

Comments on “Hemispherically-Symmetric Strategies for Stratospheric Aerosol Injection ” by Zhang al.

Zhang et al document the response of the climate system for a given stratospheric aerosol injection (SAI) strategy. To maintain the same mean surface temperature, the authors design several SAI strategies to be studied using the CESM2 Earth System Model (WACCM6-MA) and compare the results with the reference scenario, the SSP2-4.5 global warming scenario. My main concern with this paper is the lack of caution in the way the results are presented here as well as the lack of context on the complexity of our climate system and associated feedbacks, stratospheric circulation and variability as well as model biases in terms of precipitation and the lack of model representation of our complex system. I highlighted this point in my previous review, but it is not seriously addressed. The review does not address all my concerns, which is why I recommend major revisions. From a single model study, the authors intend to generalize their experiments to all models. The conclusion and abstract still marginalize the impact of SAI on precipitation and it even seems to me that the authors exaggerate their results by saying that SAI is good because it decreases temperature while ignoring the importance of the impact of SAI on precipitation and the related implication on food security, agriculture and so many others vital component for human survival. I am therefore going to reject this article and encourage for resubmission after addressing these serious issues.

Major points:

1. The authors did not address this major issue: “The surface climate response to different SAI strategies is present without a clear understanding of the impact of model internal and inter-annual variability on the distribution of SAI in the stratosphere as well as its feedback on the surface climate. According to Bittner et al. (2016), 7 ensembles in the tropics and 40 ensembles in the extra-tropics are needed to accurately capture the model circulation response to SAI, and hence the corresponding feedback on surface climate. Caution should be exercised in discussing the results here. Three ensembles are not enough to constrain the internal variability of the model”. I invite them to read the Bittner et al 2016.
2. The abstract does not reflect the content of the paper. Therefore, it needs to be rewritten

3. Page 1, line 20, please added after "latitudes" this "based on a single model study".
4. Introduction, please add a section on model limitation and biases regarding SAI and precipitation before "Defferent SAI strategie..." Models in general even struggle to reproduce Pinatubo or later volcanoes. Current climate response to SAI are still model dependent due to unconstrained internal model variability as well as interannual and decadal variability of the climate system.
5. Page 1, line 1 please added after "scenario" this "based on a single model study".
6. Page 3, line 80 please add after "variability" tis "... and model biases".
7. Page 4, line 92, the linearity hypotheses is not taking into account the feedback processes (Stratospheric water vapor, O3 and SAI) on circulation and climate.
8. Page 4, line 120, "significant perturbation of the interhemispheric temperature gradient and the associated location of tropical precipitation" only correspond to fast response of the SAI as the aerosol can be transported into deep stratosphere then impact the opposite hemisphere few month later.
9. Table1: How these aerosols and their life time are sensitive to the altitude of injection.
10. Page 9, line 223-224: This is due partly to the altitude of injection of SO₂ as the shallow branch of the BDC will wash out the aerosols.
11. Page 9, line 227, I am still not convince that the existing BDC asymmetry between SH & NH due to the wave activitives, Polar vortex, internannual variability modulation has no impact on the aerosol distribution in the lower stratosphere (Fu & Qu, 2013).
12. Page 13, line 292, Please add after "climate." this "based on the WACCM results"
13. Page 24, line 477 after "injection strategy" please add " as well ad the models ability to capture the complexity of the Earth climate system and its variability, which is not investigated here."
14. Page 24, line 477 please "based on a single model study" after "SAI strategies ..."
15. Page 24, line 481 please "based on a single model study" after "fundamental limits of SAI".
16. Page 25, line 487, what about precipitation results?