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Determination of SLR station coordinates on the basis of tracking 45 GNSS satellites: benefits for future ITRF realizations

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The SLR station coordinates and SLR-derived Earth Rotation Parameters (ERPs) are typically derived on the basis of SLR tracking of four spherical geodetic satellites: two LAGEOS and two Etalons. Between 2014 and 2016, the International Laser Ranging Service (ILRS) initiated four intensive SLR tracking campaigns for Galileo and three campaigns devoted to tracking all GNSS spacecraft. As a result, the number of SLR observations and the number of tracked GNSS satellites have dramatically increased allowing for determining SLR station coordinates and ERPs solely on the basis of SLR tracking of GNSS satellites.

This paper shows, for the first time, the solution in which the SLR station coordinates, geocenter motion, and ERPs are determined using the SLR observations to 26 GLONASS, 14 Galileo, 2 BeiDou IGSO, 2 BeiDou MEO, and 1 QZSS satellite. We compare the SLR station coordinate stability derived from GNSS-based results to the LAGEOS-only solution and from a combined 'SLR to GNSS+LAGEOS' solution. We address the issues related to the GNSS orbit determination using sparse SLR data and the issues related to handling range biases in the GNSS solutions. We found that the coordinate stability of those SLR stations which provide a large number of GNSS observations can remarkably be improved. The Length-of-day parameter can be derived from SLR-GNSS solutions with a much better accuracy than from the LAGEOS-only solutions. Finally, we show that the SLR tracking of GNSS satellites improves the consistency between SLR and GNSS solutions, and thus, can be beneficial for the future ITRF realizations.