The Synergy of Satellite Laser Ranging (SLR) and DORIS as Space Geodesy Techniques

Dr Frank Lemoine[1], Mr Nikita Zelensky[2], Dr Alexandre Belli[3], Mr Alexandre Couhert[4], Dr Guilhem Moreaux[5]
[1]NASA Goddard Space Flight Center, Greenbelt, United States, [2]SGT Inc., Greenbelt, United States, [3]NASA Postdoctoral Program @ NASA GSFC, Greenbelt, United States, [4]Centre National D' Etudes Spatiales, Toulouse, France, [5]Collect Localisation Satellites, Ramonville Saint-Agne, France

Satellite Laser Ranging (SLR) and Doppler Orbitography Integrated by Satellite (DORIS) are two of the space geodesy techniques that contribute to the International Terrestrial Reference Frame (ITRF). They are valuable techniques for orbit determination of Low Earth Orbiting (LEO) satellites. Since the early 1990's, the two techniques have been used in tandem to determine precise orbits for altimeter satellites (e.g. TOPEX/Poseidon, Jason-1, Jason-2, Jason-3, Envisat, CryoSat-2, SARAL, HY-2A, Sentinel-3A, Sentinel-3B). Scientific data products such as mission geophysical data records or Mean Sea Level Time series derived from satellite altimeter data (especially for the reference missions, TOPEX & Jasons1-3, rely wholly or in part on these two tracking observables. The DORIS data provide near-continuous observations, whereas the SLR data anchors the satellite orbit, and are essential to providing an independent assessment of radial orbit error. More recently on Jason-2, the T2L2 (Time Transfer by Laser Link) experiment has provided us valuable insight into the long-term behavior of the DORIS Ultra-Stable Oscillator, quantifying how it responds to temperature, to radiation exposure, and to long-term presence in the space environment. In addition, the T2L2 experiment has allowed us to derive a time history of the offsets of the satellite laser ranging station clocks from UTC, an-orbit metrological calibration that was previously unavailable. This presentation will give an overview of the SLR &DORIS contributions to the ITRF, precise orbit determination for LEO satellites, the estimation of the low-degree variations in the Earth's gravity field, and to the geocenter, emphasizing their intrinsic complementarity.