Waveform inversion for the 3-D S-velocity structure of the mantle transition zone beneath Central America using USArray data

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Our group previously presented evidence for paleoslabs at the base of the mantle beneath Central America (Borgeaud et al. 2017) based on waveform inversion for 3-D S-velocity structure. However, it has not yet been clarified how paleoslabs are subducted through the mantle. Travel-time tomography studies have reported that subducted slabs either are stagnant at depths of ~660 or ~1000 km or penetrate into the lower mantle (Fukao et al. 2009), showing various modalities around the mantle transition zone (MTZ). We further study the fate of paleoslabs using waveform inversion. We assemble a dataset including triplicated S phases associated with the 410 and 660 km discontinuities and infer the 3-D S-velocity structure in the depth range 300-900 km beneath Central using waveform inversion. We use ~6,500 transverse component records at epicentral distances $15 < \Delta < 35$ degrees from ~32 intermediate focus earthquakes beneath South America, Central America, and the Antilles recorded at stations of the USArray and other smaller networks (GSN, FDSN, TO, XT, XN). We filter the records between 12.5-100 s, and use the portions of the waveforms from 10 s before to 70 s after the first S-wave arrival, including S-wave triplications due to the 410 and 660 km discontinuities. We test the robustness of our 3-D inversion results to corrections for shallow mantle heterogeneities, change in model parametrization, and redetermination of the source time functions of the largest earthquakes in our dataset (Mw >~6-6.5). Our results may provide additional constraints on the complex subduction history of the Caribbean region.

Keywords: Mantle Transition zone, Waveform Inversion

