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Development of new GEONET real-time processing system

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GNSS Earth Observation Network System (GEONET) consists of more than 1,200 continuous GNSS stations operated by Geospatial Information Authority of Japan. The GNSS data are transmitted to GEONET central analysis center in real-time. Advantage of GNSS real-time positioning is better performance in estimating moment magnitude of large earthquake than short-period seismometers. Blewitt and others (2006) demonstrated accurate moment magnitude could be determined within 15 minutes after the 2004 Sumatra earthquake by GPS real-time positioning and contribute to tsunami early warning. It has been suggested that GEONET should be exploited for early warning system especially after the 2011 off the Pacific coast of Tohoku Earthquake by a committee on disaster prevention.

The previous GEONET real-time processing system launched in 2002. However, it has not enough performance to monitor crustal deformations efficiently because of the limited size of analysis network, e.g. number of stations and baseline length should be shorter than 100 km. It was also the problem that the previous system could not detect permanent displacement automatically. The real-time displacements thus were not used instantaneously. Now GSI and Tohoku University are underway to develop new GEONET real-time analysis system to improve the problems described above since 2011.

The goal of the new system is to estimate permanent displacement field and moment magnitude of giant earthquakes and notify that information near real-time. The analysis strategy of the new system is completely different from the previous system. The prototype of the new system implements RTKLIB 2.4.1 (Takasu, 2011) for real-time GNSS positioning. The timing of the extraction of permanent displacements occur are determined automatically by 'RAPiD' (Ohta et al. 2012) or 'EEW' (Kamigaichi et al., 2009) provided by Japan Meteorological Agency. Fault source model inversions are carried out just after the detection of permanent displacements. The automatically derived displacements using RAPiD are cross-checked by comparing the displacements at adjacent stations, which was proved to be effective to reduce false detection of permanent displacements (Kobayashi et al. 2012). The estimated magnitudes are e-mailed to officials of GSI. The prototype has been operated monitoring 143 stations since April 6, 2012.

We present overview of the prototype including some issues to be improved and future plan of the new system to monitor all GEONET stations.

Keywords: GEONET, RTK-GPS, real-time