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Anisotropic Tomography of Portugal (West Iberia) from ambient seismic noise

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Located on the western Iberian Peninsula, Portugal constitutes a key area for accretionary terrane and basin research, providing the best opportunity to probe a crustal formation shaped by the Paleozoic Variscan orogeny followed by the Mesozoic-Cenozoic extensions. The geology of Portugal documents a protracted history from Paleozoic basement formation to the Mesozoic opening of the North Atlantic Ocean. The inheritance of such complex geologic history is yet to be fully determined, playing an important role in the current geodynamic framework influencing, for example, the observed regional seismicity. The physical properties of its crust have largely remained undetermined so far, with unevenly distributed knowledge on the spatial distributions of a detailed crustal structure. Also, the deep seismic reflection/refraction surveys conducted in Western Iberia do not provide a clear picture of the regional characteristics of the crust.

Using Seismic Broad Band observations from a dense temporary deployment, conducted between 2010 and 2012 in the scope of the WILAS project and covering the entire Portuguese mainland, we computed a 3D anisotropic model from ambient seismic noise. The dispersion measurements were computed for each station pair using empirical Green's functions generated by cross-correlating one-day-length seismic ambient-noise records. After dispersion analysis, group velocity measurements were regionalized to obtain 2D anisotropic tomographic images. Afterwards, the dispersion curves, extracted from each cell of the 2D group velocity maps, were inverted as a function of depth to obtain a 3D shear wave anisotropic model, using a bayesian approach. A simulated annealing method, in which the number of splines that describes the model, is adapted within the inversion.

The models are jointly interpreted with the models gathered from Ps receiver functions as well as with the regional seismicity, enabling to obtain a more detailed picture of the crustal structure across Portugal. We detected a good correlation with the surface geology, namely the correspondence between sedimentary basins and low velocity anomalies.

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