Point-by-Point Reply to Reviewer Reports on the manuscript entitled

The Parraguirre ice-rock avalanche 1987, semi-arid Andes, Chile
-
A holistic revision

by J.J. Fürst, D. Farías-Barahona et al.

First of all, we want to thank all reviewers for the critical and useful comments on the manuscript. It was with great pleasure that we read their general appreciation of our work and the unanimous recommendation for publication. In the following, all review comments are repeated and addressed. Our responses are indented. Answers are given in blue and actions in orange. *Italic font* is enquoted and used to present newly added or modified text passages in direct answer to a specific comment.

We are very delighted about the fact that all three reviews are positive and supportive for publication in 'Natural Hazards & Earth System Sciences' (NHESS). Most comments have an editorial character. We tried to accomodate them to the best of our knowledge. If reviewer comments disagree, a compromise is suggested. Furthermore, reviewer #3 requested additional discussion of limitations of the employed methods (DEM differencing, climate data scarcety, ...). We accounted for these. In summary, we hope that the editor can continue to consider our manuscript for publication in NHESS.

REFEREE #1

General Comments:

This manuscript offers a thorough and insightful re-evaluation of the 1987 Parraguirre ice-rock avalanche using a multidisciplinary approach that combines modern remote sensing, climate reanalysis, hydrological data, and process-based modeling. The authors make a compelling case for interpreting the event as a meteorological compound hazard and provide improved volume estimates and simulation-based evidence supporting the damming hypothesis.

The study is scientifically sound, well-written, and rich in detail. It contributes valuable insights for understanding high-mountain hazards under changing climatic conditions. I recommend minor revisions to improve the structure and clarity of some sections, particularly in the result and discussion.

> Thank you very much for declaring you high appreciation for our manuscript. We truly appreciate your kindness and wnat to thank you for the recommendation.
>
> **ACTION:** No actions required.

Specific Comments:

The literature review is very detailed but could be condensed slightly. Emphasize the knowledge gaps and novelty of this study earlier in the section to help guide the reader.

> Thank you for this comment. We re-read this passage with the aim to make the text more concise. Yet we failed in this task because each sentence appears to introduce new pieces of information. The idea was to bring together all bits of information from the literature into a single manuscript. With this intention, we do not see how to substantially shorten the passage. Suggestions are welcome. Concerning the second partof the comment, we now decided to highlight the main research questions/knowledge gaps in the introductory paragraph by enumerating them as a list.
>
> **ACTION:** The four research questions/knowledge gaps are now highlighted as a list. Text passage of literature review could not be substantially shortened.

In Section 5.4, the process of filtering acceptable simulations is repeated and could be streamlined. Combine or summarize the filtering logic and present the retained ensemble clearly with a count and justification.

> We deeply appreciate that the reviewer pointed out this redundancy. We now condensed the presentation of the step-by-step calibration avoiding repetition with Sect. 4.2.2. This makes it easier to follow the counting of retained simula-

tions.

ACTION: Adjusted as requested.

In Section 6.2, The discussion on possible sources of flood water is technically rich but dense. Structure it into separate sub-sections or use bullet points for snowmelt, glacier ice, and soil water. Consider adding a bar chart or conceptual diagram to visually support the breakdown.

Good idea. We followed your suggestion to better strucutrre the discussion on the water budgeting. We now introduced a specific sub-subsection, which itself is separated in four paragraphs on possible water sources. We refrained from forwarding a conceptual diagramm as our estimates should not be perceive as accurate but rather serve as orientation for the plausability on clusing the water budget.

ACTION: Complete overhaul of sub-subsection on 'water budgeting' in Sect. 6.2.

Some figures (e.g., Figs. 6 - 8) are slightly difficult to interpret due to small text and dense legend content. Increase font sizes and simplify legends where possible for readability, especially in grayscale.

Thank you for this comment. The small font sizes admittedly slipped our attention. Greyscales were only used for background hillshades. They serve for orientation and hold no particular information.

ACTION: Font sizes where increased in all figures.

In Conclusions, add one or two sentences on how the results can inform future landslide hazard assessments or early warning systems in similar mountainous regions.

Thank you. We agree with this suggestion.

ACTION: Added an outlook paragraph to the conclusion section.
'Finally, the Parraguirre debris-flow event provides valuable insghts for future landslide hazard assessments. Operational warning services need to account for the longer-term meteorological pre-conditioning. The seasonal snowfall build-up and the sudden and intense melting were crucial both for the initiation and the high flow mobility. Moreover, temporary river damming - although adding minimum extra water - can be an effective catalysator for the destructive power of debris flows. River confluences and valley junctions in the vicinity of potential trigger sites in the headwaters of river networks deeply incised in steep mountain topography therefore require particular attention in hazard assessments.'

I'm convinced of the scientific aspects described in the manuscript and their contribution to progress in your research discipline.

Thank you for this appreciation.

ACTION: No actions required.