

Interactive comment on “Seasonal Variability in In-situ Supraglacial Streamflow and Drivers in Southwest Greenland in 2016” by Rohi Muthyala et al.

Anonymous Referee #3

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Supraglacial stream/river networks route large volumes of surface meltwater on the Greenland Ice Sheet but their discharge remains poorly estimated. This paper presents very valuable discharge measurements and continuous water level measurements. These measurements, to my knowledge, are the first long-term (almost entire summer 2016) observations of supraglacial streams and will significantly improve our understanding in Greenland surface hydrology. Therefore, I suggest this paper will be a very good contribution to TC and recommend it to be published.

I have the following comments. Some of these comments are proposed for further discussion so it is fine if the authors cannot address all the questions. But I suggest

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the authors consider including some of these comments in the revised paper to make their paper more broadly interesting.

General comments:

This paper compares stream discharge with surface energy fluxes and reveals short-wave radiation as the primary driver of melting (contributing 50-78 % energy). Besides surface energy fluxes, it will be useful to compare stream discharge with modeled surface runoff because these two variables can be directly compared. The catchment boundary is delineated with very high accuracy so this comparison is possible. I assume the comparison is not conducted because the studied catchment is too small to compare with coarse-resolution RCM simulations. If so, I suggest the authors briefly explain it in the revised manuscript.

Additionally, it is necessary to better explain how proportions of melt energy supplies are obtained from discharge-energy correlation analysis in the Abstract and Results.

Specific comments:

line 11, it is not clear to me what "which" means in this sentence, "surface runoff" or "supraglacial stream networks"?

lines 15-17, I think this is not the main finding of the paper and should be moved backwards.

line 29, three papers are cited so it is not clear where 286+-20 Gt comes from.

line 35, it is not straightforward to understand the importance of supraglacial streams from this sentence. I suggest adding "extensive supraglacial stream networks route large volumes of surface meltwater runoff each summer" or similar descriptions to make the logic easier to follow.

line 39, delete "drainage".

line 43, "or" the ocean?

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line 54, compared to smaller catchments with similar surface melt intensity, large catchments imply a longer stream network.

line 58, besides weathering crust, meltwater stored in firn or snow can also influence discharge magnitude and timing.

line 100, what is the purpose to introduce "cryoconite"? it is not included in the following analysis.

Figure 1, use a dot to indicate the study area; will it be useful to show the high-resolution satellite image of the study area? Any crevasses or small moulin identified in the catchment? use different line widths to show streams of order 1, 2, and 3.

line 69, why regional climate models (RCMs) are not used in this study?

Figure 2, is it possible to add scale bar in Figure 2a and 2b?

Figure 3, Thermal erosion cannot be identified because the deepest point changes over time. Is there a stable reference point during field-work period? It is fine if there is not because I understand the main point here is to quantify the uncertainties of channel cross section rather than analyzing thermal erosion.

Figure 4, put legend in the figure to save space.

lines 162, "depth measurement errors can be isolated from incision errors", not clear what this sentence means.

lines 177-179, delete this sentence. Instead, add $\text{ack} = 1, b + f + m = 1$ after equations 2-4.

line 180, although the HOBO weather station is not used, it will be useful to add several sentences to explain why it failed to provide continuous meteorological observations.

line 197, the spatial resolution of panchromatic WorldView-1 image is 0.5 m rather than 1 m. Considering showing this image in Figure 1.

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line 198, very impressive to identify catchment boundary in such convincing way. Which date was this work conducted? It will be useful to add the date. Also, it will be helpful to add a DEM-derived catchment boundary for comparison (optional though).

lines 200-201, "We estimate the catchment area to be accurate within 5% given that it was manually identified in the field. However, the precise delineation of the catchment is not relevant to the outcome of the study", what is the purpose of this sentence?

line 206, it is surprising that supraglacial streams remain stable at such low-elevation, fast-flowing area. Any reasons? It will be useful to add ice flow velocities.

Figure 6a, I think it is not necessary to calculate uncertainty of daily mean discharge by averaging hourly discharge. Actually, this is just unit transform rather than uncertainty. Also, I think it is more informative to add daily discharge on Figure 5a and move Figure 6b to Figure 5. By doing this, there will be a much illustrative Figure 5.

Figure 8 is not easy to follow. Particularly, it is not clear what "proportion of melt energy" means.

lines 273, what does "network storage" mean?

lines 293-295, delete this sentence.

lines 379-380, this sentence is not easy to follow.

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