351	2.791	3.259	3.759	4.474	5.060
41	0.792	0.902	1.275	1.550	1.934	2.247	2.585	2.951	3.480	3.920
42	0.789	0.906	1.294	1.572	1.949	2.250	2.568	2.903	3.378	3.762
43	0.811	0.915	1.260	1.508	1.849	2.121	2.410	2.717	3.154	3.510
44	0.841	0.938	1.245	1.453	1.721	1.924	2.130	2.337	2.617	2.833
45	0.838	0.938	1.253	1.465	1.735	1.938	2.142	2.347	2.621	2.830
46	0.791	0.893	1.253	1.531	1.935	2.278	2.660	3.087	3.730	4.286
47	0.811	0.919	1.273	1.522	1.854	2.115	2.385	2.667	3.059	3.371
48	0.770	0.893	1.308	1.612	2.033	2.375	2.740	3.133	3.698	4.164
49	0.793	0.903	1.274	1.547	1.928	2.238	2.571	2.931	3.451	3.881
50	0.815	0.919	1.262	1.506	1.835	2.095	2.367	2.654	3.056	3.380
51	0.814	0.914	1.250	1.496	1.837	2.113	2.408	2.725	3.181	3.556
52	0.832	0.929	1.243	1.463	1.757	1.986	2.224	2.472	2.815	3.088
53	0.843	0.945	1.257	1.461	1.716	1.903	2.087	2.269	2.506	2.684
54	0.797	0.903	1.265	1.535	1.913	2.223	2.560	2.925	3.458	3.903
55	0.812	0.931	1.300	1.544	1.853	2.083	2.312	2.539	2.840	3.068
56	0.757	0.879	1.301	1.623	2.086	2.475	2.904	3.378	4.086	4.690
57	0.729	0.856	1.313	1.673	2.209	2.674	3.202	3.801	4.725	5.537
58	0.662	0.823	1.395	1.844	2.507	3.079	3.724	4.454	5.571	6.548
59	0.829	0.933	1.256	1.488	1.822	2.108	2.431	2.797	3.360	3.856
A1	0.801	0.944	1.359	1.614	1.915	2.124	2.320	2.504	2.733	2.894
A2	0.812	0.919	1.270	1.514	1.832	2.076	2.326	2.584	2.937	3.214
A3	0.785	0.901	1.281	1.570	2.005	2.394	2.850	3.386	4.247	5.037
A4	0.784	0.904	1.301	1.586	1.973	2.282	2.608	2.953	3.441	3.837
A5	0.753	0.855	1.242	1.571	2.094	2.577	3.156	3.852	4.993	6.062
A6	0.704	0.843	1.349	1.740	2.291	2.743	3.229	3.752	4.504	5.122

7-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.820	0.918	1.247	1.485	1.812	2.073	2.351	2.646	3.067	3.410
2	0.780	0.890	1.272	1.564	1.983	2.336	2.726	3.157	3.801	4.352
3	0.801	0.913	1.280	1.542	1.896	2.176	2.471	2.781	3.218	3.570
4	0.845	0.945	1.253	1.454	1.705	1.890	2.071	2.251	2.485	2.661
5	0.826	0.930	1.263	1.491	1.788	2.015	2.247	2.483	2.805	3.056
6	0.845	0.937	1.231	1.435	1.701	1.907	2.117	2.333	2.629	2.861
7	0.798	0.914	1.292	1.558	1.912	2.189	2.477	2.777	3.193	3.524
8	0.801	0.917	1.289	1.550	1.896	2.165	2.444	2.733	3.133	3.450
9	0.758	0.885	1.315	1.636	2.086	2.456	2.856	3.291	3.926	4.455
10	0.795	0.921	1.317	1.584	1.927	2.186	2.447	2.711	3.065	3.337
11	0.819	0.927	1.271	1.508	1.816	2.053	2.294	2.541	2.877	3.139
12	0.821	0.927	1.267	1.501	1.810	2.047	2.291	2.541	2.884	3.152
13	0.847	0.939	1.231	1.430	1.690	1.888	2.090	2.296	2.575	2.793
14	0.854	0.943	1.223	1.413	1.659	1.845	2.034	2.225	2.483	2.682
15	0.833	0.931	1.246	1.465	1.755	1.980	2.211	2.450	2.779	3.038
16	0.825	0.938	1.283	1.510	1.795	2.005	2.212	2.417	2.686	2.888
17	0.764	0.890	1.314	1.626	2.059	2.411	2.789	3.196	3.784	4.269
18	0.688	0.851	1.405	1.818	2.399	2.877	3.396	3.960	4.785	5.475
19	0.785	0.938	1.386	1.663	1.990	2.218	2.433	2.636	2.888	3.067
20	0.765	0.902	1.345	1.653	2.061	2.377	2.703	3.041	3.506	3.873
21	0.827	0.934	1.270	1.496	1.785	2.002	2.221	2.440	2.734	2.959
22	0.844	0.939	1.237	1.441	1.704	1.905	2.109	2.316	2.596	2.812
23	0.819	0.925	1.266	1.504	1.818	2.061	2.312	2.571	2.928	3.210
24	0.792	0.905	1.284	1.559	1.937	2.240	2.562	2.906	3.396	3.797
25	0.847	0.943	1.242	1.442	1.696	1.886	2.076	2.266	2.519	2.711
26	0.830	0.930	1.253	1.476	1.769	1.995	2.227	2.465	2.792	3.049
27	0.755	0.894	1.349	1.672	2.105	2.445	2.801	3.173	3.694	4.111
28	0.703	0.853	1.373	1.767	2.330	2.800	3.317	3.886	4.730	5.447
29	0.745	0.873	1.317	1.654	2.139	2.546	2.994	3.490	4.229	4.858
30	0.725	0.880	1.391	1.753	2.241	2.625	3.028	3.450	4.041	4.516
31	0.744	0.890	1.364	1.700	2.152	2.507	2.878	3.267	3.810	4.245
32	0.751	0.880	1.322	1.652	2.116	2.500	2.916	3.370	4.034	4.591
33	0.673	0.842	1.421	1.854	2.465	2.971	3.521	4.121	5.001	5.741
34	0.777	0.911	1.337	1.628	2.007	2.296	2.590	2.890	3.297	3.613
35	0.775	0.888	1.279	1.577	2.006	2.367	2.765	3.205	3.862	4.423
36	0.831	0.928	1.244	1.466	1.762	1.993	2.233	2.482	2.828	3.103
37	0.831	0.936	1.266	1.487	1.769	1.980	2.191	2.403	2.686	2.901
38	0.860	0.951	1.227	1.408	1.635	1.802	1.966	2.128	2.341	2.500
39	0.843	0.940	1.245	1.451	1.714	1.912	2.111	2.311	2.579	2.784
40	0.708	0.872	1.410	1.795	2.316	2.728	3.161	3.618	4.261	4.779
41	0.800	0.910	1.274	1.538	1.899	2.189	2.497	2.825	3.293	3.675
42	0.789	0.907	1.295	1.573	1.950	2.250	2.566	2.899	3.370	3.750
43	0.803	0.907	1.257	1.517	1.882	2.181	2.505	2.857	3.369	3.797

7-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
44	0.845	0.941	1.241	1.444	1.704	1.900	2.096	2.295	2.561	2.765
45	0.844	0.943	1.251	1.455	1.711	1.900	2.088	2.274	2.519	2.704
46	0.806	0.908	1.255	1.511	1.869	2.163	2.479	2.821	3.319	3.732
47	0.816	0.926	1.276	1.516	1.831	2.073	2.320	2.574	2.919	3.189
48	0.776	0.901	1.312	1.607	2.007	2.326	2.661	3.016	3.516	3.921
49	0.798	0.909	1.278	1.544	1.909	2.200	2.510	2.838	3.306	3.687
50	0.822	0.928	1.266	1.499	1.805	2.041	2.282	2.530	2.868	3.133
51	0.809	0.909	1.248	1.501	1.857	2.151	2.469	2.814	3.320	3.742
52	0.833	0.933	1.251	1.469	1.754	1.971	2.192	2.419	2.727	2.966
53	0.846	0.948	1.257	1.457	1.703	1.881	2.055	2.225	2.444	2.606
54	0.803	0.912	1.272	1.531	1.885	2.167	2.466	2.784	3.234	3.600
55	0.806	0.924	1.296	1.549	1.876	2.125	2.377	2.633	2.979	3.246
56	0.750	0.873	1.303	1.635	2.117	2.526	2.980	3.488	4.252	4.911
57	0.726	0.856	1.319	1.683	2.222	2.688	3.215	3.812	4.728	5.531
58	0.646	0.811	1.403	1.874	2.576	3.188	3.885	4.681	5.912	7.000
59	0.837	0.942	1.260	1.483	1.796	2.059	2.351	2.677	3.169	3.595
A1	0.826	0.980	1.387	1.606	1.836	1.979	2.100	2.204	2.320	2.393
A2	0.806	0.905	1.248	1.502	1.849	2.127	2.419	2.728	3.164	3.516
A3	0.764	0.880	1.274	1.588	2.079	2.534	3.083	3.748	4.854	5.903
A4	0.788	0.908	1.301	1.580	1.955	2.252	2.561	2.886	3.341	3.707
A5	0.762	0.860	1.232	1.550	2.055	2.523	3.084	3.758	4.866	5.906
A6	0.698	0.834	1.342	1.743	2.320	2.799	3.320	3.887	4.710	5.394

10-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.824	0.926	1.256	1.488	1.796	2.036	2.284	2.542	2.898	3.181
2	0.787	0.900	1.281	1.562	1.956	2.278	2.625	3.000	3.544	3.996
3	0.803	0.918	1.289	1.548	1.891	2.157	2.432	2.716	3.109	3.419
4	0.846	0.945	1.251	1.452	1.702	1.887	2.068	2.248	2.482	2.658
5	0.828	0.934	1.268	1.492	1.780	1.997	2.214	2.434	2.728	2.953
6	0.846	0.940	1.236	1.437	1.696	1.893	2.091	2.293	2.564	2.773
7	0.802	0.920	1.295	1.554	1.893	2.154	2.421	2.695	3.070	3.363
8	0.808	0.924	1.291	1.541	1.867	2.115	2.367	2.624	2.972	3.242
9	0.758	0.889	1.327	1.646	2.086	2.442	2.821	3.228	3.810	4.289
10	0.793	0.920	1.320	1.591	1.938	2.200	2.464	2.731	3.089	3.364
11	0.817	0.927	1.278	1.518	1.830	2.067	2.309	2.555	2.888	3.147
12	0.826	0.932	1.269	1.496	1.790	2.011	2.235	2.462	2.766	3.000
13	0.855	0.946	1.230	1.420	1.660	1.840	2.019	2.197	2.435	2.615
14	0.862	0.952	1.226	1.405	1.629	1.792	1.952	2.110	2.316	2.470
15	0.838	0.937	1.249	1.461	1.734	1.941	2.150	2.362	2.647	2.866
16	0.828	0.941	1.286	1.509	1.786	1.987	2.184	2.376	2.625	2.810

10-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
17	0.773	0.898	1.312	1.611	2.019	2.347	2.693	3.061	3.585	4.011
18	0.690	0.852	1.404	1.814	2.391	2.865	3.379	3.937	4.752	5.432
19	0.789	0.942	1.388	1.658	1.976	2.195	2.399	2.590	2.824	2.989
20	0.766	0.909	1.358	1.663	2.057	2.356	2.659	2.966	3.380	3.700
21	0.829	0.937	1.273	1.496	1.779	1.988	2.196	2.404	2.679	2.886
22	0.849	0.945	1.240	1.436	1.685	1.870	2.053	2.237	2.479	2.663
23	0.810	0.918	1.271	1.521	1.855	2.118	2.392	2.678	3.077	3.397
24	0.790	0.907	1.293	1.570	1.944	2.242	2.556	2.887	3.355	3.732
25	0.849	0.946	1.246	1.443	1.689	1.870	2.049	2.226	2.457	2.631
26	0.830	0.929	1.247	1.469	1.765	1.995	2.233	2.481	2.823	3.094
27	0.752	0.893	1.355	1.682	2.119	2.463	2.821	3.195	3.717	4.133
28	0.708	0.858	1.372	1.759	2.307	2.763	3.260	3.805	4.608	5.285
29	0.746	0.878	1.328	1.664	2.138	2.530	2.955	3.419	4.099	4.669
30	0.729	0.888	1.399	1.754	2.222	2.584	2.957	3.342	3.872	4.289
31	0.748	0.892	1.361	1.693	2.138	2.487	2.851	3.231	3.762	4.187
32	0.751	0.880	1.323	1.653	2.118	2.501	2.917	3.370	4.033	4.589
33	0.670	0.841	1.423	1.859	2.477	2.988	3.545	4.154	5.048	5.799
34	0.769	0.905	1.342	1.644	2.043	2.352	2.669	2.995	3.444	3.797
35	0.778	0.890	1.279	1.574	1.996	2.349	2.738	3.166	3.803	4.344
36	0.840	0.939	1.248	1.456	1.724	1.926	2.129	2.334	2.609	2.820
37	0.835	0.941	1.268	1.483	1.753	1.952	2.148	2.343	2.598	2.790
38	0.861	0.949	1.222	1.403	1.631	1.800	1.968	2.135	2.355	2.522
39	0.847	0.943	1.243	1.441	1.694	1.882	2.070	2.257	2.505	2.694
40	0.703	0.866	1.408	1.800	2.337	2.767	3.224	3.710	4.403	4.967
41	0.799	0.913	1.286	1.551	1.905	2.184	2.475	2.780	3.206	3.547
42	0.790	0.909	1.297	1.574	1.946	2.240	2.548	2.872	3.326	3.690
43	0.810	0.913	1.256	1.507	1.854	2.134	2.433	2.754	3.214	3.592
44	0.848	0.942	1.235	1.433	1.688	1.880	2.073	2.269	2.531	2.733
45	0.841	0.941	1.253	1.460	1.723	1.919	2.114	2.308	2.566	2.761
46	0.825	0.927	1.257	1.487	1.792	2.029	2.274	2.527	2.877	3.153
47	0.814	0.923	1.274	1.517	1.838	2.086	2.342	2.605	2.967	3.252
48	0.777	0.901	1.311	1.604	2.002	2.318	2.651	3.003	3.500	3.902
49	0.803	0.914	1.278	1.537	1.887	2.164	2.454	2.759	3.187	3.532
50	0.828	0.935	1.269	1.494	1.781	1.997	2.213	2.430	2.721	2.943
51	0.813	0.912	1.246	1.493	1.838	2.119	2.422	2.749	3.224	3.618
52	0.840	0.941	1.254	1.463	1.728	1.925	2.122	2.319	2.581	2.779
53	0.847	0.948	1.256	1.454	1.699	1.876	2.049	2.218	2.436	2.598
54	0.809	0.920	1.277	1.528	1.861	2.120	2.389	2.667	3.053	3.359
55	0.800	0.920	1.302	1.564	1.906	2.169	2.436	2.709	3.081	3.371
56	0.748	0.871	1.303	1.638	2.126	2.541	3.004	3.522	4.305	4.982
57	0.728	0.858	1.319	1.681	2.213	2.671	3.187	3.770	4.660	5.437
58	0.667	0.835	1.415	1.856	2.490	3.021	3.607	4.255	5.218	6.040
59	0.834	0.939	1.258	1.484	1.804	2.074	2.375	2.713	3.226	3.673

10-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
A1	0.835	0.999	1.409	1.617	1.822	1.943	2.041	2.121	2.205	2.255
A2	0.802	0.906	1.261	1.520	1.869	2.144	2.432	2.734	3.157	3.495
A3	0.777	0.899	1.293	1.592	2.040	2.440	2.907	3.455	4.332	5.135
A4	0.786	0.911	1.314	1.595	1.965	2.252	2.547	2.852	3.271	3.602
A5	0.761	0.869	1.262	1.579	2.062	2.489	2.982	3.552	4.448	5.253
A6	0.701	0.841	1.351	1.745	2.304	2.762	3.255	3.785	4.550	5.179

20-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.826	0.923	1.243	1.471	1.781	2.028	2.287	2.561	2.947	3.259
2	0.806	0.916	1.277	1.532	1.876	2.146	2.429	2.725	3.139	3.471
3	0.811	0.927	1.292	1.538	1.855	2.094	2.334	2.577	2.903	3.153
4	0.845	0.947	1.258	1.459	1.708	1.888	2.065	2.237	2.460	2.625
5	0.839	0.943	1.264	1.473	1.734	1.926	2.114	2.299	2.541	2.721
6	0.858	0.952	1.237	1.421	1.649	1.814	1.976	2.134	2.337	2.488
7	0.814	0.935	1.305	1.546	1.847	2.066	2.282	2.494	2.771	2.977
8	0.821	0.938	1.296	1.528	1.817	2.028	2.235	2.438	2.701	2.897
9	0.766	0.897	1.327	1.635	2.052	2.382	2.730	3.098	3.616	4.034
10	0.800	0.928	1.324	1.584	1.911	2.152	2.390	2.627	2.936	3.169
11	0.819	0.932	1.285	1.521	1.822	2.048	2.275	2.502	2.804	3.035
12	0.838	0.946	1.271	1.481	1.739	1.926	2.108	2.285	2.513	2.681
13	0.863	0.956	1.233	1.410	1.627	1.782	1.931	2.076	2.261	2.396
14	0.870	0.961	1.229	1.395	1.595	1.736	1.870	1.998	2.158	2.273
15	0.846	0.945	1.249	1.449	1.699	1.884	2.066	2.246	2.482	2.659
16	0.829	0.945	1.293	1.514	1.783	1.975	2.160	2.338	2.565	2.731
17	0.794	0.921	1.319	1.588	1.934	2.195	2.457	2.722	3.078	3.351
18	0.696	0.860	1.409	1.811	2.367	2.817	3.297	3.812	4.553	5.162
19	0.777	0.936	1.400	1.686	2.025	2.261	2.483	2.693	2.954	3.139
20	0.761	0.909	1.371	1.683	2.083	2.385	2.688	2.993	3.402	3.716
21	0.843	0.954	1.281	1.483	1.724	1.892	2.051	2.201	2.389	2.523
22	0.859	0.956	1.244	1.426	1.647	1.804	1.955	2.099	2.283	2.416
23	0.829	0.933	1.261	1.485	1.774	1.995	2.217	2.444	2.750	2.987
24	0.789	0.909	1.302	1.580	1.952	2.244	2.549	2.868	3.313	3.669
25	0.844	0.944	1.252	1.455	1.711	1.901	2.088	2.274	2.518	2.702
26	0.846	0.946	1.252	1.452	1.700	1.882	2.060	2.235	2.464	2.634
27	0.751	0.889	1.346	1.674	2.121	2.476	2.852	3.249	3.811	4.267
28	0.715	0.866	1.377	1.754	2.279	2.707	3.169	3.667	4.388	4.987
29	0.749	0.881	1.330	1.663	2.127	2.508	2.918	3.362	4.007	4.544
30	0.732	0.896	1.415	1.765	2.216	2.557	2.900	3.247	3.713	4.071
31	0.745	0.890	1.363	1.699	2.149	2.504	2.874	3.261	3.803	4.237
32	0.750	0.883	1.331	1.662	2.121	2.496	2.898	3.332	3.960	4.481

20-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
33	0.673	0.847	1.434	1.866	2.469	2.960	3.488	4.057	4.881	5.564
34	0.768	0.908	1.353	1.656	2.049	2.348	2.652	2.961	3.379	3.703
35	0.788	0.903	1.287	1.567	1.952	2.263	2.595	2.950	3.458	3.876
36	0.856	0.953	1.246	1.433	1.661	1.824	1.981	2.134	2.329	2.471
37	0.833	0.939	1.266	1.483	1.757	1.960	2.163	2.364	2.631	2.832
38	0.872	0.955	1.210	1.377	1.585	1.738	1.888	2.036	2.229	2.373
39	0.853	0.948	1.240	1.431	1.670	1.846	2.019	2.190	2.414	2.582
40	0.706	0.872	1.417	1.805	2.326	2.738	3.168	3.620	4.253	4.761
41	0.807	0.925	1.299	1.551	1.876	2.122	2.369	2.619	2.954	3.212
42	0.796	0.921	1.315	1.581	1.924	2.183	2.444	2.708	3.062	3.335
43	0.813	0.922	1.273	1.518	1.843	2.095	2.356	2.626	2.999	3.294
44	0.857	0.950	1.235	1.421	1.653	1.822	1.989	2.152	2.365	2.524
45	0.851	0.952	1.255	1.448	1.682	1.849	2.010	2.166	2.364	2.508
46	0.836	0.932	1.242	1.458	1.742	1.962	2.188	2.421	2.742	2.994
47	0.832	0.942	1.279	1.497	1.768	1.965	2.157	2.346	2.590	2.771
48	0.800	0.921	1.305	1.566	1.905	2.162	2.423	2.689	3.048	3.326
49	0.817	0.926	1.276	1.516	1.830	2.069	2.314	2.564	2.904	3.169
50	0.844	0.948	1.263	1.465	1.713	1.891	2.065	2.233	2.450	2.610
51	0.818	0.919	1.254	1.494	1.820	2.080	2.354	2.644	3.054	3.386
52	0.849	0.952	1.259	1.454	1.691	1.861	2.024	2.182	2.383	2.529
53	0.856	0.961	1.265	1.449	1.665	1.814	1.952	2.082	2.241	2.352
54	0.808	0.922	1.286	1.538	1.868	2.122	2.382	2.649	3.014	3.300
55	0.807	0.928	1.305	1.556	1.875	2.114	2.352	2.590	2.907	3.147
56	0.770	0.891	1.303	1.608	2.034	2.381	2.757	3.162	3.751	4.241
57	0.754	0.887	1.332	1.656	2.103	2.464	2.848	3.260	3.850	4.334
58	0.671	0.837	1.410	1.847	2.472	2.996	3.573	4.210	5.158	5.965
59	0.852	0.956	1.257	1.462	1.740	1.967	2.213	2.481	2.874	3.204
A1	0.806	0.969	1.411	1.657	1.923	2.092	2.240	2.370	2.518	2.614
A2	0.853	0.951	1.246	1.434	1.666	1.835	2.001	2.166	2.385	2.551
A3	0.803	0.923	1.295	1.563	1.948	2.277	2.649	3.071	3.720	4.292
A4	0.805	0.929	1.311	1.564	1.885	2.122	2.358	2.594	2.904	3.139
A5	0.773	0.881	1.264	1.565	2.011	2.396	2.830	3.323	4.077	4.739
A6	0.683	0.844	1.421	1.804	2.250	2.546	2.811	3.049	3.325	3.508

30-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.835	0.930	1.240	1.457	1.746	1.972	2.205	2.448	2.785	3.052
2	0.816	0.926	1.277	1.518	1.834	2.076	2.323	2.576	2.921	3.191
3	0.812	0.928	1.293	1.538	1.852	2.088	2.326	2.565	2.886	3.131
4	0.841	0.943	1.255	1.462	1.721	1.913	2.103	2.292	2.541	2.728
5	0.847	0.947	1.252	1.450	1.698	1.879	2.056	2.231	2.458	2.627

30-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
6	0.859	0.951	1.231	1.415	1.643	1.811	1.975	2.137	2.348	2.505
7	0.822	0.942	1.302	1.532	1.813	2.016	2.211	2.400	2.642	2.819
8	0.818	0.937	1.298	1.534	1.828	2.043	2.254	2.462	2.733	2.935
9	0.769	0.900	1.328	1.631	2.040	2.362	2.699	3.053	3.548	3.945
10	0.801	0.930	1.325	1.583	1.906	2.142	2.375	2.605	2.905	3.129
11	0.827	0.939	1.281	1.506	1.787	1.994	2.198	2.399	2.663	2.860
12	0.837	0.944	1.269	1.480	1.741	1.931	2.117	2.299	2.535	2.710
13	0.860	0.951	1.229	1.411	1.637	1.804	1.967	2.129	2.339	2.497
14	0.874	0.962	1.223	1.385	1.579	1.716	1.845	1.968	2.122	2.232
15	0.855	0.952	1.246	1.434	1.664	1.829	1.989	2.145	2.344	2.490
16	0.825	0.942	1.297	1.524	1.802	2.002	2.196	2.384	2.626	2.803
17	0.798	0.925	1.322	1.585	1.918	2.166	2.413	2.660	2.986	3.234
18	0.697	0.862	1.414	1.815	2.364	2.806	3.275	3.775	4.488	5.071
19	0.759	0.923	1.413	1.725	2.104	2.376	2.637	2.890	3.211	3.445
20	0.760	0.912	1.383	1.696	2.092	2.387	2.679	2.971	3.357	3.649
21	0.836	0.948	1.283	1.494	1.750	1.932	2.107	2.275	2.489	2.644
22	0.861	0.958	1.243	1.422	1.637	1.789	1.934	2.073	2.247	2.373
23	0.834	0.940	1.266	1.482	1.754	1.956	2.156	2.355	2.617	2.814
24	0.802	0.920	1.294	1.553	1.892	2.154	2.422	2.697	3.073	3.368
25	0.852	0.951	1.250	1.442	1.677	1.847	2.012	2.173	2.379	2.531
26	0.851	0.949	1.245	1.438	1.677	1.852	2.023	2.191	2.408	2.570
27	0.743	0.885	1.354	1.692	2.154	2.524	2.914	3.329	3.918	4.397
28	0.718	0.871	1.381	1.754	2.267	2.681	3.122	3.594	4.271	4.826
29	0.747	0.885	1.344	1.678	2.135	2.504	2.895	3.313	3.909	4.397
30	0.731	0.898	1.419	1.769	2.218	2.555	2.894	3.236	3.692	4.042
31	0.744	0.893	1.374	1.710	2.154	2.499	2.855	3.224	3.733	4.136
32	0.754	0.887	1.332	1.657	2.104	2.465	2.849	3.261	3.850	4.334
33	0.676	0.852	1.440	1.868	2.458	2.933	3.440	3.981	4.756	5.391
34	0.770	0.915	1.366	1.665	2.045	2.327	2.609	2.890	3.262	3.544
35	0.793	0.912	1.297	1.569	1.932	2.217	2.514	2.824	3.256	3.600
36	0.860	0.957	1.245	1.426	1.643	1.797	1.943	2.083	2.260	2.387
37	0.838	0.945	1.269	1.479	1.739	1.928	2.112	2.293	2.526	2.699
38	0.877	0.961	1.210	1.369	1.561	1.698	1.831	1.958	2.121	2.239
39	0.860	0.955	1.240	1.420	1.640	1.798	1.949	2.095	2.282	2.417
40	0.723	0.890	1.420	1.782	2.254	2.615	2.981	3.355	3.863	4.258
41	0.809	0.931	1.307	1.555	1.867	2.099	2.328	2.556	2.856	3.082
42	0.797	0.921	1.313	1.578	1.920	2.179	2.439	2.703	3.058	3.331
43	0.817	0.924	1.268	1.508	1.826	2.072	2.327	2.590	2.952	3.239
44	0.864	0.958	1.238	1.413	1.625	1.774	1.917	2.054	2.227	2.352
45	0.857	0.958	1.254	1.437	1.656	1.809	1.954	2.092	2.264	2.387
46	0.845	0.945	1.250	1.451	1.703	1.889	2.072	2.254	2.493	2.672
47	0.845	0.955	1.277	1.477	1.715	1.881	2.039	2.188	2.373	2.506
48	0.812	0.932	1.302	1.547	1.856	2.084	2.311	2.537	2.834	3.058

30-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
49	0.823	0.932	1.276	1.508	1.804	2.027	2.251	2.477	2.778	3.010
50	0.850	0.954	1.263	1.457	1.690	1.856	2.013	2.164	2.355	2.492
51	0.831	0.931	1.250	1.471	1.762	1.986	2.216	2.452	2.777	3.031
52	0.857	0.960	1.259	1.443	1.660	1.810	1.951	2.084	2.249	2.365
53	0.860	0.965	1.262	1.441	1.647	1.787	1.916	2.036	2.181	2.282
54	0.825	0.940	1.291	1.519	1.800	2.005	2.205	2.400	2.654	2.841
55	0.814	0.935	1.306	1.548	1.849	2.069	2.284	2.496	2.772	2.977
56	0.776	0.896	1.299	1.595	2.004	2.336	2.692	3.074	3.625	4.080
57	0.769	0.900	1.328	1.633	2.042	2.366	2.704	3.059	3.556	3.955
58	0.680	0.849	1.422	1.844	2.435	2.917	3.437	4.000	4.815	5.493
59	0.862	0.964	1.255	1.447	1.703	1.907	2.125	2.359	2.695	2.973
A1	0.807	0.976	1.425	1.668	1.926	2.087	2.225	2.344	2.477	2.562
A2	0.853	0.957	1.260	1.447	1.673	1.834	1.991	2.144	2.345	2.495
A3	0.821	0.941	1.296	1.541	1.881	2.162	2.471	2.811	3.319	3.751
A4	0.814	0.930	1.294	1.537	1.846	2.077	2.308	2.539	2.847	3.081
A5	0.778	0.887	1.270	1.565	1.994	2.358	2.763	3.215	3.895	4.481
A6	0.694	0.857	1.423	1.785	2.189	2.447	2.671	2.864	3.079	3.217

45-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.836	0.934	1.246	1.460	1.741	1.957	2.177	2.403	2.711	2.952
2	0.821	0.931	1.277	1.511	1.812	2.040	2.268	2.500	2.810	3.049
3	0.814	0.932	1.296	1.537	1.843	2.070	2.295	2.521	2.818	3.043
4	0.844	0.946	1.256	1.458	1.710	1.893	2.073	2.250	2.480	2.651
5	0.852	0.951	1.251	1.443	1.678	1.846	2.009	2.168	2.370	2.519
6	0.869	0.960	1.230	1.399	1.601	1.744	1.880	2.010	2.173	2.290
7	0.819	0.941	1.308	1.541	1.826	2.030	2.227	2.418	2.661	2.839
8	0.819	0.941	1.306	1.540	1.826	2.031	2.230	2.423	2.670	2.851
9	0.777	0.909	1.333	1.625	2.009	2.304	2.606	2.916	3.340	3.672
10	0.798	0.930	1.332	1.593	1.919	2.157	2.390	2.619	2.917	3.139
11	0.833	0.944	1.279	1.494	1.761	1.954	2.141	2.325	2.561	2.736
12	0.846	0.952	1.268	1.467	1.708	1.878	2.041	2.197	2.394	2.537
13	0.868	0.957	1.226	1.396	1.604	1.753	1.896	2.035	2.212	2.341
14	0.874	0.961	1.219	1.381	1.577	1.716	1.849	1.976	2.136	2.252
15	0.859	0.956	1.247	1.429	1.648	1.804	1.952	2.094	2.273	2.402
16	0.818	0.939	1.304	1.540	1.829	2.039	2.243	2.442	2.698	2.887
17	0.791	0.920	1.325	1.597	1.947	2.211	2.476	2.744	3.102	3.377
18	0.680	0.850	1.424	1.848	2.438	2.918	3.436	3.994	4.802	5.472
19	0.743	0.909	1.418	1.752	2.169	2.475	2.776	3.075	3.464	3.756
20	0.759	0.912	1.384	1.697	2.094	2.388	2.680	2.972	3.357	3.648
21	0.831	0.944	1.284	1.502	1.770	1.964	2.152	2.335	2.571	2.744

45-day										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
22	0.864	0.961	1.245	1.420	1.627	1.771	1.908	2.036	2.196	2.310
23	0.823	0.930	1.268	1.499	1.799	2.028	2.260	2.496	2.816	3.065
24	0.805	0.921	1.293	1.549	1.884	2.141	2.403	2.671	3.038	3.324
25	0.851	0.951	1.251	1.443	1.678	1.848	2.013	2.173	2.378	2.529
26	0.855	0.953	1.246	1.433	1.662	1.827	1.986	2.141	2.339	2.483
27	0.738	0.884	1.365	1.710	2.177	2.550	2.941	3.356	3.940	4.413
28	0.700	0.848	1.368	1.767	2.344	2.831	3.372	3.974	4.876	5.651
29	0.746	0.891	1.365	1.699	2.145	2.495	2.859	3.239	3.768	4.190
30	0.706	0.874	1.422	1.808	2.325	2.731	3.152	3.592	4.206	4.695
31	0.729	0.877	1.372	1.730	2.220	2.613	3.030	3.473	4.105	4.620
32	0.746	0.883	1.343	1.679	2.143	2.518	2.919	3.349	3.966	4.473
33	0.679	0.859	1.450	1.874	2.447	2.901	3.379	3.883	4.593	5.166
34	0.763	0.912	1.374	1.682	2.075	2.368	2.660	2.954	3.343	3.639
35	0.794	0.912	1.297	1.568	1.929	2.212	2.505	2.811	3.235	3.573
36	0.858	0.954	1.243	1.427	1.651	1.812	1.966	2.116	2.308	2.447
37	0.841	0.949	1.272	1.477	1.727	1.906	2.078	2.245	2.458	2.613
38	0.876	0.960	1.212	1.372	1.568	1.709	1.844	1.976	2.143	2.266
39	0.866	0.960	1.237	1.410	1.616	1.760	1.897	2.028	2.191	2.307
40	0.720	0.889	1.426	1.793	2.269	2.632	3.001	3.377	3.887	4.283
41	0.802	0.930	1.322	1.579	1.902	2.139	2.373	2.605	2.908	3.135
42	0.800	0.927	1.321	1.580	1.908	2.151	2.392	2.631	2.946	3.185
43	0.823	0.931	1.272	1.502	1.800	2.025	2.252	2.482	2.792	3.030
44	0.871	0.965	1.237	1.402	1.596	1.730	1.854	1.971	2.114	2.215
45	0.867	0.966	1.251	1.421	1.619	1.752	1.876	1.990	2.129	2.225
46	0.856	0.953	1.245	1.432	1.660	1.823	1.982	2.135	2.331	2.474
47	0.853	0.964	1.279	1.466	1.682	1.828	1.962	2.086	2.234	2.337
48	0.813	0.932	1.300	1.542	1.849	2.076	2.301	2.524	2.819	3.042
49	0.824	0.932	1.272	1.502	1.798	2.022	2.247	2.475	2.781	3.017
50	0.856	0.959	1.258	1.443	1.662	1.814	1.958	2.094	2.262	2.382
51	0.843	0.946	1.257	1.461	1.713	1.898	2.079	2.257	2.489	2.662
52	0.866	0.967	1.256	1.428	1.624	1.757	1.879	1.991	2.126	2.219
53	0.867	0.970	1.260	1.429	1.620	1.748	1.863	1.969	2.093	2.178
54	0.829	0.947	1.297	1.518	1.784	1.972	2.152	2.325	2.544	2.701
55	0.822	0.943	1.305	1.535	1.815	2.015	2.208	2.394	2.632	2.805
56	0.775	0.900	1.312	1.608	2.011	2.332	2.671	3.031	3.540	3.953
57	0.778	0.907	1.322	1.613	2.000	2.302	2.615	2.940	3.390	3.747
58	0.668	0.834	1.412	1.853	2.488	3.021	3.609	4.261	5.233	6.063
59	0.869	0.969	1.251	1.434	1.677	1.869	2.071	2.287	2.594	2.845
A1	0.794	0.967	1.433	1.694	1.976	2.157	2.314	2.453	2.611	2.715
A2	0.856	0.960	1.260	1.444	1.664	1.820	1.971	2.118	2.309	2.452
A3	0.817	0.945	1.325	1.561	1.843	2.041	2.229	2.408	2.632	2.792
A4	0.828	0.946	1.299	1.522	1.790	1.981	2.164	2.340	2.562	2.723
A5	0.780	0.891	1.275	1.567	1.986	2.337	2.722	3.149	3.782	4.321

45-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
A6	0.713	0.880	1.430	1.754	2.089	2.287	2.446	2.575	2.709	2.788

60-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.844	0.944	1.252	1.456	1.711	1.899	2.086	2.271	2.514	2.696
2	0.825	0.935	1.277	1.505	1.794	2.010	2.225	2.440	2.724	2.941
3	0.821	0.943	1.309	1.540	1.820	2.020	2.212	2.396	2.630	2.801
4	0.843	0.946	1.259	1.462	1.715	1.899	2.079	2.255	2.485	2.655
5	0.852	0.952	1.253	1.444	1.678	1.845	2.007	2.163	2.362	2.508
6	0.876	0.967	1.228	1.387	1.572	1.700	1.819	1.930	2.066	2.162
7	0.824	0.946	1.308	1.534	1.807	1.999	2.182	2.358	2.578	2.737
8	0.822	0.949	1.318	1.547	1.818	2.007	2.185	2.354	2.563	2.712
9	0.781	0.920	1.351	1.636	1.997	2.264	2.529	2.793	3.142	3.405
10	0.798	0.929	1.333	1.595	1.922	2.161	2.396	2.627	2.928	3.152
11	0.833	0.944	1.278	1.494	1.761	1.954	2.142	2.327	2.564	2.740
12	0.845	0.952	1.268	1.468	1.709	1.880	2.044	2.201	2.400	2.544
13	0.871	0.961	1.229	1.395	1.593	1.733	1.865	1.991	2.149	2.262
14	0.876	0.964	1.222	1.382	1.572	1.704	1.829	1.947	2.095	2.200
15	0.867	0.965	1.247	1.417	1.615	1.750	1.876	1.992	2.134	2.233
16	0.817	0.941	1.314	1.551	1.840	2.046	2.244	2.436	2.680	2.858
17	0.793	0.928	1.338	1.606	1.941	2.186	2.427	2.664	2.974	3.205
18	0.670	0.840	1.423	1.861	2.479	2.991	3.549	4.159	5.054	5.807
19	0.730	0.900	1.426	1.777	2.223	2.557	2.890	3.223	3.665	4.002
20	0.745	0.900	1.391	1.724	2.155	2.482	2.813	3.149	3.603	3.953
21	0.834	0.948	1.287	1.501	1.760	1.945	2.121	2.291	2.506	2.662
22	0.865	0.965	1.251	1.423	1.624	1.761	1.887	2.005	2.149	2.249
23	0.820	0.928	1.272	1.508	1.815	2.050	2.290	2.535	2.868	3.127
24	0.807	0.923	1.293	1.546	1.874	2.125	2.380	2.640	2.993	3.267
25	0.851	0.952	1.254	1.447	1.683	1.852	2.015	2.173	2.374	2.521
26	0.864	0.959	1.241	1.416	1.626	1.773	1.914	2.047	2.214	2.334
27	0.745	0.891	1.367	1.702	2.151	2.503	2.868	3.250	3.781	4.204
28	0.710	0.858	1.369	1.753	2.300	2.755	3.253	3.799	4.605	5.286
29	0.749	0.893	1.362	1.692	2.133	2.479	2.838	3.213	3.734	4.150
30	0.706	0.871	1.414	1.802	2.324	2.738	3.172	3.629	4.271	4.787
31	0.733	0.881	1.371	1.723	2.203	2.586	2.990	3.419	4.025	4.517
32	0.748	0.885	1.344	1.677	2.135	2.503	2.894	3.312	3.908	4.396
33	0.674	0.855	1.454	1.884	2.468	2.932	3.422	3.939	4.671	5.263
34	0.762	0.912	1.377	1.687	2.081	2.374	2.667	2.960	3.349	3.644
35	0.801	0.918	1.295	1.557	1.901	2.167	2.440	2.722	3.109	3.413
36	0.865	0.962	1.243	1.416	1.621	1.763	1.896	2.022	2.177	2.287
37	0.845	0.953	1.271	1.470	1.709	1.878	2.039	2.193	2.387	2.527

60-day										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
38	0.880	0.962	1.208	1.363	1.551	1.685	1.813	1.937	2.093	2.207
39	0.869	0.963	1.237	1.405	1.603	1.740	1.868	1.989	2.138	2.244
40	0.723	0.894	1.430	1.791	2.254	2.602	2.953	3.306	3.780	4.142
41	0.796	0.927	1.329	1.594	1.927	2.172	2.415	2.656	2.972	3.209
42	0.803	0.932	1.325	1.581	1.898	2.130	2.357	2.580	2.870	3.085
43	0.832	0.938	1.267	1.485	1.762	1.968	2.172	2.376	2.646	2.851
44	0.872	0.968	1.241	1.404	1.592	1.719	1.836	1.944	2.074	2.164
45	0.867	0.968	1.253	1.423	1.617	1.749	1.869	1.980	2.113	2.205
46	0.862	0.956	1.237	1.416	1.632	1.786	1.934	2.077	2.258	2.390
47	0.860	0.970	1.276	1.455	1.656	1.789	1.909	2.018	2.146	2.233
48	0.824	0.943	1.299	1.526	1.804	2.003	2.196	2.383	2.621	2.796
49	0.834	0.941	1.270	1.485	1.756	1.954	2.150	2.344	2.598	2.789
50	0.861	0.963	1.258	1.437	1.644	1.787	1.919	2.042	2.192	2.297
51	0.843	0.945	1.258	1.462	1.716	1.902	2.085	2.266	2.500	2.676
52	0.869	0.970	1.255	1.422	1.611	1.737	1.852	1.957	2.081	2.166
53	0.871	0.974	1.260	1.423	1.605	1.723	1.829	1.924	2.035	2.109
54	0.838	0.954	1.292	1.500	1.746	1.918	2.079	2.232	2.421	2.556
55	0.826	0.948	1.309	1.534	1.802	1.989	2.167	2.337	2.548	2.699
56	0.785	0.910	1.314	1.597	1.972	2.265	2.567	2.881	3.314	3.658
57	0.772	0.903	1.327	1.627	2.028	2.342	2.669	3.010	3.485	3.864
58	0.679	0.840	1.399	1.825	2.437	2.949	3.515	4.140	5.071	5.864
59	0.872	0.972	1.251	1.431	1.667	1.853	2.047	2.253	2.544	2.780
A1	0.801	0.975	1.436	1.687	1.953	2.119	2.262	2.385	2.523	2.610
A2	0.853	0.960	1.270	1.457	1.680	1.838	1.990	2.137	2.328	2.471
A3	0.803	0.935	1.334	1.589	1.902	2.127	2.345	2.557	2.828	3.027
A4	0.833	0.954	1.305	1.519	1.772	1.946	2.109	2.262	2.451	2.584
A5	0.795	0.907	1.280	1.549	1.919	2.217	2.532	2.868	3.348	3.739
A6	0.720	0.886	1.426	1.739	2.057	2.241	2.387	2.504	2.622	2.691

Table A.9.2. Regional growth factors for hourly regions analyses for each duration 60-minute to 24-hour for the annual maximum series results. *Note that the 1.58-year was computed to equate the 1-year average recurrence interval (ARI) for partial duration series results (see Section 4.6.2) and the 1.58 year results were not released as annual exceedance probabilities (AEP).

60-minute										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.741	0.848	1.254	1.599	2.147	2.653	3.260	3.988	5.182	6.300
2	0.747	0.863	1.283	1.620	2.126	2.571	3.081	3.668	4.581	5.394
3	0.731	0.852	1.294	1.652	2.198	2.682	3.242	3.892	4.915	5.835
4	0.731	0.853	1.295	1.653	2.196	2.676	3.231	3.873	4.881	5.786
5	0.750	0.862	1.272	1.605	2.111	2.561	3.081	3.684	4.634	5.489
6	0.737	0.855	1.286	1.637	2.171	2.646	3.196	3.835	4.842	5.751
7	0.711	0.849	1.340	1.725	2.292	2.781	3.331	3.953	4.903	5.734
8	0.764	0.890	1.315	1.627	2.060	2.411	2.789	3.194	3.779	4.263
9	0.762	0.888	1.315	1.629	2.068	2.426	2.811	3.227	3.829	4.328
10W	0.625	0.794	1.409	1.908	2.667	3.340	4.119	5.022	6.442	7.721
10E	0.777	0.920	1.360	1.650	2.015	2.285	2.552	2.817	3.165	3.427
11	0.770	0.901	1.330	1.633	2.038	2.356	2.687	3.032	3.514	3.899
12	0.798	0.924	1.317	1.580	1.915	2.165	2.415	2.666	3.000	3.255
13	0.781	0.917	1.341	1.626	1.991	2.266	2.542	2.821	3.193	3.478
14	0.785	0.917	1.332	1.612	1.974	2.247	2.522	2.800	3.175	3.463
15	0.794	0.906	1.281	1.553	1.927	2.228	2.547	2.888	3.375	3.774
16	0.806	0.889	1.200	1.459	1.862	2.228	2.659	3.168	3.987	4.741
17	0.736	0.836	1.230	1.581	2.161	2.720	3.412	4.271	5.736	7.163
18	0.741	0.866	1.308	1.653	2.159	2.592	3.079	3.627	4.460	5.184
19	0.764	0.887	1.306	1.618	2.057	2.419	2.812	3.239	3.864	4.387
20	0.800	0.900	1.248	1.514	1.897	2.219	2.576	2.971	3.562	4.068
21	0.740	0.861	1.294	1.640	2.158	2.610	3.126	3.717	4.632	5.444
22	0.806	0.914	1.271	1.527	1.874	2.150	2.441	2.749	3.183	3.534
23	0.756	0.863	1.257	1.582	2.083	2.534	3.062	3.680	4.667	5.567
24	0.787	0.884	1.237	1.521	1.949	2.327	2.761	3.261	4.042	4.741

120-minute										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.786	0.891	1.258	1.542	1.955	2.307	2.699	3.137	3.799	4.370
2	0.780	0.883	1.252	1.545	1.982	2.363	2.795	3.289	4.050	4.722
3	0.760	0.877	1.288	1.607	2.070	2.465	2.906	3.399	4.145	4.789
4	0.771	0.881	1.269	1.574	2.022	2.407	2.841	3.331	4.079	4.731
5	0.771	0.870	1.236	1.541	2.015	2.444	2.950	3.547	4.507	5.390
6	0.771	0.875	1.254	1.560	2.021	2.428	2.896	3.435	4.278	5.033
7	0.735	0.867	1.327	1.679	2.186	2.614	3.087	3.612	4.397	5.069
8	0.780	0.896	1.290	1.581	1.988	2.321	2.679	3.068	3.632	4.100
9	0.777	0.895	1.293	1.587	1.999	2.337	2.701	3.095	3.668	4.145
10W	0.653	0.819	1.409	1.870	2.550	3.133	3.790	4.531	5.661	6.647

120-minute										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
10E	0.769	0.898	1.324	1.628	2.041	2.368	2.712	3.075	3.587	4.000
11	0.781	0.905	1.311	1.598	1.985	2.290	2.609	2.944	3.412	3.787
12	0.801	0.918	1.294	1.555	1.898	2.162	2.434	2.714	3.099	3.401
13	0.787	0.914	1.321	1.600	1.964	2.244	2.529	2.820	3.217	3.527
14	0.783	0.911	1.322	1.607	1.982	2.271	2.569	2.875	3.296	3.626
15	0.812	0.920	1.271	1.518	1.849	2.108	2.378	2.659	3.050	3.362
16	0.850	0.930	1.200	1.398	1.672	1.896	2.135	2.392	2.764	3.070
17	0.798	0.891	1.229	1.498	1.902	2.256	2.659	3.122	3.840	4.478
18	0.787	0.902	1.287	1.568	1.957	2.272	2.608	2.968	3.486	3.912
19	0.796	0.908	1.280	1.549	1.919	2.215	2.530	2.865	3.343	3.734
20	0.826	0.917	1.228	1.458	1.782	2.047	2.333	2.644	3.096	3.474
21	0.773	0.878	1.257	1.560	2.012	2.407	2.858	3.373	4.172	4.881
22	0.828	0.933	1.266	1.491	1.781	2.001	2.222	2.447	2.749	2.982
23	0.794	0.885	1.221	1.495	1.915	2.291	2.728	3.237	4.044	4.776
24	0.809	0.901	1.227	1.482	1.855	2.174	2.533	2.937	3.551	4.084

3-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.812	0.922	1.276	1.522	1.848	2.102	2.363	2.633	3.005	3.299
2	0.798	0.897	1.243	1.512	1.903	2.236	2.607	3.023	3.652	4.195
3	0.769	0.888	1.296	1.602	2.035	2.393	2.784	3.211	3.838	4.365
4	0.790	0.897	1.266	1.545	1.943	2.274	2.637	3.037	3.627	4.127
5	0.788	0.886	1.239	1.522	1.946	2.318	2.743	3.231	3.988	4.662
6	0.794	0.897	1.257	1.531	1.924	2.253	2.616	3.016	3.613	4.121
7	0.750	0.882	1.329	1.661	2.124	2.503	2.912	3.355	3.999	4.534
8	0.798	0.907	1.273	1.540	1.909	2.206	2.524	2.864	3.351	3.751
9	0.793	0.906	1.282	1.555	1.930	2.231	2.551	2.893	3.381	3.780
10W	0.671	0.837	1.412	1.848	2.472	2.994	3.568	4.201	5.141	5.940
10E	0.768	0.888	1.297	1.604	2.038	2.398	2.789	3.218	3.847	4.376
11	0.789	0.903	1.284	1.563	1.949	2.261	2.594	2.952	3.466	3.889
12	0.806	0.918	1.279	1.533	1.873	2.138	2.414	2.702	3.101	3.420
13	0.795	0.917	1.307	1.575	1.926	2.195	2.469	2.750	3.134	3.433
14	0.785	0.910	1.313	1.595	1.969	2.260	2.560	2.872	3.302	3.643
15	0.817	0.926	1.272	1.511	1.825	2.067	2.315	2.570	2.918	3.191
16	0.862	0.943	1.202	1.383	1.622	1.807	1.997	2.194	2.465	2.679
17	0.830	0.921	1.226	1.450	1.762	2.015	2.287	2.579	3.001	3.350
18	0.815	0.922	1.268	1.512	1.835	2.088	2.349	2.621	2.998	3.298
19	0.811	0.922	1.281	1.529	1.856	2.108	2.367	2.634	3.000	3.287
20	0.832	0.921	1.220	1.442	1.752	2.006	2.281	2.578	3.011	3.371
21	0.799	0.899	1.248	1.514	1.898	2.222	2.579	2.975	3.568	4.074
22	0.831	0.938	1.268	1.488	1.766	1.974	2.180	2.386	2.659	2.866

3-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
23	0.826	0.909	1.205	1.436	1.776	2.069	2.398	2.769	3.336	3.831
24	0.819	0.913	1.234	1.473	1.811	2.090	2.394	2.724	3.208	3.615

6-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.818	0.933	1.290	1.527	1.827	2.050	2.272	2.494	2.786	3.008
2	0.817	0.912	1.238	1.481	1.822	2.102	2.407	2.738	3.222	3.626
3	0.775	0.893	1.293	1.591	2.009	2.352	2.724	3.128	3.717	4.208
4	0.808	0.914	1.265	1.517	1.862	2.137	2.429	2.738	3.177	3.533
5	0.822	0.918	1.239	1.474	1.799	2.062	2.344	2.647	3.082	3.440
6	0.825	0.924	1.248	1.479	1.790	2.036	2.293	2.564	2.944	3.249
7	0.754	0.887	1.331	1.656	2.104	2.467	2.854	3.269	3.865	4.355
8	0.820	0.918	1.246	1.484	1.811	2.074	2.352	2.650	3.074	3.420
9	0.805	0.909	1.261	1.519	1.877	2.168	2.480	2.816	3.300	3.699
10W	0.697	0.863	1.413	1.812	2.360	2.801	3.269	3.767	4.479	5.061
10E	0.778	0.893	1.286	1.581	1.995	2.338	2.710	3.116	3.710	4.208
11	0.808	0.914	1.266	1.520	1.865	2.141	2.433	2.742	3.180	3.536
12	0.807	0.915	1.269	1.522	1.867	2.141	2.429	2.734	3.165	3.513
13	0.810	0.927	1.296	1.544	1.863	2.102	2.343	2.586	2.911	3.160
14	0.790	0.910	1.302	1.579	1.948	2.238	2.539	2.853	3.290	3.639
15	0.820	0.933	1.285	1.520	1.818	2.041	2.263	2.485	2.779	3.003
16	0.875	0.957	1.208	1.370	1.571	1.717	1.860	2.000	2.180	2.314
17	0.860	0.957	1.245	1.426	1.643	1.796	1.942	2.082	2.258	2.384
18	0.846	0.945	1.249	1.450	1.701	1.886	2.070	2.251	2.489	2.668
19	0.822	0.931	1.276	1.509	1.808	2.033	2.260	2.490	2.798	3.035
20	0.833	0.926	1.231	1.452	1.751	1.990	2.243	2.510	2.889	3.196
21	0.833	0.926	1.234	1.454	1.752	1.989	2.238	2.501	2.871	3.171
22	0.830	0.942	1.282	1.502	1.774	1.972	2.165	2.354	2.599	2.781
23	0.855	0.935	1.199	1.390	1.652	1.862	2.085	2.322	2.659	2.934
24	0.820	0.923	1.257	1.493	1.809	2.057	2.316	2.586	2.963	3.264

12-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.802	0.920	1.296	1.555	1.895	2.156	2.424	2.698	3.074	3.368
2	0.829	0.924	1.238	1.463	1.768	2.011	2.267	2.538	2.921	3.231
3	0.776	0.901	1.314	1.609	2.009	2.327	2.660	3.012	3.508	3.908
4	0.812	0.923	1.280	1.527	1.851	2.102	2.358	2.622	2.984	3.268
5	0.837	0.926	1.223	1.437	1.731	1.967	2.217	2.484	2.863	3.173
6	0.840	0.942	1.259	1.467	1.729	1.923	2.114	2.305	2.554	2.742
7	0.763	0.901	1.347	1.658	2.070	2.389	2.718	3.059	3.528	3.899

12-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
8	0.838	0.936	1.247	1.459	1.735	1.945	2.157	2.374	2.667	2.894
9	0.821	0.920	1.248	1.484	1.804	2.060	2.329	2.614	3.018	3.345
10W	0.710	0.878	1.421	1.801	2.307	2.702	3.111	3.536	4.124	4.591
10E	0.782	0.898	1.289	1.578	1.980	2.308	2.660	3.041	3.591	4.048
11	0.817	0.921	1.261	1.502	1.826	2.081	2.347	2.626	3.016	3.328
12	0.814	0.920	1.266	1.510	1.837	2.093	2.361	2.640	3.029	3.340
13	0.819	0.934	1.290	1.526	1.822	2.042	2.260	2.477	2.762	2.978
14	0.793	0.912	1.298	1.570	1.933	2.218	2.513	2.822	3.251	3.592
15	0.813	0.935	1.308	1.551	1.853	2.074	2.290	2.503	2.780	2.986
16	0.863	0.951	1.223	1.402	1.625	1.788	1.950	2.109	2.318	2.474
17	0.843	0.946	1.259	1.463	1.716	1.901	2.082	2.259	2.490	2.662
18	0.879	0.974	1.239	1.393	1.565	1.678	1.780	1.873	1.981	2.055
19	0.830	0.936	1.267	1.489	1.772	1.984	2.197	2.411	2.696	2.913
20	0.823	0.923	1.250	1.482	1.795	2.043	2.302	2.575	2.958	3.265
21	0.850	0.941	1.228	1.425	1.679	1.872	2.069	2.269	2.539	2.749
22	0.805	0.925	1.300	1.554	1.882	2.129	2.379	2.633	2.973	3.235
23	0.857	0.938	1.204	1.392	1.644	1.842	2.049	2.266	2.569	2.811
24	0.809	0.918	1.274	1.525	1.862	2.128	2.404	2.693	3.097	3.419

24-hour										
region	*1.58-year	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	1,000-year
1	0.780	0.897	1.290	1.581	1.985	2.315	2.671	3.054	3.610	4.070
2	0.840	0.933	1.233	1.443	1.722	1.940	2.165	2.400	2.724	2.981
3	0.770	0.901	1.329	1.632	2.038	2.358	2.691	3.040	3.528	3.918
4	0.810	0.926	1.293	1.541	1.862	2.105	2.351	2.600	2.936	3.195
5	0.833	0.927	1.236	1.456	1.753	1.987	2.233	2.491	2.853	3.144
6	0.832	0.942	1.276	1.494	1.765	1.963	2.156	2.347	2.595	2.780
7	0.763	0.905	1.357	1.667	2.072	2.382	2.699	3.023	3.464	3.808
8	0.825	0.929	1.263	1.492	1.792	2.022	2.257	2.497	2.826	3.082
9	0.832	0.933	1.254	1.474	1.760	1.979	2.202	2.429	2.739	2.980
10W	0.710	0.877	1.418	1.799	2.307	2.704	3.117	3.546	4.143	4.618
10E	0.783	0.901	1.293	1.579	1.973	2.292	2.632	2.996	3.518	3.946
11	0.806	0.911	1.264	1.521	1.874	2.158	2.461	2.785	3.248	3.627
12	0.822	0.930	1.273	1.506	1.807	2.036	2.267	2.502	2.819	3.064
13	0.823	0.936	1.284	1.514	1.804	2.019	2.232	2.443	2.723	2.933
14	0.791	0.910	1.298	1.573	1.942	2.233	2.536	2.853	3.296	3.651
15	0.797	0.927	1.327	1.592	1.925	2.171	2.414	2.656	2.974	3.214
16	0.843	0.943	1.251	1.455	1.711	1.901	2.090	2.277	2.524	2.710
17	0.815	0.924	1.276	1.518	1.838	2.084	2.336	2.596	2.951	3.230
18	0.871	0.963	1.230	1.396	1.592	1.729	1.858	1.980	2.131	2.239
19	0.843	0.953	1.278	1.480	1.721	1.891	2.051	2.204	2.394	2.531

24-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
20	0.809	0.914	1.261	1.512	1.857	2.134	2.427	2.740	3.187	3.551
21	0.853	0.944	1.228	1.420	1.665	1.850	2.036	2.223	2.474	2.667
22	0.783	0.910	1.320	1.605	1.981	2.273	2.573	2.883	3.310	3.646
23	0.867	0.955	1.222	1.394	1.606	1.759	1.908	2.053	2.240	2.378
24	0.782	0.892	1.275	1.565	1.978	2.323	2.702	3.119	3.737	4.261

48-hour										
region	***1.58-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**200-year**	**500-year**	**1,000-year**
1	0.769	0.889	1.298	1.605	2.037	2.394	2.781	3.204	3.824	4.343
2	0.842	0.936	1.239	1.446	1.717	1.924	2.135	2.351	2.645	2.874
3	0.732	0.867	1.333	1.688	2.198	2.625	3.095	3.616	4.390	5.050
4	0.815	0.930	1.291	1.533	1.841	2.072	2.303	2.535	2.845	3.081
5	0.820	0.918	1.246	1.484	1.810	2.073	2.351	2.648	3.072	3.418
6	0.828	0.934	1.266	1.491	1.780	1.998	2.218	2.441	2.740	2.970
7	0.757	0.903	1.369	1.688	2.101	2.417	2.737	3.064	3.507	3.850
8	0.816	0.923	1.269	1.510	1.828	2.076	2.332	2.597	2.962	3.251
9	0.819	0.922	1.259	1.497	1.815	2.065	2.325	2.597	2.977	3.280
10W	0.685	0.856	1.427	1.843	2.416	2.879	3.371	3.898	4.652	5.270
10E	0.790	0.910	1.302	1.578	1.946	2.235	2.535	2.849	3.284	3.632
11	0.797	0.909	1.280	1.548	1.914	2.207	2.517	2.846	3.315	3.695
12	0.825	0.938	1.285	1.512	1.795	2.003	2.208	2.410	2.674	2.872
13	0.818	0.933	1.289	1.526	1.826	2.049	2.272	2.495	2.790	3.013
14	0.776	0.898	1.303	1.598	2.005	2.333	2.683	3.057	3.592	4.031
15	0.770	0.907	1.345	1.646	2.039	2.340	2.648	2.963	3.392	3.727
16	0.815	0.918	1.258	1.501	1.831	2.094	2.369	2.661	3.072	3.404
17	0.790	0.903	1.282	1.559	1.942	2.253	2.585	2.942	3.454	3.876
18	0.861	0.952	1.230	1.410	1.633	1.795	1.953	2.109	2.310	2.459
19	0.830	0.947	1.293	1.512	1.777	1.965	2.145	2.318	2.538	2.697
20	0.784	0.893	1.270	1.556	1.965	2.308	2.684	3.100	3.718	4.243
21	0.840	0.934	1.236	1.445	1.721	1.935	2.154	2.380	2.692	2.937
22	0.756	0.893	1.344	1.665	2.100	2.444	2.806	3.186	3.721	4.153
23	0.857	0.943	1.215	1.403	1.647	1.834	2.025	2.221	2.487	2.694
24	0.750	0.864	1.277	1.610	2.112	2.554	3.062	3.648	4.563	5.381

Glossary

annual exceedance probability (AEP) – The probability associated with exceeding a given amount in any given year; the inverse of AEP (1/AEP) provides a measure of the average time between *years in which a particular value is exceeded at least once*; the term is associated with analysis of annual maximum series.

annual maximum series (AMS) – Time series created by the extraction of the largest single case in each calendar year of record.

ArcInfo© ASCII grid – Also known as an ESRI ASCII grid, a very simple grid format with a 6-line header, which provides location and size of the grid and precedes the actual grid data. The grid is written as a series of rows, which contain one ASCII integer or floating point value per column in the grid. The first element of the grid corresponds to the upper left-hand corner of the grid.

average recurrence interval (ARI) – Average time between *cases of a particular magnitude*; the term is associated with the analysis of partial duration series.

Cascade, Residual Add-Back (CRAB) – HDSC-developed spatial interpolation procedure for deriving grids of precipitation frequency estimates from mean annual maximum grids of different annual exceedance probability.

data years – Number of years in which enough data existed to extract maxima in a station's period of record.

depth-duration-frequency plot (DDF) - Graphical depiction of precipitation frequency estimates in terms of depth (y-axis) and duration (x-axis)

Discordancy – Measure based on coefficient-of-L-variation, L-skewness and L-kurtosis of a station's data, which represents a point in 3-dimensional space. Discordancy is a measure of the distance of each point from the cluster center of the points for all stations in a region. The cluster center is defined as the unweighted mean of the three L-moments for the stations within the region being tested. It is used for data quality control and to determine if a station is consistent with other stations in a region.

Federal Geographic Data Committee (FGDC)-compliant metadata – A document that describes the content, quality, condition, and other characteristics of data and follows the guidelines set forth by the FGDC; metadata is "data about data."

GEV - Generalized Extreme Value – A 3-parameter theoretical probability distribution function.

GLO – Generalized Logistic – A 3-parameter theoretical probability distribution function.

GNO – Generalized Normal – A 3-parameter theoretical probability distribution function.

GPA – Generalized Pareto – A 3-parameter theoretical probability distribution function.

heterogeneity measure, H1 – Measure that uses coefficient of L-variation to compare between-site variations in sample L-moments for a group of stations in a region with expectations for a homogeneous region. The H1 measure was used to assess regional homogeneity, or lack thereof.

"Index Flood" – The mean of the annual maximum series, also known as the scaling factor, at each observing station that is multiplied by the regional growth factor to produce precipitation frequency estimates. It is often referred to as the "Index Flood" because of the genesis of the statistical approach in flood frequency analysis.

intensity-duration-frequency curve (IDF) - A log-log graphical depiction of precipitation frequency estimates in terms of intensity (y-axis) and duration (x-axis).

internal consistency – Term used to describe the required behavior of the precipitation frequency estimates from one duration or frequency to the next. For instance, it is required that the 100-year 3-hour depth estimates be greater than the 100-year 120-minute depth estimates.

L-moments – Linear combinations of probability weighted moments that provide great utility in choosing the most appropriate probability distribution to describe the precipitation frequency estimates.

mean annual precipitation – The climatological average total annual precipitation. For the spatial interpolation of NOAA Atlas 14 Volume 1, the mean annual precipitation for the climatological period 1961-90 was used as a predictor grid for interpolating mean annual maximum precipitation to a uniformly spaced grid.

Monte Carlo simulation – Simulation technique used to randomly generate 1,000 synthetic data sets for each station in a region to determine sample L-moment estimates and test the fitting of theoretical distributions. The technique was also used to quantitatively assess confidence bounds.

n-minute – Precipitation data measured at a temporal resolution of 5-minutes that can be summed to various "n-minute" durations (10-minute, 15-minute, 30-minute, and 60-minute).

partial duration series (PDS) – Time series created by the extraction of all large events in which more than one large event may occur during a single calendar year. For this Atlas, the annual exceedance series (AES) consisting of the largest N events in the entire period of record, where N is the number of years of data, was used.

PE3 – Pearson Type III – A 3-parameter theoretical probability distribution function.

precipitation frequency – General term for specifying the average recurrence interval or annual exceedance probability associated with specific depths for a given duration.

Precipitation Frequency Data Server (PFDS) – The on-line portal for all NOAA Atlas 14 deliverables, documentation and information. Link to it via the HDSC home page at: http://www.nws.noaa.gov/ohd/hdsc/.

PRISM – Parameter-elevation Regressions on Independent Slopes Model – a hybrid statistical-geographic approach to mapping climate data developed by Oregon State University's Spatial Climate Analysis Service.

probability distribution – Mathematical description of a random variable, precipitation in this case, in terms of the chance of exceedance associated with each value.

pseudo data –Precipitation frequency estimates for stations that did not have observed data at a given duration. The estimates were based on ratios derived from nearby co-located stations and applied to actual observed data at the station.

quantile – Generic term to indicate the precipitation frequency estimates associated with ARIs and AEPs.

regional growth factor (RGF) – Dimensionless factors that are a function of appropriate higher order moments for a region; used to develop the site-specific quantiles for each region by multiplying by the site-specific scaling factor to produce the quantiles at each frequency and duration; there is a single RGF for each region that varies only with frequency and duration

root-mean-square-error (RMSE) – The positive square root of the mean-square-error (MSE). MSE is the mean square of any residual. RMSE is the also called the standard error of estimate.

shapefile – An ESRI vector file format for displaying non-topological geometry and attribute information for use with Geographical Information Systems (GIS). The shapefile has the .shp extension, and comes with other associated files which can include, .shx, sbx, .sbn and .dbf.

SNOTEL – An extensive automated network of stations that collect surface meteorological data at high elevations (6000 - 11,000 feet) in the western United States. The SNOTEL network is operated by the United State's Department of Agriculture's (USDA) National Resources Conservation Service (NRCS).

temporal distribution – Temporal patterns in probalistic terms specifically designed to be consistent with the definition of duration used in this Atlas and for use with the precipitation frequency estimates. They are expressed as cumulative percentages of precipitation and duration at various percentiles for 6-, 12-, 24- and 96-hour durations.

t-test – for testing whether a difference between means of two samples is significant:

$$t = \sqrt{\frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2}} \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{n_1 s_1^2 + n_2 s_2^2}}$$

, following a Student's t distribution with (n_1+n_2-2) degree of freedoms, where, $\bar{x}_1$ and $\bar{x}_2$ are the means for sample 1 and sample 2, respectively. s_1^2 and s_2^2 are sample variances. n_1 and n_2 are sample sizes. At 90% confidence level (or significance level α = 10%), reject H_0: the means have no significant difference if | t | > $t_{n_1+n_2-2,\alpha/2}$.

– for testing for population correlation:

$$t = \left| \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \right|$$

, following a Student's t distribution with (n-2) degrees of freedom. At 90% confidence level (or significance level α = 10%), reject H_0: there is no correlation or the correlation is not significant at significance level of 10% if | t | > $t_{n-2,\alpha/2}$.

Wakeby distribution – A 5-parameter theoretical probability distribution function.

References

Arkell, R.E., and F. Richards, 1986: Short duration rainfall relations for the western United States. *Conference on Climate and Water Management-A Critical Era and Conference on the Human Consequences of 1985's Climate, August 4-7, 1986,* Asheville, North Carolina.

Bonnin, G., D. Martin, T. Parzybok, B. Lin, D. Riley, and M. Yekta, 2006: Precipitation frequency atlas of the United States. *NOAA Atlas 14 Volume 2, Version 3.0,* National Weather Service, Silver Spring, Maryland.

Chow, V.T., D.R. Maidment, and L.W. Mays, 1988: *Applied Hydrology*. McGraw-Hill International Editions, 572 pp.

Daly, C., and R.P. Neilson. 1992: A digital topographic approach to modeling the distribution of precipitation in mountainous terrain. *Interdisciplinary Approaches in Hydrology and Hydrogeology,* American Institute of Hydrology, 437-454.

Daly, C., R.P. Neilson, and D.L. Phillips, 1994: A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. *Journal Applied. Meteorology,* **33**, 140-158.

Daly, C., G. Taylor, and W. Gibson, 1997: The PRISM Approach to Mapping Precipitation and Temperature, *10th Conf. on Applied Climatology*, American Meteorology Society, 10-12, Reno, Nevada. http://www.ocs.orst.edu/pub/prism/docs/appclim97-prismapproach-daly.pdf

Daly, C., W.P. Gibson, G.H. Taylor, G.L. Johnson, and P.Pasteris, 2002: A knowledge-based approach to the statistical mapping of climate. *Climate Research*, **23**, 99-113.

Durrans, S.R., and P.A. Brown, 2002: Development of an Internet-Based Rainfall Atlas for Alabama. *Water Science and Technology*, **45**, no. 2, 11-17.

Environmental Systems Research Institute, Inc. (ESRI), 2003: ArcMap, ArcGIS version 8.3. Redlands, California.

Frederick, R.H. and J.F. Miller, 1979: Short Duration Rainfall Frequency Relations for California. *Third Conference on Hydrometeorology, August 20-24, 1979,* Bogata, Columbia.

Glifford, R. O., Ashcroft, G. L., and Magnusun, M. D., 1967: Probability of selected precipitation amounts in the Western Region of the United States. T-8, Ag. Exper. Station, Univ. of Nevada. *Western Regional Research Publication*, United States Dept. of Agriculture, Department of Commerce, 150pp.

GRASS Development Team, 2002: Geographic Resources Analysis Support System (GRASS), Grass version 5.0.

Hershfield, D.M., 1961: Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. *Weather Bureau Technical Paper No. 40,* U.S. Weather Bureau, Washington, D.C., 115 pp.

Hosking, J.R.M. and J.R. Wallis, 1997: *Regional frequency analysis, an approach based on L-moments*. Cambridge University Press, 224 pp.

Hosking, J.R.M., and J.R. Wallis, 1991: Some statistics useful in regional frequency analysis. *Research Report RC 17096 (#75863) 8/12/1991*, Mathematics, IBM Research Division, T.J. Watson Research Center, Yorktown Heights, New York.

Huff, F. A., 1990: Time Distributions of Heavy Rainstorms in Illinois. *Illinois State Water Survey*, Champaign, **173**, 17 pp.

Institution of Engineers, Australia, 1987: *Australian Rainfall and Runoff, A Guide to Flood Estimation.* The Institution of Engineers, D.H. Pilgrim, ed., Canberra Australia.

Laurenson, E.M., 1987: Back to basics on flood frequency analysis. *Civil Engineers Trans.*, Institution of Engineers, Australia, **CE29**, 47-53.

Lin, B., G. Bonnin, D. Todd, T. Parzybok, M. Yekta, and D. Riley, 2004: Regional frequency studies of annual extreme precipitation in the United States using regional L-moments analysis. *International Ocean-Atmosphere Conference,* Chinese-American Oceanic and Atmospheric Association (COAA), Beijing, China, June 27-30, 2004.

Lin, B., and J.L. Vogel, 1993: A comparison of L-moments with method of moments. *Proceedings of the International Symposium on Engineering Hydrology,* American Society of Civil Engineers, July 1993, San Francisco, California.

Lin, Shao-Gong, 1980: *Basic Probability and Statistics*. People's Education Publisher, Bejing, China, 162 pp.

Maidment, D. R., 1993: *Handbook of Hydrology*. McGraw-Hill Publishing, 29.47 pp.

Miller, J.F., 1964: Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States. *Technical Paper No. 49,* U.S. Weather Bureau and U.S. Department of Agriculture, 29 pp.

Miller, J.F., R.H. Frederick and R.J. Tracy, 1973: Precipitation-frequency atlas of the western United States. *NOAA Atlas 2*, 11 vols., National Weather Service, Silver Spring, Maryland.

Myers, V.A. and R.M. Zehr, 1980: A Methodology for Point-to-Area Rainfall Frequency Ratios. *NOAA Technical Report NWS 24*, Office of Hydrology, National Weather Service, Silver Spring, Maryland.

Neteler, Markus and Helena Mitasova. 2002: *Open Source GIS: A GRASS GIS Approach*. Kluwer Academic Publishers, Boston.

Newbold, P., 1988: *Statistics for Business and Economics*. Prentice Hall, 866 pp.

NOAA, 1989: *Climatological Data Annual Summaries* - Arizona, California, Nevada, New Mexico, Utah, **93**, no. 13. Natl. Climatic Data Center (NCDC), Asheville, North Carolina.

Parzybok, T. and M. Yekta, 2003: NOAA/NWS precipitation frequency data server. *19th International Conference on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology*, 83rd American Meteorological Society Annual Meeting, Long Beach, California.

Plantico, M.S., L.A. Goss, C. Daly, and G. Taylor. 2000: A new U.S. climate atlas. In: *Proc.*, *12th AMS Conf. on Applied Climatology,* American Meteorological Society, May 8-11, 247-248, Asheville, North Carolina.

Zehr, R.M., and V.A. Myers, 1984: Depth-area ratios in the semi-arid southwest United States. *NOAA Technical Memorandum NWS HYDRO-40,* Office of Hydrology, National Weather Service, Silver Spring, Maryland.

NOAA Atlas 14 Addendum

Precipitation-Frequency Atlas of the United States

Volume 1 Version 5.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah) Addendum – Update to Version 4.0

Geoffrey M. Bonnin, Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, David Riley

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Weather Service

Silver Spring, Maryland, 2004
revised 2006
revised 2011

NOAA Atlas 14 Addendum

Precipitation-Frequency Atlas of the United States

Volume 1 Version 5.0: Semiarid Southwest (Southeast California, Arizona, New Mexico, Utah, Nevada) Addendum – Update to Version 4.0

Geoffrey M. Bonnin, Deborah Martin, Bingzhang Lin, Tye Parzybok, Michael Yekta, David Riley

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

National Weather Service

Silver Spring, MD., 2004
revised 2006
revised 2011

Library of Congress Classification Number
GC
1046
.C8
U6
no.14
v.1
(2011)

SUMMARY

The NOAA Atlas 14 Volume 1 Version 5 update reflects changes made to precipitation frequency estimates in the Volume 1 project area. Precipitation frequency estimates and supplementary information for the semiarid California included in Volume 1 were updated with the release of Volume 6, California. Volume 6 information supersedes Volume 1 information for that part of California.

In addition, precipitation and corresponding confidence limits grids of Volume 1 were shifted by 15 seconds to the west and to the north to align them with grids from subsequent NOAA Atlas 14 volumes. Estimates were interpolated to a new grid. Volume 1 Version 5 supersedes information in Version 4.

UPDATES

1. Southeastern California data

Volume 1 estimates in the southeastern semiarid areas of California were updated with the release of Volume 6. A complete description of methodology used for NOAA Atlas 14 Volume 6 is described in Volume 6 documentation posted here: http://www.nws.noaa.gov/ohd/hdsc/currentpf.htm.

The maps in Figures 1 and 2 illustrate the differences in estimates for southeastern California between Volume 1 Version 4 and Volume 6 Version 2 for 60-minute and 24-hour durations at the average recurrence interval of 100-years. Specifically, 100-year 60-minute precipitation frequency estimates changed between -1.11 and 1.61 inches; on average, updated estimates are 0.21 inches lower. 100-year 24-hour precipitation frequency estimates changed between -8.71 and 6.38 inches, and, on average, precipitation frequency estimates increased by 0.24 inches.

Precipitation frequency estimates for California in Volume 6 were not adjusted to make a smooth transition from Volume 6 to Volume 1 estimates at the California border with Nevada and Arizona.

2. Grid cell alignment

The center points of grid cells from Volume 1 did not align with the center points of grid cells from subsequent volumes, so it was necessary to shift Volume 1 grids by 15 seconds to the west and by 15 seconds to the north. This shift was coupled with interpolation where the precipitation frequency estimate for each new grid cell was assigned the average of the original surrounding grid cells values. As a result, estimates from Version 4 and Version 5 may be different. Differences are negligible for more than 99.5% of the project area (excluding California). In higher elevation areas, estimates could change up to ±10%.

The maps in Figures 3 and 4 illustrate the differences in estimates in inches between Volume 1 Versions 5 and 4 for 60-minute and 24-hour durations at the average recurrence interval of 100-years. 100-year 60-minute precipitation frequency estimates, for example, changed less than ±0.03 inches for more than 99.5% of grid cells. In the higher elevation areas, the maximum increase was 0.12 inches and the maximum decrease was -0.19 inches. Similarly, for 100-year 24-hour precipitation frequency estimates, differences between new and old estimates are between ±0.1 inches for more than 99.5% of grid cells; the maximum increase was 0.45 inches and the maximum decrease was -0.53 inches.

Precipitation frequency estimates for Nevada and Arizona in Volume 1 were not adjusted to make a smooth transition from Volume 1 to Volume 6 estimates at the Nevada and Arizona borders with California.

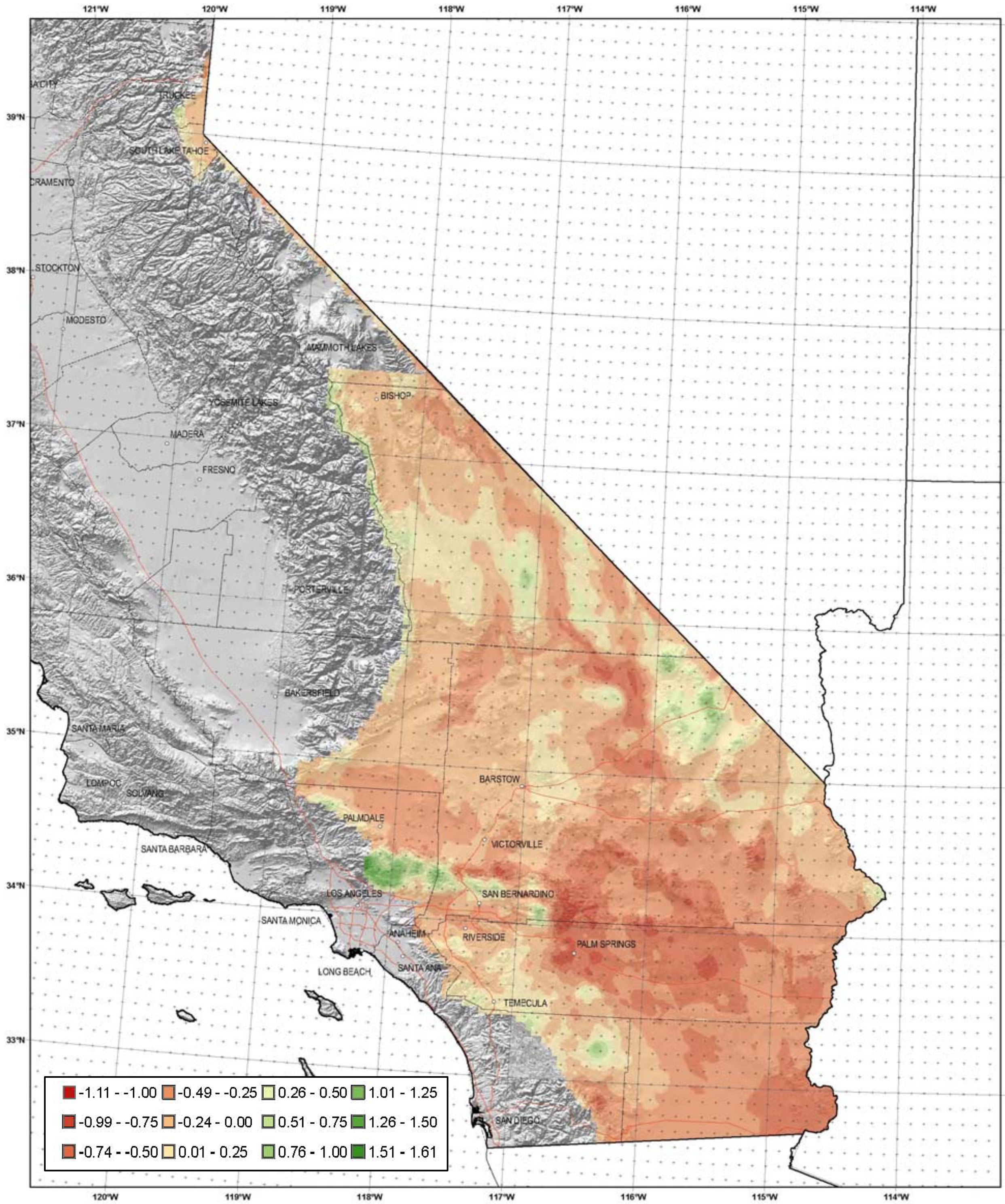


Figure 1. Difference in 100-year 60-minute estimates (in inches) between Volume 6 Version 2 and Volume 1 Version 4 for southeast California.

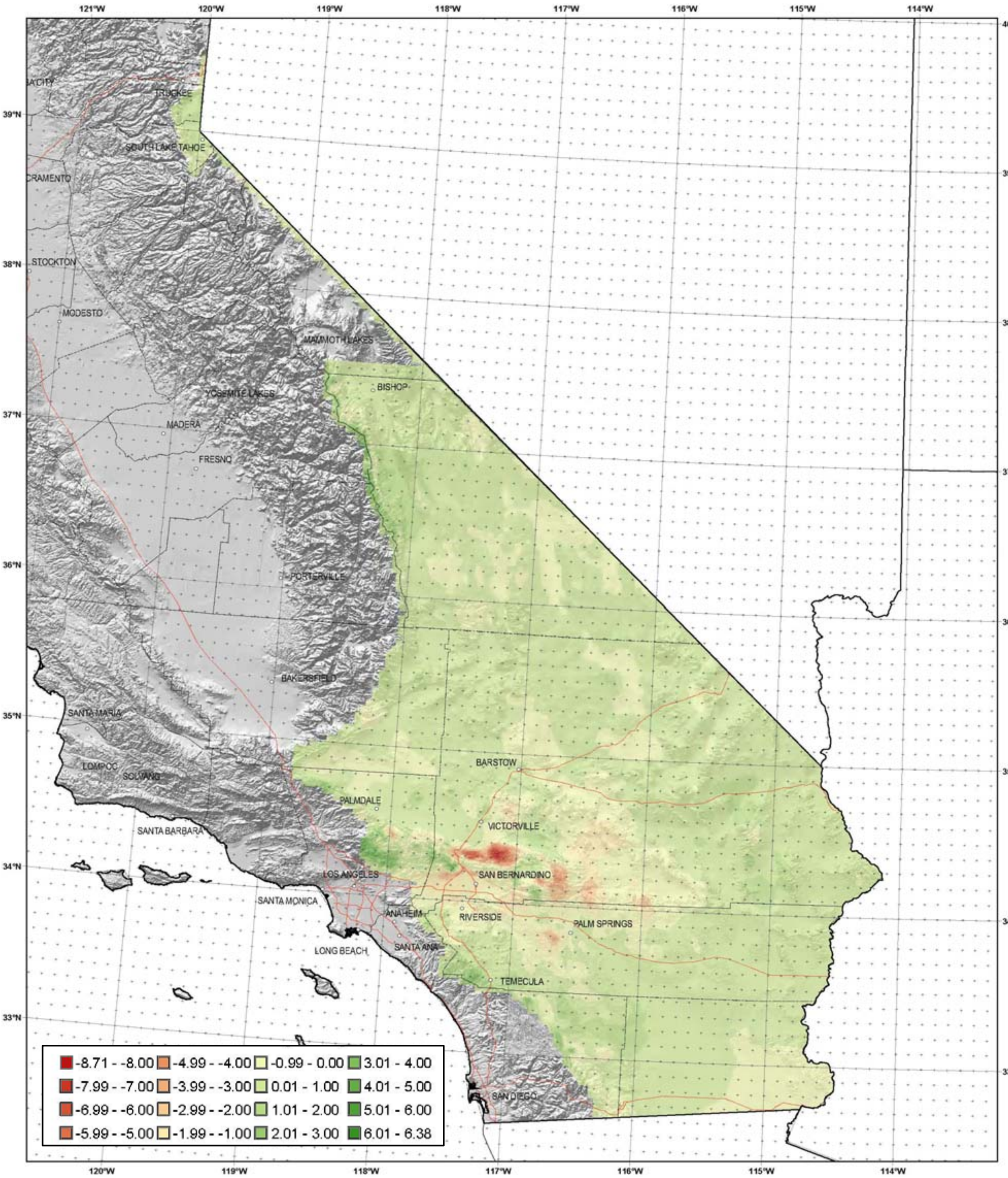


Figure 2. Difference in 100-year 24-hour estimates (in inches) between Volume 6 Version 2 and Volume 1 Version 4 for southeast California.

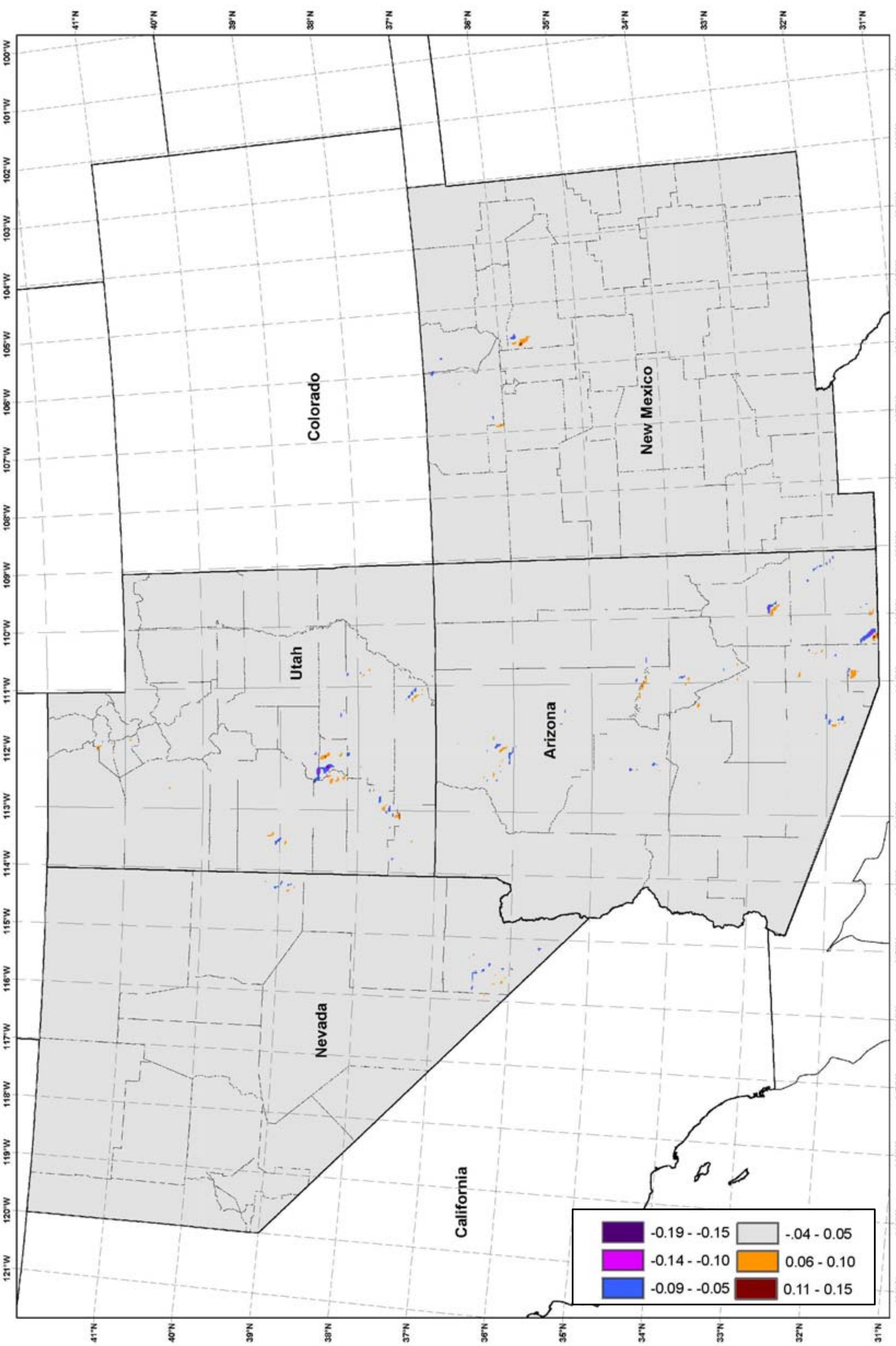


Figure 3. Difference in 100-year 60-minute estimates (in inches) between Volume 1 Versions 5 and 4 for the project area excluding California.

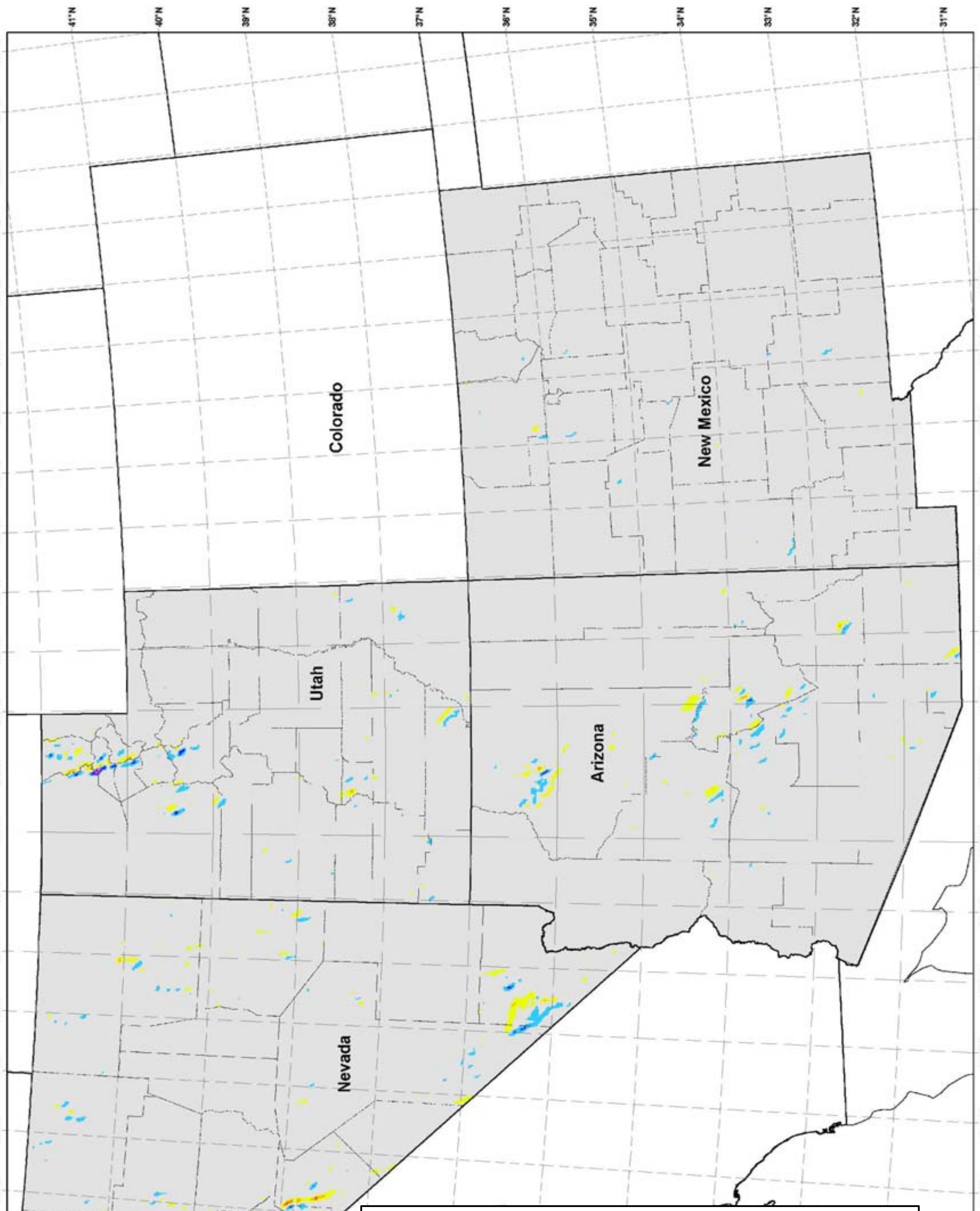


Figure 4. Difference in 100-year 24-hour estimates (in inches) between Volume 1 Versions 5 and 4 for the project area excluding California.