Simulation of long-period ground motions in the Oita Plain due to a hypothetical Nankai earthquake

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The Oita Plain is located in a sedimentary basin that is a part of the Beppu-Shimabara graben zone. During the 2000 western Tottori earthquake (Mj7.3), amplified long-period ground motions (5-10 sec) were observed for several minutes in Oita city, which showed distinct long-period ground motion characteristics reflecting the basin structure (Nagawa *et al.*, 2002). The anticipated Nankai earthquake is expected to cause large long-period ground motions to the Oita Plain as its hypothetical source area extends from off the Kii peninsula to southwest off the Shikoku island. In this study, we construct the source model and underground velocity structure model to explain the generation and propagation of long-period (3-20 sec) ground motions for quantitative estimation of long-period ground motion in the Oita Plain due to a hypothetical Nankai earthquake.

As the first step, we have conducted a long-period ground motion simulation, combining a hypothetical Nankai earthquake source model modified from that by Sekiguchi *et al.* (2008), a 3D crustal velocity structure model (Iwata *et al.*, 2008), and the deep subsurface velocity structure model of Oita area (Oita prefecture, 2007). The source model is based on the characterized source model of Central Disaster Management Council of Japan (CDMC) (CDMC, 2003) and is applied multi-scale heterogeneity to the slip and rupture velocity distribution so that it is applicable to ground motion simulations in a broad band period range. We put the source model on the upper surface of the Philippine Sea Plate of the crustal structure model (10-35 km depth). The rupture starts from off the Kii peninsula and propagates toward west. Total area of the source area is 34000 km^2 and the seismic moment is 7.4 x 10^{21} Nm (Mw8.5). The computation was performed by a three-dimensional finite-difference method (Pitarka, 1999) at 3-20 sec with the minimum grid spacing set at 200 m. The simulated maximum horizontal ground velocities are 70-90 cm/s in the bay area from Oita to Beppu cities. The pseudo response spectra (h=5%) of the simulated ground motions at K-NET OIT010 and the Beppu port strong motion station reached as high as 300 cm/s at the period of 7 sec. Compared to the pSv observed during the 2000 western Tottori earthquake, the dominant period is longer and the pSv level is more than 10 times as high.

These simulation results emphasized the importance of the prediction of long-period ground motion in the Oita Plain. We apply our microtremor observation data to check the subsurface structure model, which is to be validated by ground motion simulations of past earthquakes. We are also going to perform long-period ground motion simulations with various patterns of source and crustal structure model in order to estimate the effects of the source and propagation processes, such as the source directivity, asperity locations, and low-velocity layer at the subduction zone.