Geophysical Research Abstracts,
Vol. 11, EGU2009-2634, 2009
EGU General Assembly 2009

Impact of mapping functions and a priori hydrostatic delays on GPS-derived vertical coordinates and wet zenith delays over Japan

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We quantitatively investigated the impact of mapping functions and a priori hydrostatic delays on GPS-derived vertical coordinates and wet zenith delays over Japan through a numerical simulation. For this purpose, we first simulated the GPS data for present-day satellite distributions considering realistic cumulative tropospheric delays that are calculated using ray tracing and fine-scale regional numerical weather models. Then we analyzed the simulated GPS data by using the GIPSY software in the PPP mode with several combinations of mapping functions and a priori hydrostatic delay models. We tested three combinations, namely 1) NMF/Berg, GMF/GPT, and VMF1/ECMWF. From this numerical simulation, we found that the use of the VMF1/ECMWF results in better accuracies of vertical coordinates as well as wet zenith delays in terms of spurious biases, spurious annual variations and repeatability. We also compare the results with those from the analysis of the real observation data.