

Earth Syst. Dynam. Discuss., referee comment RC1  
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## **Comment on esd-2022-34**

Anonymous Referee #1

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Referee comment on "Northern-high-latitude permafrost and terrestrial carbon response to two solar geoengineering scenarios" by Yangxin Chen et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2022-34-RC1>, 2022

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The authors used a suit of models to explore the potential impact of solar engineering on permafrost carbon dynamics. They mainly found that the permafrost carbon feedback will be greatly inhibited in the scenario of solar engineering, and the permafrost ecosystems remains a carbon sink and the solar engineering will delay the transition of ecosystem carbon cycle from sink to source.

First, the historical simulations have a large deviation from the observed permafrost in terms of area and active layer thickness. The model evaluation needs to be performed in a great detail. Such model deficiency could definitely introduce significant biases into our understanding of the solar engineering impact on the permafrost dynamics. Whether these biases would undermine the main results and conclusions are yet to be determined. The authors should explore the model biases and their potential sources, and discuss the potential impact of these biases on the results. Such model biases would also be present in the simulated terrestrial carbon components such as NPP and ecosystem respiration.

Second, I strongly disagree with the use of permafrost carbon throughout the manuscript. Almost all of the models did not really consider the permafrost carbon processes (freezing impact on decomposition, cryoturbation etc). Moreover, the models could even fail to capture the magnitude of permafrost carbon storage. The use of observation soil carbon data in this study did not consider the yedoma carbon pool, and the results presented here would therefore definitely mislead the readers. All of the expression related to permafrost carbon should be removed, since this is nothing to do with the real permafrost carbon dynamic processes.

