Operation of REGARD: Real-Time GNSS analysis system in Japan

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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 (GSI) and Tohoku University developed a real-time GNSS analysis system named REGARD (Real-time GEONET Analysis System for Rapid Deformation monitoring), which estimated finite fault models based on the Japanese nationwide GNSS CORS network named GEONET.

REGARD has three subsystems: (1) the real-time positioning subsystem, (2) the event detection subsystem and (3) the fault model inversion subsystem. This system always conduct real-time kinematic analysis of ~1200 stations of GEONET. If REGARD receives an earthquake information from earthquake early warning system managed by the Japan Meteorological Agency or detect large displacement using RAPiD algorithm (Ohta et al., 2012), the inversion subsystem is started. Two types of finite-fault model are automatically estimated by a single rectangular fault model, which is available for both inland and subduction zone earthquakes and slip distribution model, which is suitable for grate subduction zone earthquakes. Estimated Mw from each fault model are sent to the relevant people.

REGARD has already detect several earthquake events. 2016 Kumamoto earthquake (Mw 7.0 (GCMT)) was the first time to estimate GNSS-based fault model in real-time in Japan. The system estimated Mw 6.96 and VR 96.2% within 5 minutes after the event occurred. Although REGARD could not estimate approximate fault model because of the small displacement, it successfully detected crustal deformation in many events. This system is useful for monitoring crustal deformation as well as estimating fault parameter.

Although REGARD shows potential for estimating fault model supporting early tsunami warning, the system has not yet been optimized. We keep trying to improve REGARD for operating under less cost and robustness conditions.

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