

GEONET real-time analysis system for rapid finite fault modeling

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Geospatial Information Authority of Japan (GSI) has been operating a continuous GNSS observation network system since 1994. This system is known as GEONET (GNSS Earth Observation Network) and consists of approximately 1300 nationwide GNSS stations (GEONET stations) and the analysis center. Most stations collect GNSS data with 1-Hz sampling and transfer them to the analysis center in real time. Those data are available for surveying or research using real-time kinematic positioning technique. This technique is expected for describing cataclysmic earthquake from crustal displacement in short time especially after the 2011 off the Pacific Coast of Tohoku Earthquake in March 2011.

GSI and Tohoku University have developed the Real-time GEONET Analysis System for Rapid Deformation Monitoring (REGARD) since September 2011 to estimate moment magnitudes (Mw) soon after large earthquakes struck. This system consists of three subsystems. First subsystem does real-time kinematic positioning using RTKLIB (Takasu, 2013) and GSILIB (GSI, 2015). Second one detects seismogenic behavior using the RAPiD algorithm (Ohta et al., 2012) or the Earthquake Early Warning (Kamigaichi et al., 2009) and immediately run the third subsystem. This subsystem estimates Mw within three minutes using displacement vectors of GEONET stations (Kawamoto et al., 2014). Finally, results are mailed to persons involved.

The REGARD system successfully estimated the single rectangular fault models for the 2016 Kumamoto Earthquake (M7.3) occurred at 01:25 JST on April 16, 2016. The coseismic displacements as large as 1 meter were detected. The REGARD system calculated that Mw of the mainshock is 6.85 in 58 seconds from event origin time. The final fault model of REGARD was estimated along the Futagawa fault zone within 6 minutes. This result is consistent with the evaluation by the Headquarters for Earthquake Research Promotion, which reports that the Kumamoto earthquake is considered to be mainly due to the activity of the Futagawa fault zone.

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