

Paleoslabs in the lowermost mantle detected using seismic waveform inversion

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We formulate the inverse problem of waveform inversion for localized 3-D seismic structure, computing partial derivatives of waveforms with respect to the elastic moduli at arbitrary points in space for anisotropic and anelastic media. In this study we minimize computational requirements by using the Born approximation with respect to a laterally homogeneous model, but this is not an inherent limitation of our approach. We solve the inverse problem using the conjugate gradient (CG) method, using Akaike's Information Criterion (AIC) to truncate the CG expansion. We apply our method to invert for 3-D shear wave structure in the lowermost mantle beneath Central America, the northern Pacific using waveforms at periods from 12.5 to 200 s recorded at stations of USArray and F-net for deep and intermediate-depth events and find high velocity anomalies immediately above the core-mantle boundary (CMB) interpreted as the paleoslabs subducted to the lowermost mantle and cooling the liquid outermost core regionally.

Keywords: Paleoslab, Waveform inversion, lowermost mantle