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An Evaluation of the Accuracy of Real-Time Zenith Total Delay Estimates

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The continuous evolution of Global Navigation Satellite Systems (GNSS) meteorology has lead to an increased use of associated observations for operational meteorology worldwide. In order to enhance short-term weather forecasts meteorological institutions use modern low-latency Numerical Weather Prediction (NWP) models which assimilate GNSS-derived Zenith Total Delay (ZTD) estimates. For such NWP models a number of GNSS processing strategies allow the provision of these ZTDs with the required accuracy (up to a few millimetres) and latency (hourly). However, meteorological now-casting applications, e.g. for storm tracking, require higher update rates for the ZTDs of 10 or even 5 min, which can be achieved, but only at a loss in accuracy.

Using the IGS Real-Time Service orbit and clock products together with an appropriate GNSS software, it is possible to estimate the ZTDs in real-time. Available software packages either use GNSS processing strategies based on differenced or un-differenced observations, such as Precise Point Positioning (PPP). While PPP has clear advantages for efficiently processing data streams from large GNSS networks this strategy is more affected by inaccuracies in the real-time products than when using differenced observations. On the other hand, recent advances in PPP integer ambiguity resolution nowadays provide this strategy with the benefits of ambiguity-fixed solutions.

In this study, we present an evaluation of the accuracy of real-time ZTD estimates obtained from several GNSS processing systems through comparison to those obtained from a near real-time and a post-processing system.