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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using a WRF simulation to examine regions where convection impacts the Asian summer monsoon anticyclone" *by* N. K. Heath and H. E. Fuelberg

Anonymous Referee #1

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This study presents detailed analyses on convective influences on the upper-level anticyclone (ULAC) using the high resolution Weather Research and Forecasting (WRF) model simulations for the 10-20 August 2012 period. In addition to WRF model, backward and forward HYSPLIT trajectory model simulations are utilized to quantify regions with relatively higher impacts on the transport into the upper level anticyclone. The Tibetan Plateau and the Southern Slopes are recognized as dominant sources of convection reaching to the upper troposphere and lower stratosphere. It is a well-structured paper with on-going science questions regarding the role of convection during the Asian summer monsoon over the Tibetan Plateau. I highly recommend this

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Discussion Paper

article to be published in ACP and below are my specific comments for the authors might take into consideration.

Major comments

1. Based on the results from the back trajectory model simulations, only 1.9% and 0.5 % of the total trajectory accounts for convectively influenced particles at 150 and 100 hPa, respectively. Over 99% of particles over the Tibetan Plateau, which is convectively influenced, is based on those small numbers. My first question would be what explains the origin of the rest of the particles up to about 98.1 (and 99.5) %, that are not influenced by convection? It seems to me that convection has very little impact on the ULAC. I am also curious to know if allowing back trajectory simulations up to 24 hours, instead of 6 hours, will change the results significantly and if the results are meaningful.

2. One of the main points of this paper is that only the high resolution WRF run with less than 4-km horizontal grid can be used resolving convection over this region. It would be helpful to show the coarser resolution (36 or 12 km grids) model runs failing to simulate any key features shown in the high-resolution model runs for comparison.

3. It needs to be clearly mentioned in the paper that the transport of pollutants might not be as efficient as transport of water vapor into the stratosphere though the ULAC as there is less pollutant sources over the TP than the surrounding regions. For instance, even though > 90% of convectively influenced particles originate from the TP, their contribution to the chemical composition within the ULAC can be less.

Specific comments

1. WRF has very fine vertical resolution of ~380 m in the upper troposphere and lower stratosphere. Even though it is easier to understand results at 100 and 150 hPa, I am curious to know variabilities at the levels between those two levels. I believe in the earlier studies, numbers of vertical levels in the data or the model were very limited

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(e.g., Dunkerton, 1995).

2. P24812, L6 – Remove Fueglistaler et al., 2009

3. Fig. 1 – I would recommend showing water vapor from WRF simulations along with MLS.

4. Section 2.4 – I am wondering if precipitation data (for example, TRMM) can be used instead of lightning data as convective proxies. What are the advantages or disadvantages using lightning data versus precipitation?

5. Figs.3 & 4 – I think that the geopotential height fields at 100 or 150 hPa can be representative of the strength of ULAC because it is a response to the convective forcing at the surface. I am wondering how representative or relevant the geopotential height at 700 hPa (low pressure in the lower stratosphere) to the ULAC?

6. The back-trajectory model results shown in Fig. 6 are almost confined within the anticyclone. I would expect particles spread broadly outside of the anticyclone boundaries but with highest density exists inside or near the TP.

7. The histograms in Fig. 9 show very symmetrical distributions. It would be interesting to compare this with diurnal cycles of convection observed from satellite to see if they have the same diurnal cycles.

8. Section 3.3 – I would like to know where the particles are located at 150 hPa if not inside the anticyclone as a result of the forward-trajectory run. Are they located near the anticyclone? How many particles end up their journey within the anticyclone?

9. I would recommend marking Xs on the lakes in Fig. 14 as it's done in Fig. 13.

10. Titles and annotations of the figures can use larger fonts.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 24809, 2013.