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Crustal and upper mantle structures beneath the Central Andes at 21°S and 25.5°S derived from receiver functions

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The Andes reach their greatest width between roughly 14°S and 24°S commonly known as the Central Andes. The main tectonic feature is the Altiplano-Puna plateau extending ca. 1700 km from N to S with a width of up to ca. 400 km and an average elevation of about 4 km. Previously, low-velocity layers have been found in the upper crust and delamination of lithospheric material has been suggested to explain the observed structures and the evolution of the Andean plateau. But still some processes are poorly understood. Teleseismic events have been recorded on two profiles crossing the Altiplano plateau and the Puna plateau at roughly 21°S and 25.5°S, respectively, in order to investigate the structures of the upper mantle. The profiles consisted of 59 and, respectively, 19 seismic stations with an average spacing of 10 km.

We have applied the receiver function method to investigate seismic discontinuities of the crust and upper mantle. A total of 2499 and 1659 receiver functions have been obtained for the northern and the southern profile, respectively. Our results confirm the observation of expanded low velocity zones in the upper crust. At 21°S depths to Moho shallows from 70 to 80 km in the central part to 50 km in the E. Beneath the Puna plateau a constant depth of about 60 km has been derived in the W of the profile thickening to 70 km at ca. 67°W and further east. The subducting slab can be seen clearly beneath at 21°S down to ca. 130 km and weak signal can be vaguely traced further down fitting well to local seismicity. Dipping structures have been found within the crust indicating complex dynamic processes. In addition, upper mantle discontinuities have been investigated revealing anomalous changes in depth beneath the Puna plateau indicating elevated temperatures. Finally, the results are compared with the achievements of a tomographic study independently obtained from the same data.