Dear Dr. Glen and co-authors,

Thank you for your revision of the manuscript, and apologies for my delayed response.

I appreciate the efforts put into the revision. The manuscript has significantly improved, particularly in the presentation of the slush area partition between bare ice, ice slabs, firn aquifers, and other firn areas, and in the first-order quantification of the radiative impact of slush fields.

However, I feel that one of my core concerns was not properly addressed: how slush is identified and labelled in the training data. Figure S1 is illustrative, but it confirms what I had suspected. The clustering algorithm classifies pixels into clusters, yet it remains unclear what the distinct physical meaning of each cluster is, and on what basis the expert decided to label one cluster as slush and another as non-slush. For instance, in Figure S1d,e,f (reproduced below), the upper-left part of the scene appears to be a large slush field with varying shades of blue. More specifically, the area within the black rectangle appears to me as predominantly slush. Yet the clustering algorithm allocates many pixels in that region (shown in red and orange in S1e) to clusters later categorized as non-slush (turquoise pixels in S1f). I understand that some clusters are unambiguously white snow and others are clearly open water, but the number of non-slush pixels in the upper-left area of Figure S1d,e,f raises questions about the uncertainty introduced by the inclusion or exclusion of certain clusters from the "slush" label. In other words, the manuscript still does not clearly illustrate where, and on what quantitative basis, the expert observer draws the line between slush and non-slush.

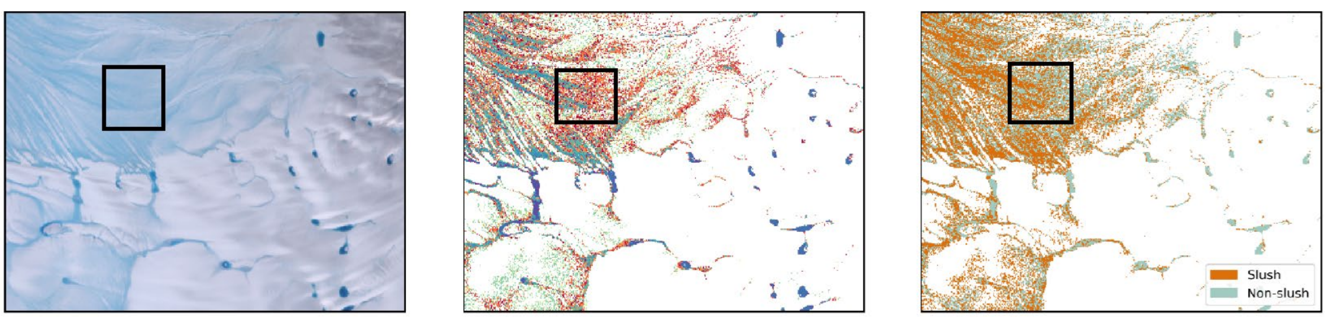

Figure 1. Reproduction of Figure S1d,e,f

I recognize that this cannot be easily fixed, as the labelling was done long ago and the RF classifier has since been trained on these labels. I therefore suggest the following additions:

- A zoomed-in version of Figure S1d,e,f that illustrates this limitation explicitly.
- A statement — potentially in the discussion — acknowledging that due to the single-expert labelling approach and the absence of a "transitional slush/non-slush" label that

would reflect the natural ambiguity an observer faces when categorizing a continuous process, the training labels carry an inherent and unquantified uncertainty.

- An *ad hoc* analysis of the training labels to improve reproducibility: specifically, what range of "blueness" ended up being classified as slush (if the observer assignmed clusters based on visual inspection of the RGB imagery). Blueness could be quantified using standard metrics based on saturation and hue, yielding threshold values (± some measure of spread) separating dry snow from slush and slush from open water. This would make the labelling process more transparent and reproducible.

In addition to these concerns, I have a few minor comments listed below. Please correct me if any of these points are already addressed in the text.

I am confident that addressing the comments above would bring the manuscript to the highest standards and make it suitable for publication, at which point I would have no further objections to acceptance.

Yours sincerely,
Baptiste Vandecrux

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page 12 l.*73 "slush occurring outside the firn zone": this phrasing appears in several places. I would suggest replacing it with "slush occurring in the bare ice area," which directly states where it occurs rather than where it does not.

page 14 l.*07 "Fig 4b" should it be 4d ?

page 19 l.*73-*81 This would be better in the methods section.

Figure S6 and S9 — If FAC is taken as the basin-average across all pixels up to the ice divide, its value will be dominated by the large number of pixels in the upper accumulation area, where FAC changes relatively slowly. This likely dampens the apparent interannual variability and weakens the correlation. The correlation would probably strengthen if FAC were computed over an area more representative of potential slush formation. This analysis also does not reveal whether local FAC values either promote or inhibit slush formation above or below a certain threshold. An alternative, pixel-level framing may be more informative: for all slush pixels, what are the spring-time FAC values and accumulated snowmelt that precede slush formation?

Similarly, I would expect stronger correlations between slush extent and snowmelt, snowfall, or air temperature when these variables are evaluated within the area that can potentially turn into slush, rather than basin-wide. Beyond improving correlations, such an approach could allow you to establish a quantitative relationship between melt (or temperature) and slush extent. Combined with your new radiative impact estimates, an exponential response of slush extent to future warming would make for a compelling result.

page 25 l.*43-*49: Please move the description from the supplementary material into the main text and present it concisely. Put the 134 PJ d^{-1} figure in context: if this energy were used to melt ice, how much additional melt would it represent? What fraction of the ice sheet's total mass deficit does this correspond to?

page 25 l.*52-*57: I found this analysis difficult to interpret as currently presented. As I understand it, the RACMO pixels located within the mapped slush area account for 28% of modelled runoff while representing only 5% of all ice sheet pixels. However, this seems like a direct consequence of runoff being naturally concentrated in the low-elevation marginal band: the slush areas you map are by definition within the runoff zone, which is where melt is highest. I would suggest condensing this analysis and integrating it with the one at l.*43–*49, along the following lines: "Within RACMO's runoff area, slush covers X% of pixels. The runoff currently modelled from these pixels is Y Gt, but could increase to Z Gt if the additional energy absorbed by slush fields due to surface darkening were fully used for ice melt." It should also be noted that regional climate models currently struggle to accurately represent the spatial extent of the runoff zone (https://doi.org/10.5194/tc-20-427-2026).