

On the Impact of Local- and Tropospheric Ties for the Rigorous Combination of GNSS and VLBI

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Abstract. Earth Orientation Parameters (EOPs) are heterogeneously determined in the current realisation of the International Terrestrial Reference Frame (ITRF). Polar motion (x-pole and y-pole) is estimated based on the combination of the four major space geodetic techniques, whereas their rates are only based on two techniques, namely Global Navigation Satellite Systems (GNSS) and Very Long Baseline Interferometry (VLBI). Moreover, the Earth's phase of rotation (UT1-UTC) and Length of Day (LOD) are taken solely from the VLBI solution. In addition, the combination of troposphere parameters from VLBI and GNSS through the use of tropospheric ties at fundamental sites is not implemented in ITRF's combination strategy. Hence, a rigorous combination of all parameter types common to the various techniques, with consistent EOPs and with appropriate inter-technique tropospheric ties, is still an ongoing challenge.

In this contribution, we study the impact of the use of tropospheric ties between VLBI and GNSS observations at co-location sites during the CONT17 campaign. In our approach, we perform the rigorous estimation of all parameter types common to these techniques: station coordinates, troposphere zenith delays and gradients, and the full set of EOPs and their rates, including their full variance-covariance information. The core element of our processing scheme is the combination of observations via local- and tropospheric ties, which are essential especially for the height estimates. By using and evaluating different weighting schemes, to obtain a unique set of consistent parameters, we analyse station coordinate repeatabilities and the characteristics and behaviour of the EOPs, and discuss the impact of the accuracy and weighting of the local- and troposphere ties on the estimation of the different geodetic parameters. We discuss the challenges and results of this rigorous inter-technique combination of VLBI and GNSS observations, and provide evidence of the need of such an approach.