Waveform inversion for whole mantle 1-D S-velocity and Q structure beneath Central America and the Caribbean

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We simultaneously infer the 1-D S-velocity and anelastic (Q) structure in the whole mantle beneath Central America using waveform inversion. Our dataset consists of ~8000 transverse components recorded at USArray broadband stations from ~40 intermediate- and deep-focus events in South America. We use waveforms in time windows cut around the minor arc arrivals which include body-wave arrivals (e.g. Sn, sSn) as well as multiple reverberations at the core-mantle boundary (ScSn, sScSn). These data provide constraints on the difference in Q structure between the upper- and lower-mantle. We use the Born approximation to compute partial derivatives for 1-D shell perturbations at depth increments of 20 km in the whole mantle. Our model is parametrized in radial splines formed by linear combination of those 20 km-increment perturbations. Synthetic tests suggest that our dataset and method can simultaneously resolve the 1-D S-velocity and Q structure in the whole mantle. Knowledge of both the S-velocity and Q structure can help to provide constraints on the origin of the S-velocity anomalies, i.e., whether they are of thermal or chemical origin.

Keywords: Waveform inversion, Earth's mantle, Anelastic structure

