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ABSTRACT

Combined multi-GNSS+LAGEOS solutions with the focus on SLR station coordinates, Earth rotation parameters, geocenter and the scale of the reference frame. Results from the ILRS intensive GNSS tracking campaigns. All satellites of new GNSS systems are equipped with laser retro-reflectors dedicated to SLR tracking. Between 2014 and 2017, the ILRS initiated three intensive SLR tracking campaigns devoted to all GNSS satellites, four Galileo, and one GLONASS campaign. As a result, the number of tracked GNSS satellites and the number of SLR observations have dramatically increased allowing for determining GNSS orbits, SLR station coordinates, geocenter coordinates, and Earth rotation parameters. This paper provides the results from the GNSS intensive tracking campaigns and shows the contribution of SLR tracking of multi-GNSS constellation to improved SLR-derived reference frame and scientific products.

We show a solution strategy with estimating satellite orbits, SLR station coordinates, geocenter coordinates, and Earth rotation parameters using SLR observations to 2 LAGEOS and 55 GNSS satellites: 1 GPS, 31 GLONASS, 18 Galileo, 3 BeiDou IGSO, 1 BeiDou MEO, and 1 QZSS satellite for the period 2014.0-2017.5. We compare the SLR station coordinate repeatability and Earth rotation parameters derived from a combined 'SLR to GNSS+LAGEOS' solution to the classical LAGEOS-only solution. We found that the repeatability of SLR station coordinates improves by 6.9, 6.4, and 15.7%, for the North, East, and Up component, respectively, when adding SLR observations to GNSS. Due to a large number of GNSS observations, the number of weekly solutions for some SLR stations, e.g., Arkhyz, Komsomolsk, Altay, Brasilia, Wettzell, is larger up to 41% in the LAGEOS+GNSS solution as compared to LAGEOS-only solution. The RMS of differences of the length-of-day parameter w.r.t. IERS-C04-14 series is reduced from 132 μs to 43 μs when adding SLR observations to multi-GNSS. Finally, we show that the SLR observations to GNSS can transfer the orientation of the reference frame from GNSS to SLR solutions. As a result, the pole coordinates and length-of-day estimates become more stable, whereas the SLR and GNSS solutions become more consistent with each other.