

The Cryosphere Discuss., referee comment RC1  
<https://doi.org/10.5194/tc-2021-302-RC1>, 2022  
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## Comment on tc-2021-302

Anonymous Referee #1

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Referee comment on "Contrasted geomorphological and limnological properties of thermokarst lakes formed in buried glacier ice and ice-wedge polygon terrain" by Stéphanie Coulombe et al., The Cryosphere Discuss.,  
<https://doi.org/10.5194/tc-2021-302-RC1>, 2022

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In general, the Introduction, Background, Methods and Discussion sections were well-written and easy to follow. The figures are clear and easy to understand. Interesting research, well presented. The conceptual model and Figure 7 are well done.

### Major edits:

(1) The Results section was confusing in terms of structure, order of the data, how the data were discussed, etc. Some examples of confusing groupings, structures, and statements:

(a) Radiocarbon dates and glacier retreat timing are discussed in the "Spatial distribution" section.

(b) In the "Morphology of lakes" the authors discuss deep vs. shallow, whether lake bottoms are smooth, etc., but the information is vague and doesn't seem to match the data in the figures. They say deeper lakes have smoother lake bottoms, but it doesn't look like they do from the figures. Is this statement based on statistical analyses?

I think the addition of more data tables would help clarify the salient results, especially for the three lakes (G, K, L) that were analyzed in detail. I do not know how the written part of Results section can be made more organized and clear, but I ask that the authors rethink the structure of the Results section and try to reorganize if possible.

(2) Page 15, Line 24–27: Here you discuss that the two sediment cores reveal two distinct basin types, but given that you only have two lake cores, this statement is a reach. If you took cores from four lakes (two shallow and two deep) you might end up with four distinct basin types or one of the deep lake cores might look similar to one of the shallow lake cores. I think the number of samples ( $n=2$ ) prevents you from definitively stating that there are two distinct basin stratigraphies for the shallow vs. deep lakes. Sample duplication is needed to make that general statement.

(3) Page 22, Fig. 1: What data did you base the mapped “glacier positions” on? Need to support these glacier positions with field and/or remote-based data that definitively shows past glacier positions (moraines, ice-contact lake deposits, etc.).

(4) The article would be strengthened by the inclusion of a data table showing the lake morphology results for all of the lakes.

#### **Minor edits:**

Page 1, Line 20: “remotely-sensed”

Page 1, Line 23: Maybe change to “subsidence. They later”

Page 1, Line 27: I do not understand what “if any” means here.

Page 1, Line 32: “massive ice, they”

Page 2, Line 1–4: long sentence

Page 2, Line 21–22: This sentence is confusing

Page 2, Line 27: em dash in “2–5”

Page 3, Line 2: “amounts”

Page 3, Line 32: em dash in "2-3"

Page 4, Line 11: em dash in "1981-2020"

Page 4, Line 11: should maybe be "189 mm/yr" or "189 mm yr<sup>-1</sup>"

Page 4, Line 13: em dash in "100-500"

Page 6, Line 11: "lakes"

Page 6, Line 30-32: This is a run-on sentence.

Page 6, Line 32: "discuss" seems like a strange verb here.

Page 7, Line 9: "Patterns of distribution emerge on this level" is confusing. On what level?

Page 7, Line 12: Which valley?

Page 7, Line 12: "clustering in short distance" is vague.

Page 7, Line 14: Here you say "highest densities occur directly in front of contemporary glaciers and within the extent of local mountain glaciations," but based on Fig. 6d it looks like there are high densities within the mapped extent of the LIS too. Please clarify.

Page 7, Line 18: Need "yr" in "120 <sup>14</sup>C yr BP"

Page 7, Line 30: "bottoms"

Page 8, Line 1: "K and L are 5.5 and 5 m, respectively, below"

Page 8, Line 3: please specify again what the "second group of lakes" are – the shallow lakes?

Page 8, Line 6: "platforms"

Page 8, Line 10: "depths"

Page 8, Line 22: "kicked saturation level up again" is too informal. Maybe "increased saturations levels"

Page 8, Line 22: "(unpubl. data)." Why not just publish the data here? Is the plan to publish it in an upcoming paper – therefore it cannot be published here? Is the author of those data not an author on this paper?

Page 8, Line 24: Maybe say "On its margin" rather than "On its side"

Page 9, Line 2: Please specify which "unit" you are talking about here. "Did not reach the bottom of this unit" is confusing due to vagueness.

Page 9, Line 12–13: Please specify how moisture content is measured/reported here. Is it gravimetric or volumetric?

Page 9, Line 22: Do you mean "shifts" instead of "sifts"?

Page 9, Line 26: what does "bottomed" mean? Do you mean "bottom"?

Page 10, Line 20: is there a better way to say "broken horizon"? Disturbed? Faulted?

Page 11, Line 4: I think there is an extra space between "content" and "measured"

Page 11, Line 4: Please specify which unit you are talking about here.  
Page 11, Line 19: "which do not reflect"

Page 11, Line 20: "Similar to"

Page 11, Line 21: delete "down" after the word "settle"

Page 11, Line 22: should be a comma after "terrestrial runoff,"

Page 11, Line 22: Maybe change to "aeolian activity, and/or 3)"

Page 12, Line 11: Capitalize "Last Glacial Maximum"

Page 12, Line 12: Maybe replace "in" with "through" so it reads "channeled through major"

Page 12, Line 12: "terminated"

Page 12, Line 22: delete dash between "and" and "meltwater"

Page 13, Line 12: Can you be more specific than "since the mid-Holocene" here in terms of timing?

Page 13, Line 13–14: This sentence "This situation applied ..." is confusing. Do not understand what you mean.

Page 13, Line 20: "preceded"

Page 13, Line 25: I don't think it should be a semi-colon in "year; the rate" because the second clause is not a complete sentence.

Page 13, Line 30: Put period after the citations.

Page 13, Line 33: Can you provide a citation for the statement that kettle lakes should be very smooth and close to a perfect circle? There are kettles, like Walden Pond in Massachusetts, that are not circles and that do not have smooth shorelines. So, the statement needs a citation.

Page 14, Line 6: "of evaporation and/or partial or complete"

Page 14, Line 12: "It influences the mixing"

Page 14, Line 19: Since all other verbs are past tense, change to "controlled"

Page 14, Line 25: Looks like there is a high dash between "L" and "The stronger." Please fix.

Page 14, Line 33: "the open-water period as compared"

Page 15, Line 17: This part is confusing since you say "There are four key arguments" but then you only list three. Is the "Moreover, analysis of lake morphometry" section the fourth argument? If so, it needs to be numbered and indented.

Page 15, Line 29: Replace "It suggests" with "This suggests"

Page 16, Line 2: "and that slumping and thaw subsidence"

Page 16, Line 3: "hydrological and ecological"

Page 22, Fig. 1: In the left part of the figure the study area seems to be shaded in (light yellow). Please mention this in the caption or delete the shading. As is, it is confusing.

Page 24, Line 3: "slump found as buried glacier ice" is confusing.

Page 25, Fig. 4: On both Lakes (K and G) the second panel in black does not have a label.

Please label.

Page 26, Line 3: Since early June is actually spring, I think this should be labeled as "late spring" and not late winter.

Page 27, Fig. 6b: Please provide a color scale and key for this figure. Even though the caption states that red denotes sediment accumulation, the other colors are not explained and the scale of the colors is not explained.

Page 27, Line 2: "120 yr BP to present" or "~1900 to 2020"

Page 27, Line 3: "unvegetated"

Page 29, Fig. A1: In caption, please explain the open circles and the error bars. Are the error bars based on a 2-sigma or 95%? What are the open circles denoting – are these outliers? Total ranges?

Page 31, Table A4: Why are the thaw settlement values red and bold?

Page 31, Table A4: Please provide a citation for footnote 3 "Values typically found in these materials."