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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 #1

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The manuscript "Scenario-based climate change modelling for a regional permafrost probability model of the southern Yukon and northern British Columbia, Canada" presents estimated effects of stepwise changes in air temperature (-1 K, +1 K, +2 K and +5 K) on the steady state permafrost distribution in north-western Canada based on a equilibrium permafrost probability model (Bonnaventure et al., 2012). The region experiences winter-time inversions in surface lapse rates (SLR) through the forested zone. The results of inverted SLRs on an annual basis are increased permafrost probabilities in valley bottoms in areas of high continentality while in more maritime environments,

SLRs are gentle but normal, so that permafrost is less common at low elevations. The paper concerns an interesting topic that I believe has great interest within the "permafrost community", but also for scientists in general working with effects of climate changes along elevation transects. The paper is well written and easy to follow. However, I have some remarks and questions that have to be clarified before the paper can be accepted for publication.

I find the title of the paper rather misleading since no climate (change) modelling is present in the paper. Rather, the modelling focuses on the effect of stepwise changes (-1 K, +1 K, +2 K and +5 K) on a equilibrium permafrost probability model. Why does the modelling exclude +3 K and +4 K? These numbers are more to the core of the air temperature projections by 2100 of the IPCC (2007). I suggest that the modelling is repeated with +3 K and +4 K and that the results are included in the text.

In the model SLRs are assumed to be constant (-6.5 °C km-1) above the treeline. This is clearly a model limitation. Could you provide any information on the observed spatial distribution of SLRs above the treeline?

Which period does "present day" refer to?

Page 4519, line 20-27. Precipitation and hydrological changes are not effects of climate change on permafrost. Does surface refere to the ground surface or permafrost surface? (if it is ground surface, this is not a permafrost effect).

Page 4523, line 10-15. You should not validate your model with other models. All models may have the same shortcomings, so that the results are incorrect even though the results are similar.

Reading the paper I have some difficulty understanding the suggested level of confidence in the model / usefullness of the modell for the society. On one hand you state that (Page 4524, line 3) "it must be emphasize that we are exploring the impacts of scenarios of past cooling and potential future warming in this paper, rather than indicating

that such changes took place or will take place" (rather modest). On the other hand, you state in the conclusion (with limited previous discussion on this) that "The use of these models in understanding the patterns of potential permafrost loss are of direct use to climate adaptations strategies as well as resource and linear infrastructure-route planning in the region" (rather bold). At what detail should these models be used?

It is sometimes difficult to understand if the SLRs are above or below the treeline (e.g. Page 4532, line 15)

Under model limitations it should be mentioned that no concerns on changes in snow conditions are considered.

Page 4532, line 26-29. I do not understand this sentence.

Fig. 1. What are the temperature conditions of the different climate regions? I miss information on this also in the text. Further, what does the "modeling locations" refer to (this paper presents modeling for the entire region)? Please include Pleasant Camp in the map or explain where the sites is in the text. Make sure that all sites mentioned are present in the map or properly explained where they are.

Please improve the reference list - Bonnaventure et al. 2012 is missing, include DOIs when available (see also below)

Technical corrections:

Page 4518, line 9. One extra "that"

Page 4522, line 23. Use SLR, explained earlier in the text

Page 4524, line 1. Replace "colder" with "lower"

Page 4524, line 4. Add a d to "emphasize"

Page 4525, line 8. Replace "colder" with "lower"

Page 4525, line 17-19. Rewrite sentence (strange structure)

Page 4525, line 21. Delete "also"

Page 4525, line 18. Write out RM

Page 4531, line 15. Replace "cold" with "low"

Page 4535, line 4. ACIA, 2005 in text, Arctic Climate Impact Assessment in References.

Page 4536, line 1. DEMR(1974) in text, Department of Energy Mines and Resources in References.

Page 4542. What is RM?

Interactive comment on The Cryosphere Discuss., 6, 4517, 2012.