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Array waveform similarity methods applied to measurements of upper mantle anisotropy beneath the Bohemian Massif

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Retrieving reliable 3D anisotropic models of the upper mantle requires a good angular coverage (both in back-azimuth and incidence angles) of arriving waves. However, commonly used core-mantle refracted shear phases characterize only subvertical directions of propagation. 'Similarity method' (EGU2009-4536) assumes that undisturbed waveforms, i.e., those with similar (or identical) shape and polarization, would be recorded at the bottom of an investigated volume beneath the array. The task is to find this similarity from waveforms recorded at individual stations of the array, from the waveforms that were disturbed while propagating within the structure beneath the array. The similarity method is feasible to apply only on data from dense arrays of seismic stations. Such method allows us to include also direct shear waves into the modelling anisotropy of the upper mantle from shear-wave splitting, and thus to enhance the amount of data and improve the coverage of directions. Inversion of splitting parameters evaluated both for core-mantle refracted and direct shear waves, as well as in combination with anisotropic results from P-waves, results in more representative 3D self-consistent anisotropic models of the lithospheric mantle. We exploit the assumed waveform similarity not only for evaluation of shear-wave splitting of direct shear waves, but also in a signal pre-processing, e.g., to check reversals of polarity or erroneous time shifts of signals. The frequency-wavenumber (F-K) method is used to find intervals of recordings with sufficient energy content. To process a large number of recordings to measure arrival times, particularly for analyses of P-wave residuals, we use a new automatic arrival-time picker based on array-waveform similarity. We apply the methods on data of three passive seismic experiments BOHEMA I-III (2001-2006) in the Bohemian Massif (central Europe) aiming at retrieving 3D anisotropic models of the upper mantle.