Estimation of fault geometry to obtain an accurate seismic intensity in real time

*YING XIAO[1], Masumi Yamada[2]

1. Key Laboratory of Earthquake Engineering and Engineering Vibration, Institute of Engineering Mechanics, China Earthquake Administration, 2. DPRI, Kyoto University

To get the seismic intensity more rapidly and accurately, we find a method to inferring the geometry of the rupture in real-time. Most of the Earthquake Early Warning system can determine the magnitude and hypocenter location only few seconds after P-wave data. For small earthquakes, we use point source model to predict seismic intensity. But for moderate-to-large earthquake, the extent of fault rupture may be hundreds of kilometers, which will cause underestimation of seismic intensity in the place near to the fault but far from the epicenter. To get the seismic intensity more accurately and rapidly, we propose a method to estimate the surface projection of a fault in real-time.
The method is based on the GMPE of shaking intensity proposed by Yamamoto et al. (2008). As the shaking intensity has a good correlation with fault distance, we can get fault distance of every site from estimated shaking intensity and published magnitude. We parameterize the fault geometry with epicenter, fault length, fault width, strike, and relative location of the fault to the epicenter. We find the most suitable parameters for fault dimension by minimizing the fault distance estimated from the GMPE and the fault distance estimated from the parameterized source model. The most probable parameter set is obtained by the grid search. We test the performance of this method on the 2011 Tohoku earthquake dataset. Figure 1 shows the fault distance estimated from the GMPE, and observed distance. For the observation, we used hypocenter distance and fault distance based on the Shao’ s source model. It shows the station close to the fault will cause more difference between hypocenter distances and fault distance. And the fault distance we calculated from the GMPE have a good correlation with observed fault distance. In our example of Tohoku earthquake, we showed that using the site with hypocenter distance less than 400km can get a good prediction of fault geometry. The azimuthal coverage is important for the robust parameter estimation.