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Comment

# ***Interactive comment on “The impact of volcanic aerosol on the Northern Hemisphere stratospheric polar vortex: mechanisms and sensitivity to forcing structure” by M. Toohey et al.***

**M. Toohey et al.**

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**We thank the reviewers for their insightful and helpful comments. In the following, the reviewers comments are in plain text and our responses to the reviewer's comments are in bold.**

Reviewer 1: Anonymous Referee 1

This manuscript presents a modeling investigation of the impact of volcanic aerosols on the NH stratospheric vortex. Model simulations are performed to examine the impact of the 1991 Mt Pinatubo eruption using four different aerosol forcing datasets. The

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analysis shows several robust results across the different forcing datasets (including changes in lower stratosphere temperatures, wave activity, and residual circulation), but also shows some differences. Perhaps the most important result is the lack of a robust NH polar vortex response.

The manuscript is well written, results are interesting and clearly presented, and I think the manuscript is suitable for publication in ACP in its current form.

I only have a couple of suggestions for the authors to consider.

1. Currently only ensemble mean quantities are shown. I think it would be useful to include at least one figure showing the variability between the ensemble members, especially for polar vortex diagnostics. Maybe something like Figure 2, e.g., equivalent of Figure 2a but for each set of 12 runs.

**We have added a figure (Fig. 9 in revised manuscript, Fig. 1 below) showing the zonal mean zonal wind at 60°N, 10 hPa for each ensemble member of each ensemble. We agree with the reviewer that this is quite useful, and makes much more clear the differences (or lack thereof) of zonal wind between the different ensembles.**

2. The full results for the 2 observation-based forcings are currently presented, and then the analysis is repeated for the model-based forcings. I wonder if it might not be better to combine together, and compare extinction and heating for all 4, then temperature and winds for all 4, etc. I found myself effectively doing this as I read the paper.

**Based on this comment, and comments from Reviewer 2 concerning the length of the manuscript, we have reorganized the presentation of results within the paper. We have used the suggested logic of grouping the results by field (zonal wind, temperature, etc). In order to shorten the paper, we have also merged the “grand ensemble” results with the results for the individual ensembles, such**

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that the response features common to all ensembles need only be described once. Sections 3.2 and 3.3 of the revised manuscript are therefore the result of some merging and rewording of the manuscript's prior Sections 3.2.2, 3.2.3, 3.3.2, 3.3.3, and 3.4. In these sections, and throughout the "tracked-changes" version of the manuscript to be submitted, text which is relocated but basically unchanged is highlighted with gray, while text which is new, or modified version of prior text is highlighted in light blue.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 16777, 2014.

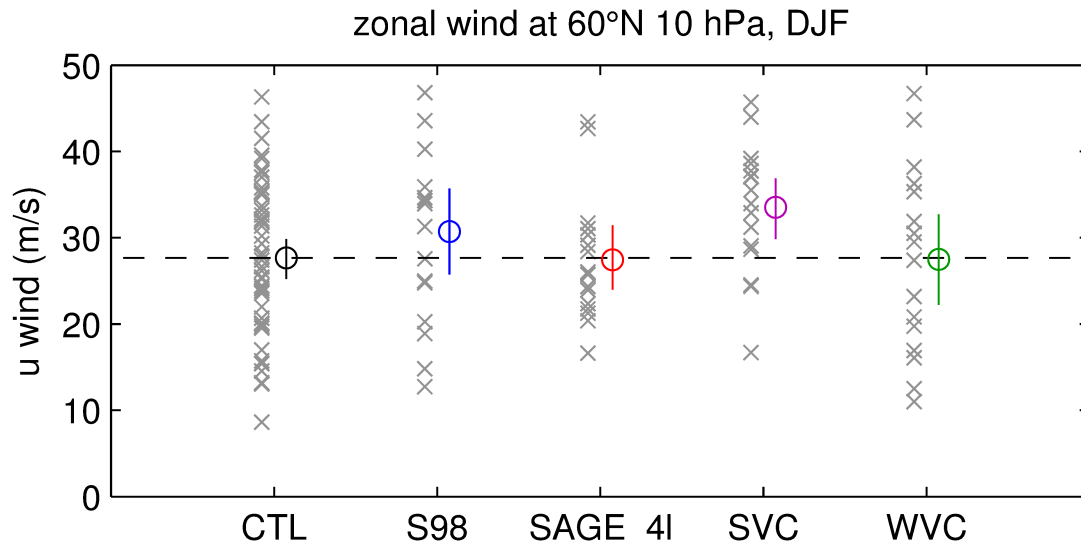
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**Fig. 1.** New figure (Figure 9 in revised manuscript) showing the zonal mean zonal wind at 60 N, 10 hPa for the individual (gray symbols) and ensemble means for the 4 volcanic forcing sets and the CTL ensemble.

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