

## **Reconstructing local ties via co-location in space onboard GNSS and LEO satellites**

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Satellite missions incorporating more than one space geodetic technique onboard the spacecraft allow for co-location in space. All Galileo satellites are equipped with the laser retroreflector, thus allowing for the co-location between GNSS and SLR data. Low Earth Orbiting (LEO) satellites, such as SWARM, track GPS signals and are equipped with laser retroreflectors, thus, integrating two space geodetic techniques onboard.

In this study, we employ Galileo satellites as a tool for the reconstruction of local ties between SLR telescopes and GNSS receiver antennas measured on the ground. We use a time series of SLR observations to Galileo satellites and a global network of stations tracking microwave GNSS signals. SLR and GNSS solutions are combined using different approaches of range bias handling and network constraining.

We also employ double SLR telescopes at one station, such as in the Wettzell Observatory, to reconstruct the local tie using the observations of SWARM satellites and high-accuracy GPS-based orbits. We test different approaches of SLR network constraining, solutions using LEO, Galileo, and LAGEOS data, as well as the solution without introducing any constraints, the so-called SLR Precise Point Positioning. We show that LEO satellites can be used for the reconstruction of the local ties with the agreement of the mean value at the level of a few millimeters when using at least several months of SLR data.