

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

### **Anonymous Referee #4**

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#### Overall Evaluation:

The manuscript by Burke et al. quantifies uncertainties of the permafrost carbon – climate feedbacks from three perspectives: future emission scenarios, different climate sensitivities and regional climate change patterns, and land surface models with different land surface processes. The paper addresses a timely and important topic, which fits the need to increase our understanding of permafrost carbon – climate feedbacks for the aim to constrain future climate projections. In the work, three versions of land surface models were coupled to a intermediate complexity climate and ocean carbon uptake model. The study showed the ranges of additional temperature increases caused by permafrost carbon feedback by year 2100 and 2300. The different representations of land surface processes, especially about soil carbon decomposition, in land surface models can introduce bigger uncertainties than climate models in estimat-

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ing the permafrost carbon – climate feedbacks. The response of permafrost carbon to climate is found to be dependent on the temporal trajectory of warming as well as the absolute amount of warming. Finally, the authors proposed a new policy relevant metric which is considered to be useful for integrated assessment of mitigation scenarios. Those results are meaningful and can serve as a valuable reference for related work. In general, in my opinion, the study is competent and indicates original contribution in the experiment design. The results were thoroughly analyzed and the conclusions are significant. The manuscript is written well with a clear structure and fluent language.

I only have a few specific comments for the authors to consider:

- Page 1, Line 21: Change “ Simulations were performed” to “Those simulations ...”
- Page 2, Line 7: “more complex land surface models”, more compare to what?
- Page 2, Line 20-21: please rephrase this sentence.
- Page 6, Line 25: please mention the names of the two different parameterisations right there in a parenthesis after “Two different parameterisations”.
- Page 12, Line 10: should the “two ORCHIDEE” be “the ORCHIDEE”?
- Page 12, Line 12-14: I feel the definition of permafrost carbon is not necessarily to be given here because it has been given in the very beginning in Page 2, Line 20 and also in Page 7, Line 27. Maybe you can just simply write here that the permafrost carbon refers to the old permafrost carbon.
- Page 13, Line 9: give the definition of continuous permafrost here in parenthesis.
- Page 13, Line 10: should the discontinuous permafrost be defined as more than 50% but less than 90% of a grid cell underlain by permafrost?
- Page 17, Line 10-11: Again, the definition of non-permafrost soil carbon has been given in Page 16, Line 8-10. Perhaps it is not necessary to be given here again.

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- Page 18, Line 2: “Less”, should here be “more” according to the figure.
- Page 20, Line 14, the last sentence is not finished . . .
- Page 36, the figure caption: Change “the vegetation carbon and change is” to “the vegetation carbon and its change are”.

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