

# Improvements of the GEONET real-time analysis system (REGARD) for more reliable operation

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## 1. GSI of Japan

The displacement data produced by GNSS observations never saturate for large earthquakes in contrast to seismometer data that has a limitation of instrument saturation. Geospatial Information Authority of Japan has launched a real-time GNSS analysis system named “REGARD” which estimates finite fault models based on the Japanese nationwide GNSS network GEONET. The REGARD system has been in operation since April, 2016. The system experienced 2016 Kumamoto earthquake, and provided a single rectangular fault model with very high variance reduction (VR) of 96%. The REGARD system has been become increasingly important for rapid response to major earthquakes for providing coseismic displacements, finite model estimate, and moment magnitude rapidly. Therefore, the system must be more stable. So we try to implement other positioning procedure to REGARD system.

The REGARD system conduct relative positioning by using reference station data and rover station data. If reference station data lacked, we can't obtain the coordinates of all other station. So we focus on Precise Point Positioning(PPP). Real-time PPP analysis needs correction data of Ionospheric delay, Tropospheric delay, satellite clock and so on. We implement as follow system. (1) Collect real time observation data from about 100 worldwide GNSS station. (2) Estimate ephemeris and collection data by using MADOCA(Multi-GNSS Advanced Demonstration tool for Orbit and Clock Analysis) developed by JAXA. (3) Conduct real time PPP analysis.

As a results of accuracy evaluation of real time PPP analysis, the accuracy is less than REGARD system. If we subtract one station results from other station(PPP-differential), the accuracy is improvement as well as REGARD system. Therefore, real time PPP analysis system is expected to be useful for improving redundancy and robustness of REGARD system.

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