On the impact of the GPS complement by the Japanese Quasi-Zenith Satellite System on positioning accuracies

Hiroshi Munekane[1]; Yuki Kuroishi[2]; Yuki Hatanaka[3]; Hiroshi Yarai[1]; Hisashi Miyazaki[4]

[1] GSI; [2] Space Geodesy Laboratory, GSI; [3] Geographical Survey Institute; [4] JAS

We have developed software for evaluating positioning accuracy with global navigation satellite systems including the Japanese Quasi-Zenith Satellite System (QZSS). The software, named ”Satellite Positioning System Simulator (SPSS)“, is composed of three modules, namely, 1) the orbit generation module where tabular positions for arbitrary satellites are generated based on their assigned orbit elements, 2) the observable generation module where observation data for chosen satellites at an observation site are generated, 3) the visualization module where relevant information are plotted. The outputs of the SPSS are satellite positions in the SP3 format and observation data in the RINEX format. Users may analyze those data with generic positioning software so that they may evaluate positioning accuracies. One may add various kinds of errors on both satellite positions and observation data so that one may reproduce realistic positioning errors.

With this software, we evaluated impacts of additional QZSS observations to GPS observations on obtainable positioning accuracies. We did a preliminary investigation on the case where one makes observations under severe meteorological disturbances. We simulated the observation data at three virtual sites in Tokyo on selected two days (Aug. 31-Sep. 1, 2004) where we had severe meteorological disturbances due both to the typhoon and weather front. In the simulation, we employed a fine-resolution (2kmx2km spatial and 1h temporal) numerical weather model to reproduce reasonable tropospheric delays expected at those sites. We analyzed the data with the following strategy 1) no troposphere delay estimation, 2) one-hour time window, and 3) L3 analysis. We got following tentative results: 1) under meteorological disturbances, one may expect severe positioning errors up to 5cm if one does not estimate tropospheric delay in the analysis for a baseline as short as 10km, 2) additional QZSS observations will improve positioning accuracies, particularly in horizontal directions, at those sites where satellite visibility is poor. In the presentation, we will give quantitative discussion on the impact of additional QZSS observations on positioning accuracies based on the results of our ongoing comprehensive investigations.