Applicability of Strong Motion Prediction Recipe for Recent Disastrous Earthquakes

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We have studied that ground motions from inland-crust earthquakes are well simulated using a characterized source model with asperities in an entire rupture area. The characterized model is constructed based on the "recipe" we proposed. In this study, applicability of the "recipe" has been examined by comparing observed ground motions with synthesized ones for recent disastrous earthquakes. We show a case of the 2007 Chuetsu-oki (Mw 6.6) as one of examples. This earthquake occurred very close to the Kasiwazaki-Kariwa Nuclear Power Plant. The surface motions there had the PGA of more than 1200 gals and even underground motions on one of the base-mats of the reactors locating five stories below the ground had the PGS of 680 gals.

Fault length L and width W as the outer fault parameters are given at 26 km and 22 km, respectively, based on the investigation of the active fault (Sugiyama, 2008) and the hypocenter distribution (Earthquake Research Institute, 2008) in and around the source region of this earthquake. Seismic moment is given from the scaling of the outer fault parameters. The areas and stress drop of the asperities as the inner fault parameters are given using the empirical relation, acceleration level versus seismic moment by Dan et al. (2001), following the "recipe" by the Earthquake Research Committee in Japan (2007). Then, the characterized source model with two asperities with large and small areas inside the rupture area is made. The area of the large asperity has twice as large as that of the small one. The locations of those two asperities are located as shown in the left of Fig. 1.Synthesized motions are calculated using the empirical Green's function method (Irikura, 1986). The synthesized motions at KSHSG4 (-250 m deep at Service Hole of the KKPP) using a standard model of the "recipe" are clearly underestimated compared with the observed ones as shown in the right middle of Fig. 1. We make a revised source model with 1.5 times stress drop of the asperities, keeping the asperity areas constant. Another modification is that the starting point of Asp2 is located at the center of the asperity as shown in the left of Fig.1, learning from the best-fit model of the earthquake. We find that the synthesized motions for the revised model have almost the same level as the observed ones as shown by red lines in the right bottom of Fig. 1. This means that the "recipe" should be modified, considering regional characteristics of the fault parameters such as stress drop and rupture starting point of each asperity to make more reliable evaluation of ground motions.

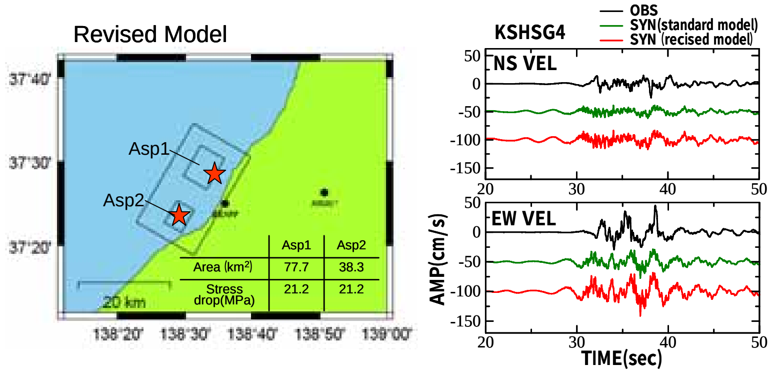

Fig. 1. Left: Map showing the revised model for simulation. Right: Comparison between the synthesized motions and observed records at KSHG4. In each panel, the top is the observed, the middle is the synthesized for the standard model, and the bottom is that for the revised model.

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