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The Cryosphere Discussions

Interactive comment on "Scenario-based climate change modelling for a regional permafrost probability model of the southern Yukon and northern British Columbia, Canada" *by* P. P. Bonnaventure and A. G. Lewkowicz

Anonymous Referee #2

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General Comments

The paper address relevant scientific questions related to permafrost distribution under past cooler and future warmer conditions in western Canada. In terms of broader impacts, the paper applies to societal concerns of areas that may be sensitive of future warming and resulting subsidence of permafrost. The paper present somewhat novel concepts, ideas, tools, and data to reach somewhat substantial conclusion. The scientific methods and assumptions appear to be fairly clearly outlined, although additional details are required (see below). With these additions, the description of experiments

and calculations will allow reproduction in other high altitude and high latitude areas of the world. The authors give proper credit to related work and clearly indicate their own original contribution. The overall presentation is well structured, but needs additional information for assessment. The number and quality of references is appropriate; however, the amount and quality of supplementary material is not appropriate; the paper refers to multiple previously published works, but does not adequately describe/summarize these works to allow the reader to make an informed decision about the validity of this paper.

Specific Comments

In the Methods section, the authors fail to mention two important modeling variables: 1) the resolution of the DEM used in the analysis and 2) how permafrost was predicted in areas that were not indicative of BTS measurements. The DEM resolution will impact the applicability of regional modeling on a continental scale (see discussion/concerns below). The BTS method raises concerns about how permafrost was predicted in areas that are snow-free. Snow accumulation greatly impacts ground temperatures ; however, it is unclear how BTS measurements are extrapolated or corrected for in areas that are wind blown and generally snow free.

The authors stat the degrees K are preferred for scenario changes so that confusion doesn't occur with changes in MAAT. Unfortunately, I think this adds more confusion to the paper than what is necessary. SLR are reported in C/km, whereas temperature change scenarios are presented in K. In my opinion, a consistent temperature system should be used, preferably degrees C throughout the paper.

In the results section, figures are referred to in the text in a non-sequential manner. i.e. – figure 4, figure 5, and figure 9 on page 10. This is confusing to the reader and doesn't permit the reviewers to properly analyze the data presented.

The results section is over simplified so that a reader may unfortunately skim over the result. There is not enough emphasis placed on the change in permafrost distribution

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through the various modeling scenarios. A table is needed so that readers can verify the significance of differences between each scenario.

I also agree with reviewer #1 that scenarios need to be run for 3 and 4 K (preferably C) so that a reader/reviewer can properly assess the changes that occur at 1 degree increments.

Figures 3 to 7 do not follow cartographic rules. The figures have too many classes which are not discernible. A maximum of 5 classes should be used so that the reader can make an informed decision about the change among scenarios. Also, the maps employ a dichromatic color scheme, which is incorrect. Positive permafrost probabilities should be represented with one color and varying the value of brightness or value. The current figures are interpretable because these cartographic rules were not followed.

My greatest concern is related to the scale issues common throughout this paper. A regional model is presented; however, local, detailed accounts of permafrost distribution are presented at the hillslope scale for Figures 11-13. It is unclear how detailed SLR at specific locations apply to a regional , continental scale model. The authors attempt to correct this with a detailed inset diagram in figure 14, but then quickly revert to a generalized susceptibility model in figure 15, which very much resembles the continuous, discontinuous, and sporadic map presented in figure 1. The authors need to address these scale concerns before the manuscript is acceptable for publication.

Technical Corrections

Building upon the corrections listed by reviewer #1....

Correct “thru” with “through”

The comma usage for however clauses is consistently used incorrectly throughout the paper. A comma is required before and after the “however” clause.

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Interactive Comment