Detecting concealed fault by microtremor H/V study in Miura Peninsula

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The Miura Peninsula in the southern part of the Kanto region has many active faults. According to geologic map described by Geological Survey of Japan, there is a concealed fault that has about E-W strike in the center of Shonankokusaimura (Etoh et al., 1998). Therefore, in this study, we adopted a microtremor H/V study to detect this concealed fault. Microtremor is a vibration that is constantly shaking the ground even when there is no earthquake. It occurs from natural phenomena and human activities. It contains information on the ground which is the medium of propagation of tremor though it seems random noise. Currently, method of microtremor H/V spectral ratio is widely used such as site effects assessment (Nakamura et al., 1986), underground structure estimation (Gueguen et al., 2000) and detecting active fault (Shibuya, 2008; Sant et al., 2017).

In this study, we carried out microtremor measurements at 15 points across the fault using the JU410 seismometer. Sampling rate was 100 Hz and 15 minutes measurements were conducted for each observational point. In the analysis, the averaged H/V spectral ratio was calculated from the non-overlapped data sets in which the data window length and number were set to 20 seconds and 45, respectively, and noisy portions were removed. The calculation method of the H/V spectral ratio in this study is as follows. At first, Fourier spectra of N-S, E-W, and U-D wave components are calculated. Secondly, H/V spectral ratio is calculated from dividing the square root of the sum of N-S and E-W components by U-D components. Finally, NS/UD and EW/UD are obtained from dividing the N-S by the U-D components and dividing the E-W by the U-D components, respectively. Final process is performed separately from the second in order to take into account the anisotropy for the N-S and E-W directions.

As a result, change of the peak frequencies of the H/V spectral ratio in the direction perpendicular to the fault strike is confirmed and the peak frequencies of the H/V spectral ratio are about 5 Hz in the northern part and about 3 Hz in the southern part, respectively, and its boundary locates approximately 100 meters south of the concealed faults described in the geological map. This suggests the depth of the boundary between the basement rock and sedimentary layer is decreasing from the north to the south in the center of Shonankokusaimura. Focusing on the direction, EW/UD tends to be larger than NS/UD at the frequency that shows the peak in the H/V spectral ratio. These results may show the possibility of existence of the concealed fault in the center of Shonankokusaimura and imply the occurrence of anisotropy of the H/V spectral ratio near the fault. It is expected that the microtremor measurements and analysis considering anisotropy of wave components can lead to future fault research.

Keywords: Microtremor, H/V spectral ratio, Concealed fault, Anisotropy

