

National Geodetic Survey

NAD 83 Reference Frame Transition

From NAD 83(CORS96)2002.00 to
NAD 83(2011, MA11, PA11)2010.00
+ other topics

2012 OSBEELS Symposium

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Mark L. Armstrong, PLS
NGS Oregon State Geodetic Advisor

Mark.l.armstrong@noaa.gov

NOAA's National Geodetic Survey
geodesy.noaa.gov

Today's Discussion

- ✓ National Spatial Reference System
 - ✓ New NAD 83 reference frame: NAD 83(2011, MA11, PA11)epoch 2010.00
 - ✓ Global Reference Frame Coordinates: IGS08(2005)
 - ✓ Review the change to absolute antenna calibrations
 - ✓ NA2011 completed (~80k passive marks)
 - ✓ GEOID12A (now available)
- ✓ Review how CORS positions are computed with the MYCS
- ✓ The OPUS Suite
- ✓ OPUS Projects (beta)
- ✓ Updating coordinates for the ORGN (Real-Time Network) from NAD 83(COR96)epoch 2002.00 to NAD 83(2011)epoch 2010.00

U.S. Department of Commerce National Oceanic & Atmospheric Administration National Geodetic Survey

Mission: To define, maintain & provide access to the
National Spatial Reference System (NSRS)

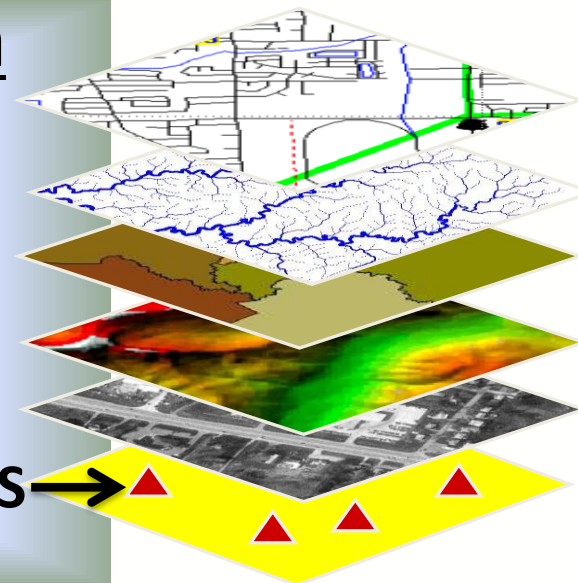
to meet our Nation's economic, social & environmental needs

National Spatial Reference System

- Latitude
- Longitude
- Height
- Scale
- Gravity
- Orientation

& their time variations

CORS →



Continuously Operating Reference Stations (CORS)

[Help](#)

Sampling Rate (clickable legend icons) Non-Operational 250 km radius

1 sec 5 sec 10 sec 15 sec 30 sec All Active Decom

Zoom to CORS:

Site ID:

Cursor Lat/Lon :

28.30438 , -139.39453

Three Nearest Sites :

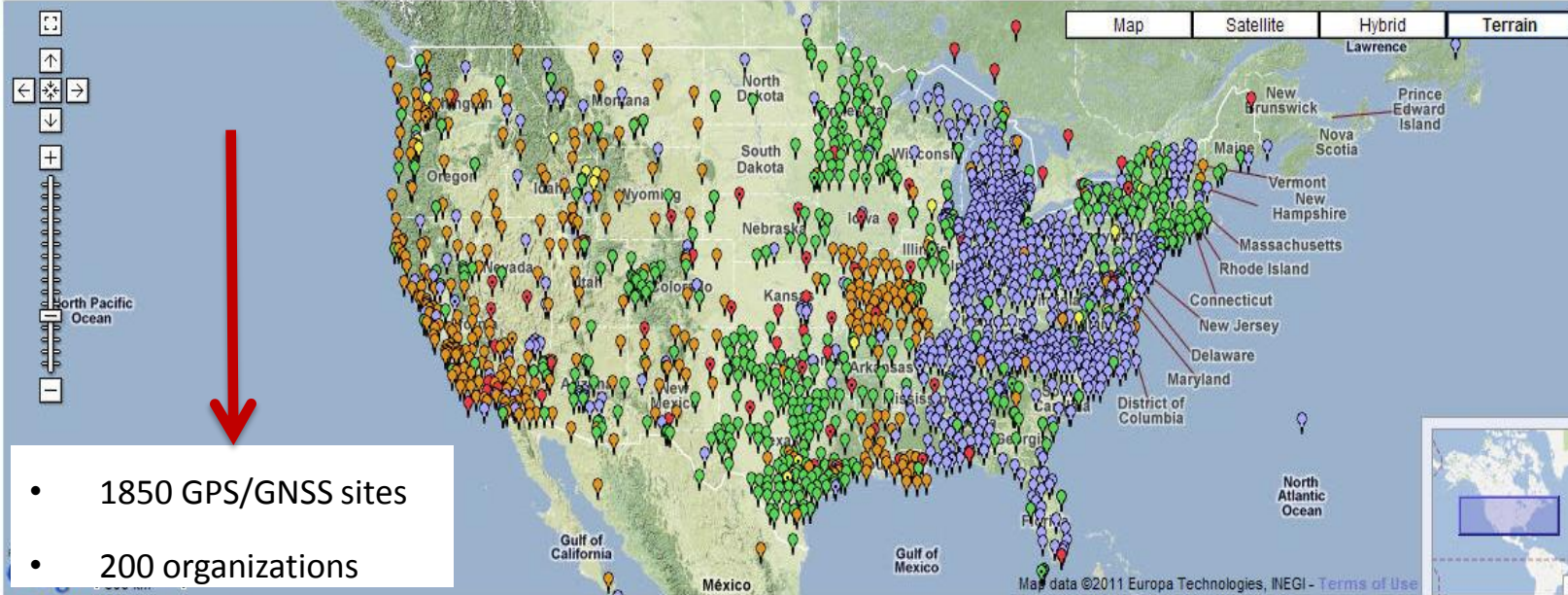
HILR 1854.10 km

PAH5 1859.04 km

PAH6 1859.07 km

Enter a location

Place X



- 1850 GPS/GNSS sites
- 200 organizations

User Friendly CORS

Version 3.6

This utility allows you to obtain a specific block of Global Positioning System (GPS) data for a continuously operating reference station (CORS) contained in the network of GPS sites managed by the National Geodetic Survey.

The GPS data will be in "receiver independent exchange" (RINEX) format, version 2.10.

[UFCORS Page Info](#) [Trimble Products Configuration](#) [UFCORS Problem/Comment Form](#)

Starting Day:

Start Time of the field observation: [Day and Time Info](#)

Time Zone relative to observation location: [Time Zone Info](#)

Number of hours of data you wish to receive: Please LIMIT requests for 1-second sampling rate data to 2 hours.



CORS Reference Frame Changes

new coordinates / velocities available now

Also with OPUS

Antenna Reference Point (ARP) : RED BUTTE CORS ARP

PID = AF9633

OLD

NEW!

ITRF00 POSITION (EPOCH 1997.0)

> IGS08 epoch 2005.0

Computed in Aug. 2007 using 1244 days of data.

X = -1797278.745 m latitude = 40 46 51.82884 N
 Y = -4491525.887 m longitude = 111 48 31.53360 W
 Z = 4145132.622 m ellipsoid height = 1667.743 m

IGS08 = International GNSS Service 2008
 (GPS-only realization of ITRF2008)

ITRF00 VELOCITY

Adapted in Aug. 2007 using 1244 days of data.

VX = -0.0133 m/yr northward = -0.0087 m/yr
 VY = -0.0008 m/yr eastward = -0.0121 m/yr
 VZ = -0.0066 m/yr upward = 0.0000 m/yr

NEW!

NAD 83 (CORS96) POSITION (EPOCH 2002.0)

> NAD83 (2011) epoch 2010.00

Transformed from ITRF00 (epoch 1997.0) position in Aug. 2007.

X = -1797278.172 m latitude = 40 46 51.80741 N
 Y = -4491527.168 m longitude = 111 48 31.49063 W
 Z = 4145132.591 m ellipsoid height = 1668.462 m

NAD83 (2011) = North American Datum 1983
 (2011 Realization)

NAD_83 (CORS96) VELOCITY

Transformed from ITRF00 velocity in Aug. 2007.

VX = 0.0041 m/yr northward = 0.0020 m/yr
 VY = 0.0002 m/yr eastward = 0.0037 m/yr
 VZ = 0.0012 m/yr upward = -0.0005 m/yr

Background - Relative vs. Absolute Antenna Models

Background

The IGS started to use absolute antenna phase center variation (PCV) patterns with GPS week 1400.

Coordinates of IGS reference stations are consistently based on the official IGS absolute PCVs.

As a consequence, a user should use the identical pattern for these sites as used by the IGS in order to get a consistent tie to the reference frame.

Relative vs. Absolute GNSS Antenna Calibration

RELATIVE

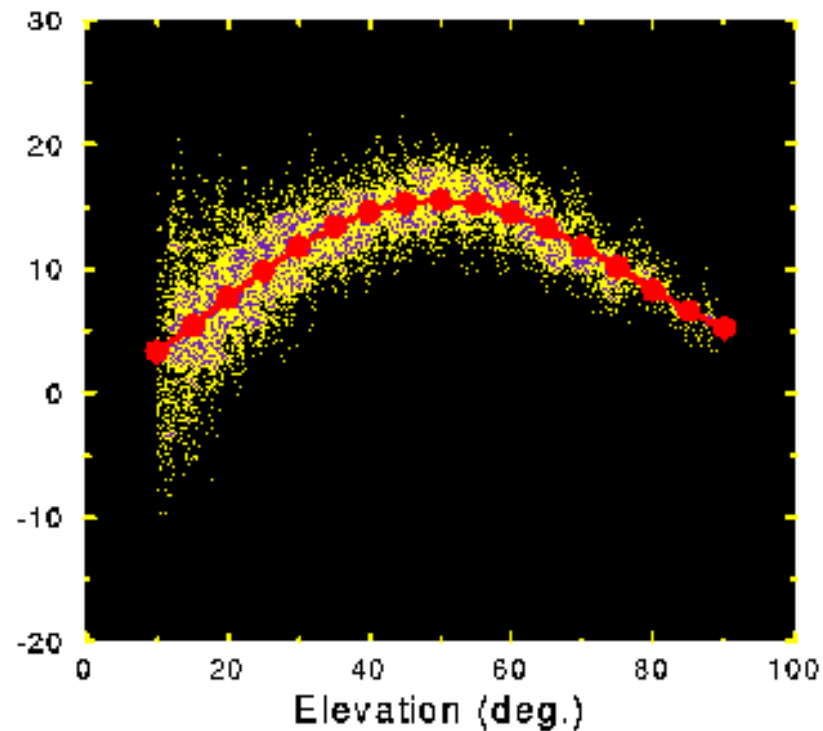
Std.

Corbin, VA

New



Phase Center Variation (mm)



Relative means all new antennae compared with the standard reference antenna Dorne Margolin Type, e.g. AOAD/MT. The standard being the “ZERO” fixed mean offset.

Advantages of the absolute antenna calibration



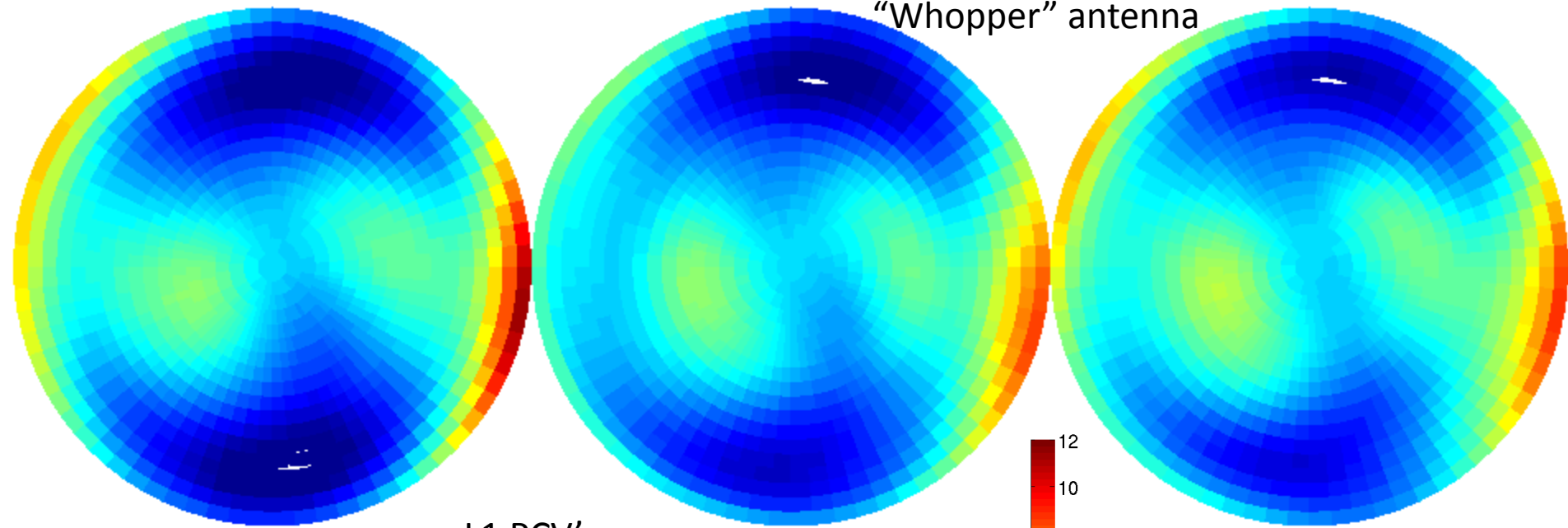
- The robot carries out fast rotations on different axes
- Saves time
 - absolute 3D-offset and PCV
 - high resolution and precision (sub mm)
 - free of multipath
 - PCV from 0° - 90° elevation, also azimuthal PCV
 - site and location independent

NGS Calibrations compared to IGS type mean

IGS05 type mean

s/n 11885 Ashtech Geodetic III
"Whopper" antenna

s/n 11869



L1 PCV's

Azimuthal, as well as elevation, differences

Get all antenna models here:

<http://www.ngs.noaa.gov/ANTCAL>

Influence of the antenna dome



1st model antenna without dome. (absolute)

2nd model with dome and compare.

Studies have shown that domes can affect network horizontal change in position < 5 mm... and vertical network changes can be as large as < 3 cm.

Site AB24 - Alaska

The position error caused by domes is not a constant but depends on the satellite geometry observed at the specific site. (CH. Volken, F. Menge, Impact of Different GPS Antenna Calibr Models on EUREF)

So, what's different about the new CORS coordinates?

- Change to absolute antenna calibrations
 - Use absolute cal. in **your** processing: DON'T MIX!
- Better because 8 more years of data (2002-2010):
 - 440 International IGS sites
 - CORS data: about 1800 stations, ~1000 w/ >2.5 yrs
 - Orbit determination sophistication
 - CORS velocity data
 - Better HTDP modeling for those w/ <2.5 yrs
 - Better processing algorithms

**with COMPUTED
Velocities**

with MODELED Velocities

How do I find the coordinates?

- Individual CORS Coordinate page, as before
<http://www.ngs.noaa.gov/CORS/coords.shtml>
- TWO basic divisions:
 - One with **COMPUTED** velocities, one **MODELED**
- TWO basic Ref Frames: **IGS08, NAD83**
- Two types of coordinates/vel for each of those:
 - **X,Y,Z AND lat/long/ht** (N,E,U)
- Recommend using only CORS w/ **computed** velocities when performing network adjustments.

IGS08

Computed

IGS08 epoch 2005.00

$x, y, z; V_x, V_y, V_z$

IGS08 epoch 2005.00

lat, lon, height; V_n, V_e, V_u

Modeled

IGS08 epoch 2005.00

$x, y, z; V_x, V_y, V_z$

IGS08 epoch 2005.00

lat, lon, height; V_n, V_e, V_u

Note: $V_u = 0$ as
HTDP can only
model Horiz vel.
At this time

NAD 83

Computed

NAD 83 (2011) epoch 2010.00

$x, y, z; V_x, V_y, V_z$

NAD 83 (2011) epoch 2010.00

lat, lon, height; V_n, V_e, V_u

Modeled

NAD 83 (2011) epoch 2010.00

$x, y, z; V_x, V_y, V_z$

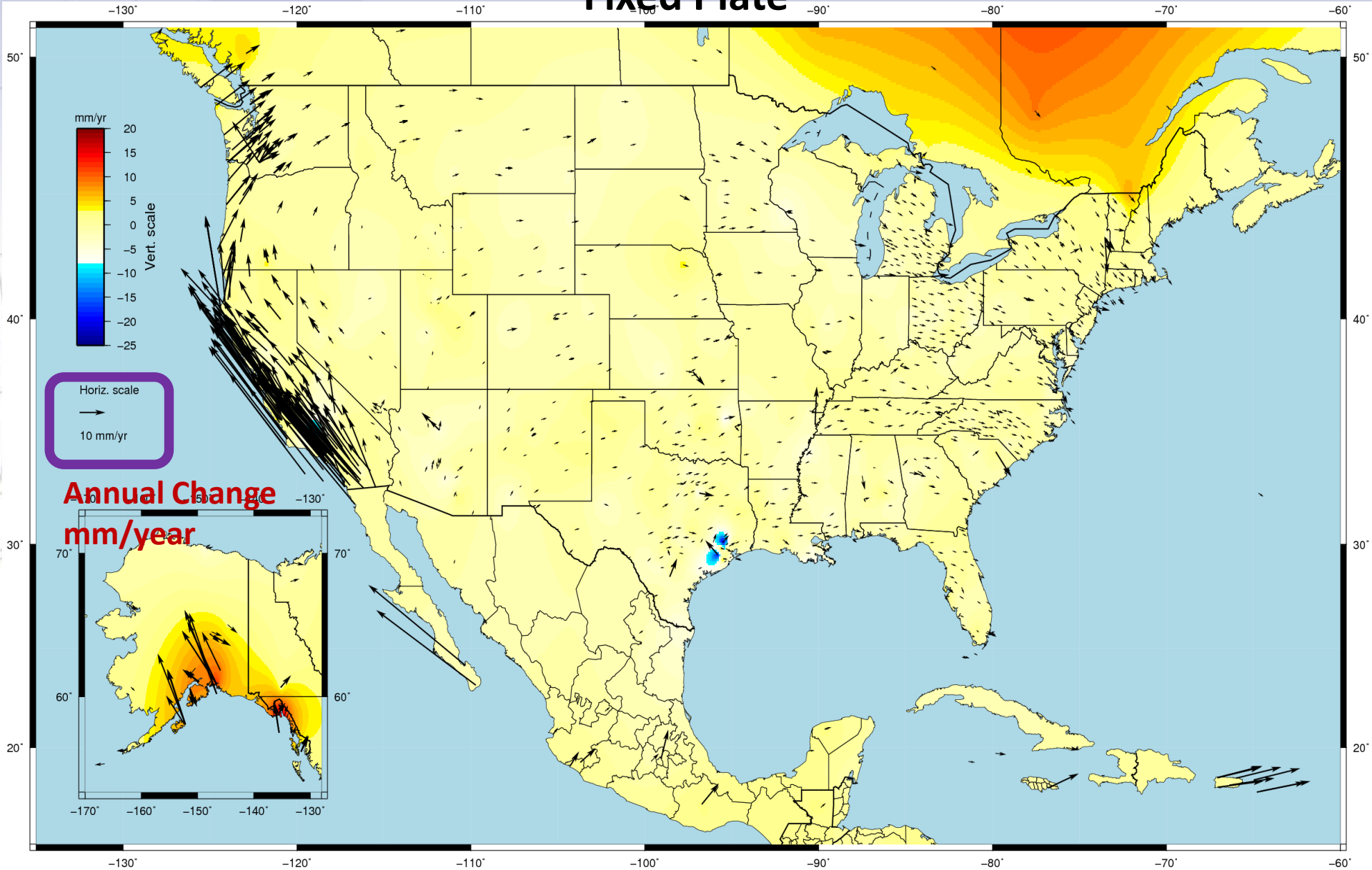
NAD 83 (2011) epoch 2010.00

lat, lon, height; V_n, V_e, V_u

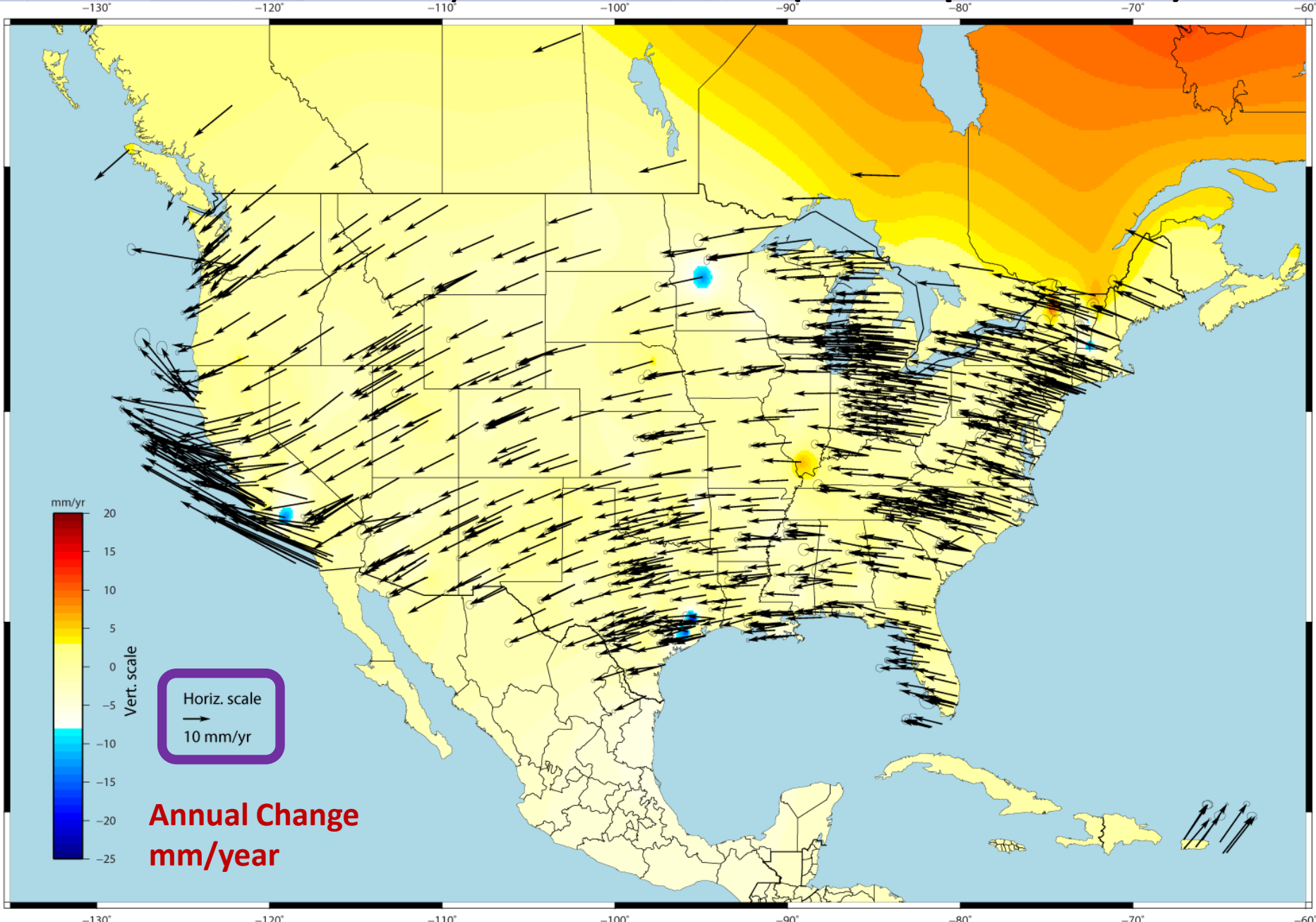
Note: V_u is not 0 as transformation to NAD 83 yields a V_u value

U.S. CORS Velocity Field: NAD 83(2011)epoch 2010.00

Fixed Plate



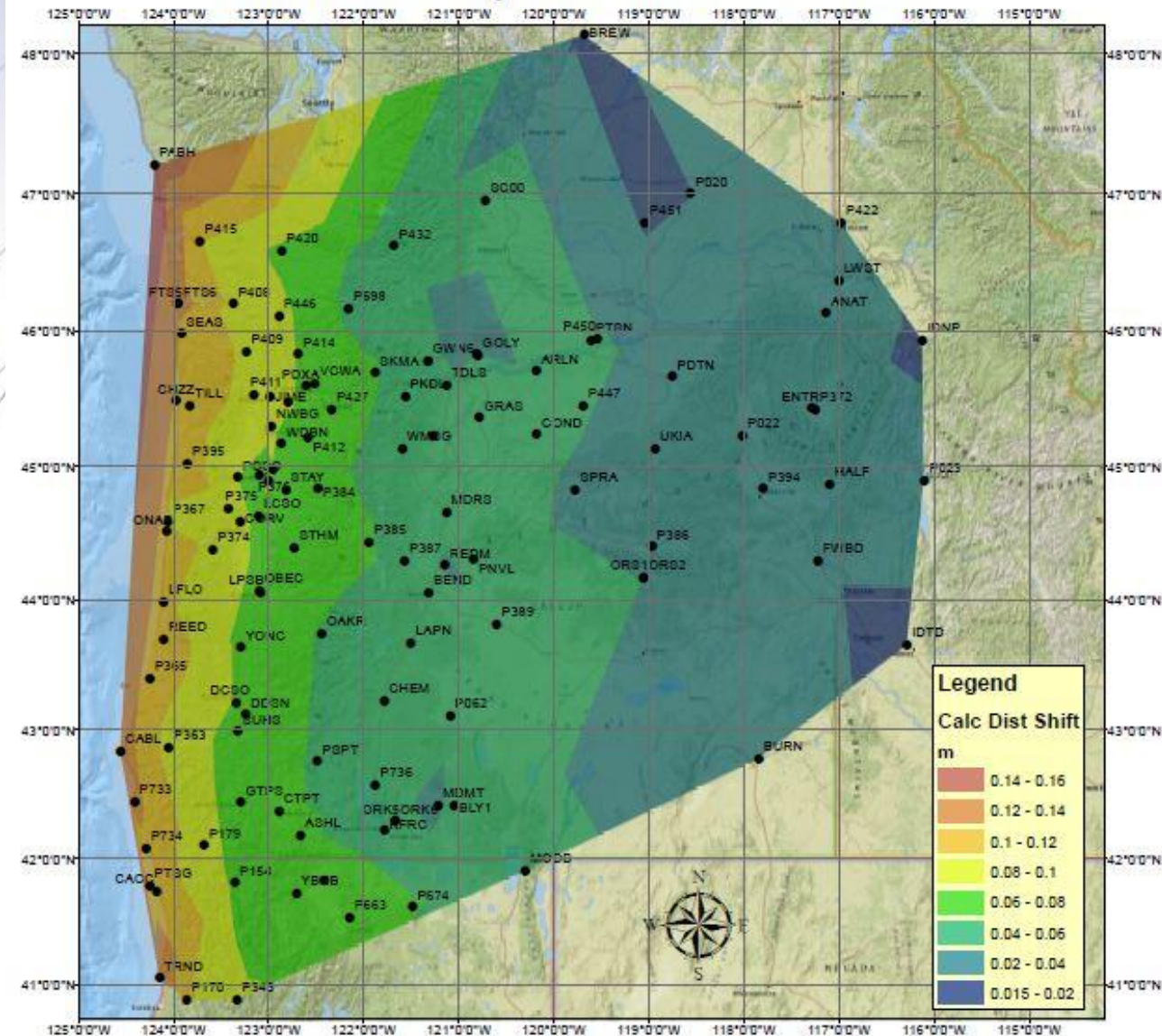
U.S. CORS Velocity Field: ITRF2008 (IGS08 epoch 2005.0)



NAD 83 (CORRS96)2002.00 - NAD 83(2011)2010.00

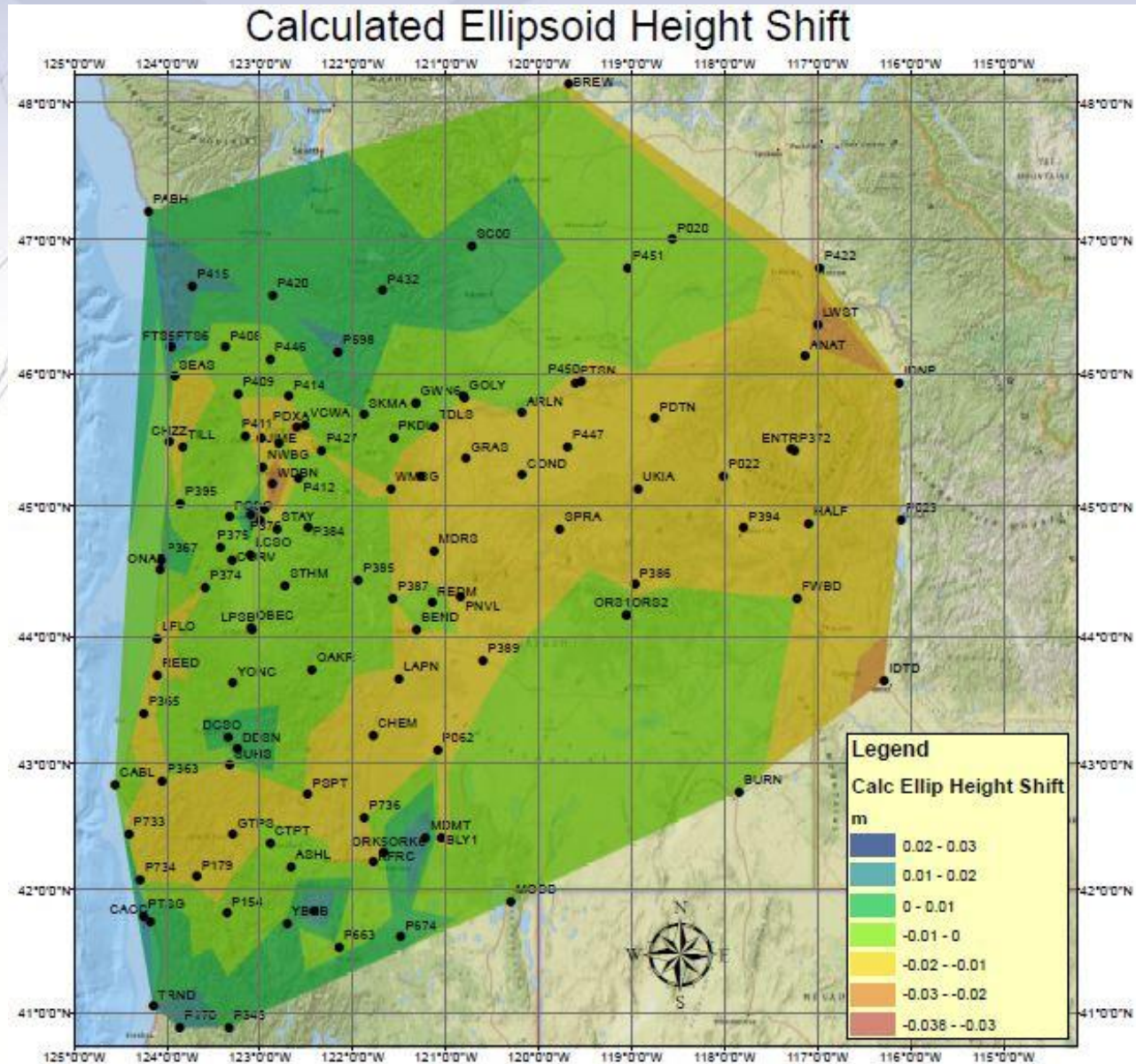
NW Active Station Horiz. Shift

Calculated Ellipsoid Difference Shift



NAD 83 (COR96)2002.00 - NAD 83(2011)2010.00

NW Active Station Vert. Shift



CORS Data and Site Information

- Many, many CORS partners freely share their GNSS data.
- Data is available with a short latency.
- The NGS acts as a data center offering a newsletter, data, coordinates, site equipment histories, photos and time series.



Continuously Operating Reference Station (CORS)

CORS

Enter SiteID
Enter 4-char SiteID

Enter String
Enter partial string to find SiteID, Site Name, or City

[CORS Home](#)
[Data Products](#)
[CORS Map](#)
[Newsletter](#)
[General Information](#)
[CORS Site Guidelines](#)

Map Satellite Hybrid Terrain

Asia Europe Africa South America Australia Pacific Ocean Atlantic Ocean Indian Ocean

POWERED BY Google 5000 mi

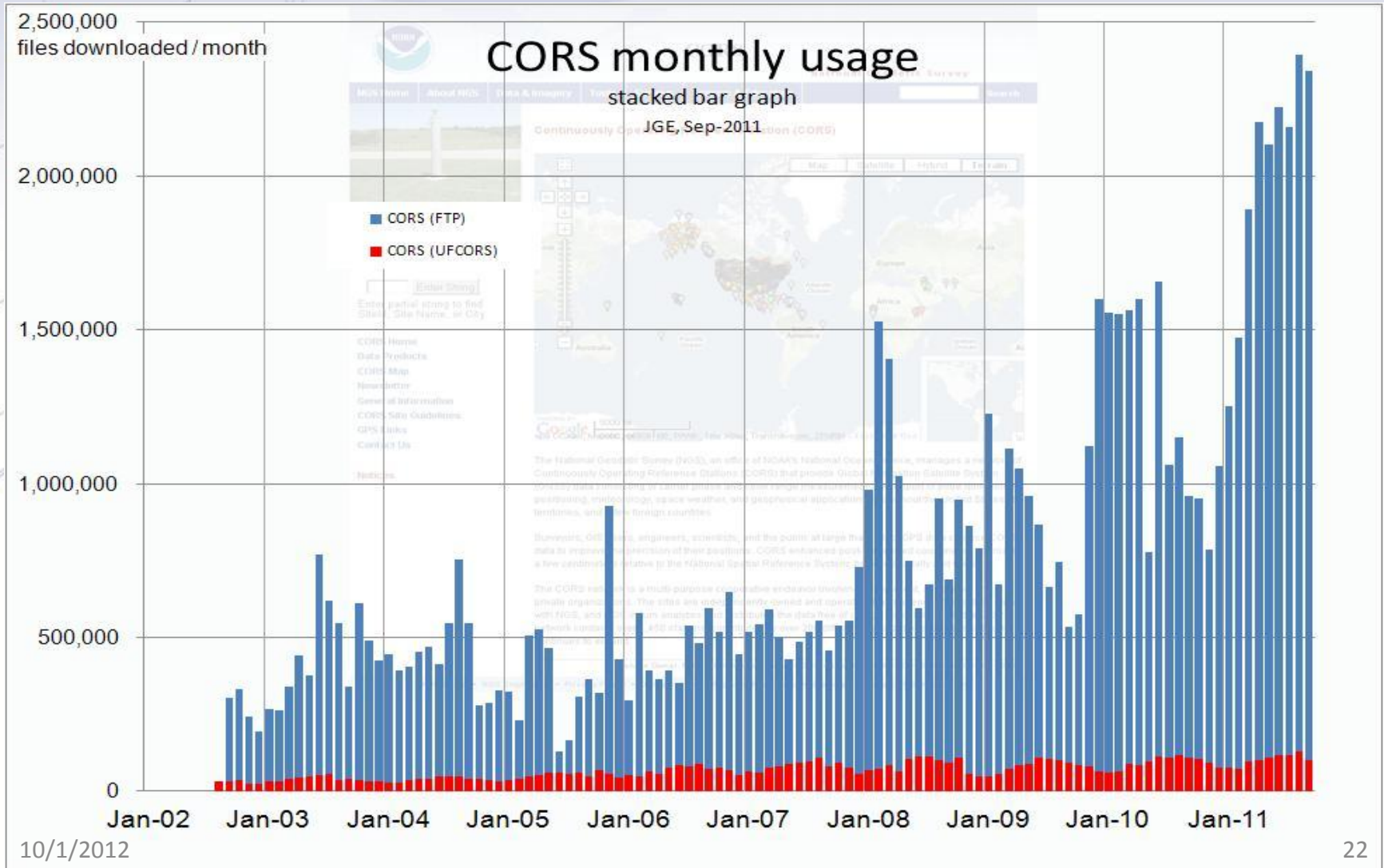
CORS Network

- Increasing with no end in sight.



CORS Use

- Increasing with no end in sight.



Monitoring CORS Coordinates

The CORS are monitored daily to help insure the correctness and continuity of their coordinates and other information.

As new CORS come on-line, their positions are computed relative to the entire network using a brief span of data, then the data, coordinates with a model velocity, hardware descriptions, photos and other information are made available.

The Multi-year CORS (MYCS) process continues. Weekly solutions with velocities continue to be logged.

CORS Data Availability

AB25
TATALINA__AK2008
McGrath, AK
USA

Site operated by:
[UNAVPB](#)

[Coordinates](#)

[SiteLog](#)

[Photographs](#)

[Data Availability](#)

[Standard Files](#)

[Custom Files \(UFCORS\)](#)

[Time Series \(60-day\)](#)

[Time Series \(longterm\)](#)


[Google Map ab25 only](#)

[Google Map all CORS](#)

Enter SiteID

[CORS Home](#)

National Geodetic Survey - CORS



SiteID: GPS Date: Zone: Days:

NOTE: Reset options and click "Submit" to view data availability for another time period.

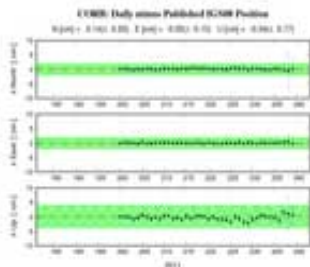
Data Availability Profile for: AB25

■ Data Available ■ Data Unavailable

| Time UTC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | |
|----------|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|
| Time UTC | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | |
| GPS Date | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011361 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011360 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011359 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011358 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011357 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011356 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011355 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011354 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011353 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011352 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011351 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2011350 | [Blue bar] | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Look at CORS Repeatability Plots

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CORS Repeatability Plots

60-day plots show the repeatability of a site for the last 60-days with respect to the published IGS08 position corrected for the effect of the published velocity. These plots are updated daily. For a detailed explanation of these plots go [here](#).

Long-term plots show the show weekly residual positions with respect to the published IGS08 coordinates from our stacked solution. Newer sites may not have a long-term plot if they were added after 16 April 2011. For a detailed explanation of these plots go [here](#).

CORS

Enter 4-char SiteID

Enter partial string to find SiteID, Site Name, or City

- [CORS Home](#)
- [Data Products](#)
- [CORS Map](#)
- [Newsletter](#)
- [General Information](#)

| | | | |
|--|--|--|--|
| 1lsu 60-day long-term | 1nsu 60-day long-term | 1ulm 60-day long-term | ab07 60-day long-term |
| ab11 60-day long-term | ab12 60-day long-term | | |
| ab14 60-day long-term | ab15 60-day long-term | ab17 60-day long-term | ab18 60-day long-term |
| ab22 60-day long-term | ab27 60-day long-term | ab33 60-day long-term | |
| ab37 60-day long-term | ab39 60-day long-term | ab41 60-day long-term | ab45 60-day long-term |
| ab48 60-day long-term | abq5 60-day long-term | abq6 60-day long-term | |
| abvi 60-day long-term | ac07 60-day long-term | ac09 60-day long-term | |

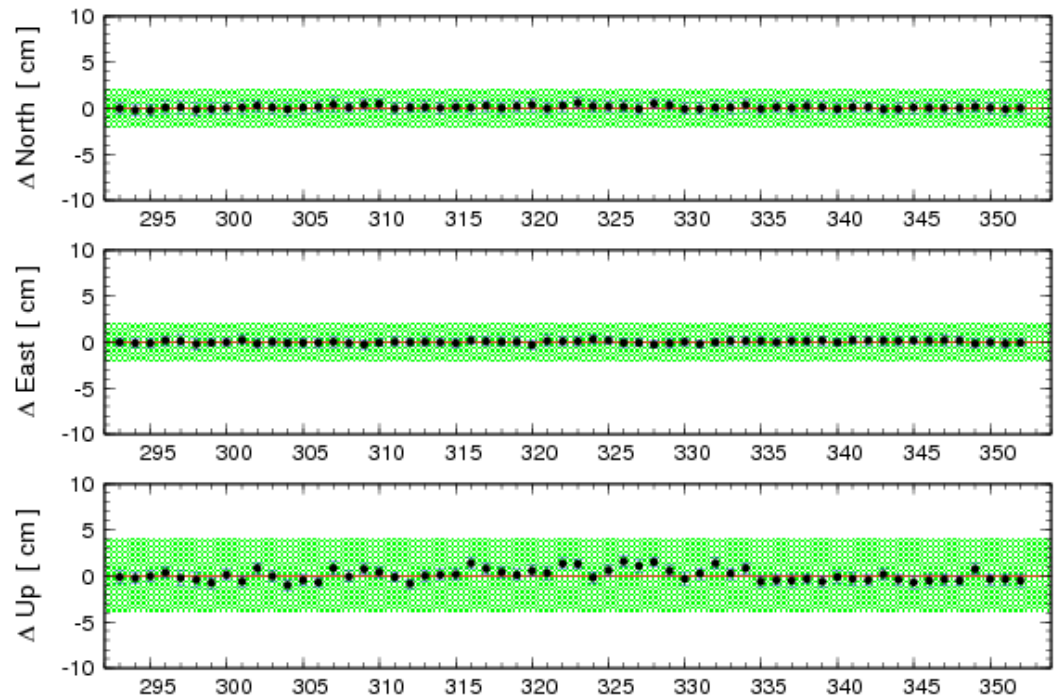
Review the plots!



60 Day Time Series

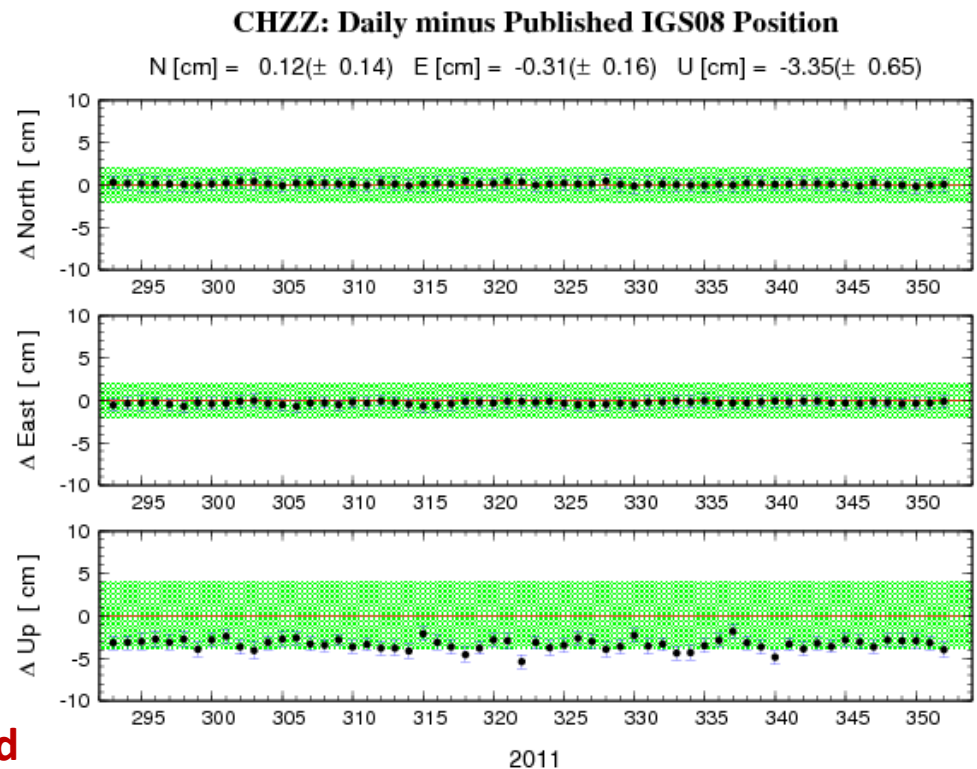
JIME: Daily minus Published IGS08 Position

N [cm] = 0.09(± 0.17) E [cm] = 0.01(± 0.14) U [cm] = 0.09(± 0.66)



2011

Review the plots!



Is there an issue here?...
 Does the Published IGS08 Position need updating?? What caused this? Equipment Change?

CORS 'CHZZ'



Equipment change in 2010, but log file not updated for ~2 years.
New SCIGN mount, antenna, and dome.

Check the Log File for Accuracy!

- Antenna Type : **TRM59800.80 NONE (?????????)**
- Serial Number : 0220373000
- Antenna Reference Point : BPA
- Marker->ARP Up Ecc. (m) : 0.0440
- Marker->ARP North Ecc(m) :
- Marker->ARP East Ecc(m) :
- Alignment from True N : deg
- Antenna Radome Type : NONE
- Radome Serial Number : N/A
- Antenna Cable Type : (vendor & type number) Antenna
Cable Length : (m)
- Date Installed : 2010-02-04T12:30Z

Review the CORS Newsletter

- Provides updates about new CORS
- Changes to CORS Products and Services
- News that impacts the CORS program
- Publications relating to the CORS program
- Statistics and usage maps
- Partners list

To SUBSCRIBE to the newsletter , send an empty email message to:

requests@willamette.nos.noaa.gov

- with subject "Subscribe NGS_CORS_news".

Your name will be added to the list and you will receive all posts

NAD 83(2011, MA11, PA11)epoch 2010.00

- **All good things!**

- CORS coordinates much improved
- OPUS solutions much improved
- User network adjustments much improved when using CORS to control.
 - CORS with computed velocities the best (at least 2.5 years of data archived – see the list!)
- ORGN users in Oregon will also see this improvement when new coordinates are adopted for ORGN stations.

NA2011 Datasheets are Available Now!

```

QE1522 *****
QE1522 CBN - This is a Cooperative Base Network Control Station.
QE1522 DESIGNATION - B 737
QE1522 PID - QE1522
QE1522 STATE/COUNTY- OR/LANE
QE1522 COUNTRY - US
QE1522 USGS QUAD - JUNCTION CITY (1986)
    
```

For ~ 80,000 passive marks including CORS

```

QE1522 *CURRENT SURVEY CONTROL
    
```

| | | | | |
|---------|-------------------------|--------------------------|---------------------|----------|
| QE1522* | NAD 83 (2011) POSITION- | 44 08 57.97448 (N) | 123 11 50.93457 (W) | ADJUSTED |
| QE1522* | NAD 83 (2011) ELLIP HT- | 85.048 (meters) | (06/27/12) | ADJUSTED |
| QE1522* | NAD 83 (2011) EPOCH | - 2010.00 | | |
| QE1522* | NAVD 88 ORTHO HEIGHT - | 108.203 (meters) | 355.00 (feet) | ADJUSTED |
| QE1522 | NAD 83 (2011) X | - 2,509,854.298 (meters) | | COMP |
| QE1522 | NAD 83 (2011) Y | - 3,835,827.328 (meters) | | COMP |
| QE1522 | NAD 83 (2011) Z | - 4,420,080.100 (meters) | | COMP |
| QE1522 | LAPLACE CORR | - 5.05 (seconds) | | DEFLEC09 |
| QE1522 | GEOID HEIGHT | - 23.12 (meters) | | GEOID12A |
| QE1522 | DYNAMIC HEIGHT | - 108.191 (meters) | 354.96 (feet) | COMP |
| QE1522 | MODELED GRAVITY | - 980,504.3 (mgal) | | NAVD 88 |

```

QE1522 VERT ORDER - FIRST CLASS II
    
```

```

QE1522 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
QE1522 Type Horiz Ellip Dist (km)
QE1522 -----
QE1522 NETWORK 0.71 1.37
QE1522 -----
QE1522 MEDIAN LOCAL ACCURACY AND DIST (056 points) 0.89 1.78 80.97
QE1522 -----
    
```



GEOID12A – Now Available

- The expectation is that USGG2012 is significantly more accurate than USGG2009 (gravimetric geoid models). Particularly in mountainous terrain.
- USGG2012 has better and more consistent terrain models, which affects the shortest wavelengths of the gravity field. It includes data from two gravity measuring satellites; GOCE and GRACE
- US bench mark control data sets used; (GPSBM2012 and OPUSDBBM12)
- The ellipsoid heights used to determine orthometric heights (NAVD88) come from NA2011.
- **THUS YOU MUST USE ONLY GEOID12A WITH**
NAD 83(2011)2010.00
<http://www.ngs.noaa.gov/GEOID/GEOID12A/>

OPUS Suite Update

- **Publishing to OPUS – Make your own datasheet**
 - Adding passive mark observations to the OPUS database
 - Publishing requirements
 - The OPUS datasheet
- **OPUS-Projects (OP)**
 - OPUS-Projects Manager Training
 - (OP) ... network baseline processing and adjustment
- **Future OPUS changes...**
 - OPUS Net – A new engine


Using OPUS for access to the NSRS



OPUS: Online Positioning User Service

National Geodetic Survey

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OPUS Menu


- Upload
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- Projects BETA
- Published Solutions
- Contact OPUS

Choose a frame to upload your data:

for current frames, click below:

NAD 83(2011,MA11,PA11)
Mexico(IGS08)
epoch 2010.00


International
IGS08
epoch of observation



for previous frames,
access expires soon*

NAD 83(CORS96,MARP00,PACP00)
epoch 2002.00

ITRF00



Going
Going
Gone

- **Why two frames? What's the difference?**
 - NGS has revised the CORS coordinates and absolute antenna calibrations. For a limited time, OPUS will provide access to both the current and previous frames. [See FAQ & difference maps.](#)
- **Which frame is best for me?**
 - **Most users should choose the current frames**, using the previous only for NAVD 88 orthometric heights, or positions consistent with existing NGS datasheets.
 - * note these will be superseded soon, when NGS completes the **adjustment of the passive control network** and release of GEOID12.
- **Why is there no NAVD 88 orthometric height for the current frame?**
 - This is a temporary situation that will be resolved soon with the release of GEOID12 (see question above.) The current GEOID09 model was built from CORS96-derived ellipsoid heights, and therefore works best with the previous frame.
- **Will published solutions use the current or previous frames?**
 - Either, for now, but soon all published solutions will be updated to the current frames, with previous coordinates retained as superseded.

Website Owner: National Geodetic Survey / Last modified by NGS.OPUS Thursday, 03-May-2012 15:54:32 EDT

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OPUS: Online Positioning User Service

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BETA

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GEOID12A (beta) has replaced GEOID12 for NAVD 88 orthometric heights. NAVD 88 heights from the original GEOID12 (used by OPUS in July and early August) **may include errors of up to 40 cm in limited areas.**

Upload your data file.

Tie your GPS observation to the National Spatial Reference System.

[What is OPUS?](#) [FAQs](#)

* **Data file** of dual-frequency GPS observations. [sample](#)

 A thumbnail image of a sample OPUS solution report. The report is a text-based document containing various technical details, including station coordinates, antenna types, and solution quality indicators. It is presented in a small, high-contrast font.

Sample Solutions

no antenna selected

Antenna type - choosing wrong may degrade your accuracy.

meters above your mark.

Antenna height of your antenna's reference point.

* **Email address** - your solution will be sent here.

Publishing to OPUS

OPUS allows users to publish their OPUS result in an on-line data base if minimum requirements for quality are met and the associated meta-data, such as photos and descriptions, are provided.



OPUS Menu

- Upload
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- Published Solutions

Prefer the old OPUS?



Browse map to locate and access datasheets.

SURVEY DATASHEET (Version 1.0)

OPUS Datasheets

PID: QE0292
 Designation: 4 M
 Stamping: 4 M 1927
 Stability: May hold commonly subject to ground movement
 Setting: Set in top of concrete monument
 Mark: G
 Condition: G
 Description: Mark (4 M) found in good condition per the original description for QE0292. This mark is now suitable for GPS observations as the nearby bushes have been trimmed.
 Observed: 2011-06-09T15:43:00Z
 Source: OPUS - page 5 1009.28



Close-up View

| | | | | | |
|------------------------------------|---------------------|--|-------------|----------------|---------|
| REF_FRAME: NAD_83(CORS96) | EPOCH: 2002.0000 | SOURCE: NAVD88 (Computed using GEOID69) | UNITS: m | SET PROFILE | DETAILS |
| LAT: 44° 6' 47.03116" ± 0.022 m | | UTM 10 SPC 3602(OR.S) | | | |
| LON: -122° 38' 41.46567" ± 0.014 m | | NORTHING: 4384492.069m 273965.493m | | | |
| ELL HT: 201.609 ± 0.022 m | | EASTING: 528419.587m 1328310.143m | | | |
| X: -2474303.955 ± 0.016 m | | CONVERGENCE: 0.24721213" -1.46739455" | | | |
| Y: -3862296.745 ± 0.014 m | | POINT SCALE: 0.99960993 1.000 | | | |
| Z: 4417260.356 ± 0.026 m | | COMBINED FACTOR: 0.99957833 0.999 | | | |
| ORTHO HT: 224.541 ± 0.040 m | | | | | |

CONTRIBUTED BY
[mark I. armstrong](#)
 National Geodetic Survey

Horizon View

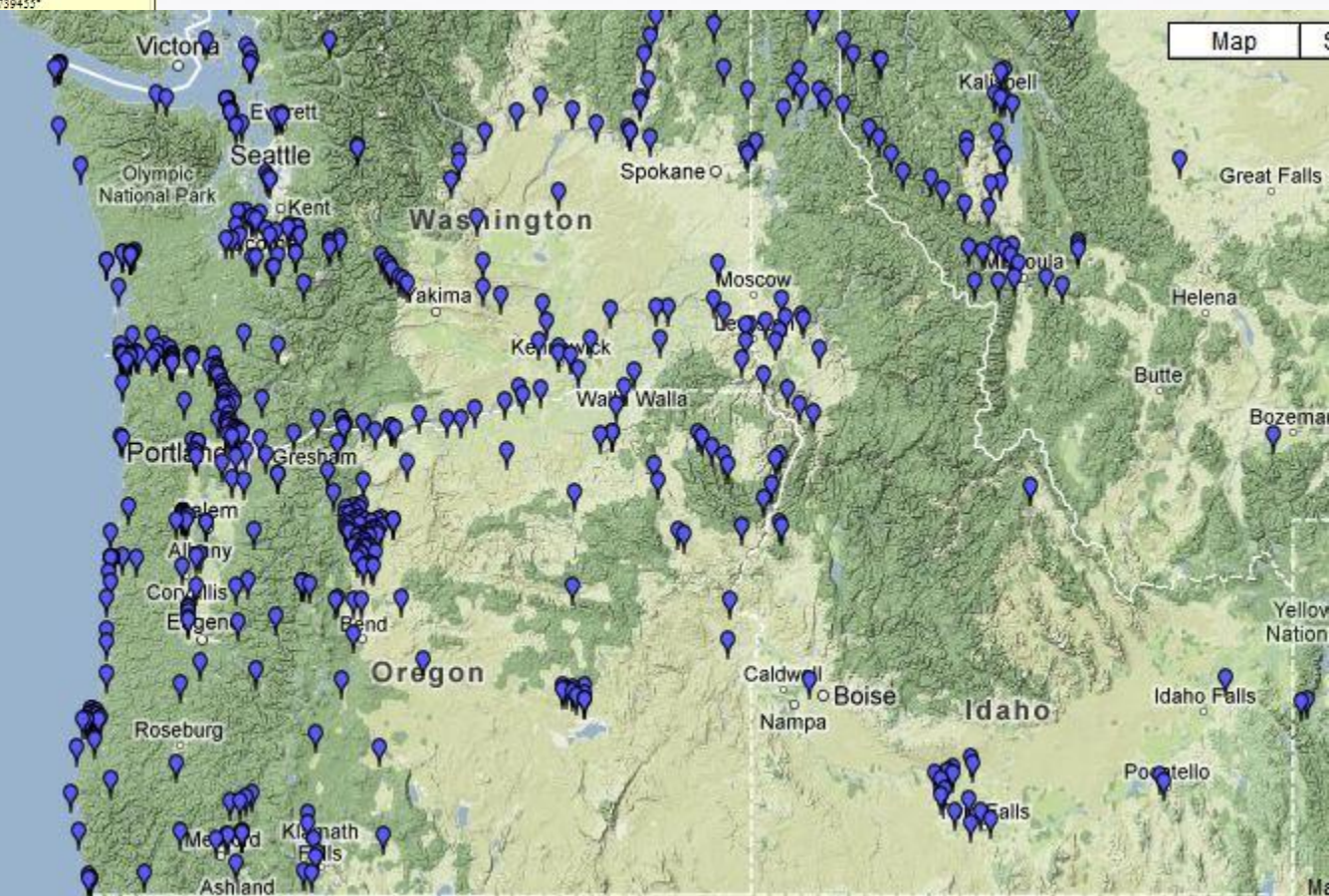
Map

4 M

Get directions: [To here](#) (new)

Map data ©

The numerical values for this position solution have satisfied the quality control criteria of the National Geodetic Survey. The information submitted is accurate and complete.



As of 9-7-2012

OPUS Publishing - Current Minimum Field Procedures

Field Procedures

- GPS **data file** \geq 4 hour duration
- quality **mark setting**
- experienced observer
- fixed height tripod recommended
- brace tripod legs with sandbags or chain
- verify **antenna height** and plumb
- see **HARN guidelines**

OPUS Current Minimum Publishing Requirements

High-Quality OPUS Solution

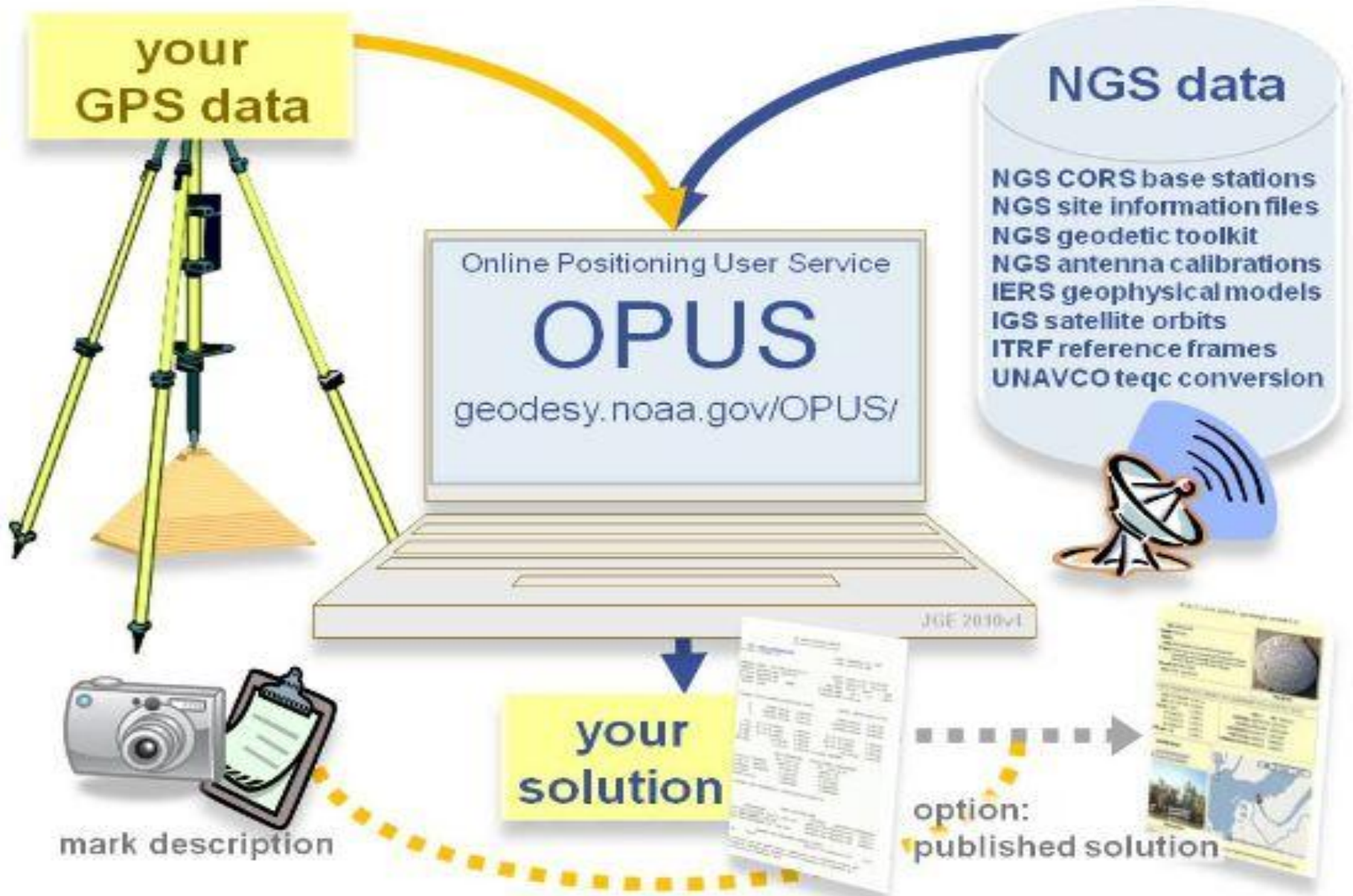
- $\geq 70\%$ observations used
- $\geq 70\%$ ambiguities fixed
- ≤ 3 cm RMS
- ≤ 4 cm peak-to-peaks, lat. & lon.
- ≤ 8 cm peak-to-peak, el. hgt.
- properly identify **antenna type**
- precise or rapid orbits (avail. next day)

Mark Information Needed to Publish

Mark Attributes

- photos of mark & equipment
- details (name, type, stability, etc.)
- description to aid mark recovery
- preview **mark description form**
& **help file**

OPUS Publishing Work Flow



OPUS Database and the IDB

For now, OPUS datasheets and the IDB exist as two separate tools.

As the NGS begins to more fully understand the characteristics of the OPUS Database and the IDB will be more fully reconciled.

In the meantime, a submission to the OPUS Database may be eligible for, but not guaranteed to be included in the IDB.

OPUS Datasheet Details

Note the "See Also" highlight. This provides access to other IDB entries for this mark.

PID: QE1114
Designation: C 590
Stamping: C 590 1965
Stability: May hold commonly subject to ground movement
Setting: Mat foundation or concrete slab other than pavement
Mark
Condition: G
Description: The primary bench mark is a disk set in the top of the SW corner of the Oregon State University Marine Science Center cement pier, 2.13 m (7.0 ft) west of the centerline of the dock, 0.30 m (1.0 ft) north of the junction of the blacktop road and the concrete pier, and 0.30 (1.0 ft) east of the west edge of the pier.
Observed: 2006-08-11T21:16:00Z
Source: OPUS - page5 0908.13



Close-up View

See Also [2007-09-04](#)

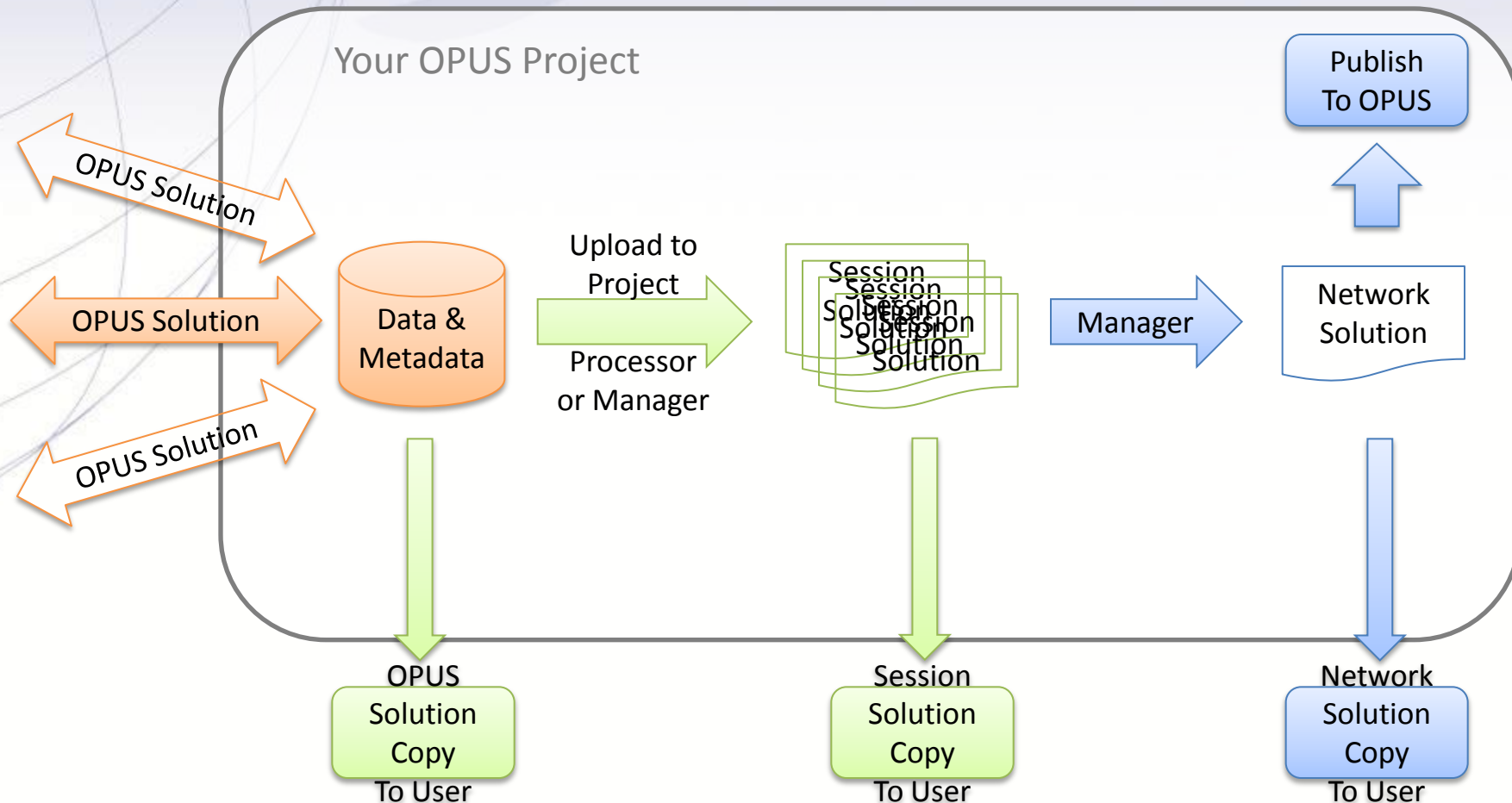
| | | | | | |
|--|----------------------------|--|--------------------|--------------------|----------------|
| REF_FRAME: NAD_83(COR896) | EPOCH: 2002.0000 | SOURCE: NAVD88 (Computed using GEOID03) | UNITS: m | SET PROFILE | DETAILS |
| LAT: 44° 37' 30.96052" ± 0.008 m LON: -124° 2' 42.84324" ± 0.029 m ELL HT: -19.362 ± 0.041 m X: -2545584.501 ± 0.032 m Y: -3767564.728 ± 0.026 m Z: 4457792.399 ± 0.023 m ORTHO HT: 4.478 ± 0.053 m | | UTM 10 SPC 3601(OR N) NORTHING: 4941854.974m 112693.348m EASTING: 417084.278m 2218760.816m CONVERGENCE: -0.73428422° -2.51423054° POINT SCALE: 0.99968454 0.99993927 COMBINED FACTOR: 0.99968758 0.99994231 | | | |

OPUS-Projects (Beta)

- What Is OPUS-Projects (OP)? Web based cloud computing survey network processing and adjustment software.
- The OPUS-Projects Interface starts on the OPUS page.
- OPUS-Projects is currently a beta product. For a period of time the NGS offered training workshops. Those have been suspended until OP is out of beta.
- In order to use OP you must be trained and your email address registered. Let the NGS know if you would like to be trained!
-web survey, Corbin training center, tell your NGS Advisor.

What Is OPUS-Projects?

Graphically, this looks like:





OPUS: Online Positioning User Service

National Geodetic Survey

NGS Home

About NGS

Data & Imagery

Tools

Surveys

Science & Education

Search



OPUS Menu

Upload

About OPUS

Projects **BETA**



Published Solutions

Contact OPUS



GEOID12A (beta) has replaced GEOID12 for NAVD 88 orthometric heights

NAVD 88 heights from the original GEOID12 (used by OPUS in July and early August) **may include errors of up to 40 cm in limited areas.**

Upload your data file.

Tie your GPS observation to the National Spatial Reference System.

What is OPUS? [FAQs](#)

* **Data file** of dual-frequency GPS observations. [sample](#)



Sample Solutions

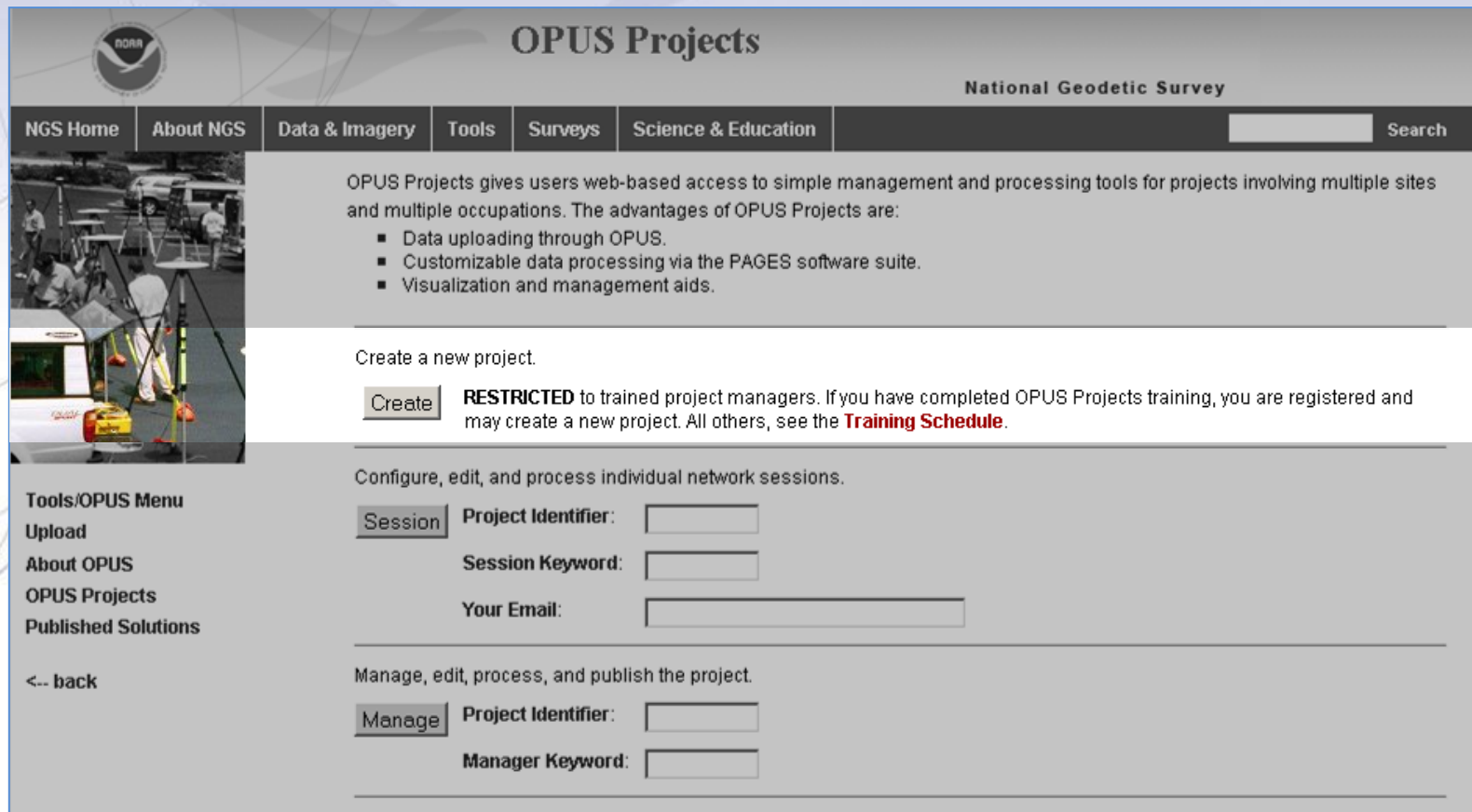
no antenna selected

Antenna type - choosing wrong may degrade your accuracy.

meters above your mark.

Antenna height of your antenna's reference point.

* **Email address** - your solution will be sent here.



The screenshot shows the OPUS Projects web application interface. At the top, there is a NOAA logo and the title "OPUS Projects" with "National Geodetic Survey" below it. A navigation menu includes "NGS Home", "About NGS", "Data & Imagery", "Tools", "Surveys", and "Science & Education". A search bar is located on the right. On the left, there is a vertical menu with "Tools/OPUS Menu", "Upload", "About OPUS", "OPUS Projects", and "Published Solutions", along with a "<- back" link. The main content area features a photograph of survey equipment and a text block describing the application's purpose and advantages. Below this, there are three sections: "Create a new project" with a "Create" button and a "RESTRICTED" notice; "Configure, edit, and process individual network sessions" with a "Session" button and input fields for "Project Identifier", "Session Keyword", and "Your Email"; and "Manage, edit, process, and publish the project" with a "Manage" button and input fields for "Project Identifier" and "Manager Keyword".

OPUS Projects
National Geodetic Survey

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

OPUS Projects gives users web-based access to simple management and processing tools for projects involving multiple sites and multiple occupations. The advantages of OPUS Projects are:

- Data uploading through OPUS.
- Customizable data processing via the PAGES software suite.
- Visualization and management aids.

Create a new project.

Create **RESTRICTED** to trained project managers. If you have completed OPUS Projects training, you are registered and may create a new project. All others, see the **Training Schedule**.

Configure, edit, and process individual network sessions.

Session **Project Identifier:**
Session Keyword:
Your Email:

Manage, edit, process, and publish the project.

Manage **Project Identifier:**
Manager Keyword:

Tools/OPUS Menu
Upload
About OPUS
OPUS Projects
Published Solutions
<- back

The first step is to create a project. This allocates on-line storage for the project's data and generates project keywords. Start by clicking the "Create" button.

OPUS: Online Positioning User Service
National Geodetic Survey

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

Create Project

* **Email address**
Refers to Project Manager who must be registered with OPUS-Projects

* **Project title**

* **Project**

* **Approx**

* **Anticip**

* **Approx**

* required fields

The page at <http://beta.ngs.noaa.gov> says:
PROBLEM: Check or enter your EMAIL ADDRESS.
OK

Website Owner: National Geodetic Survey / Last modified by NGS.OPUS Monday, 22-Nov-2010 15:53:52 EST

NGS Home | NGS Employees | Privacy Policy | Disclaimer | USA.gov | Ready.gov | Site Map | Contact Webmaster

If you haven't completed this training, you'll be notified. Information about future training classes can be found at <http://www.ngs.noaa.gov/corbin/calendar.shtml>.

Uploading Data To A Project

The second step is to “Upload” data files to your project.

This is done through OPUS implying the same restrictions:

- Your data must be dual frequency pseudorange and phase P1 (or C1), P2, L1 and L2.
- A recommended 2-hours data span for each submission.
- A collection rate of 1, 2, 3, 5, 10, 15 or 30 seconds.

Uploading to a Project

OPUS Menu

- Upload
- About OPUS
- Projects 
- Published Solutions
- Contact OPUS

* **Data file** of dual-frequency GPS observations. [sample](#)

NONE no antenna selected ▼


Antenna type - choosing wrong may degrade your accuracy.

meters above your mark.

Antenna height of your antenna's reference point.

* **Email address** - your solution will be sent here.

to **customize** your solution.

| | | | |
|--------------------------------|--|--|-------------------------------|
| Formats | Add solution details | standard solution ▼ | |
| Base stations | Type in 4-char site IDs, or select from map, any CORS you wish to explicitly include or exclude from your solution Sample NOTE: the automated selection of base stations has recently improved; this option should now be used only sparingly | Use: <input type="text"/> | Exclude: <input type="text"/> |
| | | <div style="border: 1px solid gray; padding: 5px;"> <p style="text-align: center;">Look up site IDs</p>  <p style="text-align: center;">browse map</p> </div> | |
| State plane | Customize your native SPCS zone | let OPUS choose ▼ | |
| Contribute to a project | Enter the project identifier provided by your project manager | oscc-t1 | |
| My profile | Customize OPUS defaults for future solutions | Delete my profile ▼ | |
| Publish my solution | Share your solutions | No, don't publish ▼ | |

for data > 15 min. < 2 hrs. for data > 2 hrs. < 48 hrs.

```

# Date: 2013-08-23 10:00:00
# Station: 13000000
# Antenna: LEICA
# Height: 0.00
# Base: NONE
# User:
# E-mail:
# Solution:
# Format:
# Units:
# ...
    
```

Sample Solutions



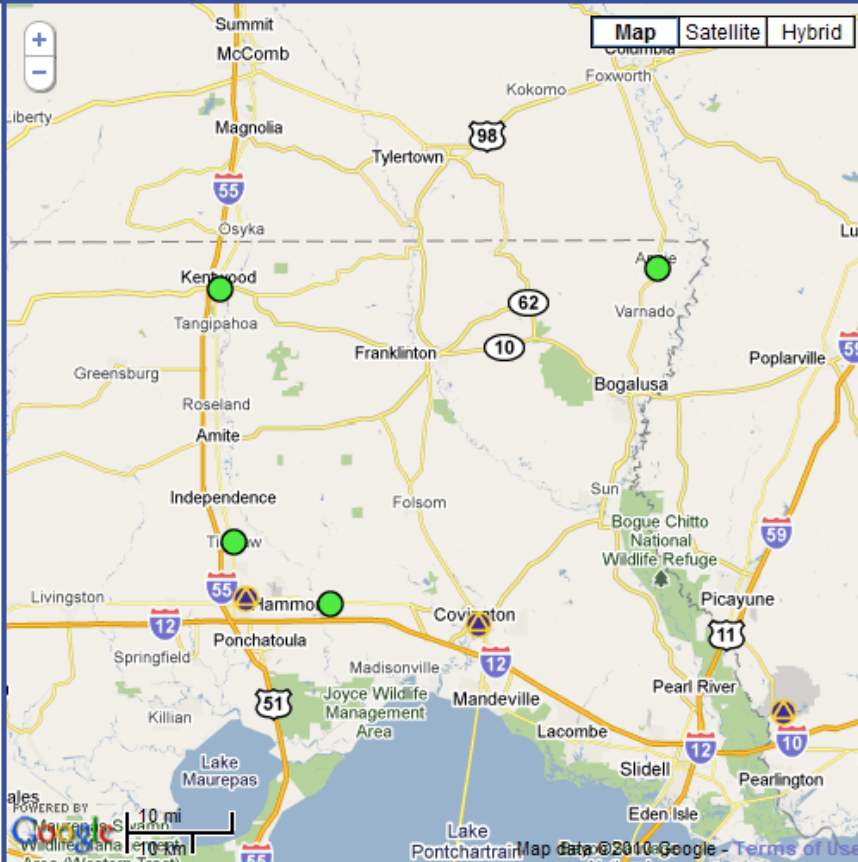
OPUS Projects BETA - Manage "Training data set 1"

National Geodetic Survey

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

Results From ALL SESSION SOLUTIONS

- Help
- Back
- Refresh
- Center Project
- Center All Sites
- Keywords
- Email Lists
- Preferences
- Design
- Serfil
- Show A File
 - Session Solution
 - 2006-276-B
 - Summary
- CORS
- Email
- Process
- Publish
- Solutions
- Delete Project



MARK

- 2123
- 2126
- 2137
- 2139

CORS

- covg
- dstr
- hamm
- msht

| MARK | Sessions & Solutions | | | | | | MARK |
|------|----------------------|----------|----------|----------|----------|----------|------|
| | 2006-274 | 2006-275 | 2006-275 | 2006-276 | 2006-276 | 2006-277 | |
| 2123 | | | ● | ● | ● | ● | 2123 |
| 2126 | ● | ● | ● | ● | | | 2126 |

The map shows the relative location of the project's marks. Here, again, the Session solution results are shown, but the OPUS solution results could be selected and displayed instead.

Next is a mockup of the datasheet if the mark were to be published. These can be edited by the manager if errors or omissions are found.

Description

PID

stamping*

name*

type*

setting*

specific setting (optional):

description*

stability

magnetic

application

condition Good condition Poor, disturbed, mutilated, requires maintenance

* required fields

Close-up View



Horizon View



Occupations

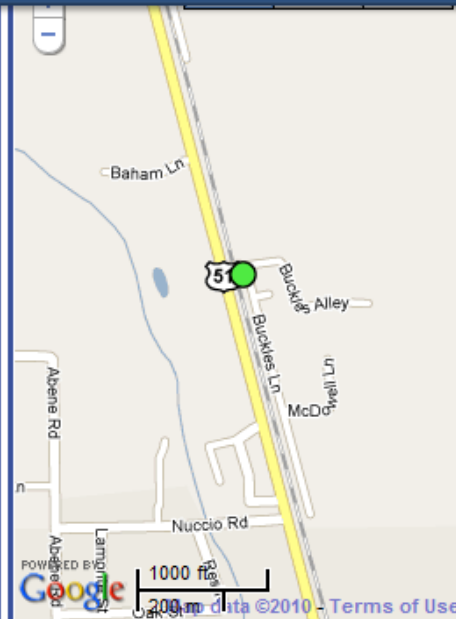
| | | | | | |
|--------------|-------------------------------------|----------|--|--|---|
| 2123275u.06o | Start: 2006-10-02T20:23:30.000 GPST | Antenna | Model: <input type="text" value="TRIMBLE 5971.00 NONE"/> | S/N: <input type="text" value="30212716"/> | ARP (m): <input type="text" value="2.000"/> |
| | End: 2006-10-03T01:15:30.000 GPST | Receiver | Model: <input type="text" value="TRIMBLE NETRS"/> | S/N: <input type="text" value="30212716"/> | Firmware: <input type="text" value="-"/> |
| 2123276g.06o | Start: 2006-10-03T06:23:30.000 GPST | Antenna | Model: <input type="text" value="TRIMBLE 5971.00 NONE"/> | S/N: <input type="text" value="30212716"/> | ARP (m): <input type="text" value="2.000"/> |

Below the summary by occupation are the coordinate and status summary tables.

| | | | |
|-------------------------------------|----------------------------|----------|--|
| REF FRAME: ITRF2000 (2006.7552) | NAD_83(CORS96) (2002.0000) | | |
| LAT: N30:35:23.60927 ±0.001 m | N30:35:23.59010 | ±0.001 m | |
| EAST LON: E269:30:47.26256 ±0.001 m | E269:30:47.28806 | ±0.001 m | |
| WEST LON: W090:29:12.73744 ±0.001 m | W090:29:12.71194 | ±0.001 m | |
| EL HGT: -8.792 ±0.007 m | -7.421 | ±0.007 m | |
| X: -46695.480 m ±0.000 m | -46694.813 m | ±0.000 m | |
| Y: -5495062.789 m ±0.001 m | -5495064.275 m | ±0.001 m | |
| Z: 3226832.681 m ±0.001 m | 3226832.871 m | ±0.001 m | |

ORTHO HGT: 19.491 m ±0.013 m [USGG2009]

| | |
|---|---------------|
| COORDINATE SYSTEM: SPC 1702 LA S | UTM 15 |
| NORTHING: 231955.817 m | 3386842.986 m |
| EASTING: 1081182.799 m | 740977.296 m |
| CONVERGENCE: 0.42324519° | 1.27952542° |
| POINT SCALE: 0.99997843 | 1.00031642 |
| COMBINED FACTOR: 0.99997960 | 1.00031759 |
| U.S. NATIONAL GRID: 15RYP4097786843(NAD 83) | |



| File | Antenna | ARP (m) | Eph | Obs (%) | Fixed (%) | RMS (m) | Lat (m) | Lon (m) | Hgt (m) | SOLUTION |
|--------------|------------------|---------|----------------|---------|-----------|---------|---------|---------|---------|---------------|
| 2123275u.06o | TRM55971.00 NONE | 2.000 | precise | 93.9 | 92.2 | - | 0.001 | 0.001 | 0.007 | network-final |
| 2123276g.06o | TRM55971.00 NONE | 2.000 | precise | 93.9 | 92.2 | - | 0.001 | 0.001 | 0.007 | network-final |
| 2123276s.06o | TRM55971.00 NONE | 2.000 | precise | 93.9 | 92.2 | - | 0.001 | 0.001 | 0.007 | network-final |
| 2123277g.06o | TRM55971.00 NONE | 2.000 | precise | 93.9 | 92.2 | - | 0.001 | 0.001 | 0.007 | network-final |
| Preferences | | | BEST AVAILABLE | ≥80.0 | ≥80.0 | ≤0.025 | ≤0.020 | ≤0.020 | ≤0.040 | Preferences |

Plotted Solution Results From All Sources

| | | | | | | | |
|------------------|-----------|------------|--|--|--|--|--|
| NETWORK SOLUTION | EAST (cm) | NORTH (cm) | | | | | |
|------------------|-----------|------------|--|--|--|--|--|

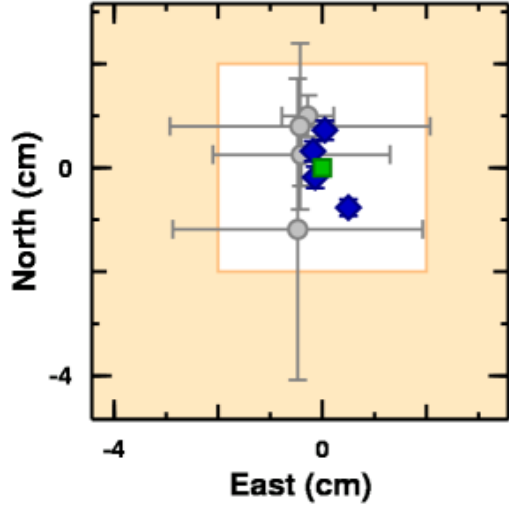
| | | | | | | | | |
|-------------|----------------|-------|-------|--------|--------|--------|--------|-------------|
| Preferences | BEST AVAILABLE | ≥80.0 | ≥80.0 | ≤0.025 | ≤0.020 | ≤0.020 | ≤0.040 | Preferences |
|-------------|----------------|-------|-------|--------|--------|--------|--------|-------------|

OPUS-Projects Results

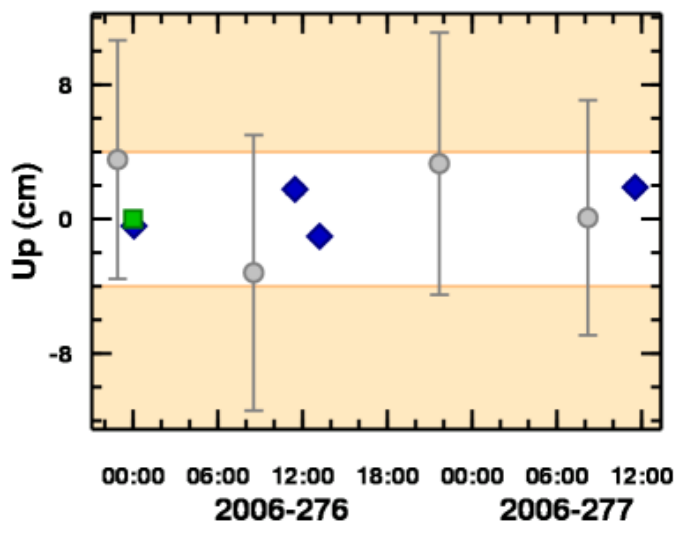
Plotted Solution Results From All Sources

| NETWORK SOLUTION | EAST (cm) | NORTH (cm) |
|------------------|-----------|------------|
| network-final | 0.0 ±0.0 | 0.0 ±0.1 |
| SESSION SOLUTION | EAST (cm) | NORTH (cm) |
| 2006-275-B | 0.5 ±0.0 | -0.8 ±0.2 |
| 2006-276-A | -0.1 ±0.0 | -0.2 ±0.2 |
| 2006-276-B | 0.0 ±0.0 | 0.7 ±0.2 |
| 2006-277-A | -0.2 ±0.0 | 0.3 ±0.2 |
| OPUS SOLUTION | EAST (cm) | NORTH (cm) |
| 2123275u.06o | -0.3 ±0.5 | 1.0 ±0.4 |
| 2123276g.06o | -0.4 ±2.5 | 0.8 ±1.6 |
| 2123276s.06o | -0.5 ±2.4 | -1.2 ±2.9 |
| 2123277g.06o | -0.4 ±1.7 | 0.3 ±0.6 |

The (0, 0) point represents W90:29:12.737 by N30:35:23.609.



And at the bottom are summary plots and tables for comparison of different solutions. The orange parts of the plots indicate regions outside the thresholds set by the project manager.



The ORGN

Oregon Real-time network

- Operated by ODOT Geometronics Unit
- Still free to public
- New users welcome!
- **Coordinates to be updated the 4th quarter of 2012**
- New coordinates will be NAD 83(2011)2010.00
- Need help getting on? Email Randy Oberg at:
Randy.d.oberg@odot.state.or.us

ORGN Active Station Adjustment Completed

Final Report (beta release 6-15-2012)

NAD 83(2011)epoch 2010.00 - Oregon CORS + ORGN Station Coordinates

New coordinates for all of the active stations in the state + some in WA, ID, CA

Controlling Stations (INPUT)

IGS08 (2005) Geod. CORS Pos. Ant. Ref. Point (ARP) [GRS80 Ellip.] Computed Vels.

| Site | Epoch | Latitude (DMS) | | | Longitude (DMS) | | | Ellip. Ht.(m) | GEOID12 (N) | Vn | Ve | Vu | Ctry. | State | Site |
|------|-------|----------------|----|------------|-----------------|----|------------|---------------|-------------|-------|-------|------|-------|-------|-------------|
| BREW | 2005 | 48 | 7 | 53.48654 N | 119 | 40 | 57.48134 W | 238.617 | | -10.1 | -12.9 | -0.3 | US | WA | Operational |
| FTS5 | 2005 | 46 | 12 | 17.59600 N | 123 | 57 | 21.94011 W | -13.776 | | -3.6 | -3.3 | 2.1 | US | OR | Operational |
| REDM | 2005 | 44 | 15 | 35.16273 N | 121 | 8 | 52.37145 W | 919.926 | | -8.3 | -13.0 | -1.1 | US | OR | Operational |
| PABH | 2005 | 47 | 12 | 46.07847 N | 124 | 12 | 16.49542 W | 12.980 | | -1.2 | 1.0 | 0.3 | US | WA | Operational |
| ORS2 | 2005 | 44 | 9 | 50.89965 N | 119 | 3 | 30.40520 W | 1438.541 | | -9.0 | -14.0 | -0.2 | US | OR | Operational |
| IDNP | 2005 | 45 | 56 | 22.95565 N | 116 | 7 | 16.58486 W | 996.585 | | -9.4 | -13.8 | 0.0 | US | ID | Operational |
| ORK5 | 2005 | 42 | 17 | 19.73369 N | 121 | 40 | 9.59579 W | 1258.397 | | -7.8 | -15.6 | -1.2 | US | OR | Operational |
| BURN | 2005 | 42 | 46 | 46.20595 N | 117 | 50 | 36.70487 W | 1180.978 | | -9.3 | -15.2 | -1.4 | US | OR | Operational |
| GOBS | 2005 | 45 | 50 | 19.74780 N | 120 | 48 | 52.83375 W | 621.562 | | -9.0 | -12.1 | -1.1 | US | WA | Operational |
| CABL | 2005 | 42 | 50 | 9.95570 N | 124 | 33 | 48.04441 W | 37.911 | | 0.9 | -6.2 | 0.7 | US | OR | Operational |

(0.01m 3D normal constraints applied to each control site)

Oregon Real Time GNSS Network + Other Active Station Coordinates (OUTPUT)

FINAL OUTPUT VALUES FOR ALL STATIONS NAD 83(2011)epoch 2010.00 at site ARP

OPUS-PROJECT Oregon Real Time GNSS Network (ODOT) Coordinates (NGS NSRS Validation*)

| Site | Epoch | Latitude (DMS) | | | Longitude (DMS) | | | Ellip. Ht.(m) | 5 sigma uncertainties | | | OP | State | Site Owner |
|------|-------|----------------|----|------------|-----------------|----|------------|---------------|-----------------------|-------|-------|------|-------|------------|
| BREW | 2010 | 48 | 7 | 53.46828 N | 119 | 40 | 57.42217 W | 238.9965 | 0.006 | 0.004 | 0.006 | MEAN | WA | IGS |
| FTS5 | 2010 | 46 | 12 | 17.58145 N | 123 | 57 | 21.87883 W | -13.4470 | 0.006 | 0.004 | 0.006 | MEAN | OR | CG |
| REDM | 2010 | 44 | 15 | 35.14645 N | 121 | 8 | 52.31554 W | 920.3462 | 0.006 | 0.004 | 0.006 | MEAN | OR | PBO |
| PABH | 2010 | 47 | 12 | 46.06428 N | 124 | 12 | 16.43193 W | 13.2793 | 0.006 | 0.004 | 0.006 | MEAN | WA | PBO |
| ORS2 | 2010 | 44 | 9 | 50.88218 N | 119 | 3 | 30.35072 W | 1439.0210 | 0.006 | 0.004 | 0.006 | MEAN | OR | CG |
| IDNP | 2010 | 45 | 56 | 22.93613 N | 116 | 7 | 16.53031 W | 997.0894 | 0.006 | 0.004 | 0.006 | MEAN | ID | NPNF |
| ORK5 | 2010 | 42 | 17 | 19.71834 N | 121 | 40 | 9.541888 W | 1258.8298 | 0.006 | 0.004 | 0.006 | MEAN | OR | CG |
| BURN | 2010 | 42 | 46 | 46.18823 N | 117 | 50 | 36.65240 W | 1181.5039 | 0.006 | 0.004 | 0.006 | MEAN | OR | PBO |

Network Adjustment of ORGN

- 6 overlapping clusters adjusted using same control stations.
- Each cluster contains 5 days of 24 hour files = 120 hours for each station
 - Each day = 1 session
 - So 5 sessions for each station
 - RINEX data downloaded
 - Log files checked for accuracy
 - Processing and adjustment in OPUS-Projects

ORGN Controlling CORS Stations

Session : 2012-068-A Results From : OPUS Solutions

Controls

? ← ↻

Manager's Page

Show File

Send Email

Set up Processing

LEGEND

MARKS: ● meet preferences ○ do not meet preferences ○ are not included ○ have error

CORS: ▲ meet preferences ▲ do not meet preferences ▲ are not included

Baselines: ██████████

LEGEND

MARKS

● corv

● idnp

+ Marks Marks&CORS -

Map Satellite Terrain

BREW
PABH
FTS5
IDPN
GOBS
BURN
ORS2
ORK5
REDM
CABL

Add MARKS

CORS

▲ brew

▲ burn

▲ cabl

▲ fts5

▲ gobs

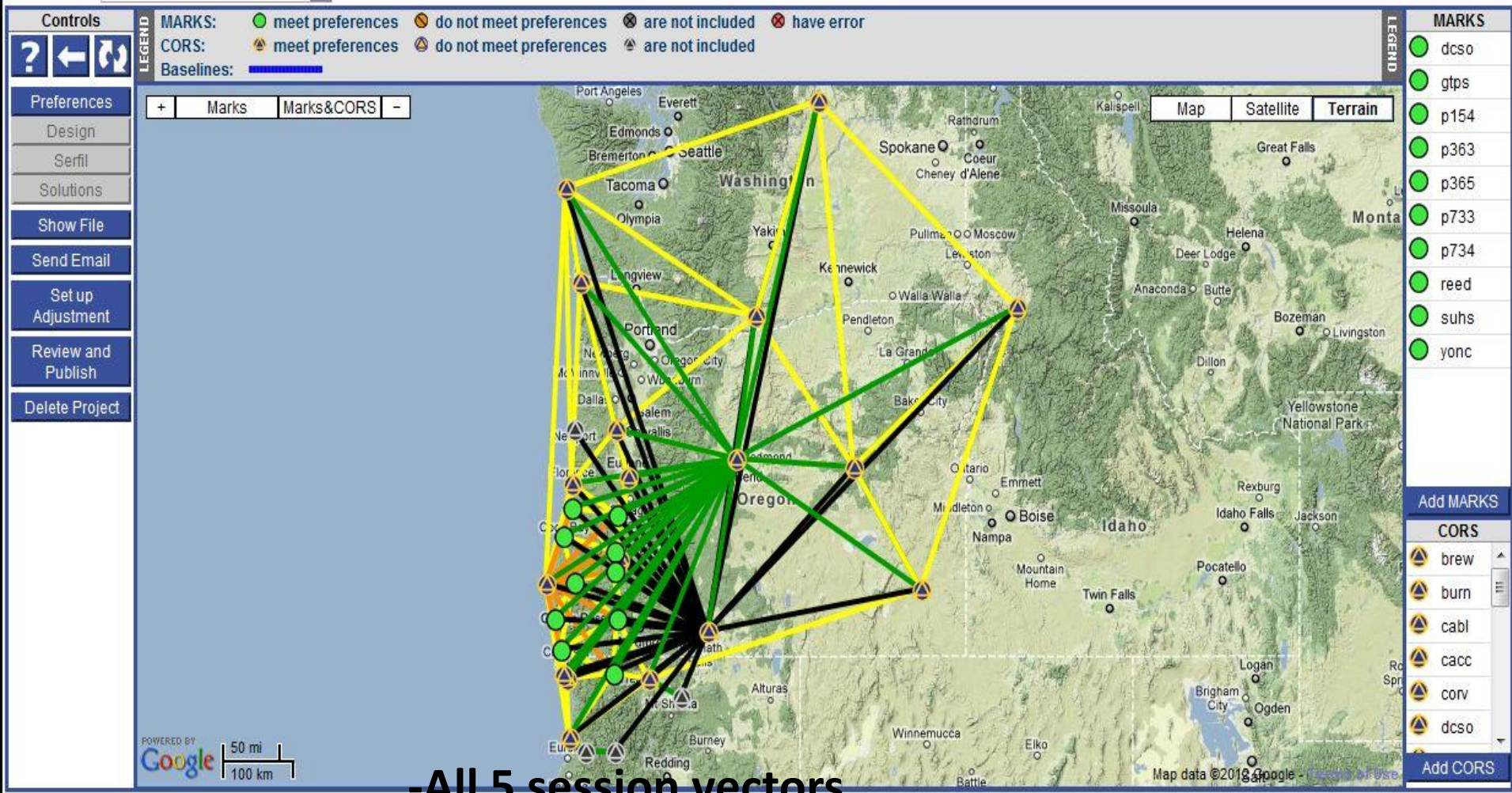
▲ idnp

Add CORS

-All CORS with 'computed velocities
-Chosen for mount stability,
geographical location, and future long
term ownership.

ORGN South Coast Cluster

Results From 2011-273-A-1

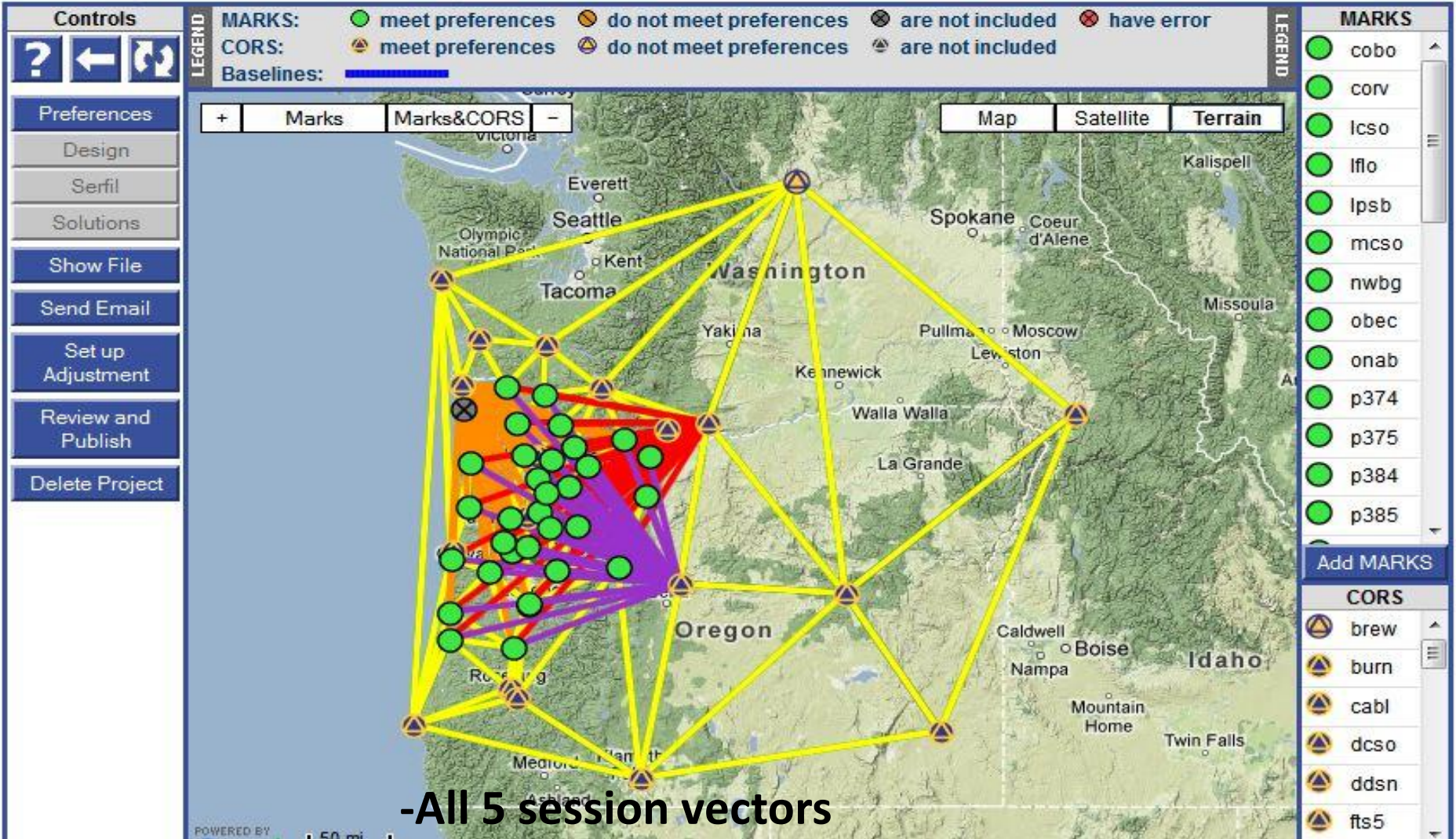


-All 5 session vectors

-Note that colors for sessions overlap each other

ORGN North Coast/Willamette Cluster

Results From ALL SESSION SOLUTIONS ▾

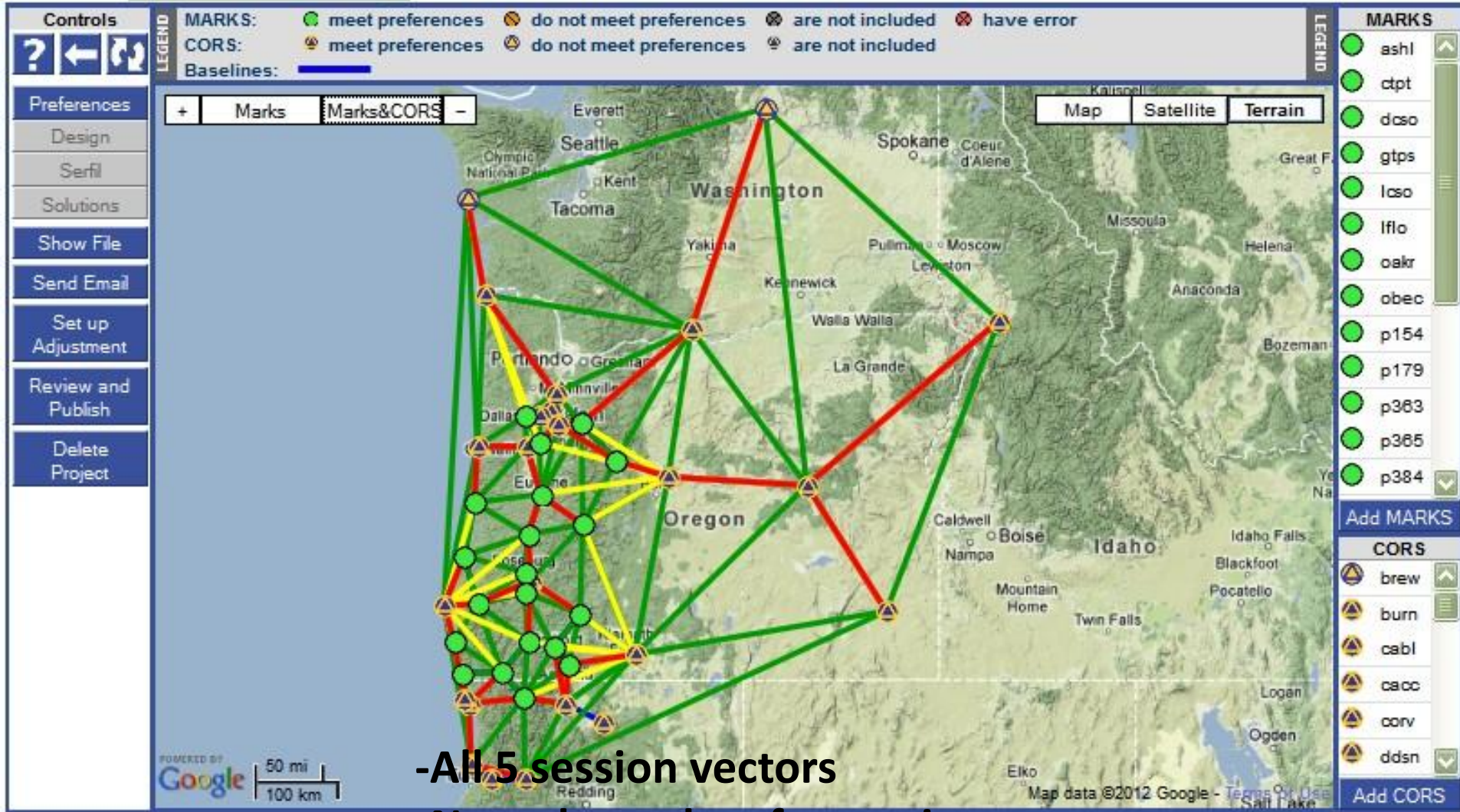


-All 5 session vectors

-Note that colors for sessions overlap each other

ORGN South Willamette/Rogue Cluster

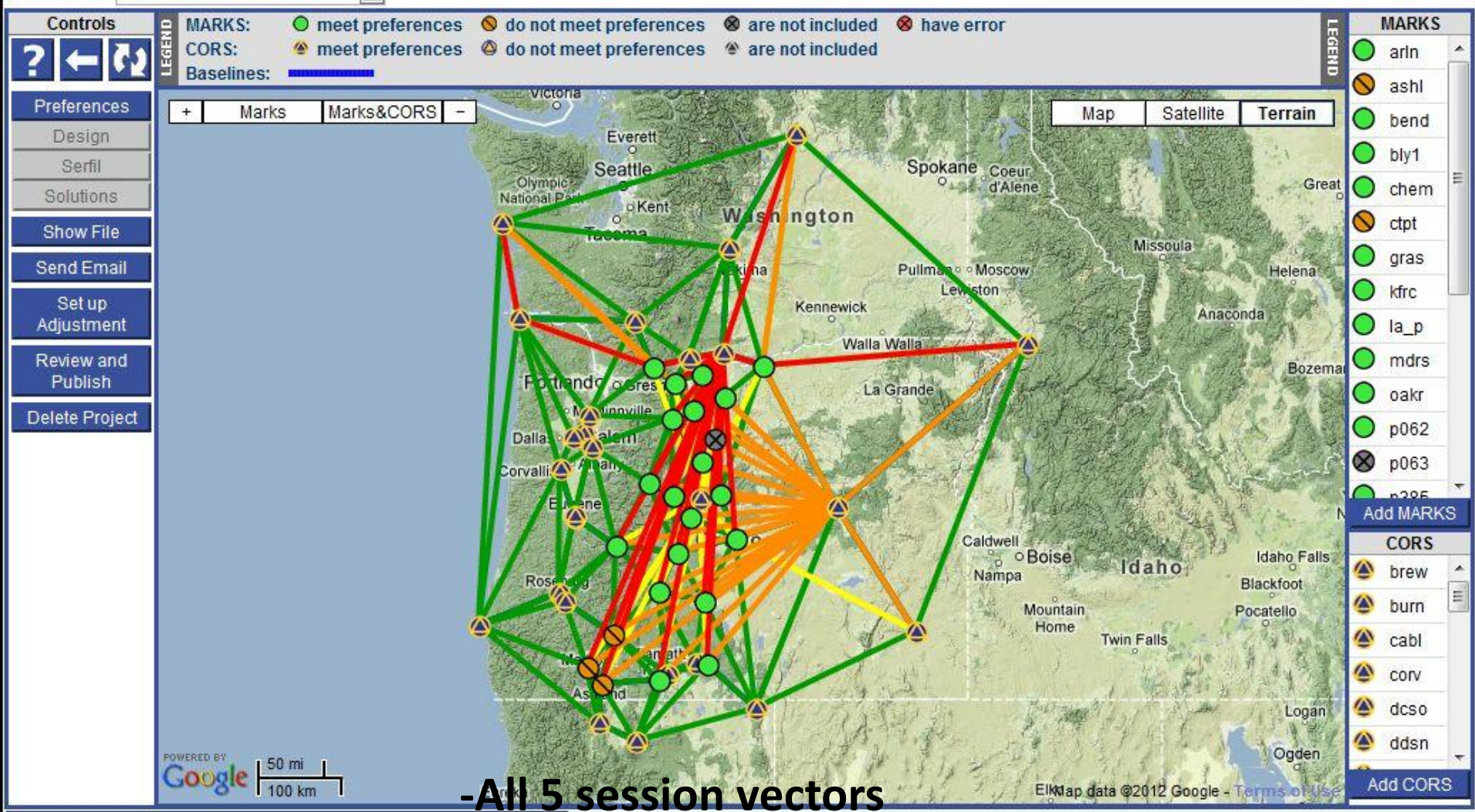
Results From ALL SESSION SOLUTIONS



-All 5 session vectors
 -Note that colors for sessions overlap each other

ORGN North/South Central Cluster

Results From ALL SESSION SOLUTIONS

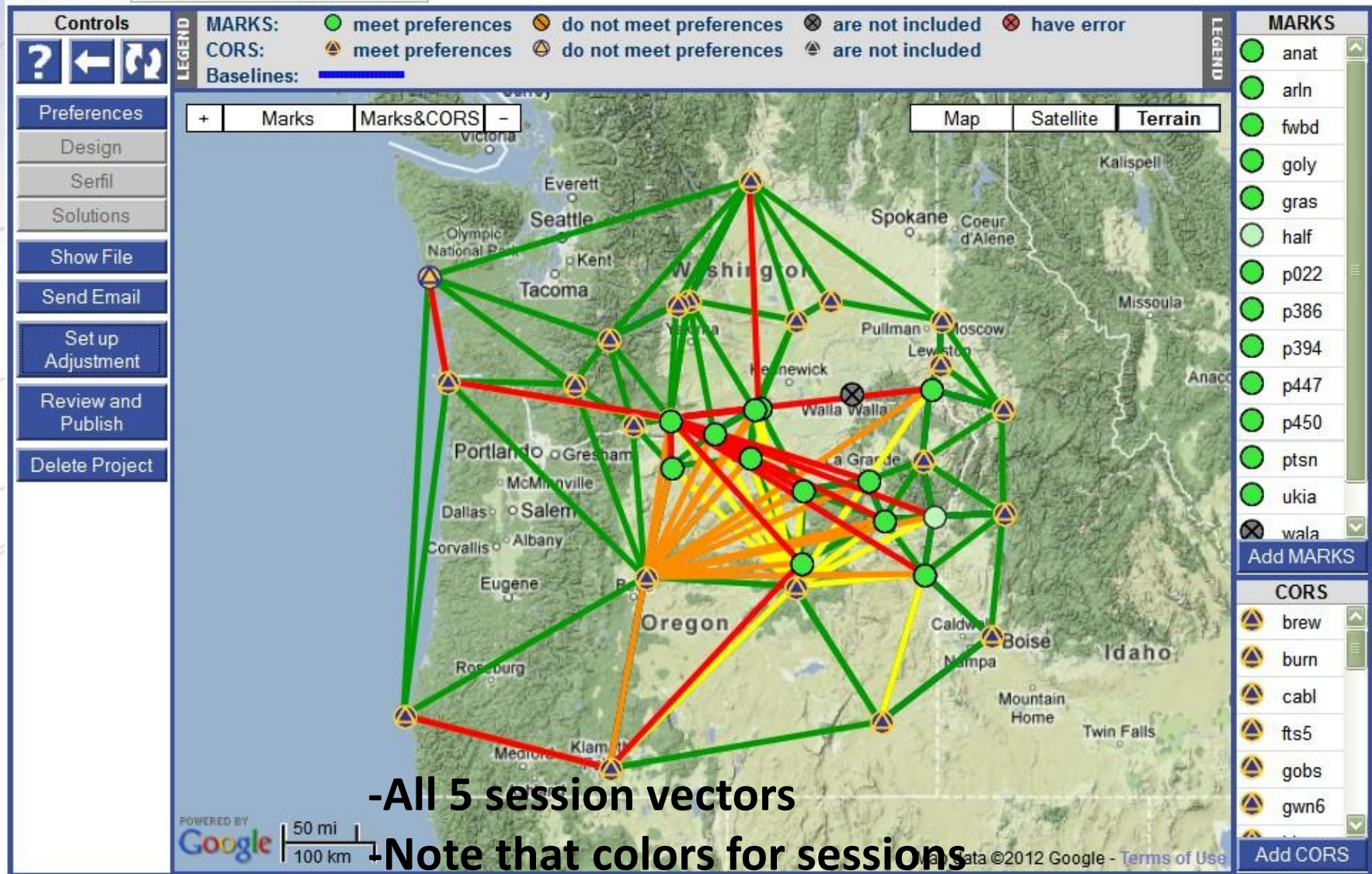


-All 5 session vectors

-Note that colors for sessions overlap each other

ORGN Northeast Cluster

Results From ALL SESSION SOLUTIONS



-All 5 session vectors
-Note that colors for sessions overlap each other

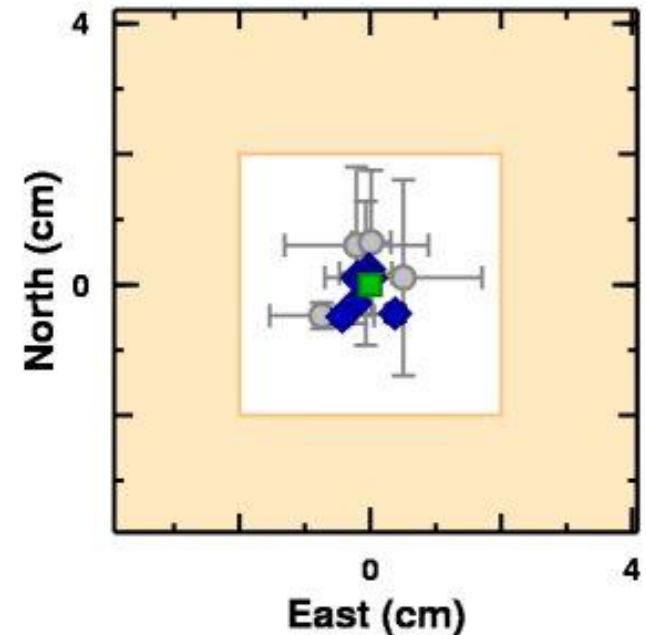
Active Station Mark Results (horiz.)

MARK dcso Plotted Solution Results From All Sources

Shaded (orange) areas in the plots are outside the project's preferences. ■ are network solutions. ◆ are session solutions. ● are OPUS solutions.

| ■ NETWORK SOLUTION | EAST (cm) | NORTH (cm) |
|--|-----------|------------|
| network-Final ORGN South Coast Cluster | 0.0 ±0.0 | 0.0 ±0.0 |
| ◆ SESSION SOLUTION | EAST (cm) | NORTH (cm) |
| 2011-269-A | -0.2 ±0.1 | -0.3 ±0.1 |
| 2011-269-A-1 | -0.4 ±0.1 | -0.5 ±0.1 |
| 2011-270-A | 0.4 ±0.1 | -0.4 ±0.1 |
| 2011-271-A | -0.1 ±0.0 | 0.1 ±0.1 |
| 2011-271-A-1 | 0.0 ±0.0 | 0.2 ±0.0 |
| 2011-272-A | 0.0 ±0.0 | 0.1 ±0.1 |
| 2011-272-A-1 | 0.0 ±0.0 | 0.1 ±0.1 |
| 2011-273-A | -0.2 ±0.0 | 0.1 ±0.1 |
| 2011-273-A-1 | -0.2 ±0.0 | 0.1 ±0.1 |
| ● OPUS SOLUTION | EAST (cm) | NORTH (cm) |
| dcso2690.11o | 0.0 ±0.3 | 0.7 ±1.1 |
| dcso2700.11o | -0.7 ±0.8 | -0.5 ±0.2 |
| dcso2710.11o | -0.2 ±1.1 | 0.6 ±1.2 |
| dcso2720.11o | -0.1 ±0.4 | 0.2 ±1.1 |
| dcso2730.11o | 0.5 ±1.2 | 0.1 ±1.5 |

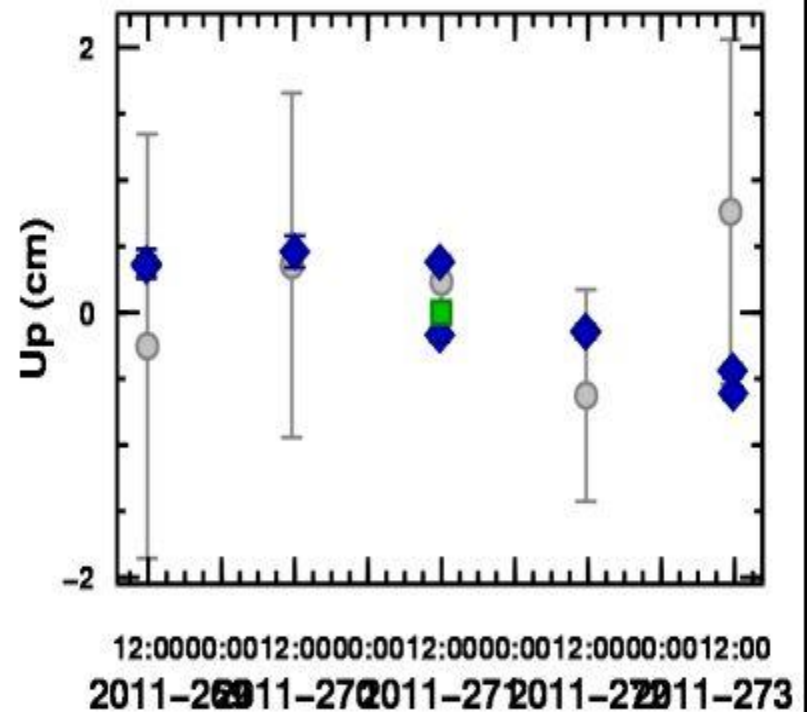
The (0, 0) point represents W123:20:29.45080 by N43:12:39.63099.



Active Station Mark Results (vert.)

| ■ NETWORK SOLUTION | EPOCH | UP (cm) |
|--|-----------------------|-----------|
| network-Final ORGN South Coast Cluster | 2011-271T11:59:45GPST | 0.0 ±0.0 |
| ◆ SESSION SOLUTION | EPOCH | UP (cm) |
| 2011-269-A | 2011-269T11:43:01GPST | 0.4 ±0.1 |
| 2011-269-A-1 | 2011-269T11:42:58GPST | 0.4 ±0.1 |
| 2011-270-A | 2011-270T11:59:45GPST | 0.5 ±0.1 |
| 2011-271-A | 2011-271T11:43:31GPST | -0.2 ±0.1 |
| 2011-271-A-1 | 2011-271T11:43:24GPST | 0.4 ±0.0 |
| 2011-272-A | 2011-272T11:37:17GPST | -0.1 ±0.1 |
| 2011-272-A-1 | 2011-272T11:37:39GPST | -0.1 ±0.1 |
| 2011-273-A | 2011-273T11:46:02GPST | -0.6 ±0.1 |
| 2011-273-A-1 | 2011-273T11:38:56GPST | -0.4 ±0.1 |
| ● OPUS SOLUTION | EPOCH | UP (cm) |
| dcso2690.11o | 2011-269T11:51:21GPST | -0.3 ±1.6 |
| dcso2700.11o | 2011-270T11:30:28GPST | 0.4 ±1.3 |
| dcso2710.11o | 2011-271T12:02:09GPST | 0.2 ±0.2 |
| dcso2720.11o | 2011-272T11:41:16GPST | -0.6 ±0.8 |
| dcso2730.11o | 2011-273T11:20:23GPST | 0.8 ±1.3 |

The UP 0 point represents 136.78328 m.



Details and Checks

- Each cluster adjustment constrained the same 10 control stations.
- Control was allowed to move $\leq 0.01\text{m}$ in 3D during adjustment.
- Most stations occurred in more than one cluster which providing independent check and if uncertainties were similar then solutions were averaged (mean).

National Geodetic Survey Ten-Year Plan

- Approved January, 2008
- Refines mission, vision, & strategy for the future of NGS actions
- Emphasis on outside capacity
 - **Modernize the Geometric (“Horizontal”) Datum**
 - **Modernize the Geopotential (“Vertical”) Datum**
 - Migrate the Coastal Mapping Program >>> Integrated Ocean & Coastal Mapping
 - Evolve Core Capabilities
 - Increase Agency Visibility



Questions?

