Variance of Ground Motion Intensity by Stochastic Green's Function Method Part 1 Characteristics of Asperity of Crustal Earthquake

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Numerical simulation technique based on characterized fault model has been widely used for strong ground motion prediction. It is important for predicting strong ground motion precisely to set not only outer fault parameters such as fault rupture area and seismic moment but also inner fault parameters such as slip distribution. However, the number of studies for evaluating variance of ground motion computed in various inner fault parameters is limited. As the first part of the study, the data of finite-source rupture models for earthquakes occurred in Japan is collected. The characteristics of asperities in the characterized fault models for inland crustal earthquakes are examined. At the next part, the ground motion simulation using stochastic green's function method is applied to evaluate the variance of the computed ground motions.

The finite-source rupture models for 19 inland crustal earthquakes (Mw5.3-6.9) occurred from 1945 to 2005 are collected from the existing papers and reports. The data include 1 normal fault model, 5 reverse fault models, and 13 strike-slip models. The asperity areas are extracted from the finite-source rupture models based on the method of Somerville et al. (1999). The ratio of the asperity area to the rupture area shows approximately 0.2. The ratio of average asperity slip to average slip is about 2.15. The scaling relations of fault parameters with the seismic moment almost agree with the result of Somerville et al. (1999).

The distribution of the asperities is examined for 13 earthquakes of the strike-slip models. The depth distribution of the backgrounds and asperities shows that the background area and the asperity area are concentrated at 1-15km depths and 5-10km depths, respectively. The horizontal distribution of the asperities normalized by the fault length shows that the asperity is concentrated in the central part of the fault whose distance is from 20% from the edge to the center. The hypocenters are located outside of the asperities in 7 earthquakes out of a total of 13. When the hypocenters located inside of the asperities, most of the hypocenters are situated at the bottom of the asperities.

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