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ABSTRACTS

Comparative Analysis of Multi-constellation GNSS Precise Point Positioning (PPP) in Kinematic Model

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Abstract

Although the PPP technique was initially applied to GPS observations, the availability of precise products for other satellite systems i.e. GLONASS, Galileo, BeiDou and QZSS emerges the multi-constellation GNSS PPP approach. It offers more accurate and reliable positioning while reducing the convergence time especially when the positioning is conducted especially in the areas where not enough numbers of GPS satellites are visible or blocked/sheltered, also areas with limited satellites and/or poor geometry like in narrow channels, canyons, waterways with severe terrain obstructions, and so on. As of today, a number of analysis centers are contributing dedicated multi-GNSS products and since then the necessary precise products for multi-GNSS have been available free for the users.

The aim of this paper is to investigate the benefits of Multi-GNSS for PPP in kinematic applications. For this purpose, a kinematic test was carried out at Obruk Dam Lake, in Çorum-Turkey in June of 2017. The kinematic data was collected for approximately 6 hours at 1-second interval from all visible GPS, GLONASS, Galileo and BeiDou satellites in view. The PPP-derived coordinates of each measurement epoch were determined by processing of the collected data by using GrafNav GNSS Post-Processing Software by applying five different solution strategies: i-) Using GPS-only observations, ii-) Using combination of GPS+GLONASS observations, iii-) Using combination of GPS+GLONASS+BeiDou observations, iv-) Using combination of GPS+GLONASS+Galileo observations, v-) Using combination of GPS+GLONASS+BeiDou+Galileo observations. The necessary precise products were retrieved from one of the Analysis Centers of MGEX (Multi GNSS Experiment), Center for Orbit Determination in Europe (CODE) and used to estimate the PPP-derived coordinates. The PPP coordinates were then compared to the reference coordinates obtained from post-processed carrier phase-based differential kinematic solutions with GrafNav Software. The results show that, the multi-constellation GNSS PPP improves the positional accuracy when compared to the single-system (GPS-only). In this study, the test procedure and obtained results are given in detail.