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Development of methods for inversion of seismic waveforms for 3-D anisotropic Earth structure and preliminary results for D" structure beneath Central America

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We have developed a methodology for inversion of seismic waveform data for anisotropy and 3-D structure. The key steps in the inversion are calculation of synthetic seismograms and their partial derivatives. We have developed accurate and efficient software to calculate synthetic seismograms in spherically symmetric transversely isotropic (TI) media (Kawai *et al.* submmited). We obtain partial derivatives for the anisotropic elastic parameters (at particular points in space, with smoothness constraints applied) by applying the partial derivatives formulated by Geller and Hara (1993) to anisotropic media.

We apply the above techniques to study the anisotropic structure in the D" region beneath Central America using waveform inversion. In this study we assume that the anisotropic structure is TI, because we do not have sufficient azimuthal path coverage to constrain a model with additional elastic parameters. However, this is not an inherent limitation of our methods.

We assemble a waveform dataset from CNSN and IRIS that samples the region from latitude -10° to 50° and from longitude -110° to -40° and depths from 200 km above the CMB to the CMB. As there is possibility that anisotropic structure caused by lattice preferred orientation of Post-Pv could strongly reflect the flow within D", it is particularly desirable to constrain not only laterally but also vertically anisotropic structure within D".

Previous studies (e.g., Kendall and Silver 1996) have reported evidence for seismic anisotropy in the D” layer. However, as there also are low velocity anomalies in D” (e.g., Garnero and Helmberger 1995) and there is a trade-off between anisotropy and lateral heterogeneity (e.g., Mochizuki 1997). Our methods may help to resolve this tradeoff.

The main constituents of the D” layer (at the base of the lowermost mantle just above the core) had been considered to be about 80 % perovskite (Pv) and 20 % MgO, as is also thought to be the case for the rest of the lower mantle (D’). However, it has recently been suggested that Pv makes a phase transition to another phase (post-Pv) under the pressure-temperature conditions in D” (Murakami *et al.* 2004). While Pv structure is not particularly anisotropic, post-Pv structure is strongly anisotropic. Detailed knowledge of seismological anisotropy in the D” layer thus might provide important evidence on geodynamic processes, including the possibility of obtaining direct evidence confirming the existence of post-Pv.