

Estimation of the seismic basement structure beneath Yokohama city based on the seismic interferometry

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Seismic basement structure beneath Yokohama city has been investigated by many researches (receiver function analysis, microtremor array analysis, etc). However, there is much ambiguity in the seismic basement model for this region, partly because of the lack of deep boreholes. We present a new seismic basement model from the seismic interferometry of strong ground motion data.

In this study, we analyzed the seismic waveforms recorded by the strong ground motion array in Yokohama city on the basis of the seismic interferometry. This strong ground motion array that consists of 150 seismic stations with an average span length of 2 km provides us with data appropriate for the study of local basement depth variation. We analyzed seismic waveforms from 31 local events. Acceleration waveforms were high-pass-filtered (C.F. = 0.5 Hz), and then were integrated to estimate displacement waveforms. After the calculation of the autocorrelation function of each SH displacement waveform with a length of 10 s from the S-wave onset, the autocorrelation functions from all events were stacked at each station.

On the most of the autocorrelation functions, we observed a distinct phase with negative polarity at a time of 4.5-6.0 s. This phase is very small on the autocorrelation function of each event; however, this phase is detected easily on the stacked autocorrelation function. The appearance time of this phase corresponding to the two-way travel time of S waves between the free surface and the seismic basement is characterized only by the S-wave velocity structure of sedimentary layer.

We investigated the depth of the seismic basement beneath each station from the S-wave velocity structure of sedimentary layer proposed by Miura and Midorikawa (2001). Our results show that the seismic basement depth varies from 2.7 to 3.7 km. The depth of the seismic basement takes its maximum (gt 3.5 km) beneath the center of the Yokohama city and its coastal side (Konan-ward, Minami-ward, Isogo-ward, etc.). The northwestern area of Yokohama city (Aoba-ward, etc.) also has a deep seismic basement (about 3.5 km). This result is consistent with that reported by Yokohama City (2000) from the seismic reflection survey. The shallow seismic basement (about 3.0 km) is observed beneath the inland areas of Yokohama city. Our results are almost consistent with those obtained by Miura and Midorikawa (2001) in variation of seismic basement depth; however, our estimate of the maximum depth is roughly 10% shallower.