

Waveform inversion for localized 3-D seismic velocity structure in the lowermost mantle beneath the Western Pacific

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We infer 3-D localized shear velocity structure in the lowermost 400 km of the mantle at the western edge of the Pacific large low shear velocity province (LLSVP) by applying waveform inversion to transverse component body-wave waveforms from the F-net seismic array in Japan. Our dataset consists of relatively long period (12.5-200 s) broad-band seismic waveforms of Tonga-Fiji deep focus and intermediate deep earthquakes. We conduct several tests to confirm the robustness of the inversion results. We find two low velocity zones at the bottom of the target region, with a high velocity zone in the middle, and a low velocity zone above the high velocity zone and contiguous with the two deeper low velocity zones at a depth of 200-300 km above the CMB. This supports the idea that the Pacific LLSVP may be an aggregation of small upwelling plumes rather than a single large thermochemical pile.

Keywords: Waveform inversion, Western Pacific, Mantle convection, Lowermost mantle, Plume cluster