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Seismic Anisotropy near Hawaii - Evidence for plume-related mantle flow

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During the Hawaiian PLUME (Plume-Lithosphere Undersea Melt Experiment) deployment, we collected continuous seismic data at ten land stations and nearly 70 ocean bottom sites from 2005 through mid-2007. Both the usage broad-band seismometers as well as the central location of Hawaii with good azimuthal seismicity coverage has allowed us to conduct a comprehensive analysis of surface wave azimuthal anisotropy at periods between 20 and 100 s. We use a sub-array approach to successively fit propagating spherical wave fronts in order to obtain frequency-dependent estimates at a large number of points. We use the standard Smith-and-Dahlen parameterization to express azimuthal variations. A systematic comparison between results obtained for different truncation levels in the trigonometric expansion allows us to assess stability of the results and assign error bars.

At short periods, the fast direction aligns coherently with the fossil spreading direction across the entire PLUME network. This result supports the idea that flow-aligned asthenospheric material is "frozen" to the bottom of the cooling plate as it thickens. However, at longer periods, that sense the asthenosphere below the fast direction rotates incoherently, indicating that flow in the asthenosphere is significantly perturbed from the direction of current plate motion. A published shear-wave splitting study (Collins et al., 2012) found no evidence for such an anomalous mantle flow and therefore seems inconsistent with our results. We present initial surface-wave inversion results that suggest that plume-related mantle flow does not reach into the upper lithosphere. We also present forward-modeling results attempting to reconcile both surface-wave and shear-wave splitting observations.

Collins, J.A., Wolfe, C.J. and Laske, G., 2012. Shear wave splitting at the Hawaiian hots pot from the PLUME land and ocean bottom seismometer deployments, *Geochem. Geophys. Geosys.*, **13**, doi:10.1029/2011gc003881.