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GNSS-specific local effects at the Geodetic Observatory Wettzell

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Global Navigation Satellite Systems (GNSS) and in particular the Global Positioning System (GPS) play an important role in the computation of the International Terrestrial Reference Frame (ITRF). Besides the densification of the global network, they help to tie the other space geodetic techniques, namely Satellite Laser Ranging (SLR) and Very Long Baseline Interferometry (VLBI): there are only very few SLR/VLBI co-locations whereas most SLR and VLBI sites are co-located with a GNSS site. Although sub-mm precision can be achieved with GNSS receivers on short baselines, the accuracy of these measurements on local as well as global scales can be degraded by local effects like multipath.

A small network of up to six GNSS permanent sites at the Geodetic Observatory Wettzell provides an ideal basis for studying these local effects. Terrestrial measurements allow for a validation of the results obtained from GNSS measurements. It is shown that these measurements differ from the GNSS-derived results by up to several cm. But also different GNSS observables and linear combinations differ from each other on the same level. Near-field multipath might be responsible for these frequency-dependent biases. To study these effects in more detail, coordinates from terrestrial measurements are fixed in the GNSS analysis in order to derive time series of residuals as well as residual maps. These residual maps might be an empirical approach to correct for the site-specific local effects. Furthermore, single differences between two sites derived from the geometry-free linear combination are used to demonstrate the local effects on the observation level: geometric effects are eliminated by forming the linear combination and ionospheric effects are mostly eliminated by the single difference.