Advantages of Multi GNSS Constellation: GDOP Analysis for GPS, GLONASS and Galileo Combinations

Claudio Meneghini, Claudio Parente*

Department of Sciences and Technology, University of Naples "Parthenope", Naples, Italy.

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Abstract

Positioning techniques made lots of progress in the last decades, thanks to the wide usage of the Global Navigation Satellite Systems (GNSS). During a satellite survey, interruption or complete absence of positioning service can happen due to obstacle presence or constrained environments. To avoid these problems, it is suitable to simulate a positioning survey determining the number of the GNSS satellites in view and their availability trend for a selected location. Using more than one constellation the number of the observed satellites is increased and the continuity and reliability of positioning significantly improved. The aim of this paper is to assess the impact of multi-GNSS constellation on positioning calculation in terms of number of available satellites and geometrical distribution in the sky. A simulation is conducted for different cut-off angles, ranging from 0° to 30°: satellites visibility predictions are performed for the city of Benevento (Italy) using short observing sessions (96 daily) and considering GPS, GLONASS and GALILEO constellation. The benefits of their combinations are investigated: in order to assess the observation quality, the Geometrical Dilution of Precision (GDOP) is used as criteria to prove how it is possible to reduce degradation of the position accuracy by using multi-GNSS combinations. Particularly, GPS+GLONASS supplies higher performances compared to the other solutions. Because the low number of satellites in view, the contribution of GALILEO is limited, and its presence instead of GPS or GLONASS in the two constellation solutions produces a decrease in positioning accuracy.

Keywords: Multi-constellation, satellite geometry, GNSS data quality, GDOP

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* Corresponding author. E-mail address: claudio.parente@uniparthenope.it
Tel.: +39-0815476608

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