

Response to editor comments

In situ measurements of meltwater flow through snow and firn in the accumulation zone of the SW Greenland Ice Sheet

Nicole Clerx, Horst Machguth, Andrew Tedstone, Nicolas Jullien, Nander Wever, Rolf Weingartner, Ole Roessler

Dear Kirstin Poinar,

We would like to thank you for your editing efforts and constructive review of our paper. Please find a response to your comments below.

Nicole Clerx,

Fribourg, September 20, 2022

A. line 253 "could be a lot higher" – please provide an estimate (a rough estimate is okay) in place of "a lot".

Based on minimum values of ‘area occupied by preferential flow paths as a percentage of total snow/firn sample area’ (5–30% as reported by Williams et al., 2010; Katsushima et al., 2013), we have included a estimate of the (maximum) potential percolation velocities in our experiments.

B. line 335 – Reviewer 1 commented that the timing is biased low, as the authors used time of first arrival, rather than time of peak concentration through. In their response, the authors pointed out that they did not measure concentrations (it was not possible with the methods/equipment they had), so the peak time could not be discerned. Nevertheless, the authors should comment on this timing bias — it means their velocities are biased high. Comment here or in the discussion how this compounds or offsets other sources of error.

OK, we will include a comment here that our simple measurements represent high estimates of the lateral flow velocity.

C. Reviewer 1 points out that the datum for the water table is the ice slab surface, which can undulate locally and is not likely to be level or even flat. The authors should comment on this – probably in the discussion (lines 466-7), or alternately lines 307-8, where the water table measurement method is described, or lines 386-8. Because the authors are concluding no correlation between the local water table height and lateral flow velocity (stated on line 466), these undulations may well matter, and should be addressed.

Agreed. We will elaborate on the potentially varying reference height for the water depth measurements due to the ice slab undulations.

D. Table 2 - unsaturated has no quotes, while 'saturated' has quotes. Why? Suggest to choose a style and apply to both for consistency.

OK. We will update the table header.

References

- Katsushima, T., Yamaguchi, S., Kumakura, T., and Sato, A.: Experimental analysis of preferential flow in dry snowpack, *Cold Regions Science and Technology*, 85, 206–216, <https://doi.org/10.1016/j.coldregions.2012.09.012>, 2013.
- Williams, M. W., Erickson, T. A., and Petrzela, J. L.: Visualizing meltwater flow through snow at the centimetre-to-metre scale using a snow guillotine, *Hydrological Processes*, pp. n/a–n/a, <https://doi.org/10.1002/hyp.7630>, 2010.