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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Multi-model comparison of the volcanic sulfate deposition from the 1815 eruption of Mt. Tambora" *by* Lauren Marshall et al.

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This work is an important contribution to intermodel comparison and evaluation of volcanic simulation. The model derived relationship between volcanic sulfur injection and ice core volcanic aerosol deposition, if the results converge, can provide critical information to verify or improve the ice-core-based reconstruction of past volcanism. The paper is well written; the results are clearly presented and discussed. I would like to recommend the paper to be published in this journal after addressing the following points:

1. In section 2 "Model set-up and ice core data"

Are the four models the only aerosol models available for Tambora simulation? If that's

the case, please state; if not, please explain if there is any criteria taken to choose the models. Also, please briefly describe model performance in previous studies.

2. In section 3 "Results"

2.1 The argument of "models have similar background sulfate deposition patterns" sounds weak to me, please provide more quantitative evidence/analysis to support the argument. The color scale in Figure 1 and few other figures seems misleading, please consider using a monotone color scale.

2.2 A short description of model configuration, especially those closely related to transport dynamic would be helpful to understand the difference in the results. A short summary of the model performance and its implication at the end of this section would be nice.

2.3 P7L3-4, "the four models simulate similar background sulfate deposition patterns and magnitudes and compare well to pre-industrial ice core sulfate fluxes", please provide a table lists all pairs of the model-ice core values to support this statement.

2.4 The differences between wet and dry deposition across models have been discussed at various part of the paper, please explain in more depth what are the implication of these differences.

2.5 Some of the discussions are overlapping or repeating, for example, the temporal evolution of different models in the last paragraph of section 3.2.1 and section 3.2.2. Please consider combine them to shorten the discussion.

3. In section 4 "Discussion"

3.1 Again, some of the discussions repeat the results in section 3. Please focus more on discussing the implication of the results, for example, the causes of the difference in model simulated Tambora deposition.

3.2 Please discuss why models can not give a converged simulation of Tambora depo-

sition, while they were able to simulate the preindustrial background sulfate deposition well.

3.3 P14L28-P15L2, the discussion in these lines seems unnecessary to me since the focus of this study is on model intercomparison.

4. In section 5 "Conclusions"

4.1 P16 L10-11, "Our derived BTD factors highlight uncertainties ..." Not necessary the actual uncertainties between the atmospheric burden and ice sheet deposition, but the uncertainties in the model's ability to derive the relationship. Therefore , I would recommend the authors to rephrase the sentence to make this distinguish.

4.2 P16L19-21, "Using..... will provide the opportunity to better understand model diversity and to advance our understanding of the climate response to large volcanic eruptions". It is true that using the same prescribed forcings could help us to better understand model diversity, but only true to advance the understanding of the volcanic climate response if the prescribed forcings are assumed to be correct. And if that is the case, what about the goal of this VolMIP study to improve the ice-core-based reconstruction?

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