Geophysical Research Abstracts
Vol. 19, EGU2017-18432-1, 2017
EGU General Assembly 2017

Consistency of different tropospheric models and mapping functions for precise GNSS processing

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The TOmographic Model of the IONospheric electron content (TOMION) software implements a simultaneous precise geodetic and ionospheric modeling, which can be used to test new approaches for real-time precise GNSS modeling (positioning, ionospheric and tropospheric delays, clock errors, among others).
In this work, the software is used to estimate the Zenith Tropospheric Delay (ZTD) emulating real time and its performance is evaluated through a comparative analysis with a built-in GIPSY estimation and IGS final troposphere product, exemplified in a two-day experiment performed in East Australia. Furthermore, the troposphere mapping function was upgraded from Niell to Vienna approach. On a first scenario, only forward processing was activated and the coordinates of the Wide Area GNSS network were loosely constrained, without fixing the carrier phase ambiguities, for both reference and rover receivers. On a second one, precise point positioning (PPP) was implemented, iterating for a fixed coordinates set for the second day.
Comparisons between TOMION, IGS and GIPSY estimates have been performed and for the first one, IGS clocks and orbits were considered. The agreement with GIPSY results seems to be 10 times better than with the IGS final ZTD product, despite having considered IGS products for the computations. Hence, the subsequent analysis was carried out with respect to the GIPSY computations. The estimates show a typical bias of 2cm for the first strategy and of 7mm for PPP, in the worst cases. Moreover, Vienna mapping function showed in general a fairly better agreement than Niell one for both strategies. The RMS values' were found to be around 1cm for all studied situations, with a slightly fitter performance for the Niell one.
Further improvement could be achieved for such estimations with coefficients for the Vienna mapping function calculated from raytracing as well as integrating meteorological comparative parameters.