Review of Mahagaonkar et al: Recent Evolution of Supraglacial Lakes on ice shelves in Dronning Maud Land, East Antarctica.

This study investigates the intra-seasonal and inter-annual evolution of supraglacial lakes in Dronning Maud Land, East Antarctica. The authors detect supraglacial lakes in Landsat-8 and Sentinel-2 satellite imagery from 2014-2021 for five ice shelf regions. They compare SGL area and volume with near-surface air temperature and positive degree days from the reanalysis model, ERA5 to climatologically explain SGL variability.

Overall, this manuscript is well-written and the figures are clear and informative. However, I have concerns about this paper's contribution to the field. Generally, it does not provide new information that is not already presented in other studies. Given the more specific comments listed below, I believe that major revisions are required.

Major comments

1) There are many previous studies that present surveys of supraglacial lakes for a specific region (Stokes et al., 2019 does so for all of East Antarctica, including DML). As such, this work feels incomplete without further investigating the climatic controls on supraglacial lake evolution in DML, especially since this is listed as an objective of this study (L65).

Further, the discussion section reads more as a literary review, providing little new information and insight into SGL evolution. Authors mention several times that the climatic factors that explain SGL development and evolution differences are still unknown and should be further investigated (i.e. L336, L359, L447, L471). I believe that this study should be expanded to provide additional insight into these climatic controls, especially for regions where air temperature and positive degree days do not explain SGL variability. For example, in L310 – what is the common factor controlling melting throughout the region? Similarly, in line 320, what are the local processes that also influence melting and ponding? This study feels incomplete without a further investigation into these climatic controls and local processes that impact meltwater ponding in DML.

2) The citations (especially in the introduction) are outdated and incomplete. Some specific examples are listed below:

- L30 – Is there a newer source that could be cited here? i.e. Johnson et al., 2022
- L34 – Banwell and MacAyeal 2015 is a more appropriate citation for ice shelf flexure and fracture.
- L34 – Please replace the DeConto and Pollard 2015 citation with: Banwell et al., 2013 and Scambos et al., 2009
- L35 - Please add a citation for "increased buttressing"
- L36 – This Kuipers-Munneke 2014 paper is on firn air depletion, not firn aquifers please cite (**https://doi.org/10.1002/2013GL058389**) instead.

- L41 – There are several newer studies that look at the pervasive meltwater ponding on the Antarctic Peninsula (Leeson et al., 2020, Banwell et al., 2021)
- L46-48 - Langley et al., 2016 look at the seasonal evolution of supraglacial lakes on an outlet glacier in DML and should be mentioned here (also in L87-89).
- Lenaerts et al., 2016 should be Lenaerts et al., 2017
- L53 – 60 – many citations are missing in this paragraph including: Leppäranta et al. 2013, Liston et al. 1999, Dunmire et al. 2020
- L58 – Add Moussavi et al. 2020
- L77 – Add Bell et al. 2017
- L84 – Add Lenaerts et al. 2017
- Dunmire et al. 2020 should be cited in several places (L426 for "partial surficial freezing and subsequent insulation of deeper meltwater", L437-440 for DML lake drainage).

3) Finally, there are several other satellite and in-situ observations that could be utilized to expand this analysis. I believe that using microwave imagery (e.g., from Sentinel-1) would help paint a more complete picture of DML lakes. For example, in L379, can this be investigated with microwave imagery? Additionally, does the seasonal evolution pattern you observe throughout the melt season match backscatter signals from Sentinel-1 indicating surface melting (L399)? Because the seasonal evolution is a large part of this paper, I believe it would be beneficial to compare with Sentinel-1, a satellite with year-round frequent observations. Sentinel-1 observations could be further used to see when/if lakes freeze completely (L430-435).

Further, extensive in-situ meteorological observations are available from Neumeyer station in DML. Why were these observations not utilized?

Minor comments

L17 – Please specify which ice shelves showed "no significant meltwater lakes"

L29 – Specify that runoff is not significant *on Antarctica*

L49 – What do you mean by "major" ice shelves? Buttressing capacity? Size?

L59 – What do you mean by "simple configuration"?

L78 – 80 – No need to cite Trusel et al. 2013 twice in this same sentence.

L80 – 82: Please remove the sentence: "The ice shelves of Dronning… East Ragnhild Glaciers" as it is not necessary.

L98 – 100: Please reword this sentence beginning with "We did not use the cloud detection…" as it is confusing.

Why were the 5 ice shelves used in this study chosen over other ice shelves in DML?

Sections 3.2-3.3: It is unclear to me where you followed methods from other papers and where you did not. For example, in lines 117-22, was this still following Moussavi et al 2020 or did you use different thresholds? If the method is the same as work previously published, then the text can be simplified greatly. If not, please explain why you chose not to follow previously established methods. Also, are there any periods for which data is lacking? If so, please explain.

L141 – Why do you use a threshold to exclude shallow lakes? I would think that by excluding shallow lakes you lead to an underestimation of SGLs as shallow lakes are still lakes!

Section 3.4 – It is my understanding that the estimation of lake depth and volume is largely based off previously published methods? If so, this section can be greatly reduced.

Figure S1 – Why does Landsat 8 estimate greater depth for deeper lakes?

Section 3.6 – why do you use ERA5 here?

L219 – How were the manually digitized lake boundaries created? Were they created completely independently from the automatic lake masks?

L228 – I believe that uncertainty with depth calculations should be considered as well in the uncertainty range for lake volume.

L240 – 250 – This section is a bit confusing to me and I think could be reworded for simplicity.

Table 1 – What is the vertical curve on the left-hand side of the table (over the ponding/advection phases column)?

L 258 – Refer to Figure 3 for the different ice shelf regions.

L265 – What do you mean by “viz.”? (also L507)

L266 – Specify what are the years with high melting.

L268-269 – Please include error when quantifying lake depths.

Figure 3 – I think it would be nice to also include the blue ice areas in this figure.

Line 280 – More specifically, what is different about the Fimbulisen/Muninisen firn pack? Less blue ice? More firn air content?

Figures 4 and 5 – Please change the color of the dot used on the Antarctica map to show the ice shelf location to something that stands out more clearly.

Section 4.3 – Is ERA5 not too coarse to resolve local katabatic wind effects?

L364 – Please include a citation after “relict lakes”.

L370 – Specify which region you are referring to – DML or the grounded ice sheet?

L385 – 389 – Please quantify the “limited meltwater production compared to snow accumulation”

L406 – What “feedback mechanisms”? Larger differences in the extents of ponding compared with what?

L437 – “No evidence of subglacial drainage of lakes…”. This statement is incorrect (Dunmire et al. 2020)

L440 – “Direct drainage into the ocean…” Are you referring to horizontal overflow drainage? If a lake drains vertically on an ice shelf it will likely drain to the ocean.

L444-445 – “r = ~0”. Is there a figure for this? I have a hard time believing there is no correlation! From what region are you taking the near-surface temperature from? i.e. just areas where melt occurs or a larger area including upstream grounded ice or ocean?

L455 – “high-resolution climate modeling over Dronning Maud Land”. What about RACMO (ie Lenaerts et. al 2017)?

L463 – Unnecessary to mention Fohn winds since they do not form in DML.

L483 – “Such shelves…” Which shelves? Do these shelves align with where melt is observed?

Technical corrections

L9 – “can cause firn air depletion” → “can potentially lead to firn air depletion”

L15 – move “ice shelves” after “Riiser Larsen, Nivlisen, and Roi Baudouin”

L17 – Please rephrase the sentence beginning with “Despite large interannual…” as it is a bit confusing

L21 – remove “in total, it”

L23 – Add “, ice-shelves…” after “Fimbulisen and Nivlisen”

L24 – Please change “the region” to “Dronning Maud Land” and “Dronning Maud Land” to “this region” in L25.

L35 – “destabilizing the ice sheet upstream” → “increasing upstream ice velocity”

L55 – “simpler” → “possible”

L56 – Add a comma after “clouds”

L127 – “pixel configuration” → “resolution”

L127 – “As in case of Landsat-8” → “Again,”

L160 – Add “However,” before “Since Sentinel-2…”

L199 – Replace “near-surface” with “2 m” and remove “, measured 2 m above the ground” in the next line.

L206 – “melt seasons” →“melt season”

L223 – Add a comma after “size”.

L233 – Remove “Judging”

L234 – Please reword this sentence to: “From the climate reanalysis data (Figure 2a), air temperature peaks around mid-January,…”

Table 2 caption: “ices helves” →“ice shelves”

L423 – Replace “draining” with “horizontally overflowing”

L475 – Move the Kuipers Munneke 2014 citation after “ice shelves” on the next line.

L482 – “liner” → “linear”

References

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