

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 #1

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“Response of the Antarctic stratosphere to warm pool El Niño events in the GEOS CCM” by Hurwitz et al

General Comments- Authors use new version of GEOS V2 CCM to investigate the response of warm pool El Niño (WPEN) events on the spring time Antarctic stratospheric circulation. This response is compared with MERRA analysis. Authors also try to do some sensitivity analysis of this response to the phases of QBO. Overall, authors show that during WPEN events, enhanced planetary wave activity leads to warming of Antarctic stratosphere, which is well simulated in GEOS CCM. However, model simulations do not show any sensitivity to the phases of QBO.

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The manuscript is well written and has good scientific basis. However, some analysis is missing in the manuscript. Hence, I recommend that manuscript to be published in ACP, after addressing following comments.

Major Comments:- A) Title:- There is not a single plot/analysis of any chemical species, so is it really CCM study or GCM study?

B) Authors argue enhanced planetary wave driving during WPEN events leads to warmer temperatures in Antarctic stratosphere and is well captured in model simulations. However, on page 18 (Table 2) MERRA data shows 40-50% increase in eddy heat fluxes during WPEN events, whereas model doesn't show significant difference in eddy heat fluxes for WPEN and ENSO events. And although authors try to provide some additional proofs in Figure 4, 5 and 6, it is difficult to believe that simulated response is real. Wave forcing depends on three different mechanism, wave generation, wave propagation and wave breaking. Authors need to show some additional analysis to argue that simulated response is indeed due to enhanced wave breaking (for e.g eddy heat flux- temperature relationship shown in Newmann et. al. 2001). Including some analysis from transient run (e.g. CCMVal REF1 run), would be also a good idea to show what happens to eddy momentum flux ($u'v'$) (and/or EP Fluxes).

C) Author select year 1991 and 1994 to create boundary conditions for the simulations. But these years are close to Pinatubo eruption (specially year 1994), which caused significant changes in tropospheric and stratospheric circulation (Robock, 2000). So authors need to caution the readers about selection of these years.

D) Page 8:- line 17 and page 9, line 8, Does it mean “Holton-Tan mechanism” is not valid for MERRA and model simulations? Again using transient run, authors can show that Holton-Tan mechanism is well represented.

Minor comments-

1. Page 2, Line 1- Abstract:- First sentence is very long(more than 60 words).

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2. Page 2, Line 23 – “OLR?” and again very long sentence.
3. Page 3, Line 20-30, again very long sentences.
4. Page 6, line 27, reference?
5. Page 9, line 10, “warming” or “final warming?”
6. Page 11, line 24, 5 days! Where?
7. Figure 1. Again is it possible to add plot showing temp, wind, eddy heat flux differences between two simulations?
8. Figure 2, 3, 4,5,6 – Non-linear colour scheme is very confusing. I think it would be good idea to have labelled contour, and shaded regions showing 90% and 95% significance.
9. Figure 4(a and b)- Is it from MERRA or from NCEP as in caption.

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