

How to construct a recipe for predicting strong ground motions from great subduction earthquakes

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Source models related to strong ground motions have been integrated in the waveform inversion analysis to better characterize rupture processes of inland crustal earthquakes and subducting mega-thrust earthquakes. Generation of strong ground motion is related to slip heterogeneity inside source areas, i.e. strong motion generation areas (SMGAs). High frequency motions are generated from SMGAs which are almost coincident with large slip area for inland crustal earthquakes. On the other hand, ground motions from subduction earthquakes clearly show differences in wave radiation at various frequencies. The short-period generations obtained from the backprojection method using short-period teleseismic arrays from subduction earthquakes are located on deeper down-dip areas. Most of slip distribution inverted from long-period records such as geodetic and tsunami data are placed at shallower depths near the trench. We estimate a source model for generating strong ground motions from the 2011 Tohoku earthquake by comparing the observed records from the mainshock with synthesized motions based on a characterized source model and the empirical Green's function method. We obtained a short-period source model consisting of five SMGAs with large slip velocity or high stress drop. The SMGAs distributed in dip direction west of the hypocenter and in strike direction north and south of the hypocenter, along the down-dip portion of the source fault of this earthquake. These results indicate that great earthquakes on inland active faults and on subduction earthquakes have different source characteristics, especially in the short-period range related to strong ground motions. We developed a recipe for predicting strong ground motions for inland crustal earthquakes (Irikura and Miyake, 2010). Earthquake scenarios based on the recipe successfully estimate ground motions. Then, we propose an improved idea for recipe of predicting strong ground motions for subduction earthquakes.

Keywords: great subduction earthquakes, strong ground motions, short-period source model, strong motion prediction recipe

