Strong Ground Motion Validation in the Tokyo Metropolitan Area (4) : Hypothetical Northern Tokyo Bay Earthquake

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The national seismic hazard map of Japan indicates a 30-year probabilitity in the Tokyo metropolitan area controlled by megathrust earthquakes along the Philippine sea plate. Four major subduction-zone earthquakes are the Kanto, northern Tokyo bay, Tokai, and Tonankai earthquakes. We have experienced the Kanto and Tonakai earthquakes, however the rest of two are hypothetical earthquakes. Source modeling and realistic ground-motion prediction for the earthquakes are quite important for disaster mitigation and hazard assessment in the Tokyo metropolitan area.

We here present ground motion validation for the hypothetical northern Tokyo bay earthquake. Two source models are set up along the geometry of the Philippine Sea slab proposed by Ishida (1992) and the new geometry by Sato et al. (2005). Using the locations of two asperities to avoid the slow slip region identified by Hirose et al. (2000) and high reflection coefficients of the large-scale reflection/refraction surveys by Sato et al. (2005), we have constructed a characterized source model consisting of asperities and surrounding background slip area. The size and slip of the asperities are constrained by the source scaling of asperities for subduction-zone earthquakes, where the scaling is based on the compilation of past slip inversion results. The stress drop was adjusted so that asperities for long-period ground motions behave as strong motion generation areas for short-period ground motions.

We adopted the 3D velocity model beneath the Tokyo metropolitan area constructed by integrating refraction, reflection, borehole, microtremor, and gravity data as well as ground motion spectra. Ground motion validation for the hypothetical northern Tokyo bay earthquake is performed by the 3D FDM. The western basin edge complicated the wave propagation, and the simulated ground motion was much larger for the source model along the new geometry of the Philippine Sea slab.