



IGS Final Troposphere Product Update



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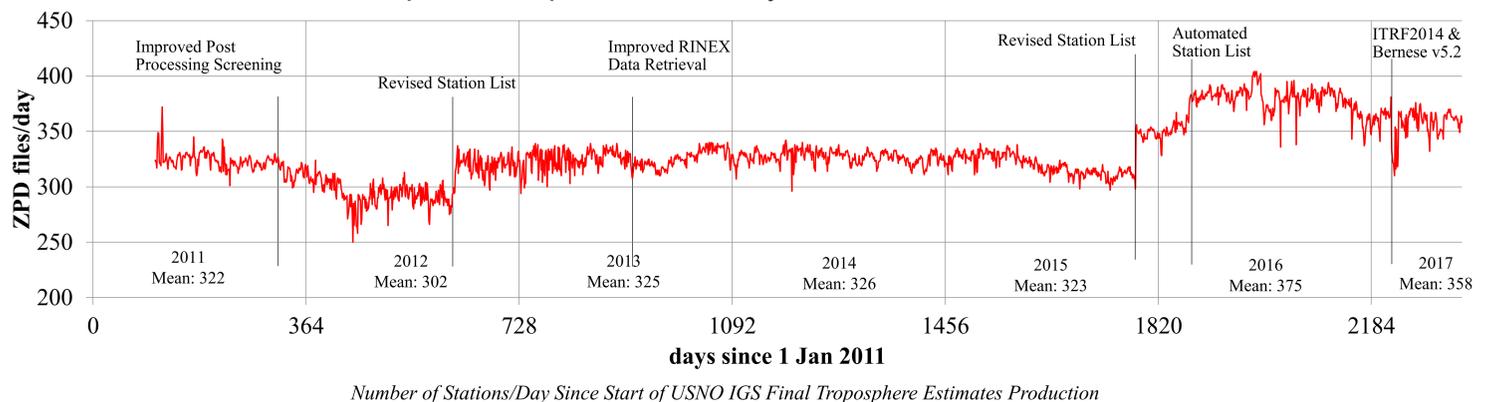
Software & Processing Setup

- Precise Point Positioning (PPP) Method
- 27-hour Observation Window
- Fixed GPS Clocks, ERPs, and Orbits as A Priori Inputs: IGS Final Products
- 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 GNSS v5.2 Software* and USNO Developed Custom Scripts
- RINEX Data Downloaded at Processing Time to Maximize Number of Stations Processed
- RINEX Data Pre-Screened for Missing Data
- Post Estimate File Screening for Product Quality

Current Status

ZPD File Production

- Produce Estimates for ~375 stations/day (2016 Average)
- 46.3 million files were downloaded in 2016 from over 1000 distinct hosts (Noll, 2017)
 - 20.9 million in 2015
- Automated Station List Updates Implemented Early 2016



Quality Screening

- Improved RINEX Data Retrieval Algorithm to Download More Stations for Processing
 - Revised Station List to Automatically Use Current IGS Station List Maintained at IGSCB
- Robust Data Getting Commands
 - Search Multiple RINEX Data Extensions (Ex: *.17d And *.17o) to Retrieve a Station's Observations
- Upgraded Observation Data Screening Procedures
 - TEQC Processing Routines
 - Checks for Station Data Gaps or Insufficient Station Data
- ZPD File Screening for Large Standard Deviations and Other Anomalies
- Ongoing Improvements as Issues are Uncovered by User Community or USNO AC Members

Improvements Since 2016 IGS WS

- Switched to ITRF2014 on DOY 029 of 2017
- Upgraded to *Bernese GNSS Software v5.2* from *v5.0*
- Incorporated Automated Station List Update to Process New Stations and Remove Obsolete Stations

Future Activities

- Incorporate the Recommendations of the Troposphere WG
- Investigate Estimates Based on Multi-GNSS Observations
- Participation in Repro2 (Need Resolution on Clock Combination)
- Update Data Retrieval to Download Rinex 3 Observation Files
- Investigate 3-Day Normal Equation Stacking to Reduce Day Boundary Effects

Summary

- Produced Using a PPP Method at USNO (Not a Combination Product) with Modified *Bernese v5.2 Software* and Custom Scripts
- Number of Stations/Day Variability Due to Improved Post Processing Screening for Data Quality and Revised Station List
 - Average ~358 files/day in 2017
- Upcoming Items of Interest
 - Repro2 Participation
 - 3 Day NEq Stacking for Day Boundary Issues

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

For more information:

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