Numerical simulation of positioning errors using numerical weather prediction models

Masayoshi Ishimoto[1]; Hiroshi Munekane[1]

[1] GSI

The tropospheric delay is one of the major error sources in the positioning using the space geodetic techniques such as GNSS. In the routine analysis of GEONET, positioning errors caused by the tropospheric delay had been occasionally observed, which make the crustal deformation monitoring a difficult task. Although the positioning errors due to tropospheric delay are largely reduced by estimation of tropospheric gradients parameters, which are introduced recently in the new analysis strategy of GEONET, certain parts of remaining positioning errors may originate from tropospheric noise.

In this research, we try to reproduce positioning errors after tropospheric gradient estimation using numerical weather prediction models. We use two kinds of data set for the investigation. One is the Japan Meteorological Agency (JMA) meso-scale analysis data with 10km horizontal resolution and 3-hour temporal resolution. The other is the high-resolution numerical weather model with 2km horizontal resolution and 1-hour temporal resolution. This model assimilates JMA meso-scale analysis data and SST data. We produced simulated GPS observation data sets for each of numerical weather models data using Satellite Positioning System Simulator (SPSS) developed by GSI (Munekane et al., 2007). Then, we analyzed these simulated data by the PPP method using GIPSY ver.5.0 to obtain positioning errors.

The positioning errors simulated the JMA meso- scale analysis data are very small compared with the observed ones. On the other hand, positioning errors simulated by the high-resolution model clearly correlated with the observed ones. The high-resolution model employs no additional meteorological observation data as those in JMA's model. We infer that the difference in the results is attributed to the difference of topographical data, and high-resolution numerical weather models which employ a fine topography have a potential for correction of tropospheric delay errors.