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GNSS-SLR satellite co-location for the estimate of local ties

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The current realization of the International Terrestrial Reference Frame (ITRF) is based on four different space-geodetic techniques, so that the benefits brought by each observing system to the definition of the frame can compensate for the drawbacks of the others and technique-specific systematic errors might be identified. The strategy used to combine the observations from the different techniques is then of prominent importance for the realization of a precise and stable reference frame. This study concentrates, in particular, on the combination of Satellite Laser Ranging (SLR) and Global Navigation Satellite System (GNSS) observations by exploiting satellite co-locations. This innovative approach is based on the fact that laser tracking of GNSS satellites, carrying on board laser reflector arrays, allows for the combination of optical and microwave signals in the determination of the spacecraft orbit. Besides, the use of satellite co-locations differs quite significantly from the traditional combination method in which each single technique solution is carried out autonomously and is interrelated in a second step. One of the benefits of the approach adopted in this study is that it allows for an independent validation of the local tie, i.e. of the vector connecting the SLR and GNSS reference points in a multi-techniques station. Typically, local ties are expressed by a single value, measured with ground-based geodetic techniques and taken as constant. In principle, however, local ties might show time variations likely caused by the different monumentation characteristics of the GNSS antennas with respect to those of a SLR system. This study evaluates the possibility of using the satellite co-location approach to generate local-ties time series by means of observations available for a selected network of ILRS stations. The data analyzed in this study were acquired as part of the NASA's Earth Science Data Systems and are archived and distributed by the Crustal Dynamics Data Information System (CDDIS).