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Atmospheric Delay Reduction using Ray Tracing Technique through Meso-scale Numerical Weather Data for Space Geodesy

Ryuichi ICHIKAWA (1), Thomas HOBIGER (2), Yoshinori SHOJI (3), Yasuhiro KOYAMA (2), and Tesuro KONDO (1)

(1) National Institute of Information and Communications Technology, Kashima Space Research Center, Kashima, Japan (richi@nict.go.jp), (2) National Institute of Information and Communications Technology, (3) Meteorological Research Institute, JMA

We have been developing a state-of-art tool to estimate the atmospheric path delays by ray-tracing through meso-scale analysis (MANAL data) data with 10km grid interval, which is operationally used for numerical weather prediction by Japan Meteorological Agency (JMA). The tools, which we have named 'KAshima RAytracing Tools (KARAT)', are capable of calculating total slant delays and ray-bending angles considering real atmospheric phenomena. The KARAT can estimate atmospheric slant delays by three different calculation schemes. These are (1) a piece-wise linear propagation, (2) an analytical 2-D ray-propagation model by Thayer, and (3) a 3-D Eikonal solver. By computing GPS PPP solutions for 57 GPS sites of the GEONET (GPS Earth Observation Network System) operated by Geographical Survey Institute (GSI) of Japan it could be shown that KARAT performs slightly better than results based on the Global Mapping Function (GMF) and the Vienna Mapping Function 1 (VMF1), whereas for the latter two also linear gradient models had to be applied. The grid interval of the MANAL data was updated from 10km to 5km on April 7, 2009. In addition, on October 27, 2009 the JMA started data assimilation of zenith wet delay obtained by the GEONET for meso-scale numerical weather prediction. We are now evaluating impacts of data scheme improvements and assimilation strategy change on the slant delay reduction. We will include these preliminary results in our presentation.