

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2022-34

Anonymous Referee #2

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-RC2>, 2022

The authors studied how the permafrost extent and terrestrial carbon fluxes and pools are in response to two solar geoengineering scenarios, ssp245 and 585 scenarios based on CMIP6 simulations. The topic is timely and fits the scope of the journal Earth System Dynamics. The paper is well structured and the results are well illustrated in the figures. However, the authors need to put more effort to explain how the difference in surface climate between solar geoengineering scenarios and ssp245 affects soil surface temperature, NPP, and ER. Vegetation response to climate forcing plays a major role here. It is strange that G6solar and G6sulfur have lower radiation or summer temperature than ssp245, but they still have higher NPP and ER. Also, snow duration and surface litter are important insulators for soil freezing and thawing. I suggest the authors should mention these aspects in their discussion. Finally, the authors should polish the language further and avoid some grammar mistakes.

Specific comments:

Title: to be more specific, like "two solar geoengineering scenarios"

Abstract:

Line 18, reduce -> reduces,

Line 18, "including" makes readers confused

Line 20-23: I suggest the authors describe more clearly what four scenarios are. Are they two solar geoengineering scenarios based on the settings of ssp245 and ssp585 respectively?

Line 25 to 30: to report results in a quantitative way.

Introduction:

Line 35: "driven by Arctic amplification", this sentence has a logical mistake. More rapid warming in the north than in the south actually means Arctic amplification.

Line 36: renders -> render

Data and methods:

Line 118: Is the G6sulfur run based on the setting of ssp585?

Line 122: You need to give some arguments on why the baseline period uses 20 years but the future period uses 10 years.

Deriving permafrost extent and ALT

Line 163 and 165: How did you linearly interpolate the soil temperature from the surface? The permafrost model should be able to simulate multi-layer soil temperature.

Results:

I suggest the authors add a table or time series for permafrost areal extent, which is complementary to figure 2.

In Figure 3 and Figure 4, I think the authors need to explain why G6solar and G6sulfur have lower radiation and summer temperature but still higher NPP and RH, compared to

ssp245.

Figure 6. In the caption, "G6solar, G6sulfur, and ssp585" need to be reversed in their order.

You should present a figure of ensemble standard deviations from each scenario in the appendix.