Spatial coherence of seismic anisotropy and interpretation of shear wave splitting - *Hawaiian upper mantle case*

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Seismic anisotropy observations at surface, as shear wave splitting of SKS waves, are usually interpreted as a result of the Lattice Preferred Orientations of minerals in the underlying upper mantle induced by the deformation of rocks. We investigate the case of a three dimensionnal forward model for seismic anisotropy in the Hawaiian hotspot upper mantle and the related synthetics of shear wave splitting at surface. We have calculated the deformation of olivine polycrystals undergoing dislocation creep and dynamic recrystallization in a numerical model of the upper mantle flow for Hawaii. The polycrystal deformation model is D-Rex (Kaminski & al., 2004) and the three dimensionnal steady state flow has been produced by a hybrid spectral/finite difference code (Ribe & Christensen, 1994). The result of this coupling is a three dimensionnal distribution of olivine crystals orientation. The corresponding seismic anisotropy model of hexagonal symmetry is obtained by decomposing the average elastic stiffness tensor at each location (Browaeys & Chevrot, 2004). We convolve this model with the sensivity kernels (Favier & Chevrot, 2003) for typical SKS wave to produce synthetics shear wave splitting parameters. An heterogeneous distribution of seismic anisotropy decreases the time delay and increases the variability of the detected azimuth. Heterogeneity can be important both vertically and laterally and have an effect depending on its length scale and the one of the Fresnel zone of the wave. Vertical heterogeneity close to the plume conduit leads to a small time delay at Hawaii.

References:

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