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Comment on acp-2022-379

Anonymous Referee #1

Referee comment on "Daily evolution of VOCs in Beijing: chemistry, emissions, transport, and policy implications" by Marios Panagi et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-379-RC1, 2022

The manuscript by Panagi et al. investigated the levels of multiple VOC species, NOx, CO, OH during campaigns in summer and winter, provided important insights on how chemistry and transport affect the VOC concentrations in Beijing. Multiple sensitivity analyses are conducted in this work, based on a dispersion model (NAME) and a chemical box model (AtChem2) which are constrained by in-situ measurements. The analyses are comprehensive and robust, providing a feasible roadmap for future researches by combining campaign measurements, inventories, and modelling. The relationship of NO_x/VOC and O_3 during summer and winter indicate that season-specific policy control measures are needed

I suggest minor revisions before publication. My detailed comments are listed below.

- Line 33: GEOS-Chem is a global transport model with relatively coarse resolution (~ 0.5 degree). Comparing the modelled concentrations between NAME-AtChem2 which focus in Beijing and GEOS-Chem is not needed in the main text. You have enough interesting results to show and including such comparison doesn't give more information. I suggest move it to SI or delete it from the manuscript.
- Line 125 – 130: It's weird that you don't use consistent emission inventories for all species. You mentioned that "ethylene, acetylene and ethanol emission inventories are not part of MEIC", is it true?
- Line 141: "ethene" or "ethylene" (as shown in Line 128)? Please keep it consistent throughout the paper.
- Figure 2: How about the chemistry during transport before arriving at Beijing? The lifetime of most VOC species is less than 24 hours.
- Line 153 – 165: suggest moving this part to SI or delete it.
- Line 249 – 259: this are very interesting and valuable sensitivity test.
- Figure 6: How about formaldehyde? It's more sensitive to chemistry. Please add similar plots for formaldehyde.
- Figure 8: Poor correlations between OVOCs and NOx in the model. Any reasons for this bias?

- Line 463 – 465: Worst performance for S5 by constraining OH is found compared to other cases. Can I interpret it in this way, constraining OH is NOT a good option for further box modeling?
- Line 476 – 478: I don’t quite understand this statement. Reducing VOC will decrease formaldehyde, and then further decrease ozone formation, right?
- Line 481 – 484: You mean in winter, it's in transition regime, and in summer, it's VOC limited? Can you explain more on this? Also, in summer, the biogenic VOC emissions can play a key role. How will isoprene emissions in summer affect your conclusion?