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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

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Please see attached supplementary files containing line by line track changes.

We thank the editor, Dr. Tingjun Zhang, for his comments. We have now uploaded a text file with the changes tracked to show our responses to the reviewers. In addition, our earlier detailed response indicated that we considered each of the comments that were made for which we made reference to the original lines in the manuscript. The track changes file shows that we have taken very seriously both the detailed remarks

and generalized remarks such as those of referee 2 who stated "The results section is oversimplified so that a reader may unfortunately skim over the result. There is not enough emphasis placed on the change in permafrost distribution through the various modeling scenarios. A table is needed so that the reader can verify the significance of differences between each scenario." We greatly expanded the description of the results and included a new table. In sum, we believe that we have responded to the extent possible to the reviewers. We have given our reasons wherever we have not been able to respond or disagree with the reviewers' suggestions. Regarding the editor's comments, we certainly agree that snow cover is an important control on permafrost distribution in the discontinuous zone. We have done the following to make this clear: (1) Changed the title so that it refers to air temperature change, not climate change; (2) Inserted a sentence in the abstract (second sentence) that acknowledges the limitation; (3) Added a sentence in the last paragraph of the Introduction (sentence 2) to state the limitation and clarified in sentence 3 that only the air temperature is perturbed; (4) Added a phrase in Conclusion 5 to indicate the limitation. Regarding BTS measurements, we do not use them in the traditional manner employed in the European Alps. The BTS values are predicted using the input variables of solar radiation, equivalent elevation and slope. The modeled BTS field is then calibrated by logistic regression from the direct observations of presence or absence of frozen ground in hundreds of pits and ground temperature monitoring sites. In the perturbed model, the input variable of equivalent elevation is changed to reflect alterations in MAAT, but the relationship between the newly modeled BTS temperature and the probability of permafrost is assumed to stay the same. Therefore, changes to snow cover are not taken into account in a functional way and cannot be incorporated into the model. The importance of snow was briefly explored in Lewkowicz and Ednie (2004) by developing two logistic regression curves, one for low and one for high snow conditions. However, there is essentially no means to transfer these curves to the rest of the region. Therefore, this element of climate change cannot be explored at present. Regarding what is new about this paper, we have added a sentence in the

final paragraph of the Introduction indicating what is new and have followed it with an explicit goal: “This paper is based on perturbing the mean annual air temperature field in a regional model previously developed to show the probability of permafrost under current climatic conditions (Bonnaventure et al., 2012). The objective of the scenario-based modelling presented here is to reveal the degree and spatial pattern of potential permafrost loss, highlighting how this varies across the study region.” We hope that the additional information provided in this response and the uploaded file with changes tracked will assuage the editor’s concerns and permit publication.

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/6/C3098/2013/tcd-6-C3098-2013-supplement.pdf

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