Thank you for your decision! We appreciate your comments and suggestions. Please see our changes and replies below.

I have few technical details for you to address, as I feel the English of the text could still be more polished.

We have re-read the manuscript again and smoothed the language.

I have suggested a restructured version of the abstract below, which maintains all your content of course. I feel the order of the paragraphs was not entirely logical, and some of the wording could be improved. Feel free to use that or a modified, more fluent and tidier version of yours.

We followed most of the suggested changes to the abstract, see below. We changed some wording as well.

I would encourage the authors to go through their text once more, and try to polish it some more and correct style/grammar, based on some of my comments below (in few instances the text contains still grammar errors). This is something that the co-authors could help with.

We have re-read the manuscript again and smoothed the language.

REVISED SUGGESTED ABSTRACT:
Many glaciers are thinning rapidly beneath melt-reducing debris cover, including the Kennicott Glacier in Alaska. The zone of maximum thinning at Kennicott Glacier is located under debris. Scattered within the debris cover, melt hotspots, such as ice cliffs, locally increase melt rates. We explore the roles of debris and ice cliffs in controlling rapid thinning under thick debris at Kennicott Glacier.

We collected abundant in situ measurements of debris thickness, sub-debris melt, and ice cliff backwasting allowing for extrapolation across the debris-covered tongue (the study area and the lower 24.2 km 2 of the 387 km 2 glacier). A newly developed automatic method, the Adaptive Binary Threshold, uses for the first time only optical satellite imagery to delineate ice cliffs. We show that the method accurately estimates ice cliff coverage even where ice cliffs are small and debris color varies.

Kennicott Glacier exhibits the highest fractional area of ice cliffs (11.7 %) documented to date. Ice cliffs contribute 26% of total melt across the glacier tongue. Although the relative importance of ice cliffs to area-average melt is significant, the absolute area-averaged melt is dominated by debris.

At Kennicott Glacier, glacier-wide melt rates are not maximized in the zone of maximum thinning, and we show that this rapid thinning is due to a decline in ice discharge through time. There is more debris-covered ice in Alaska than any other region on Earth. Through our efforts, Kennicott Glacier is now the first in glacier in Alaska and the largest globally where melt across its debris-covered tongue has been rigorously quantified.

We follow these suggested changes to the abstract (minus some minor changes to the wording) and move the two sentences to the end. Here is the new abstract:

“Many glaciers are thinning rapidly beneath melt-reducing debris cover, including Kennicott Glacier in Alaska where glacier-wide maximum thinning also occurs under debris. This contradiction has been explained by melt hotspots scattered

within the debris cover. However, melt hotspots cannot account for the rapid thinning at Kennicott Glacier. We consider the significance of ice cliffs, debris, and ice dynamics in addressing this outstanding problem.

We collected abundant in situ measurements of debris thickness, sub-debris melt, and ice cliff backwasting allowing for extrapolation across the debris-covered tongue (the study area and the lower 24.2 km^2 of the 387 km^2 glacier). A newly-developed automatic ice cliff delineation method is the first to use only optical satellite imagery. The Adaptive Binary Threshold method accurately estimates ice cliff coverage even where ice cliffs are small and debris color varies.

Kennicott Glacier exhibits the highest fractional area of ice cliffs (11.7 %) documented to date. Ice cliffs contribute 26% of total melt across the glacier tongue. Although the *relative* importance of ice cliffs to area-average melt is significant, the *absolute* area-averaged melt is dominated by debris.

At Kennicott Glacier, glacier-wide melt rates are not maximized in the zone of maximum thinning. Declining ice discharge through time therefore explains the rapid thinning. There is more debris-covered ice in Alaska than in any other region on Earth. Through this study, Kennicott Glacier is the first glacier in Alaska, and the largest glacier globally where melt across its debris-covered tongue has been rigorously quantified."

COMMENTS
COMMENTS RELATED TO THE REBUTTAL TEXT'

_On line 265 of the document (in the authors' reply to reviewer 1): you show as original and new paragraph exactly the same text! Please clarify here if and how you made changes to that text.

It looks like we mistakenly put the same text in for the rebuttal text: our apologies. The entire paragraph was re-written as was the discussion for the last iteration following Reviewer 1's comments to reduce repeated text.

_Text on line 590: there is a "in" missing I assume?

Original text:

"Expanding and thickening debris cover should reduce glacier thinning relative to glaciers without debris (Banerjee, 2017; Gibson et al., 2017), but the melt-suppressing effect of debris is not always apparent the observed thinning patterns of glaciers even when debris is thick and debris coverage is extensive (e.g., Kaab et al., 2012; Gardelle et al., 2013)".

It should be:

Expanding and thickening debris cover should reduce glacier thinning relative to glaciers without debris (Banerjee, 2017; Gibson et al., 2017), but the melt-suppressing effect of debris is not always apparent IN? the observed thinning patterns of glaciers even when debris is thick and debris coverage is extensive (e.g., Kaab et al., 2012; Gardelle et al., 2013)".

The 'in' was added as suggested.

_Lines 765 and following: In response to a comment by Reviewer 2: Krajeenbrink et al (2017) only consider ponds, not ice cliffs, in their melt estimates for HMA. I would also say that the evidence available until now suggests that the two do not melt at the same rate. So I suggest you rephrase the sentence you have added:

"While we do not explicitly document the melt rate of ponds and streams (i.e., melt hotspots) we follow Kraaijenbrink et al. (2017)'s approach and assume they melt at the same rate as ice cliffs. Using this

logic, in order for ice cliffs (melt hotspots) in the ZMT to compensate for the insulating effects of debris, ice cliff (melt hotspot) area would need to increase from 11.7% to 90% of the glacier surface. Ice cliffs, ponds, and streams assuredly do not occupy 90% of the ZMT. This again suggests that ice cliff and other melt hotspots do not control the location of the ZMT."

I would recommend that in this paragraph you simply state that you do not address ponds and streams here, that you will do it in a follow up publication, but that, given current estimates of their contributions to ablation, their inclusion will not change your main conclusions.

Reviewer 2 from the last round of reviews provided a clear way to include the plausible effects of these melt hot spots which we followed. It makes our analysis much more complete and therefore makes sense that we include it.

Through the three iterations of the review we have already changed the inclusion of ponds and streams in this manuscript multiple times. Reviewer 2 requested that ponds and cliffs be removed in the first round of review, then asked me to include them as we have for the minor revisions iteration. Now we are being asked to remove them again.

Everything written in the paragraph in question is factually accurate and the assumptions are clearly stated following Krajeenbrink et al (2017)'s approach and Reviewer 2's suggestion.

Here is Reviewer 2's full comment from the last iteration, which we followed for the latest revisions:

"L98-99. I think it's fine to relegate the analysis of streams and ponds to another paper, but if these are also potential contributors to surface mass balance, doesn't this cut your thesis short? I.e. you are no longer able to make a statement for all melt hotspots combined, but only for cliffs. Now, we certainly know that there are few ponds on Kennicott, and their location is different to the TMZ; why not simply pretend they melt at the same rate as cliffs (somewhat as in (Kraaijenbrink, Bierkens, Lutz, & Immerzeel, 2017)) so that your ablation budget is complete? Streams are even more problematic, since they are prevalent and unconstrained. I make this point not to criticize your work; I am convinced that the hotspots are only part of the explanation and that ice dynamics are vital to explain the debris cover anomaly. I just this your huge amount of work here will be much stronger by representing these somehow (even as a hypothesis test)."

We clearly state in the text that we 'assume that all melt hotspots melt at the same rate as ice cliffs.' Our methodology is very clear and the assumptions have been stated. We do not want to cite a future paper of ours to make this point that may or may not actually make the exact calculations that are included in the text now. This sensitivity analysis regarding ice cliffs and streams also naturally follows from the other sensitivity analyses in this section of the discussion. For these reasons and following the suggestion of Reviewer 2 we include the text below:

"While we do not explicitly document the melt rate of ponds and streams we follow Kraaijenbrink et al. (2017)'s approach and assume that all melt hotspots melt at the same rate as ice cliffs. Using this assumption, in order for melt hotspots to compensate for the melt-reducing effects of debris in the *ZMT*, melt hotspots would need to cover 90% of the glacier surface, specifically in the *ZMT*. This assuredly is not the case."

_Line 802: provide the source of that 20% value (your own digitisation).

Ok, the sentence now reads: "As of 2015, 20% of Kennicott Glacier was debris-covered (based on manual digitization of a Landsat image)."

_Line 876 and following: on uncertainty of ablation measurements: how do you combine the uncertainty in the marking and the uncertainty due to the tilt of the stake? Can you please explain?

Here is the updated text:

"We estimated uncertainty using data from all ablation stakes based on the uncertainty in marking and measurement as well as the tilt of the stake. We assume a ±2 cm error in the distance measurement along ablation stakes. The average-measured tilt of the ablation stakes was 5° from vertical. Bare-ice melt rates were also measured at several locations in the northeastern portion of the study area on the Root Glacier."

Depending on the ± of measurement error along the stake different tilt will change the uncertainty of the final measurement.

_Line 946: the reviewer suggested added reference: "L231-2. Makes sense to reference (Steiner, Buri, Miles, Ragettli, & Pellicciotti, 2019) here". And I would agree with that, even if this is one of our studies.

Ok, reference added.

_Line 970: I agree with the reviewer that you should provide units.

The units were already stated at the end of the sentence so there is now need to add them in again. Furthermore for the equations below: we use the to inform the reader about the model but do not make any calculations using those equations. We could put in units but it limits our aim, which is to teach the reader about the model.

COMMENTS RELATED TO THE REVISED TEXT
The following comments and lines refer to lines of the revised paper (in track-changes):

_Line 1340:
«Greater surface elevation changes»: say if these are positive of negatine, I assume you refer to thinning patterns here?

This was fixed by referring to 'thinning' instead of 'surface elevation changes.'

_Line 1434: I would remove this sentence
"leaving a detailed examination of other melt hotspots for another contribution.", or rephrase it. The sentence has it is grants an explanation of why they are not included here, and does not add much to the paper. There will most likely be a second contribution, and readers will be aware of it.

The inclusion of this text was suggested by Reviewer 2 in the last round and it reconciles issues related to mentioning hotspots but then only addressing ice cliffs in detail in this manuscript.

As this is a very minor issue and we prefer to keep the text as is and to keep the sensitivity analysis in as well. This text keeps the reader from wondering if we address the other hotspots in this manuscript and points them to the sensitivity analysis that was also suggested by Reviewer 2 in the discussion. See comments above regarding this additional sensitivity analysis.

_Line 1442
I would add, after (DEMs), “but showed that the method is sensitive to the DEMs resolution and its predictive skills diminish for coarser resolution”.

We do not see the need to go into the details of performance for the respective ice cliff delineation methods. Adding this sentence distracts from the main direction of the paragraph so we prefer to keep the text more simple as it is.

_Line 1448
Consider removing: “thereby addressing the questions outlined above»

removed as recommended.

_Line 1496: I would remove “better”

We clarify this so our intent is more clear. The sentence now reads:

“For debris to be incorporated into large-scale models, debris thermal properties and onglacier meteorology must also be documented as they vary across glacier surfaces.”

_Line 1566: I would rephrase as: We DEVELOP an automated algorithm to delineate ice cliffs from optical satellite imagery.

Changed to ‘develop’ as suggested.

_Line 1567 and previous occurrences: WorldView (WV) satellite- check where you use WorldWiew as a word for the first time, provide the acronym there and be consistent in its use. You have used both acronym and extended word in the text before this occurrence.

We only use WorldView in the text now. Thank you for catching that.