

Interactive comment on “The climate effects of increasing ocean albedo: An idealized representation of solar geoengineering” by Ben Kravitz et al.

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The paper discusses climate effects of the ocean albedo GeoMIP experiments. It is well written and organized. I support the publication in ACP after the following minor comments have been addressed.

Minor Comments

Page 2, Line 11: “stratospheric sulfate aerosol geoengineering”; please consider adding an abbreviation here, to refer to later in the text.

Figure 1 is showing the albedo change. Why is the color scale (red negative) different

from Figures 2 and 3 (where red indicates a positive change)?

Figure 2 and 3, please make sure to add the direction of the forcings shown in the figure caption (positive downward or upward), which will help explain these figures in the text (e.g., Page 4, line 30: so it makes sense why positive shortwave values indicate a reduction in clouds).

Page 8, Equation 8: It would be helpful to describe in more detail how this equation is coming about, either a reference or a more detailed derivation.

Equation 9: Delta A is defined as the time-dependent LOET (W/m²). However, it was also defined earlier as albedo changes, please change.

Line 17: In Experiment -> In experiment Line 25: “necessarily” does not make sense, please remove. Line 30ff: These lines does not make much sense, since it seems that the calculations are not right, why discuss them, and why not just remove Line 25-33?

Figure 7 caption: change Equation 3 to Equation 10.

Equation 10: Delta S is the net surface flux, but earlier it is defined as solar radiation. It is confusion to use the same acronyms for different quantities.

Page 10, Line 6: What do you mean by land processes? If you see a reduction in SH (so warming) over land and an increase in LH (so reduction in evaporation), you could say that “... are due to changes in the turbulent fluxes over land rather than ocean heat content reductions, and those also increase temperatures over the ocean through LOET.” However, I am not convinced that the discussion on surface energy fluxes justifies any conclusions on ocean heat uptake changes. One way to look at this is actually looking at quantities like ocean temperatures, AMOC changes. Also, changes over the ocean seem to be strongly latitudinal dependent. The continued warming of high latitudes likely results in continued sea ice reduction and potentially decrease salinity, which may further slowdown the AMOC and reduce heat update in the ocean. Changes in precipitations would also play a role in changing runoff and

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salinity. Therefore, I think, from the global investigations given in this paper, one has to be careful to draw any conclusions.

Page 11, Line 5: G1ocean-albedo seems to show a drying band over mid-latitudes between 30-60 degrees and a potential reduction over the ITCZ, which can be pointed out in the paper. Changes in ocean albedo therefore could have specific impacts on tropospheric circulation. Please comment.

Page 11: 11-16: The first 6 lines of the conclusions seem to give the same message in different ways, this could be shortened.

Discussion and conclusions: The authors discuss various topics that need to be still investigated, including different experimental design, timescales for climate response, questions on fast and slow response, going away from the science presented in the current study (over 2 pages).

Instead of discussing the various research areas somewhat related to this topic, I suggest to shorten this part substantially and would rather appreciate a discussion and summary closer to the findings of this paper. What was the result of investigating the 3 hypotheses? There seems to be still a lot of open questions on the impacts of G1ocean-albedo that are directly related to the results in this paper that could be mentioned, for instance more research is needed to understand the changes in atmospheric dynamics and temperatures (beyond surface temperatures), hydrological cycle and ocean changes, as partly discussed in the last section.

Figure 3S, add captions for experiments shown in each panel

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