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Comment on essd-2022-397

Anonymous Referee #2

Referee comment on "Moho depths beneath the European Alps: a homogeneously processed map and receiver functions database" by Konstantinos Michailos et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-397-RC2, 2023

The present manuscript (and dataset) provides a consistently processed database of receiver functions as well as a crustal thickness map of the Alpine region that is a product of the AlpArray initiative. This large dataset is the result of considerable effort in data acquisition and processing, and will be a very useful and widely utilized resource for the community. Overall, the manuscript is reasonably well written, and as it is mainly intended as a data description article it makes sense that the authors refrained from going into interpreting the results. However, some parts of how the presented Moho map was obtained deserve a clearer explanation and description, and some choices on what data are made available should also maybe be reconsidered, so that moderate revisions will be necessary. I will outline my main points below, followed by more specific comments by line number.

General Comments:
1. The main product provided here is the crustal thickness map for the Alpine region, which was manually picked on a series of CCP stacked receiver function profiles. While the receiver function processing and quality checking procedure is nicely and comprehensively described, there is no detail at all on how the manual picks on the CCP profiles were retrieved. This part of the analysis is a complete blackbox at the moment. I recommend to add:
- A description on how manual picking was performed. What guided finding the right anomaly in the profiles? Was the pick set in the center of the anomaly or onto the maximum amplitude? What was the procedure in case of a double anomaly? Was any interpolation performed for sections where the Moho was not really visible, etc.
- These descriptions could be accompanied by one or two examples where the set picks are shown on top of the CCP profile...at the very least, they could be added to the current Figures 7 or 9 (at the moment, as far as I can see, the manual picks made in this study are not shown anywhere in the article)
- It is also mentioned, without further explanation, that these manual picks were labeled as either certain or uncertain. Based on what was this labeling performed, again it would be interesting to see examples

2. The other reviewer had a number of comments about the provided datasets, with which I wholeheartedly agree. It would make a lot of sense to also provide the raw, cut three-component waveforms, so that other researchers can apply different rotation (e.g. 3D,

into LQT system) and/or deconvolution approaches.

3. The comparison to previously existing compilations of crustal thickness in the Alpine area should be extended, at the moment there is only a quite brief section on this, and the comparisons in Figures 7 and 9 are only along selected profiles, do not show the picks of the present study, and make it difficult to appreciate the differences due to the large scale of the cross sections. I would recommend to compile a map view figure that shows absolute differences between the new crustal thickness map and one or several pre-AlpArray ones.

Specific comments:
l.1: Unnecessary first sentence; this may fit into the Introduction but not into an abstract
l.14 (and elsewhere throughout the manuscript): why say crustal structure when you mean crustal thickness?
ll.19-32: this very basic introduction to the Moho is not necessary and makes the Intro chapter rather unstructured. Better leave out
ll.62-67: that is comparing apples and oranges. Tomography studies yield crustal velocity structure, whereas RFs give the crustal thickness (and NOT crustal structure, see above)...this means that the two methods are largely complementary
ll.79-88: quite repetitive, maybe better to present this basic network information in a small Table?
l.94: as well as having: sounds clumsy, please reformulate

l.108: maybe mention how the orientation was determined for the ocean-bottom instruments?
l.130: this means that the last quality criterion (STA/LTA) was determined in a frequency range (f>1 Hz) that has basically no overlap with the one that is finally used for deriving the RFs (0.01-1 Hz). This seems like a rather strange choice to me.
l.146: how is this amplitude range chosen?
l.155: Unnecessary to go back to the very first RF studies here
l.158: I thought that the first uses of CCP stacking in RF analysis was by others...not sure who was first, but studies like Yuan et al. (1997) or Kosarev et al. (1999) already showed CCP stacked RFs
ll.170-175: circular text flow
l.174: grid spacing [...] consists of three layers: no, the model does! Please reformulate
l.175: Was some kind of half space added for the region below the EPcrust model (representing the mantle)?
l.178 (and later): ray trace paths ☐ ray paths
l.197: look (-s)
ll. 198/199: explain in more detail or provide a reference!
l.203: I would not call the ray coverage shown in Figure 5 great. There is a gap of 90-100 degrees in southern directions, and at least one station also has very few RFs from westerly directions
l.204: maybe use amplitude instead of strength?
l.213: this was done using the EPcrust velocity model mentioned before?
l.216: maybe supply what the range of horizontal offsets from the stations is...this can then be compared with station spacing
l.224: I fail to understand what direction exactly East-East-Northeast is supposed to stand for
l.226: distinguish from what?
l.228: Hard to compare in the profiles because this study's picks are not supplied, and scale is rather large. Maybe better to plot residuals somehow? (see General Comment #3)
l.241: Needs more detail on how picking was performed, and what the criteria for certain/uncertain picks are (see General Comment #1)
l.256: just semantics, but aren't routines always systematic?
ll.260-262: This should be analyzed in much more detail, and I would appreciate some

kind of map view residual plot compared to at least one previous study (see General Comment #3)
l.271: how was the presence of a double signal (overlapping Mohos) treated in the present study? Was only the shallower signal picked, were both picked, or what? The manual picking procedure needs some more explanation!
l.275: 10 km is quite substantial
l.300/301: quality and consistency of the manual Moho picks...these are a complete blackbox as is, no explanation of the procedure is given and no examples are shown

l.307: Would a map of mists between dierent models not be a more straightforward way of identifying critical regions? Also, as your Moho picks have labels for certain/uncertain, can the spatial distribution of these labels be shown?
ll.309-311: Clumsily formulated, please change
l.312: These meetings are not relevant in the Conclusions of an article

Appendix:
In the text says that three figures are contained, then the text describes four, whereas the actual content is five

Figures:
Most figures: I do not understand why the authors use color scales with (often very few) constant colors for rather large ranges of values. Using a continuous color scale would, in many cases, give more detailed information using the same plot
Figure 2: Why plot a line for the close cut-off distance (30 degrees) but not for the far one? And why choose a color scale for depth that assigns constant color for 70 km intervals, instead of taking a continuous scale (see above)?
Figures 4/5: is there any logic according to which the sequence of the highlighted stations (a through d) was chosen? Naming according to position (e.g. start with a in the W and move E, or something similar) would seem more straightforward
Figure 7: It would also be interesting to see where the picks performed in this study are situated

Figure A2: Here you show many many dots that are all on top of each other, thus it is really hard to see much...could you maybe plot point density instead?
Figure A3b: The absolute number of discarded RFs per station is not that interesting, could you maybe display the proportion of discarded RFs per station (i.e. what percentage of all RFs for that station was discarded)? This would be more of an indicator of data quality and less of data amount