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Global lower mantle structure from multifrequency P- and Pdiff-wave tomography

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We present a new global seismic tomography model of isotropic P-wave velocity anomalies at all mantle depths. This broadband waveform inversion seamlessly incorporates a very large set of 391,320 core-diffracted P-phase measurements (Pdiff) alongside conventional teleseismic P and PP waveforms. All phases are measured and modelled from 30 s dominant period to the highest frequencies that produce satisfactory fits ($\sim$3 s). The few examples of prior tomographies that incorporated Pdiff phases included only a few hundred measurements and not in a broadband, multifrequency framework, such as here.

Pdiff waves extensively sample the lower third of the mantle and the core-mantle boundary. Hence their inclusion in a technically rigorous manner vastly improves spatial resolution of the deepest mantle.

We present our methods and discuss first-order features of the lower-mantle structures thus obtained: geometries of fast velocity anomalies representing the oldest subducted slabs still visible, and the subdivisions of Large Low Shear Velocity Provinces, as imaged by P-waves.