FREQUENCY DEPENDENT ATTENUATION IN THE INNER CORE

Vernon F. Cormier • University of Connecticut
Xu Li, Massachusetts Institute of Technology

Broadband velocity waveforms of PKIKP in the distance range 150° to 180° are inverted for a model of inner core attenuation due to forward scattering by a three-dimensional heterogeneous fabric. A mean velocity perturbation of 8.4%±1.8% and a scale length of heterogeneity of 9.8±2.4 km are determined from 262 available PKIKP ray paths. The velocity perturbations are larger for polar than equatorial paths, decrease with depth, and show anisotropy in both global and regional data (Figure 1). For paths beneath North America, the smallest scale lengths (1-5 km) tend to lie in either the upper 200 km of the inner core or along paths close to the rotational axis. The depth dependence of attenuation is roughly similar to that obtained assuming a viscoelastic origin, except a more abrupt transition is seen between higher attenuation in the upper inner core and lower attenuation in the lower inner core. This transition may be sharp enough to produce either a first or second order discontinuity with depth in the long-wavelength (composite) elastic moduli. A fabric that satisfies the observed depth dependence and anisotropy of attenuation requires solidification of iron crystals having high (>10%) intrinsic anisotropy, which are preferentially aligned in time and depth. Since weak velocity dispersion, elastic anisotropy, attenuation anisotropy, and their depth dependence are consistent with what is predicted by such a fabric, we suggest that scattering attenuation is not a small fraction but rather the predominant mechanism of attenuation in the inner core in the 0.02 to 2 Hz frequency band.