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Numerical simulation of ground motion using 3D basin model in Kanto plain

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Numerical simulations of seismic wave propagation in a large 3D basin model have been often conducted since 1990,because of a rapid increase of computer ability. In such a 3D simulation, we must prepare a realistic model of a whole of basin. In the Kanto plain, there exist several 3D basin models from various geological and geophysical investigations. Such basin models were used in numerical simulation of strong ground motions (e.g., Sato et. al, 1999). We introduce recent results of numerical simulations using 3D models of the Kanto basin.

The most popular 3D model of the Kanto basin in earthquake ground motion simulations was proposed by Suzuki (1999). This is a 3D model, which is characterized by three sedimentary layers in Quaternary and Tertiary ages over pre-Neogene basement. Although the 3D model covers wide area, velocity for each layer is not indicated. Koketsu (1995) also proposed a 3D basement depth map using travel time data of explosion records. The model consists of a surface layer of sediments over the basement with a P-wave velocity of 5.5 km/s. A 3D S-wave profile based on results of microtremor array observations was made by Yamanaka and Yamada (2002). Recently several geophysical explorations were conducted in the Kanto basin by local governments. These data can be included in construction of new 3D models in future.

Simulations of long-period ground motion in the Kanto basin were already conducted using existing 3D models. In these simulations, construction and validation of 3D model is one of the important keys to successful simulation of ground motion in a basin. Sato et al (1999) indicated that calibration of 3D model from simulation of ground motions from small events is effective way for simulation of strong motion due to the 1923 Kanto earthquake. Yamada and Yamanaka (2001) concluded that 3D model constructed from results of inversions of phase velocity of long-period microtremors is the most suitable model for estimation of long-period motion in a basin from simulations of moderate earthquakes. Although 3D simulation of ground motion is possible using a 3D basin model, present 3D models are not always sufficient for simulation for any events. Therefore we should make clear which part of basin model is good or not. Such an inappropriate part of 3D model must be corrected. We also need to develop an effective procedure how to improve 3D model. Although 2D waveform inversion techniques are available, 3D inversion is still computationally difficult task. This can be one of important targets in future research.