Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

SSS27-13 Room:411 Time:April 29 12:30-12:45

Separating body and Rayleigh waves with cross terms of the cross-correlation tensor of ambient noise

TAKAGI, Ryota[1*] ; NAKAHARA, Hisashi[2] ; KONO, Toshio[1] ; OKADA, Tomomi[1]

[1]RCPEV, Graduate School of Sci., Tohoku Univ., [2]Geophysics, Graduate School of Sci., Tohoku Univ.

We develop a novel method to separate body and Rayleigh waves with the vertical-radial (ZR) and radial-vertical (RZ) components of the cross-correlation tensor of ambient noise. Furthermore, analyzing ambient noise records observed at a seismic array, we validate the method. For the separation, we utilize the difference in polarizations between the rectilinear P and the elliptic Rayleigh waves. Assuming the two-dimensional surface and three-dimensional body waves are the superposition of random uncorrelated plane waves, we derive two fundamental characteristics of the ZR and RZ correlations. One is that, between the ZR and RZ correlations, Rayleigh wave contributions have the opposite signs and P waves have the same signs. The other is that, for both ZR and RZ correlations, Rayleigh wave contributions are time-symmetric and P waves are time-antisymmetric. Accordingly, we can separate P and Rayleigh waves by just taking the sum and difference between ZR and RZ correlations and by just taking the time-symmetric and time-antisymmetric components. This method can be performed (1) without any knowledge of velocity structure, (2) using only two stations with three-component sensors on a ground surface, (3) even in the case of anisotropic wave incidence, and (4) with the quite simple procedure. We consider that the developed method can make better use of three-component observations of ambient noise for evaluating the cross-correlation tensor accurately, for improving deep velocity structure using both of extracted body and surface waves and, more fundamentally, for understanding the composition of ambient noise.

Keywords: ambient noise, seismic interferometry, cross-correlation function, wavefield separation, polarization, body and Rayleigh waves