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Mapping the indentation between the Iberian and European crusts between the Pyrenees and the Cantabrian Mountains (N Iberia) from seismic methods.

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In the last decades, active seismic profiling in the northern part of the Iberian Peninsula have evidenced that the Alpine collision between the Iberian and European plates resulted in a complex crustal structure. Beneath the central Pyrenean chain, active and passive seismic data reveal an Iberian crust deepening northwards and reaching depths of 50-55 km, while the European Moho is observed around 26-30 km depth. The southern limit of this European crust seems to be located roughly at the vertical of the axial zone of the belt, while the northern limit of the Iberian crust lay few tens of km northwards. To the West, beneath the Cantabrian Mountains, wide-angle and onshore-offshore seismic data have shown a similar structure, with the imbricated Iberian crust reaching depths of 45-50 km and extending northwards to the vertical of the coastline. At the transition between the Pyrenees and the Cantabrian Mountains (longitude range: 0.5W – 2.5W) the situation is more complex, as has already been evidenced by wide-angle and passive seismic data.

In the last 5 to 10 years, some permanent stations have been installed in both the Spanish and French sides of the Pyrenees. Our purpose in this contribution is to analyze the data of those stations to get new clues to the crustal structure of this area and provide a state-of-the-art framework prior to the next deployment of the TopoIberia and Pyrope seismic networks. Teleseismic data from those stations has thus been used to calculate receiver functions (RF), and different processing techniques (H-K stacking, pseudo-migration, synthetic modeling) have been applied. We have inspected up to 3 years of data for 3 stations from the Spanish IGN network (ELAN, EALK, EARA) and 4 stations of the French Renass-PYRF network (OSSF, ORDF, LARF and ATE). Passive seismic data from previous temporary deployments in the zone have also been reworked.

The first order result is that passive seismic data are grossly consistent with the limits of the Iberian and European crusts inferred from recentmost active seismic profiling. Therefore, this contribution provides a completely independent confirmation of this feature. The Iberian Moho is documented beneath the stations located in the North Pyrenean Zone, underlying the European Moho. Additionally, RF data shows, at some of the stations, clear indications of dipping interfaces that are modeled by qualitative synthetic models, further constraining the geometry of the problem.

Even if the agreement between active and passive data is generally good, the new RF data seem to point to a significant modification of the geometry of the indentation of both crusts beneath the Basque Massifs, suggesting that the Hendaya and Pamplona faults may have played a major role in the regional geodynamic history.