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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effects of convection on the summertime mid-latitude overworld" *by* A. E. Dessler

Anonymous Referee #2

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Review of "The effects of convection on the summertime mid-latitude overworld" by Dessler

This paper is an interesting analysis of the HALOE dataset. However the central hypothesis, that convection directly goes up to the altitude where HALOE sees zonal water vapor anomalies, is not justfied by the analysis. The claims for convection are not supported with any measure of convection, but 'inferred' in an inappropriate manner.

To be publishable, this manuscript would need further analysis of some proxy of convection in conjunction with the water vapor data to support the conclusions, or a modification of the discussion.

There are two serious flaws with the analysis, and some minor ones:

First, HALOE has a 2km field of view, and is reported at higher vertical resolution. So there is likely an impact of lower levels on higher levels. If elevated water vapor is seen at 18km, it might be due to higher H2O at 16km. The retrieval will try to take account of this, but it may not be able to. This at least should be noted. Also, the sign of the HALOE bias and cause should be made explicit: HALOE has a dry bias and cannot see near convection. How might this affect the results? It might mean that near 380K in convective regions there are significant problems with HALOE near convection, and it might be biased low (and should be higher).

Second, as noted above, this paper implies that convection occurs up to the height of the HALOE water vapor anomalies. The paper does not convincingly demonstrate that convection is directly responsible. The paper totally ignores the role of horizontal transport in the water vapor anomalies. The authors need to do a lot more work to justify the statement on p8326, line 13.

The HALOE maximum at 380K over Asia is in a region where there is not convection underneath. Or maybe there is for these HALOE points. Can you show there is convection here? High water vapor anomalies tilt westward with height in the monsoon anticyclone (this is clearly evident in figure 3), and it is likely that horizontal transport is playing a significant role in advecting convective outflow from 15km (˜380K) to higher altitudes. This is more likely than direct convective injection, unless all the convection in this region were to detrain above 380K! Figure 3 shows this: Anomalies below 380K are over the Bay of Bengal, and then shift westward at higher levels.

Also, convection in the Asian monsoon region is not confined to 30-40N, but extends south of this as well. There is a transport effect from convection in this region to the region you are analyzing.

Over North America, there is continental convection in the North American monsoon at 30-40N, but this is advected southward and eastwards by the circulation as well. The author has not shown that this might be occurring, or ruled it out of the analysis (for

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example from back trajectories). This is not as clear as the Asian example.

This paper might be publishable if the authors were to better discuss the role of horizontal transport and incorporate some observations of convection into the analysis.

Some minor points:

1. Please mention the HALOE 2km Field of View.

2. If the HALOE correction is not important for the analysis please don't apply it. (See 3 below).

3. What if the bias in the HALOE data does have a longitudinal dependence? What is the correction based on? For example, since HALOE as a limb measurement cannot see near clouds, there is a dry bias, but it is stronger near convection. This would appear as a zonal mean bias, but in reality the data should not be corrected everywhere (hence comment 2 above). This of course would ENHACE the zonal asymmetry in your data, but I am not sure how high it would be applied without knowing the origin or justification of the correction.

4. NCEP data have a 4K positive bias around the tropopause (Pawson and Fiorino, 1998) this might be inflating your theta values by ˜8K (theta). I am not sure how deep the bias reaches in altitude (see reference). I think you should do a bit more careful conversion, or use some other data source for temperature (how about HALOE temperatures? are they okay?). In fact, this might explain why your 380K values seem low in altitude (below 16km).

S. Pawson and M. Fiorino. A comparison of reanalyses in the tropical stratosphere. Part 1: thermal structure and the annual cycle. Climate Dynamics, 14:631-644, 1998.

5. As noted above, on pg 8426, line 13 " ... the only possible explanation for this upward transport is convection." This is not supported by the data, and ignores the longitudinal shift in figure 3. It would be much better do discuss the possible role of horizontal transport of convective detrainment. You might also take a look at recent

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work by Randel and Park, 2006 on the dynamics of the monsoon, and water vapor and convective coupling.

Randel, W. J., and M. Park (2006), Deep convective influence on the Asian summer monsoon anticyclone and associated tracer variability observed with Atmospheric Infrared Sounder (AIRS), J. Geophys. Res., 111, D12314, doi:10.1029/2005JD006490.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 8421, 2006.