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Seismic anisotropy from the interferometric analysis of seafloor records

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The seismic interferometry is now widely applied to the ambient noise source in continental regions [e.g. Shapiro et al., 2005] and in an oceanic region, the East Pacific Rise (EPR). Harmon et al. [2007] used the vertical components of ocean bottom seismometers deployed in the EPR region for analyzing the Rayleigh wave. In this study, we apply similar method to the three-component record of broadband ocean bottom seismometers (BBOBSs) deployed in (i) the Shikoku Basin (SB) region by the Stagnant Slab Project and (ii) the French Polynesia (FP) region by the TIARES (tomographic investigation by seafloor array experiment for Society hotspot) project. The spacing of the stations is about 100-200 km. For each region, we obtain the phase velocities of (i) the fundamental mode of Rayleigh wave (14-29 sec), (ii) the first higher mode (5-11 sec) of Rayleigh wave, and (iii) the fundamental mode of Love wave (2.5-14 sec) by the SPAC method [Aki, 1957]. The propagation of the first higher mode of Rayleigh wave appears (i) in the horizontal component (7-11 sec) for the SB region, (ii) in both vertical and horizontal components (5-10 sec) for the FP region, and (iii) in the vertical component (3.5-7 sec) for the EPR region. The difference between EPR and SB regions can be interpreted by the difference between the periods of analysis. To account for the difference between FP and SB regions, on the other hand, we need to discuss other causes such as the difference of sedimental thickness and the source intensity of ambient noise.

By further using the phase velocities measured by array analysis of teleseismic waveforms, we obtain one-dimensional radially anisotropic structures at the uppermost mantle beneath SB and FP regions. Both structures show that the velocity of horizontally propagating shear-wave with horizontal polarization (V_{SH}) is 3 % higher than that with vertical polarization (V_{SV}). We also focus on the azimuthal anisotropy. By the analysis of teleseismic waveforms, the phase velocity (30-50 sec) beneath the FP region is revealed to depend on the back-azimuth, t, in a form with sin(2t) and cos(2t). We obtain consistent pattern at shorter periods (20-30 sec) by the ambient noise interferometry with assuming homogeneous structure beneath the array. We will discuss the effects of inhomogeneous structure and inhomogeneous source distribution, and will estimate the azimuthal dependence at shorter periods.

Keywords: Seismic interferometry, ambient noise, anisotropy