Author response to reviewer comment: Reviewer 1

General comments:
The authors present an interesting and engaging manuscript combining remote sensing and field measurements to outline a interesting change to supraglacial hydrology on the Greenland Ice sheet. The quality of the writing is very high, and the paper is clear in its aims and objectives. The results are presented clearly and flow naturally into the interpretation and discussion. I feel the implications of this work could have been taken further as this is very interesting and has implications for further observations and modelling. I feel the greatest changes, albeit minor ones should be made to the study site and results sections to make them easier to follow and compare as outlined in my specific comments. For these reasons I suggest minor edits to be made to the manuscript.

We would like to thank the reviewer for their positive comments on our work and for the suggestions which will improve the quality and clarity of our manuscript. We will incorporate all of the minor comments raised by the reviewer in the revised manuscript. Below we respond to each point raised by the review with our text written in **blue** and each response will detail how we will update our manuscript to address each concern.

Sincerely,
Jessica Mejia on behalf of all coauthors

Specific comments
Title: The title is quite long and could be condensed to the key message.
We agree with the reviewer that the title in its current form is quite long. We will update the title to read as: *"Greenland supraglacial catchment consolidation by streams breaching drainage divides"*. This change will reduce the title's length from 26 words in the old version to 9 words.

Study Area: In this section I found myself wondering why this site was picked and how the catchments were delineated, I appreciate the method is explained in section 2.2 however a nod towards this would be appreciated.
We thank the reviewer for raising these points regarding the text in Section 2 that describes our study area. We selected this area with the goal of finding the highest-elevation catchment with a visible and accessible moulin (via helicopter reconnaissance) that the snow-line had retreated past by the time of field camp establishment on 28 July 2017. We will update the manuscript to clarify that these were the highest-elevation catchments that we could safely install a field camp and map supraglacial streams on-foot. We will also include a reference to section 2.2 on line 57 to coincide with the first mention of the area occupied by the three catchments in our study.

Figure 1: I find the choice of colour for contours, particularly the 50m contour colour and stream colours very similar and slightly confusing, consider changing symbology. Stream flow direction would also be appreciated.
We thank the reviewer for directing our attention to the color choices in Figure 1. We will update the figure by choosing different colors for our elevation contour lines to make them more distinct and visible from other symbols used. We will also update the colors of our stream traces to ensure they are distinct from the color of contours and to include arrows that indicate stream flow direction for each of

the terminal streams. In returning to this figure we have also noticed that we did not include an indication of ice flow direction in Figure 1b, we will update the legend to include that as well.

Tables 1 and 2: I find the arrows in the tables slightly confusing, perhaps this could be explained in the table title.
We thank the reviewer for raising this concern. We will update the text in the titles of Tables 1 to include a description of the arrows. In Table 1 the arrows indicate catchment consolidation and explain the increasing size of Mars Catchment between 2017-2019. We will remove the arrow in Table 2 and replace it with a "-" to indicate no-data for ArcSav moulin in 2018 to improve clarity.

Line 80: How much elevation change was recorded during the transects? A number here would help the justification
We agree that stating the elevation change would help with putting the error associated with our dGPS transects into context on Line 80. We recorded an elevation change of 11.09 m and 3.86 m in our transects of Mars and ArcSav Catchments, respectively. We will revise the sentence on Line 80 to include that our *"recorded elevation change exceeded 3 m during the transects"*.

Line 92: "by visual inspection of remote sensing imagery" is very vague, I would like some more specifics here as to how these were determined.
We agree with the reviewer that this statement was vague and will expand on our methodology for adjusting the calculated catchment bounds. Specifically, we will add a paragraph to the end of the subsection which contains the following information:

> *The catchment boundaries calculated from the preceding analysis were then corrected to align with supraglacial streams identified in WorldView-2 imagery with a spatial resolution of 0.5 m acquired on 03 July 2017, 27 June 2018, and 08 June 2019. Maxar (2021) reports a geolocation accuracy of approximately 5.0 m of circular error int he 90th percentile, for areas without ground control points such as on the ice sheet. WorldView scenes from each year were acquired after the melt season had begun and supraglacial streams are clearly identifiable across our study area. We compared the calculated catchment boundaries to supraglacial streams visible in WorldView imagery by inspecting the perimeter of each catchment in QGIS using a screen scale of 1:5000. We adjusted catchment boundaries by manually relocating individual points comprising the catchment polygon at a screen scale of 1:500 for areas that did not align with supraglacial stream paths identified in WorldView imagery. Adjustments made to catchment boundaries were located in areas where surface slopes are shallow and are generally less than 1°, with individual adjustments resulting in a change of ±0.1 km2 to the catchment area.*

Line 108: How much does stream depth increase?
We thank the reviewer for calling our attention to this line that does not explicitly state the stream's depth. The answer to this question is that the stream's depth increased by at least 11.09+/-0.4 m. While we report this number in the text on Line 110 we can see how by stating that the drainage divide is this height above the lake shoreline we do leave it to the reader to infer the meaning. To clarify this sentence following the reviewer's suggestion, we will rephrase the text on Line 108 to explicitly refer to stream depth. We will explain that the stream's depth is at least 11.09+/-0.4 m below the drainage divide, however, because we could not measure the incised depth of the stream within the channel, we know that the stream's base would be deeper than ~11.09 m below the topographic divide.

Section 3.2: I found this section a tad hard to follow. Perhaps this could be augmented with a figure denoting a timeline for key events, perhaps combining some of the field images you have? This would

help condense the information and may make it easier to follow. I found the images of varying size with little text hard to follow and this could be better communicated as this information is very valuable.
We thank the reviewer for pointing out a lack of clarity in Section 3.2. We do understand that there are many photos associated with the text. To address this issue we will combine Figure 8 (map view of stream transects) with Figures 10 and 11 (field photos). We will do this by aligning the Mars drainage field photos horizontally in the order of the pins on the map indicating the location each photo was taken. This will allow the reader to more easily understand the locations of the stream features and the order in which they appear relative to the lake shoreline. We will do the same for ArcSav Lake's drainage (Figure 11), by including the field photos vertically on the left side of the map to indicate each feature's location.

We will take a similar approach to the figures in Radical Catchment, by reorganizing Figure 13 (field photos) in a similar manner to Figures 10 and 11 described above. Here, we will enhance the size of Figure 12c (map view with pins corresponding to field photo locations) with each photo organized following the feature's location along the stream transect. We will take the additional step of including more text to supplement the field photos to explicitly identify the features.

Finally, we will add a figure that denotes the timeline for interannual catchment variability for all three catchments considered. By making these changes we believe the interpretation of all figures included within the results section, particularly those from 2018, will be easier for the reader to interpret.