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Integrated processing of GNSS observations of LEO satellites and ground tracking network

Liangwei Nie[1,2], Jungang Wang[1,3], Maorong Ge[1,2], and Harald Schuh[1,2]

[1]GFZ German Research Centre for Geosciences (GFZ), 14473 Potsdam, Germany
[2]Institut für Geodäsie und Geoinformationstechnik, Technische Universität Berlin, Kaiserin-Augusta-Allee 104-106, 10553 Berlin, Germany
[3]Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai, China

Abstract Global Navigation Satellite Systems (GNSS), which are fundamental to Positioning, Navigation, and Timing (PNT), play also a critical role for the determination of ITRF and the monitoring of global geodetic parameters, such as geocenter and Earth Rotation Parameters (ERP), thanks to the globally distributed network. The Low Earth Orbit (LEO) satellites with onboard GNSS receivers as moving stations can significantly improve the observation geometry of a ground tracking network, and thus enhance the solutions. Previous studies have demonstrated that integrated processing of ground GNSS stations and LEO satellites can improve the GNSS satellite orbits and the determination of the geocenter, especially for spare networks. In this study, we further investigate the contribution of having five LEO satellites (two GRACE-FO satellites and three SWARM satellites) to a rather robust ground GNSS network, i.e., 120 stations. We focus not only on the GNSS satellite orbits, and the geocenter and ERP, but also on some other parameters like ambiguities. We further investigate the impact of the LEO orbit modelling and the weighting strategies of the LEO observations in order to properly consider the fact that onboard GNSS observations can be modelled more precisely than that from ground stations due to the differences in station environment and atmosphere.