**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

Anonymous Referee #2

Received and published: 12 March 2009

General: The authors present the impact of directly injected water vapour into the stratosphere by a volcanic eruption. They point out that this effect is of importance for volcanoes located in oceanic regions, e.g. Krakatau. The paper is short and focused, unfortunately some parts need to have more explanations and some parts need to be addressed in more detail in order to clarify the significanceof the reults.

Major comments:

- The mechanism othe direct injection due to the vicinity of an ocean is totally unclear to me. This should be clarified.

- The model description is insufficient. The simulation deals with stratospheric (H2O

transport) and tropospheric (climate) issues. How many stratospheric layers does the model have in the stratosphere? Which processes are included e.g. in the stratosphere? PSC formation and sedimentation? E.g. Fig 1 doesn't show a significant dehydration at polar regions, e.g. in the polar vortex.

- A validation (or summary of previous papers) especially on aspects relevant for the application should is missing. E.g. age of air, tropical ascent rates, sub tropical barrier, strat-trop exchange..

- How well is the current approach simulating the PINATUBO induced stratospheric temperature changes?

- Experimental desciption: How many years were simulated. How is the ensemble produced? Different initial conditions?

- RF: It is unclear how the RF is calculated: a) How is the V Water vapour change calculated and b) how is the associated RF calculated. As far as I understand this is then referred to the initial forcing term Q in Forster and Taylor. The Forster and Taylor method should be summarized, an explained how it is applied here since it is essential to the paper.

- Statistical significance of the results: To examine the impact of a volcanic eruption the comparison to a 3 years period is insufficient. The reference should be a 20 year mean of the simuation. It would be nice to see a 20 year mean annal cycle including a standard deviation of global temperature (Fig.3) and superimposed the V and VSW simulations. This would show the change with respect to the variability. The t-test on a 3 year basis is not sufficient. I am not quite sure, what the p value is referring to. Does it mean that there is a 6% chance that 0.1 K are within natural variability. That would be low! (p5452 l18)

- The abstract states that the effect is reduced in magnitude. However looking at Figure 6 I do not see this magnitude.

- What is about other impacts, e.g. via chemistry? ozone depletion etc. This should be discussed.

- My overall impression is that the impact is minor. This has to be clarified in more detail.

Specific Comments:

5448 l10 that->than

- The abstract states that Strat. H2O perturbations warm the climate and p5449 l 20 indicates a cooling. Please clarify that additional H2O cool locally but warms the troposphere. ...

5445 l23: What is the different mechanism leading to the different time scales. If only transport is considered than the timescales are equal.

5453 l17 Randall et al.

5454 27ff Why are global means better known?

Fig. 1 zero line is within the green scale - please change so that pos and neg values can be better identified.

Fig. 4 What is M1000 and the sampling referring to??

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