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Evaluations of Modern Mapping Functions using the Fast Ray Tracing Tools through the JMA Mesoscale Numerical Weather Data

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http://www2.nict.go.jp/w/w114/stsi/index.html

We have simultaneously evaluated atmospheric parameters (equivalent zenith total delay and linear horizontal delay gradients) and position errors derived from slant path delays obtained by new ray tracing technique [Hobiger et al., 2007] through the Japan Meteorological Agency (JMA) meso-scale analysis data (MANAL data) with 10 km horizontal resolution. The JMA MANAL data which we used in our study provides temperature, humidity, and pressure values at the surface and at 21 height levels (which vary between several tens of meters and about 31 km), for each node in a 10km by 10 km grid that covers Japan islands, the surrounding ocean and eastern Eurasia. The 3-hourly operational products are available by JMA since March, 2006.

Most of the early mapping functions developed for use in VLBI and GPS geodesy were based on the assumption of azimuthal isotropy. On the other hand, the recent geodetic analyses are carried out by applying the modern mapping functions based on the numerical weather analysis field.

For example, the Isobaric Mapping Function (IMF) by Niell[2001], Global Mapping Function (GMF) by Boehm et al. [2006], and Vienna Mapping Function (VMF) by Boehm and Schuh [2004] have been successfully used to remove the zenith hydrostatic delay in the past few years. In addition, the lateral spatial variation of wet delay is reduced by linear gradient estimation.

However, the mapping function errors associated with the lateral heterogeneity of the atmosphere have not been assessed sufficiently so far. Our goal is to see how well the modern anisotropic mapping functions can mimic the directional variability associated with the intense mesoscale disturbances typical of the Japanese monsoon over one year. At the National Institute of Information and Communications Technology (NICT), Japan the so-called KAshima RAy-tracing Tools (KARAT) have been developed which can calculate total slant delays and ray-bending angles. We perform a successive 19 months run of KARAT calculations from March 2006 to September 2007. During this period, heavy rainfall amounts exceeding 200 mm were observed over western Japan. We will present comparisons between 'observed' slant delays using KARAT and those calculated using the best-fit isotropic and anisotropic mapping functions. We also present PPP results applying the different mapping functions.