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VLBI Estimation of Short Baselines at the Fundamental Site Wettzell

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The identification of systematic biases among space geodetic techniques and the detection of technique-specific modelling problems are crucial steps for the improvement of the consistency and accuracy of the terrestrial reference frame. The use of intra-technique experiments on short local baselines provides a tool to investigate and quantify these technique-specific error sources, biases and delays, as the local baselines are known from terrestrial measurements, the relative atmospheric delays can be modelled and a common clock can be used. In particular, the assessment of short baselines of Very Long Baseline Interferometry (VLBI) is expected to provide insights into local effects and instrument-specific biases. Moreover, the study of short baselines in VLBI is of major interest as the intended replacement of legacy antennas by new dishes requires an accurate determination of the local baselines.

We present results on the analysis of the short baseline of the co-located VLBI telescopes at the Geodetic Observatory in Wettzell (Germany), realised by the legacy 20 m dish Radio Telescope Wettzell (RTW) and the new 13.2 m TWIN Telescope Wettzell (TTW1). Through the use of several strategies, i.e. global VLBI solutions and Wettzell baseline solutions, 57 VLBI sessions (spanning approximately 1 year) are processed to estimate station coordinates, troposphere zenith delays and clock parameters. Results from this analysis demonstrate a sub-millimetre agreement of the VLBI-based vectors and the terrestrial measurements (local ties). Differences between VLBI- and GNSS-based tropospheric zenith delays, with respect to a co-located GNSS station at the site, are also evaluated to investigate the behaviour of absolute and relative atmospheric delays.

In addition, the analysis of the local Wettzell baseline benefits from a recently installed optical time transferring system. This two-way optical time-transfer system (TWOTT) allows to create virtual common clock between TTW1 and RTW. The estimated clock differences between VLBI and TWOTT show an acceptable agreement, with differences below 50 ps. How the derived clock differences help in the analysis of instrumental delays, environmental effects and observation characteristics, is also discussed in this contribution.