

Overall, this revised manuscript presents a novel method of examining holes in lakes ice that are presumed to be associated with methane release. The introduction section presents the context for the research problem very well; the methods section is extremely detailed for reproducibility; the results are clearly and explicitly presented; and the discussion/conclusions wrap up the ‘story’ of the research well. I enjoyed reading this manuscript and feel that it provides a substantial contribution to lake ice remote sensing overall and stands to make major contributions towards the ability to detect and eventually through using this method on the large scale in combination with methane work, improve the quantification of total methane release from arctic lakes.

I have read the previous reviewer comments along with the author responses and believe the authors have more than adequately addressed all concerns. The main issues raised were the physical process of the slushing not being correctly identified and the overly ‘assertive’ statements regarding what the findings were showing considering there is no ground data to confirm. The authors revised the suggested mechanisms of the backscatter anomaly formation following the Reviewer’s advice and revised the content throughout to present the findings as hypothesis that needs to be confirmed in the field, though I do agree, what they are suggesting is quite plausible and physically makes sense given what I have observed from slushing on lakes that experience mid-winter temperature climbs above freezing. We also occasionally see warmer temperatures in the lower layers of the on-ice snowpack.

I believe this paper is publishable in its revised form with a few minor concerns that can be addressed at the Authors/Editor’s discretion:

Lines 81-85: The very detailed dielectric information requested by Reviewer 1 is interesting, but the authors might consider adding a few words to clarify for the reader why they are listing those GHz ranges at those temperatures (I did realize in the data section that this list aligns with the data sets but that was not clear to me at that stage of reading the introduction).

Line 145 – 151: this doesn’t fit in study area section, it reads as intro/objectives and should probably be combined with the last section of the introduction section.

In the methods, the summary of most important methods with the flow chart is great, it really helps bring together all the steps happening in the detailed pre-processing.

Lines 560 – 580, Discussion section: I think the revisions here are great, I was nodding along agreeing as I read this. The one thing I did not see in the discussion that I was hoping to see (perhaps I missed it in the results section) is why the other 29% of the holes are not in the anomalous backscatter regions. Could a sentence be added to the discussion with thoughts/comments on why this might be (perhaps the time difference? The snow had not flooded yet? or variations in the snow depth and hence moisture amounts affect the backscatter? Or more technical reasons related to the processing? Or yet unknown reasons?).

Minor typographical observations:

Throughout, lake is not capitalized when part of a name. This is perhaps normal for the naming convention of the region? The study map however does capitalize Lake, so consider revising this to match the lowercase lake throughout the manuscript.

Line 32: Placement of ‘only poorly’ reads strangely to me in that sentence, you might consider rewording that sentence, or perhaps just use ‘poorly’ if you keep the current sentence structure.

Line 123: Consider second ‘largest’ rather than second ‘biggest’

Line 124: You say ‘about’ 60 km but used ‘ca.’ in the previous sentence, consider using the same term.

Line 130: Snow Depth Liquid Water Equivalent (SDLWE), I was not familiar with that term so explored the reference, which I see is for ERA5 data. Consider mentioning that this is from reanalysis, I don’t think the acronym is used elsewhere in the paper so consider rephrasing as something along the lines of ‘Snow depth (liquid water equivalent) from ERA5 is ...’.

Section 3.6 heading – I think you can just call it ERA5 2 m air temperature since that’s all you used from the dataset, more consistent with the other headings that way. You mention here that it is from the 1979-present single level hourly data. Later in the paper you again mention its the 1979-present single level data, I don’t think you need that detail. If it’s explained in section 3.6 you can just refer to it as Era5 2 m hourly air temperature after section 3.6. This is how I am more used to seeing reanalysis data presented, however, this is my opinion not a fact to follow! Revise as you see fit.

Lines 251: Word missing? Over the lake? Or over lake Neyto?

Line 339: I think a word is missing: Yen-thresholding was in the following performed using `skimage.filters.threshold_yen` with default parameters.

Line 347: Figure 2 gives, or shows ... (remove shall)

Line 563: “leakage of liquid water” I would say flooding – but its just semantics. To me, leaking implies ‘dripping’ while flooding implies ‘over the surface’.