



CORS, OPUS, and Reprocessing status

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with significant contributions from the CORS and OPUS team
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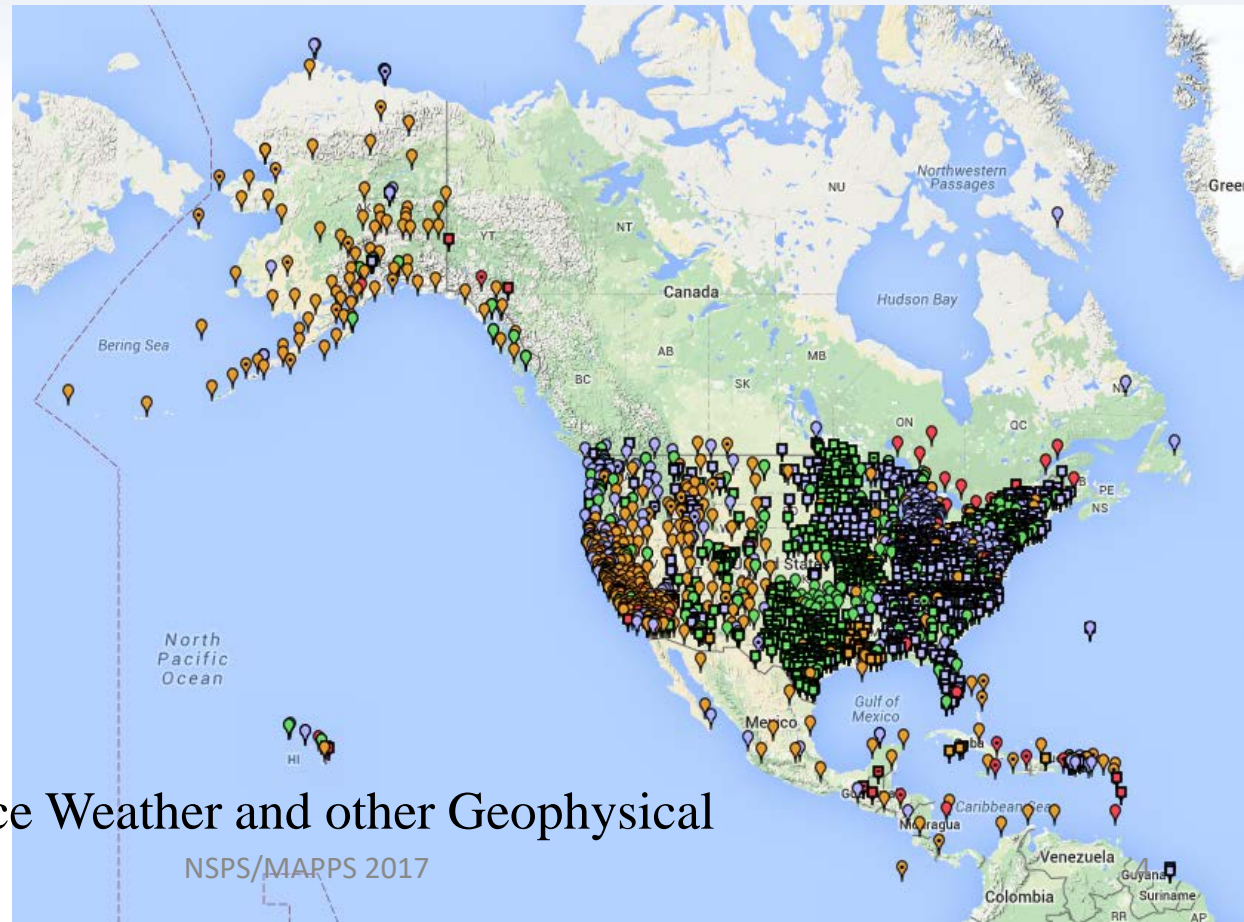
- National Spatial Reference System
- CORS status
- Accessing the NSRS using OPUS
- Why Reprocessing?
- Future of CORS

National Spatial Reference System

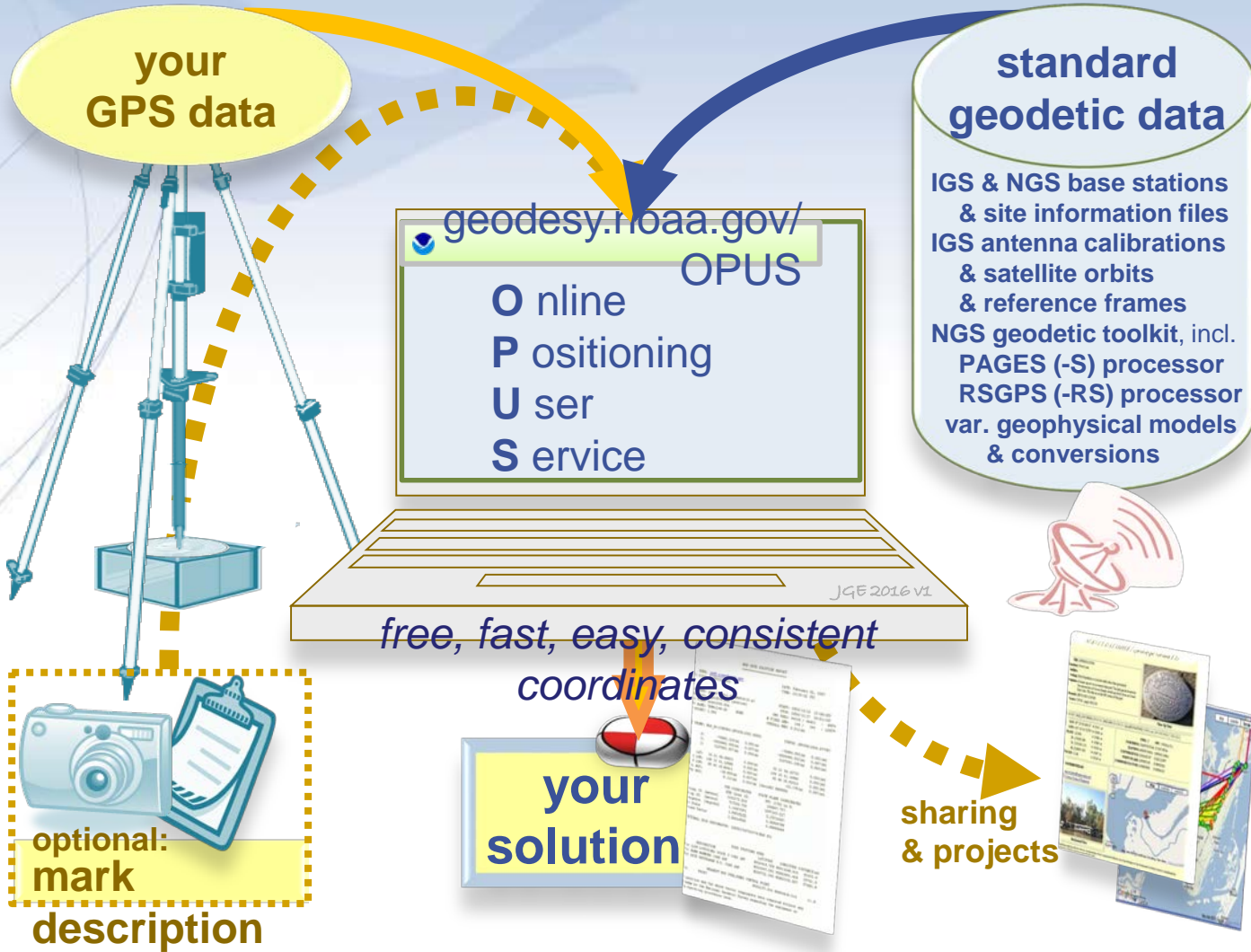
- NOAA's National Geodetic Survey (NGS) defines, maintains, and provides access to the National Spatial Reference System (NSRS)
 - Consistent coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States
- Continuously Operating Reference Stations (CORS)
 - Maintains and monitors 3-dimensional coordinates of the ground stations and GPS orbits to provide direct access to NSRS

U.S. CORS Network

- ~2000 Continuously Operating Reference Stations
 - Run by various agencies and research groups
 - Provide access to the U.S. National Spatial Reference System

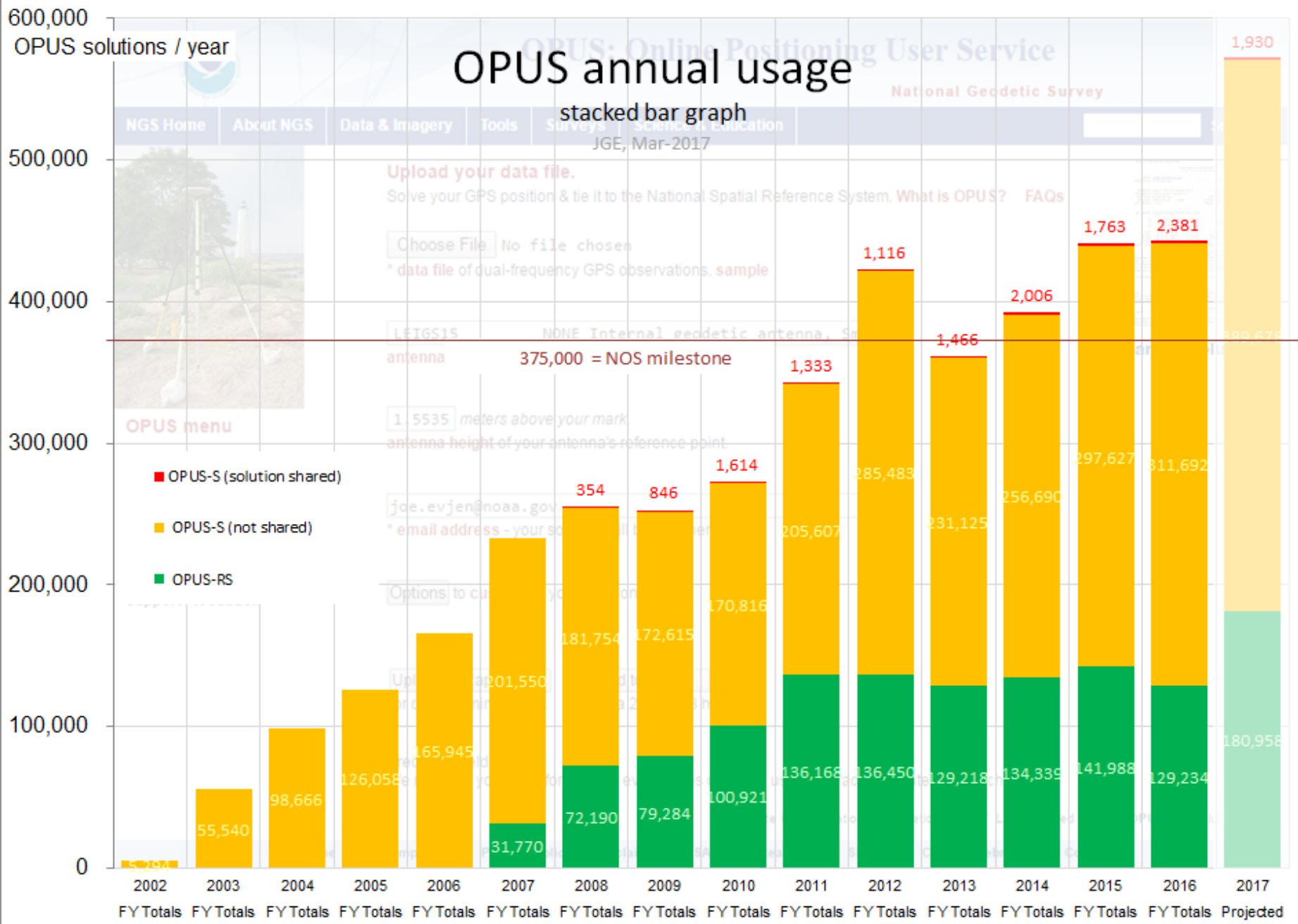


- Also support Space Weather and other Geophysical applications.

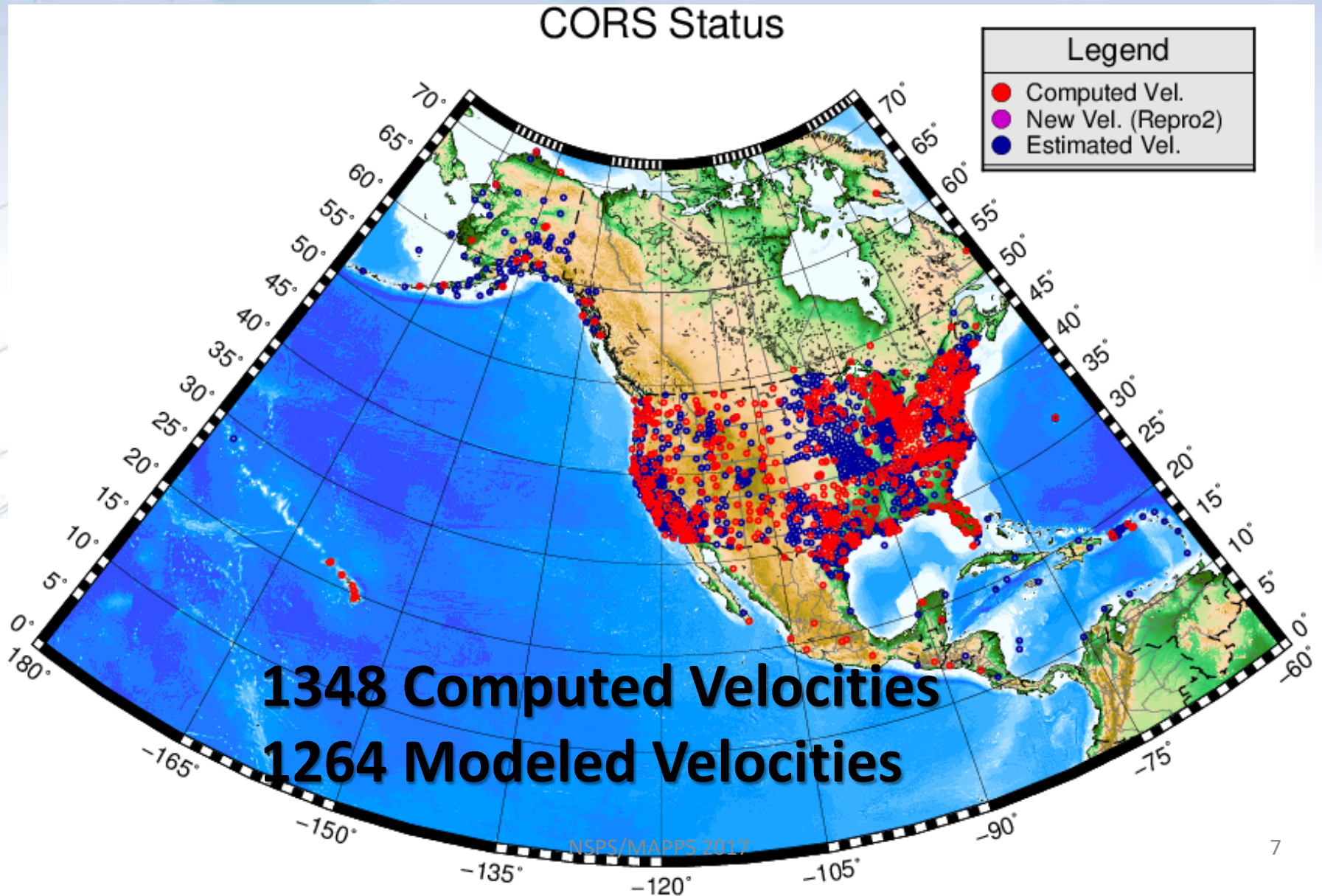


OPUS annual usage

stacked bar graph



Current CORS stations



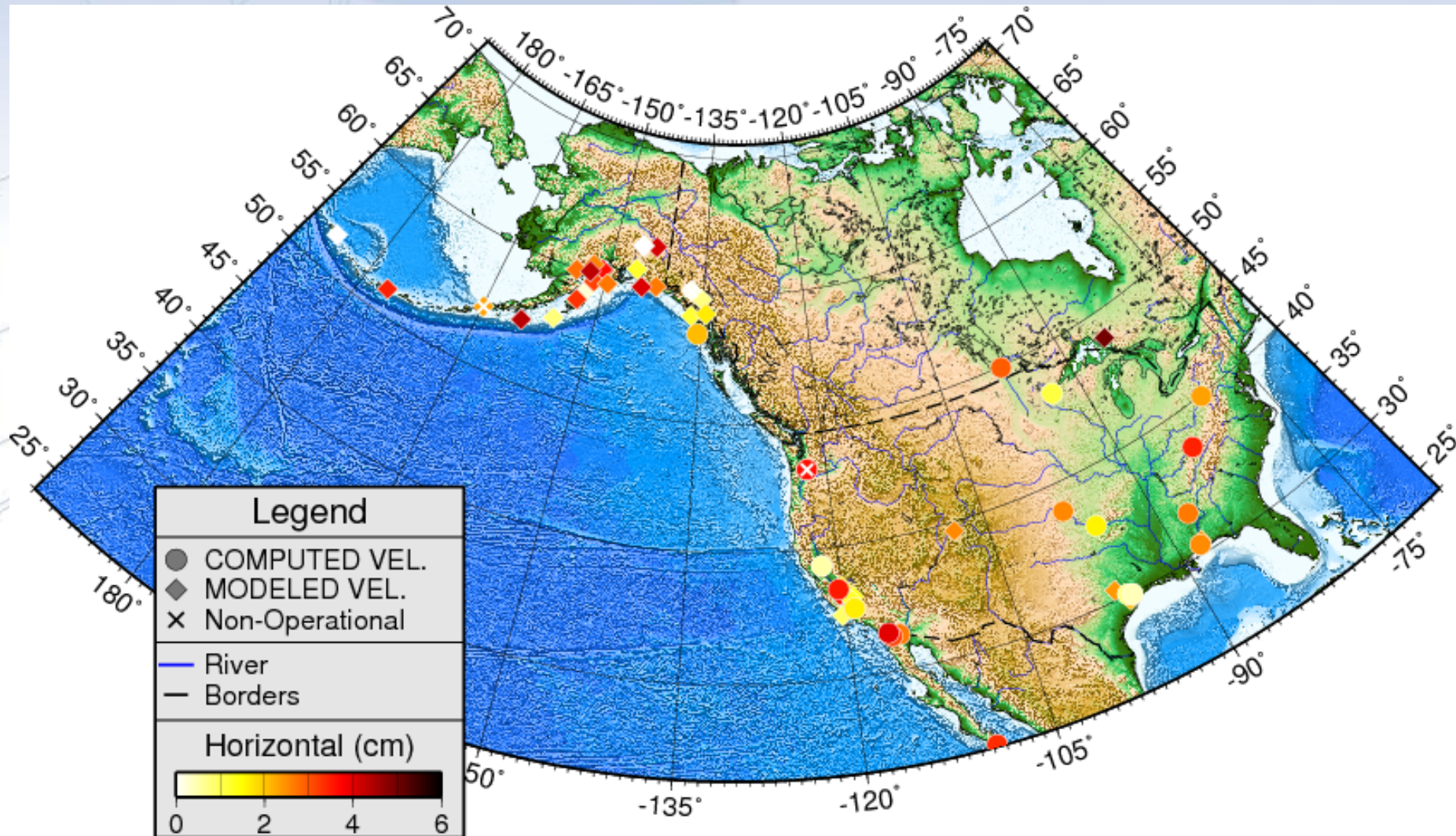
Reprocessing Campaigns

- Why reprocessing?
 - Consistent use of up-to-date geophysical models (IERS convention)
 - Consistent processing strategies
 - Linearize plate rotation velocities
 - Refine station velocities by accommodating earthquakes and equipment changes (discontinuities)
 - Realign to the updated ITRF.
 - ITRF2014 and corresponding IGS14 has been released.

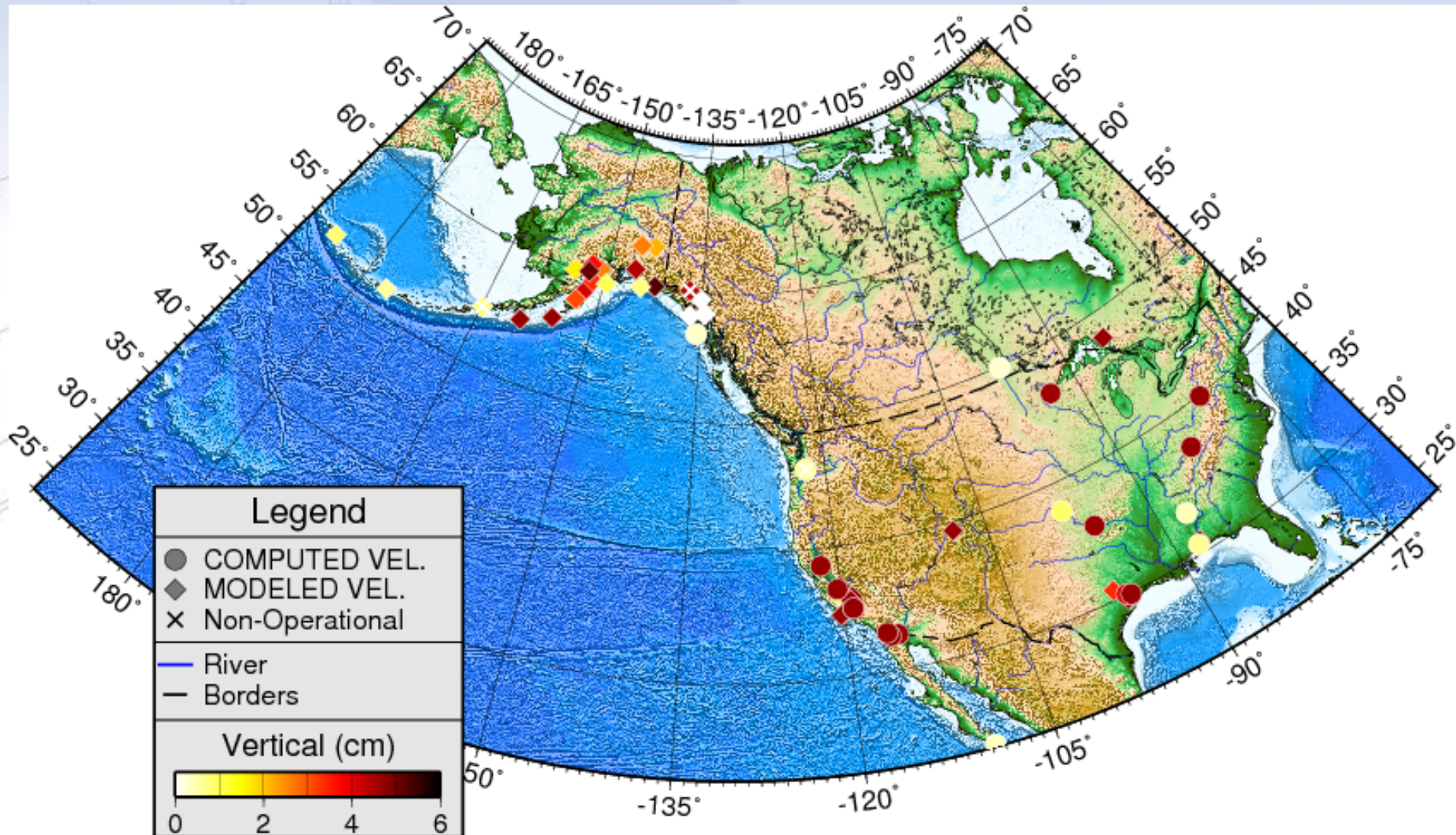
Out-of-Tolerance CORS coordinates

- Stations outside of 2/4 cm (H/V) threshold
 - Excluded in the OPUS processing
- Sept 19 2013 – Mar 19, 2016 (2.5 years)
 - 24 Repro1 stations
 - 43 Modeled velocity stations (horizontal model only)
 - Geophysically active area
 - Alaska, California
 - Short data span
 - Subsidence area
 - ~900 new CORS stations since Repro1

Out-of-Tolerance CORS coordinates



Out-of-Tolerance CORS coordinates

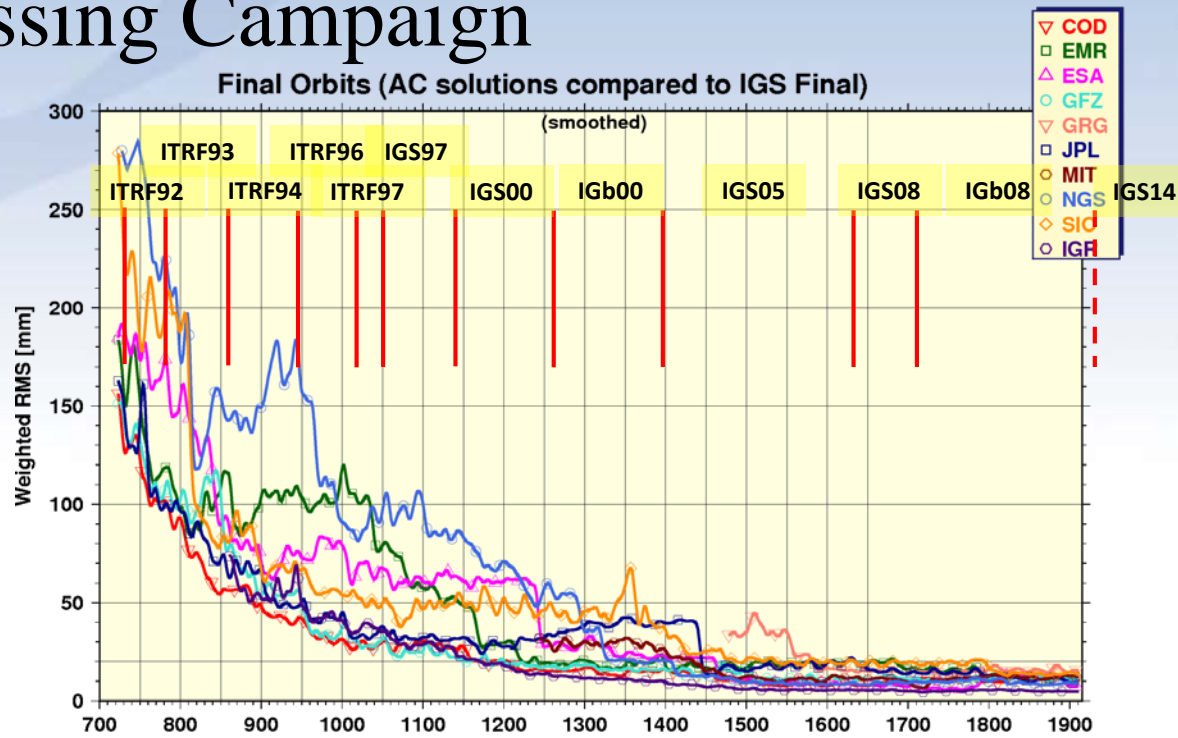


IGS Reprocessing Recommendations

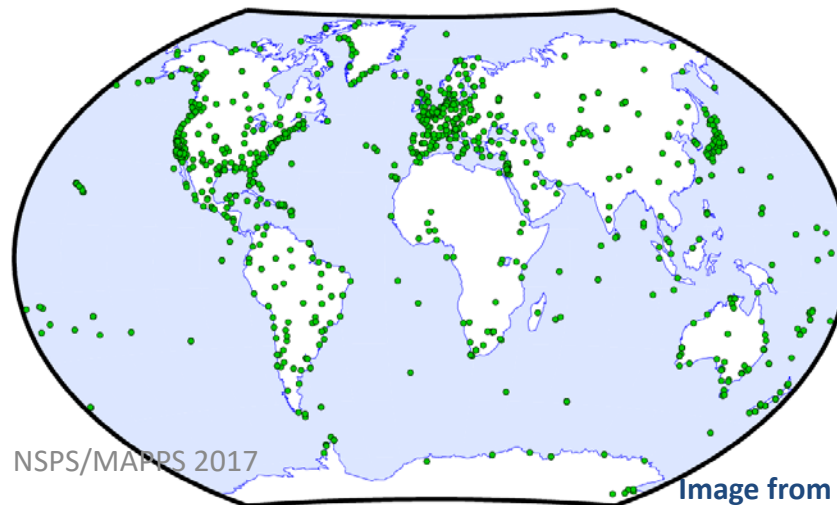
	1 st Reprocessing	2 nd Reprocessing
Duration	1994 - 2007	1994 - 2014
<i>Reference Frame</i>	IGS05 (aligned to ITRF2005)	IGb08 (aligned to ITRF2008)
<i>IERS Convention</i>	IERS 2003	IERS 2010
<i>Geopotential Field</i>	EGM96	EGM2008 <ul style="list-style-type: none"> time-variations of low-degree coefficients mean pole trajectory model
<i>Antenna calibration</i>	IGS05 ANTEX (absolute calibration)	IGS08 ANTEX (absolute calibration)
<i>Tropospheric delay model</i>	GPT / GMF	GPT2 / VMF1_HT
<i>Higher order Ionosphere</i>	Not applied	IERS 2010 & IGRF11 (2 nd order)
<i>Ocean Pole Tide (Station Displ.)</i>	Not applied	IERS 2010
<i>Orbit Dynamics</i>	No Earth Albedo model	Earth Albedo model [1][2][3] Block specific SV thrusting (ERPFBOXW.f)

NGS 2nd Reprocessing Campaign

- NGS' Orbit product quality has been very stable in recent years,
- IGS Repro2 is completed and ITRF2014 was released in Jan. 2016
 - Periodic Signal models
 - Post-Seismic Deformation models
- IGS14 orbit/clock has been started since Jan 29, 2017

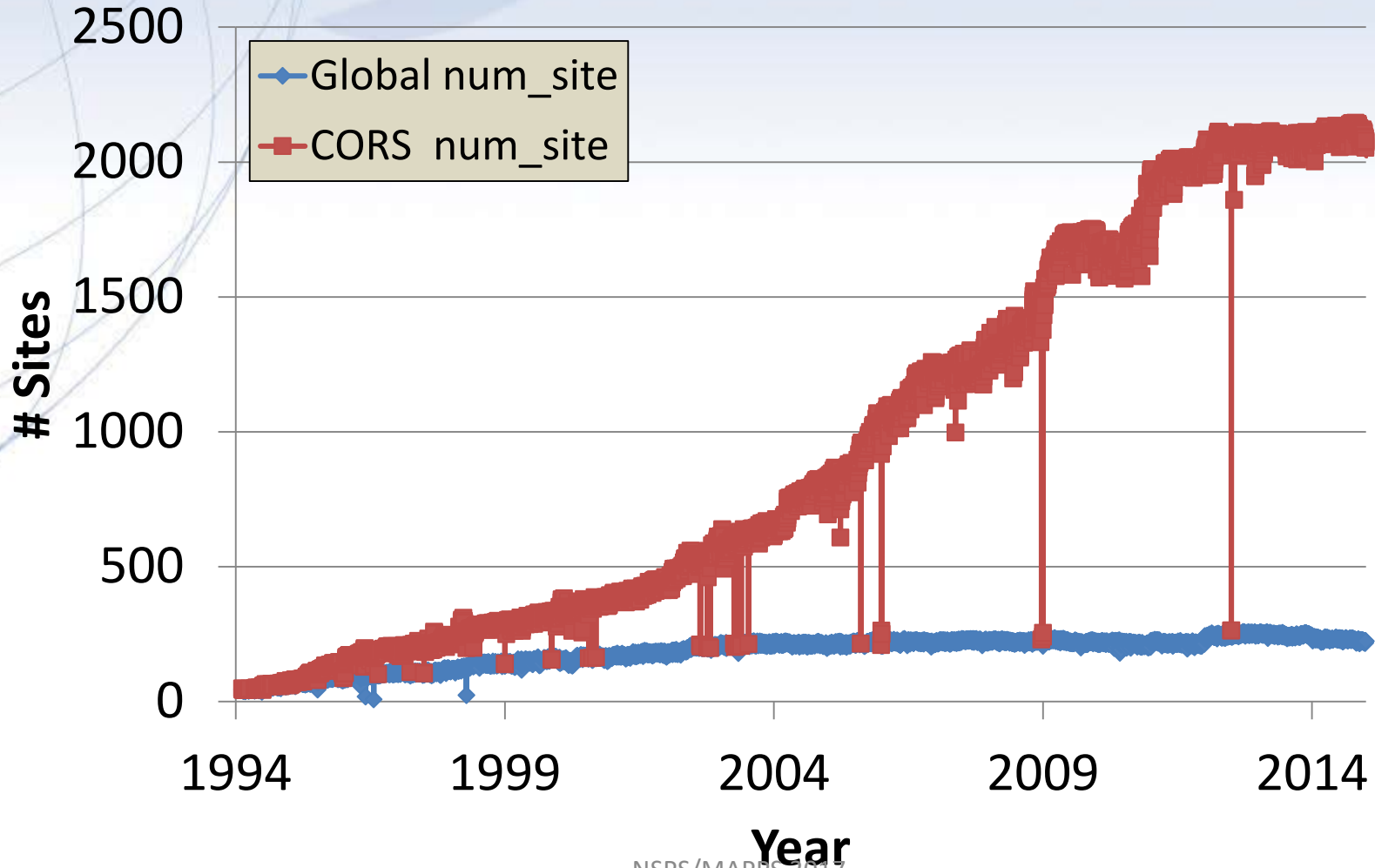


strails/MIT, 8.09.2016 20:16 (GMT)



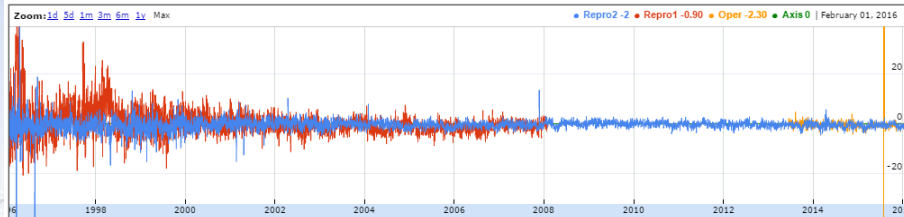
NSPS/MAPPS 2017

NGS 2nd Reprocessing Campaign

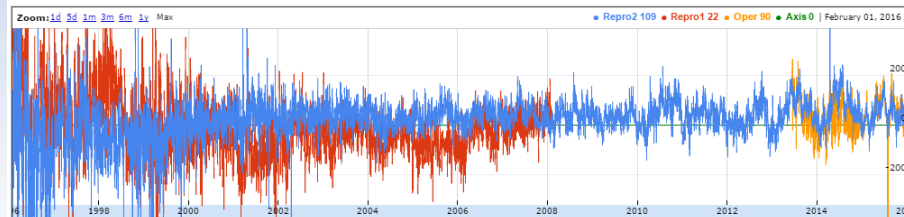


NGS 2nd Reprocessing Preliminary Orbit Quality

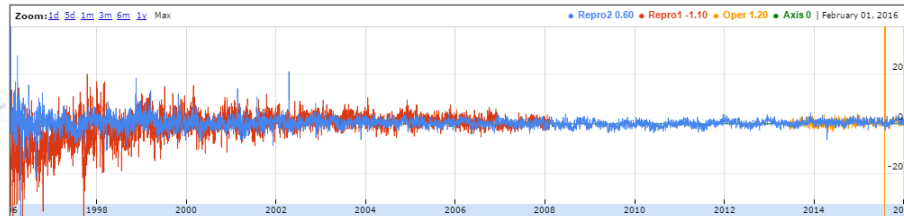
TX (mm)



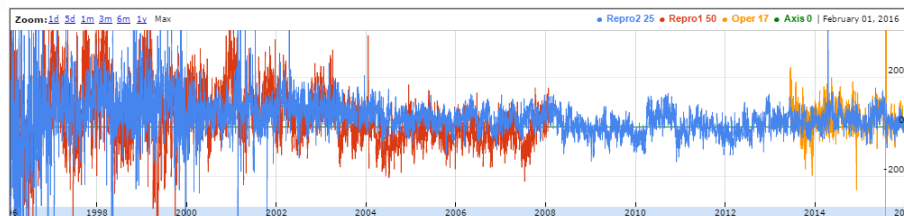
RX (uas)



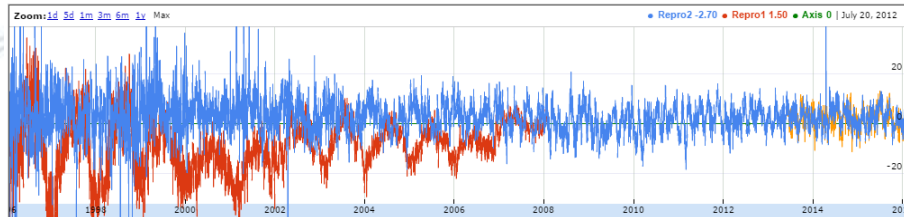
TY (mm)



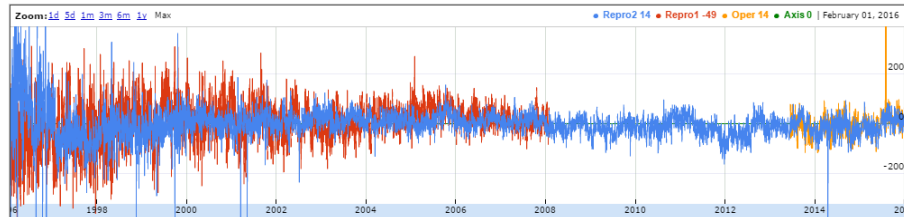
RY (uas)



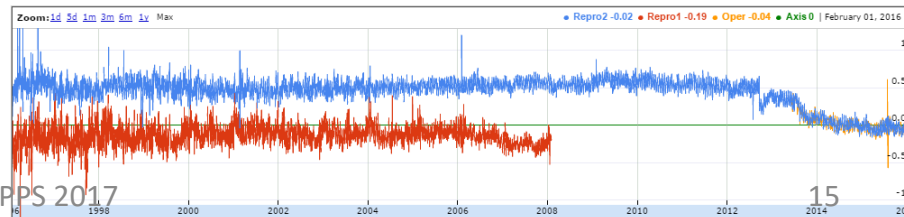
TZ (mm)



RZ (uas)



SC

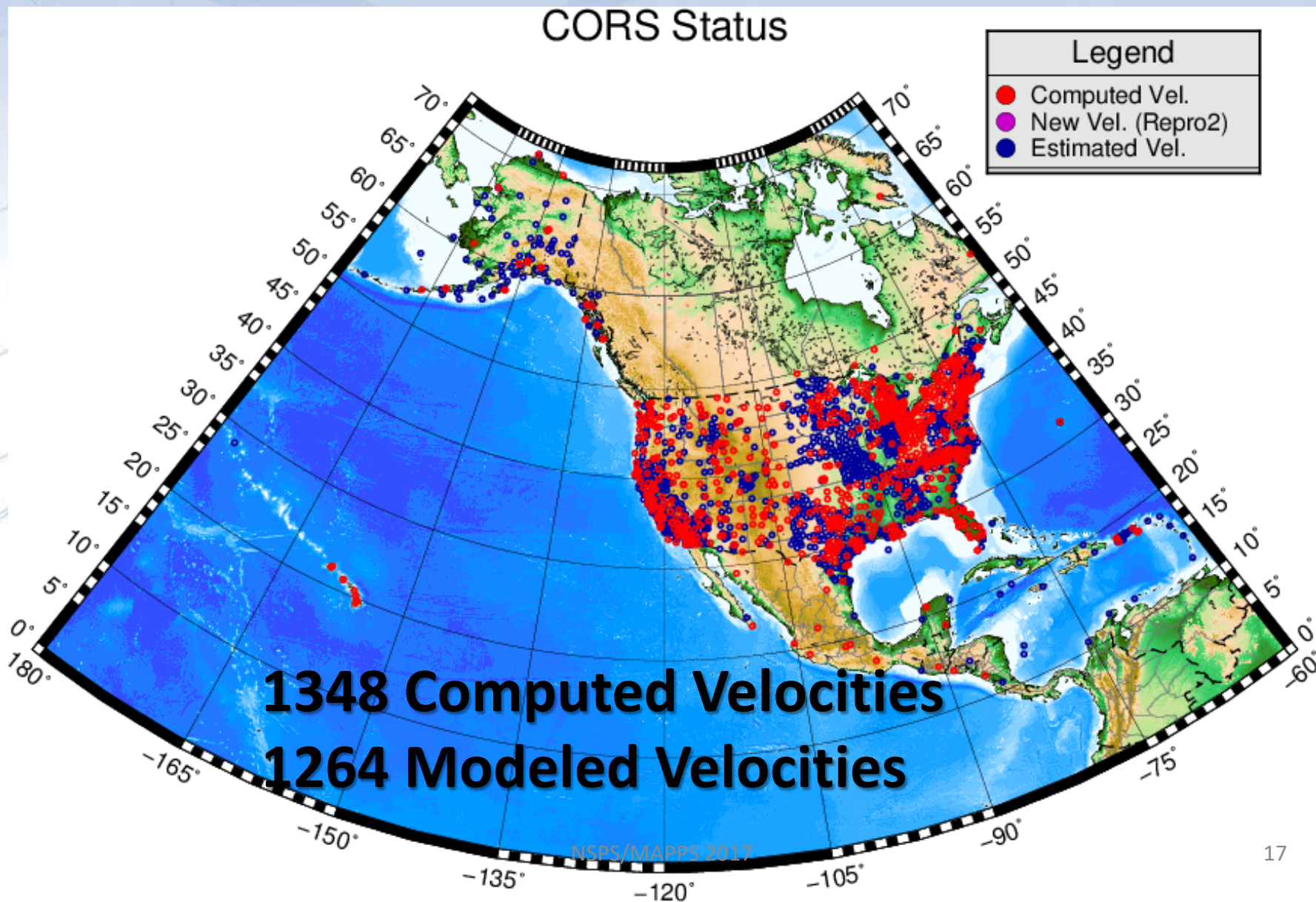


wrt. a priori orbits
(ig1 +IGS Final)

SUMMARY: NGS 2nd Reprocessing

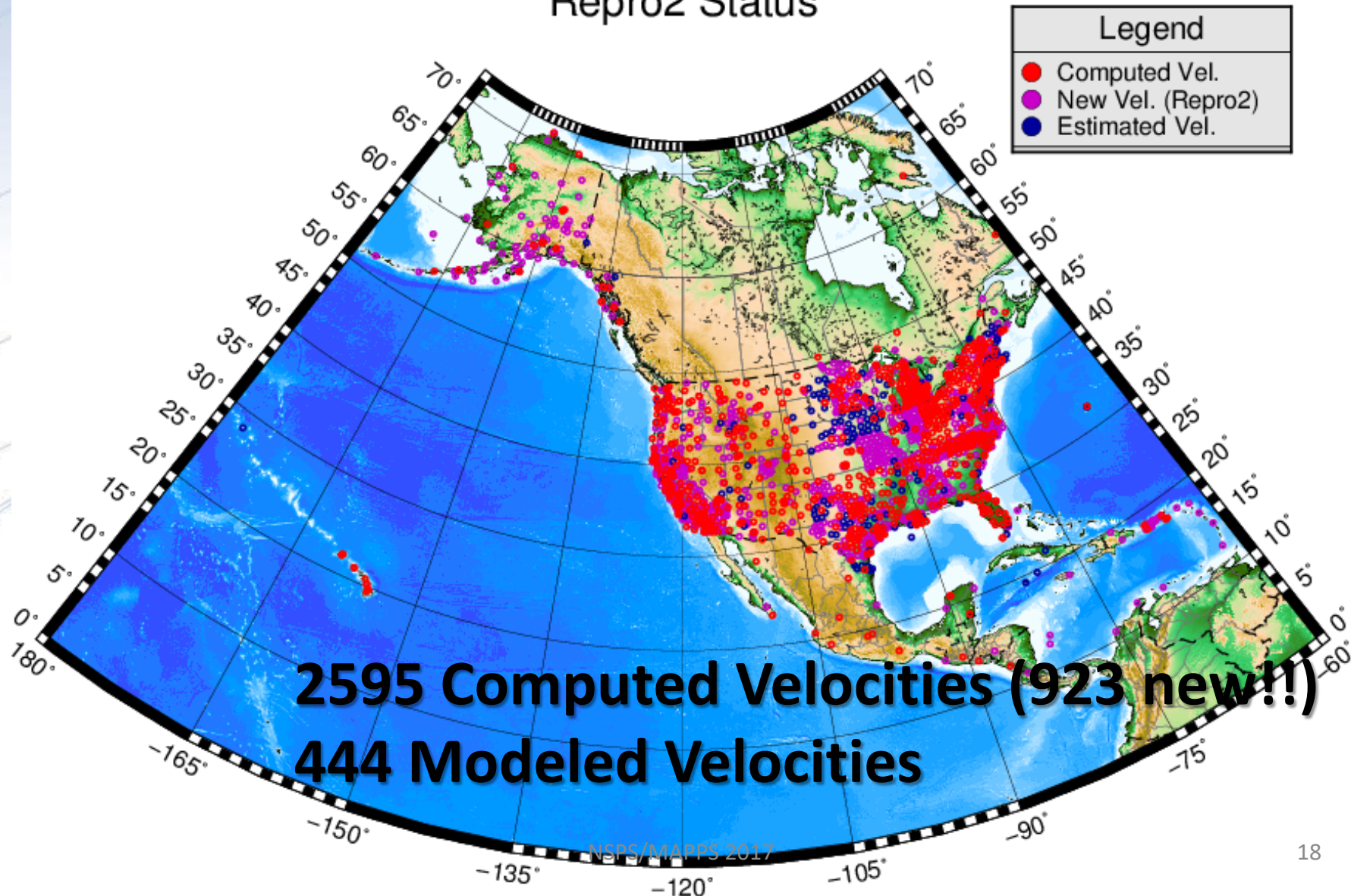
- Catching up the international standards
 - ITRF2014 and IGS14
- Utilized the new Cloud computing environment
 - Faster distributed processes
- 22 years of data (1994-2015)
 - 3039 unique stations
- Follow the Repro1 processing strategies with updated models.
- As of March 1, 2017, discontinuity detection by stacking using CATREF – 3rd iteration.
- Found some issues in some areas → we will fix it!

Current CORS stations



Reprocessing Campaigns

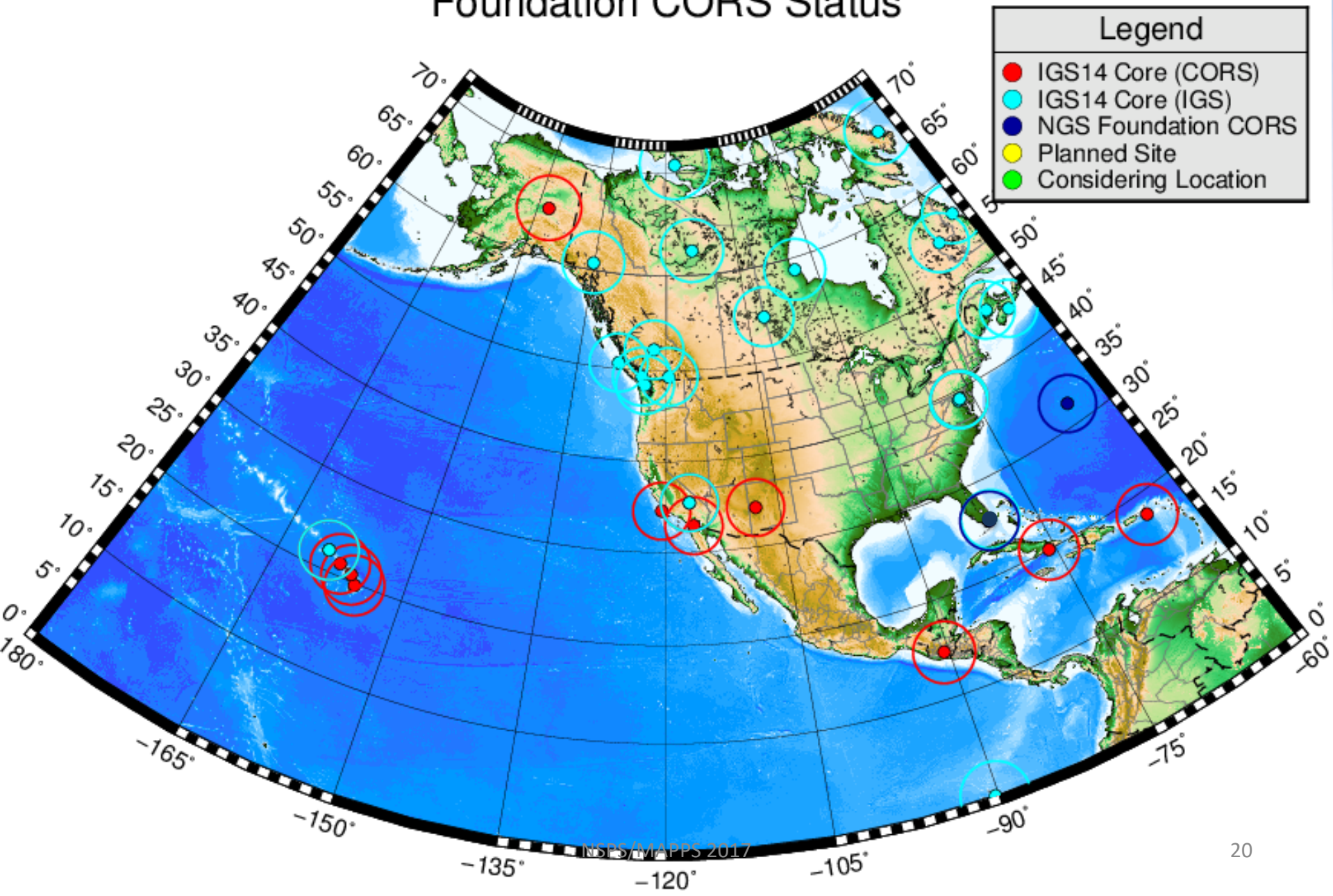
Repro2 Status



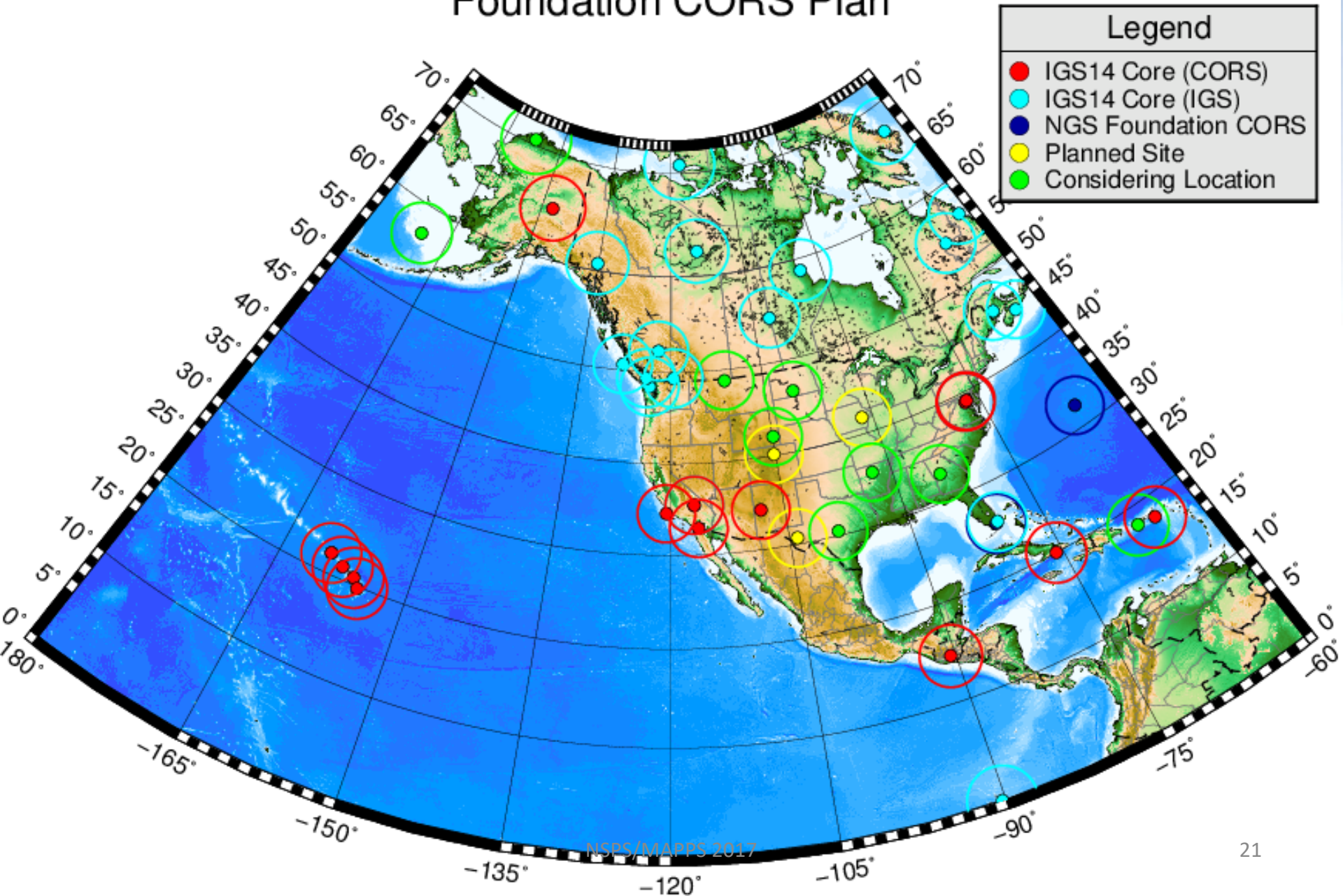
Future Plans: Foundation CORS

- CORS rely heavily on the partners.
 - NGS owns only ~40 stations
- Contribute more on the ITRF/IGS Reference Frame Stations
 - Sites collocated with other techniques: VLBI, SLR, DORIS
 - Locations with existing geophysical observatories (gravity, seismic, atmospheric)
 - Adopt or build to cover geographically deficient areas.

Foundation CORS Status



Foundation CORS Plan



Summary and Conclusion

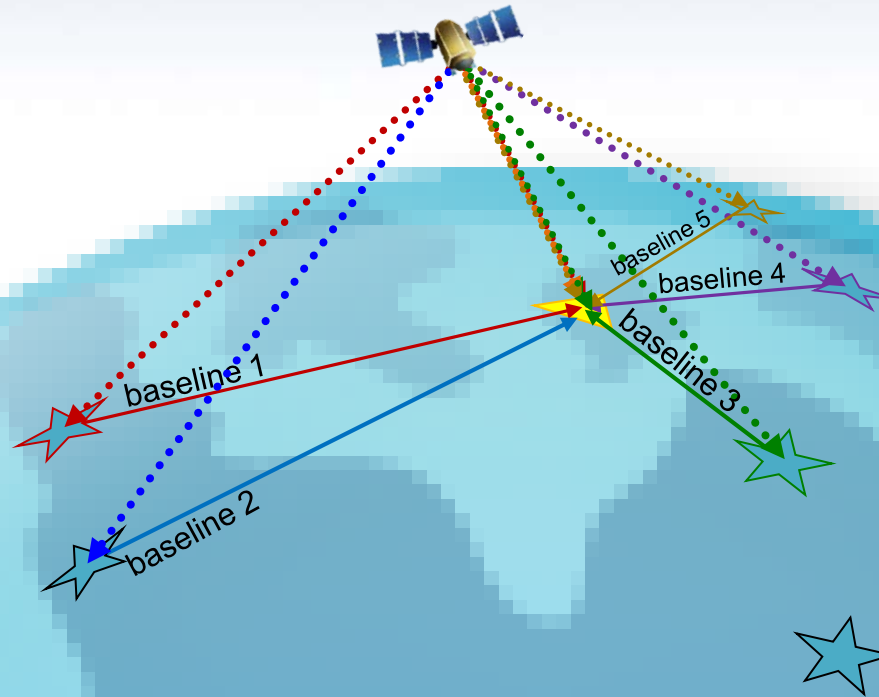
- Uncertainty of the velocity model, Earthquakes, and other regional deformations cause discrepancies in the propagated coordinates.
- 2nd reprocessing at NGS of global and U.S. CORS GPS data collected since 1994 is being processed with IGS08 Frame.
- Next step: Finalize discontinuity detection and align to IGS14 for the CORS stations once it's ready
- On-going discussion with Canada and Mexico for the next NAREF definition

Thank you!

Backup slides

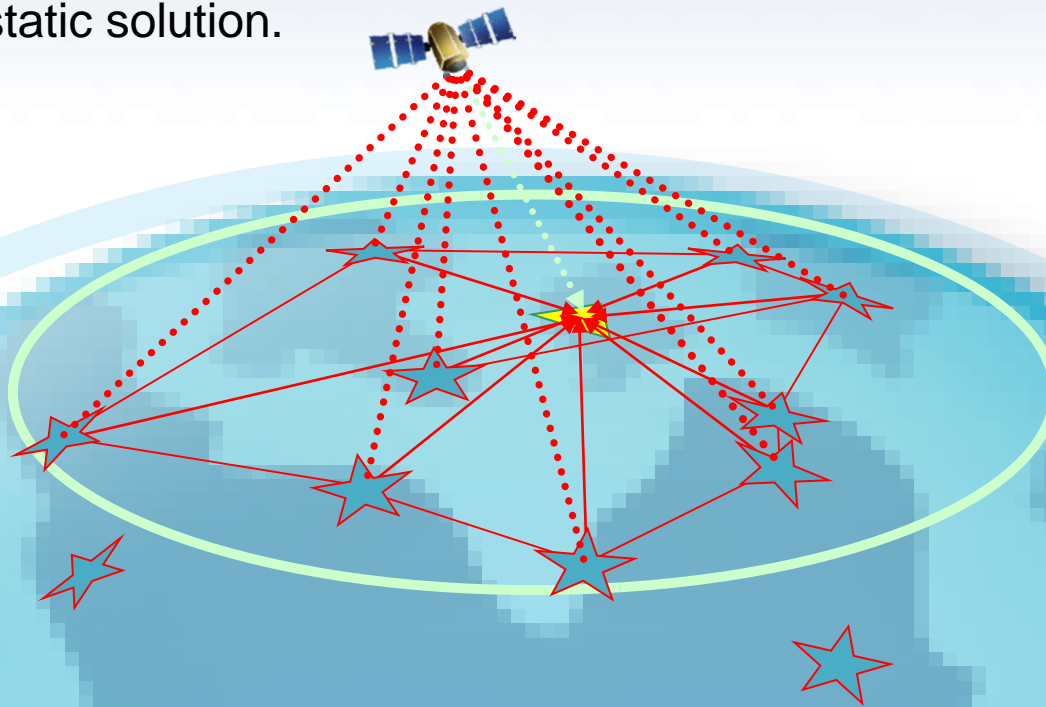
Static: OPUS determines your position with a differential GPS static solution, using hours of data.

This process is repeated 4x from other CORS.



Rapid-static: OPUS first creates an atmospheric delay model from surrounding CORS data.

Your position is then quickly determined by differential GPS static solution.



Shared solutions: describe the mark to share it.



Located in the SW corner of a 2 ft square concrete pad projecting 0.3 ft above ground, 3.3 ft S from S edge of sidewalk ...



requires 4+ hours on a permanent mark of public interest

<http://geodesy.noaa.gov/marks/sharing/>

OPUS-projects:

first, run OPUS to harvest all project data

OPUS automatically forms sessions from simultaneously observed marks, enabling multi-baseline processing and adjustment of redundant observations.

Review and Share

Bluebooking via OPUS projects is expected in 2017.

Improved solutions for simultaneous or repeated observations

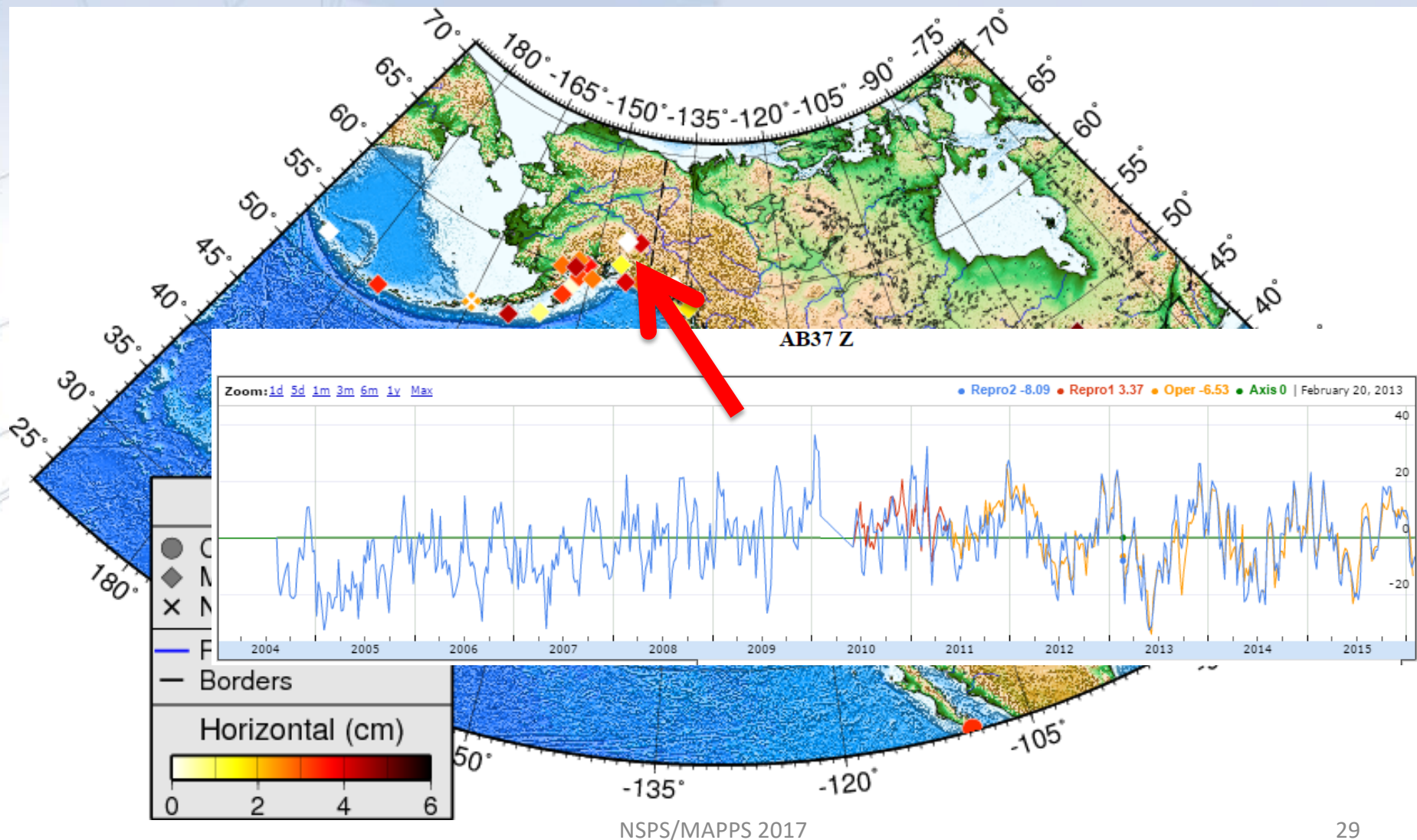
harvest data from multiple observers

*share upload & processing tasks
customize your processing using
PAGES*

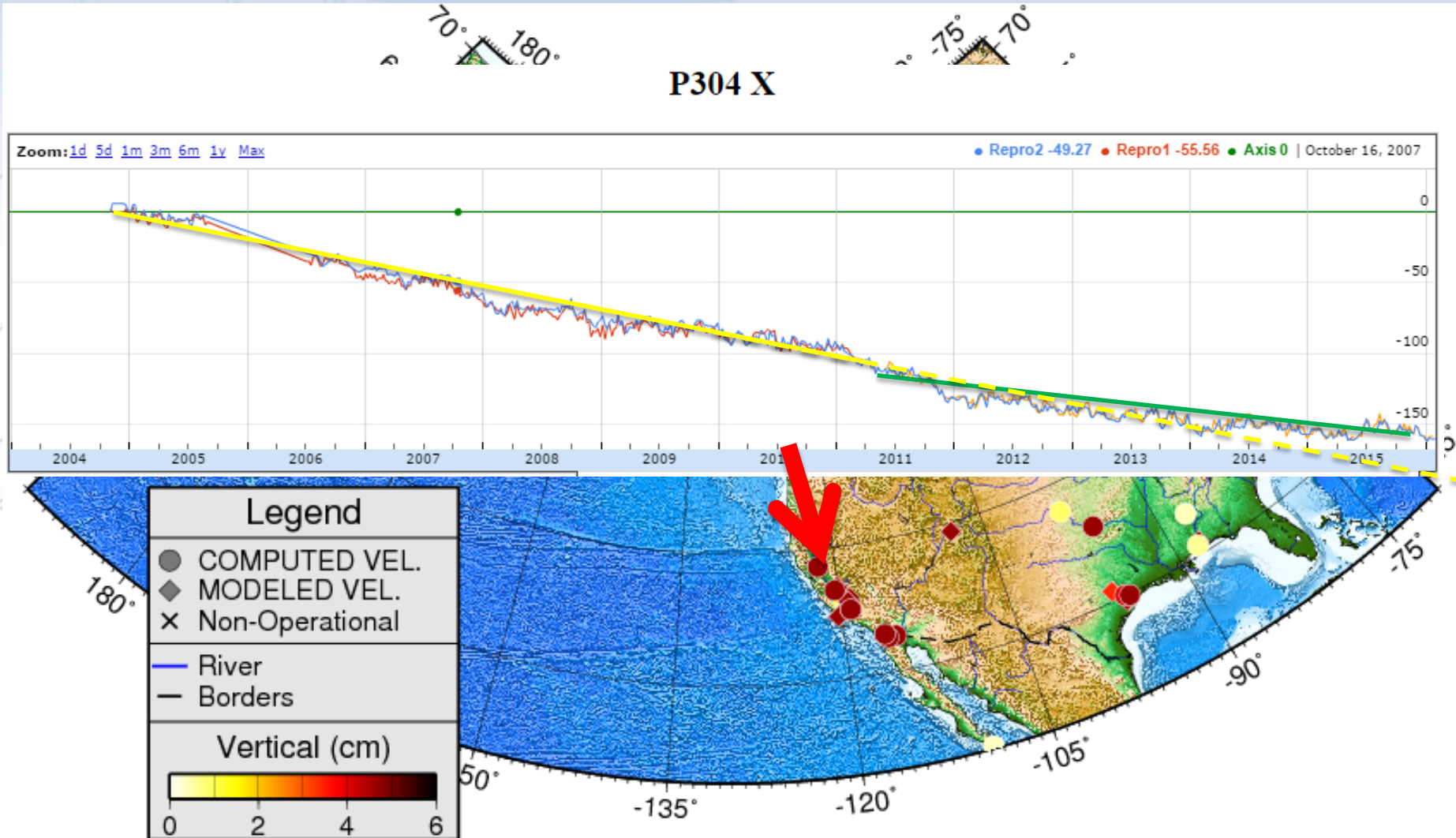
*simple data quality analysis
improve survey accuracy*

*constrain to local networks
publishing support (limited)*

Out-of-Tolerance CORS coordinates (AB37)



Out-of-Tolerance CORS coordinates (P304)



Out-of-Tolerance CORS coordinates (ASPA)

