EGU2020-3620
https://doi.org/10.5194/egusphere-egu2020-3620
EGU General Assembly 2020

On the prospects of a future GNSS constellation on the global terrestrial reference frame

Susanne Glaser[1], Grzegorz Michalak[1], Rolf Koenig[1], Benjamin Maennel[1], and Harald Schuh[1,2]
[1]GFZ German Research Centre for Geosciences, Geodesy, Potsdam, Germany (susanne.glaser@gfz-potsdam.de)
[2]Technische Universita□t Berlin, Chair of Satellite Geodesy 10623 Berlin, Germany

Global terrestrial reference frames (TRFs), as one of the most important geodetic products, currently miss the imperative requirements of 1 mm accuracy and 1mm/decade long-term stability. In this study, the prospects of a future Global Navigation Satellite System (GNSS) to improve global TRFs is assessed by simulations. The future constellation, named “Kepler”, is proposed by the German Aerospace Center DLR in view of the next generation Galileo system. In addition to a contemporary Medium Earth Orbit (MEO) segment with 24 satellites in three orbital planes, Kepler consists of six Low Earth Orbit (LEO) satellites in two near polar planes, all carrying long-term stable optical clocks. The MEO satellites in one orbital plane and the LEO and MEO satellites in different planes are connected with optical two-way inter-satellite links (ISLs) as the innovative key feature. The ISLs allow very precise range measurements and time synchronization (at the picosecond-level) between the satellites. Different simulation scenarios are set up to evaluate the impact of the Kepler features on the TRF-defining parameters origin and scale as well as on the Earth rotation parameters (ERPs). The origin of a Kepler-only TRF improves considerably by factors of 8, 8, and 43 in X, Y, and Z direction, respectively, w.r.t. a Galileo-only solution. The scale realized by a Kepler-TRF shows improvements of 34% w.r.t. Galileo-only. In a combination with simulated observations of Very Long Baseline Interferometry the impact on multi-technique TRFs is assessed as well. The ERPs of both techniques are combined as global ties and benefits especially on the determination of UT1-UTC are expected.