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AN EVALUATION OF POSITIONING ERROR ESTIMATED BY THE MESOSCALE NON-HYDROSTATIC MODEL -PART 2-

Ryuichi Ichikawa[1], Hiromu Seko[2], Michael Bevis[3]

[1] CRL, [2] Forecast Dep.,MRI,JMA, [3] HIGP, Univ. of Hawaii

We evaluate atmospheric parameters (equivalent zenith wet delay and linear horizontal delay gradients) derived from slant path delays obtained by ray-tracing through the non-hydrostatic numerical weather prediction model (NHM) with 1.5 km horizontal resolution. Our ultimate purpose is to establish a new method for reducing atmospheric effects on geodetic positioning. We first seek to establish the level of positioning error due to intense mesoscale phenomena such as the passing of cold fronts, heavy rainfall events, and severe storms. The NMH provides temperature, humidity and pressure values at the surface and at 38 height levels (which vary between several tens meters and about 35 km), for each node in a 1.5 km by 1.5 km grid that covers Izu peninsula of the central Japan and surrounding ocean.

We performed ray tracing experiments for the entire grid of the NHM at one epoch of the 1200 UT 3/7/1997. For each station we invert the simulated data set, consisting of 52 slant delays, using an isotropic and an anistropic delay model. The isotropic model has only one parameter - the zenith wet delay (ZWD). The anisotropic delay model of Chen and Herring (1997) has two additional lateral gradient parameters. We compare the 'true' ZWD, computed by directly integrating the wet refractivity field of NHM, with the ZWD estimated by least squares inversion of the 'observed' slant delays obtained by ray tracing. We did this using the isotropic and the anistropic delay models [e.g. MacMillan, 1995; Chen and Herring, 1997].

A characteristic GMS cloud pattern caused by the mountain lee waves is presented in the study area. At the east of the Izu peninsula ZWDs are lying in a north-south band about 10 km in width and about 50 km in length. This ZWD pattern is consistent with that of cloud image. Large gradient vectors are shown nearby the north-south ZWD band. In addition the biggest gradients occur at the northern part of the peninsula where topographic variations produce a much more complex distribution of water vapor.

We are numerically examining positioning errors calculated from the slant delays through the NHM, assuming single point positioning and relative positioning. The behavior of the positioning errors under the atmospheric disturbance in local scale, the relation between the slant delay errors and the vertical positioning errors, and the efficiency of the reduction of the azimuthal anisotropy of the atmosphere using the anisotropic mapping function will be represented.