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An assessment of zenith total delay corrections from numerical weather prediction models

G.V. Bennitt (1) and T. Schueler (2)

(1) Met Office, Exeter, United Kingdom (gemma.bennitt@metoffice.gov.uk), (2) Institute of Geodesy and Navigation, University FAF Munich, Germany (torben.schueler@unibw.de)

Precise positioning applications using GNSS require corrections for the delay in the received satellite signal due to the atmosphere through which the signal travels. Many of these applications use the Zenith Total Delay (ZTD) estimated from climatology. The use of numerical weather prediction (NWP) models to provide estimates of ZTD for positioning may have some benefits over using climatological values. NWP models can provide atmospheric information at a time frequency which could be useful for precise positioning. An advantage of using NWP models is that ZTD can be provided as forecasts, thereby allowing precise positioning to be calculated in a timely manner. The spatial resolution of NWP models continues to increase, resulting in better representation of the meteorological features which affect the ZTD on hourly timescales. With the enhanced positioning accuracy which the Galileo satellite navigation system will provide, techniques to improve ZTD correction could prove to be increasingly useful.

A short study was conducted to compare two different techniques to derive ZTD from NWP models. The first technique uses three-hourly surface meteorological fields from the US NOAA-NCEP Global Forecasting System NWP model to estimate the hydrostatic and wet components of the ZTD. The second technique uses hourly ZTD fields produced from the Met Office (UK) global NWP model, which are produced by integration of the model refractivity through the vertical column. Comparisons were made of the NWP derived ZTDs with the EUREF combined post-processed ZTD product for the GNSS sites in the EUREF Permanent Network. Both techniques display certain advantages and disadvantages, but the relevance of these will depend on the requirements for a ZTD correction product, and the ability of the NWP derived ZTD to improve positioning precision compared to climatology.