

Author's Response:

We thank the editor for following up on the reviewer's comments. We addressed the additional comments in the revised version of the manuscript and hope that it is now ready for publication.

Editor's comment:

"Having followed it up with the Referee, in Section 4 (Summary and Conclusions), you propose a number of science questions which could be addressed using your experimental setup. However, the reviewer felt that list was too exhaustive and was not convinced that the experimental layout could deliver everything. As a result, I am asking you to alter Section 4 by including some definitive statements about what results can be realistically achieved/expected and the limitations of the proposed experimental design."

We do believe that all of the science questions listed in Section 4 can be addressed at least in some way with the proposed experiments. But we agree that we have not specified what the model requirements are to address specific questions. Therefore in the revised version of the manuscript, we added to the following paragraph after:

"The following scientific questions may be addressed with the proposed geoengineering experiment, especially if performed in a multi-model framework like CCMI: What are the impacts of geoengineered stratospheric aerosols and the termination of geoengineering on chemical composition, dynamics, and climate, in a changing future environment on

- Stratospheric chemistry, in particular ozone and its impact on UV?
- Tropospheric ozone, methane lifetime?
- Stratospheric dynamics, including stratospheric heating rates, BDC, and QBO?
- Tropospheric dynamics and temperatures?
- Climate, surface temperatures and precipitation?
- Environmental impacts and agriculture?"

"To address the different science questions specific capabilities of models are required. Changes in tropospheric dynamics, temperatures, and precipitation can be investigated based on model results from all GCMs, some of which may not include comprehensive chemistry. In addition, most of the CCMI models are expected to be able to simulate interactions between and increased aerosol layer in the stratosphere, stratospheric chemistry and dynamics, including changes of heating rates and the BDC, as is the case when simulating past volcanic eruptions. An offline UV model may be required to identify the impact on surface UV, as done by Tilmes et al. (2012). The impact of geoengineering on the QBO can only be investigated if models produce the QBO interactively, which may not be the case for any participating CCMI models. However, applying this experiment to other GCMs may allow producing results to investigate this question. The results from models that simulate tropospheric chemistry can be used to identify the impact on tropospheric ozone and methane lifetime. Differences in the impact on methane lifetime will

occur whether models prescribe methane concentrations at the surface, which is likely the case, or they emit methane. Finally, changes in agriculture and the environment due to geoengineering may not be addressed directly from any model output at this time, but offline model simulations using crop models can be applied to investigate the impacts of geoengineering (e.g., Xia et al., 2014).”

In addition to these listed limitations, the largest limitation but also advantage of this experiment is that aerosols are prescribed and not interactively transported. This is discussed in detail in the last paragraph of the manuscript.