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Determination of geocenter coordinates and Earth rotation parameters based on Galileo observations

Radosław Zajdel (1), Krzysztof Sośnica (1), Grzegorz Bury (1), Rolf Dach (2), and Lars Prange (2)

(1) Wroclaw University of Environmental and Life Sciences, Institute of Geodesy and Geoinformatics, Wrocław, Poland (radoslaw.zajdel@upwr.edu.pl), (2) University of Bern, Astronomical Institute, Bern, Switzerland

Global Navigational Satellite System (GNSS) is one of the major satellite technique, which can deliver valuable information about Global Geodetic Parameters (GGP) i.e. daily and sub-daily Earth Rotation Parameters (ERPs), including pole coordinates and length-of-day variations, and low-degree gravity field coefficients, including coefficients of degree-1 corresponding to the geocenter coordinates. The European GNSS called Galileo is on the final stretch to achieve the full operational capability in the next years with 27 operational satellites. Unlike the Galileo system, the contribution of GPS and GLONASS systems in GGP determination has widely been discussed in recent years.

This contribution shows the results of Galileo-based Earth Rotation Parameters and geocenter coordinates from 2-year (2017-2018) global processing when compared to the results delivered by GPS and GLONASS. The processing is based on RINEX3 files from the global network of 100 multi-GNSS stations, which track Galileo satellites. We test also the impact of different approaches to the solar radiation pressure modelling for Galileo satellites on the GGP determination. Thanks to the official optical and geometrical metadata for the Galileo satellites, which were released by the European GNSS Agency in 2017 we prepared a box-wing model, which is additionally implemented and employed in the processing.

We found that Galileo can provide geocenter coordinates, whose quality correspond to the GPS series. Moreover, the geocenter coordinates from Galileo are of a better quality than those based on GLONASS data, despite the same number of nominal orbital planes, much lower number of active satellites and lower success-rate of the phase ambiguity resolution for Galileo when compared to GLONASS. Moreover, we decoupled the formal error of Galileo-based GCC from a mutual orientation of orbital planes within the constellation using box-wing model. Using a box-wing model allows for reducing the number of estimated empirical parameters of the ECOM2 model in the solution. Some diurnal and semidiurnal tides in the polar motion and LOD are strongly correlated with orbital parameters for the GPS system, due to proximity of periods of these tides to the revolution period of GPS satellites. Galileo satellites have a different revolution period than GPS, and moreover, two Galileo satellites are orbiting on an eccentric orbit which help to decorrelate tidal constituents from those originating from orbital periods.