Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-399

Anonymous Referee #2

Referee comment on "Composition and reactivity of volatile organic compounds in the South Coast Air Basin and San Joaquin Valley of California" by Shang Liu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-399-RC2, 2022

Review for Liu et al., "Composition and reactivity of volatile organic compounds in the south coast air basin and San Joaquin Valley of California"

Review Summary

Liu et al present atmospheric composition measurements collected during two flights associated with the FIREX-AQ campaign in 2019. They analyzed VOCs, CO, NOx, and ozone from measurements collected below 1.2 km altitude. They estimated total OH reactivity including contributions to OH reactivity by different chemical constituents. They found that VOCs accounted for most OH reactivity, and oxygenated VOCs, in particular, accounted for more than 60% of the OH reactivity attributed to VOCs. Biogenic VOCs comprised a minor portion of the total VOC mixing ratio but accounted for 21% of the OH reactivity from VOCs in the South Coast Air Basin. Biogenic VOCs contributed to less of the OH reactivity in the San Joaquin Valley on these flight days. A steeper gradient in OH reactivity was observed in the South Coast Air Basin than the San Joaquin Valley, the latter of which was more homogeneously distributed. The data-set is unique, valuable to the scientific community, and a good fit for the journal. The analysis and context of the measurements could be improved with some minor modifications that I describe below.

General Comments

The authors should comment on expected temporal variability throughout the year to provide some context for how representative these two flight days were. Would you expect BVOC and OVOC emissions to be higher or lower in the winter and spring? And

why? Many of the plants in the region are drought deciduous and go dormant in the summer and fall. In the San Joaquin Valley, what is the context for agricultural activity on these two days? Are there times of year when the BVOCs from ag plants might have a stronger contribution to OH reactivity in this area?

The conclusions would be better supported with some simple box modeling to estimate how much of the VOCs could have reacted away by the time the air parcel reached the aircraft. The authors mention this in a qualitative sense, but knowing the reaction rate constants, assuming some oxidant concentration, and estimating the air parcel age would allow them to be more quantitative in this assessment. Even some range of values would be helpful. Has >80% of the BVOCs reacted away already? <20%? They state that the VOCs have undergone photochemical processing for minutes to several hours, but this could be translated into a more meaningful estimate of how this equates to estimated percent loss of VOCs vs OVOCs. You could even estimate how much of the HCHO was contributed by BVOC oxidation vs OVOC oxidation, etc.

Specific Comments

The authors mention they only included measurements collected below 1.2 km. Can they clarify the PBL height? Are these within the PBL or in the free troposphere?

Table 2 provides incredibly detailed measurement information, but it's unclear to me why it is in the methods section instead of the results. Aren't these results?

It's unclear what the main takeaway is from Figure 4. Can the authors please strengthen the discussion of this figure, better highlight its relevance, or remove it if that is not possible? As far as I can tell, the figure isn't referenced anywhere in the text directly.

On page 16, the authors make comparisons to OVOC contributions reported in mainland China, Seoul, and Mexico City. Can the authors clarify that these were also flight measurements at a similar altitude? Or were these surface measurements? It would be helpful to know to provide context for the comparison.