

## Comment on **essd-2022-397**

Anonymous Referee #1

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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-RC1>, 2023

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Manuscript "Moho depths beneath the European Alps: a homogeneously processed map and receiver functions database" presents an exhaustive database of P-wave receiver functions computed for teleseismic earthquakes recorded by multiple networks of seismic stations across Europe, with a central focus on the AlpArray Seismic Network. The major highlights of the manuscript are: (a) homogeneous processing scheme to compute RFs, which includes multiple quality and signal-to-noise checks on the waveforms, (b) time-to-depth migration in 3D, (c) Moho map created from the manually picking the discontinuity signal, (d) open availability of the RFs, codes for computation of RFs and the Moho map results. Overall, it is a well written manuscript and documents each step in fair amount of detail. I have a few observations regarding the data availability, quality checks applied and the results presented.

1. I downloaded the radial and tangential RFs from the repository, provided with the manuscript. However, the 3-component waveforms from which the RFs have been calculated are not provided. The RF waveforms have signal from 0 to 70 s, with the time marking starting  $\sim 30$  s before the P-arrival time. Only 40 s of the P-to-S converted signal is provided. This is sufficient to observe crustal phases, but not upper mantle phases. Moreover, additional information about data processing e.g. Gaussian filter parameter (if any) applied to the waveforms during the RF computation is not provided. This restricts the scope of use of the data by other users. In my opinion if data is suppose to be made open and available to the community, it should be done so that (a) the RF computation can be re-done by an independent user, and (b) information/analysis, other than the one presented in this manuscript can be extractable/done. Providing the 3-component waveforms for 45 s before the P-wave arrival and 120 s after, will allow users to compute P-RFs using other algorithms, different frequency content, vary the number of iterations (other than 200) and also study structure beyond the crust.

2. An event list of all earthquakes used and the detailed information of all the stations (e.g. lat, long, elevation, instrument type and, if possible, response files) should be provided, so as to enable the user to perform time-to-depth migration for each trace using

different velocity structures.

3. The CCP stacks uses only the P-to-S converted phases for ascertaining the Moho. These can have significant dependence on the velocity structure. Using the converted phases would reduce such dependence to a large extent.

4. The CCPs presented in this manuscript serve two purposes (as I see it): (a) provides confidence to the data quality and uniformity of analysis (b) re-confirms most of the Moho structure observed from previous studies. As this manuscript is more of a data mine article, I believe that the discussion presented on the results is acceptable. Given the quality of the analysis and the results, I would have been tempted to discuss the results (variation in the structure) in greater detail and also correlate it to the geology/other geophysical observations.

5. A few minor points:

(i) I did not entirely follow the filtering scheme of the RFs. If the data is filtered between 0.05 and 1 Hz (L130), why perform a high pass filter at 1 Hz (L125)?

(ii) L129 - What is meant by "the effect of the signal"?

(iii) Why is the time referencing of the RFs from -30 s of the P-wave arrival time and not at the point of the largest amplitude arrival?

(iv) L100 - Iterative deconvolution used for the RF calculation does not "deconvolve the vertical component seismogram". It follows a convolution of the updated spike train with the vertical to match the radial component.

(v) the CCP is done as a 3D migration, but the 3D models are not presented. This would reveal the influence of the 3D model in the final Moho maps obtained.

(vi) L300 - why are uncertainties "difficult to assess"?