



Crustal architecture of the Mauléon Basin (Western Pyrenees) from high resolution local earthquake tomography using the large-N Maupasacq experiment

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The Pyrenees are an Alpine orogen that resulted from the tectonic inversion of an Early Cretaceous rift system formed between the Iberia and European plates. Inheritance of the structure of this rift is presumably one of the controlling factors of the evolution and present structure of the Pyrenees. In particular, in the Western Pyrenees, recent 2D models obtained from full waveform tomography have imaged for the first time serpentinized subcontinental mantle from the hyperextended margin, emplaced at shallow crustal levels beneath the Mauléon basin.

To further refine the crustal structure of the Western Pyrenees, and to determine the 3D geometry of the emplaced mantle, we conducted a large-N passive seismic experiment in the region. From April to October 2017, the Maupasacq (Mauléon Passive Acquisition) temporary network was installed in the northwestern Pyrenees. The network consisted of a total of 441 3-component stations: 190 nodes, 197 short period instruments, and 54 broadband stations. 417 of them were deployed in an area of approximately 1500 km², with 24 additional stations installed in an outer ring in order to extend the range of take-off angles, and therefore increase the quality and area of the earthquake locations. During the 6 months of operation of the network, a total of 1980 local earthquakes were detected and located, with 996 of them sufficiently well recorded to be used in local earthquake tomography. These events produced a total of 87,122 P-wave and 72,445 S-wave arrival times, which were jointly inverted for P and S wave structure and earthquake relocation.

This dataset has allowed to obtain detailed images of the upper crust beneath the Mauléon basin and neighboring regions. The new P and S models confirm the existence of a high velocity body beneath the basin ($V_p > 6.8$ km/s at less than 8 km depth) reaching shallow depths. This anomaly does not extend throughout the region, having a sharp eastern boundary at approximately 0.8W. This boundary coincides with the western limit of the prominent positive gravity anomaly coincident with the basin, and with the change in the seismicity pattern. East of the boundary, seismicity is relatively intense, and it is apparently located inside a low velocity zone (this region is located near the edge of the network and resolution is lower). However, to the west of the boundary, seismicity jumps approximately 10 km to SW, is generally deeper than in the east, and occurs inside the high velocity body.