

CORS/OPUS: Status & Future Prospects

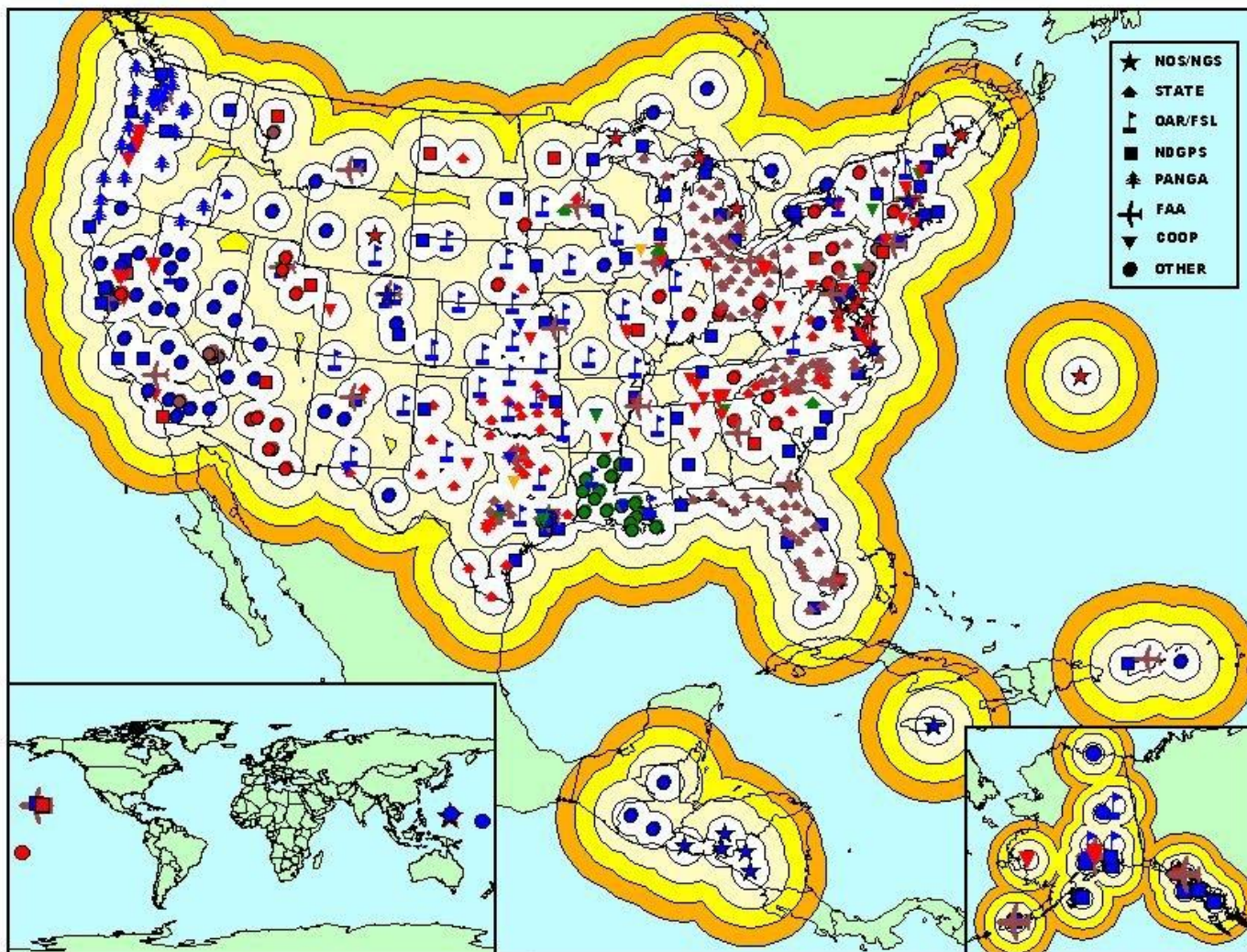
Richard Snay, Gerald Mader, & Neil Weston
NOAA's National Geodetic Survey

CORS Users Forum
44th CGSIC Meeting
Long Beach, CA
September 21, 2004



Continuously Operating Reference Stations

CORS Coverage (100, 200, 300, and 400 km radius) June 2004



Symbol color denotes sampling rates: (1 second) (5 seconds) (15 seconds) (30 seconds)

CORS OVERVIEW

- Network contains 850+ sites as of Sep. 2004
- Growing at rate of 8 sites per month
- More than 130 organizations participate in the CORS program
- Provides code range (C/A, P1, P2)
 - and carrier phase observations (L1, L2)
- Provides meteorological data at some sites

CORS APPLICATIONS

- Postmission Static Positioning (cm-level accuracy with a few hours of data, dm-level accuracy with one minute of data)
- Postmission Kinematic Positioning (dm-level accuracy for an aircraft, a boat, or a land vehicle)
- Geophysics / Crustal Motion
- Meteorology / Water Vapor in Atmosphere
- Space Weather / Free Electrons in Ionosphere

CORS Accomplishments in FY 2004

- NGS orbits improved by 50% (8cm → 4cm)
- NOAA's Forecast Systems Lab provides hourly models for tropo delay
- OPUS accepts non-RINEX data files
- CORS West becomes operational
- Plate Boundary Observatory funded
- UFCORS offers 'same-day' service

Accomplishments - continued

- NGS generates comprehensive map of 3-D velocities for CONUS
- NGS and NOAA's Space Environment Center develop capability to model the distribution of free electrons in the ionosphere
- OPUS enables users to select Coop CORS sites for control stations

Accomplishments - continued

- National CORS network rapidly approaching 500-station milestone
- Cooperative CORS network rapidly approaching 100-station milestone
- NGS develops new software to
 - (1) manage CORS metadata
 - (2) monitor site status, and
 - (3) monitor data collection

Accomplishments - continued

- NGS publishes transformation relating NAD 83 (CORS96) to ITRF00
- NGS and Natural Resources Canada agree to an open policy for distributing GPS data and utilizing positioning services (OPUS & PPP)
- NGS establishes four real-time CORS
- CORS products and services provide \$150 million of benefits in FY 2004

Accolades

- GeoWorld magazine recognized OPUS as its Internet Resource of the month for March 2004
- Mark Meade published the article, “CORS: Still a national asset” in the September 2004 issue of Point of Beginning (POB) magazine

What is OPUS?

- Provide GPS users easier access to the National Spatial Reference System (NSRS).
- Direct connections to CORS network
- Consistency and reliability
- Intended for use in the conterminous U.S. and territories.

It is NGS policy to not publish geodetic coordinates outside the U.S. without the agreement of the affected countries.

How Does OPUS Work?

- Submit GPS data files to NGS
 - Through NGS web site
 - Uses NGS computers and software
 - Processed with respect to 3 CORS sites
 - Reported back to you via email in a few minutes
- Completely automatic - minimal information from user
 - email address where you want the results sent
 - data file that you want to process
 - Rinex or raw receiver formats
 - Multiple files in zipped/compressed format
 - antenna type
 - height of the Antenna Reference Point (ARP)
 - Options
 - state plane coordinate code
 - Specify CORS base stations
 - Extended output



- Search for

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GPS data Find/Update a point

Monday, March 15, 2004

- [Upcoming Events](#) • [NGS In The News](#) •
- [The Observer](#) Newsletter •

Check these out...

NGS Dedicates Commemorative Marker at U.S. Mint in Philadelphia: On March 12, NOAA dedicated a survey marker at the U.S. Mint in Philadelphia that commemorates Lewis and Clark's expedition across America two hundred years ago. ... [more info](#) ... Denver Mint dedication is March 15.

Cooperative CORS Providers/Users Group Meeting: The 2nd Annual Cooperative CORS Providers/Users Group Meeting will be held at the [ACSM conference](#) in Nashville. ... [more info](#)

New Options added to OPUS: This new version of OPUS optionally allows users control over which CORS sites are used for a solution, to receive their output in an extended format, and have their solution computed in State Plane coordinates. See Option #5 on the [OPUS main page](#).

Lewis And Clark Bicentennial: To honor Lewis and Clark's contributions to mapping, NGS is installing a series of commemorative markers along the route that Lewis and Clark traveled.

The National Readjustment

Quick Link to OPUS
from NGS Home Page
www.ngs.noaa.gov



ARP

The height is measured vertically (NOT the slant height) from the mark to the ARP of the antenna.

The height is measured in meters.

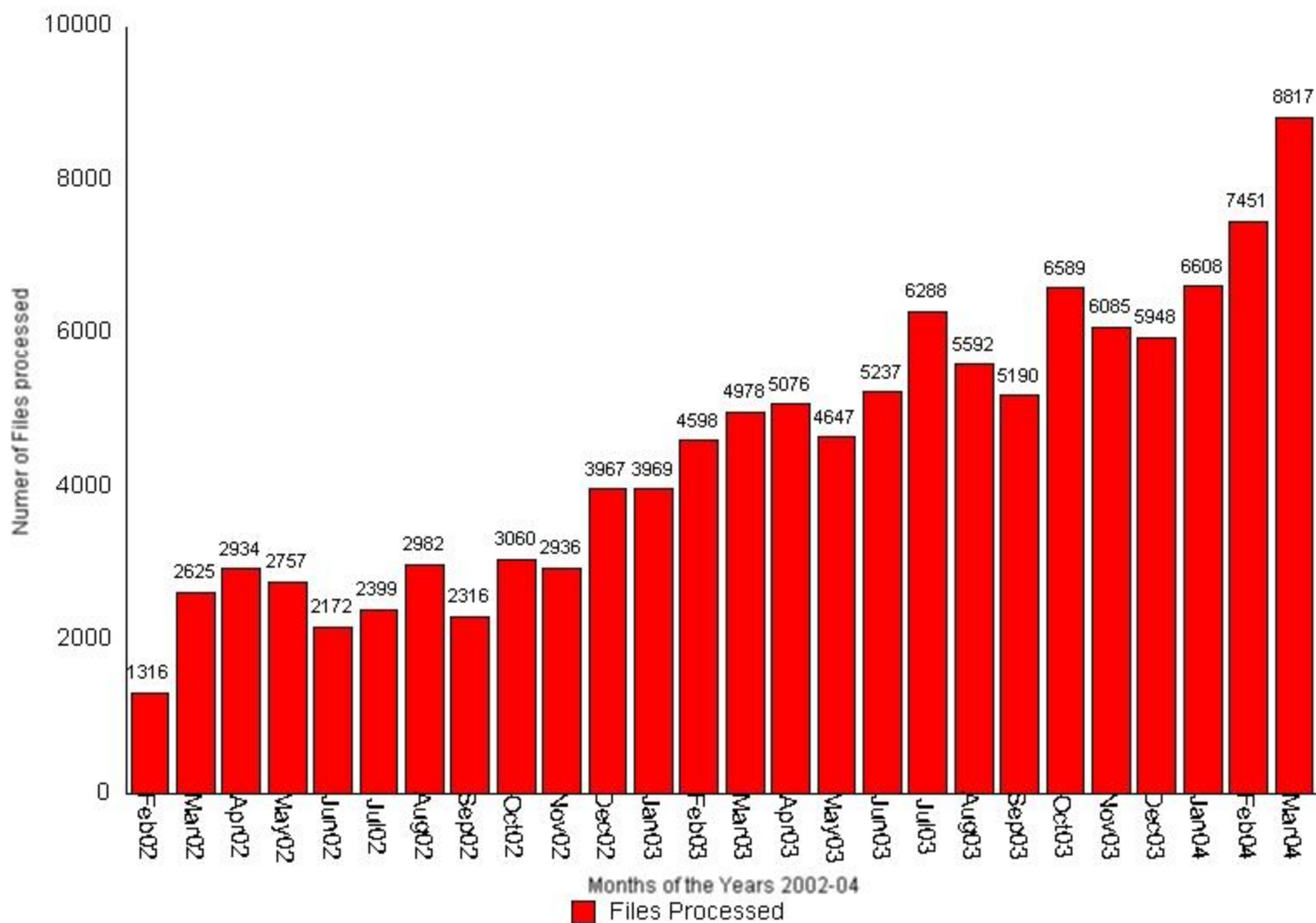
The ARP is almost always the center of the bottom-most, permanently attached, surface of the antenna.

See [GPS Antenna Calibration](#) for photo's and diagrams that show where the ARP is on most antennas.

If 0.0000 is entered for the height, OPUS will return the position of the ARP.

MARK

OPUS Statistics for 2002-04 Files Processed



User Profile Option

OPUS allows the antenna type, antenna height, SPC code, selected base stations and extended option choices that you have just identified to be assigned to the email address that you have entered. These entries & selections will be saved and used for your next OPUS submission, saving time for multiple or repetitive submissions using the same equipment and options configuration. When your profile is set, you will only need to enter your email address and your data file and then upload. Your profile will automatically supply the saved entries. When you data is finished uploading, the upload page will display your profile entries.

To change and reset your profile, complete all the main page entries to gain access again to the options page. You may also elect to delete your profile. (Hint: You might use different email alias's to identify different equipment and processing configurations that you frequently use)

- **Set / Reset my profile**
- **Delete my profile**

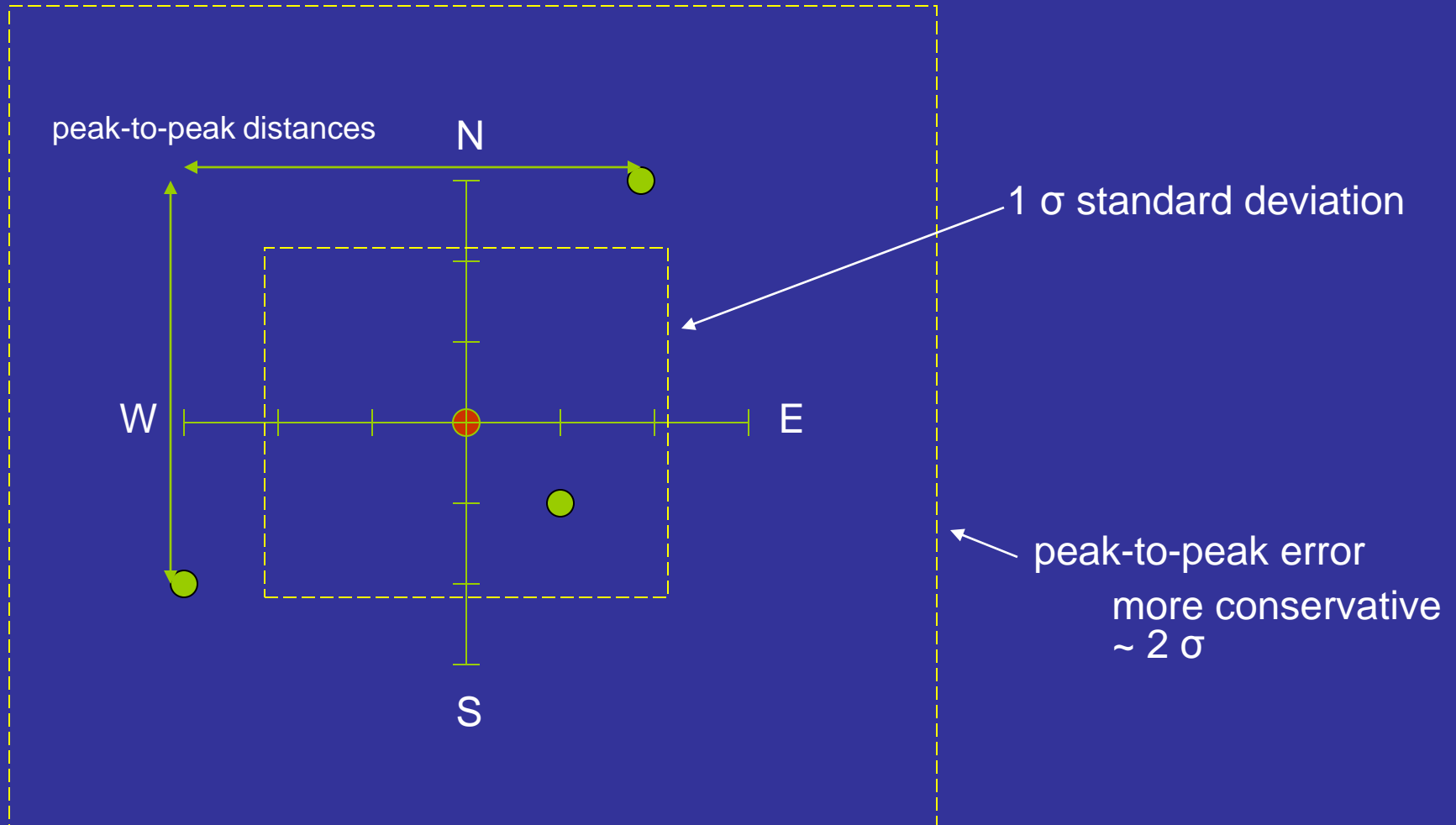
Option to Archive OPUS Results in NGS Data Base under Consideration

OPUS solutions meeting certain *criteria* and accompanied by metadata describing the site may be eligible for publication as Data Sheets in the NGS Integrated Data Base (NGSIDB). Users submitting OPUS solutions to the NSGIDB must be registered with NGS to receive a user ID and password and agree to the terms of this publication.

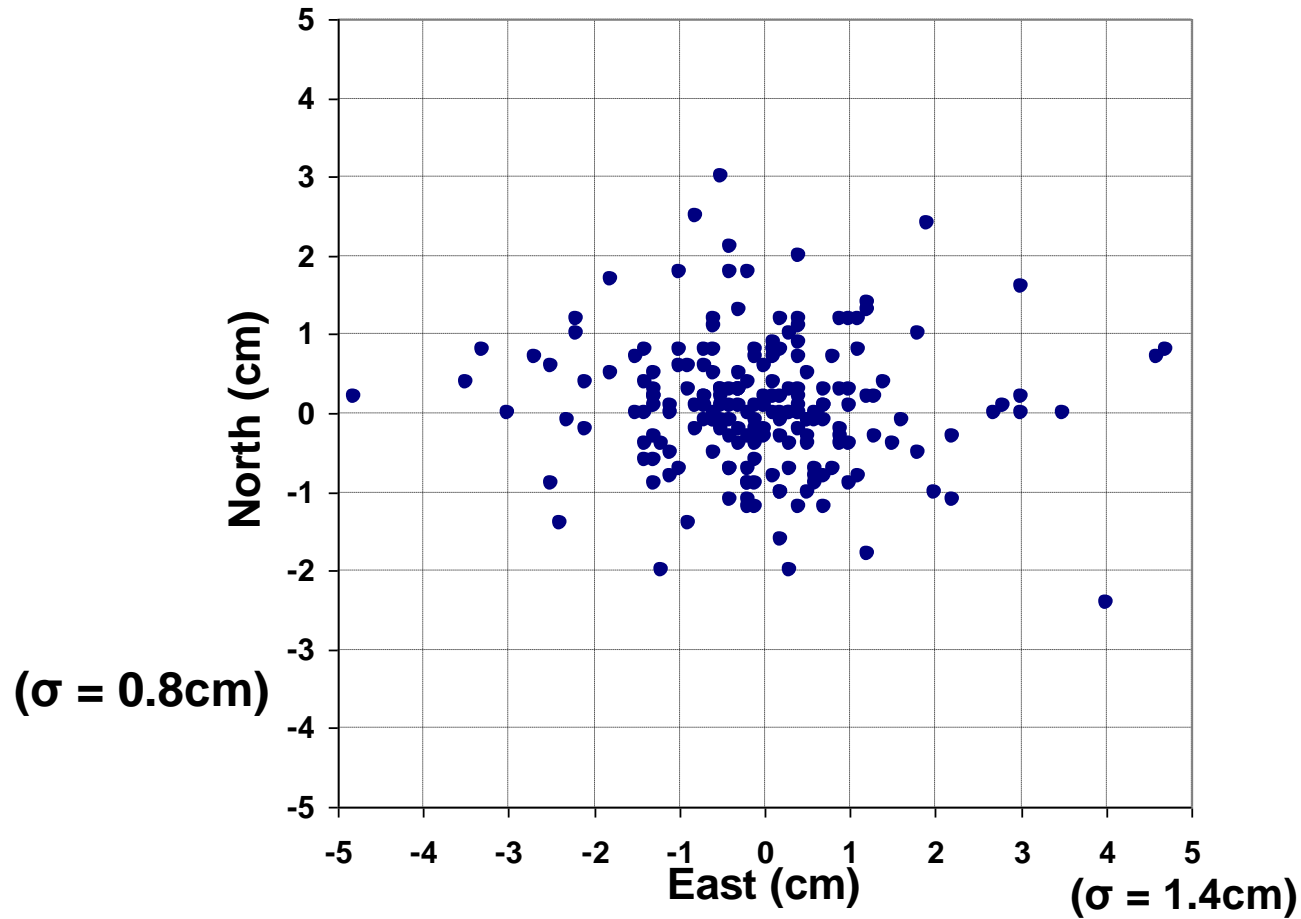
OPUS – coming attractions

- Differential Range Solutions (2005)
 - Meant to enhance handheld GPS
 - Address GIS community
- Single Frequency Solutions (2005)
 - Requires ionosphere modeling

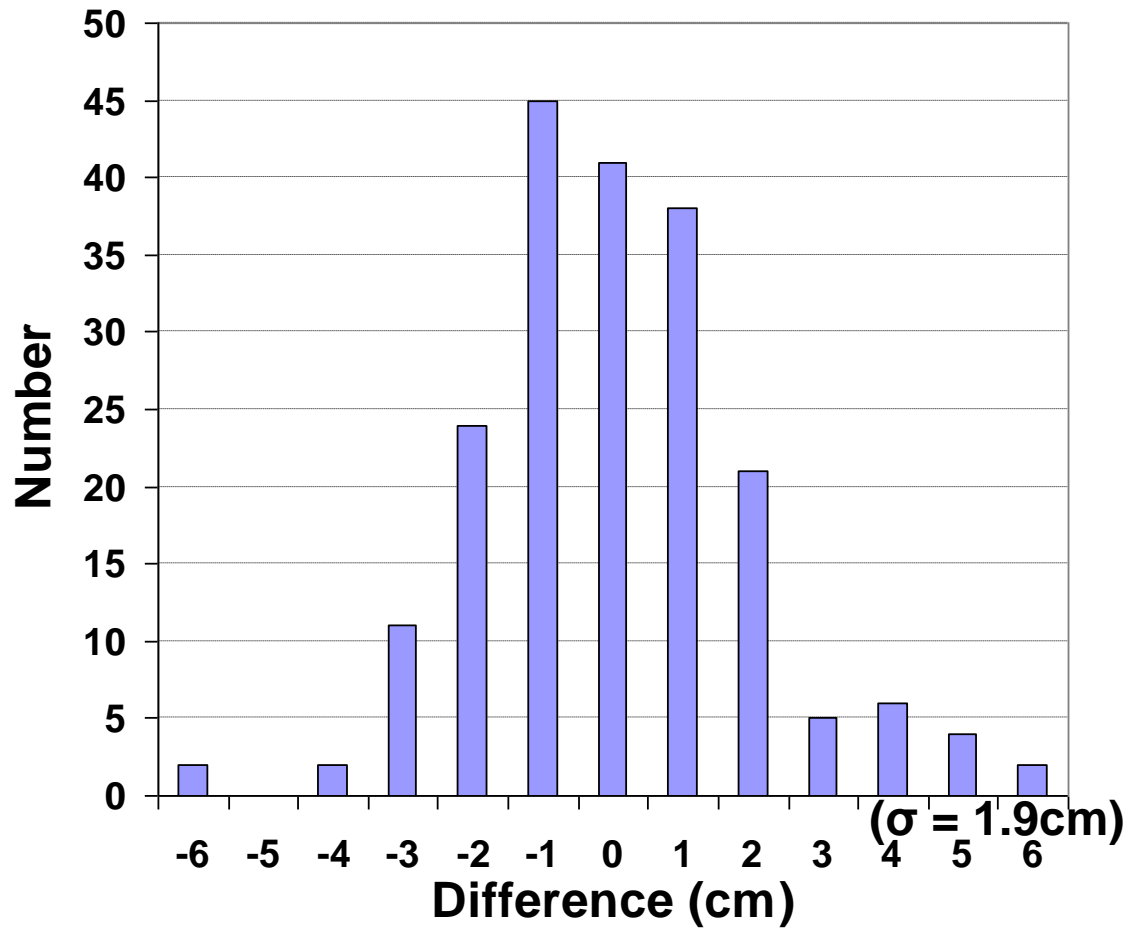
How Does OPUS Compute Errors?



Horizontal Distribution From Accepted Values



Vertical Distribution From Accepted Values



OPUS for projects that deploy multiple GPS receivers over a period of time

- OPUS enables project manager to create a directory on NGS computer to organize/manage project data and its processing
- Project manager uploads data files into the appropriate directory as these files become available
- Reports sent to project manager
- Project manager activates a solution for each day of data when ready
- Project manager reviews individual solutions for each day of data and edits data as necessary
- Project manager activates an adjustment for combining the individual daily solutions into a single solution
- Project manager reviews combined solution and edits data as necessary

OPUS ergo sum!



www.ngs.noaa.gov