


National Geodetic Survey Positioning America for the Future geodesy.noaa.gov



Recently Adopted Changes to the Terrestrial Reference Frames used in the United States

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Outline

- Introduction
- Reprocessing
- ITRF2008
- IGS08
- Latest Realization of the North American Datum of 1983
- 2011 Adjustment
- Concluding Remarks

Introduction

- Reference Frame Milestones
 - ITRF2008 – May 31, 2010
 - IGS08 Reference Frame – April 17, 2011
 - North American Datum of 1983 – October 6, 2011
- 2011 North American Adjustment (final stage)
 - United States and the Caribbean
 - Alaska
 - Pacific Islands

Benefits of Reprocessing

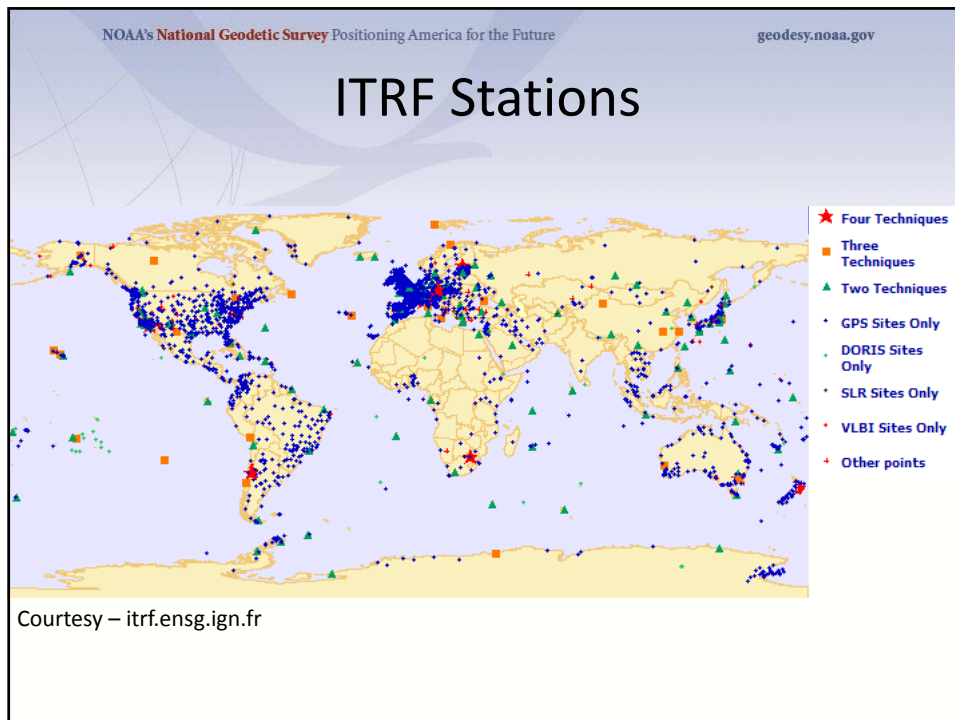
- Implementation of the latest geophysical models in processing software
 - Ocean tidal models (FES2004)
 - Improved phase ambiguity integer fixing
 - Troposphere modeling (GPT and GMF *a priori* models)
 - Absolute antenna patterns for satellites and ground antennas

Reprocessing cont.

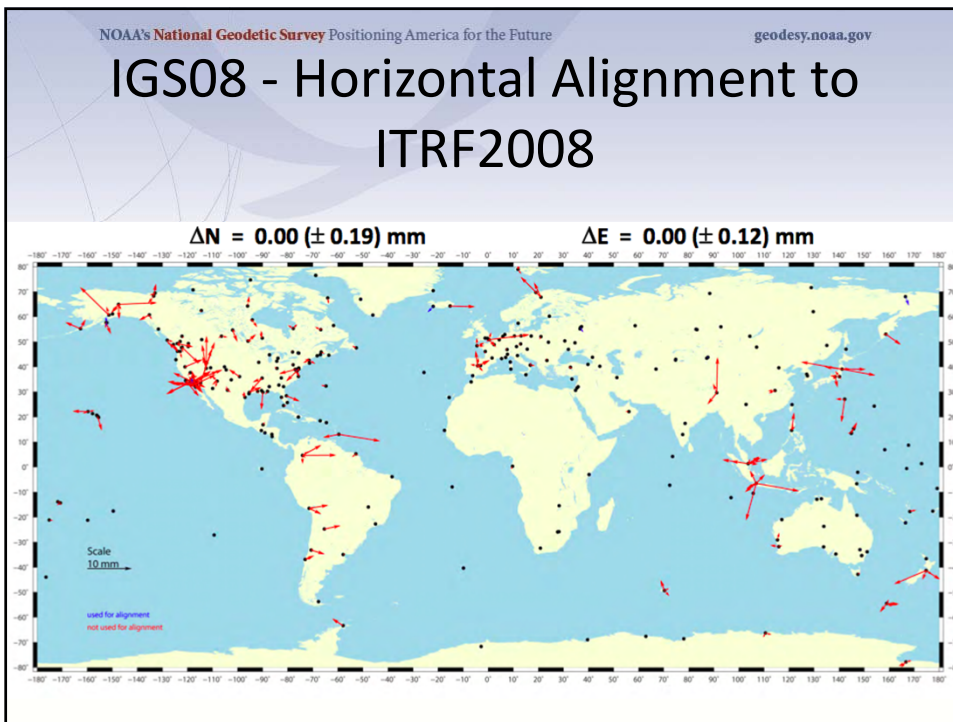
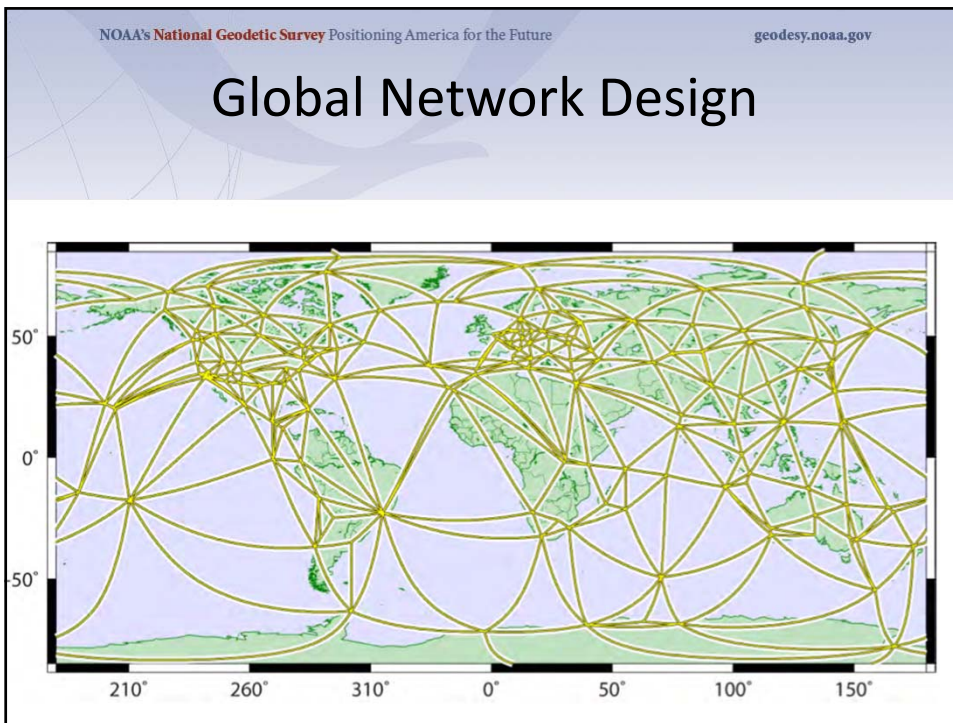
- Generate a consistent set of products
 - Coordinates for global reference stations and regional CORS (North America)
 - Precise IGS orbits and Earth Orientation Parameters (EOPs)
- Longer data spans – 1994 through 2010
- Network designs based on Delaunay triangulation

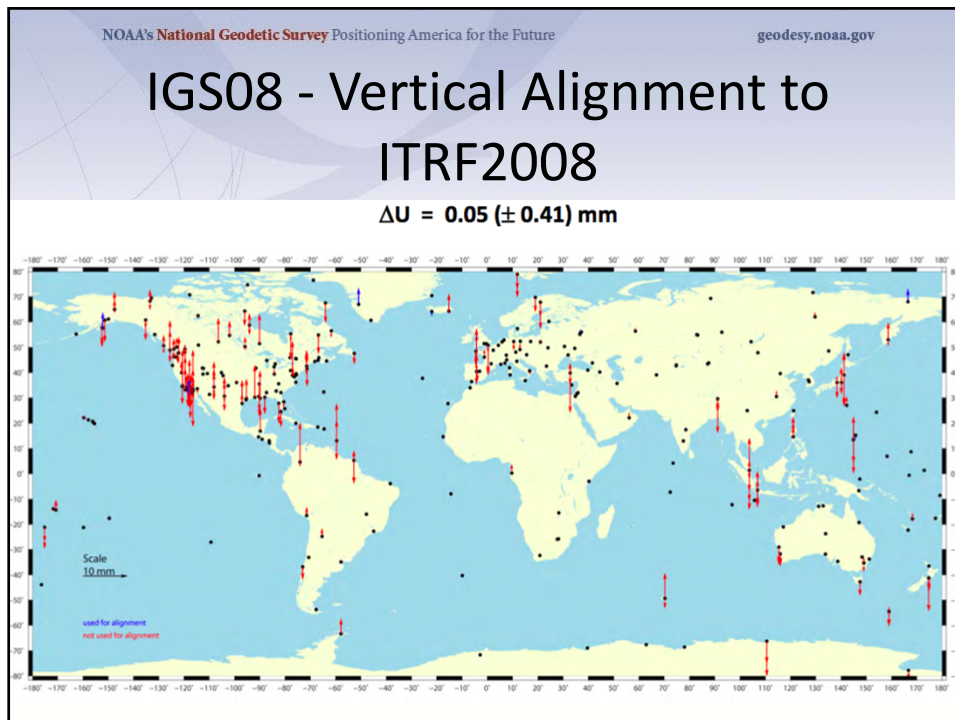
ITRF2008

- Latest realization – epoch 2005.00
- Derived from several space-based techniques
 - DORIS, VLBI, GPS, SLR
 - Linked to International Celestial Reference Frame (ICRF) via Earth Orientation Parameters (EOPs)
- ITRF constantly being updated
 - Equipment improvements
 - Data available increases with time
 - Maintaining links to prior realizations is very important
 - Combination – IGN's CATREF s/w



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- ## IGS08
- Frame designed with 232 ITRF2008 stations
 - Global distribution
 - Well performing, stable, accurate velocities, few discontinuities
 - 167 stations with ITRF2008 coordinates
 - 65 stations had modified positions due to
 - Absolute antenna pattern changes
 - Satellite antenna PCOs/PCVs changes
 - Reprocessed data from 1994 to late 2010

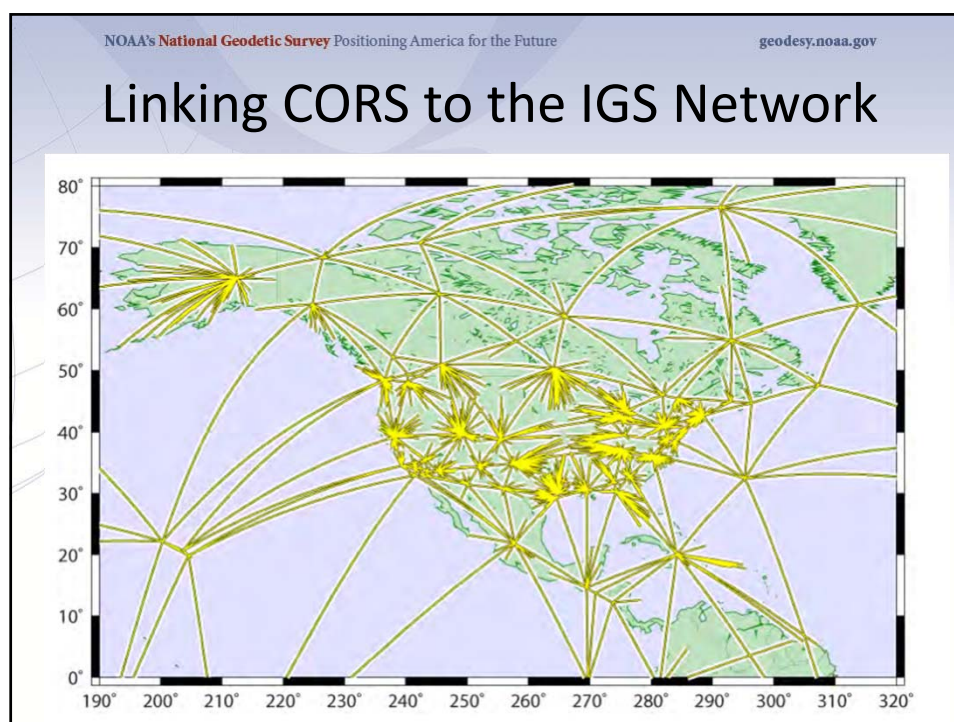




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Outcome for North American CORS

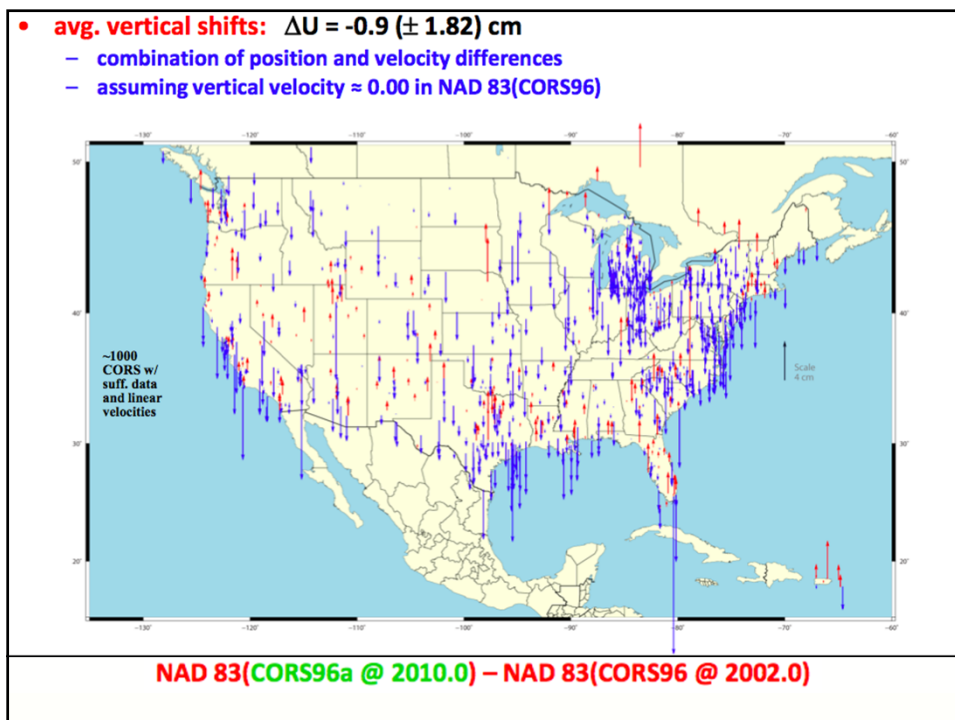
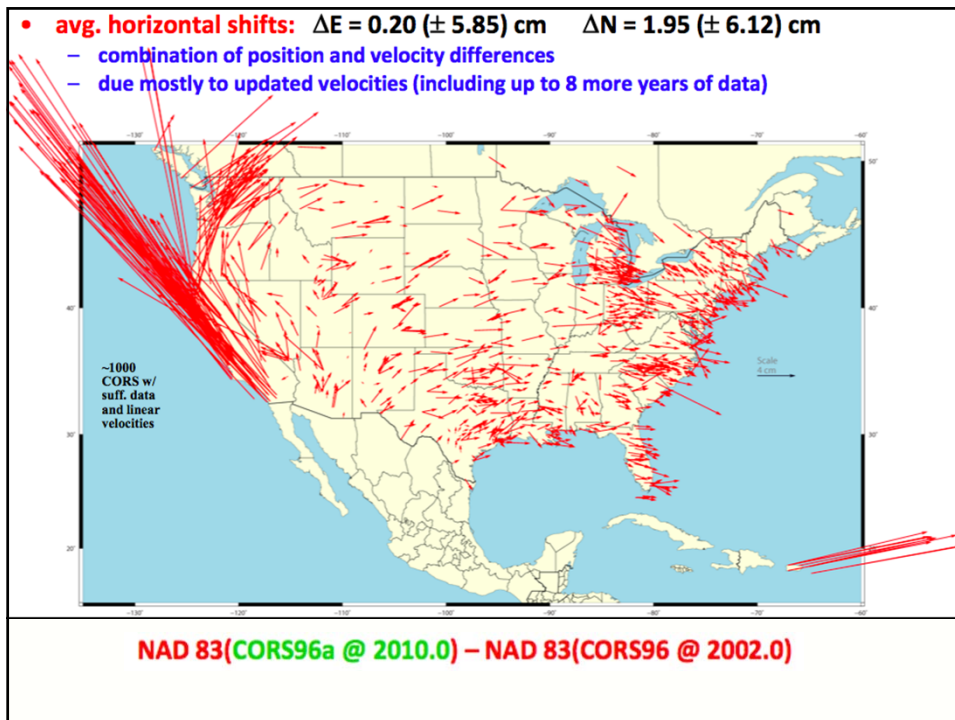
- Coordinate and velocity differences between IGS08 and ITRF2008 are very small
- Transformation between IGS08 and ITRF2008 is the identity.
- Position and velocity differences primarily due to earthquakes and discontinuities
- Large differences could be due to different time spans



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North American Datum of 1983

- Latest NAD 83 realizations defined at epoch 2010
 - NAD 83 (2011) – North American plate
 - NAD 83 (PA11) - Pacific plate
 - NAD 83 (MA11) – Marianas plate
- Data from 1994 to 2011.3
- CORS + global sites processed to be consistent and aligned with IGS08
- Weekly SINEX solutions combined with CATREF



NA2011 Project Status

- Total: 4267 GPS projects; 81,055 stations; 424,721 vectors
 - Observations from April 1983 thru Dec 2011
 - Includes 1010 CORS with Multi-Year CORS Solution coordinates
 - Adjustment constrained **ONLY** to MYCS CORS coordinates
- United States and the Caribbean
 - 4228 GPS projects and 80,515 stations
 - 422,869 vectors total (approximately **405,000** enabled)
 - All referenced to North American tectonic plate
- *Comparison to NSRS2007 network (also U.S. + Caribbean)*
 - 3418 projects → **24% more in NA2011**
 - 67,693 stations → **19% more in NA2011**
 - 283,691 vectors enabled → **43% more in NA2011**

NA2011 Adjustment Regions

- United States and Caribbean adjusted together
 - Both referenced to North American tectonic plate
- Alaska adjusted separately from U.S. and Caribbean
 - 142 projects, 969 stations, 2846 vectors
 - No useable ties to the United States
 - Also referenced to North American tectonic plate
- Pacific region also adjusted separately
 - 39 projects, 540 stations, 1852 vectors
 - Referenced to different tectonic plates
 - Hawaii, American Samoa, Marshall Is., etc. → **Pacific plate**
 - Guam, Northern Mariana Islands, Palau → **Mariana plate**
 - ***Pacific was not adjusted in the NSRS2007 project***

