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Simulation of the Green's function estimated from seismic interferometry in the Kanto basin

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The correlation of long time series of microtremors makes possible to reconstruct the Green's function between two stations. The authors have validated the appropriateness of the surface wave group velocity by comparing between the Green's functions estimated from seismic interferometry and the theoretical ones in the last meeting. Although it is possible to reconstruct the Green's function theoretically, a lot of previous studies have used it only for the estimation on arrival times. Recently, Prieto and Beroza (2008) and Yamanaka et al. (2010) showed the similarity of the waveforms between the estimated Green's function and seismic event. Prieto et al. (2009) tried to infer a one dimensional model of the depth dependent Q structure in southern California. Ma et al. (2008) showed significant similarity between the estimated Green's function and the theoretical Green's function using finite element method in greater Los Angeles area. However as realistic wavefield is very complicated, numerical calculation is one of the most proper ways for investigation on the amplitudes of cross correlations. Here we calculated the theoretical Green's functions and made a comparison with the estimated Green's functions in the Kanto basin.

We estimated the Green's functions in a similar way we used in the last meeting based on more than half year microtremor data. Cross correlations are calculated after 1-bit normalization [Campillo and Paul, (2003)] and bandpass filtered between 2.0 to 6.0 seconds. The theoretical Green's functions are calculated by using three dimensional finite difference method at each observation sits. We referred Yamanaka and Yamada (2006) as subsurface structure model of the sedimentary layers and we used Ricker wavelet which has central frequency at the period of 6.0 seconds as the vertical point source. Comparison between theoretical and estimated Green's functions made it clear that the most of arrival times are similar from those of two waveforms and that there is a great possibility to estimate the velocity in the realistic wavefiled. Moreover not only arrival times but also amplitudes are similar with each other when the two observation sites locate close each other and the variation of subsurface structure is not big. On the other hand, there is a significant difference between the two waveforms when the observation sites are located in the marginal part of the basin and inter station distances are large. This result may come from the difference of the model from the actual basin structure because the theoretical Green's functions have significant later phases and the waveforms are very complex. In such a case, because of the complexity of the waveform, we need to take care for even estimation on velocity.

Keywords: seismic interferometry, Green's function, simulation, microtremors, Kanto basin