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Effects of the different earthquake magnitude estimations on strong ground motion simulation for multi-segment-coupling ruptures

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For the case of multi-segment-coupling ruptures, the method in seismology to estimate earthquake magnitude is different from that in active fault study. These two methods give the different source models for scenario earthquake. In this study, we constructed two kinds of the characterized source models based on those different methods. We examined how different would be caused in predicted ground motions between these models for the case of multi-segment-coupling ruptures.

We demonstrated strong ground motion simulation for the case of multi-segment-coupling ruptures in the northern and middle part of the Itoigawa-Shizuoka Tectonic Line fault zone. We assumed two source models based on the ideas of seismology and active fault study. In the first model (total-L(t-L) model), we calculated the total seismic moment of the scenario earthquake by applying the seismological scaling relationship that gives seismic moment from the total area of a causative fault. The seismic moment of each segment was calculated by dividing the total seismic moment according to the area of each segment under same average stress drop assumption for all segments. The total area of asperity was estimated from following relationships between: (1) short-period spectral level and seismic moment and (2) short-period spectral level and parameters of asperity (The Headquarters for Earthquake Research Promotion, 2005). In the second model (segment-L(s-L) model), we calculated the total seismic moment by summing up the seismic moment of each segment by the characteristic earthquake model (Schwartz and Coppersmith, 1984) in active fault study. The area of asperity of each segment was calculated by applying the same manner used in the t-L model for each segment. The location of asperity in each segment was assumed by the average slip rate distribution along this fault zone compiled by Nakata and Imaizumi (2002). Following the study between active fault branching pattern and rupture starting point by Nakata *et al.* (1998), three possible rupture starting points can be assumed for this fault zone. Totally, we constructed six model-cases by combining the two models and the three rupture scenario cases. We calculated synthetic waveforms by the empirical Green's function method (Irikura, 1986) at 11 K-NET stations.

The simulated peak horizontal velocities for most stations distributed within the standard deviation of the empirical attenuation relationship (Si and Midorikawa, 1999). We compared the simulated peak horizontal velocities in the t-L model and s-L model. We computed the ratio of simulated peak horizontal velocity at each station in t-L model to s-L model with the same rupture starting point. That ratio averaged among the 11 stations was 1.2 in each rupture scenario case. We also calculated the horizontal velocity ratios from the attenuation relationship (Si and Midorikawa, 1999) using the computed moment magnitude of two models in order to examine the effect of the difference in the earthquake magnitude between t-L model and s-L model. This average ratio was estimated to be 1.4.

We also examined the effects of the different rupture scenarios on peak horizontal ground velocity. We defined a case ratio as a ratio of maximum peak horizontal velocity among three cases to minimum one for each model at each station. The case ratios averaged among the 11 stations was 1.4 in each model. These results showed that the effect of the different models was less than that of the different rupture scenarios on the estimated ground motions.