Waveform inversion for the radial elastic and anelastic structure of the lowermost mantle beneath Central America and the Caribbean

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The origin of velocity anomalies in the lowermost mantle, e.g., thermal, chemical, or due to phase transition, is still debated. Intrinsic seismic attenuation (Q) strongly depends on temperature, thus could provide additional constraints on the thermal contribution to seismic anomalies in the lowermost mantle. In this study, we investigate the radial (1-D) elastic (Vs) and anelastic (Q) structure of the lowermost mantle beneath Central America and the Caribbean using waveform inversion. We use ~50 intermediate and deep focus earthquakes in South America recorded at the USArray and other small networks between 2004–2015. Waveforms are filtered between 12.5–200 s and cut ~20 s before the arrival of the direct S phase, and ~60 s after the arrival of the ScS phase. We use the S phase as a reference phase to correct for the effects of the structure near the events and receivers on the travel-time and amplitude of ScS waveforms (Konishi et al., 2017). Synthetic tests show that we can resolve the 1-D Q and Vs structures of the lowermost mantle, with some amount of tradeoff between them. In an attempt to reduce the tradeoff between the Vs and Q structure, we perform iterative inversion inferring in a first step the Vs structure only, and in a second step the Vs and Q structures simultaneously.

Keywords: Seismic attenuation, Waveform inversion, Lowermost mantle

