Geophysical Research Abstracts
Vol. 17, EGU2015-11951, 2015
EGU General Assembly 2015

On troposphere delay constraining in real-time GNSS Precise Point Positioning

Tomasz Hadas, Kamil Kazmierski, and Jaroslaw Bosy

Institute of Geodesy and Geoinformatics, Wroclaw University of Environmental and Life Sciences, Poland (tomasz.hadas@up.wroc.pl)

A common procedure in Precise Point Positioning (PPP) is to have the adjustment model accounting for the correction to an a priori value of the total troposphere delay (ZTD) given at the first epoch of data processing, and the troposphere wet delay filter is updated epoch by epoch. This approach requires some time so that a change in satellite geometry allows to efficiently de-correlate among tropospheric delay, receiver clock error and height. Empirical troposphere state models and mapping functions are available, however they may not reflect properly the actual state of the troposphere, especially in severe weather conditions. It might be more appropriate to take advantage on a regional troposphere model derived from near real-time (NRT) processing of GBAS network.

To evaluate the impact of troposphere constraining in real-time PPP, one week long period was selected, that was characterized with active troposphere conditions. Using the development version of original GNSS-WARP software, a 1 Hz kinematic positioning was performed for 10 selected Polish GBAS stations using IGS Real-Time Service (RTS) products. Two processing strategies were used, one reflecting the common PPP approach and the second with NRT ZTD to constrain the troposphere delay estimates. GPS only and GPS+GLONASS positioning was performed and analyzed using both strategies.

For unconstrained solutions, the convergence time of one hour (GPS only) and 15 minutes (GPS+GLONASS) was reached, providing the sub-decimeter accuracy in horizontal and vertical component. However, for some epochs, and outlying height estimates were observed with the residuals reaching up to 0.5m with the estimated error of 0.2m. At the same time, the unconstrained estimated troposphere delay differs up to 12 cm from the reference NRT ZTD solution. In case the troposphere delay is constrained, all three coordinate components remains accurate and precise for entire processing period after the convergence is reached. From the very beginning of the data processing, the residuals with respect to true receiver position are small. The standard deviation of height component residuals is reduced on average by 40%, however the height are shifted by about 1cm. The results confirm the usefulness of near-real time troposphere delay models in real-time PPP kinematic processing and a significant improvement is noticed in active troposphere conditions.