Statistical properties of random velocity fluctuation of sedimentary layers in Kanto basin, Japan

Sato Hiroaki[1]; Hiroaki Yamanaka[2]; Takashi Furumura[3]; Takashi Hayakawa[4]; Shinichi Okajima[5]

[1] CRIEPI; [2] T.I.Tech; [3] ERI, Univ. Tokyo; [4] SIT, Shimizu Corp.; [5] NGP

Recently, numerical simulations of seismic wave propagation in a large 3D basin model have been often conducted for predicting long period ground motion. In a 3D simulation, generally, underground velocity models are characterized by two or three sedimentary layers and velocity for each layer is approximated by a constant value for each layer. However, actual velocity profile (e.g. well-log data) indicates existing random fluctuations of velocity, which induce scattering attenuation. Therefore it is important for more reliable 3D simulation to make 3D random velocity model of sedimentary basin based on random velocity fluctuation data.

In order to characterize statistical properties of random velocity fluctuation of sedimentary layers in Kanto basin, we analyzed random P-wave velocity fluctuation data at 23 wells, which were investigated by NIED. First, we scanned well-log figures and digitized it. Digitized well-log data were separated both direct component (depth dependency of velocity) and random fluctuation component of velocity. Random velocity fluctuation data were fitted to vonKarman type autocorrelation function for estimating correlation length and Hurst number by an inversion based on simulated annealing.

The following results were mainly derived from our analyses.

1) Median P-wave velocities in Kanto basin were about 2.2km/s for Quaternary, 2.8km/s for Neogene, and 5.0km/s for pre-Neogene or Tertially basement.

2) Random fluctuations of P-wave velocity were characterized by standard deviation of 5.8% for Quaternary, 7.7% for Neogene, and 8.1% for pre-Neogene or Tertially basement.

3) Autocorrelation functions of random fluctuations were optimized by vonKarman type autocorrelation function with correlation lengths of 30m for Quaternary, 41m for Neogene, 22m for pre-Neogene or Tertially basement and Hurst number of 0.36 for Quaternary, 0.24 for Neogene, 0.25 for pre-Neogene or Tertially basement, respevtively.