



Providing Data to NGS customers in the Modernized NSRS

National Geodetic Survey Industry Workshop

May 6, 2021

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The Future Data Delivery System

Public queries and access to the NSRS

Currently ➡ datasheets, shoreline, UFCORS, OPUS, ...

Data Formats (JSON, Shapefiles, GeoPackage, GeoTIFF, GGXF, XML)

Web Services and API's (JSON, WMS, WFS, WMTS)

OPUS (Static, Projects)

Amazon Web Services (AWS)

Emergency Response Imagery, CORS data (S3 storage bucket)

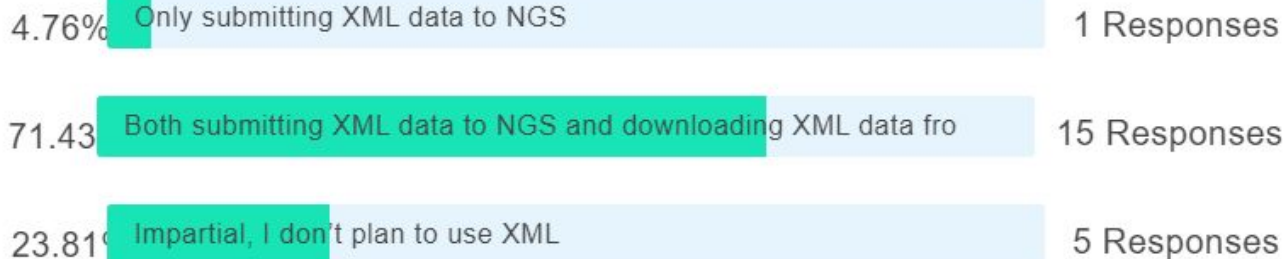
ArcGIS Online and the NOAA Geoplatform

Poll Question 1

With the plans for GVX, LVX and the other standard file formats, would you prefer to only **submit** XML data to NGS or would you also like services to **download** XML data from NGS?

1 of 5. Given plans for GVX etc, is submitting XML data to NGS enough, or would you also like services to download XML data from NGS?

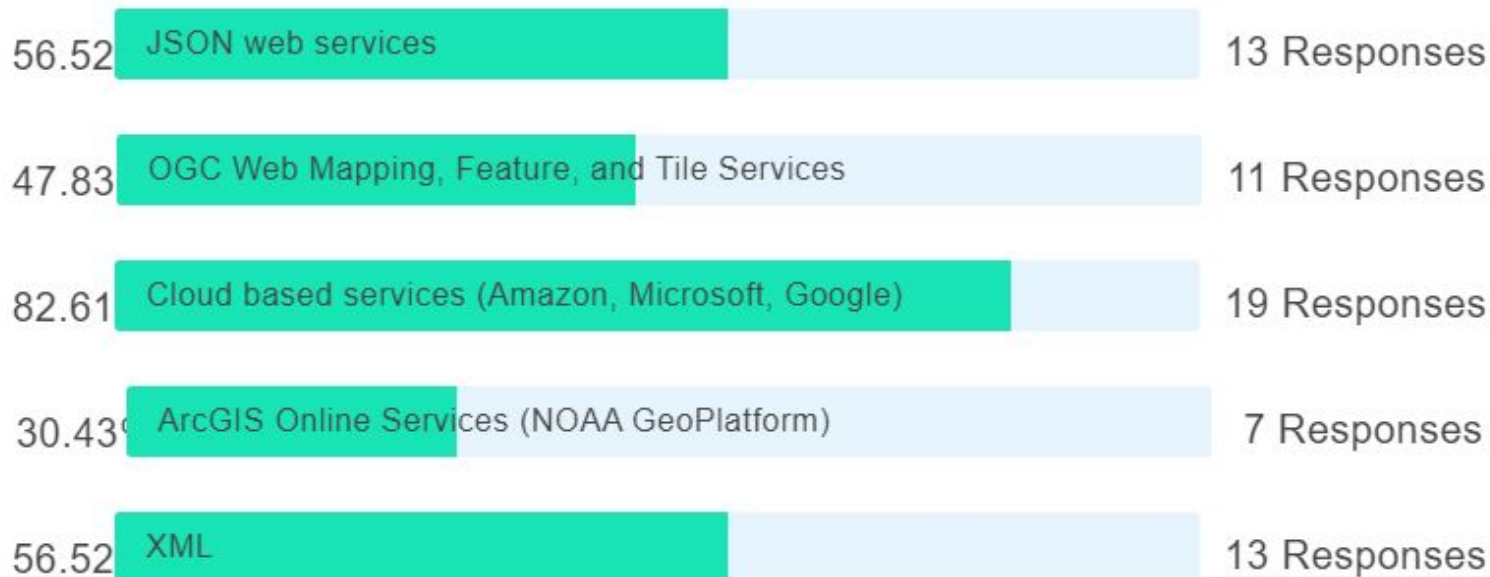
Multiple choice with single answer



Poll Question 2

2 of 5. What type of web service would you prefer to access NGS data in the future?

Multiple choice with multiple answers

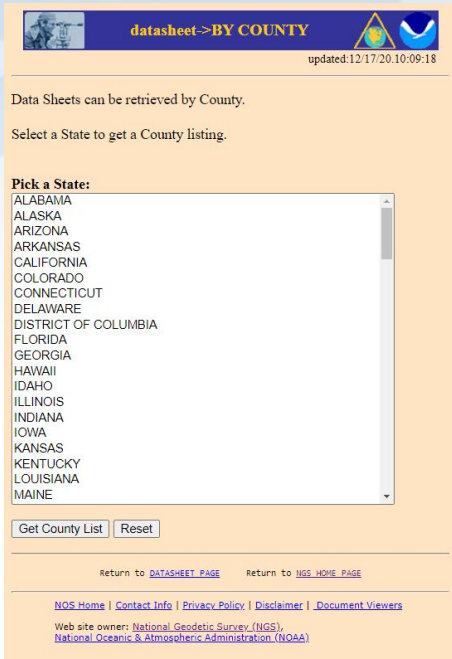
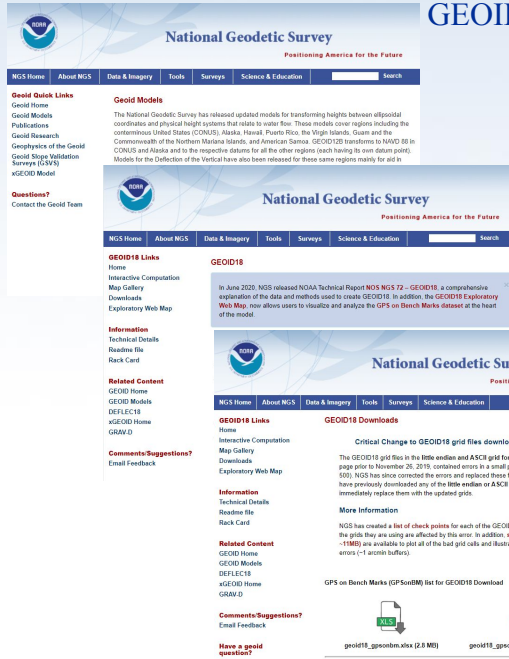


Not always easy to find/use data

The NGS Data Sheet

See file [data.pdf](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.5.12
Starting Datasheet Retrieval...
1 National Geodetic Survey, Retrieval Date = APRIL 27, 2021
SS0436 *****
SS0436 DESIGNATION - A 2 Z
SS0436 PID - SS0436
SS0436 STATE/COUNTY - MT/CASCADE
SS0436 COUNTRY - US
SS0436 USGS QUAD - BELT NE (2017)
SS0436
SS0436 *CURRENT SURVEY CONTROL
SS0436
SS0436* NAD 83(1986) POSITION- 47 22 39. (N) 110 48 04. (W) SCALED
SS0436* NAVD 88 ORTHO HEIGHT - 1341.642 (meters) 4401.70 (feet) ADJUSTED
SS0436
SS0436 GEOD HEIGHT - -13.278 (meters) GEOD18
SS0436 DYNAMIC HEIGHT - 1341.525 (meters) 4401.32 (feet) COMP
SS0436 MODELED GRAVITY - 980,477.3 (mgal) NAVD 88
SS0436
SS0436 VERT ORDER - SECOND CLASS 0
SS0436
SS0436.The horizontal coordinates were scaled from a map and have
SS0436.an estimated accuracy of +/- 6 seconds.
SS0436.
SS0436.The orthometric height was determined by differential leveling and
SS0436.adjusted by the NATIONAL GEODETIC SURVEY
SS0436.in June 1991.
SS0436
SS0436.Significant digits in the geoid height do not necessarily reflect accuracy.
SS0436.GEOD18 height accuracy estimate available here.
SS0436
SS0436.Click photographs - Photos may exist for this station.
SS0436
SS0436.The dynamic height is computed by dividing the NAVD 88
SS0436.geopotential number by the normal gravity value computed on the
SS0436.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
SS0436.degrees latitude (g = 980.6199 gals.).
SS0436
SS0436.The modeled gravity was interpolated from observed gravity values.
SS0436
SS0436; North Est Units Estimated Accuracy
SS0436;SPC MT - 348,340. 501,800. MT (+/- 180 meters Scaled)
SS0436
SS0436 U.S. NATIONAL GRID SPATIAL ADDRESS: 12TW150471(HAD 83)
SS0436
```

GEOID Home Page

GEOID18 Page

GEOID18 Downloads

80 character wide Datasheets

Perl Webpages

Nested Web Pages

Continuing to improve



National Geodetic Survey
Positioning America for the Future

NGS Home About NGS Data & Imagery Tools Surveys Science & Education Search

Learn more about GPS on Benchmarks

NOAA's National Geodetic Survey (NGS) provides the framework for all positioning activities in the Nation. The foundational elements of latitude, longitude, elevation, and shoreline information impact a wide range of important activities.

- Process GPS Data (OPUS)
- NGS Data Explorer
- Looking for Bench Marks
- Conversion & Transformation (NCAT)
- NOAA CORS Network
- New Datums

Popular Links **New Visitor**

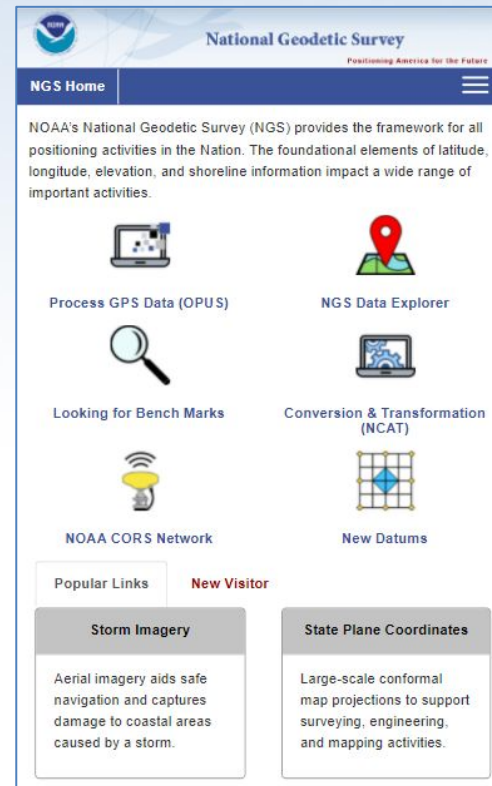
Storm Imagery
Aerial imagery aids safe navigation and captures damage to coastal areas caused by a storm.

State Plane Coordinates
Large-scale conformal map projections to support surveying, engineering, and mapping activities.

Stay Informed: Subscribe

Updates
Important Updates:

- Southeast TX Orthometric Heights Suppression
- NSRS Modernization Delay Message



National Geodetic Survey
Positioning America for the Future

NGS Home

NOAA's National Geodetic Survey (NGS) provides the framework for all positioning activities in the Nation. The foundational elements of latitude, longitude, elevation, and shoreline information impact a wide range of important activities.

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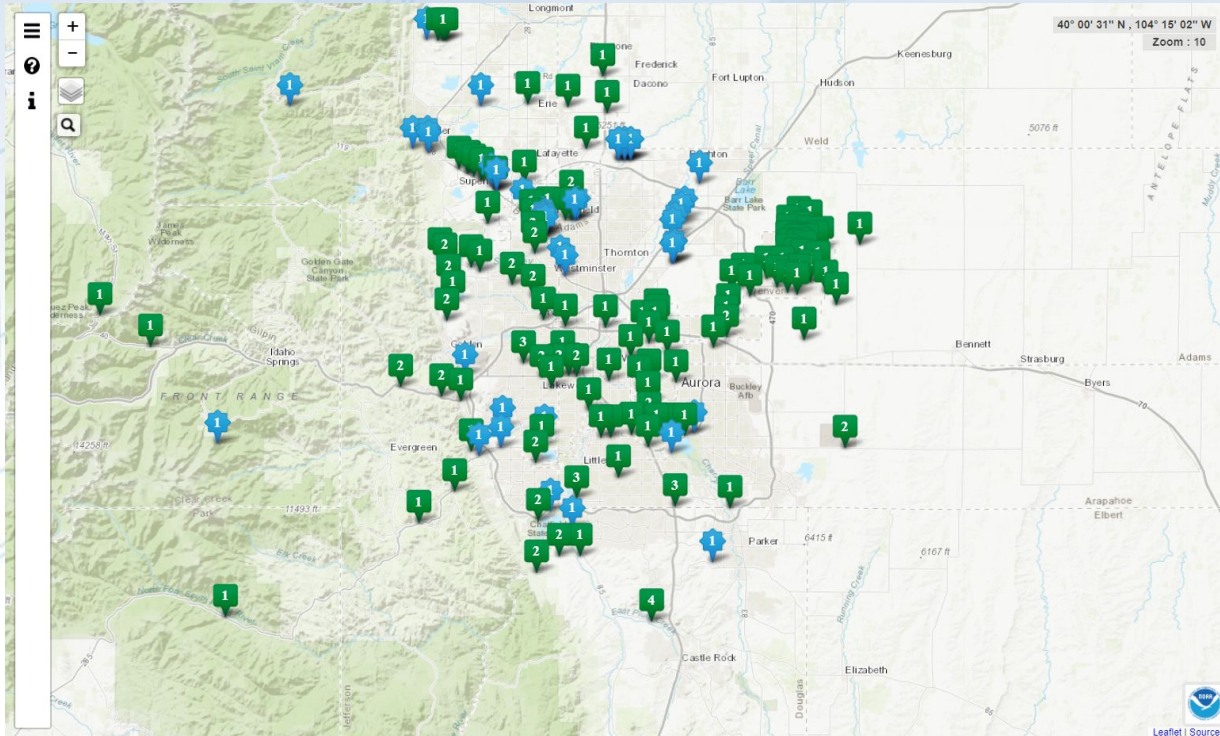
Popular Links **New Visitor**

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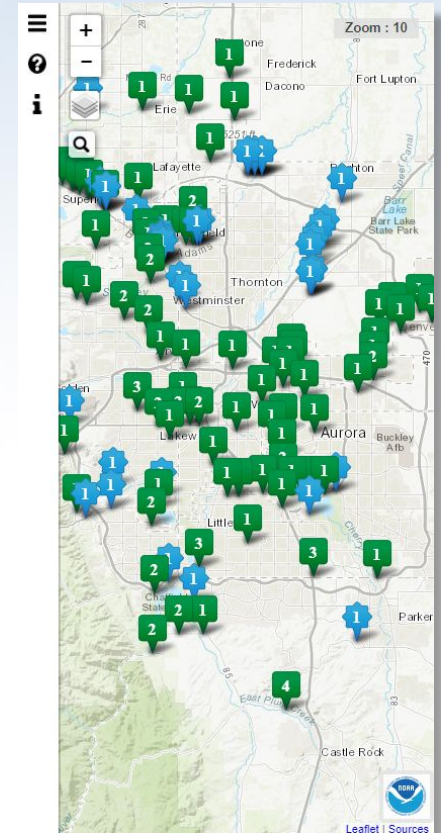
State Plane Coordinates
Large-scale conformal map projections to support surveying, engineering, and mapping activities.

New Responsive Home Page

Continuing to improve



<https://geodesy.noaa.gov/opusmap/>



Passive Mark Page

Passive Mark Page

***Note: This page does not work with Internet Explorer.

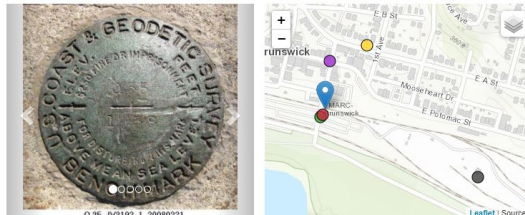
This is a Beta product. NGS is interested in your feedback concerning its function and usability as well as how users would like to interact with NGS datasheet information in the future. Email us at ngs.feedback@noaa.gov

The information provided on this page may be out of date with the current published datasheet. Whenever there are differences the datasheet will be the authoritative source. Visit the [Datasheet](#)

Enter PID: [Get Data](#) [Recover this mark](#) [Go to Datasheet](#)

Designation: ⓘ	Q 35
Setting: ⓘ	36 = SET IN A MASSIVE STRUCTURE
Last Recovery Date/Condition/By: ⓘ	06/05/2019 - Recovered in good condition - NATIONAL GEODETTIC SURVEY

PID: ⓘ	JV3192	State, County: ⓘ	MD,FREDERICK
Stability: ⓘ	B	Country: ⓘ	US
GNSS Useable: ⓘ	Y	Latitude: ⓘ	N 39° 18' 42.63"
Orthometric Ht. (m): ⓘ	75.185	Longitude: ⓘ	W 077° 37' 37.59"
Vertical Datum: ⓘ	NAVD 88	Ellipsoid Ht.: ⓘ	
Vertical Source: ⓘ	ADJUSTED	Position Datum: ⓘ	NAD 83(1986)
Order/Class:	1/2	Position Source: ⓘ	HD_HELD1
Geoid Ht (m): ⓘ	-33.056	Network Accuracy Hz (cm): ⓘ	N/A
Geoid Model: ⓘ	GEOID18	Network Accuracy Ellip (cm): ⓘ	N/A
GNSS Ortho Ht. (m): ⓘ	N/A	Ortho Ht. Residual (cm): ⓘ	N/A



Nearby Marks ⓘ					Hide
PID	Designation	Position Source	Vertical Source	Condition	
JV3193	RAIL SECTION BORR	SCALED	ADJUSTED	MARK NOT FOUND	
JV3194	IRON BAR BORR	SCALED	ADJUSTED	GOOD	
JV3191	266 RESET	HD_HELD1	ADJUSTED	GOOD	
JV3190	266	SCALED	ADJUSTED	GOOD	
JV3189	P 35	SCALED	ADJUSTED	MARK NOT FOUND	

Superseded Values	
NOVD 29 (11/26/84) 75.397 (m) 247.37 (f)	ADJUSTED 12

Projects			
Leveling Projects Hide			
L24378/1			
Start Date:	05/07/1979	Order:	1
End Date:	06/06/1979	Agency:	NGS
		Class:	2
		BM Count:	84
L9532/3			
Start Date:	04/10/1942	Order:	2
End Date:	04/21/1942	Agency:	NGS
		Class:	0
		BM Count:	22
L8007			
Start Date:	05/27/1938	Order:	1
End Date:	06/25/1938	Agency:	NGS
		Class:	2
		BM Count:	71
Descriptive Information Hide			
PID: ⓘ	JV3192	Designation ⓘ	Q 35
Setting Agency: ⓘ	CGS	Setting Date: ⓘ	1938
Marker Type: ⓘ	DB	Magnetic Code: ⓘ	
Stability Code: ⓘ	B	Setting Class: ⓘ	36
Setting Phrase: ⓘ	SIGNAL BRIDGE FOUNDATION	Logo: ⓘ	CGS
Stamping: ⓘ	Q 35 1938	UDG Mark Type: ⓘ	
UDG Magnetic Code: ⓘ		UDG Mark Stability: ⓘ	
UDG Mark Setting: ⓘ		UDG Mark Set Date: ⓘ	
Rod/Pipe Depth: ⓘ		Sleeve Depth: ⓘ	
Position Source: ⓘ	O	Position Quality: ⓘ	4
Position Technique: ⓘ	X	Alias: ⓘ	

Leveling Project Page

Leveling Projects Page

***Note: This page does not work with Internet Explorer.

This is a Beta product. NGS is interested in your feedback concerning its function and usability as well as how users would like to interact with NGS datasheet information in the future. Email us at ngs.feedback@noaa.gov

Enter a valid HGZ below to view data about a leveling project. Examples include: L20346, L24718/51, L11218

To find HGZs associated with a PID, [click here](#)

Enter Leveling Project ID:

HGZ: L24378/1	From Date: 05/07/1979	To Date: 06/06/1979
Project Title: WASHINGTON DC--FREDERICKSBURG-CULPEPER-FRONT ROYAL VA--		
Agency Code: NGS	Agency Name: NATIONAL GEODETIC SURVEY	
Order: 1	Class: 2	Chief: DCF
Main Length: 106.28 km	Spur Length: 2.28 km	Accept Length: 139.03 km
Run Count: 118	BM Count: 84	Temp BM Count: 0

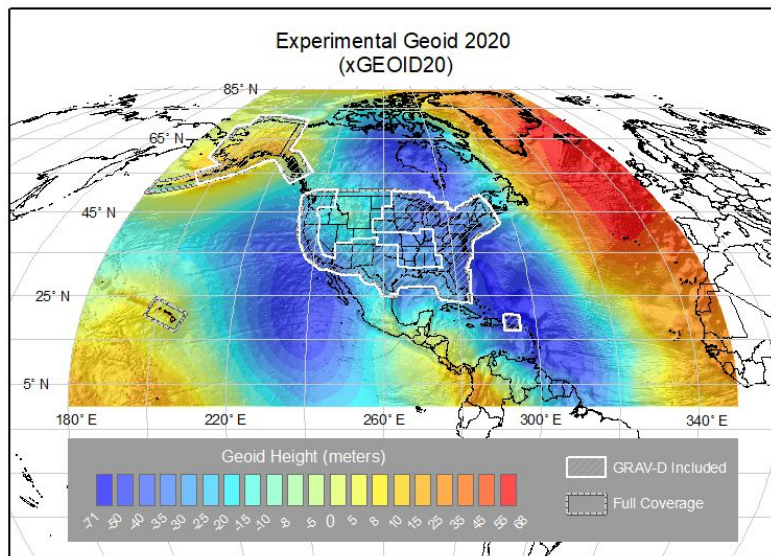
Showing Observations

From SSN	To SSN	Date	Start Time	End Time	Run Length	Units	Elev. Dif.	Units	Order	Class	Setup Num.	Initials
1101	1102	19790515	750	0830	0.30	KM	3.10530	MT	1	2	4	DJB
1102	1103	19790515	834	0850	0.17	KM	1.11525	MT	1	2	6	DJB
1102	1111	19790515	908	0925	0.26	KM	3.86030	MT	1	2	4	DJB
1103	1102	19790515	853	0907	0.17	KM	-1.11530	MT	1	2	6	DJB
1111	1112	19790515	929	1100	1.42	KM	-2.22382	MT	1	2	22	DJB
1112	1111	19790606	1300	1440	1.50	KM	2.22392	MT	1	2	24	KWS
1112	1111	19790606	1300	1435	1.50	KM	2.22462	MT	1	2	24	LJL
1112	1113	19790515	1104	1230	0.98	KM	-11.47642	MT	1	2	14	DJB
1112	1113	19790606	1500	1555	0.93	KM	-11.48115	MT	1	2	16	KWS
1112	1113	19790606	1500	1550	0.92	KM	-11.46240	MT	1	2	16	LJL

Showing Bench Marks

PID	Designation	SSN	Latitude	Longitude	Order	Class	Spur Count	Datasheet
HV1831	R 4 WMATA	1101	N385352	W0770201	1	2	0	Datasheet
HV1832	S 4	1102	N385356	W0770211	1	2	0	Datasheet
HV1895	NW 3	1103	N385354	W0770217	1	2	1	Datasheet
HV1833	T 4 WMATA	1111	N385400	W0770218	1	2	0	Datasheet
HV1865	F 1 RESET	1112	N385351	W0770303	1	2	0	Datasheet
HV1868	G 1 RESET 1948	1113	N385409	W0770327	1	2	0	Datasheet
HV1879	J 1 RESET 1956	1114	N385417	W0770410	1	2	0	Datasheet
HV1880	M 1	1115	N385421	W0770446	1	2	0	Datasheet
HV1965	NW 26	1116	N385455	W0770541	1	2	0	Datasheet
HV1967	331 PBPP	1117	N385547	W0770626	1	2	0	Datasheet

NGS Grid Files



GeoTIFF

☰ README.md

GGXF (Gridded Geodetic data eXchange Format)

Motivation

The use of gridded data in geodetic applications is increasing. For some geodetic datum transformations the Natural Resources Canada NTV2 format is widely used although other national and ad hoc formats are also in use. There is no global standard for these and other geodetic data such as geoid grids, position displacement grids and numerous others. Producers often define a proprietary or some other convenient format. The adoption of a standard file format will facilitate the creation and use of gridded data sets. It would relieve grid producers of the necessity for producing file readers and will assist application developers to incorporate new grids with minimal effort. Users will benefit from quicker access to the data. GGXF is a proposed standard format for the exchange of gridded geodetic data.

Development History

GGXF is an Esri research and development project to define a standardized format for the exchange of gridded geodetic data. The project began in 2013 and has progressed in fits and starts since then. The requirements of GGXF are as follows:

- Multi-dimensional
- Multi-resolution
- Self-defining (metadata/header)
- Applicable to any datatype defined on a graticular grid
- Binary data storage structure
- Open-source GGXF reader/writers from commonly used existing formats

OGC & GGXF

Shapefiles and GeoJSON

Finding Survey Marks and Datasheets

NGS provides information about survey marks (including bench marks) in text **datasheets** or in GIS **shapefiles**. Note some survey markers installed by other organizations may not be available through NGS. To learn more about survey marks, visit our [Frequently Asked Questions \(FAQs\)](#). Visit here for [updates to the Datasheet format](#).

Select a data format:

- Datasheets** can be viewed in word processors or as text files. [View an example datasheet online.](#)
- Shapefiles** can be used in GIS software.

Select a retrieval method:

- Interactive Map:** Zoom to your location of interest and search for geodetic control. Use [NGS Data Explorer](#) or [DS World](#).
- Archived Control:** Download data for an entire state at once (generated once a month). Read more about [archived datasheets](#) and [archived shapefiles](#). Archived control by state is recommended for large downloads (>20).
- Search By:** Submit queries based on location (e.g. county) or mark information (e.g. station name).

Mark Recovery

Submit Mark Recovery

You may find or "recover" a survey mark and review information about it online. Sometimes, you may want to update the information about a mark you find by reporting its current condition or submitting a photograph. This can be very helpful if you find physical evidence that the mark is destroyed. [Learn more about submitting a recovery note online.](#)

Beta Passive Mark Page

The **Beta Passive Mark Page** is a new product that presents the information that is on the Datasheet, but with a modern interface. *Additional information that is not displayed on the Datasheet is also*

Retrieval Options

Interactive Map

GPS on BM Links

Home

Recover

Observe

Report

Web Map Application

Instructions

Progress Dashboard

Monthly Updates

Technical Details

Resources

GPS on BM FAQ

Related Links

NGS Data Explorer

Mark Recovery Form

OPUS Upload

Tutorial Video

GEOID18

Archived 2018 Campaign

Contact information

Email Us

[Subscribe for OPUS on Bench Mark Updates](#)

GPS on Bench Marks

Help improve the National Spatial Reference System (NSRS) and 2022 by participating in the GPS on Bench Marks (GPS on BM) for efforts will support the following objectives:

- Improve the 2022 Transformation Tool, which will enable datums to the North American-Pacific Geopotential Datum integrated into the NGS Coordinate Conversion and Tool
- Update Passive Control Status: mark recoveries and status users of the NSRS with insight into the health of the information for project planning.
- Automatic Reprocessing in 2022: Shared data will be re-coordinates after the NSRS modernization occurs in 2022

Recover, Observe, Report



Regardless of your objective, GPS on BM will always include three report.

Recover: Use [GPSonBM web map](#) to identify priority marks in your area. Read the description of existing bench marks. Follow the instructions of interest.

Observe: Follow instructions on the [Observe](#) page and record field GPS observations for the bench mark you visit.

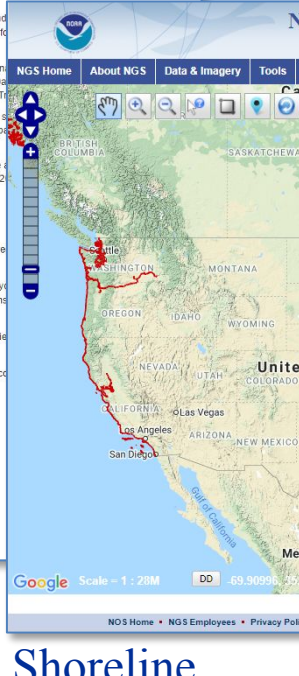
Report: Use the online [Mark Recovery Form](#) to submit your recovery report. Use the [OPUS Solutions](#) from your GPS observations.

[Visit the Web Map](#) [Visit the Dashboard](#)

Datasheets

GPS on Benchmarks

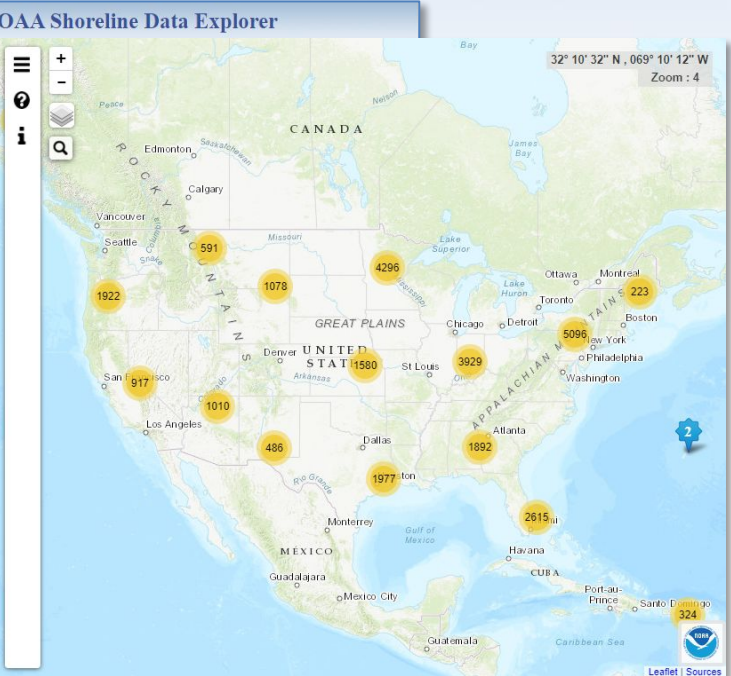


NOAA Shoreline Data Explorer

NGS Home About NGS Data & Imagery Tools

Scale = 1 : 20M

NOGS Home • NGS Employees • Privacy Policy



32° 10' 32" N, 069° 10' 12" W

Zoom : 4

Leaflet | Sources

Shoreline

OPUS Share

11

Application Programming Interfaces (APIs)

GEOID API - The Geoid Height Service

Web service that distributes the geoid height of the NGS geoid models in a concise and portable way. The web service provides the geoid height (of a model specified by its model ID) at any given latitude and longitude. [Learn more](#)

Related Content: [GEOID Models](#)



API for NGS Coordinate Conversion and Transformation Tool (NCAT)

NGS's Coordinate Conversion and Transformation Tool (NCAT) allows users to easily convert between different coordinate systems as well as different datums, in a single step. [Learn more](#)

Related Content: [NCAT](#)



API for Gravity Predictor using GRAV-D (airborne gravity) Data

Web service that distributes gravity data collected from the GRAV-D project in a concise, portable, and expandable way. The web service allows a user the ability to provide any geodetic location (latitude, longitude, and ellipsoid height), and the tool will output a gravity value based upon the GRAV-D data. [Learn more](#)

Related Content: [GRAV-D](#), [GRAV-D Data Blocks](#)



API for VDatum Tidal

VDatum Tidal API is designed to vertically transform geospatial data among a variety of ellipsoidal and orthometric vertical datums to tidal datums. [Learn more](#)

Related Content: [VDatum](#)



API for NGS Data Explorer

Web service that distributes limited attributes from publishable data sheets for varying types of survey control. The primary purpose of this web service is to provide location and metadata for the many survey control marks throughout the nation and territories. [Learn more](#)

Related Content: [NGS Data Explorer](#)



API for OPUS

Web service that distributes limited attributes from OPUS shared solutions. [Learn more](#)

Related Content: [OPUS](#)



API JSON Outputs

GEOID

Example:

<https://geodesy.noaa.gov/api/geoid/ght?lat=40.0&lon=W0800000.0>

Sample Result Set (Units of Geoid Height and Error are meters):

```
{
  "geoidModel": "GEOID12B",
  "station": "UserStation",
  "lat": 40.0,
  "latDms": "N400000.00000",
  "lon": -80.0,
  "lonDms": "W0800000.00000",
  "geoidHeight": -33.185,
  "error": 0.07
}
```

Data Explorer

Examples:

<https://geodesy.noaa.gov/api/nde/radial?lat=40.0&lon=-80.0&radius=0.5>

Using METER as units

<https://geodesy.noaa.gov/api/nde/radial?lat=40.0&lon=-80.0&radius=400&units=METER>

Sample Result Set:

```
{
  "pid": "KX2493",
  "name": "MR 63 LB",
  "lat": "40.00258",
  "lon": "-79.99739",
  "ellipHeight": "",
  "posDatum": "NAD 83(1986)",
  "posSource": "HD_HELD1",
  "posOrder": "",
  "orthoHt": "239.017",
  "vertDatum": "NAVD 88",
  "vertSource": "ADJUSTED",
  "vertOrder": "2"
}
```

Geospatial Web Services

Today

Emergency Response Imagery (WMTS, cloud formatted GeoTiff)

<https://storms.ngs.noaa.gov/storms/tilesp/services/tileserver.php/wmts>

Shoreline

WMS <https://geodesy.noaa.gov/GeoServer/NSDE/ows?service=wms&request=GetCapabilities>

WFS <https://geodesy.noaa.gov/GeoServer/NSDE/ows?service=wfs&request=GetCapabilities>

Tomorrow

Datasheets, CORS, OPUS Share, OPUS Projects, GNSS Vectors, Leveling, NGS Grid WMS

OPUS for Everything (OPUS 6.0)

Simplify upload and allow for multiple file upload

Will provide simultaneous processing for multiple files

Eliminates the email currently required to get solution

Will migrate to a browser based system and provide a URL to the solution that can be shared

Download solutions in multiple formats

Cloud Based Platforms

Amazon Web Services (AWS)

Emergency Response Imagery hosted and served

<https://storms.ngs.noaa.gov/>

<https://registry.opendata.aws/noaa-eri/>

NOAA CORS Network S3 bucket (data downloads)

<https://registry.opendata.aws/noaa-ncn/>

Database and Website testing on AWS

Cloud Based Platforms

ArcGIS Online (AGOL)

GPS on Benchmarks

Web Map Application, Dashboard, Feature Layers

OPUS Shared Solutions

Web Map, Dashboard, Feature Layers

GEOID18 Exploratory Map

Web Map, Tile Layers, Feature Layers







Mark Recoveries

Dashboard, Feature Layers

ArcGIS Online Prototype Galleries

NOAA's National Geodetic Survey AGOL Web Map Gallery

This is a listing of all the ArcGIS Online Web Maps, Web Map Applications and Dashboards that are publicly available.

 <p>GPS on Benchmarks Web Map Application</p> <p>Web Map Application to explore the GPS on Benchmarks priority list throughout the United States and Territories.</p>	 <p>GEOID18 Web Map</p> <p>Web Map to explore GEOID18 and evaluate the changes from GEOID12B including many new GPS on Benchmarks.</p>	 <p>OPUS Share Monthly Web Map</p> <p>Web Map to explore the complete, annual and monthly submissions to OPUS Share.</p>
 <p>GPS on Benchmarks Dashboard</p> <p>Dashboard to analyze completed GPS on Benchmark priority marks by year, month, state and more.</p>	 <p>Mark Recovery Dashboard</p> <p>Dashboard to analyze mark recovery submissions by year, month, state and more.</p>	 <p>OPUS Share Dashboard</p> <p>Dashboard to analyze submissions to OPUS Share by year, month, agency and more.</p>

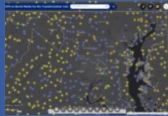



<https://noaa.maps.arcgis.com/apps/opsdashboard/index.html#/449e3051fb444202ba6606e2dbcb0e29>

Web Maps and Dashboards


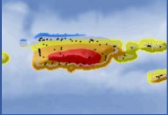

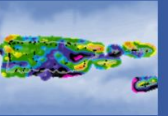
NOAA's National Geodetic Survey AGOL Data Gallery

This is a listing of all the ArcGIS Online Feature Collections, Feature Layers and Tile Layers that are publicly available.

NGS Public Feature Layers

 <p>GPS on Benchmarks Date Type: Feature Layer Collection Extent: CONUS, Puerto Rico & Virgin Used for: GPS on Benchmarks Web Map</p> <p>Open Page</p>	 <p>GPS on BM GEOID18 Date Type: Feature Layer Extent: CONUS, Puerto Rico & Virgin Used for: GEOID18 Web Map</p> <p>Open Page</p>	 <p>GPS on BM GEOID12B Date Type: Feature Layer Extent: US States and Territories Used for: GEOID18 Web Map</p> <p>Open Page</p>	 <p>OPUS Shared Solutions Date Type: Feature Layer Extent: US States and Territories Used for: OPUS Share Map & Dashboard</p> <p>Open Page</p>
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NGS Public Tile Layers

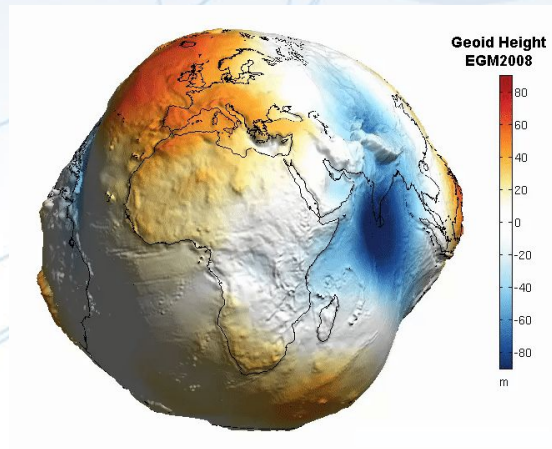
 <p>GEOID18 Height Date Type: Tile Layer Extent: CONUS Used for: GEOID18 Web Map</p> <p>Open Page</p>	 <p>GEOID18 Height Date Type: Tile Layer Extent: Puerto Rico & Virgin Islands Used for: GEOID18 Web Map</p> <p>Open Page</p>	 <p>GEOID18 Difference Date Type: Tile Layer Extent: CONUS Used for: GEOID18 Web Map</p> <p>Open Page</p>	 <p>GEOID18 Difference Date Type: Tile Layer Extent: Puerto Rico & Virgin Islands Used for: GEOID18 Web Map</p> <p>Open Page</p>
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Datasets

Magnitude of the Deflection of the Vertical

Questions?

NGS Industry Workshop



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