

The study uses one Earth System Model (CAM4-chem) to investigate the effect of stratospheric aerosol injections on photosynthesis. It is found that the increase in diffuse radiation from the increase in aerosols combined with cooler temperatures increases the photosynthesis rates and the global mean terrestrial GPP.

Overall, I think the topic of the study is important and the effect of diffuse radiation increases from SRM needs further study. This is a valiant start on this line of investigation. The article is suitable for the journal and the GeoMIP special issue after some improvement.

I feel there is a bit of a gap between the title, abstract and what is shown in the paper. The results section is rather brief and could benefit from deeper analysis. Photosynthesis is only one part of the carbon cycle. Analysis of the carbon fluxes and stores would also help shed some light on the response of the terrestrial carbon cycle to stratospheric sulfate geoengineering.

I would recommend doing the G3S scenario on a background of RCP6 instead of RCP4.5, with the same radiative forcing as in G4SSA. This would aid the interpretation of the results.

Are ozone effects on plants included? Is stratospheric ozone reduced in accordance with increased sulfate injections?

There is little discussion on the hydrological impacts on productivity.

What about carbon fluxes and stores?

**Title:** Considering the limitations of the study I would recommend amending the title of the article to reflect that there are uncertainties around this statement. Also you are not showing any GPP figures (or tables) in the paper.

**P 25628 Abstract:**

Line 2 - 3: "With an 8 Tg yr<sup>-1</sup> injection of SO<sub>2</sub> to balance a Representative Concentration Pathway 6.0 (RCP6.0) scenario" - What is meant by this? What are you balancing. Please clarify.

**Introduction:**

Line 18 – 19: "Stratospheric sulfate injection is the most discussed geoengineering strategy to manipulate the climate system to counteract anthropogenic global warming": Do you mean out of all RSM options? Or is it your opinion that it is more discussed than carbon dioxide removal methods too? Amend accordingly.

**P 25629**

Line 11: "After 1991 ...": Specify what happened in 1991. Most readers know about Mt. Pinatubo erupting then, but it is polite to remind them.

Line 21: "... by the continents ...": change this to the terrestrial biosphere – if that is what is meant.

Line 24: change "fertilizes terrestrial vegetation" to "... promotes terrestrial vegetation growth ...", as diffuse radiation is not really a fertilizer.

Line 17: Rap et al. (2015): put the fires and resulting aerosols more into context by providing a sentence or two more on the topic. I.e. effect largest during dry season. And removing vegetation reduces carbon fluxes since it removes vegetation.

**P25630 Model simulation:**

Section 2 might be better re-labeled: Model and experiment design. Or similar.

Some comment on the limitations of the model and experiment design should be made:  
Including: if 26 vertical levels is sufficient; The usage of prescribed aerosols; The choice of switching off carbon – nitrogen cycling.  
Also are you using prescribed vegetation cover or dynamic vegetation? Some more description of the CLM is needed.

Line 16: What is the radiative forcing of 8 Tg SO<sub>2</sub> yr<sup>-1</sup>?

Line 21: “ ... 2072 to 2089 to study the termination effect.” This is rather a short period for the termination effect. Some of the terrestrial carbon cycle feedbacks occur on longer time scales.

G3S only first mentioned here. Some mention on solar constant reductions as proxy for stratospheric sulfur injections or mirrors in space earlier would be useful. You should also say why you are running the G3S and RCP4.5 experiments.

Would it not make more sense to do the same experiment design as G4SSA with the solar constant reduction? I strongly recommend doing this.

**P 25631 Results:**

Line 13: Define what is meant by “The terrestrial total solar radiation”.

Line 16: new paragraph where you go on to describing the differences in G4SSA, such that the first paragraph describes the baseline scenario RCP6.

Line 18: the downwelling solar radiation at the the surface change is not the “radiative forcing”.  
Change text.

Line 19: increase the precision of the temperature reduction estimate.

**P 25632**

Line 8: “Solar constant reduction climate intervention”, see comment above. You need to clarify this experiment design and explain what is done and why.

**P 25633**

Line 1. You should be a bit clearer about when you are referring to the real world and to the model. Nitrogen and phosphorus fertilization is not included in CLM4. Nitrogen cycle you said was turned off, and phosphorus is not included in any case.

Nuance the discussion on the temperature effects more. You start the geoengineering in year 2020, and the plants are not under extreme heat stress at this stage.

Lines 13 – 15 refer here to Figure 3 (b).

Line 19: Increase in diffuse radiation is most important for the highest level canopy, as the lower layers are already shaded. But, typically it is the tallest canopy that can absorb and store the most carbon, through longer trunks and developed root systems.

Line 24: Could there also be a decrease in photosynthesis from an increase in snow cover with colder temperatures from the climate intervention?

**P 25634**

Photosynthesis is also dependent on available moisture / water. Would a spatial correlation to temperatures and moisture availability be useful?

**P 25636**

The paper would benefit from finishing with an overall conclusion.

The discussion could also say something about how this model compares to the rest of the GeoMIP models. Was it included in Glienke et al. (2015) or Jones et al. (2013)? Was there not a large spread in primary productivity responses amongst the models?

**Figures:**

Also plot P-E, or in place of P in Figure 1 (b).

Legend on Figure 3. Make numbers larger. They are hard to read.

Figure 3: Show statistical significance. Why are only 10 years shown? Why not use 30 – 40 years?

*References:*

Jones, A., et al. (2013), *The impact of abrupt suspension of solar radiation management (termination effect) in experiment G2 of the Geoengineering Model Intercomparison Project (GeoMIP)*, *J. Geophys. Res. Atmos.*, 118, 9743–9752, doi:[10.1002/jgrd.50762](https://doi.org/10.1002/jgrd.50762).

Glienke, S., P. J. Irvine, and M. G. Lawrence (2015), *The impact of geoengineering on vegetation in experiment G1 of the GeoMIP*, *J. Geophys. Res. Atmos.*, 120, 196–10,213, doi:[10.1002/2015JD024202](https://doi.org/10.1002/2015JD024202).