3-D P- and S-velocity structure of the D″ layer beneath Central America and the Caribbean using waveform inversion

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We present 3-D P- and S-velocity models of the lowermost mantle (0–400 km above the core-mantle boundary) beneath Central America and the Caribbean inferred from waveform inversion of a large dataset of ~16,000 USArray waveforms data. The origin of seismic velocity anomalies in the D″ region, e.g., thermal, chemical, or due to the phase transition from Bridgemanite (brg) to post-perovskite (pPv), is still debated. Insights into the origin of velocity anomalies can be obtained by comparison of P- and S-velocity models (Wentzcovitch et al. 2006). Previous tomographic studies have reported large S-to-P velocity ratio in the lowermost mantle based mainly on normal modes, which can constrain the large-scale structure of the mantle (e.g., Masters et al. 2000; Koelemeijer et al. 2018). There are, however, few local high-resolution models of the 3-D P- and S-velocity structure of the lowermost mantle due to the difficulty of measuring the arrival-time of the small-amplitude PcP phase. Since waveform inversion does not require measuring arrival times, it might provide a more robust way of using the PcP phase to constrain the high-resolution structure of the lowermost mantle. In this study, we use ~7000 transverse component and ~7000 vertical component records from ~38 intermediate and deep-focus earthquakes in South-America recorded at USArray stations between 2004–2015. The records are cut ~10 s before the arrival of the P (S) phase, and ~40 s after the arrival of the PcP (ScS) phase. Resolution tests shows that we can resolve separately the P- and S-velocity structure of the lowermost mantle on scales less than ~300 km. Our preliminary results show a relatively good correlation between S- and P-wave anomalies on small-scales, with a large S-to-P velocity ratio in the range 100–300 km above the CMB, and a smaller ratio 0–100 km above the CMB, in general agreement with the results of Koelemeijer et al. (2018).

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