

Referee # 1 Comments

L10 (and elsewhere): I wonder if the lake volumes would be better quoted in metres cubed? The cubic kilometres numbers are very small indeed, and on line 27 discharge rate from lakes is discussed in cubic metres per second.

CB response: change made as above

L14-15: I'm not convinced that the paper does show that 'background winter ice motion can trigger rapid lake drainage'. Rather the paper indicates that lake drainage occurred in the absence of surface melting and discernible ice flow acceleration.

CB response: Line has been edited to now read "The findings show that lake drainage can occur in the winter season in the absence of active surface melt and notable ice flow acceleration. . ."

L19: 'by reducing' would be more specific than 'via their effects on'.

CB response: change made as above

L53: Missing space.

CB response: change made as above

L54-55: I suggest that 'In another study, proglacial stream evidence from one study suggested that water was released from englacial or subglacial stores' is deleted.

CB response: Have deleted and moved Rennermalm reference to previous sentence, as appropriate.

L56-57: The wording here suggests that this evidence was linked to the Rennermalm study, which I assume (based on the dates of the studies) it was not.

CB response: edited to read "On another occasion, proglacial stream evidence together with the appearance of surface collapse features on the ice sheet were used to suggest that . . ."

L102: 'Orbit File Application' (to fit with the way the other stages are worded).

CB response: We are choosing to keep the phrase in this form as this is the precise wording in the SNAP workflow that is used by Google Earth Engine.

L103: 'Geocoding' or 'Orthorectification' might be a better term as otherwise this could be confused with correcting backscatter for local terrain-derived incidence angle.

CB response: Added 'orthorectification' in parentheses for clarification but retained original Terrain Correction as that is the name of the step in the SNAP workflow used by GEE.

L114-115: This sentence is slightly repetitive and awkwardly worded.

CB response: edited to read "To examine changes in lake behaviour, we created a time series of mean backscatter for each lake through each winter season using Sentinel-1 imagery."

L115: 'over the winter' might be better after 'process'.

CB response: Changed as suggested

L152: 'summed' might be better than 'added'.

CB response: agreed. Changed as above

L187: This error seems to have been calculated by adding the component errors in quadrature (which is the correct method). The same method should be used for calculating the error in differencing the ArcticDEM (see comment below).

CB response: Agreed. Change has been made as above.

L192: ICE should be subscript.

CB response: Changed as above.

L199: Should the DEM errors not be added in quadrature to determine the error in the DEM difference calculation? $\sqrt{0.2.^2 + 0.2.^2} = 0.28$ m

CB response: Agreed, change has been made as above.

L227: 'single image transition' - state what time period this is - 12 days?

CB response: Changed as above

L264: 0.08 should be 0.28 I believe if the correct error calculation is used.

CB response: Agreed. Change made as above.

L267: To be consistent the ArcticDEM differencing error should be included again here.

CB response: Agreed. Change made as above.

L323: 'most' would be better as 'best'.

CB response: changed as above.

L332: 'physically based depth measurements' should be 'empirically based depth estimates' (or something along those lines). These are not really measurements as such, but rather estimates (here and in the following section).

CB response: changed to "physically based depth estimates"

L349: Is there a missing 'in' in this sentence?

CB response: changed as above.

Referee # 2 comments:

L 13: change "demonstrating" to "which demonstrates"

CB response: changed as above

L 55: I suggest adding a reference to Lampkin et al. 2020 here

(<https://www.frontiersin.org/articles/10.3389/feart.2020.00370/full>)

CB response: changed as above.

L 57 and 60: change "suggested" to "suggests"

CB response: incorporated into edits from Referee #1

L 122: I suggest adding a reference to Dunmire et al. 2020 here

(<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020GL087970>)

CB response: added above

L 138: Sentence that begins with "Lakes were also checked" is confusing

CB response: edited sentence to read "Time series were also checked for a dip in backscatter prior to the large rise (see 'C' in Figure [\ref{fig:timeseriesprocessing}](#)). In the instances where the magnitude of the dip was greater than 25% of the magnitude of the sudden increase, the lake was removed from consideration as a draining lake."

L 161: Section 2.5: I suggest renaming this section "Elevation change from photoclinometry". When I first read the section header I thought that both photoclinometry and DEM differencing would be included in this section. I think

the “and elevation change” is somewhat misleading.

CB response: Changed as above

L 162: Change “This technique: to “photoclinometry:

CB response: Changed as above

L 236: Change “signifying” to “signify”

CB response: Changed to “that signify”.

Figure 3: In the caption, please comment that the red outlines signify the lake margins detected from optical imagery.

CB response: changed as above

L 266: Section 3.3: I suggest changing “the ArcticDEM” to “ArcticDEM differencing” in the section heading

CB response: changed as above

L 281: The sentence beginning with “ The use of an NDWI_ice – based mask...” seems out of place in this paragraph and I got lost while reading this part.

CB response: Sentence replaced with “Delineating lakes based on optically visible water means that the lake outlines may omit possible subsurface water obscured by an ice lid.”

Figure 7: I suggest using a non-diverging color scale when indicating elevation changes between 0 and 12.

CB response: change made as above

Figure 8: It is more appropriate to use a diverging color map that is symmetric (centers on 0). At first glance it appears that the green indicates an increase in elevation everywhere outside the lake but I believe this is not the case?

CB response: changed as above.

L 229: Change “changes in SAR backscatter” to “SAR backscatter changes”.

CB response: changed as above.

L 469: Appendix section A4: What do you mean by “Process” for this section header?

CB response: changed to “Photoclinometry point sampling”

Appendix Figure B1: Again, I suggest using a non-divergent color scale to indicate velocity between 0 and 1000 m/yr.

CB response: changed as above.

Appendix Figure C1: Comment that the red boxes surround the lakes in this study.

CB response: changed as above.