Multi-Constellation GNSS Baseline Solutions – a Perspective from the User's and Developer's Point of View

Danijel Šugar (Croatia), Boris Skopljak (USA) and Željko Bačić (Croatia)

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SUMMARY

At the Chair of Satellite Geodesy of the Faculty of Geodesy, University of Zagreb, Croatia, in Satellite Positioning courses and for diploma theses too, the GNSS receivers and software used for processing of static relative observations are provided by Trimble Inc., a company which has a long tradition in GNSS technology, both hardware baseline processing software and workflows. The baseline processing engine (initially having support for GPS-only observations) was deployed with the GPSurvey software, evolved later through the Trimble Geomatics Office (TGO) software, while the combined GPS + GLONASS baseline solution was enabled within Trimble Total Control (TTC) software. In 2005 Trimble company released the Trimble Business Center (TBC) software package with GNSS processing engine including a capability to process GPS-only as well as a combined GPS + GLONASS baseline solution. The updated baseline processor was released within TBC ver. 3.50 in 2015 supporting the independent GNSS constellation solutions including BeiDou-only, GLONASS-only, and BeiDou + GLONASS only combinations. Starting with the TBC, ver. 3.90, Galileo-only post-processing baseline solution was enabled as well. Currently, the sophisticated geodetic GNSS receivers featuring several hundred channels, support a multi-constellation GNSS observations including GPS, GLONASS, Galileo and BeiDou. The fact that TBC is the only commercially available software capable of processing individual constellation information, was a motivation to test and obtain a baseline solution based on GLONASS-only observations and to provide a comparison with the combined GPS + GLONASS solutions which are both supported by CROPOS – CROatian POsitioning System (national network of permanent GNSS stations). The observations collected at 4 stations of the GPS network of the City of Zagreb (plus one additional station) in May 2017, were processed with GLONASS-only data taking into consideration the surrounding CORS stations of CROPOS network. Subsequently, the results were compared with solution obtained from a combined GPS + GLONASS data. Additionally, as at four stations were utilized Galileo enabled GNSS receivers, upon careful mission planning seeking for favorable time

windows, the baselines were processed with GALILEO-only data and subsequently the solutions comparison obtained from different GNSS combinations was given, showing the potential of individual and combined solutions. All computations including baselines processing and network adjustment were carried out utilizing the latest version 4.00 of TBC which was released in September 2017. Currently (November of 2017), GPS and GLONASS are the only two fully operational systems featuring 31 and 25 operational satellites, respectively, whereas the constellations of Galileo and BeiDou systems are still under construction. Approaching their Full Operational Capability (FOC) in the in upcoming years, the availability and reliability of multi-constellation observations will be improved having a direct impact on the reliability of baseline solutions and consequently providing the coordinates of geodetic network stations with improved reliability and accuracy.