Validation of 3D S-wave velocity model of Kanto basin using peak periods of horizontal-to-vertical ratios from earthquake records

Hiroaki Yamanaka[1]; Hiroaki Sato[2]; Nobuyuki Yamada[3]

[1] T.I.Tech; [2] CRIEPI; [3] Fukuoka University of Education

Estimation of effects of deep sedimentary layers on surface wave propagation in a basin is one of the important factors to predict long-period strong ground motion. In particular, knowledge of 3D S-wave velocity structure must be accurately prepared and their effects are appropriately evaluated. Several 3D basin models have been already proposed for the Kanto basin. These models were constructed with different data, such as geological, geophysical and earthquake data. This makes then different from each other. Simulations of earthquake ground motion observed during moderate events have been also conducted using these 3D models. Yamanaka and Yamada (2002) proposed a 3D basin model from S-wave velocity profiles from microtremor explorations and revised it by compiling additional data from microtremor explorations. They concluded that simulation using the revised model can reconstruct observed long-period motion better than that of previous model. Tanaka et al. (2005) and Sato and Higashi (2006) validated or improved their 3D models of the Kanto basin using horizontal-to-vertical ratio (H/V spectra) of observed records during moderate events to better fitting of simulated long-period motion with observed one. In this study we validate the 3D model for the Kanto basin proposed by Yamanaka and Yamada (2006) using peak periods of observed H/V spectra.

The 3D model discussed in this study consists of 4 layers. The top layer has three kinds of S-wave velocities of 0.4, 0.5 and 0.6 km/s. The second and third layers are sedimentary layers having S-wave velocities of 1.0 and 1.5 km/s, respectively. The bottom layer is the basement with an S-wave velocity of 3km/s. We calculate peak periods of ellipticity of fundamental Rayleigh wave for a 1D model at each site in the model. We compare these calculated peak periods of the ellipticity with the peak periods of observed H/V from moderate earthquakes at 188 sites by Sato and Higashi (2006). A linear relationship is found between the observed and calculated peaks, although the calculated peaks are 10 % smaller than observed ones. The observed peak periods in the central part of the basin are similar to the calculated ones, while they differ from each other at sites in marginal parts of the basin. In particular, the differences between the two periods of the peaks are large in valley from Kumagaya to Maebashi in the north western part and southern part of the Boso peninsular. We can also identify the differences in the northern part of the Boso Peninsula. Since the examined 3D model was constructed with 1D S-wave profiles from microtremor explorations, the original data are not sufficiently conducted in the marginal part of the basin. Improvement of such a marginal part of the 3D model using seismic reflection profiles is necessary for further accurate modeling the deep sedimentary layers in the Kanto basin.