

Answers to ‘comments to the author’

Title: 3D crustal structure of the Ligurian Basin revealed by ambient noise tomography using ocean bottom seismometer data

Dear Topical Editor Mark Handy,

We thank you for the fair and constructive editing and review of our manuscript se-2021-55. We have implemented the suggested linguistic improvements. We address the more detailed comments below. The editor comments are indicated in **black** and our replies are in **red** colour.

Commented [MOU2]: Just a question/suggestion: In this text, clarify what you mean by “Sea” and “basin”. Are you referring to topography or geology? Geologists often use “Sea” or “Ocean” to refer only to the part of a basin underlain by oceanic crust, whereas “basin” is a general term meaning a structural depression that has accumulated sediments.

Thank you for pointing this out. We checked the manuscript and now consequently refer to the Ligurian Basin.

There is an apparent contradiction in the following sentences of the paragraph above:

“However, the location and even existence of such a prolongation of the Alpine front beneath the Ligurian sea is not yet resolved. As mentioned above, the seismic records indicate no spreading this far northeast in the basin. Therefore, detection of the proposed offshore Alpine front in the crust is feasible.” First, the authors seem to call into existence the location and even existence of the orogenic front. Then, two sentences later, they say that the detection of this front is possible. Another problem is a logical disconnect between the lack of seismic evidence for spreading in the NE and the existence or non-existence of the Alpine front. The reader is left asking “What does spreading have to do with the front?” They are structures associated with two separate events (spreading in Oligo-Miocene, Alpine orogenic front in Eo-Oligocene) oriented at high angles to each other. Therefore, I would recommend the following change (which includes the small changes above):

“Rollet et al. (2002) raised the question of whether an offshore prolongation of the Alpine front can be observed onshore France and onshore Corsica. These authors suggested that the southwestern and northeastern parts of the Ligurian Basin form, respectively, the footwall and hanging wall of the Alpine front. Thus, the Alpine front would be located approximately at the boundary between the northeastern and southwestern crustal domains distinguished in our data (illustrated by the dashed line in Fig. 8e). Dannowski et al. (2020) observe a gradual thickening of the continental crust towards the northeastern part of the Ligurian Basin. They did not need the sharp step that Makris et al. (1999) introduced between Corsica and the Liguro-Provencal coast to explain the free-air anomaly derived by Sandwell et al. (2014). In keeping with Dannowski et al. (2020), our spatial shear-wave velocity data does not show a sharp lateral boundary, but a gradual change of the velocity layers. Detection of an offshore Alpine Front is therefore not feasible with the current resolution.”

We gratefully follow your recommended changes and rewrote the section accordingly. We applied minor changes to clarify that it was Dannowski et al. (2020) who explained the free-air anomaly derived by Sandwell et al. (2014), not Makris et al. (1999).

Commented [MOU6]: You mean the Po Basin filled with sediments, not the Po Plain which is a flat geographical feature.

We agree and applied the change.

Commented [MOU7]: Actually, this is misleading given the tremendous variation in depth of the Po Basin, which ranges from only 0- 1 km along the southern front of the Alps to 9 km beneath the foreland of the Apennines (see isopachs in sheet 1 of the Structural Map of Italy, Bigi et al. 1989). Therefore, the average thickness is closer to 4-5 km. Molinari's larger estimate is valid only for the S part of the basin.

As proposed, we now state an average thickness of 4-5 km.

Commented [MOU8]: "Geology" is a generic term for everything from lithology to structure to fluids to the geological history. It's too general. Try to be more specific, in this case, referring to the two characteristics of geology (rock type and structure) that are almost always related to changes in rock physical properties.

We applied the suggested changes and now state "rock types and structure" instead of "geology".

Figure 1

The grey line is barely distinguishable from the background blue of the Ligurian Basin, especially compared to the clear yellow and orange lines. Please use a stronger colour instead of grey, for example, light green.

We changed the colour of the grey line to light green.

Commented: "We decided not to mention the stations that we did not use. Instead, we only focus on the 22 stations that did record all components for the complete deployment, in order to increase the focus of the manuscript. The other stations were not used, because they did not record (enough) data." Please state this in the text explicitly, if not done already.

Regarding the confusion it caused, when we mentioned the unused stations in an earlier version of the manuscript, we stick to not mentioning them at all. We use all available OBS that recorded for the eight months of the deployment.