

***Interactive comment on* “Simulation of the climate impact of Mt. Pinatubo eruption using ECHAM5 – Part 2: Sensitivity to the phase of the QBO” by M. A. Thomas et al.**

Anonymous Referee #3

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Review of Simulation of the climate impact of Mt Pinatubo eruption using ECHAM5 - Part2: Sensitivity to the phase of the QBO, by M. A: Thomas et al.

General comments

The authors investigate if the impact of the eruption of Mt Pinatubo on the stratospheric temperature and circulation and at the surface is sensitive to the phase of the QBO, as simulated by the ECHAM5 GCM.

The scientific issue addressed in the manuscript is relevant for the domain covered by ACP, but the authors should discuss in more details their findings concerning what they

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define the pure QBO response in the lower stratosphere and the response including all the forcings. Results concerning the impact of the phase of the QBO on the surface fields is weak. The methodology is valid but the description of the simulations could be improved as well as English.

In the manuscript, the words response and impact are used, but it is not always specified of/on what the authors could maybe prefer anomalies of T/geopotential instead of responses in T...

Hereafter, text from the manuscript is reported in upper case.

Specific comments:

Abstract:

line 3, IMPACT OF MT PINATUBO ERUPTION IN THE TROPICS..., impact on what?

line 12, THE COMBINED (AEROSOL+OCEAN+QBO) RESPONSES, not clear for an abstract.

line 14, WINTERS is plural, line 16, it is singular

line 17, RESPONSE of what?

Introduction:

page 9242, line 5, ERUPTION is repeated

line 4, DECAY RATE of what?

line 5, SYNCHRONIZED, what do the authors mean? the same phase?

line 11-12, IT WOULD BE INTERESTING..., why? I think this sentence could be included in the following HERE, THE MAIN FOCUS...

line 13: RADIATIVE AND DYNAMICAL is very general, could the authors be more precise?

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Section 2:

page 9243

Line 13: I don't think it is correct starting sentences with TO INCLUDE, maybe it is better IN ORDER TO...

line 21: please define what PERTURBED and UNPERTURBED simulations are

line 24: please specify that the correlation coefficient is calculated using a window of 23 months; when I have read it for the first time I was wondering how it is possible to calculate a correlation coefficient between a time series of 23 months (June1991-May1992) and a time series of (12x51years) months

page 9244

line 4: WESTERLY AND EASTERLY WINDA ARE COMPARABLE..., do the authors mean westerly/easterly QBO with westerly/easterly opposite QBO(hereafter referred to as QBObar) and not westerly QBO with easterly QBO (westerly QBObar with easterly QBObar)?

line 7-8: IT CAN BE SEEN THAT THE ZONAL WINDS..., sentence not clear at all.

line 9: CYCLES should be CYCLE ?

line 12: TABLE 1, please describe the table, it is very difficult to understand it without reading PART 1 (is the table really necessary?)

line 13: ARE SHOWN BY QBO, do the authors mean LABELED?

line 15, please define what an OCEAN RUN is

line 15-20, please define in a more clear way that: PURE QBO = (ObsSSTs + QBO) minus (ObsSSTs) (AOQ = (Aer+ObsSSTs+QBO) minus (climSSTs) (the same for QBO-bar), is better defined) and specify why this choice has been done (why the authors analyse PURE QBO defined as above and AOQ).

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Section 3

page 9244

line 1: THE FIRST PART... of what?

line 1: DISCUSSES THE RESPONSES... do the authors mean the simulated responses in T, and not reality? If so, please specify simulated

lines 23-26 and page 9245 lines 1-4: text should be in the introduction, it is not a description of results. Text could be maybe repeated close to the description of a specific result (a figure) in order to help interpretation.

Section 3.1

The title of this section is not clear, (Maybe: Response of T/GH in the lower stratosphere to pure QBO forcing...) in any case, the authors should describe what a PURE QBO RESPONSE is

lines 22-23 (page 9245): TO EXPLAIN THIS BETTER..., please rewrite it

lines 22-25: it does not seem to me that figure 2c represents a CLIMATOLOGY, but the difference between figure 2b and 2a. If it is so, please correct.

page 9245 lines 25-26 and page 9246 lines 1-2. Is the text describing figure 2c or something else (personal communication)?

Section 3.1.2

line 6, page 9246: IS PRESENTED ... are presented discussion of figure 3, page 9246:

line 19: QBO FAVORS, maybe the authors mean should favor? (the text is describing what is not happening in the simulations)

line 20: THIS MAY BE BECAUSE.... Please, add arguments. In the analysis the anomalies are calculated as (QBO+ObsSSTs) minus (ObsSSTs), so the ENSO effect on the polar vortex should be present in both the terms of the difference. Figure 3c

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(1991/1992 observed QBO) should represent the QBO effect on polar vortex (east-erly=more disturbed) + ENSO (more disturbed) + non linear QBO/ENSO interaction minus the ENSO(alone) effect, so why the pure QBO signal does not show a more disturbed polar vortex? is it due the non linear QBO/ENSO interaction? Is the QBO not acting as a wave guide for planetary wave propagation or maybe the effect is too small? could the authors comment on it? Have you looked at zonal winds?

Page 9246, last sentence: A POSSIBLE EXPLANATION..., sentence not clear, do the authors mean that if there is no anomalous planetary wave propagation (in this case due to ENSO) they do not expect to find the HT mechanism on the polar vortex?

Section 3.2.1.

Line 15, page 9247. Is the text describing figures 4a and 4b or comparing them with figures 2 a and b? (why AS FIGURE 4A AND B?)

line 24, THERE WAS AN ONGOING NINO, but just in the first winter.

line 25, WHEN ONE COMPARES THESE RESULTS WITH THE PURE QBO T RE-SPONSES..., comparing figure 4 and 2, how can I see that the anomalies at high lati-tudes are insignificant? No significances are shown. if conclusions about figure 4 are that the anomalies are a RESULT OF THE COMPLEX INTERACTIONS BETWEEN AEROSOLS, QBO AND SSTs, what is the utility of doing this kind of exercise?

page 9248, line 1. IT IS SHOWN THAT... I cannot see this. Where is it shown? The strongest differences between figure 4a and 4b high latitudes are: beginning of the first and second winter following the eruption (colder and more persistent vortex in westerly QBO - consistent with HT). JFM, second winter following the eruption, warmer and more disturbed vortex in westerly than easterly (consistent with HT), could the authors add/comment in the text?

Section 3.2.2

Could the authors comment on why the HT mechanism is found in the AOQ simulation

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but not in the pure QBO? (also in the conclusions?)

Section 3.2.3

please refer to the correct figure number of Part I and define what the OCEAN RESPONSE is

line 15: THE COMBINED EFFECTS DO TO AEROSOLS... ARE SEEN, not clear If the MAIN FEATURES OF THE VOLCANIC WINTER PATTERN are not reproduced by the simulations, what is the interest of looking at the AOQ and AOQbar difference? How are the anomalies in SLP?

Conclusions

Conclusion number 2, last sentence: THIS IS SUGGESTED TO BE DUE..., please add explanations/arguments (see comment on section 3.1.2, line 20)

Conclusion number 3, THE MODEL TRIES TO SIMULATE..., strange sentence (the model is able/ is not able...)

Conclusion number 3, lines 24-25: WEAK POLAR VORTEX - WESTERLY PHASE - AOQ, not correct (maybe the authors mean STRONG ?)

Conclusion 4, please define OCEAN RESPONSE

Conclusion 5, STRONG WARM ANOMALIES ARE OBSERVED IN THE NH LAT... , they are also found in westerly (figure 4). Any comment about the ENSO impact on T? Why this conclusion is the last one?

page 9251, line 19. Why is it called DYNAMICAL RESPONSE? same comment in section 3.2.2

Could the authors please add significances in figures 2 and 4?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9239, 2008.

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