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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Geographic and seasonal distributions of CO transport pathways and their roles in determining CO centers in the upper troposphere" *by* L. Huang et al.

Anonymous Referee #1

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Review of "geographic and seasonal distributions of CO transport pathways and their roles in determining CO centers in the upper troposphere" submitted to ACP by Huang et al.

General comment:

This paper could provide some scientific value that may help interpreting the source of the CO vertical transport. However, the analysis method is ambiguous and impairs the reliability of the results in many ways. The description of the method is not clear as current stage. Considering the amount of efforts needs to make this work publishable, I recommend not accepting the manuscript for publication at the moment.

Recommendation: reject

Major comments:

1. After reading the manuscript, I am lost of what the main scientific questions are. Yes, even if you do a good job showing the contribution of these three pathways, what usefulness of these three pathways? What are the questions you want to address?

2. The direct transport pathway by convection is easier to identify, but other two pathways LT-Convection and UT advection are relatively difficult, if not possible, to separate. Using 8-day average could smear many things out. Explanation of the first case by LT-Convection is very difficult to believe especially when you are inferring 1000 km horizontal transport without significant mixing.

3. Using cloudsat as the presence of deep convection is problematic. Remember CloudSat only provide a thin vertical cross section. More often it only crosses the edges of a large MCS. Therefore, it is difficult to use it as a direct measure of the strength of convection. There are a lot of cirrus clouds contributing CWC that are not necessarily from deep convection. Sampling is another problem. If you plot the samples from CloudSat daily, the holes are huge globally. I am not sure if 8-day cloudsat average can give a good representation of the convection, even in a big 4x8 grid.

4. The scenario of LT advection-convection is very ambiguous. When there is increasing UT CO, with convection, but without high surface CO, it must be LT-convection? Logically, it can also be quite possible a UT advection case. I would rather believe latter, unless you can provide evidences to rule out the UT advection by using upper level wind and low upstream CO.

5. The method of analysis is not quantitatively described. What determine UT CO increase? What CWC determine convection? What determine surface CO? These are very important to understand the results.

6. The proof of the success of the classification is weak (see minor comment #10).

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Though the final results seem somewhat reasonable in certain ways, better validation of the method is still needed.

7. Though the focus is on South America and Africa, it is still useful to show how the classification works globally. It is another way to test if the method works or not.

Minor comments:

1. 32424, line 8, be specific on these three pathways. It is kind of confusing in the current abstract.

2. 32424, line 13, define LT.

3. 32424, line 17, highest CO near surface or at upper troposphere?

4. 32425, line 27, citations needed for the case studies

5. 32429, line 5-7, I do not think averaging 8 days NCEP data is a good idea. 8 days is enough for a major transition of atmospheric environment. The mean wind field could be very misleading.

6. 32429, How much confidence do you have on the CWC above 6 km representing the deep convection transporting CO to 215 hPa and 100 hPa? There are many cirrus clouds can give you CWC, but have nothing to do with the deep convection.

7. 32429, what are the criteria that you use to define a) increase of CO (by increase 10% from the mean CO for example, or just greater than the earlier 8 day period?) b) deep convection, what CWC value represents deep convection? c) surface CO emission, what value of surface CO is defined as presence of CO emission?

8. 32430, line 12-25, what are the strength of low level winds during the event? Why makes you think CO was advected southward? What strength of southerly flow can transport CO 1500 km within 8 days? Also how much horizontal mixing could that be during the horizontal transport at low levels? The local convection can very well transport the local CO emission to upper troposphere make a bull's eye near Angola.

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Keep in mind that you do not need a strong surface emission to give high values of CO in UT given a healthy deep convection.

9. 32431, line 17, what convective source do your mean?

10. 32431, Table 1 shows me that when there is high CO around at 215 hPa between 0-20S, your classification is only correct 3 out of 5. I am not sure if this is successful.

11. 32433, How do you determine dominant pathway? 40% of cases as one class?

12. 32434, line 22-25. Southeast Asia is a good place to test if your classification works or not. I am interested to see what kind of results you get. UT advection should be dominant over a large area due to the strong anti-cyclone above.

13. 32436, fig 9, how about UT advection? No change of CO by UT?

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 32423, 2011.