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Understanding the lithosphere in complex tectonic scenarios by integrating geophysical data: The Pyrenees case study

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Tectonic processes dominate the development of the outermost layer of the Earth over a timescale of millions of years. The locations where these processes take place provide a great opportunity for Earth scientists to study and understand the dynamics and properties of the lithosphere. The Pyrenees are a particular case of continental collision formed as a result of the collision between the Iberian and European plates, which caused the subduction of the Iberian lower crust below the European crust. Large amounts of geophysical data have been acquired in the area providing spectacular images of lithospheric subduction beneath the Western and Central Pyrenees, confirming the occurrence of this generally well-understood process. The Eastern Pyrenees, however, are a most puzzling part of the orogen and the geodynamical evolution of this area cannot be understood without the influence of the Neogene Mediterranean rifting, following the continental collision. The complexity of this area and the controversy of the geophysical results set in debate concepts well recognized in the other parts of the Pyrenees such as the subduction of the Iberian lower crust and the depth of the lithosphere-asthenosphere boundary.

The aims of this study are to characterise major tectonic and geophysical variations along the Pyrenean mountain range at a lithospheric-scale and constrain the causes of the observed lateral variations. A preliminary model of the lithospheric configuration and dynamics, based on magnetotelluric geophysical results, has been developed and constrained using independent and available geophysical, geological and geochemical data. Computational petrology methods, using Litmod, were used for integrated modelling of all data.