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Transition zone thickness and its correlation to the Nazca slab position in South America

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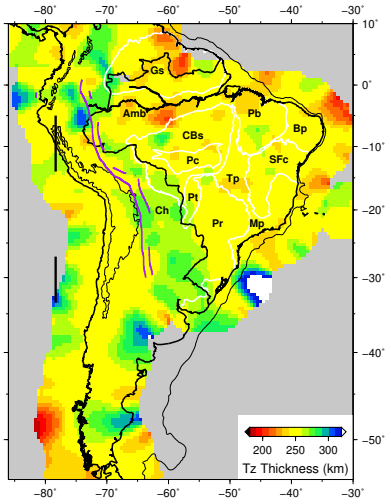
Abstract

Nazca subducted plate under stable South America (SA) influences the position and thickness of the transition zone (TZ) under the continent. TZ variations are associated with mantle temperature and also to mantle P- and S-waves velocities. TZ thickness is an indirect method to map Nazca slab position at greater depths. Recent tomography results show that Nazca plate is being held below TZ for latitudes around 20°S and longitudes between 70-55°W. We use a database of 63,809 LQT deconvolved P-wave receiver function traces (from 1,126 seismographic stations) to image the mantle TZ under different terranes. Dataset was automatically processed to obtain moved-out corrected, stacked P-wave receiver functions in boxes of 3x3 degrees every 1x1 degree. In total, we obtained 1,879 and 2,214 stacked receiver function traces that images the 410km and the 660km discontinuities respectively. An automatic extraction routine picked discontinuities times that were corrected using SL2013 global tomography model to obtain depths. In the end, we constructed IASP91 time residuals maps, maps of individual discontinuity depths and, a final map showing TZ thickness. The main result is a thickened TZ in a trend following the Andean cordillera where Nazca plate is. To the north of the latitude 18°S the TZ thickened zone has a map extension of ∼250km, to the south, we observed that the thickened zone reach up to a 1,100km width. This observation gives a clear indication that the Nazca slab flattens close to the TZ creating a perturbation in the mantle temperature and thickening the TZ. Looking at individual discontinuities depths, it looks like that 660km discontinuity is more affected than 410km favoring that the Nazca slab could flat below the TZ and not in the TZ. Individual discontinuities times indicates that upper mantle velocities are faster than IASP91 for cratonic areas and, slower than expected for the Altiplano as also mapped by local tomography.



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