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Structures of the Crust and Mantle Lithosphere in South America: trying to find the Lithosphere-Asthenosphere Boundary

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During the past years, a series of seismological investigations have been carried out to study the crustal and mantle structures all over the world. In South America, this investigation has not been an easy task as there are different regions where the geodynamics involves the subduction of the Nazca plate, the building of the Andean mountain range, old cratonic areas as the Brazilian Shield and the presence of active deformation fronts. Here we use S-wave receiver functions to investigate the structure and thickness of the crust and mantle lithosphere in such a complex area using data from permanent and temporary stations.

The S receiver function technique looks for the S-to-P converted waves at seismic discontinuities beneath a seismic station in a similar way as the conventional P receiver function method dealing with P-to-S conversions. The S receiver function technique has proved to be useful to map the Moho discontinuity and the LAB in many regions where other methods (i.e. surface waves) failed to provide this information.

We present here the results of the S receiver function technique that has been applied to the data of all available temporary seismic experiments (e.g. BANJO, SEDA, REFUCA, BLSP, CHARGE) and permanent stations from the different networks (e.g. GEOSCOPE, GTSN, GSA, GEOFON). We have been able to map the upper mantle discontinuities at all the depths beneath the stations. We obtained coherent Moho depths along the entire Andes and in other South American continental regions. The Lithosphere-Asthenosphere Boundary has been clearly detected below some stations, particularly those that are located far away from the subduction zone. By comparing our results with those obtained from the P receiver functions, we have been able to

further constrain the thicknesses of the crust and lithosphere in different regions including shields, mobile belts, basins and mountain ranges. Beneath some stations we have also been able to map the 410 and 660 km upper mantle discontinuities in South America. The topography of these discontinuities should reflect the changes in temperature and thermal state of the materials in the mantle transition zones, and may correlate with the tectonic events at depth of the lithosphere.