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Stripping analysis of S and Ps waves traveling through a dipping anisotropic layer structure

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The seismic anisotropy in a horizontal layer structure can be determined as a function of depth by the stripping analysis of the Ps waves converted at velocity discontinuities (Oda, 2011). Stripping analysis of a Ps converted wave that originates at velocity discontinuity located at a deep portion in the earth tells us about the seismic anisotropy in the deep layer, but the Ps wave can be sometimes difficult to identify on the receiver functions. In such a case, a direct S wave that travels into the deep layer should be analyzed instead of the Ps phase. So we try to determine anisotropic structure by the stripping analysis of S and Ps converted waves. Synthetic seismograms were produced for the case where P and S waves were incident on the subduction zone structure that consists of upper and lower crust, mantle wedge, a dipping oceanic crust and the oceanic plate. We gave direction and dip angle of hexagonal symmetry axis and anisotropy intensity to each layer. The Ps converted waves were identified on the P-wave receiver functions constructed from the synthetic seismograms. Polarization anisotropies in the upper and lower crust were determined by the stripping analysis of the Ps converted waves at the Conrad and Moho discontinuities. As a result, they were in agreement with those given to the upper and lower crust. Similarly, seismic anisotropy in the mantle wedge was estimated from the direct S wave which was corrected for the polarization anisotropy in the crust by the stripping analysis. The estimated S-wave polarization anisotropy was consistent with that given to the mantle wedge. This result shows that the stripping analysis of Ps and S waves is applicable to estimation of the anisotropic structure in the subduction zone consisting of dipping layers.

Next we investigate the polarization anisotropy of S wave traveling through a horizontal three-layer structure which consists of two anisotropic layers and a semi-infinite bottom layer of isotropic elastic body. The top layer is assumed to be thinner than the middle layer. The S-wave polarization anisotropy is measured as a function of period from S-wave splitting which is observed on synthetic seismograms calculated for the anisotropic layer structure. The synthetic S wave shows polarization anisotropy predicted for the seismic anisotropy of the top layer when the period of S wave is shorter, and that of the middle layer when it is longer. Thus the S wave polarization anisotropy changes with changing the period of S wave.

Keywords: Stripping analysis, S-wave polarization anisotropy, dipping anisotropic layer structure, Ps converted wave