Verification and Applicability of “Recipe” of Predicting Strong Ground Motions for Inland Crustal Earthquakes

Kojiro IRIKURA[1], Susumu KURAHASHI[2], Ken MIYAKOSHI[3]

1. Aichi Institute of Technology, Japan, irikura@geor.or.jp
2. Aichi Institute of Technology, Japan
3. Geo-research Institute, Japan

ABSTRACT

Slip heterogeneities inside rupture areas of large earthquakes have been found from the results of the waveform inversion using strong motion data. Destructive ground motions including short-period components are generated from such heterogeneities. Asperities are defined as areas with large slip based on slip distributions from the waveform inversion. We confirmed that the areas generating strong ground motions coincide with the asperities mentioned above. Then, we define a characterized source model with asperities in an entire rupture area for simulating strong ground motions. We found that ground motions from recent inland-crust earthquakes are well simulated using the characterized source model. Then we developed a “recipe” to construct the characterized source model for predicting strong ground motions.

This recipe gives source modeling for earthquakes caused to specific active faults obtained from geological, geo-morphological surveys and geophysical investigations and two kinds of the scaling relationships for the fault parameters. One is the conventional scaling relations such as rupture area versus seismic moment and fault slip versus seismic moment. The other is the new ones such as asperity area versus seismic moment and asperity slip versus seismic moment. Based on such scaling relationships, the source model for predicting strong ground motions is characterized by the outer, inner, and extra fault parameters. The outer fault parameters are to outline the overall pictures of the target earthquakes such as entire source area and seismic moment. The inner fault parameters are parameters characterizing stress heterogeneity inside the fault area. The extra fault parameters are considered to complete the source model such as the starting point and propagation pattern of the rupture.

The verification and applicability of the procedures for characterizing the earthquake sources for strong ground prediction are examined in comparison with the observed records and broad-band simulated motions for recent disastrous inland 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. Ground motions from this earthquake are well simulated based on the characterized source model. We also examined the applicability of the recipe to other recent disastrous earthquakes such as the 2007 Noto-hanto earthquake, 2005 Fukuoka earthquake, and so on.

We find the “recipe” is useful for predicting design ground motions for earthquake safety designs as long as the source fault is specified through investigation of active folds and faults and the fault parameters are given considering regional characteristics.

Key words: strong motion prediction, recipe, characterized source model, asperity, active fault, 2007 Chuetsu-oki earthquake.

PRESENTER’S BIOGRAPHY

Professor of Aichi Institute of Technology, Professor Emeritus of Kyoto University, Main Subjects: Strong Motion Seismology, Seismic Hazard Analysis