Response to the Comments of the Reviewers

Dear Editor and Reviewers,

We would like to thank you for the elaborate work on this manuscript.

We revised the manuscript by responding to each of the suggestions in the reviews. In our response, the questions of the reviewers are shown in *Italic* form and the responses in standard form.

We appreciate your help and time.

Sincerely yours,

Xin Li and Co-authors.

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Manuscript Title: Development of multi-channel whole-air sampling equipment onboard unmanned aerial vehicle for investigating VOCs vertical distribution in the planetary boundary layer.

Response to Reviewer #1

General comments

Yang et al developed multi-channel whole-air sampling equipment onboard an unmanned aerial vehicle (UAV) platform, which is essential for measuring vertical concentrations of VOCs in the planetary boundary layer. The UAV platform is well designed and have been tested in field campaign in Chengdu city. The newly designed UAV successfully "capture" the characteristics of VOCs at different heights, demonstrating the capability of UAV for vertical VOC measurement. The manuscript is very well written. I recommend that the manuscript is published after some minor revisions.

Response:

We would like to thank reviewer #1 for the positive and constructive comments, which helped us improve the quality of the paper. Below, we answer the reviewer's question point by point.

Comments

1. Line 220, The impact of ozone on VOC concentration can be quantified for certain alkenes, if you have the reaction rate constant for a given alkene, the reaction time (7 days) and ozone concentration.

Response:

We appreciate the reviewer's comments and agree with reviewer that the impact of O_3 on certain alkenes concentration can be quantified with the reaction rate constant, reaction time, and O_3 concentration. However, the O_3 concentration in the sampling canister could not be equal to the ambient concentration. If using the ambient O_3 concentration, the quantitative attenuation of alkenes will be far greater than reality. Taking ethene, propene, and 1,3-butadiene as examples, we used the box model to simulate the concentration change of alkenes and O_3 within a week (Fig. R1). The O_3 concentration in model was set to the ambient concentration during sampling (83 ppbv) and the reaction rate constant was taken from Goliff et al. (2013). Simulation results show that the 7-day recovery of ethene is only 15%, while propene and 1,3-butadiene almost disappear. This is significantly inconsistent with the measured 7-day recovery rate (red line). Therefore, the uncertainty of O_3 concentration in canisters makes it difficult to quantify the impact of O_3 on alkenes. Previous studies investigated the reasons of O_3 concentration uncertainty: 1. O_3 in canisters was destroyed by contact with the deactivated inner walls (Palluau et al., 2007a); 2. O_3 disappeared rapidly by auto-oxidation reactions (Harper, 2000); 3. O_3 was destroyed by deposition during the process of introducing into the canisters (Palluau et al., 2007b). However, it is certain that the residual ozone will react with alkenes, which is the reason that alkenes are the VOC group with the fastest decline different from other VOC species.

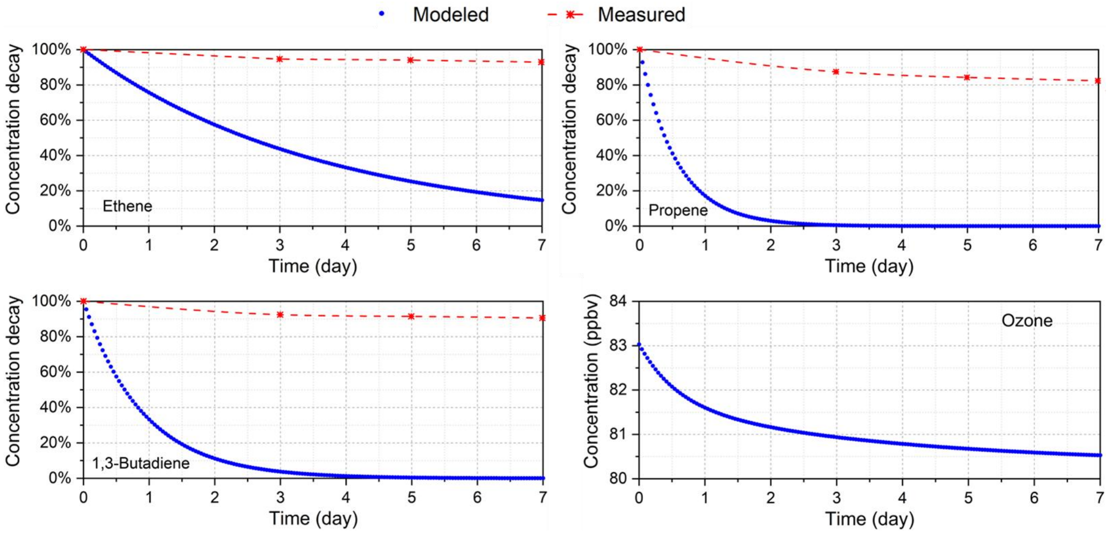

Figure R1: Simulation of the alkenes and O_3 concentration during the reaction.

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2. Line 292: Did you mean no significant emission sources are around the sampling site?

Response:

Yes. We have clarified this sentence in the revised manuscript. Now the sentence reads as follows: There were no significant emission sources are around the sampling site except for some motor vehicles.

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3. Line 62, 119, and 163, O3, NO2, SO2 -> O_3, NO_2, SO_2

Response:

We appreciate the reviewer's comments, and we have revised accordingly in the manuscript.

References

Goliff, W. S., Stockwell, W. R., & Lawson, C. V. (2013). The regional atmospheric chemistry mechanism, version 2. Atmospheric Environment, 68, 174-185.

Harper, M. (2000). Sorbent trapping of volatile organic compounds from air. Journal of Chromatography A, 885(1-2), 129-151.

Palluau, F., Mirabel, P., & Millet, M. (2007a). Influence of ozone on the sampling and storage of volatile organic compounds in canisters. Environmental Chemistry Letters, 5(2), 51-55.

Palluau, F., Mirabel, P., & Millet, M. (2007b). Influence of relative humidity and ozone on the sampling of volatile organic compounds on Carbotrap/Carbosieve adsorbents. Environmental Monitoring and Assessment, 127(1-3), 177-187.