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Troposphere delay models in blind mode - towards improved predictions of the wet component

Michael Schindelegger (1), Gregor Möller (1), Johannes Böhm (1), Robert Weber (1), and Gregory Pain (2)
(1) Vienna University of Technology, Department of Geodesy and Geoinformation, 120-4, Vienna, Austria (michael.schindelegger@tuwien.ac.at), (2) Ecole Nationale des Sciences Geographiques, Paris, France

The accuracy of positioning products derived from space geodetic observations such as GNSS (Global Navigation Satellite Systems) critically depends on a precise account of the microwave path delay caused by the troposphere and in particular the highly variable amount of humidity at altitudes below 10 km. Slant path delays, typically split into hydrostatic and wet components that have been mapped from the zenith to the observational elevation, are preferably modeled on the basis of local instantaneous pressure values, operational analysis data of numerical weather prediction systems, and zenith wet delay values determined within the least-squares adjustment. In case such a priori meteorological information is inaccessible, empirical or so-called 'blind' delay models provide a viable replacement in the form of grid point-wise mean parameter values and their seasonal variations. Here, we summarize the recent improvements made in this field of blind delay models by reference to GPT2 (Global Pressure and Temperature 2), which has been constructed upon 10 years of monthly climatological ERA-Interim data of the ECMWF (European Centre for Medium-Range Weather Forecasts) and displays an excellent usability for GNSS applications as seen from comparisons to ray-traced delays during 2012. Particular emphasis is placed on a currently developed extension of GPT2 in terms of a priori estimates for zenith wet delays. While being potentially beneficial for real time positioning and navigation tasks, the effectiveness of such an extension largely relies on how accurate the water vapor decrease factor through the entire troposphere is represented locally. We resolve this intricacy by inverting ray-traced zenith wet delays from GPT2's ERA-Interim data and issuing mean, annual, and semi-annual components of the water vapor decrease factor on a global 1 degree grid. A tentative validation of the resulting zenith wet delays comprises 90 globally distributed GNSS sites during January 2013, for which 6-hourly, observed zenith total delays are reduced to proximate wet contributions by virtue of pressure values of nearby meteorological sites. Statistical comparisons of these measured delays to their corresponding blind predictions demonstrate the performance and limitations of GPT2's newly suggested extension.