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Comment on acp-2022-116

Anonymous Referee #2

Referee comment on "Variations and sources of volatile organic compounds (VOCs) in urban region: insights from measurements on a tall tower" by Xiao-Bing Li et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-116-RC2>, 2022

Li et al. report interesting time-resolved VOC measurements on the Canton Tower in Guangzhou, China using a QiTOF PTRMS. The Guangzhou region is impacted by air pollution and underrepresented in atmospheric observations which is why data from this region are a valuable opportunity to learn about the processes and regional sources. The identification of these sources from the data must be challenging due to chemical complexity. PMF was utilized to help with this task and five factors were obtained from the PMF source apportionment conducted on the 225 VOC ions which were assigned different mostly anthropogenic categories. The observations focus on abundant VOCs and correlations with inorganic pollutants which might be helpful to understand variability of pollutants, oxidation and sources in the atmosphere. The text reads generally clear and there are rich figures to illustrate observations and thoughtful analyses. However, I'd have some comments and suggestions before the paper is published, and in particular there seem to be some issues or inconsistencies in a few compounds and PMF interpretations which hopefully can easily be addressed.

Major

- Ethanol (e.g. Fig 1) is rather high as for the outdoor atmosphere and what I am most surprised with is that it is attributed to human emissions from tower visitors. If ethanol was emitted by human visitors on the tower why were siloxanes, not co-emitted? It is difficult to get convinced that such a large concentration of ethanol comes from human breath as is suggested in the SI Page 19. Was maybe a sanitizer dispenser in the vicinity to the sampling inlet? A picture or at least a schematic of the inlet location would be useful (as well as the info if the particle filter was used or not).
- The concentration data at least for ethanol are inconsistent. Ethanol concentration is shown in multiple figures with overlapping times in Fig 1 and 11. Ethanol concentration is different in those figures (e.g. 9/30, 9/29).

- The lack of dependence on wind direction (L397) is surprising and makes me wonder if the instrument may have been sampling from indoors, indoor plumes, or if there may have been a leak in the line or other factor which would explain high ethanol, and acetic acid concentrations. Wind roses or polar plots for VOCs would also be useful to help in clarifying these issues and help in source interpretations.
- The PMF analysis results seem surprising to me. It almost seems like the same compounds and factor profiles appear in every factor (Figure S5). Methanol and acetone appear in multiple factors as most abundant. Visitor factor is lacking siloxanes. Given it is the QiTOF with very high sensitivity, I'd expect the clearer factors including biogenic, oxygenated biogenic, and cooking could be obtained without merging. I wonder if optimizing uncertainties or dividing the dataset into shorter periods could further help in those source interpretations.

Minor

- I really like Table S1 with nicely tabulated masses and formulas identifications and sensitivities with clear note which ion was explicitly calibrated. I think it is exemplary for all PTRMS papers. I only have minor suggestions here: 69.03 should be furan (not fural), 51.99 monochloramine, 71.03 add MACR. Did you not see D5 fragment at 355.06? This is extremely surprising as is the unexpected D5 fragment at 299. I am again curious what the E/N ratio was.
- It is mentioned that ethyl acetate was one of the most abundant VOCs, but how did the authors exclude butyric acid or subtracted it from the signal?
- Nowhere in the text or SI PTRMS parameters are shown. It would be great to provide at least E/N, which is a common practice in a PTRMS papers, because it helps interpret the VOC data and estimate expected fragmentations.
- Fig. 3: I wonder why the traffic rush hours are not clearly seen on the plots presenting aromatics. The period was probably not during the lockdown if the visitors are allowed in the tower. Ethanol and monoterpenes coincide with lunch and dinner so might be cooking emissions(?).
- Fig. 5: Super interesting effect of Typhoon on VOC concentration reduction. I wonder about the dependence of the observed concentrations on the wind speed.
- I could not find in the main text or SI how exactly the PTRTOF data were processed, what software was used for mass scale alignment, peak fitting, as well as quality control, formula assignment, compound inference, total number of ions detected and steps taken for ion reduction or any abundance filters. This info would be greatly appreciated in the methods or SI.
- I am quite intrigued by the chromium ion reported in the SI Table. Did its signal show some ambient structure or was it coming from the ion source? There are many cool molecules in this table that could be useful to explore as source markers and complement PMF.

Technical

L 75 "were" should be "are"

L109 "by far" should be "so far"