Geophysical Research Abstracts
Vol. 15, EGU2013-13362-2, 2013
EGU General Assembly 2013

GPS Time Series in ITRF and Derivative Frames: Trade-offs Between Precision, Frequency, Latency, and Spatial Filter Scale

Geoffrey Blewitt (1), Hans-Peter Plag (1,2), Yoaz Bar-Sever (3), Corné Kreemer (1), William Hammond (1), and Jay Goldfarb (1)

(1) Nevada Geodetic Laboratory, University of Nevada, Reno, NBMG, Reno, United States (gblewitt@unr.edu), (2) Global Change and Sustainability Research Institute, Wits University, Johannesburg, South Africa, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, United States

The Nevada Geodetic Laboratory (NGL) delivers GPS time series products for up to 11000 stations in reference frames derived from ITRF, most of which are publicly available, with a range of latency, positioning frequency (averaging interval), and consequently with a range of precision. Time series of station coordinates and QA (quality assurance) parameters are derived from ambiguity-resolved precise point positioning using the GIPSY-OASIS II software and orbit products from JPL, with automatic step detection subsequently applied. The reference frames themselves include JPL's daily realization of ITRF2008(IGS08), and our own NA12 which co-rotates with stable North America, and provides a spatial filter to suppress errors correlated at the continental scale. Moreover, NGL uses 1-second real-time streaming coordinates delivered from JPL to invert for earthquake source parameters in the event of a seismic trigger. We exploit this rich data set to infer the various trade-offs between precision, frequency, latency, and spatial filter scale in ITRF and its derivative frames. The goal of such a study is to identify and resolve sources of error at various spatio-temporal scales, leading to improved models and data processing procedures. All such studies ultimately rely on the accuracy and stability (forward predictability) of the ITRF, and thus can provide a feedback mechanism that can be used to improve future realizations of ITRF. Our results indicate that JPL's "final" orbits together with JPL's daily transformations into ITRF(IGS08) delivers daily precise point position precision of $\sim$2 mm (horizontal), which is reduced to $\sim$1 mm in the continental-scale frame NA12. This in turn is reduced to $\sim$0.5 mm when going from 24 intervals to 7 day position averages. An experimental global spatial filtering approach (presented at EGU in 2012) shows further improvement when the spatial filter scale is reduced from $\sim$3000 km to $\sim$300 km, but at the expense of suppressing any real long-wavelength signals. There is little degradation in precision going from "final" ($\sim$10 day latency) to "rapid" time series, which are available $\sim$0.5 day following the end of the GPS day ($\sim$1 day average latency). Perhaps surprisingly, precision in ITRF(IGS08) degrades from $\sim$2 mm to only $\sim$6 mm going from 24 hour intervals to 5-minute intervals with $\sim$1 day latency. We show examples where these 5-minute products can be used to infer co-seismic offsets that are unbiased by rapid post-seismic deformation. Currently there is an order of magnitude degradation in precision when going from $\sim$1 day latency to real-time (few-second latency). We also aim to present new results that explore the bridging of this gap, including the use of ultra-rapid orbit products (few-hour latency), with the goal to address the needs of emergency assessment and response to natural hazards.