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Troposphere delay modeling in VLBI and GNSS analysis

Johannes Boehm (1), Peter Steigenberger (2), Robert Heinkelmann (3), and Harald Schuh (1)

(1) Vienna University of Technology, Vienna, Austria (johannes.boehm@tuwien.ac.at), (2) Technical University Munich, Munich, Germany, (3) Deutsches Geodätisches Forschungsinstitut, Munich, Germany

Troposphere delay modeling is a major error source in the analysis of space geodetic observations at radio wavelengths, like those from Very Long Baseline Interferometry (VLBI) or Global Navigation Satellite Systems (GNSS). As recommended by the IERS Conventions, the zenith hydrostatic delays determined from pressure values are mapped down to the elevation of the observation to get a priori slant hydrostatic delays, and the wet mapping functions are applied to estimate the residual (wet) zenith delays. To account for azimuthal asymmetries of the tropospheric delays, so-called north-south and east-west gradients are estimated, too. We show the effect of applying different mapping functions (analytical formulations vs. discrete 6h time series), different pressure values (e.g., local measurements or standard models), and different gradient models on the celestial and terrestrial reference frames determined from GNSS and VLBI analysis, with a special emphasis on European stations. We also provide an outlook how direct ray-tracing could replace the concept of mapping functions and gradients in future, and we report our experience on troposphere delay modeling and VLBI2010 simulations.