

Imaging the sharpness of the lithosphere-asthenosphere boundary (LAB)

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Abstract: Imaging the sharpness of the lithosphere-asthenosphere boundary (LAB) is important for understanding the nature of the LAB. It was recently suggested that the LAB beneath continents is probably a sharp discontinuity (over < 30 km) associated with partial melting, and, SS precursors with a dominant period of ~20 seconds are consistent with such model. In this study, we investigate seismic signals associated with the sharpness of upper mantle discontinuities. We compare seismograms generated in 1-D reference earth models with varying discontinuity sharpness. We found that SS precursor waveforms in general do not show visible differences at 10-100 seconds periods when a first-order discontinuity is replaced by gradient zones over 50 km, as long as the average S wave speed over the depth range is the same in the two models. This indicates that the sharpness of the LAB discontinuity may not be resolvable using long-period SS precursors (~20 seconds). We show that surface wave overtones at those periods are most sensitive to the sharpness of the discontinuity and can be potentially used to better constrain the LAB. Finally, we will compare synthetic LAB signatures with seismograms recorded at GSN stations and discuss implications for discontinuity imaging.