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Sensitivity to anisotropy of finite-frequency body waves based upon adjoint methods

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We investigate how finite-frequency body-wave data 'see' the anisotropic structure of the mantle using sensitivity kernels calculated by the combination of forward and adjoint spectral-element modeling of wave propagation. A common observable for isotropic imaging is the time shift measured by cross-correlation between real and synthetic signals. Because of S-wave splitting, this observable is not appropriate to analyze S waves propagating in anisotropic media. New observables must be defined for this case. One possible extension of the time shift to anisotropic S waves is the splitting intensity of Chevrot (2000). We describe anisotropy with the 21 elastic parameters naturally involved in asymptotic description of wave propagation in weakly anisotropic media. We observe that body-wave sensitivity to anisotropy is characterized by complicated patterns with large variations of the kernel amplitude along the path and with the orientation of the path. This is asymptotically explained by a dependence with the propagation incidence angle and local azimuth. The most popular method to study anisotropy from body waves is to consider SKS splitting. The sensitivity of SKS-splitting intensity shows the characteristics of S-wave sensitivity with some particularities due to the SKS specific path-geometry. These properties make SKS-splitting intensity an interesting observable for imaging.