Reanalysis of the CORS Network Data tied to a Global Frame

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with significant contributions from the CORS team

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- Why Reprocessing?
- Summary of processing strategy
- Quality of NGS orbits and some example of station position timeseries

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
  - 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
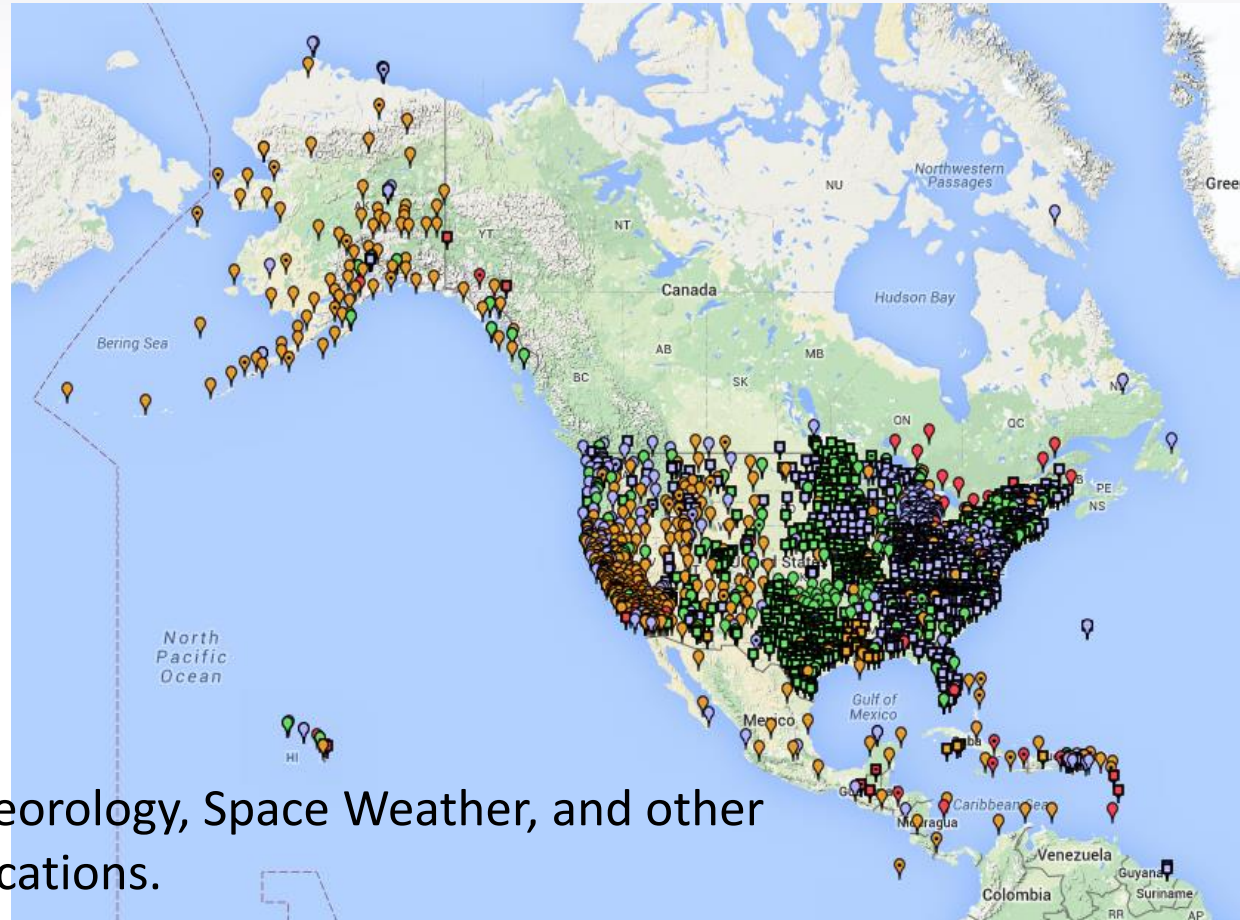
  - Also support Meteorology, Space Weather, and other Geophysical applications.

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.

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
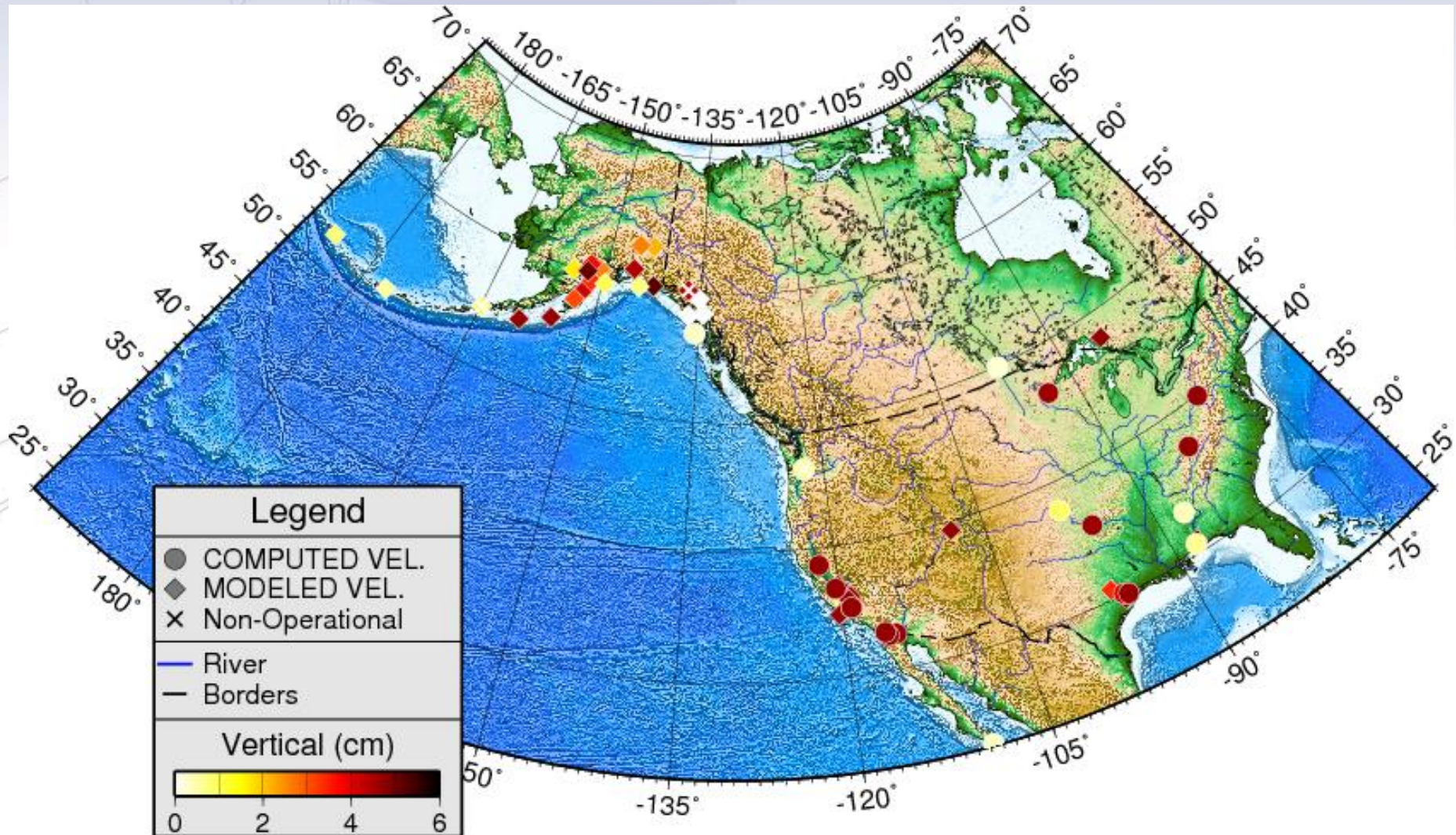 - Short data span
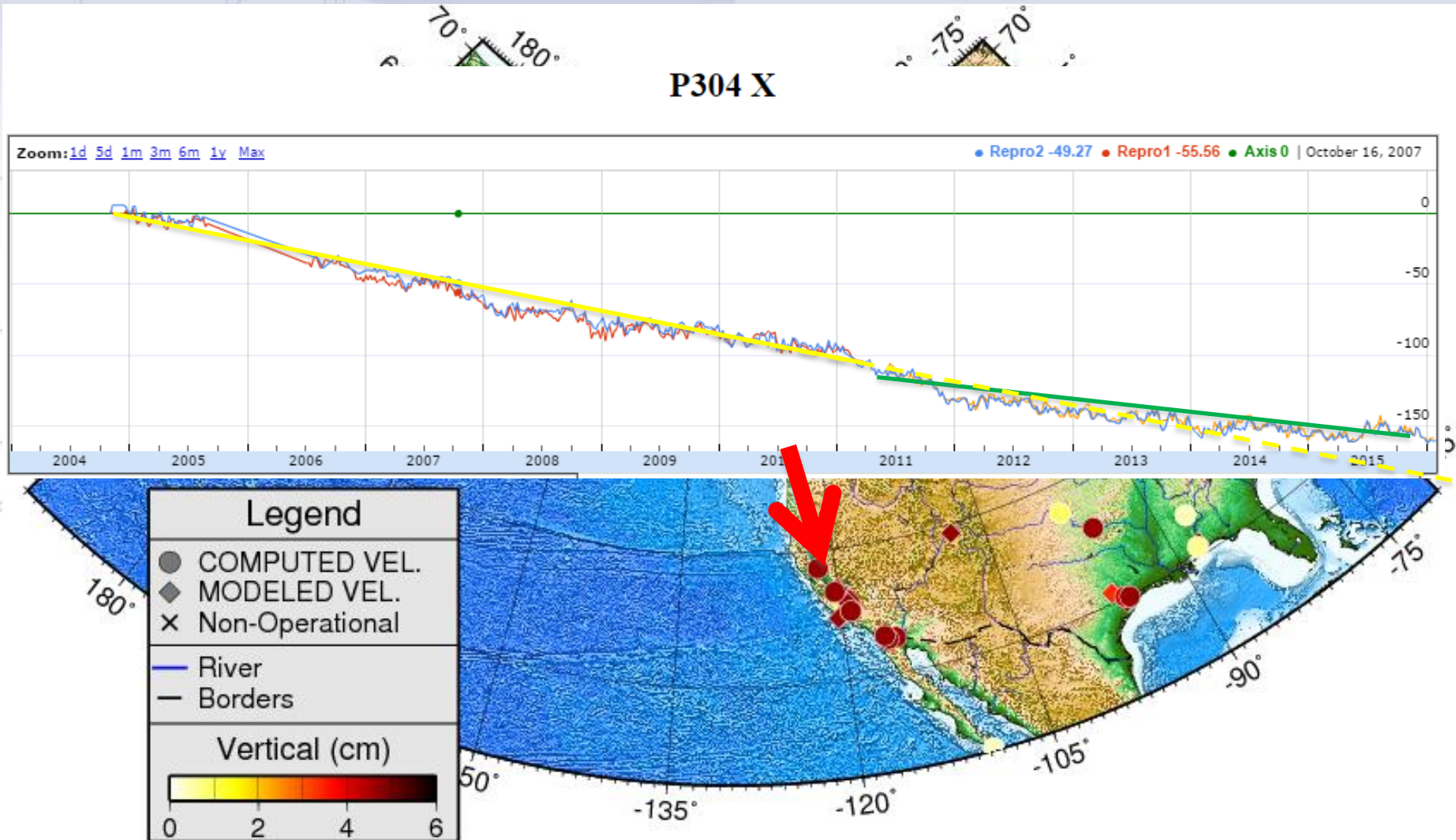 - Subsidence area

Out-of-Tolerance CORS coordinates
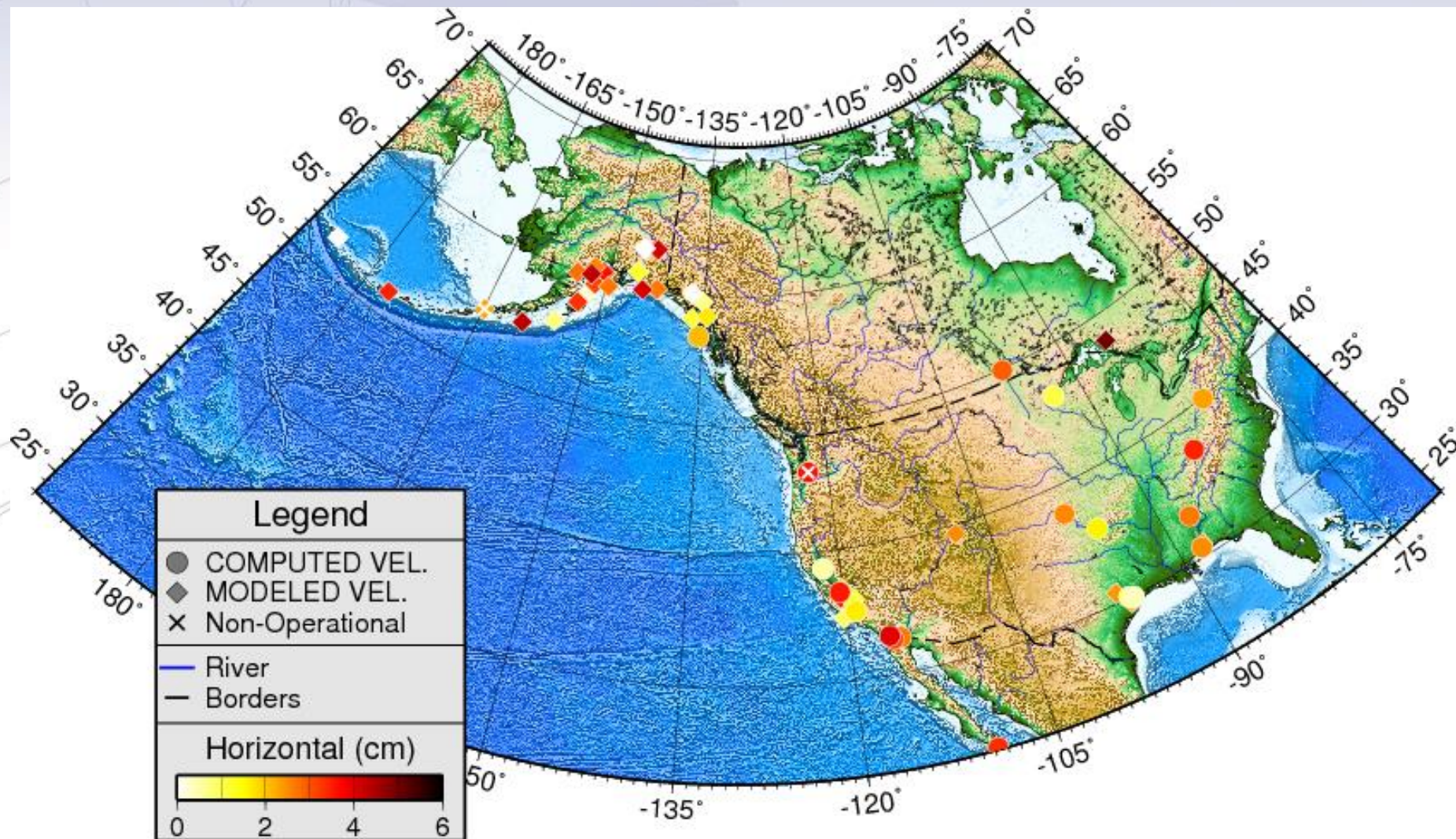
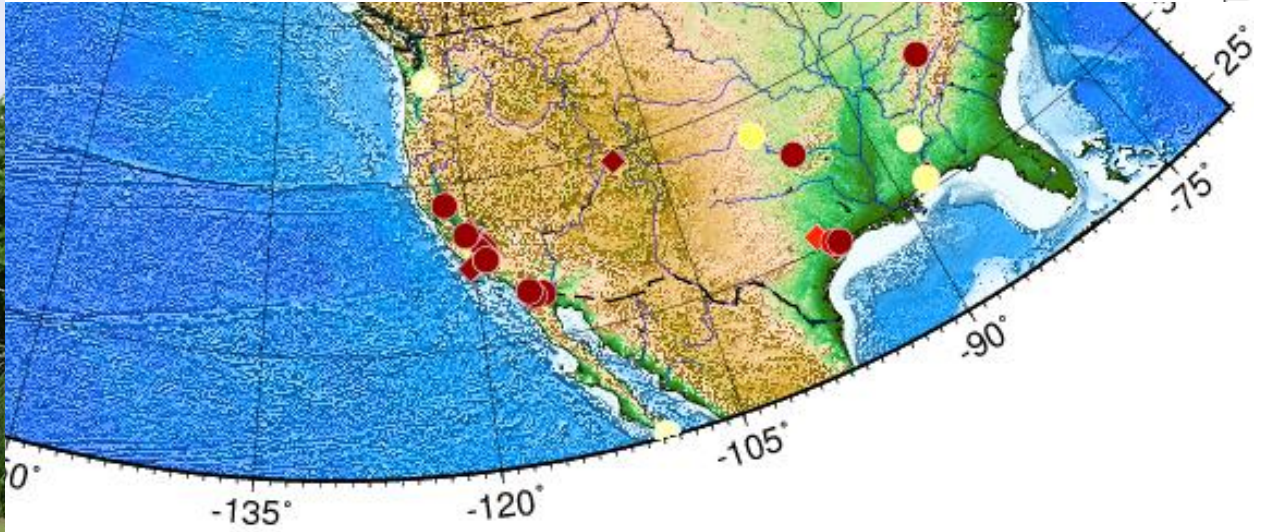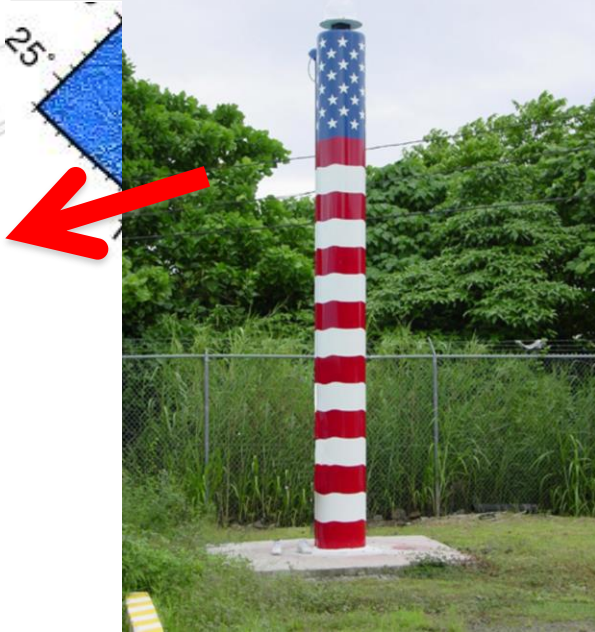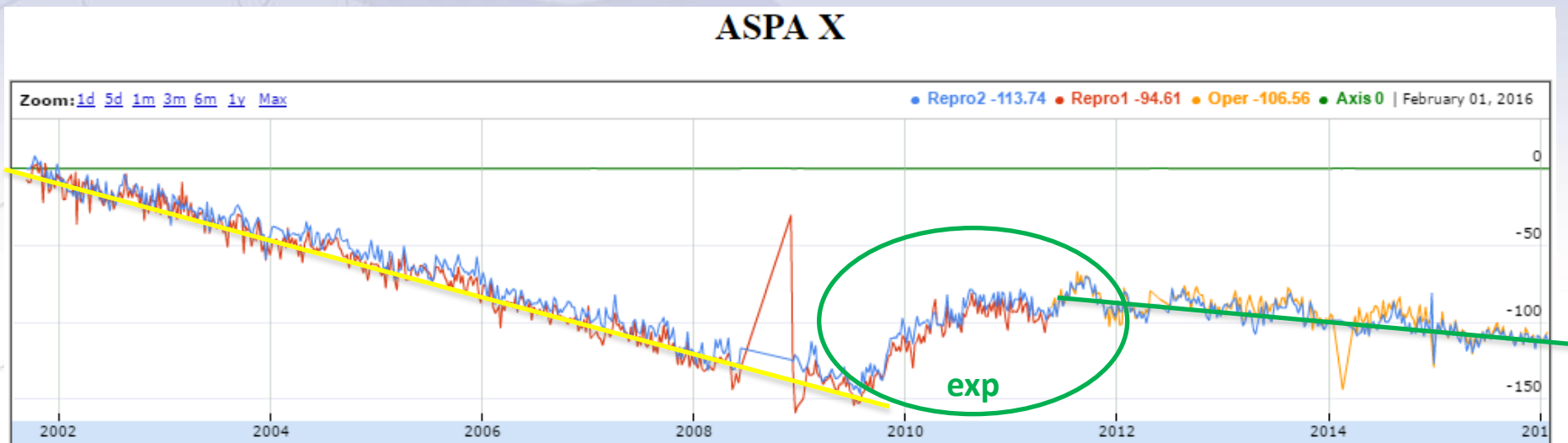# Out-of-Tolerance CORS coordinates (AB37)
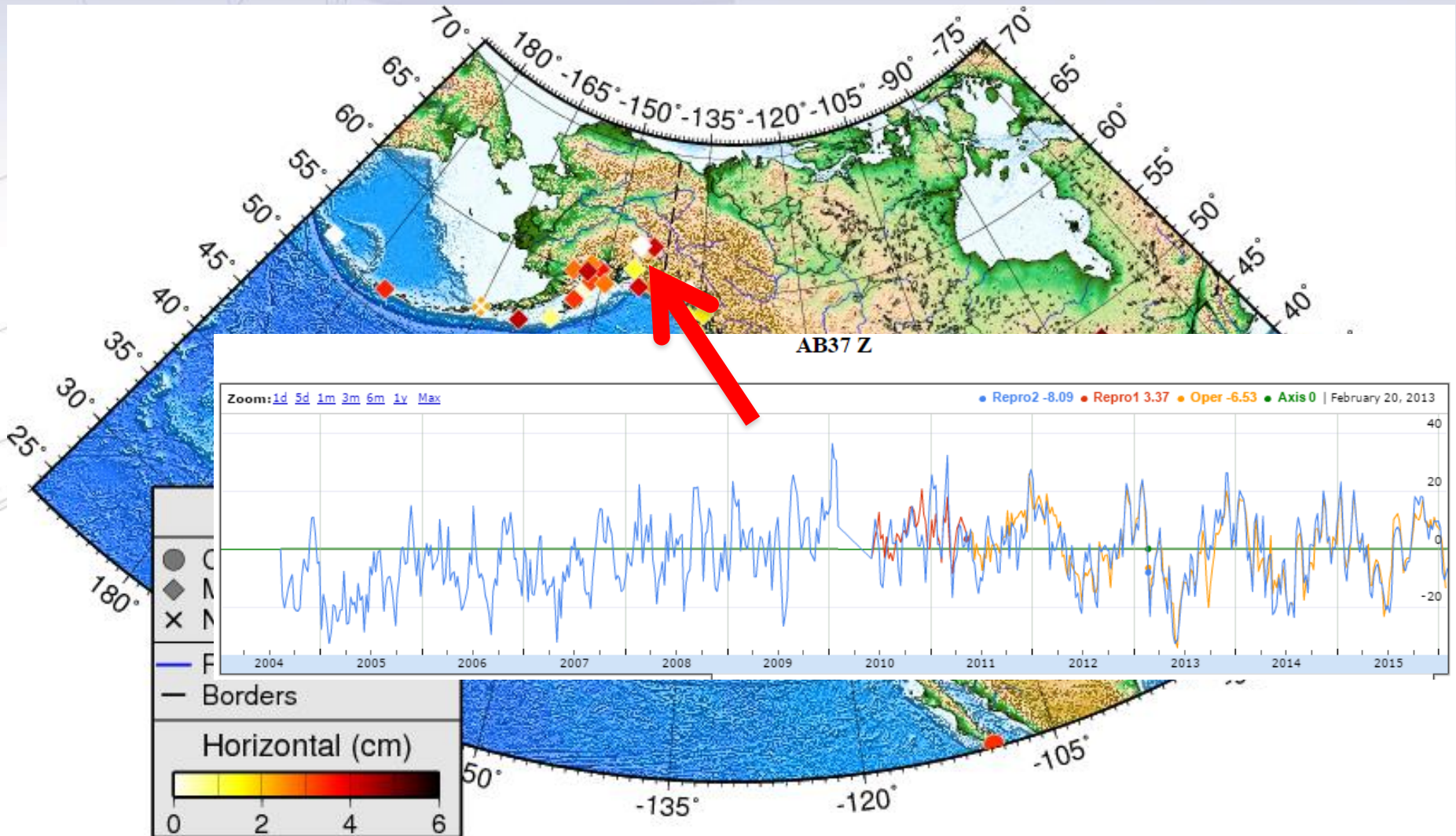
Out-of-Tolerance CORS coordinates

Out-of-Tolerance CORS coordinates (P304)

Out-of-Tolerance CORS coordinates (ASPA)

IGS Reprocessing Recommendations
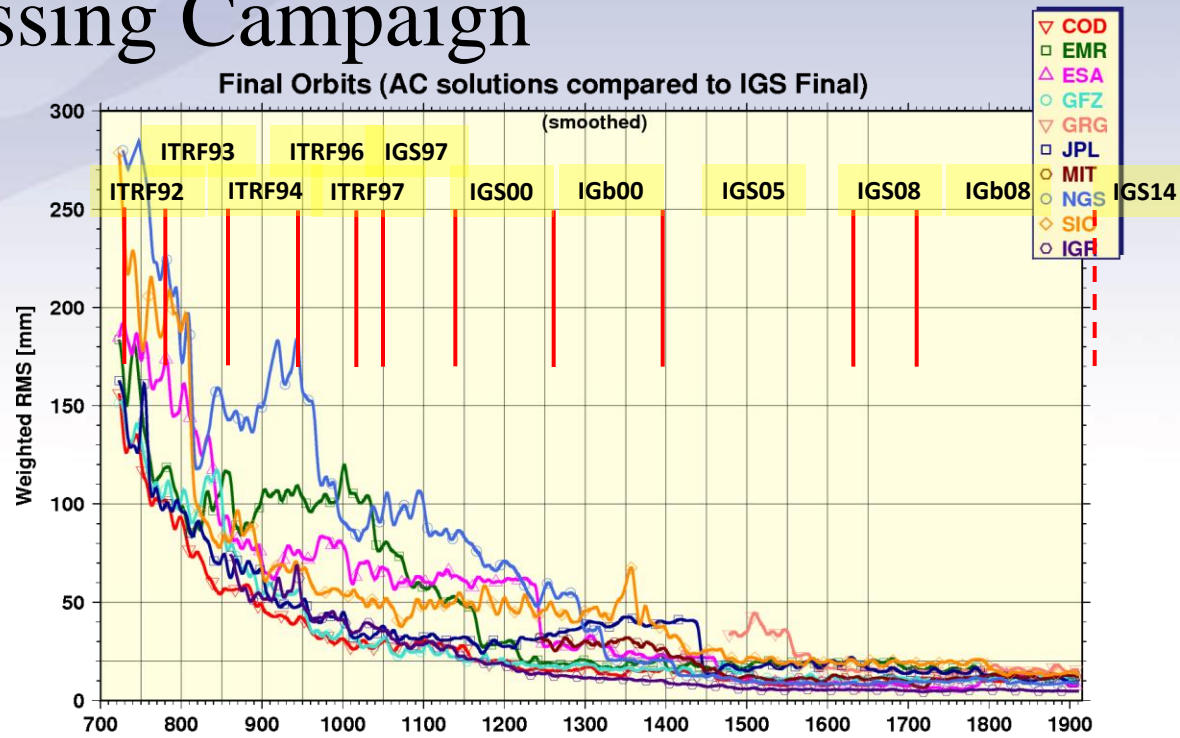
	1st Reprocessing	2nd Reprocessing
Duration	1994 - 2007	1994 - 2014
Reference Frame	IGS05 (aligned to ITRF2005)	IGb08 (aligned to ITRF2008)
IERS Convention	IERS 2003	IERS 2010
Geopotential Field	EGM96	EGM2008 • time-variations of low-degree coefficients • mean pole trajectory model
Antenna calibration	IGS05 ANTEX (absolute calibration)	IGS08 ANTEX (absolute calibration)
Tropospheric delay model	GPT / GMF	GPT2 / VMF1_HT
Higher order Ionosphere	Not applied	IERS 2010 & IGRF11 (2nd order)
Ocean Pole Tide (Station Displ.)	Not applied	IERS 2010
Orbit Dynamics	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, BUT …

- IGS Repro2 is completed and ITRF2014 was released in Jan. 2016
  – Periodic Signal models
  – Post-Seismic Deformation models

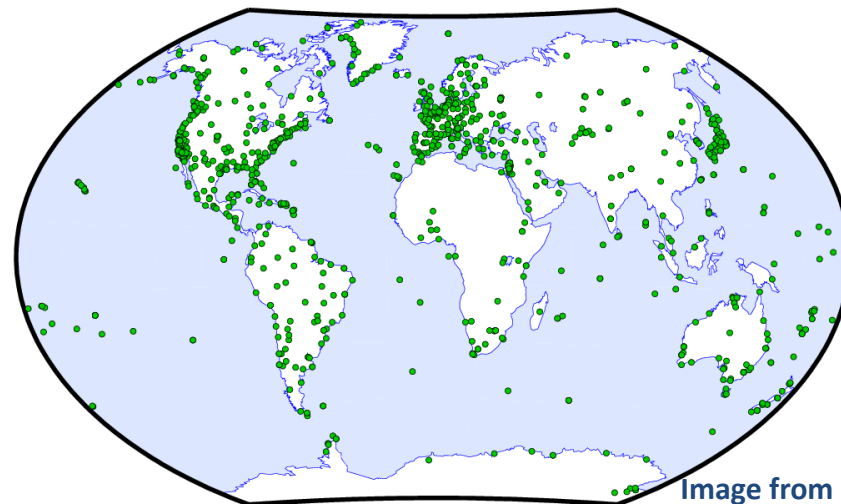- IGS14 orbit/clock combination is nearly complete.

Image from P. Rebischung 2015

NGS 2ⁿᵈ Reprocessing

- Catching up the international standards
  - ITRF2014 and IGS14
- Utilized the new Cloud computing environment
  - Faster distributed processes
- 22 years of data
- Follow the Repro1 processing strategies with updated models.

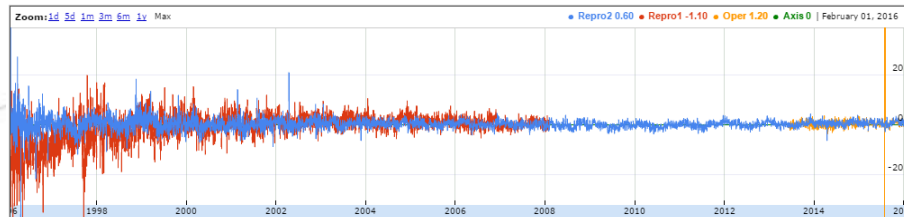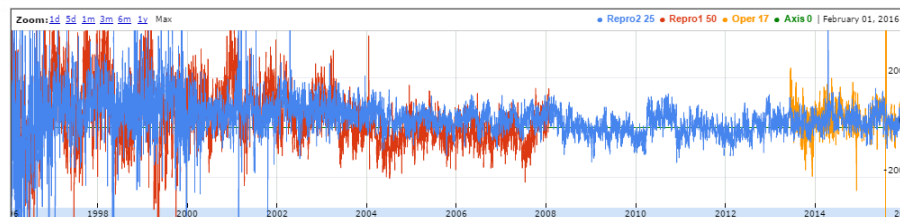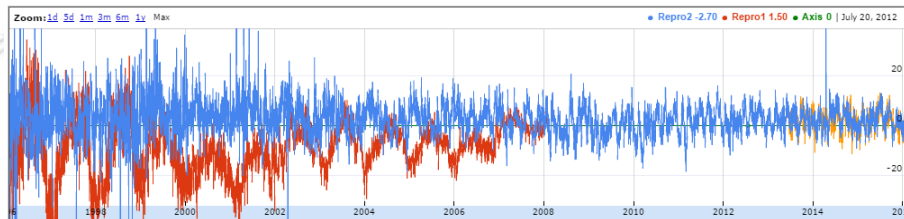# NGS 2nd Reprocessing Preliminary Orbit Quality
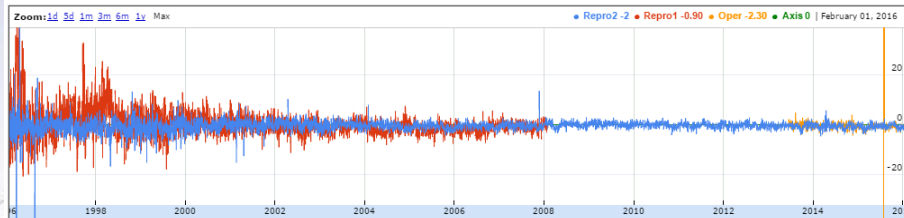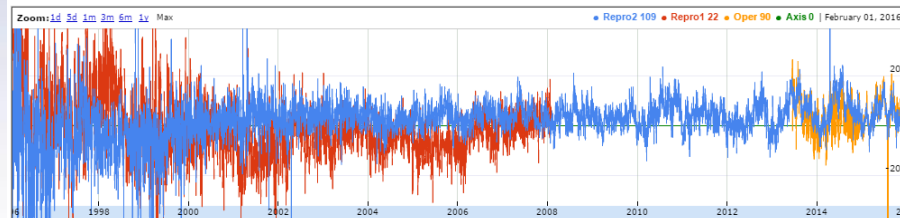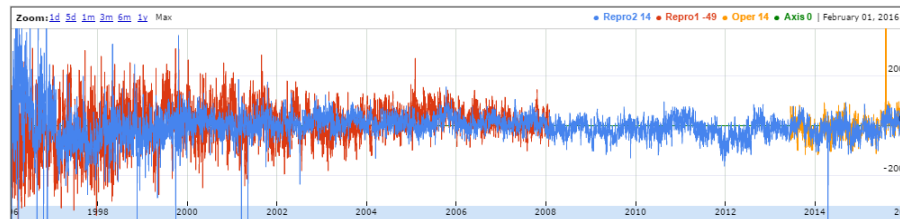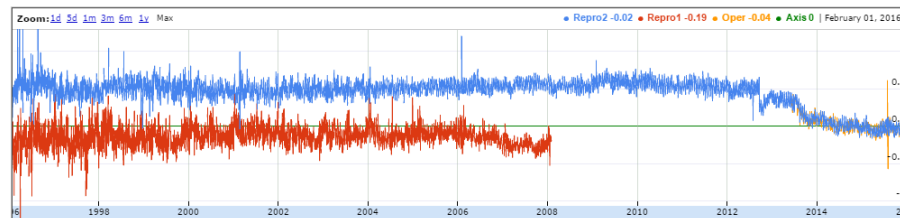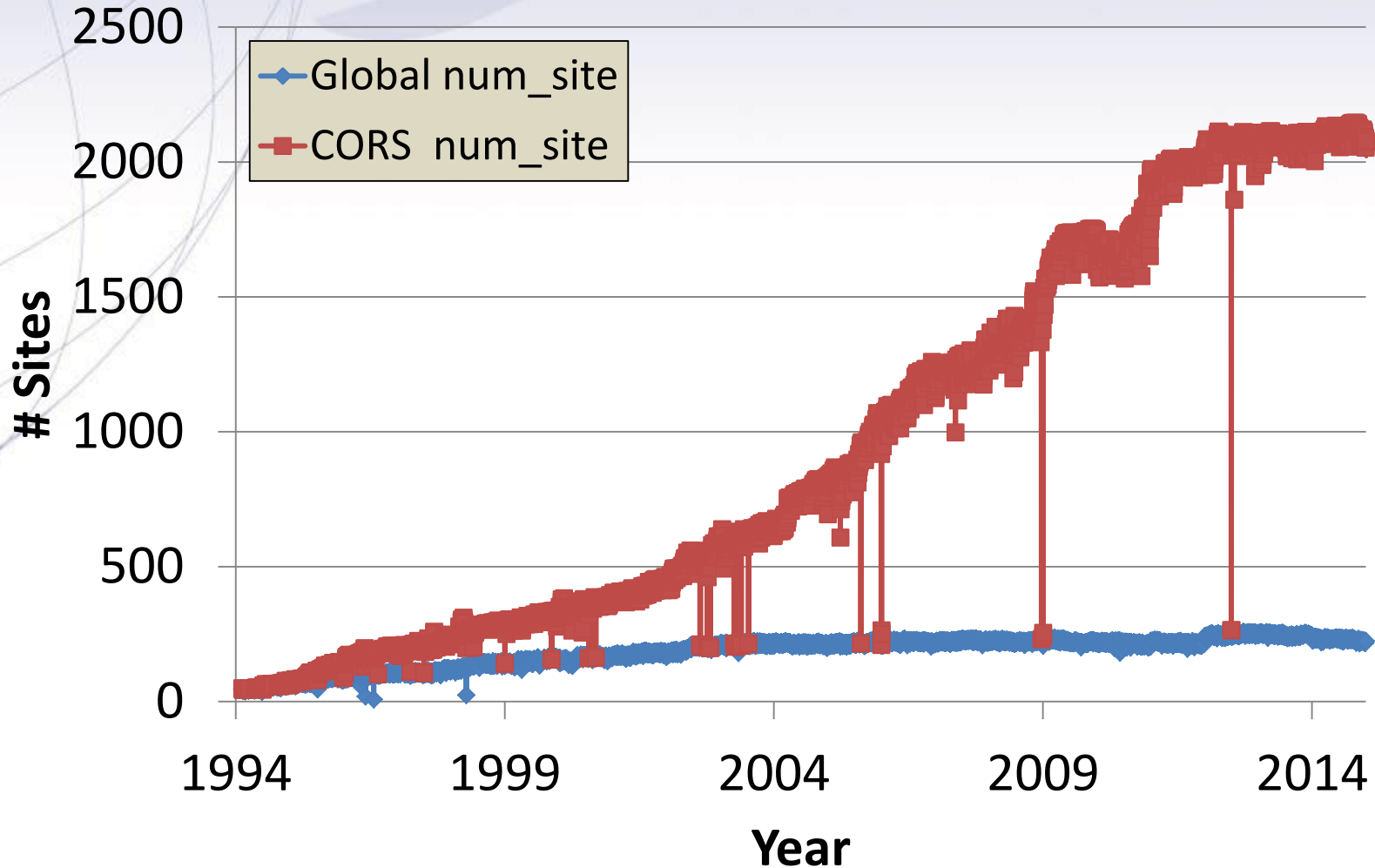

wrt. apriori orbits
(ig1 +IGS Final)

NGS 2nd Reprocessing Campaign

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: aligning to IGS14 for the CORS stations once its ready

- On-going discussion with Canada and Mexico for the next NAREF definition