

## ***Interactive comment on “The Tropical Tropopause Layer 1960–2100” by A. Gettelman et al.***

**A. Gettelman et al.**

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Replies to Reviewer #3:

We thank the reviewer for their comments. We believe that these comments have helped to improve the manuscript. We note replies to the major and minor comments below.

Major Comments:

1. Instead of another analysis, we have added interannual anomalies from a radiosonde archive to estimate trends. This provides a check on the reanalyses, and a much better basis for comparisons
2. We have analyzed the vertical gradient of potential temperature and discussed it in the discussion of figure 15. This is a helpful suggestion, but also indicates that things are not as clear:  $d\theta/dz$  is increasing at 100hpa, but also at 150 hPa, well below the

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tropopause. We have discussed this surrounding figure 15. We have also performed a multiple linear regression on the anomalies of the model TTL diagnostics to pick apart what contributes to tropopause temperature and pressure.

Minor comments:

Information on the vertical resolution in the TTL of all models and reanalysis data should be described in Table 2 or in a separate table. This should be the critical information for the TTL research.

>> The information has been added to the table for the models, and also to figure 3.

The ozone concentration in the TTL is quite different in different models (Figure 8) due to the difference in photochemical and perhaps dynamical processes considered in these models. The correlation between the CPT temperature and TTL ozone, described at page 1381 and in section 5, may not be associated solely with direct radiative connection between the two but may be associated with indirect connection through, for example, dynamical processes. The direct (radiative) connection is only one of the candidates at the moment, and may not be appropriate to be stated strongly in the abstract.

>> This is a good point. We have removed the discussion of causes from the abstract, and discussed possible dynamic influences in the analysis and conclusions.

In page 1383, lines 5-7, cloud height changes in WACCM are described. Are such tropospheric changes consistent with the IPCC 2007? How about other models?

>> We discuss this now with respect to the changes in the underlying GCM. IPCC2007 multimodel trends are not significant.

Regional and seasonal distribution of temperature at CPT should be critical for determining the water vapor mixing ratio in the tropical lower stratosphere, while the discussion in section 5.3 is based on zonal mean value. At least with WACCM outputs, the authors should be able to investigate this point further.

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>>We discuss this complication, but also note there are correlations between average CPT and average water vapor found by other authors looking at interannual variability (Randel et al 2006, Fugelistaler and Haynes 2005).

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 1367, 2008.

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