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Long-period ground motion evaluation for the Sagami Trough megathrust earthquakes

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It is important to assess seismic hazard in consideration of uncertainty and occurrence frequency in order to mitigate disasters from future earthquake. Iwaki et al. (2013) examined the influence of the long-period ground motion on uncertainty of asperity (strong motion generation area) or hypocenter location, and the heterogeneity of rupture velocity or slip direction for megathrust earthquakes occurring at the Sagami Trough region. They showed that the asperity or hypocenter location largely affects to the amplitude and predominant period of simulated long-period ground motions. Based on their results, we simulate long-period ground motions by a large number of source models considering the uncertainty of asperity or hypocenter location, and we try to assess long-period ground motion due to megathrust earthquakes occurring at Sagami Trough by evaluating the simulation results statistically.

We set ten source regions containing Taisho and Genroku earthquakes by changing those from Iwaki et al. (2013) referring the model by Central Disaster Council (2013). The range of moment magnitude (Mw) is 7.9 to 8.6 and total number of source model is more than 150. We use a ”characteristic source model” and source parameters are evaluated by following the method in ”Recipe” by Headquarters of Earthquake Research Promotion of Japan. We use a velocity structure model by Earthquake Research Committee (2012) but we revise the topography of the Philippine Sea plate based on recent researches. The long-period ground motions are simulated using a 3D finite difference method with discontinuous grid coded by Aoi and Fujiwara (1999). As long-period-ground motion hazard assessment, we first calculate average and slightly large (i.e. +1 sigma; sigma is the standard deviation) amplitude of peak velocity and velocity response spectrum whose natural period is 5, 7 and 10 seconds respectively on engineering bedrock for every ten source region. And then we integrate them by assuming the ”weight” which corresponds to occurrence frequency of each source region.

Although a large number of source models are set up in this study, the uncertainty on the megathrust earthquake occurring at Sagami Trough cannot be covered completely. So it should be required to examine much source models. On the other hand, the source region of magnitude 8-class earthquake at Sagami Trough extends to beneath the metropolitan area. In addition, it is said that the occurrence of the magnitude 7-class earthquake, which does not take in this study, is imminent in southern Kanto region. It is necessary to advance broadband ground motion hazard assessment also including a short-period ground motion.

Keywords: long-period ground motion, seismic hazard assessment, Sagami Trough, megathrust earthquake, GMS