Evaluation of anisotropic parameters using virtual cross-dipole data with full waveform approach

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Crack density and orientation in the subsurface dominates velocity anisotropy of S-wave. S-wave anisotropy estimation is also practically useful for the exploration and development of natural resources and understanding tectonics. The estimation of S-wave anisotropy is, therefore, a quite important clue to grasp subsurface stress field information from past to present. In spite of the importance of S-wave anisotropic parameter estimation, S-wave survey in the offshore is quite difficult because S-wave never propagates in the sea water. In our previous study, we proposed a novel analysis scheme in order to estimate S-wave anisotropic parameters with virtual cross-dipole data utilizing seismic interferometry from air-gun sources and a single tricomponent ocean bottom seismometer. However, there are still some limitations to apply our method because of some assumptions for anisotropic medium. In this study, we developed another novel analysis scheme, which combines our virtual cross-dipole method and a full-waveform inversion method. In the proposed method, we set 5 components of the stiffness matrix, anisotropic azimuthal angle and dip angle as estimated parameters. This strategy makes the inversion process stable. For a performance test of this scheme, we conducted simple numerical experiments with a numerical model containing an anisotropic target. The numerical results indicate that the proposed method could provide anisotropic information in the subsurface with sufficient accuracy.

Keywords: Seismic Interferometry, Cross-dipole survey, S-wave survey, S-wave anisotropy, Full waveform inversion

