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Comparison between ray theory and synthetic seismograms for transversely isotropic media

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Imaging seismic anisotropy is essential for a better understanding of geodynamics, since it provides information on deformation and flow in the crust and mantle. S-wave splitting has been widely used to infer the presence and extent of anisotropy. The inference of anisotropy from S wave splitting relies, however, on ray theory, which is strictly valid only for infinitely high frequencies, and thus may not accurately reflect real finite-frequency seismic data. For example, a recent study by Komatitsch et al. (2010) showed that splitting of diffracted S waves in the D” region, just above the CMB, is present in synthetics computed for an isotropic velocity model. In this study we compute travel times for a transversely isotropic (TI) medium using a newly developed software package (Konishi et al., JpGU, 2015). We then compute full-wave synthetics using the Direct Solution Method (DSM; Kawai et al., 2006). We focus on two regions of the mantle: D” and the upper mantle. We confirm apparent S-wave splitting in synthetics computed for the isotropic IASP91 velocity model for epicentral distances over 100 degrees, in agreement with the results of Komatitsch et al. (2010). We also compare the predictions of geometrical optics to synthetics for TI models for phases which sample the upper mantle and the D” region.

キーワード: DSM, Travel time, D double prime, Upper mantle, Anisotropy, S-wave splitting
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