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Fast Network Solutions using Precise Point Positioning with Ambiguity Resolution for all Geodetic GPS Stations in the World

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We have developed an end-to-end system that automatically seeks and routinely retrieves geodetic GPS data from ∼8000 stations (currently) around the globe, reduces the data into unique, daily global network solutions, and produces high precision time series for station coordinates ready for time-series analysis, geophysical modeling and interpretation. Moreover, "carrier range" data are produced for all stations, enabling epoch-by-epoch tracking of individual station motions by precise point positioning for investigation of sub-daily processes, such as post-seismic after-slip and ocean tidal loading. Solutions are computed in a global reference frame aligned to ITRF, and optionally in user-specified continental-scale reference frames that can filter out common-mode signals to enhance regional strain anomalies. We describe the elements of this system, the underlying signal processing theory, the products, operational statistics, and scientific applications of our system. The system is fundamentally based on precise point positioning (PPP) using JPL's GIPSY OASIS II software, coupled with ambiguity resolution and a global network adjustment of ∼500,000 parameters per day using our newly developed Ambizap3 software. The system is designed to easily and efficiently absorb stations that deliver data very late, by recycling prior computations in the network adjustment, such that the resulting network solution is identical to starting from scratch. Thus, it becomes possible to trawl continuously the Internet for late arriving data, or for newly discovered data, and seamlessly update all GPS station time series using the new information content. As new stations are added to the processing archive, automated e-mail requests are made to H.-G. Scherneck's server at Chalmers University to compute ocean loading coefficients used by the station motion model. Rinex file headers are pars ed and compared with alias tables in order to infer the correct receiver type and antenna/radome phase calibrations to apply to the data. Strict quality control is implemented at all levels of the system, with the exception that time series analysis is not used to remove outliers, as that could inhibit discovery of unusual site motions. Implemented on a 100-cpu cluster with custom server-client software, the system in summer 2010 computed from scratch the entire time series for ∼8000 stations from 1996-2010 within 2 months. The latest GPS orbits from JPL's "FlinnR" re-analysis was applied together with transformations into the IGS05 reference frame. Custom reference frames were applied for analysis of station motions with respect to stable North America. Results from this re-analysis will be presented in terms of time series quality, computation time, and scientific products.