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# Role of Real-Time GNSS in Near Field Tsunami Forecasting

Ohta, Y.[1], Hino R. [1] and Koshimura S. [2]

1 *Graduate School of Science, Tohoku University, Miyagi, Japan*

*2. International Research Institute of Disaster Science, Tohoku University, Miyagi, Japan*

Earthquakes beneath the sea-floor possibly generate tsunamis. Tsunamis caused by the large interplate earthquakes will hit near-field coasts within several minutes to an hour. For the accurate and rapid near-field tsunami forecasting, the reliable estimation of earthquake size and its fault expansion will be extremely important. How can large earthquake magnitudes be accurately determined? This is one of the vital questions for reliable near-field tsunami early warning. Following the 2011 Tohoku-Oki earthquake, Geospatial Information Authority of Japan (GSI) and Tohoku University jointly developed the nationwide real-time GNSS analysis system (real-time GEONET Analysis system for Rapid Deformation monitoring, REGARD for short). The primary purpose of the REGARD system was to estimate unsaturated magnitude for earthquakes larger than M8, based on finite coseismic fault model estimation. In this presentation, we introduce the recent trial for rapid estimation of tsunami inundation using the REGARD system in Japan.

The rapid tsunami inundation method was developed sustained efforts. The pre-computed scenario database is extremely useful as estimation of the tsunami inundation can be determined as soon as the hypocenter and magnitude information are identified. An alternative approach is the “forward” type. It means that the initial sea-surface distribution will be assumed on the basis of external observation such as seismometer and real-time GNSS data. The accuracy and precision of the resulting tsunami forecasting will strongly depend on the quality of the assumed coseismic fault model, which can serve as a disadvantage. Additionally, the computation time for the tsunami inundation is the problem for the real-time purpose.

Since 2014, Association for Real-time Tsunami Science has been developing rapid tsunami inundation system based on the “forward” modeling approach with the high-performance computing. We employed three different types of the coseismic fault model. Slip distribution in the plate interface and single rectangular fault model from the REGARD of the GSI, or empirical determined finite coseismic fault model using earthquake early warning (EEW) issued by the Japan Metrological Agency. Once obtained the fault model, we calculated the initial sea-surface distribution. We utilized the vector-parallel supercomputer SX-ACE at Tohoku University and/or Osaka University for tsunami inundation calculation with the TUNAMI code, which can solve non-linear shallow water equations and uses the staggered leap-flog finite difference method as the numerical scheme. Although grid size all along the Nanak trough was 30m, with calculation time period of 6 hours after the event, the computational time was less than 10 minutes.

In the presentation, we will shows the more detailed procedure of our developed system and the impact of the rapid coseismic fault model deduced using real-time GNSS on the estimation of tsunami inundation.