Reply Letter: 3D crustal seismic structures delineation beneath western Tibet and Himalayan range using local earthquake tomography

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Q1. I understand that before applying tomoDD you determined a minimum 1D model for the area. I think this step needs a bit more explanation in terms of the initial and final model used. Additionally, I am missing some information about how this step improved the initial model, including some statistics on locations, residuals, and – if apply – station corrections.

A1: The present version of the manuscript discusses the VELEST model, and the describes the advantages of using the velest program as the starting model of the 3D inversion. We thank the reviewer for the suggestion. We would also like to add, that shallow 3D velocity model may have artifacts from near surface features directly beneath the stations, which can be addressed by applying necessary station corrections. However, in the presented study, it was observed that the station corrections did not seem to alter the recovered shallow model, and thus have been omitted. As suggested, we have added the same in the manuscript.

Q2. For the tomoDD stage, it would be to also incorporate more data on final results (i.e. error in relocations, numbers about the velocity models, etc). One important thing is that you mentioned the determination of Vp, Vs and Poisson ratio images, however the ratio is not shown in any of the figures. I suggest that you include these results or remove the sentence in the manuscript.

A2: Thank you for the suggestion, added details about the velocity models have been incorporated to the results section. Thank you further for pointing out towards the men-

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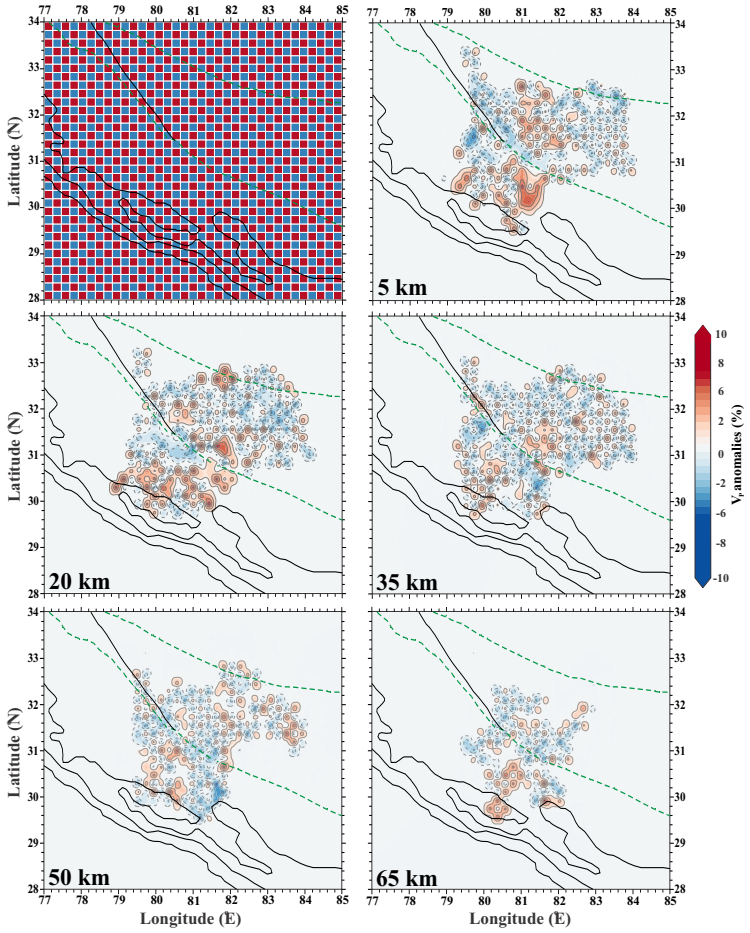

Figure 1. Checkerboard test conducted across the study area. The first panel on the top left represents the input model, while subsequent panels represent the checkerboard output at various depths as indicated in each panel.

tion of the Poisson's ratio. It has been removed from the manuscript, and we are solely focusing on the P and S-wave velocity anomalies.

Q3. Although I understand that DWS is a good way to assess resolution, I still missed the standard checkerboard test. The latter can also serve for determining which size of anomalies you can discuss, and things that need to be left aside due to poor resolution. I suggest running a couple of standard checkerboard tests with different sizes of anomalies.

A3: Thank you for the suggestion, we have incorporated the checkerboard analysis and have included it in the main manuscript as Figure 4.

Q4. In terms of the results, the visualization of tomographic images can provide more information to better understand your experiment. In that line, it would be good to add labels in the Figures (5-8) associated with the anomalies you are describing in the manuscript.

A4: Thank you for your suggestion, appropriate labels have been added in the figures, as it befits the discussions.

Q5. Following the previous point, one of my main concerns here is that the description of the model is made by following absolute values of Vp and Vs, however, Figures 5-8 only show %v. My suggestion here is to swap the current images to absolute values and send the %v to the SI.

A5: Thank you for the suggestion, we have made the neccessary switch in the figures as it fits the discussion. We are discussing the anomaly changes in the main manuscript, and doing away with the absolute velocities. the reference velocities are indicated in the top right corner of each slice for the reference of the reviewers/readers.

Q6. Finally, I am missing a wrap up Figure that summarizes the results and interpretation of your work. The article is getting nice images of an area that as you stated in the introduction is still not well understood. In that line, it is critical that you highlight your main findings and put them together into a single image that explains your observations.

A6: A final figure summarizing the idea of the study have been incorporated as the graphical abstract. Thank you for your suggestions that have enriched the overall manuscript. We are attaching the summary figure here as well.

Minor comments below:

Line 52: you mentioned several earthquakes that have occurred around the Indian – Eurasian boundary. It would be good to incorporate these events in Figure 1. This can serve as a complement to context and why you are studying the area.

Reply:

Line 145: Consistency. Either you call Fig X (as in previous paragraphs) or Figure X (as from this line and further in the text).

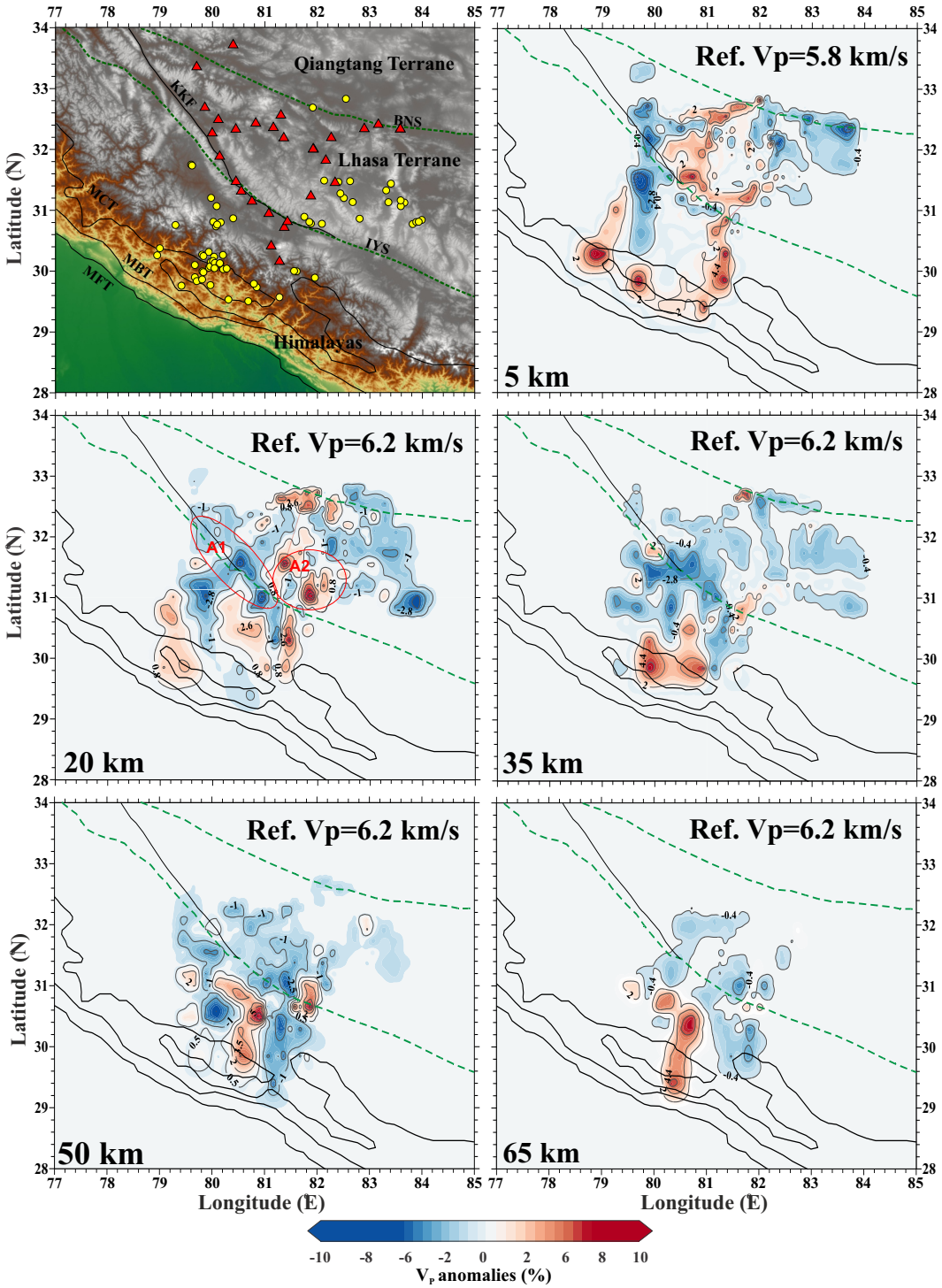

Figure 2. P-wave velocity anomaly tomographic images across the study area at the several depth as indicated in bottom left corner of each panel. The average Vp is indicated at the top right corner of each slice.

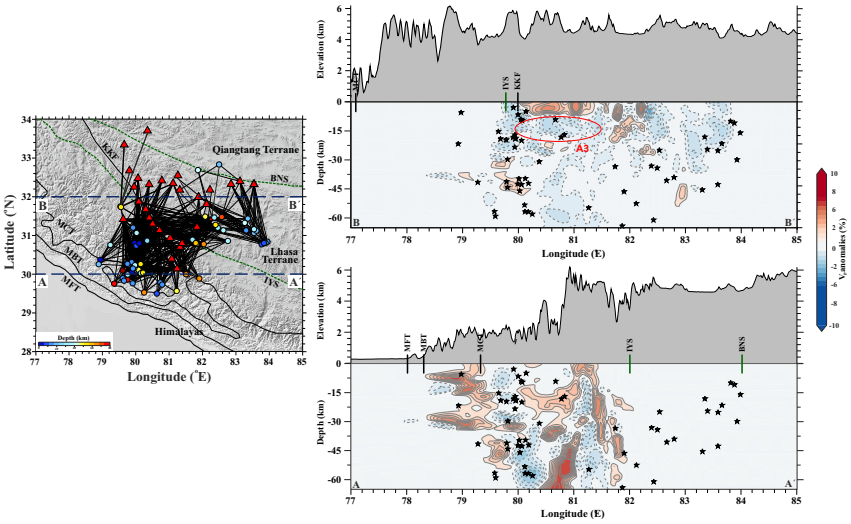

Figure 3. Vertical cross-section of the velocity structures (Vp) along the latitudes 30.0°N (Profile AA') and 32.0°N (Profile BB'). The color scale represents the percentage deviation of velocity anomaly from mean value. The topographical map is also represented to understand the changes in elevation and tectonics along the profile length. The inset map on the left represents the study area with the profiles marked.

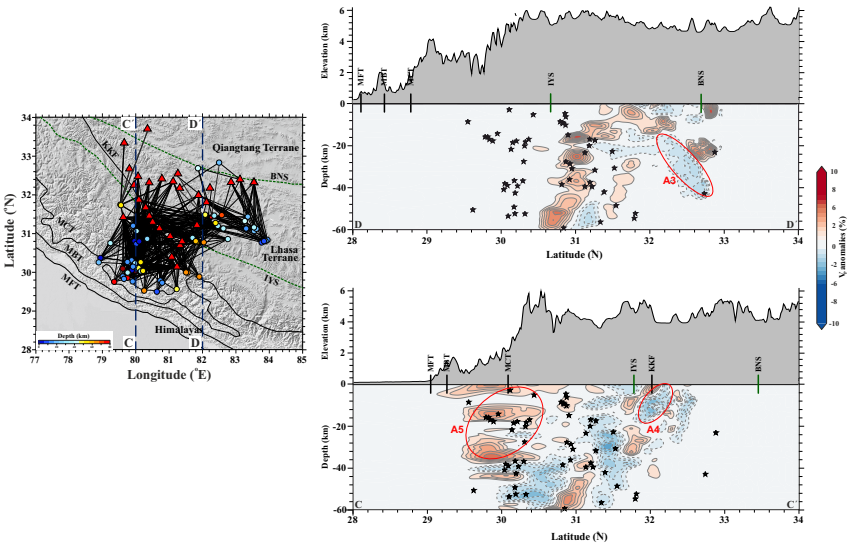

Figure 4. Vertical cross-section of the velocity structures (Vp) along the longitudes 80.0°E (Profile CC') and 82.0°E (Profile DD'). The color scale represents the percentage deviation of velocity anomaly from mean value. The topographical map is also represented to understand the changes in elevation and tectonics along the profile length. The inset map on the left represents the study area with the profiles marked.

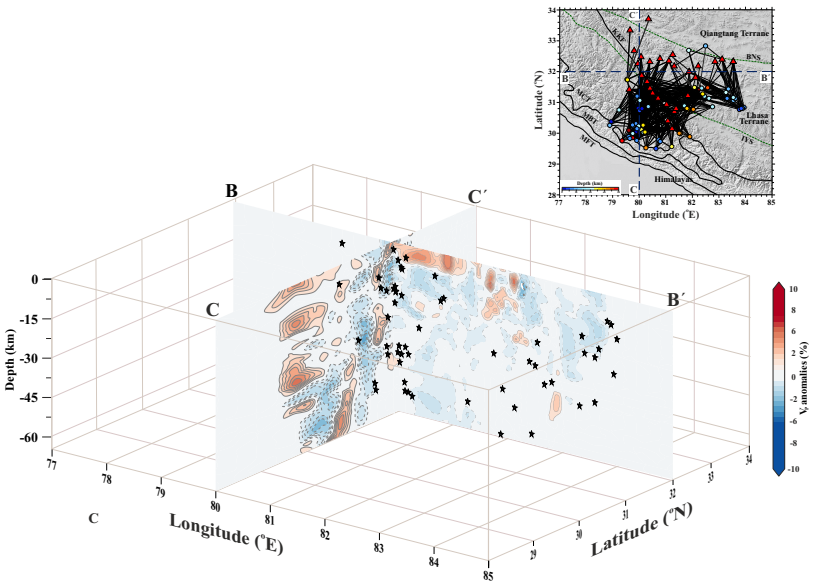

Figure 5. Schematic figure that represents the idea of the manuscript.

Reply: Thank you for pointing out the inconsistency, we have rectified the manuscript accordingly.

Line 188: check reference format

Reply: It has been rectified in the main text.

Figure 5-8: It would be good to have the locations on the figure to visualize the sources and clusters you mentioned in the text. This can be done either in these figures or by separated Figures for map- and profile- view of the relocated earthquakes.

Reply: The suggestion have been incorporated.

Figure 7-8: (1) it is hard to see the profile labels (AA', BB', etc). Make them bigger for better legibility both in mapview and profile. (2) you can add the slab interface for reference.

Reply: The reviewers suggestion has been duly noted, and the font size has been accordingly taken care.

Review Details: Delineation of 3D crustal seismic structures beneath western Tibet and the Himalayan range using local earthquake tomography

Raffaele Bonadio

Once this review has been read, press "Confirm" to indicate that the review process may proceed. If the reviewer has submitted their review elsewhere, you may upload the file below and then press "Confirm" to proceed.
Completed: 2024-11-05 02:41 PM
Recommendation: Resubmit for Review

Reviewer Comments

For author and editor

Dear Editor,

Thank you for the opportunity to review the manuscript titled "3D Crustal Seismic Structures Delineation Beneath Western Tibet and Himalayan Range Using Local Earthquake Tomography".

After carefully reviewing the files provided by the authors, I must, unfortunately, conclude that the manuscript, in its current form, is not yet ready for publication in Seismica. However, the underlying research could potentially contribute meaningfully to the seismological community once the text has been revised for clarity and consistency.

The manuscript contains several grammatical and syntactical errors, together with incorrect comma usage, inconsistent terminology, and formatting issues. Specific problems include missing or misplaced parentheses, incorrect citation formatting, unformatted bibliographic entries (e.g., "by tian2005joint, vergne2002seismic"), and frequent capitalization errors. Additionally, "its" and "it's" should not be confused, and plurals are often incorrectly formed.

These issues all together impact the readability of the text and suggest that the manuscript might not have undergone an in-depth review or proofreading process prior to submission. I would strongly encourage the authors to carefully revise the manuscript. A clear, precise, and consistent presentation is essential, especially in scientific writing. As a non-native English speaker myself, I understand the challenges of writing scientific work in a second language (if that is the case); a revision of the manuscript would enhance its readability, and

I am confident that this manuscript will reach its full potential, for a future submission, once these issues have been addressed.

Thank you,

Best Regards

Subject: second round of revision for “3D crustal seismic structures delineation beneath western Tibet and Himalayan range using local earthquake tomography” by Dey et al.

Main comments:

The authors have addressed all of the comments made in the first round of revision. Overall, the manuscript reads well and now contains more information that sustains the results and robustness of the model and their subsequent interpretation.

Minor changes that should take longer to edit are listed below:

Check the reference format along the manuscript. They are written as saved for a reference application and not in the article format.

L195: we observe **that** the station did not seem to alter …
L197: replace moves by **varies**
L220: add units when explaining the grid size
L223: indicate the number to what the grid depth increases
L252: Add the DWS resolution test in this sentence as both, the checkerboard and the DWS are assessing the model robustness.
L256: In my opinion, the DWS is not a result by itself but a control tool for evaluating the model resolution. I suggest adding a 2.2 section titled model resolution and describe the standard checkerboard and DWS tests. Then in section 3 with the results you can start straight with the 3.2 section.
L302: Double check unit for RMS.
L374 and 401: Replace terminus by **end**.
L408: check value. It says 510%.
L417: missing the “-” in 2040, 3050 and 3070 as follows: 20-40, 30-50, 30-70.

Figure 8: Label the anomalies described in the manuscript and previous figures.

The title is not correct grammatically. I would suggest a slight different one “Delineation of 3D Crustal Seismic Structures Beneath Western Tibet and the Himalayan Range Using Local Earthquake Tomography”.

Lines 9-12: This study aims to image the crustal structure of the western Tibetan Plateau by analyzing the velocity structure of elastic waves, using manually picked P- and S-wave arrival times from waveform data recorded by temporarily installed seismic stations in western Tibet.

Lines 12-14: Preliminary events located using the VELEST algorithm resulted in the development of a 1-D velocity model through inversion, which was then used in the TomoDD algorithm to relocate earthquakes and generate a high-resolution 3-D velocity structure model.

Line 15. A significant number of…

Lines 16-18: A low P-wave anomaly of approximately 8% is noted in the vicinity of the Karakoram Fault, while a significant low P-wave anomaly is also observed in the crust beneath the western margin.

Lines 18-19: A low P-wave anomaly is concentrated beneath the Lhasa block, whereas a relatively higher P-wave anomaly is evident below the in the Himalayan terrane.

Line 47: here and then write Ma instead of ma.

Line 75: The KKF is a dextral strike-slip fault,…

Line 79: “and is also known as the…”

Lines 84-88: "Previous studies report that crustal thickness varies from 26 to 88 km across the Indian Shield and the Himalayan–Eurasian subduction belt (Singh et al., 2017, 2015; Yuan et al., 1997), while the Moho depth beneath the western Himalayas and Tibet is reported to be around 70–75 km (Biswas & Singh, 2020b; Razi et al., 2014)."

Line 93. In understanding what?

Line 108: add ; before ‘however’.

Lines 115-118: "To achieve this, local earthquake tomography and relocation techniques are employed to model the 3-D P-wave and S-wave velocity structure, using data collected from a spatially distributed seismic array that operated across western Tibet between 2007 and 2011."

Lines 118-122: Suggestion: “Local earthquake data offer significant advantages over teleseismic data, as inversion of teleseismic data for crustal structure typically involves higher frequencies and larger incident angles. Therefore, in regions of high seismicity, the upper crustal architecture can be effectively studied from multiple directions by installing a seismic network (Kissling, 1988).”

Line 123: “emphasize”

Line 129: “To image the seismically active western Tibet…”

Lines 131-135: "For this analysis, we used continuous waveform data recorded by a seismic array deployed across western Tibet, operating from July 2007 to May 2011 (Razi et al., 2014). Only seismic events recorded by three or more stations were considered to ensure high-quality data for both P- and S-waves."

Lines 139-140: “124 well-constrained earthquakes. The initial location was enabled by SEISAN algorithm (Havskov & Ottemoller, 1999).”

Line 163: “we observed that the station…”

Line 170: “The initial velocities…”

Line 177: 55x55x30 grid…in degrees?

Line 199: remove dot after km^2

Line 255: please remove, or a fast anomaly,… it is redundant.

Line 259: a fast anomaly of…

Lines 265-266: "A prominent low Vp anomaly (A3) is observed drifting downward in the depth section along 32°N latitude (Fig. 6) and 82°E longitude (Fig. 7)."

Line 291: These high-velocity zones strongly suggest…

Once you define the acronym of Karakoram fault as KKF please use always that.

Line 308: low velocity anomaly

Line 335: does not need

Line 339: higher Vp anomaly fragments

Line 342: suggest

Line 346: remove ‘to result in an overall low Vp’

Line 347: unusually high velocities

Line 354: 5. Conclusions

Line 361: remove ‘Our research reveals that’

Line 369: remove ‘while’ (it is wrong starting a sentence with while)

Line 376: define AKD (is he/she the author?)

Line 382: is available from…

Table 1. Add dot at the end of the sentence.

Figure 1. “(see red triangles)”. The most significant earthquakes have been mentioned in the figure.

Figure 2. “(b) Raypaths from the earthquake epicenter to…”; “the hypocentral depth of the earthquakes is represented…”.

Figure 3. Please put letters to define panels in the figure and in the description in the captions. Add dot at the end of the sentence.

Figure 5. “at several depths”.

Figure 5 and Figure 3 (supplement): “at the depth indicated at the bottom left…”

Figure 6 and 7: “ from the mean value”; “the topographic map is”.

Figure 8. Please rewrite as “Schematic representation of the velocity anomaly variation observed at the intersection with the Karakoram Fault. The relocated earthquakes (black stars) mostly coincide with the low-velocity anomaly”.

Review Discussions

Note about round of review

cciviero
2024-11-11 04:39 AM

Dear Author,
You should have received an email with the decision regarding your article submission. Please note that due to an oversight, "Round 1" was mistakenly labeled as "Round 2." Kindly disregard this minor error. If you have any questions or need further clarification, please do not hesitate to contact me.
Best regards,
Chiara Civiero

120191_120191
2025-04-09 07:26 AM

Dear Editor,

Kindly find our revised manuscript for the Round 2 of review. We are extremely sorry for the delay in submission of the revised manuscript. We look forward to your feedback on our manuscript.

regards,

Niptika

120191_120191
2025-04-25 02:40 AM

Request for status update on the manuscript

Dear Editor,

Requesting an update on the manuscript, since the status of the manuscript is very confusing owing to the technical glitch where Round 2 status reads as "Round 2 StatusWaiting for reviewers to be assigned." and round 3 status reads as "Round 3 StatusNew reviews have been submitted and are being considered by the editor."

Looking forward to your kind response, it would be very convenient if you could kindly clarify which status update should I follow.

Thanks and regards,

Niptika

cciviero
2025-04-28 03:10 AM

Dear Niptika,

At the moment, I have received only one review by one of the previous reviewers (so you can follow the Round 3 update). I am waiting for another review. I will be able to send you a decision by mid-May at the most. Apologize for the confusion regarding the status, but I find it very difficult to find available reviewers on this round.

Best Regards,

Chiara

120191_120191
2025-04-28 03:27 AM

Dear Chiara,

Thank you for your response. I will be following the Round 3 status, and thank you for clarifying.

Looking forward to the reviewers feedback

Niptika

Revised Manuscript for Review for Round 3

120191_120191
2025-05-19 01:14 PM

Dear Editor,

We are thankful for the positive feedback on our manuscript and have carefully attended to all the suggestion and submitted the manuscript back for the further reviews as you deem fit.

regards,

Niptika Jana