Note to the editor: We thank the editor for their feedback and summary of the main points made by the reviewers, as well as the link to the study mentioned by Reviewer A. We would also like to thank the two reviewers for their detailed and helpful comments, which greatly improved our manuscript. Below, we provide a summary of the changes made and responses to the comments/ suggestions from both reviewers. The reviewers' comments are shown in blue, and our responses are shown in black. Citations from the manuscript will be shown in *red italics*. The line numbers indicated here refer to the cleaned version of the manuscript.

Summary of the changes made:

The revised manuscript includes a redesigned synthetic experiment that explicitly accounts for the water layer above OBS stations using the Telewavesim package (Audet et al., 2019). RUN01 was removed from the analysis and replaced by the broadband station RER, and Figures 5 and 7, along with the related text, were updated accordingly. Additional supplementary figures are added to show the phase-weighted stacks for the remaining stations. The station-selection strategy is now clarified, emphasizing the primary focus on OBS data. The manuscript now clarifies the definition of crustal thickness relative to both station level and sea level, and specifies that for volcanic island stations, the estimated thickness includes both the pre-existing crust and the overlying volcanic edifice. A reference to A. Dofal's thesis (Dofal, 2021) was added to the revised manuscript, and relevant insights from it were incorporated where appropriate. The discussion of sediment thickness and its effect is included. Statements relating crustal thickness to plate age were corrected, and plate-age contours were added to the crustal thickness map. Figure 1 is revised to show the fracture zones and to extend the CIR trace northward; part of the introduction was reorganized. Relevant previous studies, including receiver-function studies (Fontaine et al., 2015; Dofal et al., 2021, 2022), reference to mantle imaging (Tsekmistrenko et al., 2021, and Barruol et al., 2019), and Phạm's thesis (Phạm, 2019), were added to the manuscript. The reference list is also updated.

Reviewer A:

We thank the reviewer for the careful assessment of our manuscript.

The paper presents an analysis of the P-wave autocorrelation technique on an amphibious network in the Indian Ocean for crustal imaging. This is a welcome application of the technique to explore the challenging settings of ocean-bottom seismometers (OBS). The paper is concise and clearly presented.

Thank you very much for the positive and encouraging feedback on our work.

However, my primary reservation with the current manuscript is the inadequate synthetic experimental settings, which do not account for an important factor: the water layer above the OBS. The author noted Audet's (2016) work, which outlined the challenges of using the P-wave receiver function method to study submarine crustal structures. I anticipate that P-wave autocorrelation can encounter very similar issues. The P-wave-to-acoustic conversion that reverberates within the water layer could arrive several seconds after the main P-wave, potentially contaminating the Moho reflection. The water reverberation signals may vary with ocean depths, which could give the wrong impression of the Moho depth variability. Thus, I would strongly encourage the authors to consider the water-layer effect on the recoverability of Moho-related signals. The authors could consider following Audet (2016) to use his Telewavesim package (https://paudetseis.github.io/Telewavesim/index.html) rather than respknt to generate structure reflectivity in the presence of a water layer.

We thank the reviewer for this insightful and important comment regarding the potential influence of the water layer on OBS autocorrelation results. We agree that water-column reverberations (WCR) can, in principle, generate additional phases that may interfere with Moho-related signals.

In response, we have significantly revised the synthetic experiment to explicitly account for the presence of a water layer. Specifically, we now use the Telewavesim package (Audet et al., 2019), as suggested, to generate synthetic seismograms for an OBS located beneath a 4 km water column. The model includes realistic acoustic properties of seawater.

The updated synthetic results (Figure 4 in the revised manuscript) show that WCR are clearly identifiable and occur at predictable arrival times controlled by water depth. Importantly, these phases arrive sufficiently later than the primary Moho-related reflection (2p) and therefore do not interfere with its identification under the conditions considered in this study.

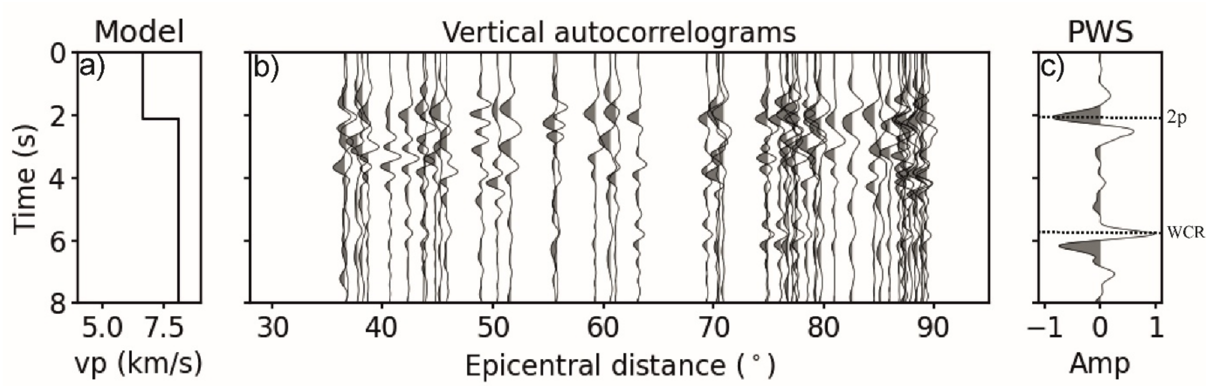

Figure 4 of the revised version: (a) Input a one-dimensional P-wave velocity model, where a major discontinuity at 7 km depth is converted to vertical two-way travel time (~2.1 s), assuming V_p = 6.65 km/s. (b) One-sided vertical autocorrelograms of individual synthetic events are displayed as a function of epicentral distance. (c) PWS of the one-sided vertical autocorrelograms, where 2p denotes the phase associated with reflections from the Moho, and the WCR phase is also indicated.

Furthermore, we do not observe significant water-column multiples in either the recorded teleseismic waveforms or the corresponding autocorrelograms (Figures S3-S5 of the revised manuscript), which supports the interpretation that their influence on the estimated crustal thickness is minimal.

These additions and clarifications have been incorporated into the revised manuscript, including an updated description of the synthetic experiment (lines 194-199) and discussion of water-layer effects (lines 223-233).

Figure 5d: I am not convinced by the pick of the Moho-reflection signal at station RUN01, as the picked signal is not coherent in the individual auto-correlograms. As the autocorrelation method relies on strong sub-surface reflectivity, which is often associated with a sharp interface, i.e., the Moho discontinuity, as considered in this study. The fact that station RUN01 does not exhibit coherent reflectivity may mean that there's no sharp enough discontinuity beneath this station. Such negative results should be acknowledged and documented properly.

We agree that the Moho-related phase at station RUN01 is not sufficiently coherent in the individual autocorrelograms to support a robust interpretation. This likely reflects the limited data quality at this station and/or the absence of a sufficiently sharp impedance contrast beneath the site.

Following this comment, we have removed RUN01 from the analysis and replaced it with station RER, which provides higher-quality broadband data and yields a clearer Moho-related phase. Figures 5 and 7, and the corresponding text have been revised accordingly.

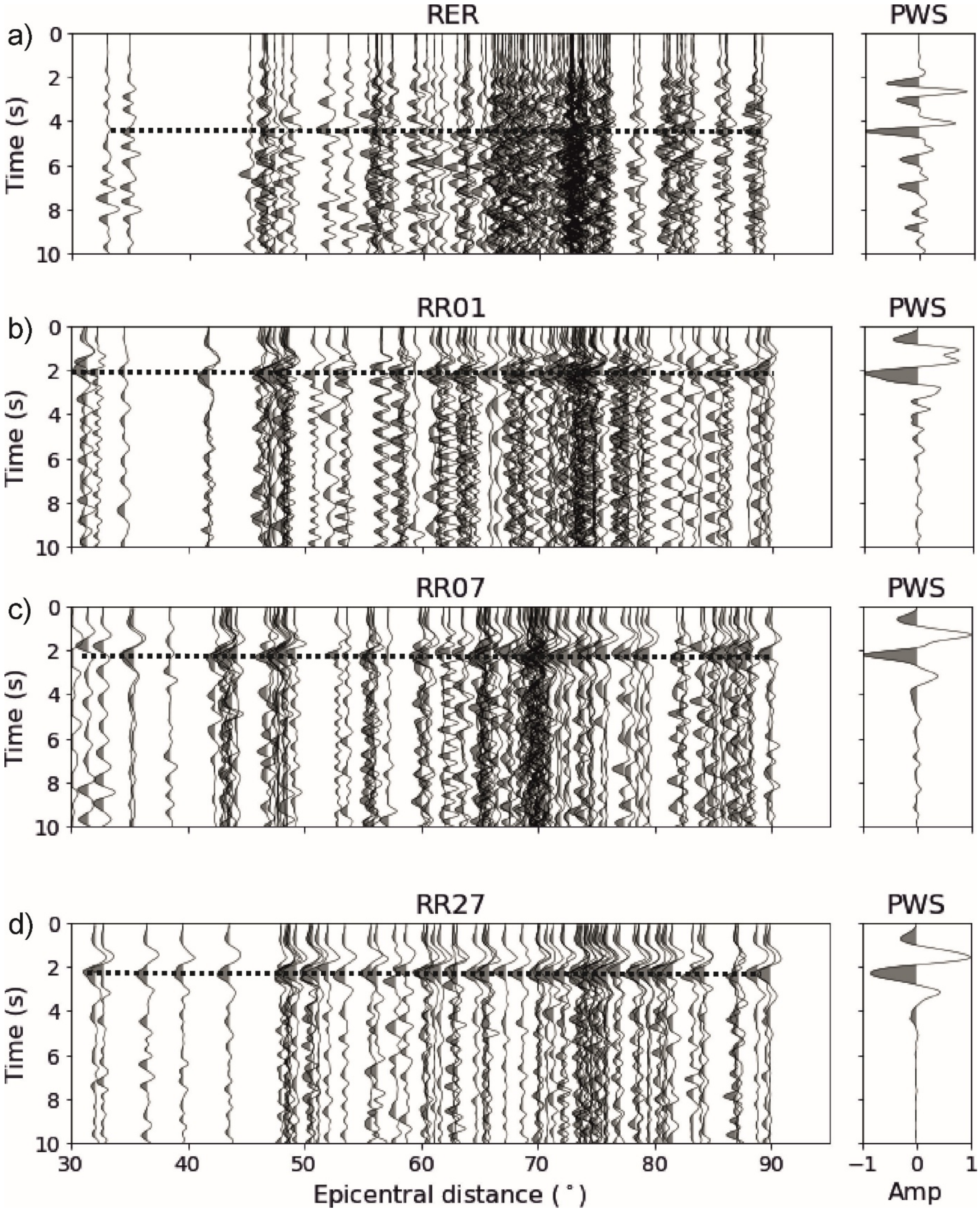

Figure 5 of the revised manuscript: Individual vertical autocorrelograms as a function of epicentral distance (°) (left) and their corresponding PWS vertical autocorrelograms (right) for four representative stations (RER, RR01, RR07, and RR27) shown in Figure 1 in the revised manuscript. The dashed lines highlight the coherent phase across the *autocorrelograms, interpreted as the Moho discontinuity. The PWS autocorrelograms for the remaining stations are presented in Supplementary Figures S3-S6 in the revised manuscript.*

Although the phase coherence in the individual autocorrelograms at RER remains weaker than for the OBS stations, the stacked result shows a clearer and more stable Moho-related phase than that obtained from RUN01. This highlights the importance of stacking, which enhances persistent Moho-related signals while suppressing incoherent noise and event-dependent variability. The reduced coherence of individual autocorrelograms at RER may be attributed to both data quality and structural effects. In addition to higher ambient noise levels typical of island stations, previous studies suggest the presence of magmatic underplating beneath La Réunion, which produces a more gradational crust–mantle transition rather than a sharp interface. This reduces the impedance contrast at the Moho and may result in weaker, less coherent reflected phases in individual traces. We now discuss this point and its possible explanation in the revised manuscript (lines 246-257).

… Station RER (Figure 5a) exhibits a dominant negative phase at ~4.5 ± 0.018 s, corresponding to a comparatively thick crust of ~14.63 ± 0.47 km. Although the phase coherence in individual autocorrelograms at RER is weaker than that observed for the OBS stations, the stacked result reveals a clearer and more stable Moho-related phase. This emphasizes the importance of stacking, which enhances persistent Moho signals while suppressing incoherent noise and event-dependent variability. The reduced coherence of individual autocorrelograms at RER may reflect both data quality and structural factors. In addition to elevated ambient noise levels typical of island stations (Stutzmann et al., 2000), previous studies suggest the presence of magmatic underplating beneath La Réunion (Fontaine et al., 2015), resulting in a more gradational crust–mantle transition rather than a sharp interface (Dofal, 2021). This reduces the impedance contrast at the Moho and may lead to weaker and less coherent reflected phases in individual traces.

I would also encourage plots like Figure 5 for all stations in the network in the supporting information. I believe that the exhibition of detailed autocorrelograms of other stations is important for subsequent studies to have more solid references, should they want to reproduce/benchmark the results of this study.

In the revised manuscript, we have included the phase-weighted stacks (PWS) for the remaining stations in a supplementary figure (Figures S3-S6 in the revised manuscript). We agree that presenting these results provides a useful reference for future studies and improves the reproducibility and benchmarking value of our work.

Reviewer B:

We thank the reviewer for the careful assessment of our manuscript.

This work presents results of P-wave autocorrelation in the SWIO to infer the thickness of the oceanic crust in this region. The study is largely based on OBS data from the RHUM-RUM experiment and provide interesting results that deserve to be published in Seismica after some revision.

The paper is well written and illustrated. The general approach is valuable and interesting and will provide useful quantification of crustal thickness in poorly instrumented oceanic regions.

Thank you very much for the positive and encouraging feedback on our work.

General comments:

Station selection:
You present analyses at a large number of stations but, as you certainly know, there are number of others in interesting places: in Madagascar (networks YV, ZE, XV; why only RUM2?), in Mauritius (3E), in Rodrigues Island (G), in La Réunion (YV, G and PF, why only RUN01? there are tens of other BB station on the island). An extensive analysis would, of course, be extremely valuable, but if you choose to focus on OBS and a few terrestrial stations for comparison, that would at least help to justify the choice of stations/networks for the study (e.g. L97).

The main objective of this study is to investigate crustal structure primarily using the OBS dataset through teleseismic P-wave coda autocorrelation. The terrestrial stations were included for limited comparison and validation of the OBS-based results. For consistency, we used broadband land stations from the RHUM-RUM experiment rather than attempting a comprehensive analysis of all available permanent and temporary regional networks, which is beyond the scope of the present study.

Regarding La Réunion, we agree with the reviewer that the station choice needed to be better justified. In the revised version, we have removed RUN01 because its data quality was not sufficiently robust for our analysis and replaced it with station RER, which provides a much longer, higher-quality broadband record. We have clarified this station-selection strategy in the manuscript (lines 102-106).

… As this study primarily focuses on crustal structure derived from teleseismic P-wave coda autocorrelation of the OBS dataset, only six well-studied land stations, together with the well-established RER station, were retained to provide limited comparison with and validation of the OBS-based results, while also improving spatial coverage.

We also agree that an extensive analysis, including all available stations from Madagascar, Mauritius, Rodrigues, La Réunion, and surrounding regions, would be highly valuable. However, such a regional-scale investigation would require a dedicated study. Incorporating the full set of available stations across the area will be an important objective of future work.

RUN01 station quality:
Referring to L224 and Fig. 5, the results shown at station RUN01 are not at all convincing. You highlight a dominant phase at 3.65 s in Fig. 5d, but the PWS plot also shows a large peak at ~2 s. The results for the three OBS shown in Fig. 5abc are quite convincing, but much less so for this terrestrial station, RUN01. From what I know, this station is probably one of the worst in La Réunion: it is located in the middle of St Denis city, in a university workshop, where there is likely to be high ambient noise. There are a number of other BB stations available in La Réunion (in the YV or PF networks) in much quieter environments. I would suggest not using this station, and if you want to include at least one point on La Réunion island, consider using a higher-quality BB station.

Following this helpful suggestion, we have removed RUN01 from the analysis and replaced it with station RER, a well-studied broadband station (e.g., Fontaine et al., 2015) that is better suited for terrestrial comparison in the present study, owing to its more favorable noise conditions and overall higher data quality. Our analysis of RER yields a clearer Moho-reflected phase than that obtained from RUN01 (Figure 5a in the revised manuscript), supporting its use as a more reliable terrestrial reference.

Depth reference:
It would be helpful for the reader if you could be more explicit about the depth of the Moho and the crustal thicknesses you are considering, particularly in a paper where you compare stations installed on volcanic edifices at the Earth's surface with stations at 3–5 km below sea level (bsl) directly on top of the oceanic crust. When discussing crustal thickness, it is important to distinguish between the oceanic crust sensu stricto and the overlying volcanic edifice, which can be 2 to 5 km high and has likely grown on top of the pre-existing oceanic crust at a later stage. This is the case for the islands in the Mozambique Channel, as well as for Tromelin and La Réunion. This could be clarified in section 4.1.

We agree that, given the comparison between stations located on volcanic edifices and those installed several kilometers below sea level, it is essential to clearly define the depth reference and the meaning of crustal thickness.

In the revised manuscript (lines 294-299), we now explicitly clarify that crustal thickness is defined as the depth from the station level to the Moho discontinuity (i.e., below station level, bst). We further adjusted all reported depths to a common reference level, sea level (bsl), and listed these values in Supplementary Table S2. We also clarified that, for volcanic island stations, the estimated thickness includes both the pre-existing crust and the overlying volcanic edifice.

… In this study, crustal thickness refers to the depth from the station level to the Moho discontinuity (i.e., below station level, bst) identified from the autocorrelation analysis. For volcanic island stations (RER, TROM, GLOR, EURO, JNOV, and MAYO), this definition includes both the underlying pre-existing crust and the overlying volcanic edifice. To compare stations at different elevations, we shifted the single-station models so that all reported depths are referenced to sea level (bsl); these values are listed in Supplementary Table S2.

We have also revised Figure 7 in the revised manuscript by referencing all station models to sea level, which allows a more direct comparison among stations.

Anthony Dofal thesis:
You properly cite the two papers from A. Dofal but there is also his thesis which is referenced below and available at the link : https://theses.hal.science/tel-03345990v1 .
I obviously recognise the difficulty in accessing theses as they are not published like articles in accessible journals, but in the present case, I believe that the thesis (available online) could provide useful inputs into your paper. The thesis is partly in French but contains the 2 papers that have been already published and more interestingly a third paper that was in preparation and (unfortunately) never published (the manuscript #3, “Imaging magma underplating around the Réunion hotspot track with receiver functions”). This last paper covers the exact topic of your paper, ie the crustal thickness below the RHUM-RUM OBSs and contains useful information, for instance on the sediment thickness beneath OBSs and a thorough discussion on the crustal thicknesses, on volcanic plateau, and on magmatic underplatting. Of course, this part of the thesis is not published, but it has been at least reviewed for the thesis defence.

We thank the reviewer for this valuable suggestion and for bringing A. Dofal’s thesis to our attention. We have read the thesis and found that it contains relevant and useful material, particularly regarding crustal thickness estimates in the study region, which are directly related to the present study.

In the revised manuscript, we have now included a reference to this thesis and incorporated relevant insights where appropriate (Lines 59, 256, 301, 354, 390, and 409). In addition to these citations, the thesis also informed our interpretation of the results for stations RER and TROM.

We acknowledge the importance of this work and appreciate the reviewer's suggestion, which has helped improve the completeness of our discussion.

Sediment thickness: You mention the possible effect of sediments beneath the OBS. Did you consider them in the determination of the PWS? In other words, if you had some independent information on sediment layer (can be found in Dofal's Thesis), could you better constrain the thickness of the underlying crust?

In the present study, sediment thickness beneath the OBS stations was not explicitly incorporated into the PWS-based crustal thickness determination. The autocorrelation method is sensitive to strong subsurface reflectors, which may include both the sediment-basement interface and the Moho discontinuity. With appropriate processing, this approach can also be used to identify sediment thickness beneath a station, as shown by Viens et al. (2022). However, in this study, our objective was specifically to identify the Moho discontinuity and estimate crustal thickness.

In addition, our processing includes spectral whitening, which helps suppress sediment-related resonance in the autocorrelograms and improves the clarity of Moho-related phases (Wang et al., 2020). We agree that independent constraints on sediment thickness, such as those available in Dofal's thesis, could help refine the assumed velocity structure and thereby improve the time-to-depth conversion. However, fully integrating such constraints would require additional forward modeling and station-specific velocity parameterization, which are beyond the scope of the present study.

We agree that incorporating independent sediment-thickness information could further improve crustal thickness estimates. We have therefore added a statement in the revised Discussion to acknowledge this limitation and highlight it as an important direction for future work (lines 305-307).

… However, independent constraints on sediment thickness beneath the stations could further refine the velocity model used for time-to-depth conversion and improve the resulting crustal thickness estimates.

Crustal thickness and oceanic age (section 4.2)
This section highlights a weakness in the paper that needs to be addressed.
You present Fig. 6 a map showing the spatial distribution of crustal thickness, and discuss its relation to plate age. It would be useful to include a map showing the plate ages alongside Fig. 6. However, be careful: just because you observe a correlation between crustal thickness and plate age does not mean that the crust thickens over time.

Following this suggestion, we have included seafloor age information by adding plate age contours in Figure 6 in the revised manuscript.

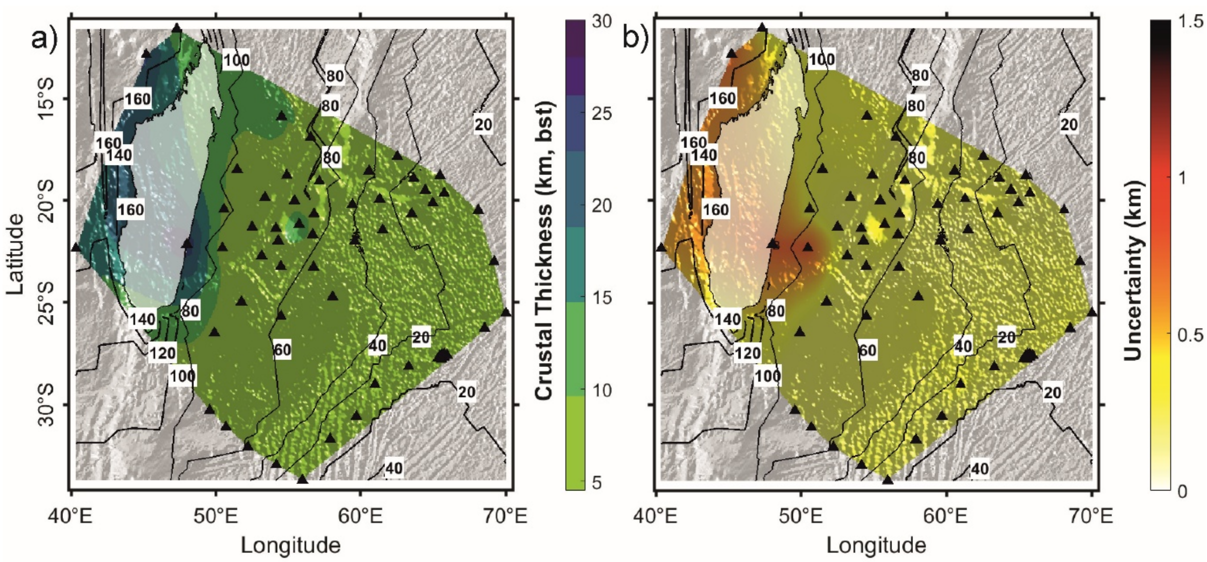

Figure 6 of the revised manuscript: (a) Crustal thickness map (linearly interpolated) shown relative to station level (bst) and (b) the corresponding uncertainty distribution across the study area. Black triangles indicate seismic station locations. Black solid lines denote seafloor age contours, with ages labeled in white boxes near the contours in Ma. The region over Madagascar is masked.

L332-333: This sentence suggests that a thin oceanic crust indicates a young oceanic crust. However, there is no expected link between the thickness of the crust and its age. While you can find a correlation with the plate velocity and the magmatic activity (as indicated L335) you cannot find one with age. The crust is formed at the ridge and then does not change in thickness over time, until other processes occur (magmatic underplating, for instance).

We thank the reviewer for this important clarification and agree that oceanic crustal thickness is not expected to vary with plate age. In the revised manuscript, we have corrected this statement and now clarify that oceanic crustal thickness is established at the time of formation at mid-ocean ridges and does not evolve significantly with age (lines 376-380).

… Although an apparent spatial correlation between crustal thickness and plate age can be observed in our dataset, this relationship should not be interpreted as evidence for progressive crustal thickening through time. Instead, crustal thickness largely reflects the magmatic and tectonic conditions prevailing at the time of formation (e.g., Wang et al., 2011).

L338-340: As for the above comment, this statement is absolutely not true. While the lithosphere thickens with age due to plate cooling and the deepening of the isotherms within the upper mantle, the thickness of the crust, at the top of the lithosphere does not change. The oceanic crust is formed at the ridge and its thickness does not vary over time, until other external effects such as posterior underplatting add crustal-like material at the crust-mantle interface.

In the revised manuscript, we have removed this statement and now clarify that the thicker crust observed in the study area is more plausibly related to additional magmatic processes, such as hotspot-related volcanism and magmatic underplating, which can add material at the crust–mantle interface (lines 386-390).

…These thicker crusts likely reflect a combination of magmatic addition, including hotspot-related volcanism and magmatic underplating, and the inheritance of stretched and thinned continental crust associated with the opening of the Mozambique Channel (Charvis et al., 1999; Fontaine et al., 2015; Andriampenomanana et al., 2017; Dofal et al., 2021; Dofal, 2021).

Specific comments:

L35 Fig. 1; you could indicate on Fig.1 where the mentioned fracture zones are on the map.

Figure 1 has been updated to indicate the mentioned fracture zones on the map.

Fig.1: The black line underlying the CIR should be extended north, up to the map boundary.

We agree, and the black line representing the CIR in Figure 1 has been extended northward to the map boundary in the revised manuscript.

L40-42: you introduce here some results from the RHUM-RUM experiment, which is introduced later, in the next paragraph (L43-53). This sentence should appear after the description of the experiment.

The manuscript has been revised accordingly (lines 52-69),

L52: the references for the mantle imaging could be updated (Tsekmistrenko et al., 2021 and Barruol et al., 2019).

We have updated the references per the reviewer's suggestions (line 52).

L56 but also L264-266: I agree that surface waves and ambient noise cannot resolve the crustal structure but you should better mention here that there have been already some receiver function (RF) studies in the area which provided good crustal thickness constraints: Fontaine 2015, Dofal 2021, Dofal 2022. (and also Dofal's PhD thesis).

In the revised manuscript, we have added references to Fontaine et al. (2015), Dofal et al. (2021), Dofal et al. (2022), and Dofal's PhD thesis (Dofal, 2021) in the relevant sections (lines 59 and 301).

Fig. 7: The abrupt change associated to RUN01 is poorly convincing nor constrained. Update the figure with a better quality station and modify the corresponding text accordingly (L356-360). There are number of BB stations on the island (network YV but also PF), with decades of continuous data.

In the revised manuscript, we have replaced station RUN01 with station RER, a broadband station that provides higher-quality data and a more robust terrestrial comparison. Figure 7 has been updated accordingly, and the corresponding text has been modified to reflect this change.

L513: that could be interesting to add the reference of Pham's thesis, if available.

We agree; we have now added the reference to Phạm's thesis in the revised manuscript (lines 138, 149, 157, and 576).

References:

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Fontaine, F.R., Barruol, G., Tkalˇci´c, H., Wolbern, ¨ I., Rümpker, G., Bodin, T., Haugmard, M., 2015. Crustal and uppermost mantle structure variation beneath La R ´eunion hotspot track. Geophys. J. Int. 203 (1), 107–126. https://doi.org/10.1093/gji/ggv279.

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