

Using Sentinel-2 imagery and a water identification algorithm, the authors analyze the seasonal evolution for the years 2014 to 2019 at the 79N glacier in northeast Greenland. They analyze their results alongside topographic, climatic and surface mass balance data to assess the role of these factors in lake evolution.

While there have been numerous studies of lake evolution in Greenland, this study focuses on an area of the ice sheet where there are few studies of supraglacial lakes. The study also devotes substantial attention to the role of climatic factors in lake development, in a way that many previously published papers do not. Therefore, I believe that this paper will be of substantial interest to the scientific community.

Key Comments

There are some key areas/issues that I think could be improved in a revision:

- I would like to see more explanation and justification of the lake identification method. A brief explanation and reference is provided within, but I think more detail needs to be provided, especially with it being a new approach. Key things I'd like to see are
 - Why is this method used rather than other often-used NDWI or band-thresholding approaches? Reference to Williamson et al. (2017), which assesses various methods, would be appropriate here.
 - How exactly are the bands used to distinguish water from ice/slush?
 - What are key limitations? Will some slush be falsely identified as water? Will some streams be identified as lakes or is there a shape criteria to avoid this?
 - Why is depth not calculated?
 - Why are lakes below 0.015km² not included?
- Following from that, given that the average size of lakes in 2018 is 0.02km², eliminating lakes below 0.015km² seems like it will lead to a substantial amount of lakes being missed, distorting some analysis. I suggest considering a lower cut-off. If not, this limitation needs to be stated.
- The discussion leads off with, and primarily focuses on, comparison with Antarctic studies. Comparison with Antarctic studies is worthwhile too, but I would be more interested in comparison with other areas in Greenland. The well-studied W/SW (e.g. Miles et al 2017, and numerous others), and Petermann Glacier in northwest Greenland, at a similar latitude to this study (Macdonald et al., 2018).
- One of the key interests regarding supra glacial lakes is how they drain, especially given the role this can play in dynamics, but there is little mention of it in this study. It is okay that if drainage speed or mechanism is not systematically studied, but it would be good to make some comment on your assessment of how lakes drain based on your observations.
- I think a few figures need substantial work to make the study clearer - Fig. 3 and 1 in particular. More below.
- There are parts where the structure and paragraphs needs some review. I ask the authors to review this generally - assess whether material is in the correct section (i.e. intro v results v discussion v conclusion), and check for sentences that seem out of place with theme of paragraph. Some key suggested changes:
 - The NAO is not mentioned at all in the introduction and then takes substantial space in the discussion. I think this needs to be indicated as a theme in the intro given its

- significance - some of its discussion in the discussion section can be put in the intro.
- A large part of the conclusion seems out of place. New discussion is brought in - e.g. the Neckel et al. reference part
 - I think the conclusion needs substantial work. In addition to the above comment, in addition to the summaries of each year, I think the key take aways need to be highlighted and, importantly, there should be some discussion of the wider implications of the findings.

A small suggestion: perhaps it would be worth looking at the role of atmospheric rivers. See Mattingly et al. (2020) - all references at the bottom.

Overall I very much enjoyed reading this valuable study and hope that these points can help the authors to make the most out of the hard work they have put in. I provide line-by-line remarks/suggestions below.

Line-by-line and figure comments

L34 - “meltwater drainage channels” ?

L36 - “and therefore **they** absorb...”

L47 - “have investigated **the relationship between** the seasonal evolution...”

L55 - Sundal et al. say “Since the ASTER image used for the test was acquired at a later stage in the melt season, the percentage of unidentified **lake area at the start of the summer is likely to be somewhat higher than 12%**”

L56-58 - this sentence about Sentinel 1 SAR seems out of place and without explanation, since the next sentence is instead about Sentinel 2.

L60-61 - this sentence about what you do in this study does not fit well with the structure of the intro. It led me to think you were about to elaborate on your own approach, but you go back to background discussion.

L66 - please provide some elaboration on the point about teleconnection signals.

L79 - “whether **and how**”

L93 - it would be more useful to give the approximate return time at high latitudes than the equator

L167-168 - Specify for where this fact refers to. Also, I suggest leading the paragraph/section with your results and mentioning this later - it seems odd to lead a results section with results from the literature.

~L175-180 - I note an inconsistent use of tense. I don't mind if in present or past tense, but check for consistency.

L178 - Careful to be specific. Does July refer to July in all years? Have just been referring to June 2017 so not totally clear. Check always clear with this. Also consider starting a new paragraph here.

L203 - “largest peak **total** SGL area” - check clear on this sort of thing in all instances

L204 - “smallest peak **total** SGL area”

L207-209 - Rephrase for clarity. I think part of issue is ‘close up’ can be read as in ‘close up to something’.

L215-216 - Rephrase - something like “Given sufficient meltwater availability, the location of lake formation...”

L223-4 - You say earlier that you don’t identify lakes below the grounding line due to issues with lack of DEM and them moving. So I assume this is based on visual analysis? If so, mention in the methods that you will do this.

L223 - “the lakes move position laterally” is not clear. Do you mean they advect downglacier with the flow of the glacier (e.g. as in Macdonald et al 2018 and Langley et al 2016)?

L225-226 - please rephrase this for clarity

L233-235 - it seems odd to make a first mention of depth here. If you make some assessment of depth in this way, you should mention it in the methods section. Also, I’m uncertain what ‘not shown’ means - I think not in any of the figures? It would be good to at least show an example in a supplemental figure. If you need to convey ‘not shown’ anywhere, please state what you mean more specifically.

L236-238 - this paragraph seems out of place.

L246 - I think for this audience you should explain what ‘skin temperature’ means

L270 - “agreement **with**”

L430-L432 - Please be explicit about what your point is here. I assume you’re suggesting that the calving event possibly implies warm temperatures?

L469 - Do you mean to say “Not only local meteorology ...but also SMB prior to pond development”. A reader might think from the sentence structure that you’re implying “not only local but regional”. Please state.

L472-3 - I believe here you mean across the Greenland Ice Sheet, but since you don’t state it might read as if you mean for the study area.

L474 - I would lead with comparison to Greenland, see main points at the start.

L493-4 - “however **a high amount of** accumulation can ...and **reduce** melting”

L505 - “second largest **total** (?) SGL area” And I think I know what you mean by ‘spread’ (a broader area?), but please explain

L555 - ~”While we do not consider meltwater channels in our analysis and focus only on SGLs...”

L558-61 - state where this Schröder study focuses on. And I do not think you need to explain here that S1 SAR works without sunlight.

L564 - Given the title of the paper refers to 79N Glacier, it seems odd to summarize the study as being of the 'North East Greenland Ice Stream'

L573-75 - leave out the reference to Schröder in conclusion, leave that to earlier sections, and just make your assessment here.

L580-81 - This sentence about volume measurements is out of place in the paragraph and section

Fig1

Please provide a small map showing location within Greenland. (Newly-released QGreenland may help with this).

Please mark on the groundling line.

Please label the 'NE Greenland Ice Stream'. This is mentioned in paper but it's not clear how it fits in with 79N Glacier.

I suggest showing and labelling the wider study area in a satellite image/mosaic. Then show terrain height on that, or make it a separate panel.

Is it important to show calving in main figure? The calving event is a very minor part of the paper.

Fig2

Since you refer to months in the text, please put them on the x axis.

I find this color scale difficult - the change from 0 to 300 isn't a lot, making it hard to decipher medium or smaller changes.

Fig3

I find it very difficult to make an assessment of what is happening in this figure without spending a while looking at it. Perhaps consider having a zoomed in sample site. If you use this approach please label July/August on the figures themselves, and consider using a satellite images as the background (though I understand that may not work if other surface features make it busy)

Fig5

Can you make the scale consistent with Fig2? If not the scale itself, please make the labels consistent (i.e. add day of year, and add month labels to Fig2)

References

Bartholomew et al (2011) - <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011GL047063> (not mentioned above but seems particularly relevant, as looks at observations of temperature and upglacier spread of lake drainages)

Macdonald et al (2018) - <https://www.cambridge.org/core/journals/annals-of-glaciology/article/seasonal-evolution-of-supraglacial-lakes-on-a-floating-ice-tongue-petermann-glacier-greenland/3FB0176ABB47735A10DFB8F72E47534D>

Mattingly et al (2020) - <https://journals.ametsoc.org/view/journals/clim/33/16/jcliD190835.xml>

Miles et al (2017) <https://www.frontiersin.org/articles/10.3389/feart.2017.00058/full?sa=X&ved=2ahUKEwiL-eX06pHnAhUPnq0KHarTC7oQuAIwLXoECBIQAg>

Williamson et al (2017) <https://www.sciencedirect.com/science/article/pii/S0034425717301918>