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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characteristics of intercontinental transport of tropospheric ozone from Africa to Asia" *by* Han Han et al.

Anonymous Referee #1

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General Comments:

The authors provide a detailed analysis for the long-range transport of tropospheric O3 from Africa to Asia. They indicated that African O3 have important influences on free tropospheric O3 over Asia, and the imported African O3 peaks in winter because of the shifts of transport and emission patterns. I recommend the paper for publication after consideration of the points below.

1) The paper isn't concise enough for me. For example, Section 5 provides a summary for the transport and emission processes, which is actually a repeat of Section 4.2. In addition, considering the small contribution from SHAF (shown by Figure 4), it may not be necessary to have an individual section (Section 4.3) to discuss its influence.

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Discussion paper

2) The discussion should be improved. The authors should explain why the seasonal variability of biogenic isoprene is so weak (Figure 6); and revise the discussion about the contributions from various sources (i.e. biogenic, biomass burning and lightning, Section 4.2).

Specific Comments:

1: Line 147-149 Are the O3 production and loss rates generated using the full-chemistry simulation with the current model settings or from other studies (Wang et al. 2998; Zhang et al. 2008)?

2: Line 149-153 It would be better to show these regions as boxes in the map (e.g. Figure 5). It is difficult to imagine the regions just based on these lat/lon numbers.

3: Line 155-157 Did the authors evaluate the possible influences from interannual variations of meteorology on chemistry?

4: Line 166-167 Is there any other station available? Why are these three stations selected?

5: Section 2.3 Is the meteorological data the same as used by the HYSPLIT model? If they are the same, it would be better to combine Section 2.2 with Section 2.3.

6: Line 237-239 The influence of African O3 to south America across Atlantic is discussed, but isn't shown in the Figure. It could be better to remove the discussion about the transatlantic transport here.

7: Line 262-269 Although may not be necessary to explain, I am just curious about the reason for the discrepancy between western and eastern Africa.

8: Line 276-277 Figure 6 shows significant seasonal variation for biomass burning CO. Surprisingly, the seasonal variation of biogenic isoprene is ignorable, which seems inconsistent with other study (e.g. Marais et al. 2014). Is it associated with the color scale?

On the other hand, the normalized magnitudes of seasonal variability (Figure 7) are comparable between CO and isoprene. Is it due to the usage of standard deviation in the calculation? The approach for normalization is confusing.

Marais, E. A., Jacob, D. J., Guenther, A., Chance, K., Kurosu, T. P., Murphy, J. G., Reeves, C. E., and Pye, H. O. T.: Improved model of isoprene emissions in Africa using Ozone Monitoring Instrument (OMI) satellite observations of formaldehyde: implications for oxidants and particulate matter, Atmos. Chem. Phys., 14, 7693-7703, https://doi.org/10.5194/acp-14-7693-2014, 2014.

9: Line 315-362 The discussion in this section is superficial. The authors discuss the contributions from various sources without detailed calculations. For example, the authors indicated: 1) “In boreal spring, a region with high ozone concentrations (>40 ppbv) appears in higher altitudes and . . . mainly due to the highest biogenic emissions in the NHAF” 2) “In boreal autumn, the locations of the ITCZ and the Hadley cell are similar to these in boreal spring. Ozone in the African middle troposphere ... attributed to stronger lightning NOx emission”

However, there is no evidence to demonstrate that the contributions from biogenic and lightning activities are evaluated carefully. The discussion is simply based on the spatial distribution of Figure 6. The biogenic and lightning activities are highly similar between spring and fall, and it is hard to explain why the spring-time O3 is biogenic dominant, whereas autumn-time O3 is lightning dominant.

10: Section 4.2 It seems that Figure 8 and Figure 9 are already sufficient for the discussion. I suggest to remove Figure 10 to make the paper more concise.

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