**A simulation study for future geodetic satellite constellations**

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Satellite laser ranging (SLR) is currently one of four space geodetic techniques that provide a relevant contribution to the International Terrestrial Reference Frame (ITRF) realization as well as to the determination of global geodetic parameters or low-degree harmonics of the Earth's gravity potential. ITRF realizations are mostly based on the observations to the two LAGEOS and two Etalon satellites, however, the impact of observations to Etalon satellites is marginal when compared to LAGEOS. Currently, an extension of the ITRF solution to include the LARES and LARES 2 is under consideration. The latter was designed and developed by the Italian Space Agency ASI and launched on July 13, 2022.

This study aims at evaluating the contribution of the LARES 2 satellite to the realization of ITRF and deriving global geodetic parameters. Moreover, we consider adding subsequent satellites which supplement the existing constellation of LARES and LAGEOS satellites. Our research aims to investigate a maximized contribution to the accuracy improvement of global geodetic parameters. We also examine various approaches to estimating geodetic parameters depending on the number of determined empirical once-per-revolution parameters for satellite orbits and different approaches of parametrization for the Earth rotation parameters, including piecewise linear and piecewise constant parametrization.

We simulate satellite orbits and SLR observations to LAGEOS-1/-2 and LARES 1/2, as well as to possible pairs of LARES 3/4 and LARES 5/6. We check how the satellites at different inclination angles and heights contribute to deriving global geodetic parameters and compare the results to LAGEOS-1/-2 solutions based on simulated data. We show the improvement that can be obtained by adding observations to the LARES 2 satellite, e.g., for geocenter coordinates, whose median formal errors from weekly solutions based on simulated data are 0.8, 0.8, and 1.6 mm for X, Y, and Z coordinates, respectively when adding LARES 2.