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Study on New Recipe for Predicting Strong Ground Motions from Intra-slab Earthquakes

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The Headquarters for Earthquake Research Promotion (HERP) have been making the long-term evaluation reports for inland crustal earthquakes along the major active faults and the major subduction-zone earthquakes which will occur in and around Japan in the future, and established the procedure to predict strong ground motions for scenario earthquakes, which has been named the Recipe. The objective of this study is to establish a new Recipe for intra-slab earthquakes.

Though both of inter-plate and intra-slab earthquakes belong to subduction-zone earthquakes, the present Recipe by HERP for subduction-zone earthquakes is fundamentally the one for inter-plate earthquakes. As for intra-slab earthquakes, few historical earthquakes have been observed, few data and knowledge have been obtained, and their characteristics have not been clarified enough. However in the last decade, some intra-slab earthquakes occurred, new knowledge was obtained from new data, and it is becoming necessary to consider the knowledge into the earthquake resistant design of important structures. Therefore, the Subcommittee for Evaluation of Strong Ground Motion of HERP has started studies to establish a new Recipe for intra-slab earthquakes.

Recently, procedures to make characteristic fault models of earthquakes were newly proposed, for example, Dan et al.(2006), Sasatani et al.(2006), Iwata and Asano(2010). Compared with inter-plate earthquakes, an intra-slab earthquake generates much more short-period seismic waves from its asperity with smaller size. Such characteristics of intra-slab earthquakes are important for the earthquake resistant design of short-period structures. Especially, Dan et al.(2006) and Sasatani et al.(2006) applied the empirical Green ’s function method to the strong ground motion records from recent intra-slab earthquakes, and presented empirical relations between the combined area of asperities and the seimic moment, empirical relations between the short-period source spectra level and the seimic moment, respectively. In this study, a new Recipe for intra-slab earthquakes is proposed, focusing on the asperity area and the short-period source spectra level, which are evaluated by using the above mentioned empirical relations. Firstly, the asperity area and the short-period source spectra level are evaluated from the assumed seimic moment. Then the effective stress on the asperity and the average static stress-drop on the entire fault plane are evaluated theoretically. The inner and outer source parameters are calculated successively by using empirical and theoretical relations.

Keywords: subduction-zone earthquake, intra-slab earthquake, strong motion prediction, recipe, fault model, asperity