

Response to Editor Joe MacGregor's second review on egosphere-2023-2731

Dear Editor Dr. MacGregor,

thank you for thoroughly reviewing our MS again and for providing helpful suggestions for last improvements. We agree with all of your suggestions and hope that you find our adaptations satisfying. Thank you again for taking your time to edit this MS, we believe that this process significantly improved its quality.

Kind regards,
Falk Oraschewski
on behalf of all co-authors.

Remarks

My apologies for the delayed decision, but I have now had a chance to review your revised MS. I consider it well organized, improved upon the original, and responsive to the reviewers' concerns. While the physical scale of the survey is small, the breadth of the technical accomplishment, the exposition on the technical methods, and the improved interpretation and connection with previous glaciological studies in this region are all excellent. I recommend to publish but have noted the following minor issues for you to address beforehand.

Author response: Thank you for highlighting these strengths of our MS. We agree that the spatial coverage of this proof of concept is limited. This can not least be attributed to the technical difficulties and the current limitations of the mobile pRES system that we describe in the MS. Nevertheless, we believe that our results are promising and hope that this work will help to overcome the limitations to achieve a more extensive mapping of the deep stratigraphy of mountain glaciers in future surveys.

The link to the raw data (<https://doi.org/PANGAEA.965199>) does not work.

Author response: You are right, I made a mistake when copying the link. Now the correct link is provided.

35: "aircraft" not "aircrafts"

Author response: Fixed.

37-38: The following phrasing makes more sense: "Here we address the need for a lightweight...for SAR processing."

Author response: Agreed. Thank you for this suggestion.

65 and elsewhere in the MS: When referring to specific values, unit abbreviations are fine (e.g., "5.5 cm"), but when referring to a unit for a sense of scale, they should be spelled out, i.e., decimetre for dm, centimetre for cm.

Author response: Fixed

72: Clearer: "...antennas extends further along-track than cross-track and ground targets..."

Author response: Fixed. Thank you for the suggestion.

74-5: This final sentence is better suited to the discussion on potential software/hardware improvements.

Author response: Agreed. Because the previous sentences already introduce this discussion point, we decided to move them, as well. As this would make Section 5.1 quite long, we moreover decided to split it into two parts ("Feasibility assessment" and "System improvements").

76: Define GNSS acronym at first use.

Author response: Fixed.

80: I see what you mean but the phrasing that starts this sentence is awkward ("build upon" and "low-cost" are sort of opposing), and as for 74-5 this sentence on potential improvements likely belongs later on to better separate what was done from what could be done.

Author response: Thank you for pointing out this subtle meaning of "build upon". We have moved this sentence to the discussion and now write "In addition, to follow the low-cost approach of the pRES, we suggest to combine it with low-cost GNSS receivers that can achieve a positioning accuracy that is comparable to commercial instrumentation (Still et al., 2023; Pickell and Hawley, 2024)".

88: What type of signal was used to indicate to the operator the chirp was complete? Audible or visible?

Author response: The signals were audible. Different types of beep tones were used for indicating to start and stop moving. In addition, constant beeping indicated that the operator has moved too far.

90-2: Again, save this last statement for the discussion.

Author response: Agreed. We have removed the sentence and instead just point in the initial paragraph of Section 2 to the discussion of potential system improvements.

212: "systems" not "system"

Author response: Fixed.

225: "...data reveals deep IRHs..."

Author response: Fixed.

257: remove comma

Author response: Fixed.

257-261: Could the thickness decrease also be attributable to local thinning associated with recent climate warming?

Author response: No, we regard this option as highly unlikely. The glacier saddle and the upper parts of Grenzgletscher are still frozen at the base and do not show dynamic changes that could explain such strong thinning. Neither has snow precipitation reduced or surface melting increased enough to thin the glacier from the top. Moreover, we do not see any substantial differences in the two-way travel times of the bed reflections between the radar data recorded in 2008 and 2021.

260: "non-straight", i.e., "non-vertical"?

Author response: Fixed.

350: "less thick", i.e., "thinner"?

Author response: Fixed.

354-5: Perhaps clearer: "... , a redesigned FMCW system is desirable that is similar to many airborne systems whose chirps are much shorter ($\leq X$ us)."

Author response: Thank you for the suggestion, we have adapted it.

Figure 1: Could the E-plane direction mentioned the text be added here?

Author response: Yes, the E-plane direction is now included in the schematic figure.

Figure 3 caption: "example" not "exemplary"

Author response: Fixed.

Figure 5: This figure is great, but I think the range of panel b could be reduced to $\pm 10^\circ$ without substantial information loss, and inequalities used to illustrate that sometimes the apparent slope is higher.

Author response: Agreed, we have adapted the color range of the figure now.

References

- Pickell, D. J. and Hawley, R. L.: Performance Characterization of a New, Low-Cost Multi-GNSS Instrument for the Cryosphere, *Journal of Glaciology*, pp. 1–7, <https://doi.org/10.1017/jog.2023.97>, 2024.
- Still, H., Odolinski, R., Bowman, M. H., Hulbe, C., and Prior, D. J.: Observing Glacier Dynamics with Low-Cost, Multi-GNSS Positioning in Victoria Land, Antarctica, *Journal of Glaciology*, pp. 1–18, <https://doi.org/10.1017/jog.2023.101>, 2023.