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Estimation of shallow velocity structure by seismic interferometry of microtremor

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Recently, seismic interferometry(for example, Wappenaar and Fokkema, 2006), which is the method to get Green's function between two sites by cross correlating recordings of the wave filed at the two sites, is used for many analysis. It is also applied to investigate sedimentary layer structures. For example, Yamanaka and Uchiyama(2008). conducted the microtremor measurement in the Matsumoto basin, and obtained group velocity of surface wave and estimated the S wave velocity structure. In our study, we conducted microtremor array measurements with several tens of meter spacing and examine the applicability of seismic interferometry to investigate sallow subsurface sedimentary structure in detail.

The target are of our microtremor measurements is Uji campus, Kyoto University. In the past, various kinds of subsurface structure exploration have been done in and around the Uji Campus. P wave seismic reflection exploration and borehole survey to investigate the Oubaku fault running near the Uji campus (Koizumi et al., 2002) have shown velocity profile under the Uji campus up to about 500m deep. From the surface down, P wave velocity gradually increases from 1500 to 2500m/s, and sharply rises over 3000m/s at around 400m deep. Layer structure is clear beneath the campus.

We conducted microtremor measurement on 8th and 9th March, 2011. We put 10 SMAR strong-motion seismometers in a line array, and recorded 15-minute-long microtremor data for 10 times, so we got totally 150-minute-long record, on each day. We set sampling rates 200Hz, and the seismometers were placed about 30m apart, and recorded 3 components data. Then, we applied seismic interferometry to these records. Frequency components higher than 0.2Hz can be used for the analysis judging from the Fourier spectra of the data. We prepared 30 segments of 30-seconds-long window from each 15-minutes-long record. We calculated cross-correlation functions of the records between one endmost station and other 9 stations and stacked them for 300 times. By arranging the stacked cross-correlation functions according to the distance between stations, we see clear propagation of wave packet along the measurement line. We will also discuss the character of the wave packet and its propagation velocity.