Dynamic rupture simulation for seismic hazard assessment: Application to the Yamazaki fault zone, central Japan

*Yuko Kase[1], Kohei Abe[2], Atsushi Miwa[2], Hideki Kosaka[3]

1. Geological Survey of Japan, AIST, 2. Oyo Corporation, 3. Kankyo Chishitsu Company Limited

In seismic hazard assessment, many earthquake rupture scenarios need to be weighted. For these scenarios, rupture area is one of the important factors, but the evaluation of the rupture area is unfortunately difficult before event. On the other hand, dynamic rupture simulations can calculate physically reasonable rupture processes based on fault geometries, stress conditions, and frictional constitutive laws. We propose dynamic rupture modeling for weighting of earthquake rupture scenarios, and apply the modeling to the Yamazaki fault zone, central Japan.
The Yamazaki fault zone is left-lateral strike-slip active fault in central Japan. We model three faults, the Ohara, Hijima, and Yasutomi faults in the northwestern part of the Yamazaki fault zone as a continuous vertical fault plane about 50 km long with surface rupture, based on the fault traces. The fault model is combined with assumption of stress field. Principal stresses are proportional to depth, based on the borehole data (Yamashita et al, 2004). A stress inversion result shows that the azimuth of the maximum principal stress is from N60˚E to N100˚E. We calculate dynamic rupture processes, using a finite-difference method (Kase and Day, 2006), to search the azimuth of the maximum principal stress and frictional coefficients most consistent with an observed left-lateral dislocation of about 2 m on the surface (Okayama Prefecture, 1996).
We simulate a variety of rupture processes on the Yamazaki fault zone, depending on parameters, but the simulation results show some characteristic rupture processes. For example, when the coefficients of friction are the same on the three faults, a rupture initiating on the Ohara fault propagates to the Hijima fault, but it terminates in the boundary between the Hijima and Yasutomi faults because of negative stress drop. When the coefficients of friction of the Yasutomi fault are less than those of the other faults, on the other hand, the rupture initiating on the Ohara fault propagates to both of the Hijima and Yasutomi faults, but the deep portion of the Yasutomi fault remains unrupture. These characteristics of rupture process can be useful information for weighting of earthquake rupture scenarios.

Keywords: dynamic rupture, Yamazaki fault, numerical simulation, seismic hazard assessment

