

## Response to Editor and Reviewers

We would like to thank the Editor and the Reviewers for their careful reading of our manuscript and for their constructive comments. All suggestions have been carefully considered and have helped us improve the clarity, robustness, and overall quality of the paper. Below we provide a point-by-point response to all comments.

### Editor

Dear Editor,

Thank you very much for your careful review and for the constructive suggestions provided. We are grateful for the opportunity to clarify the points raised and to improve the manuscript accordingly.

We would like to kindly note that all of the requested revisions have been addressed. With regard to the presentation of receiver functions (RFs) and  $H-\kappa$  stacking results, instead of including all individual figures in the manuscript, we have compiled the complete set of RFs and  $H-\kappa$  results in `pickle` format. These files contain Python dictionaries with the  $H$  and  $\kappa$  axes, the  $H-\kappa$  matrix, the  $H-\kappa$  values of the maximum of the matrix, and the standard errors of these values. This ensures full reproducibility while avoiding excessive length and redundancy in the manuscript. In addition, we have extended the explanation of the newly implemented correction method for the  $\kappa$ -values. This clarification has been incorporated into the revised manuscript to improve transparency and reproducibility. We also aim to include this correction method in a future update of the `RFUN` program later in the current half-year.

We have also included a more extensive discussion justifying the use of local receiver functions in the Andean context. This added argument highlights the suitability of local RFs for resolving crustal and upper-mantle structures in regions characterized by strong lateral heterogeneities, such as the Andes.

Additionally, we would like to clarify that the inversions performed in this study did not involve a formal sensitivity analysis. Instead, the inversion strategy consisted of systematically toggling the input parameters used in the forward modeling of the receiver functions. This iterative procedure was carried out until a reduction in the misfit was achieved, resulting in an improved fit between observed and modeled RFs. This methodology has now been clarified in the revised manuscript.

Finally, we have included a final summary figure that serves as a model résumé of our main findings. In this figure, the main seismic discontinuities are explicitly plotted, seismic velocities are indicated, and velocity gradients are clearly visible, providing a concise and comprehensive overview of the inferred structure.

We trust that the revisions and clarifications provided adequately address the concerns raised. We thank you again for your time and consideration, and we hope that the revised manuscript is now suitable for publication.

## Reviewer #1

1. **Reviewer Comment:** *It would be useful to add comments on the  $H$  vs. Latitude graph shown in Figure 5 and on the  $v_p/v_s$  variations for the deeper layers, not just for depths between 1.4 and 2.0 km.*

**Response:** We thank the reviewer for this helpful suggestion. The discussion associated with Figure 5 has been expanded in the revised manuscript to better explain the observed trends and to include a more comprehensive interpretation of the  $v_p/v_s$  variations at greater depths.

2. **Reviewer Comment:** *Figure 8 appears in the text before Figure 6. I suggest renumbering the figures.*

**Response:** We appreciate the reviewer for noticing this issue. The manuscript has been carefully revised to ensure a consistent figure numbering and ordering throughout the text.

3. **Reviewer Comment:** *The discussion related to the velocity profiles and stacking is confusing and should be reorganized.*

**Response:** We thank the reviewer for this important remark. The relevant section has been substantially reorganized and clarified in order to improve the logical flow and to better explain the relationship between the stacking procedure, the velocity models, and the displayed profiles.

4. **Reviewer Comment:** *Have you tried a different bandpass filter (e.g., 0.1–0.5 Hz) to capture more energy in the signal?*

**Response:** We appreciate this constructive suggestion. We have tried several bandpass filters; however, the one we provided (0.1–0.5) proved to be the most meaningful. The strange appearance of the plot can be explained by the fact that the noise sources are not isometric. Most of the noise visible in the noise window comes from the southeast edge of the basin, which pushes the acausal and causal parts of the cross-correlated traces in this direction.

5. **Reviewer Comment:** *Please specify the magnitude of the events and define what is meant by “deep earthquakes”.*

**Response:** We thank the reviewer for pointing this out. Additional clarification regarding event magnitudes and depth criteria has been included to improve transparency and reproducibility.

6. **Reviewer Comment:** *Please explain why a fixed  $P$ -wave velocity was chosen and whether it represents an average value for the region.*

**Response:** This is a valuable comment. The manuscript has been revised to better justify the choice of the reference  $P$ -wave velocity and to clarify its representativeness for the studied region.

7. **Reviewer** Comment: *Several sections are written in the future tense, although the analyses have already been performed.*

**Response:** We thank the reviewer for this observation. The manuscript has been carefully edited to ensure consistent use of the past tense throughout the Methods and Results sections.

8. **Reviewer** Comment: *Please add latitude and longitude coordinates to the maps and mark the main tectonic lineaments.*

**Response:** We appreciate this suggestion. The figures and their descriptions have been revised to improve geographical context and readability.

9. **Reviewer** Comment: *Some figures lack color bars, labels, or sufficient explanation in the caption.*

**Response:** We thank the reviewer for highlighting this issue. The affected figures and captions have been revised to improve clarity and completeness.

10. **Reviewer** Comment: *Several minor typographical and formatting issues are present throughout the manuscript.*

**Response:** We appreciate the careful reading. The manuscript has undergone a thorough proofreading to correct typographical errors and improve formatting consistency.

## Reviewer #2

1. **Reviewer** Comment: *The definition and identification of the four discontinuities are unclear.*

**Response:** We thank the reviewer for raising this concern. However, we disagree with the reviewer on this point, as the identification of the four discontinuities is clear. The four boundaries appear in most receiver function stacks; however, the quality or number of traces at some stations sometimes makes it difficult to find them all.

2. **Reviewer** Comment: *Some figures require corrections, clearer labels, or reformatting.*

**Response:** We appreciate this observation. The relevant figures have been revised to enhance readability, consistency, and interpretability.

3. **Reviewer** Comment: *Several references and citations need to be reformatted or corrected.*

**Response:** We thank the reviewer for noting these issues. The reference list and in-text citations have been carefully revised for consistency and accuracy.

4. **Reviewer** Comment: *Some assumptions and methodological choices require stronger justification.*

**Response:** This is an important point. The manuscript has been updated to better motivate the adopted methodological choices and to explicitly state their underlying assumptions and limitations.

5. **Reviewer** Comment: *Please clarify which figures are being referred to in specific parts of the text.*

**Response:** We appreciate this remark. The text has been revised to ensure that all figure references are explicit and unambiguous.

6. **Reviewer** Comment: *There are several language and formatting issues (units, symbols, punctuation).*

**Response:** We thank the reviewer for the detailed feedback. The manuscript has been carefully edited to improve language quality and ensure consistency in units, symbols, and notation.

We trust that the revisions and clarifications provided adequately address the concerns raised. We thank you again for your time and consideration, and we hope that the revised manuscript is now suitable for publication.