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Lessons learned from receiver function analysis: Variation of the seismic discontinuities along the Alboran Sea region

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The Western Mediterranean region has been developed in a frame of continuous interaction between the Eurasian/Iberian and African plates. We investigate large scale discontinuities beneath the Alboran Sea area in order to better understand the complex tectonic evolution at this prominent plate boundary. The receiver function method is used to characterize the seismic boundaries within the crust, lithosphere and upper mantle. The methodology is developed based on the conversion of elastic body waves (P and S) at bi-material interfaces representing a boundary between different elastic properties. The teleseismic recordings of large size earthquakes (M>5.7) are extracted from the database of IRIS and GEOFON data centers using U.S. Geological Survey catalog. Combined regional network consists of 38 broadband stations along the target area. The event database is restricted to epicentral distances ranging from 30° to 95°, from 60° to 85° and from 85° to 120° for P-, S- and SKS phases, respectively. We analyzed a set of ∼5000 P- and ∼14000 S- receiver functions . The data quality is manually evaluated to eliminate the waveforms with unclear P-, S- and SKS- onsets. The seismograms are then rotated into P-, SH- and SV components to achieve the highest energy of converted phases. The receiver functions are computed using a time-domain deconvolution approach that allows eliminating unknown source and path effects. Move-out correction is applied prior to stack of individual traces in order to combine coherent phases. P- receiver functions indicates a relatively shallow MOHO depths along the Alboran Sea that gets deeper below the surrounding onshore areas. Additionally, we observe a systematic decrease in thickness of the crust which is the deepest in the westernmost part of the study area and getting shallower through the Alboran Sea region. S- receiver-function-derived lithosphere-asthenosphere boundary (LAB) follows up a similar pattern suggesting crustal/lithospheric delamination beneath this collision zone. We have not found an unusual feature in depths of upper mantle discontinuities (410km and 660 km) supporting the idea that the collisional tectonics of the area does not influence the mantle transition zone.