

Atmos. Chem. Phys. Discuss., referee comment RC1
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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.,
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The manuscript by Panagi et al. investigated the levels of multiple VOC species, NO_x, 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 O₃ 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 NO_x 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?