Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SSS33-P21 Room:Convention Hall Time:May 19 18:15-19:30

Updating of source scaling relationships evaluated from the waveform inversion of recent inland crustal earthquakes

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Somerville et al.(1999) compiled slip models for fifteen inland crustal earthquakes (Mw5.7-7.2), and obtained empirical scaling relations for source parameters (total rupture area and asperity area). Irikura and Miyake (2001) proposed a recipe for predicting strong ground motion for future earthquakes based on mainly Somerville's empirical scaling relations.

After 1995 Hyogo-ken Naubu earthquake, a lot of strong ground motion stations (K-NET, KiK-net) have been installed in Japan by NIED (National Research Institute for Earth Science and Disaster Prevention). A large amount of the waveform inversion analyses have been done in recent years for estimating rupture processes using strong ground motion data.

Using the waveform inversion results of resent fifteen crustal earthquakes (Mw5.6-6.9), which happened after the 1995 Hyogo-ken Naubu earthquake, we try to revise the empirical scaling relationships between seismic moment and entire rupture area and between seismic moment and asperity area. According to the criterion of Somerville et al.(1999), we extracted the entire rupture area (S) and the asperity area (Sa) from inverted heterogeneous slip distribution. The combined area of asperities over the entire rupture area is about 0.17 in average for fifteen earthquakes. The averaged ratio (Sa/S) of the combined area of asperities to the entire rupture area is smaller than Somerville's result (0.22). The averaged ratio (Sa/S) varies dependent on fault type (strike slip, reverse slip, and normal slip) as follows.

Strike slip type (seven earthquakes): Sa/S = 0.16
Reverse slip type (seven earthquakes): Sa/S = 0.16
Normal slip type (one earthquakes): Sa/S = 0.22

It should be examined whether the asperity areas (Sa) obtained above are effective for strong motion prediction, comparing them with strong motion generation areas from simulation using the empirical or stochastic Green's function method.

Acknowledgments: We thank Dr. Asano(DPRI), Associate professor Sekiguchi (DPRI), Professor Iwata, Dr. Horikawa(AIST), Dr. Hikima(TEPCO), Dr. Suzuki(NIED), and Dr. Aoi(NIED) for providing waveform inversion results. We also used waveform inversion results from JMA.

Keywords: strong ground motion, a recipe for predicting strong ground motion, empirical scaling relations, waveform inversion