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The contribution of the seismic component of Topo-Iberia to the imaging of the deep structure of the Iberian Peninsula and North Morocco

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Topo-Iberia has been a large-scale Spanish project running from 2007 to 2013 that integrated more than 150 researchers on Earth Sciences. One of its key assets was the management of an observatory platform, named IberArray, aimed to provide new geophysical datasets (seismic, GPS, MT) to constrain the structure of Iberia with unprecedented resolution. The IberArray seismic pool was composed by 70+ BB stations, covering the study area in 3 deployments with a site-density of 60km x 60km. The data base holds ∼300 sites, including the permanent networks in the area. Hence it forms a unique seismic database in Europe that allows for multiple analyses to constrain the complex geodinamics of the Western Mediterranean. A summary of new results coming from different techniques is presented here. The SKS splitting analysis has provided a spectacular image of the rotation of the fast velocity direction along the Gibraltar Arc. In central and northern Iberia, the fast polarization directions are close to EW, consistently with global mantle flow models considering contributions of surface plate motion, density variations and net lithosphere rotation. Those results suggest an asthenospheric origin of the observed anisotropy related to present-day mantle flow. Receiver functions have revealed the crustal thickness variations beneath the Atlas, Rif and southern Iberia, evidencing a relevant crustal root beneath the Rif, in agreement with recent, high-density active seismic experiments. The Variscan Iberian massif shows a flat Moho discontinuity, while the areas reworked in the Alpine orogeny show a slightly thicker crust. Beneath N Iberia, the imbrication of the Iberian and Eurasian crusts results in complex receiver functions. Depths exceeding 45 km are observed along the Pyrenean range, while the crust thins to values of 26-28 km close to the Atlantic coasts. The geometry of the 410-km and 660-km discontinuities has been investigated using novel cross-correlation/stacking techniques. Ambient noise tomography allows to identify the main sedimentary basins and to discriminate between the Variscan and the Alpine reworked areas. Local body-wave tomography in North Morocco has improved the location of the small magnitude events on the area and the details of the crustal structure. Teleseismic tomography has confirmed, using an independent data set, the presence of a high-velocity slab beneath the Gibraltar Arc.