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Seismic anisotropy beneath North Iberia evidenced from shear wave splitting

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During the last decade, the anisotropic features beneath the northern part of the Iberian Peninsula have been investigated by the shear-wave splitting technique, using data from temporary deployments. Successive seismic transects were instrumented from east to west, to sample areas affected by the Alpine compressional tectonics (Western Pyrenees and Cantabrian Mountains), as well as hinterland parts of the Iberian Variscan belt.

A remarkable consistency is found in the retrieved anisotropic parameters throughout the study area, with an average fast velocity direction close to E/W. Delay times up to 1.5 s are observed in most transects, but lower values, not exceeding 1 s are measured at the westernmost part.

Although the averaged values are compatible among the different stations, a significant variation of the splitting parameters is observed in each station with respect to the backazimuth direction. Synthetic models including two distinct anisotropic layers with an orthorhombic symmetry provide a satisfactory fit of such variations. The 2-layers exhibit different thicknesses; the most prominent anisotropic contribution comes from a lower layer consistently oriented close to E/W, whereas the thinner secondary layer, located above, 'modulates' the result. The anisotropic parameters of this secondary layer change along the transect, accounting for the differences in splitting delay times observed.

The dominant E-W layer throughout could not be associated to major compressional events, as in the westernmost part the Variscan terrains exhibit N-S main lineaments. It may rather correspond to an anisotropic imprint around the lithosphere-asthenosphere

transition related to the eastward displacement of the Iberian plate due to the Mesozoic extensional processes during the opening of the North Atlantic and Bay of Biscay domains. The weaker anisotropic layer could be associated either with crustal anisotropic materials, or more likely, to an additional anisotropic signature within the lithosphere led by major Variscan and Alpine orogenic processes.