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Comment on acp-2021-959

Anonymous Referee #2

Referee comment on "Measurement report: Ambient volatile organic compound (VOC) pollution in urban Beijing: characteristics, sources, and implications for pollution control" by Lulu Cui et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-959-RC2, 2022

The research focused on ambient volatile organic compounds pollution at urban Beijing, and analyzed their characteristics, sources, and control effects. This study is of interest to the atmospheric scientists and suitable for the ACP. The observation data were detailed presented, the chemical composition and emission sources were analyzed aiming at different months and different O3- or PM2.5- pollution days, and the VOCs decline was found through comparing with reference results to support the control effects. However, I have a few concerns that should be addressed before the acceptance of the manuscript.

Major comments:

- In introduction section, the air pollution status has greatly changed in past several years in Beijing, due to the strict control measures implemented. However, the corresponding introductions were outdated and can't present the current pollution characteristics. For example, line42 about SOA fraction in PM2.5, line 48 about SOA contribution to haze pollution, line 56 about the contribution of biogenic and anthropogenic sources, and so on. The recent references and their conclusions should be referred to.
- Methodology section, VOCs detection system should be GC-MS, but not GC (as mentioned in lines 95-96), for Agilent 5975 uses mass spectrometry detector. If the detector only included MSD but not included FID, C2 hydrocarbons would not be detected but they widely exist in atmosphere. This point should be illustrated. In addition, the efficiency of this analyze system for aldehydes should be well discussed. Because various monitoring standards don't explicitly recommend the "canister sampling-GC/MS analyzer" to detect aldehydes.
- This study used the fact that O3 or PM2.5 pollution event happening to define high-O3 months (Apr, May, Jun, Jul and Sep) and high-PM2.5 months (April, May, Oct, Nov, Dec, Jan). It seems weird. For example, although O3 event never happened in Aug, but ozone level was also relatively higher in Aug than in Apr and Sep. So Aug should be considered as the high-O3 month, comparing with Apr and Sep. And then, in the results

of PMF, the source apportionment in low-O3 months (Oct, Nov, Dec, Jan) was different with that in high-PM2.5 months (April, May, Oct, Nov, Dec, Jan), but similar to that in low-PM2.5 months (Jun, Jul and Aug). This conclusion was unreasonable to a certain extent.

- When using PSCF to explore the spatial potential sources of VOCs in urban Beijing, 24h was considered for all species. However, the lifetimes of various VOCs species were greatly different, several hours for alkenes, but several days for some alkanes and halocarbons. I suggest various groups of VOCs should be individually considered, to give the lifetime hours in backward trajectories.

Minor comments:

Abstract: "O3/PM2.5" frequently appeared but without an explicit definition. It is hard to understand the "high and low-O3/PM2.5 months", "O3/PM2.5 polluted days", and "high O3/PM2.5 levels", etc.

Lines 32-34: "The positive matrix factorization (PSCF) analysis showed that O3 and PM2.5 pollution was mainly affected by local emissions. " PSCF was conducted for VOCs, but not for ozone and PM2.5. No evidence to support this conclusion.

Line 47: VOCs chemistry in ozone formation involves gas-phase reaction, but not multiphase reaction.

Line 104: the "coefficient" should be coefficients; "was" should be "were"

Line 111-112: air pressure appeared twice.

More detailed model performance verifications (RF) are necessary, although R^2 has provided in Fig. S2.

Line 191-193: I cannot figure out the sentence, suggesting checking out syntax rules.

Line 234: Fig. S3 was mentioned, however, there is not Fig. S3 in the supplement of this passage.

line 243-244: “Alkenes, aromatics and OVOCs were the three contributing chemical groups to O3 formation”, should be “the three biggest contributors”.