Development of New GEONET Analysis Strategy: Incorporating GLONASS Observations Data

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Geospatial Information Authority of Japan (GSI) has been operating CORS system involving over 1300 GNSS stations, called GEONET (GNSS Earth Observation Network System), since 1996. The daily coordinates for each station are estimated by Bernese GNSS software to monitor the crustal deformation in Japan. The analysis strategy was updated three times. Current version is called F3, which was established in 2009. We are now developing new strategy (F4), because the software, reference frame, and other physical models used in F3 have been obsolete. Major topics of F4 development are 1) Updating reference frame, 2) GPS and GLONASS integration, 3) Improvement of the troposphere model, and 4) Stabilizing the daily coordinates of the reference station (TSUKUBA-1) for the whole GEONET analysis.
In this paper, we focus on the topic 2: GPS and GLONASS integration. Only GPS was used for F3 or older strategies. However, the receivers and antennas in GEONET were already updated into the multi-frequency type in 2013, preparing for the multi-GNSS environment. Furthermore, the final orbit for GLONASS provided by IGS has reached almost the same accuracy in comparison with the one for GPS (according to IGS web site, ~3cm for GLONASS and ~2.5cm for GPS). Such circumstances enable us to process GLONASS data by Bernese software. We process GPS and GLONASS data independently to estimate the ambiguities, and then combine the solutions with normal equations. The result based on GLONASS observations data shows the apparent fluctuation with the period of 8 days that was not found on the GPS result. Such a phenomenon is significant for the stations apart from the reference station. Several IGS analysis centers using GLONASS observations reported the same phenomenon that seemed to be caused by the GLONASS constellation geometry (Ray et al., 2013, Rebischung et al., 2016). We discuss the method to suppress the apparent 8-day fluctuation in our presentation.

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