

# ***Interactive comment on “Quantifying uncertainties of permafrost carbon-climate feedbacks” by Eleanor J. Burke et al.***

## **Anonymous Referee #2**

Received and published: 31 January 2017

### Overall Evaluation

This manuscript presents the results of a study that couples three land surface models with vertically stratified soil carbon to an intermediate complexity climate and ocean carbon uptake model to explore climate uncertainties in the context of permafrost carbon-climate feedbacks. The results of this study provide additional information about the impact of permafrost carbon-climate feedbacks in comparison to past studies that have not explored the full range of uncertainty across different climate models. The study also explores a fuller range of uncertainty than has been explored across land surface models. The study provides additional corroboration of the finding of MacDougall et al. (2012) that the permafrost carbon feedback has a greater impact on low emission scenarios than on higher emission scenarios. The study also finds that structural differences among the land surface models are a larger source of uncertainties

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than among the climate models. Finally, the study proposes the Frozen Carbon Vulnerability (FCV) metric that can be derived from the simulations to quantify the permafrost carbon response for particular pathways of global temperature change. The FCV may particularly useful to include in integrated assessment methodologies.

In general, I like the design of this study, and the analyses are quite competent. The presentation is very straight forward, and the manuscript is well written. There are of course substantive issues with how the land surface models treat soil carbon, but resolving those issues is beyond the scope of this study which does a very good job of communicating the need to reduce such uncertainties. I think this is a very good first-order study that provides some nice information on the range of uncertainties associated with both structural differences and differences among climate models/scenarios. My comments below are all minor.

#### Specific Comments

Page 1, line 28: Change “this range reflecting” to “these ranges reflecting”.

Page 2, line 3: Change “between climate models” to “among climate models”.

Page 2, line 5: Change “is dependent on” to “depends on”.

Page 2, line 20: Change “large stocks ... is stabilised” to “large stocks ... are stabilised”.

Page 2, line 22: Change “Adding the” to “The addition of” to avoid dangling participle.

Page 3, line 24: Change “theory” to “approach”.

Page 4, line 1: Change “0.1 and 0.8” to “0.1 to 0.8”.

Page 8, lines 1-4: It seems to me that the last two sentences of section 2.1 are redundant.

Page 9, line 26: Change “is itself dependent” to “itself depends”?

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Page 11, line 6: Change “spun up” to “spin up”?

Page 12, line 1: Change “10 times each time followed by 2 year run of the full” to “10 times, with each time followed by a 2-year run of the full”?

Page 12, line 9: Change “In order to” to “To”.

Page 12, line 20: Change “in order to” to “to”.

Page 15, line 1: Change “north America” to “North America”.

Page 18, lines 12 and 13: I think this is the first use of “Arctic” in the manuscript. I suggest change “Arctic”, which has several connotations and has not been defined in the manuscript, to “northern permafrost region”.

Page 21, line 5: Change “eprmafrost” to “permafrost”.

Page 22, line 21: Change “in order to” to “to”.

Page 23, line 1: Correct spelling of “Schadal”.

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