

AUTHOR RESPONSES TO EDITOR COMMENTARY ON MANUSCRIPT 2022-38

Manuscript ID#: **2022-38**

Title: **Significant underestimation of peatland permafrost along the Labrador Sea coastline**

First Contact: **Yifeng Wang**

Second Contact: **Robert Way**

EDITOR

[Authors' Response]: We thank Dr. Hauck for taking the time to review the referee reports and our responses to each of the comments. We greatly appreciate their consideration of this manuscript. We have responded to the three referee reports below and have made corresponding changes to the revised manuscript. A summary of implemented changes has been included as follows:

SUMMARY OF ALL CHANGES:

[1] All technical corrections were incorporated as suggested.

[2] All corrections to figures were incorporated as suggested.

[3] We have clarified that the sediments in L336 are frost-susceptible sediments.

[4] We have clarified the discussion on the thickness of ice lenses that may develop in fine- versus coarse-grained sediments.

AUTHOR RESPONSES TO REFEREE 1 COMMENTARY ON MANUSCRIPT 2022-38

Manuscript ID#: **2022-38**

Title: **Significant underestimation of peatland permafrost along the Labrador Sea coastline**

First Contact: **Yifeng Wang**

Second Contact: **Robert Way**

REFEREE 1

[Authors' Response]: We thank Referee 1 for taking the time to provide helpful comments and revisions on our manuscript. We appreciate their constructive review, which has certainly helped to improve the manuscript. We have responded to each comment below and have made corresponding changes to the revised manuscript. A summary of implemented changes has been included at the bottom of this response.

COMMENTS TO THE AUTHORS

Ln 94 consider changing “solid precipitation” to “snow”

[Authors' Response]: We agree and have changed “solid precipitation” to “snow”.

Ln 107 change to “kyr BP”

[Authors' Response]: We agree and have changed “k years BP” to “kyr BP”.

Ln 113 “flat deposits” or “flat surfaces” – ie only over sedimentary deposits or over bedrock as well?

[Authors' Response]: We agree and have changed “flat deposits” to “flat areas”.

Ln 124 change “does become” to “is”

[Authors' Response]: We agree and have changed “does become” to “is”.

Ln 188 change to “quality-control check”

[Authors' Response]: We agree and have added a hyphen to change “quality control check” to “quality-control check”.

Ln 241 change “possibly” to “possible”. Although, in text, the term “possibly” is used, it is best to best consistent with terms used in final mapping and as relating to Figures 4 and 5.

[Authors' Response]: We agree and have changed “possibly” to “possible”.

Ln 245 “limited to the largest” – suggest adding in brackets, an indication of what minimum surface area this represents. Example (\geq ## m²). At present it is unclear what is meant by the largest.

[Authors' Response]: We have changed the sentence to clarify the minimum size of the peatland permafrost landforms that were included in the inventory. This is also mentioned in Section 3.2.1 Identifying wetlands of interest (WOIs).

Ln 288 change to “possible”

[Authors' Response]: We agree and have changed “possibly” to “possible”.

SUMMARY OF CHANGES:

[1] All technical corrections were incorporated as suggested.

AUTHOR RESPONSES TO REFEREE 2 COMMENTARY ON MANUSCRIPT 2022-38

Manuscript ID#: **2022-38**

Title: **Significant underestimation of peatland permafrost along the Labrador Sea coastline**

First Contact: **Yifeng Wang**

Second Contact: **Robert Way**

REFEREE 2

The detailed response by the authors to the review comments is very much appreciated. Revisions have been made to the manuscript to address the review comments, such as including additional material and clarifications (e.g. clear definition of study area). These revisions have improved the MS and in my view it is acceptable for publication with a few very minor revisions (mostly editorial) as outlined below. I look forward to seeing the published paper.

[Authors' Response]: We thank Referee 2 for taking the time to provide helpful comments and revisions on our manuscript. We appreciate their constructive review, which has certainly helped to improve the manuscript. We have responded to each comment below and have made corresponding changes to the revised manuscript. A summary of implemented changes has been included at the bottom of this response.

COMMENTS TO THE AUTHORS

L37 – “activities” could probably be deleted

[Authors' Response]: We agree and have removed “activities”.

L51 – Suggested revision: “...peatland permafrost occurrence has...”

[Authors' Response]: We agree and have added “occurrence” to the sentence.

L327 – Do you mean permafrost persistence rather than landform persistence?

[Authors' Response]: We agree and have changed “landform” to “permafrost”.

L332 – “support” might be a better word than “protect”

[Authors' Response]: We agree and have changed “protect” to “support”.

L336 – Are you referring specifically fine-grained sediments here?

[Authors' Response]: We have clarified that we are referring specifically to frost-susceptible sediments, or sediments capable of facilitating frost heave. This is based on the findings of Allard

and Rousseau (1999), who compare deposits of clayey silt with deposits of sandy-silty clay in the formation of palsas versus peat plateaus.

L 380-381 – Heginbottom et al. (1997) refers to a conference paper rather than the circumpolar permafrost map itself the reference of which is Brown et al. (1997): Brown J, Ferrians Jr. OJ, Heginbottom JA, Melnikov ES (1997) Circum-Arctic map of permafrost and ground-ice conditions. U.S. Department of the Interior, U.S. Geological Survey, Map CP-45 The same comment applies to the reference to Heginbottom et al. (1997) in the Supplementary Information. You could just cite Heginbottom et al. (1995) since you are referring specifically to the Permafrost Map of Canada.

[Authors' Response]: We have changed the "Heginbottom et al. (1997)" reference in L380-381 to "Heginbottom et al. (1995)". We have changed the "Heginbottom et al. (1997)" reference in the Supplementary Information to "Brown et al. (1997)".

L511-512 – You should give page numbers for the paper

[Authors' Response]: We have revised the reference and included the page numbers for the paper instead of the number of pages of the paper.

L524 – The URL should be provided for the website

[Authors' Response]: We have revised the reference and included the URL for the Canadian Climate Normals website.

Section S5 L58 – This should be “larger scale permafrost distribution products” since the various national and circumpolar scale maps mentioned are smaller scale products.

[Authors' Response]: We agree and have changed “smaller” to “larger”.

SUMMARY OF CHANGES:

[1] All technical corrections were incorporated as suggested.

[2] We have clarified that the sediments in L336 are frost-susceptible sediments.

AUTHOR RESPONSES TO REFEREE 3 COMMENTARY ON MANUSCRIPT 2022-38

Manuscript ID#: **2022-38**

Title: **Significant underestimation of peatland permafrost along the Labrador Sea coastline**

First Contact: **Yifeng Wang**

Second Contact: **Robert Way**

REFEREE 3 (DR. STEVE KOKELJ)

I have reviewed the revised manuscript and the Authors' responses and commend them for robustly addressing comments. Some relatively simple adjustments have improved the manuscript, such as clarifying the spatial scope of the inventory. I note that the Authors have included some additional figures in the main body of the manuscript to better explain methods or support results and interpretations. Reviewers' requests for further detail on methods or interpretations were addressed by some elaboration or additions of text, and by adding material to the Supplement. The revised version explains the inventory methods and workflow better and provides some interpretation of variation in the landform type. The study is straightforward yet represents a good empirically-based contribution to the knowledge of permafrost distribution and periglacial landforms over an important region of northeastern Canada. The data, analyses, and synthesis are sufficiently robust to warrant publication in *The Cryosphere*. I expect the paper will be well cited because of its regional significance, straightforward, and clearly expressed methods, and because it highlights the importance of empirical datasets in understanding the thaw-sensitivity of Arctic Landscapes.

[Authors' Response]: We thank Dr. Steve Kokelj for taking the time to provide helpful comments and revisions on our manuscript. We appreciate their constructive review, which has certainly helped to improve the manuscript. We have responded to each comment below and have made corresponding changes to the revised manuscript. A summary of implemented changes has been included at the bottom of this response.

COMMENTS TO THE AUTHORS

P3 L69. In the first review, developing hypotheses were suggested to help a reader understand the scientific focus of the paper and to frame the methods and analyses. In the revised version, I don't think that the hypothesis as stated is explicitly tested in the study, so consider either reframing it or stating it more generally as a few objectives that allow a reader to understand the logic behind what is going to be presented and how it will be analyzed. So for example, Objectives were to develop inventory methods to.....; evaluate the distribution of permafrost peatlands to.....; compare the empirical data to model products to While this may be more of a point of style, I think slight improvement and additional information will help better frame a good study and help a reader understand what to expect in the manuscript.

[Authors' Response]: We have reformatted the last paragraph of the Introduction as suggested and have outlined three objectives:

- 1) *To use a multi-stage, consensus-based review process, coupled with extensive validation efforts from a combination of field visits and low-altitude image and video acquisitions, to develop a point inventory of contemporary peatland permafrost complexes in coastal Labrador*
- 2) *To characterize the distribution of peatland permafrost in coastal Labrador using selected climatic and physiographic variables*
- 3) *To provide insights into the reliability of relevant peatland permafrost and permafrost distribution products, which currently claim an absence or low abundance of both peatland permafrost and permafrost along the Labrador Sea coastline*

I find the addition of Figure 2 helpful. Is there the possibility of linking an oblique shot to the imagery so that others attempting to map similar features have a point of visual reference?

[Authors' Response]: We agree and have revised the figure by including oblique shots of two example areas to provide nadir and oblique perspectives of the same wetlands of interest and by removing two of the original example areas to avoid overcrowding the figure.

Pg 16 L297-303. The addition of text describing different forms and their frequency of occurrence has been helpful.

[Authors' Response]: Thank you.

I would suggest adding a reference to Figure 6 on P16 L297-303.

[Authors' Response]: We agree and have added a reference to Figure 6 on P16 L298.

P18. L330-333. Do the Authors think that drainage may contribute to the resilience of permafrost in Labrador peatlands? I am not familiar with the terrain, however, in the poorly-drained Taiga Plains, lateral degradation due to advection contributes to the rapid expansion of collapse scars and basins. I raise this only as a point of interest given that they suggest extremely large thermal offsets.

[Authors' Response]: We do think that drainage plays an important role in permafrost resilience. We recognize that we do not discuss drainage in particular detail in this study, as it focuses primarily on identifying contemporary peatland permafrost complexes rather than identifying past peatland permafrost landforms through mapping of collapse scars or thermokarst ponds. However, our research group is currently working to investigate historical changes in the lateral extent of palsas and peat plateaus in selected complexes, where drainage is expected to play an important role in long-term changes. Thermal modelling may also help to address questions related to the importance of drainage and heat transfer through water flow in palsas and peat plateaus.

P18. I don't follow the logic behind vertical ice lens size distribution and grain size. Slight elaboration would be helpful so the physical basis for the statement can be understood without going to Allard and Rousseau, 1999.

[Authors' Response]: We have revised the sentence to focus more on differences in the thickness of ice lenses between finer versus coarser sediment types.

Figure 7A-D. Please distinguish the inventoried area.

[Authors' Response]: We have revised the figure and included a black boundary for the study area in each of the four maps to distinguish the inventoried area.

P21 L403-404. This section reads well and provides a helpful discussion of the inventory's strengths and weaknesses.

[Authors' Response]: Thank you.

Figure S6. Is there a scale unit missing for map A?

[Authors' Response]: We have added the units of metres as "(m)" to the legend for map A in Figure S6.

SUMMARY OF CHANGES:

[1] All technical corrections were incorporated as suggested.

[2] All corrections to figures were incorporated as suggested.

[3] We have clarified the discussion on the thickness of ice lenses that may develop in fine- versus coarse-grained sediments.