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Study on a recipe for strong ground motion prediction for large inland earthquakes along long strike-slip faults

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It has been pointed out that an application of 'the recipe' for predicting strong ground motion to the case of faults with great length leads to negative amount of slips on the background area of the fault model (Headquarters for Earthquake Research Promotion (HERP), 2005). In order to solve the problem, Dan et al. (2011) proposed the new idea of asperity model that can set the fault parameters without having negative slip on the background area for the strike-slip crustal earthquakes even with great length.

In this study, fault models for a scenario earthquake along the Median Tectonic Line faults with overall length of 360 km are established based on the methods by Dan et al. (2011) and the ones by HERP (2005). The spatial strong ground motions are simulated based on the fault models by the stochastic Green's function method. The results of the simulations are examined discussing the adequacy and the problem for each method to establish fault models.

In the cases with reference to the examinations by HERP (that is, the asperity area on the fault plane is calculated by the empirical regression related to the short-period spectral level), it was confirmed that the fault models could not be set due to the negative slip on the background area. For this problem, two fault models ('reference case A') were developed based on the improved method by HERP (2005) in order to set the fault parameters successfully. The ratios of the asperity area to the whole fault area were assumed to be 22 % (Somerville *et al*., 1999). The averaged stress drop of 'reference case B' was calculated by the equation derived from a circular crack model, and that of 'case C' was set to be 3.1 MPa (Fujii and Matsu'ura, 2000). Another fault model ('case D') based on the method by Dan et al. (2011) was also developed.

In order to discuss the simulation results, the peak ground velocities of simulated ground motions are compared to the ones calculated by using the attenuation relationship by Si and Midorikawa (1999). In the 'reference case B', the simulated peak ground velocities reached about 300 cm/s near the source fault and became much greater than the ones by the attenuation relationship since the short-period spectral level was about three times of the other two models. In the 'case C', while most of the results of the simulated ground motions are in the range of the dispersion of the attenuation relations, in the near-field of the source fault, the simulated peak ground velocities reached about 150 cm/s and became a little greater than the ones by the average attenuation relationship. In the 'case D', the simulated peak ground velocities reached about 100 cm/s near the source fault and corresponded well to the attenuation relationship. Therefore, it is concluded that the method by Dan et al. (2011) is the most appropriate to evaluate strong ground motions of a large earthquake along a very long strike-slip fault.

Keywords: very long fault, fault model, strong motion prediction