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Variation of the upper mantle velocity structure along the central-south Andes

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Variations in the subduction angle of the Nazca plate beneath the South American plate has lead to different modes of deformation and volcanism along the Andean active margin. The volcanic gap between the central and southern Andean volcanic zones is correlated with the Pampean flat-slab subduction zone, where the subducting Nazca slab changes from a 30-degree dipping slab beneath the Puna plateau to a horizontal slab beneath the Sierras Pampeanas, and then to a 30-degree dipping slab beneath the south Andes from north to south. The Pampean flat-slab subduction correlates spatially with the track of the Juan Fernandez Ridge, and is associated with the inboard migration of crustal deformation. A major Pliocene delamination event beneath the southern Puna plateau has previously been inferred from geochemical and geological and preliminary geophysical data. The mechanisms for the transition between dipping- and flat-subduction slab and the mountain building process of the central Andean plateau are key issues to understanding the Andean-type orogenic process.

We use a new frequency-time normalization approach with non-linear stacking to extract very-broadband (up to 300 second) empirical Green's functions (EGFs) from continuous seismic records. The long-period EGFs provide the deeper depth-sensitivity needed to constrain the mantle structure. The broadband waveform data are from 393 portable stations of four temporary networks: PUNA, SIEMBRA, CHARGE, RAMP, East Sierras Pampeanas, BANJO/SEDA, REFUCA, ANCORP, and 31 permanent stations accessed from both the IRIS DMC and GFZ GEOFON DMC. A finite difference waveform propagation method is used to generate synthetic seismograms from 3-D velocity model. We use 3-D traveltime sensitivity kernels, and traveltime residuals measurement by waveform cross-correlation to directly invert the upper mantle shear-wave velocity structure. The preliminary model shows strong along-strike velocity variations within in the mantle wedge and the subducting NAZCA slab. Low upper mantle velocities are north of 29°S and south of 35°S, corresponding to the low velocity mantle wedge of dipping-subduction. The upper mantle beneath the Sierras Pampeanas has a higher velocity than that beneath the central and south volcanic zones, which is consistent with the Pampeanas flat-slab. Though we observe substantial heterogenity within this flat-slab zone.