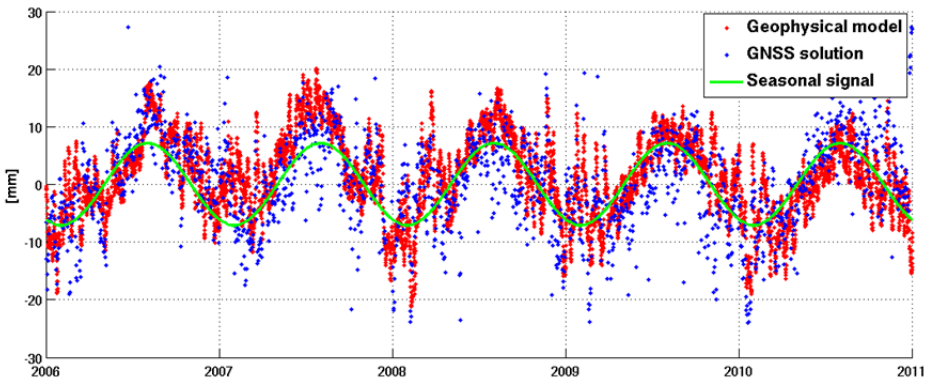
Current topic for a Master's Thesis

Analysis of non-linear station motions in terrestrial reference frame computations

The computation of highly precise and long-term stable terrestrial reference frames is one of the major research topics at DGFI. Calculations are based on the combination of observations from space-geodetic observation systems, such as GNSS, VLBI, SLR, and DORIS. Respective normal equations include station positions and Earth rotations parameters. In current realizations (e.g., DTRF2014), the station motions are represented solely by linear velocities, whereas conventional models are applied to account for phenomena like, e.g., tidal deformations. Various significant effects, however, are not captured by these models. Among those are atmospheric and hydrological loading, although present for the majority of stations with effects in the cm-range (Figure). Non-linear station motions are a major limiting factor for the accuracy of the ITRF. Besides seasonal signals, various stations are affected by large earthquakes, causing co-seismic displacements and post-seismic deformations. Within this master's thesis, such non-linear station motions shall be studied. A major focus shall be on a new approach for an improved handling of the non-linear station motions based on an extended parameterization for the estimation of seasonal signals, which has been implemented into the DGFI-TUM combination software (DOGS-CS).



Height time series for GNSS station Zwenigorod (Russia, blue) compared to deformation from geophysical models (red) and estimated seasonal signal (green)

Main tasks:

- Study current and improved methods for the handling of non-linear station motions.
- Analyse the estimated seasonal signals obtained from the new approach.
- Compare the seasonal signals with the original time series and with geophysical model results (which will be provided externally).
- Compare the seasonal signals of different space techniques at co-location sites.
- Select stations that are affected by large earthquakes and investigate strategies for a suitable parameterization of post-seismic deformations (e.g., logarithmic functions).

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