

A study on ground motion simulation by using different source characterization approaches

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In the standard ground motion simulation method recommended by the *Headquarters for Earthquake Research Promotion* (HERP), titled *strong ground motion prediction method for earthquakes with specified source faults* (revised in 2016, hereafter referred to as the recipe), there are two approaches (hereafter referred to as approach I and II) to characterize the seismic source for earthquakes occurring on active faults. Approach I determines the seismic moment from source area, whereas approach II estimates the magnitude from the length of the active fault of interest and adjusts the finite fault model from the magnitude. Given the same value of fault length as input, the two approaches result in different parameters such as magnitude, stress drop, and so on. It is known that the 2016 Mj 7.3 Kumamoto earthquake was mainly due to the rupture on the Futagawa segment of the Futagawa fault zone. Before the Kumamoto earthquake, a length of 19km was estimated for the Futagawa segment according to the long-term evaluation of active faults (HERP; 2013). On the other hand, a finite fault composed of the Futagawa fault and a segment of the Hinagu fault with a total length of 40~50km has been assumed to analyze the source rupture process by using waveform inversion of strong ground motions (e.g., Asano and Iwata (2016), Kubo et al. (2016), and Yoshida et al. (2017)). This study assumes a fault length by referring to information like source models obtained from waveform inversion, constructs characterized source models by applying the two approaches mentioned above, respectively, and simulates short-period ground motions by using the stochastic Green's function method. Furthermore, we construct characterized models to account for uncertainties of the location of asperities as well as the fault length (e.g., the length estimated by HERP for long-term evaluations, and those referring to the investigation results of surface rupture), and implements ground motion simulation by using the same method mentioned above. Our simulation results show that the response spectra (mainly short periods are targeted in this study) of calculated ground motions vary with characterized source models and the difference is mainly due to the different relative position between the asperity and the evaluation site.

Acknowledgement

This research was part of the 2016 research project 'Improvement for uncertainty of strong ground motion prediction' by the Secretariat of Nuclear Regulation Authority (NRA), Japan.

Keywords: characterized source model, strong ground motion prediction, 2016 Kumamoto earthquake