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Examination of construction methodology of source model in case of multi-segment rupture

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Investigating a fault model of the 1891 Nobi earthquake, which is one of the multi-segment rupture events, is significant for the establishment of source model construction methodology for strong ground-motion prediction. In Kuriyama and Sato (2010), we measured microtremors in the heavily damaged region caused by the Nobi earthquake to examine the relationship between seismic intensities, the ratio of the damaged houses, and the predominant period of H/V spectral ratio. We estimated the distribution map of seismic intensities by considering the local site effect of surface geology based on the above mentioned relationship. From these results, we found that the microtremor-measurement stations with questionnaire-based intensity of 7 in the Nobi Plain are almost linearly distributed only along the northern part of the Gifu-Ichinomiya Line (hereafter, GI Line) of the Research Group for Active Fault of Japan (1991). In this study, we conduct strong ground-motion simulations of the 1891 Nobi earthquake for three multi-segment rupture cases: (1) including the GI Line, (2) omitting the GI Line, and (3) including northern part of the GI Line.

For strong ground motion simulations, we construct three characterized source models (Irikura and Miyake, 2001). This type of model is one of the most reliable approaches for broadband strong ground-motion prediction. We conduct strong ground-motion simulations using the stochastic Green's function method for each third area mesh in the Nobi Plain. The horizontal acceleration waveforms are simulated on the seismic bedrock to examine the effect of the causative faults on the generation of the destructive ground motion. Here, we use the subsurface structure model of the Chukyo area of Horikawa et al. (2008). Based on the distribution of the simulated seismic intensities, we discuss the fault model of the Nobi earthquake.

Here, we compare the distribution pattern of simulated seismic intensities on the seismic bedrock in each case with that of estimated seismic intensities by considering the local site effect of surface geology in Kuriyama and Sato (2010). We could not find the linear distribution of larger seismic intensities that were present in Kuriyama and Sato (2010) along the GI Line from the distribution of simulated seismic intensities on the seismic bedrock in the multi-segment rupture case omitting the GI Line. In the case including the GI Line, the simulated seismic intensities along the southern part of the GI Line are slightly larger than expected. Meanwhile, the distribution of simulated seismic intensity in the case including the northern part of the GI Line is similar to the distribution map of Kuriyama and Sato (2010).We will conduct strong ground motion simulations on the engineering bedrock in the Nobi Plain and discuss the fault model of the Nobi earthquake.

Acknowledgement: The subsurface structure model of the Chukyo area of Horikawa et al. (2008) is used in this study.

Keywords: The 1891 Nobi earthquake, Predominant period of H/V spectral ratio of microtremors, Questionnaire-based intensity, Strong ground motion simulation, Source-model construction methodology