Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1133-RC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Verification of anthropogenic VOC emission inventory through ambient measurements and satellite retrievals" *by* Jing Li et al.

Anonymous Referee #1

Received and published: 27 January 2019

Comments to Li et al., 2019, ACPD, acp-2018-1133: Verification of anthropogenic VOC emission inventory through ambient measurements and satellite retrievals

General Description of manuscript:

The authors developed an emission inventory of anthropogenic non-methane volatile organic compounds for Beijing-Tianjin-Hebei (BTH) region of China for 2015 using emission factor approach. Their estimate of total anthropogenic VOCs emissions over BTH in 2015 is 3277.66 Gg. The authors reported that their emission inventory shows significant consistence with both ambient measurements and satellite-derived emission inventory. PMF analysis of online measurements and their emission inventory

Printer-friendly version

Discussion paper

show that vehicle emissions dominate the anthropogenic VOCs in Beijing. This study is interesting, and within the general scope of ACP. However, there are some weaknesses in current version. For example, many key statements come without citation; some references are inappropriate; some conclusions are not fully supported by their figures and numbers; some discussions are not quantitative. Therefor, I think this manuscript needs a major revision before it become suitable for publication.

General Comments:

Activity data is quite important in EF-based emission inventory. Where did the activity data come from? Can you please provide a table of activity data for each source and for each category?

What is the monthly variability of the EF-based emission inventory? And what's the difference between your monthly emissions and the satellite-derived monthly emissions?

Can you please add comparison between source structure from PMF analysis and that from your emission inventory for each season? As there might be a seasonal variability in source structure of your emission inventory.

Specific Comments:

1. Line 33: "Their direct emission sources include biogenic and anthropogenic sources". Forest fire emissions are also worth to mention here. In addition, please include some appropriate citations here.

2. Line 42-46: Zhang et al. (2009) and Li et al. (2014) have done a lot work in compiling anthropogenic VOCs emissions over China. They are also worth to cite here.

3. Line 63-66: Both Karplus et al. (2018) and Henne et al. (2016) are not appropriate references here, because Karplus et al. (2018) talks about SO2 and Henne et al. (2016) talks about methane. Please include some NMVOC-related references here.

4. Line 67-69: Please include some references here to denote "Earlier studies" and

Printer-friendly version

Discussion paper

"most studies".

5. Line 105: what is "COPERT 4" short for? Please give a full name of this software when you first mention it.

6. Line 122-123: Where did "county-level", "city-level", and "provincial-level" data come from? Please include corresponding references here.

7. Line 132: Please give the source profile of Wu and Xie (2017), you can put it in the supplementary information.

8. Line 137: Please also give the height of roof site.

9. Line 169-170: Please give the emission ratios of VOC species relative to CO you obtained from the linear fit model.

10. Line 171-172: Please include references to support "(1) CO has similar sources as that of anthropogenic VOC and (2) CO emissions show lower uncertainty compared with VOC emissions".

11. Line 177: Please include appropriate references on validation of CO emission inventory of MarcoPolo Project.

12. Line 186-187: Can you please give a brief description (or formulas) on how your sampled VOCs uncertainties were calculated?

13. Line 198: "...limited..." should be "...constrained..."

14. Line 199-200: "HCHO is a high-yield product of VOCs species oxidation" should be "HCHO is a high-yield product of many VOCs species oxidation". Also, please include some appropriate references to support this sentence. Such as Millet et al. (2006), Stavrakou et al. (2015).

15. Line 200: "...relative to..." should be "...against..."

16. Line 235: "...in January, with an average value of 62.26 ppbv"? But figure 5 shows

that the January average was less than 60 ppbv.

17. Line 237: “In October, the average mixing ratio of VOCs was 50.64 ppbv”. Again, the October average in figure 5 seems to be less than 50 ppbv.

18. Line 246: “The VOCs accumulated in early October decreased sharply in the middle of the month, then began to accumulate again with the change of the diffusion condition”. Can you please provide some meteorological analysis or some references to support this sentence?

19. Line 265: “. . .a few different emission sources from CO” should be “. . .a few emission sources different from CO sources”

20. Line 275-277: “After the comparison with results obtained from measurements, the emissions for a majority of the non-methane hydrocarbon (NMHC) species were agreed within $\pm$100% in the emission inventory”. Can you please quantify the “a majority”?

21. Line 277: “The emissions for acetonitrile came from the two methods were similar” doesn’t seem to be supported by the acetonitrile emissions values (0.21 Ton yr-1 vs 16.52 Ton yr-1) listed in Table S2.

22. Line 282-283: “The annual emissions for alkanes were in agreement between the two methods”. Can you please quantify the “agreement”? As the detailed emission values of many alkanes in Table S2 have large difference between these two methods.

23. Line 287: “The annual emissions for the alkenes, except ethene, correlated well”. Again, please quantitatively state the “correlate well”.

24. Line 288-289: “Ethene and acetylene are mainly emitted through an incomplete combustion process”. Please include appropriate references for this sentence.

25. Line 293-297: What’s the local VOC emission standards? Can you please give a reference?

26. Line 303: “. . .reaction. . .” should be “reactivity”.

27. Line 316: “appointment” should be “apportionment”?

28. Line 323-335: Can you please add some comparison between your PMF analysis with PMF analysis from other studies during these seasons?

29. Line 384: Can you please make markers of Xingtai and Handan on the maps of figure 13?

30. Line 386-391: The subtitle of this part is “Verification of spatial distribution”, but here you are discussing the monthly variabilities of satellite-derived emissions and another bottom-up emission inventory (Li et al., 2017) at length. It seems a little odd. If you want to discuss monthly variation, can you please provide the comparison between your monthly VOCs emissions and satellite-derived monthly emissions? And also, please keep the subtitle consistent with your text.

31. Line 392-393: Again, Geng et al. (2017) talks about NO2 and NOx emissions. Can you please include some appropriate references on top-down VOCs emissions and OVOC satellite observations? Such as Palmer et al.(2006), Fu et al. (2007), Marais et al.(2014), Stavrakou et al. (2015), Bauwens et al. (2016).

32. Line 407-408: Again, can you please quantify the consistence between the NMHCs emissions derived from online measurements and those from your emission inventory?

33. Table 1.: What are “1,1,2,2-” and “1,2-” in the last 3 rows?

34. Figure 2.: The unit “Ton/grid” should be “Ton year-1 grid-1”.

35. Figure 4.: What’s the difference between “Other VOCs” and “Others” in the bar plot? What’s “Other thenes”? Why is “Others” the largest contributor in bar plot, while it is the smallest one in the pie plot?

36. Line 580-586: “. . .Sci Total Environ . . .” in line 582, and “. . .Journal Of Geophysical Research-Atmospheres. . .” in line 585. The formats of references are not unified.

Please unify the reference format throughout the whole references.

References:

Bauwens, M., Stavrakou, T., Müller, J.-F., De Smedt, I., Van Roozendael, M., van der Werf, G. R., Wiedinmyer, C., Kaiser, J. W., Sindelarova, K., and Guenther, A.: Nine years of global hydrocarbon emissions based on source inversion of OMI formaldehyde observations, Atmos. Chem. Phys., 16, 10133-10158, https://doi.org/10.5194/acp-16-10133-2016, 2016.

Fu, T.-M., Jacob, D. J., Palmer, P. I., Chance, K., Wang, Y. X., Barletta, B., Blake, D. R., Stanton, J. C., and Pilling, M. J.: Space-based formaldehyde measurements as constraints on volatile organic compound emissions in east and south Asia and implications for ozone, J. Geophys. Res., 112, D06312, https://doi.org/10.1029/2006jd007853, 2007.

Li, M., Zhang, Q., Streets, D. G., He, K. B., Cheng, Y. F., Emmons, L. K., Huo, H., Kang, S. C., Lu, Z., Shao, M., Su, H., Yu, X., and Zhang, Y.: Mapping Asian anthropogenic emis- sions of non-methane volatile organic compounds to multiple chemical mechanisms, Atmos. Chem. Phys., 14, 5617–5638, https://doi.org/10.5194/acp-14-5617-2014, 2014.

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

Millet, D. B., Jacob, D. J., Turquety, S., Hudman, R. C., Wu, S., Fried, A., Walega, J., Heikes, B. G., Blake, D. R., Singh, H. B., Anderson, B. E., and Clarke, A. D.: Formaldehyde distribu- tion over North America: Implications for satellite retrievals of formaldehyde columns and isoprene emission, J. Geophys. Res., 111, D24S02,

https://doi.org/10.1029/2005jd006853, 2006.

Palmer, P. I., Abbot, D. S., Fu, T.-M., Jacob, D. J., Chance, K., Kurosu, T. P., Guenther, A., Wiedinmyer, C., Stanton, J. C., Pilling, M. J., Pressley, S. N., Lamb, B., and Sumner, A. L.: Quantifying the seasonal and interannual variability of North American isoprene emissions using satellite observations of the formaldehyde column, J. Geophys. Res., 111, D12315, https://doi.org/10.1029/2005jd006689, 2006.

Stavrakou, T., Müller, J.-F., Bauwens, M., De Smedt, I., Van Roozendael, M., De Mazière, M., Vigouroux, C., Hendrick, F., George, M., Clerbaux, C., Coheur, P.-F., and Guenther, A.: How consistent are top-down hydrocarbon emissions based on formaldehyde observations from GOME-2 and OMI?, Atmos. Chem. Phys., 15, 11861–11884, https://doi.org/10.5194/acp-15- 11861-2015, 2015.

Zhang, Q., Streets, D. G., Carmichael, G. R., He, K. B., Huo, H., Kannari, A., Klimont, Z., Park, I. S., Reddy, S., Fu, J. S., Chen, D., Duan, L., Lei, Y., Wang, L. T., and Yao, Z. L.: Asian emis- sions in 2006 for the NASA INTEX-B mission, Atmos. Chem. Phys., 9, 5131–5153, https://doi.org/10.5194/acp-9-5131-2009, 2009.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1133, 2019.

Printer-friendly version

Discussion paper