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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparing different generations of idealized solar geoengineering simulations in the Geoengineering Model Intercomparison Project (GeoMIP)" *by* Ben Kravitz et al.

Anonymous Referee #3

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This paper compares how two generations of Geoengineering models perform in a 50 year G1 experiment, where CO2 is instantaneously quadrupled and at the same time, insolation is reduced so the net TOA radiative flux is essentially unchanged. Key aspects of the CMIP5 vs. CMIP6 model ensemble results remain unchanged.

This is a worthwhile exercise for identifying where to focus more detailed analysis in future studies. However, it should also be stated clearly that consistency among ensembles of two generations of models demonstrates only that the differences do not significantly affect the results, at least when aggregated into ensemble averages; it by

no means shows the results to be robust in any deeper sense. (E.g., lines 186-188) This is especially important, as there are policymakers who cite the model results as support for proposed action in response to a possible severe climate crisis. The statement in lines 205-207 does not seem to be enough; this point also needs to be made much earlier in the paper in my opinion.

Without exploring more specifically the similarities and differences among the models, one cannot assess how significant the model diversity really is for generating the parameter values analyzed here. As such, this paper could go further in at least identifying which processes are most important for future focus (in addition to cloud parameterizations, which is already well known).

Notes

Figure 1. I can see that IPSL-CM6A-LR shows a long-term trend in temperature, as stated, but it seems CNRM has one too. UKESM1.0-LL has a jump at about 50 years that produces an overall pattern with the opposite sign. And if GISS shows trends in precipitation and evaporation, MPI seems to have these features as well.

Figure 1. For precipitation (and evaporation), two models are systematically below all the others, bringing the ensemble average to below the larger model cluster. This might require some explanation. For example, is there a fundamental unresolved issue in modeling precipitation, where a poorly constrained choice produces dramatically different results?

Lines 170-173. The fact that the CMIP6 models show less diversity does not mean that the uncertainty is lower. As more model inter-comparisons take place, it is not surprising that model behavior tends to converge. But to make a statement about model uncertainty requires critical tests, based on measurements at least of the processes involved.

Minor Notes

Table 2. The caption says Column 3 reports a fraction, whereas the column itself is labeled “%,” which seems correct.

Figures 1 and 2. The colors assigned to the different models are not the same in these two figures, which seems unnecessarily confusing.

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