Atmos. Chem. Phys. Discuss., 14, C7014–C7017, 2014
www.atmos-chem-phys-discuss.net/14/C7014/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying contributions to the recent temperature variability in the tropical tropopause layer" *by* W. Wang et al.

Anonymous Referee #1

Received and published: 12 September 2014

General Comments

This paper explores the causes behind a recent decadal warming of the tropical tropopause layer (TTL) using a series of well-designed climate model experiments with NCAR's WACCM model. The authors conclude that natural (QBO, SST) variability, rather than anthropogenic factors, are responsible for the recent warming of the TTL. They also illustrate the importance of the model's vertical resolution in simulating temperature trends in the TTL.

The manuscript is generally well written and appropriate for publication in ACP. However, after reading through the manuscript, I have some unanswered questions about the authors' methodology and their interpretation of the results, which I think should be

addressed prior to publication.

Specific Comments

1. The warming trend mentioned in this paper from 2001-2011 has not continued to the present (see, e.g., recent article in EOS: DOI: 10.1002/2014EO270001). If you were to redo this analysis with slightly different end years (e.g., 2002 to 2012, 2003 to 2013), you might reach very different conclusions, so I'm not entirely comfortable with the short 11-year trend period used in this paper. The authors need to discuss the sensitivity of their results to the short period chosen for the trend analysis, and make readers aware that the warming trend has not continued (at least monotonically) from 2011 to 2014.

2. When assessing the statistical significance of trends in time series, autocorrelation can sometimes inflate the significance of a trend. This is easily corrected by changing the n in equation 3 to an effective sample size (see Santer et al. 2000, as well as the Wigley 2006 paper that the authors cite). It's not clear from the text if the authors did this, but if not, they should double check to make sure that their trends are still significant after accounting for autocorrelation.

3. Figures 9b-d and 10c-d are extremely difficult to read. As a reviewer, I cannot properly assess many of the statements of the authors in Sections 4.1 and 4.2 because I cannot see what they are referring to in the figures. Either the signatures the authors are discussing are not robust, or the figures need to be improved. I'm not sure what to suggest here, but I would encourage the authors to closely read their text and make sure their conclusions are readily visible in the figures.

4. Page 22120, Line 25: Reflecting and scattering incident solar radiation back to space does not lead to a warming of the lower stratosphere. Please rephrase.

5. Figure 1c: Please explain how the QBO values are determined in the model for future years.

6. Page 22126, Lines 7-9: Why are the observed SSTs and simulated SSTs (from a fully coupled model) decreasing over exactly the same period? Shouldn't the model's SST variability be internally generated and thus independent from that in the real world?

7. Sections 3.2 – Section 3.6: The uncertainty in each figure is listed in each paragraph as 0.2 K/decade. Yet, in some paragraphs, the uncertainty is stated as "small", and in other paragraphs, it's stated as "large." This is confusing. Please clarify and rephrase.

Technical Corrections

Page 22119, Line 4: Delete "masses"

Page 22119, Line 19: Delete "for"

Page 22120, Line 27 (and references hereafter): I think you mean Solomon et al. (2011) (which discusses aerosols), rather than Solomon et al. (2010) (which discusses stratospheric water vapor).

Page 22122, Line 10: 2100 contradicts 2099 used in Table 1.

Page 22124, Equation 3: Please rewrite. It has two division signs.

Page 22126, Line 11: Has should be have.

Page 22127, Line 25: Should be "Sect. 2.3"

Page 22128, Line 24: Text says "insignificant", but figure shows shading.

Page 22131, Line 10: Change "errors" to "arrows"

Page 22131, Line 19: Change "divergence" to "convergence"

Page 22131, Line 27: 12-16 km is in the mid-latitude lower stratosphere.

Section 4.1: The term upwelling (instead of upward vertical wave propagation) is mistakenly used in this section several times. Please correct.

Page 22133, Line 9 (and elsewhere): Transit branch? Do you mean shallow, or perhaps, transition branch?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 22117, 2014.