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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model physics and chemistry causing intermodel disagreement within the VolMIP-Tambora Interactive Stratospheric Aerosol ensemble" *by* Margot Clyne et al.

Anonymous Referee #2

Received and published: 14 October 2020

Clyne and co-authors investigate causes of model disagreement in stratospheric aerosol optical depth following the Tambora eruption simulated by the VolMIP models. They show that the differences are largely due to differences in aerosol particle size, and explore the underlying representations of model physics and chemistry to explain the differences. This is no small task, and I congratulate the authors – it's really nice to see such a thorough investigation of inter-model differences. The paper will no doubt serve as a useful point of reference for the VolMIP community and modelling groups. I recommend publication and have made some comments below, most of which are fairly minor – although I do encourage the authors to include uncertainties on Figures 1-3, as discussed below.

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Comments:

Line 31: A “pre-study” experiment is unclear – does this refer to an experiment performed before VolMIP officially got underway? Is the experiment not an official VolMIP experiment?

Line 47: define “ISA”

Lines 50-52: Sentence does not quite make sense; I think some words are missing.

Line 118: Please also specify the latitude of Tambora.

Line 280: Section 4.1. Somewhere in this section it would be worth pointing to Appendix A so you can contrast how your ‘approximate’ AOD was calculated compared with how ‘real’ AOD was calculated by the models.

Line 677: are there disadvantages to using point eruptions? Otherwise why not recommend that they always be used?

Figures 1-3: I understand that the mean of five ensemble members is shown for each model. It would be good to get some measure of the internal model variation, perhaps by plotting the mean plus/minus one standard deviation in a lighter shade. Otherwise it’s hard to assess just how different the models are from one another.

Figure 4: mentions ‘Figure 4’ twice in the caption.

Figure 9: SOCOL-AER. The green lines are indistinguishable, which might be worth commenting on in the caption.

Please also check the order of figures; it looks like figure 9 is discussed before figure 8.

Appendix D is not referred to in the text, so figures D1 and D2 caught me by surprise – I found myself wondering how the SOMs were created; where the representative patterns had come from, etc. Potentially figures D1 and D2 could be moved to the

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main body since they are central to the paper, but I leave that decision to the authors.

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