

Interactive comment on “Response of the Antarctic stratosphere to warm pool El Niño Events in the GEOS CCM” by M. M. Hurwitz et al.

Anonymous Referee #2

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This work uses time-slice experiments performed with the GEOS V2 Chemistry Climate Model in order to study the response of the AA stratosphere to the WP El Niño. The manuscript is well-written and clearly focused on one aspect of the El Niño / QBO relationship, applying the same ideas and methodologies of Hurwitz et al 2011, here on a set of simulations specifically constructed. The manuscript presents quite convincing conclusions about the insensitivity of the modeled AA stratosphere to the westerly phase of the QBO.

I would suggest to publish the manuscript, after clarifying some points (below):

In general, this manuscript appears to be strongly connected to Hurwitz et al 2011 and this is clearly outlined by the authors, but in some parts the authors are too quick in justifying their motivation/description (for example see discussion of figure 4). I would

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suggest to let the manuscript become more autonomous (and not as if it were a sort of Hurwitz et al part II)

Having to deal with a larger size than reanalysis data, why not extending this analysis to the CT El Niño too?

Introduction: could you add some reference to the works that relate the strength of the southern polar vortex to the phase of the QBO (e.g., Butchart and Austin 1996; Baldwin and Dunkerton 1998)?

Table 1: year 2002 is classified as a easterly QBO year, but according to the QBO data (look at figure 1 on this webpage: <http://www.geo.fu-berlin.de/en/met/ag/strat/produkte/qbo/index.html>) it seems to me a westerly year. Am I wrong?

The choice of excluding the years 2002-2003 is not clearly motivated. The ENSO of 2002 was not affecting the SSTs of SON of year 2003, so why not including this year in generating the boundary conditions? Moreover, if the ENSO of 2002 had a role in the wave events from the troposphere leading to the major warming over Antarctica, this fact again cannot justify the choice of excluding year 2002 or 2003 in the boundary conditions. It would certainly be more consistent either to include year 2003 in the boundary conditions (if there was an WPEN ENSO as reported in Table 1), or eventually to exclude it in both the boundary conditions and the MERRA composites. (for example Table 2: the eddy heat flux in the WPEN/QBO-E composite is different. It would be more consistent to recalculate it by excluding the "special" year 2003 in MERRA? The same holds for the other fields: T, OLR ...)

I would not stratify ENSO neutral with QBOE and QBOW, I would consider the ENSO neutral without stratification

Do composite years change if using the 30hPa level in MERRA too?

Figure 2: could you show the time-series of the cut at 50 hPa (in both MERRA and the

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model) and the cut at 30 hPa?

Table 2: could you describe it also in terms of anomalies of the eddy heat flux?

Could you add some specific comment about the role of the representation of the climatological stationary waves (in the model) in the stratospheric response to the convective heating at high latitudes? (see for example Fletcher and Kushner, J climate, 2010)

It is not clear why the 'Vera et al 2004' region (red box on figures 5 and 6) should be the same in the model as well as in the observational datasets: the mechanism identified by Vera et al (enhanced convection → stronger poleward wavetrain in the SH in that region) is not verified in the model.

Figure 5b-5d shows that there are biases in the QBOe-QBOw (WPEN) OLR also at equatorial latitudes, implying possible biases in the convection. How do this could affect the representation of the QBO itself? (for example, if there is not enough wave flux by resolved waves due to biases in the reprint of convection there could be no downward propagation of the westerly winds from down to 100 hPa ?)

Figure 6: the RWS: at which level is shown? Could you describe in Figure 6 also the RWS in other regions and not only in the red-box area (cyclonic, anticyclonic...)? Could you spend few words for clarifying the choice of this diagnostic (have you looked at the lat-lon wave activity)?

Could you speculate about the behavior of the models QBO? Why does it not reach the 100 hPa level and stays confined above? What is the role of the resolved and unresolved equatorial waves? What is the role of the vertical resolution in the representation of the QBO? How many vertical levels are there in the 100-10 hPa region? Was the QBO internally generated in the previous model version? What is the role of the convection scheme in the model in the representation of the QBO?

Could you add a comment on the implications of not having a quasi-biennial signal in the convection in CCM simulations of present and future climate?

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A curiosity: how do the model behave in the NH stratosphere (CTEN ENSO/QBO relationship)?

page 9754, line 24: five days (?) -> this is not shown

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 9743, 2011.

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