



IGS Final Troposphere Product Update



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Purpose

- Describe Processing of IGS Final Troposphere by USNO
- Status Update of IGS Final Troposphere Processing
- Future Plans

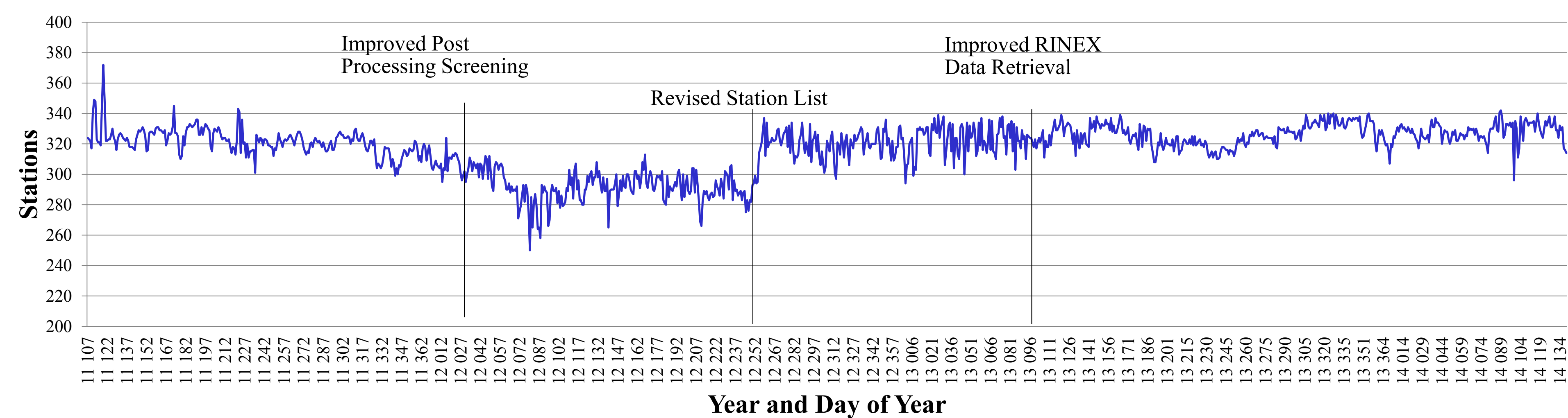
Software Setup & Processing

- Precise Point Positioning (PPP) Method
- 27 hour Observation Window
- Fixed GPS Clocks and Orbits: IGS Finals
- Elevation Angle Cutoff: 7 degrees (Receiver Dependent)
- Troposphere Mapping Function: GMF (Global Mapping Function)
- A Priori Troposphere Estimate: Dry Niell Model
- Temporal Resolution: 5 minutes
- Relative A Priori Sigmas: 1 mm (ZTD), 0.1 mm (Gradients)
- Latency: 3 weeks (Result of Using IGS Finals)
- First Day Processed by USNO: DOY 107 of 2011 (April 17, 2011)
- Not a Combination Production Like Other IGS Products
- Generated Using *Bernese 5.0 Software* and USNO Developed Routines
- RINEX Data Pre-Filtered for Missing Data
- Post Estimate Screening for Product Quality

Current Operations Status

ZPD File Production

- Produce Estimates for ~325 stations/day (2013 Average)
- 10.3 Million Files Downloaded from CDDIS FTP Site in 2013
- Variability Due to Availability of Station Data at 3 weeks Latency, Improved Post Processing Screening for Data Quality, Revised Station List, and Improved RINEX File Routines



Number of Stations/Day Since Start of USNO IGS Final Troposphere Estimates Production

Quality Screening

- Improved RINEX Data Retrieval Algorithm to Download More Stations for Processing
 - Revised Station List to Increase Stations Downloaded
 - Robust Data Getting Commands
 - Search Multiple RINEX Data Extensions (Ex: *.14d And *.14o) to Retrieve a Station's Observations
- Upgraded Observation Data Screening Procedures
 - TEQC Processing Routines
 - Checks for Station Data Gaps or Insufficient Station Data
- Upgraded Post Processing ZPD File Screening
- Ongoing Improvements

Coordinate Repeatability

- Coordinate Comparison of ~325 Stations Over Each Ten Day Period for DOYs 112 through 142 of 2014 (Most Recent)
- Outliers Screened Out (~10 Stations/Period)
 - Same Stations Filtered Out of File Submission for Quality at End of Troposphere Estimate Processing
- ~10-20% Improvement from 2012 in All Directions (2012 Average Values: N 1.85, E 2.85, W 5.33 mm)

DOYs of 2014	N [mm]	E [mm]	U [mm]
112-121	1.50	2.58	5.10
122-131	1.44	2.24	4.48
131-141	1.43	2.48	4.68
<i>average</i>	<i>1.45</i>	<i>2.43</i>	<i>4.75</i>

Station Repeatability Associated with IGS Final Troposphere Estimates in Ten Day Increments

Future Plans

- Incorporate the Recommendations of the Troposphere Working Group
- Incorporate Other GNSS Signal Data (Maybe Improve Estimates at Higher Latitudes?)
- Participation in Repro2 Processing (Waiting on Repro2 Orbit Products)
- Incorporate Repro2 Models/Standards in Daily Processing
- Upgrade to *Bernese 5.2 Software* (Testing Now)

Summary

- Produced Using a PPP Method at USNO, Not a Combination Product
- Number of Stations per Day Variability Due to Improved Post Processing Screening for Data Quality, Revised Station List, and Improved RINEX File Routines
- Station Repeatability Consistent Over Time Demonstrating Excellent Internal Stability of the Processing (and Improving)
- Many Future Plans including Repro2 Models and Upgraded Software

Troposphere Products Available Online: <ftp://cddis.gsfc.nasa.gov/gps/products/troposphere/zpd/>
USNO Archive: <ftp://maia.usno.navy.mil/GPS/tropo/>

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