

# Review of Wendleder et al.: Basal Sliding and Hydrological Drainage at Baltoro Glacier

Wendleder et al. have addressed most of my major concerns and those of the other reviewer. I appreciate their detailed and thorough responses, and I am satisfied by their explanation of why they have not followed two of my suggestions. The Results section in particular has been reorganized and I find it much easier to follow and to identify the key findings. I have just a few remaining minor and technical corrections to suggest.

Line 6: I'm sorry, I acknowledge that I asked for more precision about the use of "runoff index", but I wonder if maybe the abstract is not the best place to add this much detail, however I do think it's important to highlight this is specifically proglacial runoff. Maybe the sentence about glacier variables could read, "For the glacier variables, we used surface velocity, supraglacial lake extent, snow and ice melt extent, and proglacial runoff index derived from Earth Observation data", and then you do not need the following sentence defining the runoff index.

Line 25: I'm sorry for being particular about the wording, but I think the wording that "sliding is initiated [...]" could be clarified further, since the authors responded to my original comment by agreeing that there is likely to be sliding in winter. Maybe it is more accurate to say that "sliding increases as the ice decouples from the bed"?

Line 31: I appreciate citing Weertman (1957) for regelation, but this explanation is still not clear to me. It is possible that you mean to explain enhanced ice-roof closure rates around obstacles (e.g., Creyts & Schoof, 2009). In that case, please provide correct and precise citations, including the listed paper and some of the references within. Otherwise, for the canonical description of channel opening and closing mechanisms, see e.g. Section 6.3 of Cuffey & Paterson (2010).

Line 32: The transition from hydrology to dynamics is quite abrupt. Given the change in topics and that this is already a long paragraph, maybe this should be split into two paragraphs to separate hydrology and dynamics.

Line 47: Reading this line, about how supraglacial lake drainage into an efficient drainage system can reduce ice velocities, has made me think: you have attributed fall speed-ups to supraglacial lake drainage. Does this explanation for fall speed-ups fit with your conceptual model of subglacial drainage development in Section 5.1? If not, could you explain this in Section 5.1 and provide some possible reasons why?

Figure 1: Please indicate in the caption what the white crosshairs represent. It would also be nice to add the flowline distance along with each place name. E.g., Urdukas / 3900 m / XX km.

Table 1: Could you explain more precisely the difference between "maximum" and "summarized" lake area in the text? My interpretation is that the "maximum" lake area refers to the maximum area that is instantaneously covered by supraglacial lakes, and that the "summarized" lake area

refers to the total area that is ever covered by lakes, but the text was not completely clear on this.

Line 308-309: The sentence "In 2018, 2020, and 2022, air temperature..." there is a comma or adjoining word missing somewhere here.

Section 5.1 and Line 359: The authors had nice and detailed responses to my earlier comments about these two sections. Could you add one to two sentences summarizing your responses to these sections? I think this would add value for the reader.

For section 5.1, maybe it would help to explicitly say that this is a hypothesis or a conceptual model. Maybe change the first sentence to something similar to, "Although each year is different, here we present a general conceptual model that explains the observed seasonal patterns".

Line 392: My apologies, I think my earlier comment was not clear. Sundal et al. (2011) show that, in a year with high surface melt rates, the peak surface velocity might be higher, but the development of efficient subglacial drainage leads to slower late-summer velocities (Figure 3). The net effect is that the overall annual ice displacement (in meters) is similar for years with low and high surface melt rates. Can you comment on whether or not you find something similar? Or does annual total displacement (or annual average velocity if you prefer to think of it that way) also increase strongly with surface melt for this glacier?

Figure 5: I like this addition to further support the discussion about changes in the time lag between peak melt and the summer velocity peak. Could the authors add just a few sentences explaining more specifically what physical processes they think could explain this dramatic change in lag time?

I am concerned that the conclusions in line 404-409 are too strong. There are only six years of data, and for processes with such a large variability, the trends are not robust. It is an interesting finding that you are correct to highlight, but I think the conclusions need to be more careful. Perhaps this could be highlighted as an interesting feature that emerged from your dense, multi-method and multi-sensor observational record that warrants further investigation. As a technical note, the dotted lines (especially the yellow line for Urdukas) are thin and hard to see.

## References

Creyts, T. T., and C. G. Schoof (2009), Drainage through subglacial water sheets, *J. Geophys. Res.*, 114, F04008, doi:[10.1029/2008JF001215](https://doi.org/10.1029/2008JF001215).