

***Interactive comment on* “Simulation of the climate impact of Mt. Pinatubo eruption using ECHAM5 – Part 1: Sensitivity to the modes of atmospheric circulation and boundary conditions” by M. A. Thomas et al.**

**Anonymous Referee #2**

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Review of Simulation of the climate impact of Mt Pinatubo eruption using ECHAM5-Part 1: sensitivity to the modes of atmospheric circulation and boundary conditions by M. A. Thomas et al.

General comments

The manuscript analyses the climate response to the eruption of Mt Pinatubo as simulated by the ECHAM5 model under different boundary conditions. The individual and combined effect of QBO, SST and volcanic forcing are addressed through specifically

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constructed ensemble of simulations. The response of tropospheric and stratospheric circulation to individual and combined forcings and the capability of the model to correctly simulate the radiative and dynamical response is a relevant topic. The scientific method is valid, though the description of the methodology would require an effort of clarity

### Specific comments

Section1, Introduction: some sentences are not clear, for example page 9212 lines 4-6: "The observed climate evolution"; line 20 : "What is the response (of what?) to combined "; lines 22-24: "None of the simulations";, could you be more specific and add few references concerning the simulations carried out so far and not including all the factors but just some of them?

Could you cite the recent work by Bo Christiansen J climate 2008 at the end of introduction?

Section 2, Model and datasets used Which values of prescribed gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs) have you used?

Section 3, set up: If there is space, you could maybe add a figure with Singapore winds (1991-1993). It would be easier reading the discussion concerning the phase of the QBO at 30 hPa, with a figure of winds.

Lines: 12-15, PAGE 9216. "Aer 1 gives the aerosol response";, maybe you mean the simulated climate response to aerosol forcing?

Section 4, Results and discussion: Page 9216, "Here, we analyze the stratospheric";, sentence not clear. The following sentence is not clear too: "To estimate the dynamical";, this study also concentrates";, why "also";?

Section 4.1, line22: "different from the well structured observed anoma-

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lies?; not clear, where are the well structured; observed; anomalies? Lines 26-27, comparison of Aer3 with figure 3j: Whilst it is clear that Aer1, Aer2 and Aer3 are compared among them and that the AOQ anomalies (perturbed+O+Q minus climatological) are compared with ERA40 (if the climatology is a long term mean, in the text, it is not specified how these anomalies for ERA40 are calculated), it is not straightforward for me understanding the comparison between the ERA40 anomalies and Aer3. Aer3 does represent the isolated impact of Aerosol+ozone in the AOQ simulation whilst the ERA40 anomalies have all the forcings (+ feedbacks).

Page 9218, lines 3-5: you would like to assess if the model reproduces the El Nino and QBO circulation; realistically;. Do you mean consistently with other studies or specifically with observational studies (but for ENSO you refer mainly to other modeling studies).

Line 20: ;the reference model have no QBO;.;, sentence not clear

Why in the pure aerosol response with climatological SSTs (Aer1) there is no cooling of the polar vortex? and why the cooling in the second winter following the eruption is weakly reproduced just by AER3?

A curiosity: Have you looked at winds at extratropical latitudes ? (I am thinking of contours in ALT(from the surface to the model top )-TIME(as figure 3) for zonal mean zonal wind at 60N/S and polar T) Do you have any comment about it?

Figure 3, please specify how the ERA40 anomalies are calculated

Section 4.2, page 9219: why do you compare the pure aerosol response of AER1 and AER2 with the ERA40 anomalies (the same is done in section 4.3, Maybe I have not understood how the ERA40 anomalies have been constructed)?. Maybe you could first describe the comparison between AOQ and ERA40, if they are in good agreement then your pure aerosol response could indicate if or which part of the simulated

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strengthening of the polar vortex could be ascribed to the aerosol perturbation in the model.

In the first winter following the eruption, the ENSO effect seems to be the dominating effect (figure 4g), maybe you could specify it at the end of section 4.2

Curiosity: have you seen if the February anomaly in the lower stratosphere and at the surface is different with respect to the beginning/mid of the winter?

Page 9223, 11-15: why do you define the ERA40 pattern (I think) as the 'observed volcanic pattern'? same question as before, how have you defined the ERA40 anomaly?

Figure 5 is small, if it is not complicated to enlarge it that would be fine

Have you looked at the SLP patterns?

Description of ERA40 should be included in the dataset section

Textos: In the text you describe figure 5 but it is actually figure 4, the same for figure 5

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9209, 2008.

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