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The velocity structure of the Alboran Basin (westernmost Mediterranean) along a north-south transect

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The deep structure of the Alboran Basin (westernmost Mediterranean) has been under debate since the first surveys in the late 1980's. Although the regional crustal and upper mantle structure has been extensively studied recently (i.e. global tomography, receiver function analysis or full-waveform inversion) the lithosphere underneath the Alboran Basin remains inadequately imaged, as the resolution of the crustal model is limited due to sparse data, inhibiting a precise characterization of the crust underneath the basin. The deep structure of the Alboran Basin is directly linked to the seismogenic potential of this area, as the main faults seem to be located at the edges of the crustal domains. Thus, an accurate seismic characterization of the crustal domains of the Alboran Basin and the transition between them is key to improve our understanding of the seismogenic potential of the faults in this complex area.
Based on multichannel seismic reflection studies (i.e. TOPOMED project), with seafloor and basement ground-truthing through available drill and dredge samples, four different crustal domains have been defined for the area: (i) a thin continental domain (West Alboran and Malaga basins), (ii) the magmatic arc domain (East Alboran Basin), (iii) the North-African continental domain (South Alboran, Pytheas and Habibas basins) and (iv) oceanic crust (Algero-Balearic Basin).
Unfortunately, basement dredges and well data are scarce, and, to a better understand of the deep structure of the Alboran Basin, wide-angle seismic deep-penetrating data are needed. Here we present the velocity and density model obtained from the inversion of profile P01 (WESTMED project), running from the south of Iberia (Almeria) to the north African margin (east of Nador). This profile includes 24 ocean bottom hydrophones and seismometers (OBH/OBS) with a spacing <2.5km, and 13 onshore geophones located on both margins. Velocity modelling has been carried out using the Korenaga inversion method. The result resolves the crustal structure and the Moho depths across the Alboran Basin. This profile runs coincident with a crustal-scale multichannel seismic reflection profile, allowing the association of the velocity variations and anomalies with their tectonic origin. Further, the comparison between 1D vertical Vp structure and density models with empirical Vp and density relationships sheds light on the petrological nature of the basement, fulfilling the crustal domain characterization.
The analysis of the refraction seismic profile will advance the characterization of the deep basin structure and its fault geometry and hence contribute to an improved hazard assessment and refined prevention plans for the area.