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Effect of seismic attenuation on S-wave polarization anisotropy

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In order to verify whether or not seismic attenuation has an influence on S-wave polarization anisotropy, we investigated shear-wave splitting of Ps phases that are identified on synthetic P-wave receiver functions calculated for a seismic velocity model of three-layer structure. Top two layers of the velocity model are anisotropic and anelastic medium, and bottom layer is a semi-infinite isotropic elastic body. Horizontal c-axis is assumed to lie in the anisotropic layers, and anisotropy intensity is set at 2 % for P-wave velocity and 5 % for S-wave velocity. Azimuth of the c-axis is 35 degrees from the north in the first layer and 65 degrees in the second layer. Thicknesses of the two anisotropic layers are 35km. Attenuation quality factors, Qp and Qs, of P and S waves are 50 and 25 in the first layer and 100 and 50 in the second layer. Appropriate values are assigned to the isotropic P and S wave velocities and density of the velocity model.

Three-component response functions caused by P-wave incident on the bottom layer is calculated as a function of back azimuth for the three layer structure by layer matrix method (Crampin, 1970). Incident angle is set at 10 degrees measured from the vertically downward direction. The radial and transverse components of P-wave receiver functions for different back azimuths are constructed from the P-wave response functions by water level method (Langston, 1979).

We compared P-wave receiver functions calculated in two cases: one is a case where seismic attenuation exists and the other is a case where there is no seismic attenuation. The receiver function with seismic attenuation shows smoother waveform than that in the case of no attenuation, because high-frequency components of the receiver functions are attenuated by anelasticity of the anisotropic layers. We identified two conspicuous phases on the receiver functions as Ps-converted phases generated at layer boundaries. By using stripping method (Oda, 2011), we estimated splitting parameters, fast polarization direction and split time, of the Ps phases. Values of the estimated splitting parameters, with or without seismic attenuation, are approximately in agreement with those predicted from the anisotropic parameters of the three-layer velocity model. Thus we can say that the seismic attenuation does not have a significant influence on the shear-wave polarization anisotropy of Ps phases.

Keywords: seismic attenuation, S-wave polarization anisotropy