Atmos. Chem. Phys. Discuss., 12, C4232–C4235, 2012
www.atmos-chem-phys-discuss.net/12/C4232/2012/
© Author(s) 2012. This work is distributed under
the Creative Commons Attribute 3.0 License.

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric ozone trend over Beijing from 2002–2010: ozonesonde measurements and modeling analysis" *by* Y. Wang et al.

Anonymous Referee #1

Received and published: 3 July 2012

This study analyzes the seasonality and trend of tropospheric ozone over Beijing in ozonesonde observations during 2002-2010 and reports a significant positive trend of 4.6% in the tropospheric ozone column. The relative contributions of two ozone sources (dynamics processes and photochemical production) to the trend in different altitude ranges of the troposphere are investigated in combination with passively transported ozone from the CLaMS model (without tropospheric chemistry); the trend differences generally indicate the contribution from photochemical production. Results show that although transport processes drives most of the tropospheric ozone seasonality, photochemical production contributes significantly to the positive trend especially in the lower troposphere during spring and summer. This paper is generally well organized

and written and is suitable for publication on ACP. However, some of the discussions could be improved (see specific comments below). The abstract could be improved to more accurately reflect the main conclusions of this study. I recommend this paper to be published after addressing the following specific comments:

1. "With a clear positive trend in the maximum summer ozone concentration" in the abstract emphasizes the trend during the summer, but according to Table 2, there is a similar trend (relatively larger) trend during the winter for 3-9 km and 0-3 km. Maybe you should change it to "with a clear positive trend over the last decade", consistent with what is said in the conclusion section.

2. In abstract, I am not clear about the main purpose of the sentence "This trend is close to the significant trend of ... 3.4 %/yr-1". This does not really support the connection between the overall trend and 0-3 km trend during summer. As shown in Table 2, the overall trend is even closer to the trend of 0-3 km ozone during winter (4.6%) and the trend of 3-9 km during the summer (4.8%). I suggest removing it or changing this sentence to what accurately reflects the conclusion.

3. In abstract, suggest changing "contributed to" to "contributes to" (i.e., use current tense for scientific statement).

4. Section 2.1, Total ozone from Dobson spectrometer, and satellite observations (when Dobson not available) are used to scale the ozone profile. Since total ozone columns from different sources are used to scale the entire ozone profile and this study focuses on tropospheric ozone, it is worthwhile to check the trend without applying any correction based on recommendations from the SPARC report (1998) and a recent study by Morris et al. (2012). The authors mentioned that there is no significant rend in the correction factors, but it would be more useful to check and report whether the trend is affected and report that how much the trend is changed if the change is significant.

5. P11179, line 10, please specify which OMI total ozone product is used as there are

two products: OMTO3 and OMDOAO3.

6. P11180, line 1, change “near to the surface” to “near the surface”

7. In Figure 1 caption, it would be better to define LRT1 and LRT2 as the readers understand them without reading the text.

8. P1181, first paragraph, what does LRT1 and LRT2 mean? The two tropopause levels in case of double tropopause? I think that more description of their physical meaning is needed here.

9. P11181, line 23: LRT2 does not seem to have a strong seasonal cycle.

10. P11182, line 20, change “chemistry” to “tropospheric chemistry”

11. P11183, line 8, change “exactly” to “almost” as there are some differences

12. P11183, line 16, I would not call them consistent if aircraft and ozonesonde observations peak at different time. Do you have any idea about their discrepancy (ozonesonde data peak in June and aircraft data peak in spring)?

13. In section 3.2 and Figure 2, there is a major difference between ozonesonde and CLaMS-PO3: in August and September, low ozone reaches much higher altitude, above some high ozone in the middle troposphere (Fig. 2b), causing more negative ozone gradients in Fig. 2d than in Fig. 2c. Please comment on this.

14. P11184, lines 2-4, as the positive trend is not caused by enhanced ozone, this sentence may be rephrased to “there is a positive trend during periods (spring and summer) of enhanced lower tropospheric ozone concentrations over the last decade”

15. P11184, line 8, change “each profiles” to “each profile”

16. P11184, line 13, what is the source of OMI TCO?

17. Fig. 3a shows the trend in tropopause but there is no discussion related to this. Since the tropopause trend is in different units, it is not clear about the contribution of

tropopause to the overall TCO trend. To evaluate its impact, I suggest calculating TCO using the all-year average monthly mean tropopause and check the change in the TCO trend.

18. Footnotes in Tables 1 and 2, change “slop” to “slope”

19. Table 2 should also include the trend comparison for the TCO as well as 9-15 km layer to make the discussion/abstract/conclusion clearer as there are discussions of the trends/mean values of TCO and upper layer ozone between winter and summer in the text (e.g., P11186, lines 15-18, abstract, conclusion).

20. P11187, line 22: “the largest . . .during summer” seem to contradict to the sentence in line 19 (3.1% yr-1), please clarify this or modify the sentence.

21. P11188, line 5, the sentence “This constitutes with . . .” is confusing. I suggest changing it to “Most of the trend is caused by photochemical production ($\sim$3%)”

References

SPARC-IOC-GAW: Assessment of Trends in the Vertical Distribution of Ozone, SPARC report No. 1, WMO Global Ozone Research and Monitoring Project Report No. 43 Geneva, 1998.

Morris, G. A., Labow, G., Akimoto, H., Takigawa, M., Fujiwara, M., Hasebe, F., Hirokawa, J., and Koide, T.: On the use of the correction factor with Japanese ozonesonde data, Atmos. Chem. Phys. Discuss., 12, 15597-15638, doi:10.5194/acpd-12-15597-2012, 2012.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 11175, 2012.