Current topic for a Master's Thesis

Analysis and refined generation of SLR normal points from full-rate data

Satellite Laser Ranging (SLR) is a space-geodetic techniques which measures the travel time of a laser pulse shot from a crust-fixed station on Earth to a near-Earth orbiting satellite. This measurement is usually done multiple times (few to millions) per second and overflight over a station, depending on the measurement rate of the observing telescope. The respective data is called SLR full-rate data. To reduce the amount of data and screen the raw observations for outliers and systematics already at the station level, the International Laser Ranging Service (ILRS) defined the so-called normal point (NP) data type which is formed from full-rate data averaged over a certain satellite-dependent time span (bin size). Thereby, the stations are, in principle, free to apply any algorithm to generate NPs although the ILRS recommends a verified program developed by Wilkinson/NERC (2018, cf. figure). Both data types are operationally sent by the stations to the global data centers at DGFI-TUM (Eurolas Data Center, EDC) and NASA (Crustal Dynamics Data Information System, CDDIS). Any official ILRS product is based on this NP data. However, the impact of the algorithm on the results and the "best" algorithm to generate NPs are subject to discussion (e.g., the data screening approach).

It shall be investigated if the ILRS-recommended NP generation program orbitNP.py is correctly used by all SLR stations. In addition, other available NP generation algorithms shall be investigated and applied. Finally, their impact on derived selected geodetic parameters such as station and geocenter coordinates and Earth orientation parameters shall be investigated.
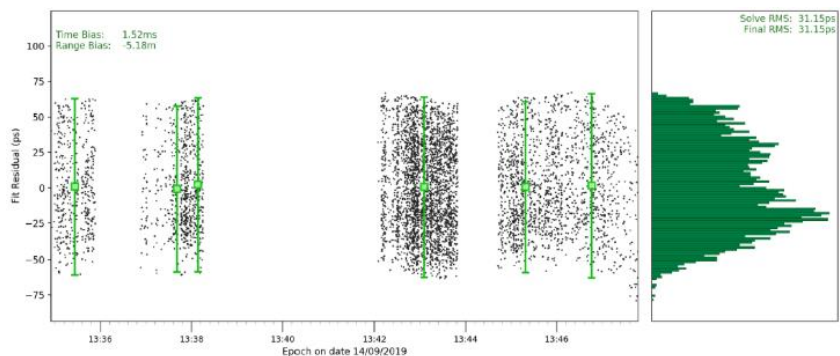

Figure: SLR orbit fit residuals and NPs with statistics provided for a LAGEOS-1 pass over Potsdam (cf. Wilkinson/NERC, 2018).

Main tasks:

- Analysis of full-rate and NP data provided by globally distributed SLR stations to DGFI-TUM (EDC).

- Comparison of different NP generation algorithms by variation of satellite-specific parameters (e.g., bin size, Center-of-Mass model) and generation of a global NP data set.

- Analysis of NP observations to selected near-Earth orbiting satellites based on different NP data sets (generated by the stations vervus generated centrally at DGFI-TUM).

- Estimation of geodetic parameters based on different NP data sets.

- Investigation and interpretation of the parameter differences caused by the different NP generation algorithms.

References:

Noll C. E., Ricklefs R., Horvath J., Müller H., Schwatke C., Torrence M. (2018). Information resources supporting scientific research for the International Laser Ranging Service. J Geod 93, 2211–2225, DOI: 10.1007/s00190-018-1207-2.
Wilkinson/NERC (2018). https://ilrs.cddis.eosdis.nasa.gov/technology/software/orbitNP_1.0.tar.gz.
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