

Interactive comment on “Hourly surface meltwater routing for a Greenlandic supraglacial catchment across hillslopes and through a dense topological channel network” by Colin J. Gleason et al.

Anonymous Referee #1

Received and published: 8 December 2020

This paper details a study using the Hillslope River Routing Model (HRR) to better constrain surface meltwater routing on Greenland, improving on results that only use surface mass balance models. This is a good example of taking more advance techniques used in hydrology and applying them to glaciology, something which can greatly benefit the field.

However, I don't find the way in which the paper is currently written to be suitable for the target audience of a journal such as The Cryosphere. Many of the terms and methods which may be more familiar to trained hydrologists will not be familiar to many glaciologists. I would very much like to see this paper published in The Cryosphere

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as it would be a good step towards better collaboration between these fields, but I would recommend a detailed re-write to make it more accessible to those without a background in hydrology.

My detailed comments are below:

Line 34: and lakes?

Line 40: Also Leeson et al. 2012 DOI: 10.5194/tc-6-1077-201

Line 82: What about subglacial channels/ transport through firn?

Line 97: Is this the only data available for the whole of Greenland? It seems a big weakness of this paper is the lack of validation data available. If other datasets were not used it should be explained why (but if this is really all there is then fair enough!).

Line 122: Related to the previous comment, is there data for other times available? Can you explain why it is so important only the peak of the melt-season can be used?

Line 129-133: Were other images available? What if other streams are present and just didn't have water flowing on this particular day?

Line 134: Please define DEM

Line 142: How do you determine all of the water in each of these grid cells will remain in this catchment, could any of it be being transported elsewhere?

Line 167: Please define Froude number.

Line 163 onwards: Why was none of this data suitable to use to validate the model?

Line 176: I know what you're getting at here but I'm not sure 'factorial' is the correct description?

Line 185: Is it possible that the SMB values are correct and water just isn't making it to the channels where the ADCP measurements are made? E.g. What about refreezing in firn?

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Figure 1: The middle 4 squares could be laid out in a clearer way. Why does including or excluding hillslope flow have a 'yes' or 'no' but there is no differentiation between coarse and fine network?

Line 195-6: 'generalizing the process of water routing from satellite image collection to water routing' doesn't make sense to me.

Line 195 onwards: This paragraph was one I especially felt could be better explained for the non-hydrologist. It would also be good to see justification for 'standard hydrologic' practices being applied to icy surfaces.

Line 210-11: 0.5 is more than twice 0.2 so I wouldn't say they are matching, does this difference matter?

Line 217 onwards: Again this paragraph could be clearer. The authors discuss stream order again in the results so an introduction to what this means and why this matters would be helpful.

Line 234: Do any other models have this rigorous representation? If they are written in other, more accessible, languages it may still be useful to briefly mention them for those who may want to build on this but not use FORTRAN.

Line 245: Please give a little more detail about how EAs work.

Line 255: Please define Manning's n.

Line 296-7: Please define acronyms.

Line 311 and figure 4: Please comment more on why we are assuming here that MERRA2 is incorrect. Could it not be that all the other inputs are less accurate and MERRA2 is actually getting it right?

Line 402 onwards: How is the slow lateral transport accounted for in the model?

Line 420: Can you give an example(s) of the physical processes that may be leading

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to this to support this conclusion?

Line 443: Anywhere or just in the bare-ice ablation zone?

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-273>, 2020.

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