GAGE Facility GNSS Data Analysis and Products Update

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Prepared by
Thomas A. Herring (MIT, GAGE GNSS Analysis Center Coordinator)
Walter M. Szeliga (CWU, GAGE GNSS Analysis Center)
David A. Phillips (UNAVCO Data Center, Archives and Projects Manager)

Introduction

The National Science Foundation's Geodetic Facility for the Advancement of Geoscience (GAGE), operated by UNAVCO, provides geodetic infrastructure, data services, and education and community engagement support for NSF, NASA and community research projects and investigators. The GAGE Facility provides a suite of derived GNSS data products for the community including station position solutions, time series, velocities, coseismic offsets, time series properties, and tropospheric (zenith delay) parameters. These data products are generated by the GAGE GNSS Analysis Center at Central Washington University and the GAGE GNSS Analysis Center Coordinator at MIT, and archived/distributed by UNAVCO. The current GAGE Facility Cooperative Agreement (C/A) began on 2018-10-01 and includes several key changes compared to prior GAGE and PBO C/As. A summary of recent and planned changes related to GAGE GNSS data analysis and products is provided below.

Recent Changes

- Discontinuation of the NMT analysis center. For the past 15 years, GPS data products for PBO and then GAGE were generated by two independent AC's using independent analysis methods as documented in Herring et al. (2016). The CWU AC generated solutions using Gipsy software and the New Mexico Tech (NMT) AC generated solutions using GAMIT software. NMT AC operations ceased on 2018-10-01. NMT data products will continue to be available from the UNAVO Data Center but will only include solutions up through 2018-09-15. Since 2018-09-16 (GPS week 2019) only CWU solutions have been used for rapid, final and supplemental analyses.

- Discontinuation of PBO combined data products. For the past 15 years, three complementary suites of GPS data products for PBO and then GAGE were generated by the ACC: CWU solutions, NMT solutions, and PBO combined (CWU+NMT) solutions as documented in Herring et al. (2016). Because NMT AC products have been discontinued, PBO combined products have also been discontinued since there is now only a single AC. PBO combined data products will continue to be available from the UNAVO Data Center but will only include solutions up through 2018-09-15. Since 2018-09-16 (GPS week 2019) only CWU solutions have been used for rapid, final and supplemental analyses.

  *Note: due to the discontinuation of NMT and PBO combined solutions, **only CWU files contain solutions for the period after 2018-09-15**. The CWU time series files are:*

  <SSSS>.cwu.rapid_nam08.pos
  <SSSS>.cwu.rapid_igs08.pos
  <SSSS>.cwu.final_nam08.pos
  <SSSS>.cwu.final_igs08.pos
  <SSSS>.cwu.nam08.pos (includes rapids and finals in one file)
  <SSSS>.cwu.nam08.csv (simplified contents, includes rapids and finals in one file)
  <SSSS>.cwu.igs08.pos (includes rapids and finals in one file)
  <SSSS>.cwu.igs08.csv (simplified contents, includes rapids and finals in one file)
  where <SSSS> is the 4-character site code.

  Users examining time series before AND after 2018-09-15 should use CWU solutions ONLY to avoid discontinuities associated with these changes. Users examining time series prior to 2019-08-15 only can use CWU, NMT, or PBO solutions.

- Network of the Americas (NOTA). Under the current GAGE Facility, UNAVCO has integrated and federated pre-existing, NSF-funded cGNSS-Met networks into a single pan-American network that encompasses the EarthScope Plate Boundary Observatory (PBO - spanning Alaska, the continental US, and Puerto Rico), TLALOCNet (40 stations in Mexico), and COCONet (85 stations spanning the Caribbean). We have designated this hemispherical-scale, distributed cGNSS-Met resource as Network of the Americas (NOTA). This change has not had direct impacts on data product analysis or generation per se, but solutions and products previously referred to as PBO, TLALOCNet or COCONet are now referred to as NOTA.

Near Future Plans

- ITRF 2014 products release. On 2018-06-10 (GPS week 2005 day 0) the GAGE analysis centers switched fully to the IGS14 reference system as documented previously. However, GAGE data solutions have continued to only be released in the ITRF 2008 system for reasons of continuity. A full reprocessing effort using ITRF 2014 was performed by both the CWU and NMT AC's (prior to discontinuation) that included data back to 1996 as well as 500+ additional stations. New and reprocessed solutions in ITRF 2014 will become available from the UNAVCO Data Center during the summer of 2019. There will be an announcement for this release.

- New GAGE Facility GNSS Data Analysis Plan. An updated and revised document to replace the current version will be released during the summer of 2019.

Long Term Plans

- Development of new combined data products from multiple analysis centers. We intend to develop and release new combined GNSS data products that would facilitate comparison of results between GAGE and non-GAGE analysis centers. The current concept is that in addition to solutions from the GAGE CWU AC, time series from other GNSS analysis centers will be incorporated into analyses by the GAGE ACC at MIT. It is envisioned that available solutions from the University of Nevada, Reno (UNR), the Jet Propulsion Laboratory (JPL), the US Geological Survey (USGS) and the NASA Measures program could be used. The Measures program combines two solutions, one from GIPSY PPP generated at JPL and a GAMIT network solution generated at SIO. Measures also generates a solution that combines the JPL and SIO solutions. Four of the five solutions to be compared to the CWU Gipsy solutions are generated with the same software package (although possibly with different versions) and rely on the same orbit and clock files being generated by JPL. The product comparison and merging of time series would be performed using products available at the time of the analysis and results would be made available in time series format. This new data product remains a concept at present time, and will be further explored and developed.

- Transition from GPS-only to multi-GNSS data analysis. Current GAGE data products are based on analysis of legacy GPS-only observables (e.g., GPS L1 C/A, L2 P). Eventually, we will develop new products based on analysis of future GPS observables (L5, L1C, etc.) as well as multi-constellation GNSS observables (GLONASS, Galileo, BeiDou, QZSS, etc.). This transition will depend partially on the transition from Gipsy (currently 6.4) to GipsyX software at CWU. This new data product remains a concept at present time, and will be further explored and developed.

- Increase in number of GNSS stations analyzed. The number of GNSS stations analyzed by the GAGE Facility AC and ACC will eventually increase from ~2,000 at present time to >10,000 over the coming years. This increase in the number of stations analyzed remains a concept at present time, and will be further explored and developed.

The most current information and resources regarding GAGE Facility GNSS data analysis and products, including updates, documentation, ancillary files, products log, technical news articles, and user notices and advisories is available from http://www.unavco.org/data/gps-gnss/derivedproducts/derived-products.html.