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Application of troposphere model from NWP and GNSS data into real-time precise positioning

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The tropospheric delay empirical models are usually functions of meteorological parameters (temperature, pressure and humidity). The application of standard atmosphere parameters or global models, such as GPT (global pressure/temperature) model or UNB3 (University of New Brunswick, version 3) model, may not be sufficient, especially for positioning in non-standard weather conditions. The possible solution is to use regional troposphere models based on real-time or near-real time measurements. We implement a regional troposphere model into the PPP (Precise Point Positioning) software GNSS-WARP (Wroclaw Algorithms for Real-time Positioning) developed at Wroclaw University of Environmental and Life Sciences. The software is capable of processing static and kinematic multi-GNSS data in real-time and post-processing mode and takes advantage of final IGS (International GNSS Service) products as well as IGS RTS (Real-Time Service) products. A shortcoming of PPP technique is the time required for the solution to converge. One of the reasons is the high correlation among the estimated parameters: troposphere delay, receiver clock offset and receiver height. To efficiently decorrelate these parameters, a significant change in satellite geometry is required. Alternative solution is to introduce the external high-quality regional troposphere delay model to constrain troposphere estimates. The proposed model consists of zenith total delays (ZTD) and mapping functions calculated from meteorological parameters from Numerical Weather Prediction model WRF (Weather Research and Forecasting) and ZTDs from ground-based GNSS stations using the least-squares collocation software COMEDIE (Collocation of Meteorological Data for Interpretation and Estimation of Tropospheric Pathdelays) developed at ETH Zurich.