The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-143

Adam Emmer (Referee)

Referee comment on "Dam type and lake location characterize ice-marginal lake area change in Alaska and NW Canada between 1984 and 2019" by Brianna Rick et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-143-RC1, 2021

This study provides insight into the evolution of ice-marginal lakes in the Alaska and NW Canada between 1984 and 2019 by employing supervised classification and semi-automated lake area delineation from Landsat images. The authors present novel findings and the text reads well. I find this study thematically suitable and of potential interest for the readers of The Cryosphere.

I have four more general (methodology-related) comments and a couple of specific ones.

The first general comment is related to inventory building. Using a semi-automated classification, you could possibly be missing some lakes identified as other features (false negatives); while you eliminated possible false positives by manual assignment of qualitative characteristics, this won't help you dealing with false negatives in a systematic way. Optimally, mapping outcomes of semi-automated classification would be checked against existing (e.g. sub-regional) inventory (you mentioned some in the intro), or manually prepared subset (e.g. manual mapping of 100 lakes to see the performance of semi-automated approach in terms of possible false negatives).

The second comment is related to possibly missed fill-drain events (outbursts) typical for ice-dammed lakes (briefly mentioned on L104-107). This is actually quite important issue in my opinion (especially for formulating outburst hazard implications); I'm wondering whether any insight can be gained from histograms of pixel values used for mosaicking (for instance if two peaks of values in bare land and water spectra can indicate there was a lake outburst)? Please provide more discussion on this issue of possibly short-lived lakes (maybe a separate discussion section)

The third one is related to dam type classification scheme. Your classes (Section 2.3.1) are defined in a clear, straightforward way. However, my experience from Peru is that I've

been often facing cases where assignment to one of the classes was not at all straightforward in reality. For instance, I frequently observed lakes dammed by bedrock dam with discontinuous moraine cover (I ended up classifying these lakes as lakes as 'combined dams'). Sometimes, it was not possible to assign a dam to any of the classes, e.g. because of low quality / poor resolution of satellite imagery (and so I introduced 'not specified' dam category). Moreover, lake dam type can change in time (e.g. a shift from ice-dammed to bedrock-dammed is not rare). I'm also wondering whether you have observed any possibly landslide-dammed lakes in your inventory? Please comment on / discuss whether you've been facing similar issues when manually classifying lake dam types.

It is not fully clear how disappeared lakes (and there are many in fact) are considered and treated in statistics of total lake area change (e.g. Tab. 2), see also my specific comments; please provide more methodological details on that

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Specific comments:

L33: GLOF may also result from dam overtopping; dam breach is a sub-type (one of mechanisms) of dam failure in my understanding

L56: can supraglacial lake also be located on debris-free glacier?

L85: you may consider confronting results of these previous Alaska-focusing studies in separate discussion section

L94: A separate figure (workflow) depicting individual steps of the procedure, input and output data would be beneficial for readers

L112: can 'supraglacial debris' located on a glacier be distinguished from 'just debris' located elsewhere based on the spectral profile?

L117: pixel is areal unit (doesn't need to be squared)

L119: maybe you could specify date of images RGI is based on in your study area

Fig. 2: These examples with false-color images are not very illustrative in terms of diustinguishing different lake dam types; (e-f) instead of (d-f)

Fig. 4: part a: you show drainages of lakes for individual periods (e.g. 11 drainages of moraine-dammed lakes in 1984-1988) – does it mean that you actually have insights into the within-period lake dynamics (and it is not blurred by mosaicking as described in methodology)? Please clarify

L208: please unify Number of lakes (e.g. Fig. 4a) and frequency (e.g. Fig 5a) or explain the difference

L214: how did you actually deal with possibly merging lakes? Have you observed any such a case? Please comment

L224: 130 disappearing lakes from 791 total lakes is quite high number; if these were GLOFs, you observe 16.4 GLOFs per 100 lakes, which is extremely high ratio

L234-255: I suggest to start with % of lakes which actually experienced change and describe them in more detail in this chapter; taking into account lakes which did not experience areal change is confusing (and resulting in median change of 0.00 km^2 which is not very useful insight in my opinion)

Tab. 2: isn't this statistics biased when disappeared lakes are not considered – I mean, If you would consider 791 lakes instead of 661 lakes in this table, the overall pattern of lake area would be different I guess (count disappeared lakes as lake area decrease); further, I suggest to mention also min and max values, so the reader can get an idea about the range of observed values (median is ok, but I'm also interested in extremes); please consider re-designing this table

L257-258: you mentioned that most of the lakes did not experienced detectable change – how can then median change on subregional level when considering all lakes be 0.04-0.06 km^2 (I would expect 0.00 as well km^2)?

Tab. 3: an interesting indicator could be lake area per deglaciated area

Fig. 7: please consider plotting relative cumulative lake area against relative cumulative

lake count (that could provide clear insights what % of the largest lakes (count) represent what % of total area); analogically to Lorenz curve

L281: some part of discussion are more results (e.g. section 4.3)

Fig. 8: please specify how many lakes are plotted in this figure

L315: 'loss of an ice for'?

Fig. 10: captions on x axis are confusing (if this is a change rate between two periods, both should be included, e.g. (1984-1988 to 1997-2001); (1997-2001 to 2007-2011); and (2007-2011 to 2016-2019), or similar)

L395-400: I think that important control of possible transferability of observed evolutionary patterns is topographical (relief) similarity (shape of a hypsometric curve of a mountain range); please consider taking this aspect into discussion

L414: please replace 'basins' by 'parts of the study area'

L459: second?

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To sum up, I'm convinced this is valuable contribution to our understanding to dynamics of lake evolution in deglaciating mountain landscapes of Alaska and NW Canada. This study is undoubtedly worthy publishing as soon as some revisions are made. I suggest moderate to major revisions (especially methodological issues should be clarified, see my general comments).

Kind regards

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