Near-field tsunami forecast system based on near real-time seismic moment tensor estimation in the regions of Indonesia, the Philippines, and Chile

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We have developed a near-field tsunami forecast system based on an automatic centroid moment tensor (CMT) estimation using regional broadband seismic observation networks in the regions of Indonesia, the Philippines, and Chile. The automatic procedure of the CMT estimation has been implemented to work for tsunamigenic earthquakes. A tsunami propagation simulation model is used for the forecast and hindcast. A rectangular fault model based on the estimated CMT is employed to figure the initial condition of the tsunami height. The forecast system considers uncertainties due to two possible fault planes and two possible scaling laws, and shows four possible scenarios with the uncertainties for each estimated CMT. The system requires approximately 15 minutes to estimate the CMT after earthquake occurrence, and approximately another 15 minutes to make tsunami forecast results available, including the maximum tsunami height and its arrival time at the epicentral region and near-field coasts. The retrospectively forecasted tsunamis were evaluated by the deep-sea pressure and tide gauge observations, for the eight past tsunamis (Mw7.5-8.6) that occurred around the regional seismic networks. The forecasts were shown to range from half to double the amplitudes of the deep-sea pressure observations, and range mostly in the same order of magnitude of the maximum heights of the tide gauge observations. It was found that the forecast uncertainties become larger for greater earthquakes because the tsunami source is no longer approximated as a point source for greater earthquakes (e.g., Mw>8). The forecast results for the coasts nearest to the epicenter should be carefully used because the coasts often experience the highest tsunami with the shortest arrival time (e.g., <30 minutes).

Keywords: tsunami forecast, seismic centroid moment tensor, forecast accuracy, forecast uncertainty

