Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS23-01 Room:211 Time:May 1 09:00-09:15

Study on long strike-slip fault model with heterogeneous dynamic stress drops on asperities

OANA, Atsuko[1*] ; ISHII, Toru[1] ; DAN, Kazuo[1] ; FUJIWARA, Hiroyuki[2] ; MORIKAWA, Nobuyuki[2]

[1]Institute of Technology, Shimizu Corporation, [2]National Research Institute for Earth Science and Disaster Prevention

Oana *et al*. (2013) has established the long strike-slip fault model for a scenario earthquake along the Median Tectonic Line fault zone using the procedure for evaluating the fault parameters by Dan *et al*. (2011), and has simulated the strong ground motions. On that fault model, the dynamic stress drops on the asperities have been homogeneous. However, this is unnatural because the all stress drops on the asperities must be inhomogeneous in the actual earthquakes. How we consider the heterogeneity of the fault rupture is very important subject on the strong motion prediction, because the heterogeneity will have great effects on the spatial distribution of strong ground motions along a fault, especially along a very long fault. The uncertainty of the fault parameters also should be considered into the evaluation of the fault parameters.

In this study, for the strike-slip fault, the procedure for establishing the fault model which takes into account the heterogeneity of the dynamic stress drops on the asperities is examined, and then the spatial strong ground motions are simulated using the fault model based on the procedure. And also, some fault models with the uncertainty of the rupture starting point, the layout of the asperities, and the relationship between the asperity area and the dynamic stress drop on the asperity are established, and then the spatial strong ground motions are simulated using these fault models.

First, the procedure for establishing the fault model to give each asperity the heterogeneous dynamic stress drop is examined. Concretely, first, the probability density distribution of the stress drop is calculated based on the data of the stress drops on the strong motion generation areas of the past earthquakes by previous studies. And then, the procedure is proposed, that gives each asperity the dynamic stress drop corresponding to the frequency of the midpoint of the probability density distribution which is equally divided by the number of the asperity. Here, to satisfy the all relationships among the fault parameters of the asperity model is impossible. So we preceded satisfaction of the relationship formula of the seismic moment, and allowed an error between the obtained short period spectral level and the relationship formula of the short period spectral level. But the error became smaller than about 6 % of the short-period level of the fault model with the homogeneous dynamic stress drops on the asperities. As one of the ideas, we assumed that the relationship between the ratio of the asperity areas and the ratio of the dynamic stress drops on the asperities is random.

Next, for a scenario earthquake along the Median Tectonic Line fault zone, we established the long strike-slip fault model with the heterogeneous dynamic stress drops on the asperities based on the above proposed procedure, and also simulated the strong ground motions by the stochastic Green's function method. As a result, the deviation for the average of the attenuation relation by Si and Midorikawa (1999) of PGA became 0.20 and that of PGV became 0.16. Each deviation is smaller than 0.25, 0.23, which are derived from Si and Midorikawa (1999). It is concluded that this result is relevant, because the attenuation relation is based on a lot of observed records of various earthquakes and sites, while this study targets for the specific earthquake, the local pass, and the local site condition.

Finally, we examined the effect of the uncertainty of the source parameters for the strong ground motions. In the cases of the various rupture starting points, the deviation for the average of the attenuation relation of PGA became 0.23 and that of PGV became 0.21. In the cases of the various layouts of the asperities, those became 0.22 and 0.17, respectively. In the cases of the various relationships between the asperity area and the dynamic stress drop on the asperity, those bacame 0.20 and 0.17, respectively.

Keywords: Very long fault, Heterogeneity, Strong motion prediction