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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The climatic effects of the direct injection of water vapour into the stratosphere by large volcanic eruptions" *by* M. M. Joshi and G. S. Jones

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L. Glaze (referee) comments:

General comment (also made by other reviewers): we had not sufficiently explained our mechanism, which is entrainment of water into the coignimbrite ash plumes resulting from the pyroclastic flows associated with the eruption. Since the pyroclastic flows from an island volcano travel over water rather than land, a large amount of water vapour may be transported into the coignimbrite plumes in this way. We also comment on the scale, i.e.: why Pinatubo, which is 30-50 km away from the ocean, did not exhibit this mechanism while an island volcano like Krakatau might. We also note that the

pyroclastic flows following the eruption of Mt. Pinatubo did not reach the ocean.

Specific comments:

1. We have gone through the manuscript and clarified the use of the term coignimbrite to mean the plumes that result from pyroclastic flows. This is indeed different from the Plinian eruption plume itself.

2. We have clarified our language on p5449; "this" refers to the present paper.

3. We have clarified what the water came from for each of the references. We also change one reference to refer to the original source of information.

4., 5., 6., 7. We have changed the wording.

8. It was not clear to us which vertical distribution would be best, which is why a constant one was chosen. We now state this in the text.

9. The control simulation is "V", as it represents the "standard" volcano. We have clarified this in the text.

10. We have added the definition of SW.

11. 1.5m temperature is the temperature at 1.5m above the surface and is a standard climatological measure- we have added this to the text.

12. We think this is a fair statement as a warming of 1.5m temperature implies a warming of the climate in the vast majority of cases.

13. Often the significance of the difference between two quantities is presented by stating that the differences are "statistically significant" at some level, e.g. 90 or 95% but it is also common to see the actual probability or p-value given. As the probability that the differences are due to internal variability alone are not all very small (<5%) we showed the p value or probability that the difference is due to variability alone. The relative significance of the results can then be interpreted by the reader. This way of

presenting results is not unusual, and we thought this was more useful considering how a priori we would expect VSW to be warmer then V due to the known stratospheric water radiative effects. We have changed the text to make it clearer what is being shown.

14. It's +0.1K; we've added this to the text.

15. We have made this change.

16. The introduction stated that 10 Mt-540 Mt resulted from the Pinatubo eruption- indeed remote sounding observations following Pinatubo's eruption suggest a maximum increase of 100-150 Mt; we have now clarified this in the text.

17. Figure 6 should be examined to compare each model simulation with the observed temperatures- not to compare the models with each other. Figure 3 compares the simulated temperature responses of the two scenarios (V and VSW) with each other. The ranges shown in Figure 6 give the uncertainty on where a single ensemble member would lie around the ensemble mean for the given simulation. So where the observations are outside that range it could be said that the probability of that difference happening by internal variability is <2.5%, i.e. highly significant. We describe earlier in the text the significance of the difference between the ensemble means of the V and VSW simulations. As we are comparing the ensemble means of the simulations in that case, a smaller difference can still be very significant.

The graph clearly shows that the observations are outside the error bars for the global mean of V 1884-1885, and for 1884-1889 for the NH, but within the error bars for V. Whilst the SH observations are within the error bars for both V and VSW, there does seem to be a better match with VSW immediately after the eruption, however we agree that our statement may be too strong and have reworded it. We have changed some of the text to make these descriptions clearer.

18. We have changed to hypothesize

19. "Known" is too strong; we have changed "known" to "conjectured", and added references in the text.

20. We have made this change.

21. We have made this change.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5447, 2009.