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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity of the radiative forcing by stratospheric sulfur geoengineering to the amount and strategy of the SO_2 injection studied with the LMDZ-S3A model" *by* Christoph Kleinschmitt et al.

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I have read your paper with interest and would like to know more about how atmospheric chemistry is treated in your model. This could be important for a variety of reasons. For example, changes in ozone (which would occur under sulfate geoengineering) can affect the calculated radiative forcing, tropopause height, the QBO, the Brewer-Dobson circulation. Since ozone's SW and LW effect are strongly dependent on altitude, this could also affect the small dependency of the calculated RF on injection height (p.9, l.17), in particular if stratospheric temperature adjustments would be

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considered. For discussions on some of these effects, see for example:

Pitari, G., V. Aquila, B. Kravitz, A. Robock, S. Watanabe, I. Cionni, N. De Luca, G. Di Genova, E. Mancini, and S. Tilmes (2014), Stratospheric ozone response to sulfate geoengineering: Results from the Geoengineering Model Intercomparison Project (GeoMIP), J. Geophys. Res. Atmos., 119, 2629–2653, doi:10.1002/2013JD020566.

Nowack, P. J., Abraham, N. L., Maycock, A. C., Braesicke, P., Gregory, J. M., Joshi, M. M., Osprey, A., and Pyle, J. A.: A large ozone-circulation feedback and its implications for global warming assessments, Nat. Clim. Change, 5, 41–45, doi:10.1038/nclimate2451, 2015.

Rind, D., J. Jonas, N. K. Balachandran, G. A. Schmidt, and J. Lean (2014), The QBO in two GISS global climate models: 1. Generation of the QBO, J. Geophys. Res. Atmos., 119, 8798–8824, doi:10.1002/2014JD021678.

deF. Forster, P. M., and K. P. Shine (1997), Radiative forcing and temperature trends from stratospheric ozone changes, J. Geophys. Res., 102(D9), 10841–10855, doi:10.1029/96JD03510.

Could you put your results into context depending on how ozone is treated in your model and accordingly add some information to your model description?

In addition, I am highly interested in your point on potential impacts on air quality (PM2.5 etc, section 3.7). Could you discuss how such effects might interact with the treatment of atmospheric chemistry (e.g. OH, ozone fields)? If you have ozone model output, could you compare your surface ozone results briefly with

Nowack, P. J., Abraham, N. L., Braesicke, P., and Pyle, J. A.: Stratospheric ozone changes under solar geoengineering: implications for UV exposure and air quality, Atmos. Chem. Phys., 16, 4191-4203, https://doi.org/10.5194/acp-16-4191-2016, 2016.

Xia, L., Nowack, P. J., Tilmes, S., and Robock, A.: Impacts of Stratospheric Sulfate Geoengineering on Tropospheric Ozone, Atmos. Chem. Phys. Discuss.,

https://doi.org/10.5194/acp-2017-434, accepted for publication.

https://www.atmos-chem-phys-discuss.net/acp-2017-434/

or put your air quality results into a more general context (ozone, NOx etc)?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-722, 2017.

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