

Earth Syst. Dynam. Discuss., referee comment RC1
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Comment on esd-2021-85

Anonymous Referee #1

Referee comment on "Exploration of a novel geoengineering solution: lighting up tropical forests at night" by Xueyuan Gao et al., Earth Syst. Dynam. Discuss.,
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This manuscript studied a new geoengineering method – lighting tropical forest to enhance terrestrial carbon sink, using CESM2. Although this is a new idea, and it is interesting to research the forest response with model simulation, this manuscript is missing some important analysis on: (1) the impact on ecosystem. We cannot ignore the whole ecosystem but only focusing on the carbon cycle. (2) energy needed for lighting the forest. The manuscript only shows a figure with couple sentences on this topic. There is detailed calculation discussed. (3) model uncertainty. Models are built and designed for current plant phenology and plant physiology. Can the model simulate plant and soil chemistry without night? (4) some of the results. Results are not fully analyzed and discussed (see general comments below). I suggested to reject this manuscript, but encourage resubmit after addressing those important issues.

General Comments:

- More detailed literature review on plant response to longer light explosion.
- Why do you assign a random 0-1 value of cosine for tropical forest during night? If you provide a constant diffuse light at night, shouldn't be the cosine number and surface albedo constant?
- Figure 1: why is the night time NEP even higher than daytime control? If 200 W/m² provides maximum NEP, why during daytime in the control, the maximum NEP is at the time of 13:00-15:00? It is better to have a local time axis there. This also applies to Fig. S2 and Fig. S3
- It is not clear how the diffuse light is added during day time. If they are not added

during daytime, then why in Figures are there colored lines (indicating adding difference amount of diffuse radiation)?

- Why does night NEP show different responses to added diffuse radiation in different regions (Figure 1, Fig. S2 and S3)?
- If there are more burning materials after lighting, why wildfire simulated decreases? (Figure 2)
- Why does GPP drop to lower than the control level after termination? (Figure 2, Line 182)
- Figure 2: The shaded area in f is confusing. Why does the local temperature go back to the control level after lighting terminated, but the global averaged temperature keeps lower than the control? If this is CO₂ effect, how could the local temperature is back to the level of control?
- Line 143: this is not correct. The energy consumption for lighting the forest is not calculated.
- Line 169 (Figure 5): how does this calculate?