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Imaging the crustal and lithospheric structures beneath the Alboran Domain and its surrounding area

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The knowledge of the crustal and lithospheric structures plays an important role in understanding the geodynamic evolution of the Earth's interiors within the framework of plate tectonics. The receiver function method is used to resolve the seismic discontinuity structure of the crust and upper mantle beneath a recording station and to infer possible geodynamic processes within the Earth. The methodology is developed based on the conversion of elastic body waves (P and S) at an interface which represents a boundary between different elastic properties. In this study, we analyze the P- and S-wave receiver functions in order to investigate seismic deep structures beneath the Alboran Domain which is still in debate despite a large amount of research effort conducted along the region of interest. The Alboran Domain is located at the western end of the Mediterranean and Betic-Rif orogenic system. The study area is on the edge of a prominent plate boundary, which is dominated by the tectonic interaction between the Africa and Iberian plates. Thus, it represents a complex tectonic process consisting of composite compressional and extensional regimes. The teleseismic recordings are extracted from the database of IRIS and GEOFON data centers according to the earthquake catalog obtained from U.S. Geological Survey. We analyzed totally 4976 P- and 12673 S- receiver functions.To achieve the sufficient energy in waveforms, we analyze events greater than M5.7, located at epicentral distance ranging from 35° to 90°, from 60° to 85° and from 85° to 120° for P-, S- and SKS phases, respectively. The data quality is manually checked to restrict the event database to the clear P-, S and SKS- onsets. The seismograms are rotated into P-, SH- and SV components of local ray coordinate system in order to get the highest energy of converted phases. We perform a time-domain deconvolution approach to derive the receiver functions in order to eliminate the source and path effects. Move-out correction is applied prior to stacking the individual traces in order to compare and then to better identify the coherent phases. We alternatively use piercing-point approach for stacking process subdividing the region into the grids with a size of 1°x1° and stack the individual traces based on their corresponding grids (piercing-points). The S-receiver function is used to avoid complications due to the crustal-reverberations and thus to better resolve the variation of lithosphere-asthenosphere boundary (LAB). The variation of crustal thickness derived from P-wave receiver functions is well-correlated with the pattern obtained from S-wave receiver functions.The results suggest that the thickness of the crust as well as the depth of LAB systematically decreases towards the east. The greatest crustal thickness is observed along the Betic and Rift mountains. The relatively shallow Moho as well as the shallow LAB beneath the Alboran Sea are consistent with the extensional nature of the boundary between Iberian and African plates.