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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Volatile organic compounds and ozone air pollution in an oil production region in northern China" *by* Tianshu Chen et al.

Anonymous Referee #2

Received and published: 16 February 2020

General Comment The impact of the O&NG exploration on the O3 formation in both summer and winter is one of the key issues in the studies of tropospheric chemistry. Negative impact of the O&NG exploration in North America had already been presented in a series of field studies in both United States and Canada including the warnings of serious wintertime ozone non-attainment for the Basin landscape. The study of O&NG exploration on the atmospheric chemistry is missing in China and has been nicely filled up by the current paper based on winter and summer field studies in Yellow River Delta (YelRD) which is a place famous for open oil fields in China. The dataset obtained in this study are very valuable and the data analysis is systematic and scientifically sound. The paper has been clearly written. Overall, I suggest to publish

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Discussion paper

the paper after the authors addressed the following comments.

Major Comment 1. It will be very valuable for the current paper to analyze the radical budget and the ozone production rates also for the winter campaign. And compare with the corresponding US studies to show from a chemical perspective why the ozone pollution is not appeared in the YeIRD region.

Specific Comment 1. Page 6, lines 1- 6, as described by the authors, the VOC samples were analyzed in the US lab which is far away. How did the authors make sure that the reactive compounds are not decayed away during the time span between sampling and the lab analysis?

2. The authors used “Atmospheric Oxidative Capacity” (page 6, line 17; page 11, line 17), “Atmospheric Oxidizing Capacity” (page 6, line 28; page 12, line 13), to denote AOC. I suggest the authors to use “Atmospheric Oxidation Capacity” for that. At least, it should be unified throughout the paper.

3. Page 7, lines 9-11, I don’t think the authors can refer the calculations of the ozone production rates simply to previous papers. The detailed equation needs to be given here and the uncertainty of the calculations is worth to be analyzed.

4. Figure 2, Y title, ‘jO1D’ the number 1 shall be superscript.

5. Figure 4, from the plot of the subgroups of the NMHCs, it is not clear to the readers how the high concentrations up to hundreds and thousands of ppbv of NMHCs is make up?

6. Page 11, line 29 -30, why not compared your results to measurements of HOx radicals in NCP such as Tan et al., ACP, 2017. And Tan et al., ACP, 2018 needs updated (it is already published in ACP).

7. Page 12, line 21 – 29, there were a number of direct total OH reactivity measurements published for field studies in NCP and PRD by the PKU and FZJ groups. I suggest the authors shall compare those in addition to the comparison to US cities. To

my knowledge, the kOH in this study is within the range of the available measurement in China.

8. Figure 10, a lot of OVOCs is calculated in the model. The summed reactivity is much higher than that of their precursors (alkanes, alkenes, and aromatics) which is normally difficulty to achieve. The large accumulation of OVOCs in the model may be related with the lifetime of those OVOCs implemented in the model. Could the authors breakdown the speciation of the calculated OVOCs and compare with the measurements as mentioned in the part of methods. The comparison between model and measurements for OVOCs could help the authors to define the lifetime of the OVOCs in the model.

9. Figure 11, the OH production rate from O3 photolysis seems to be a little large according to your O3 concentrations presented in Figure 3. I assume you calculated the photolysis rate of O3 (O3 + hv –> O1D), but the OH production needs a further reaction with H2O (O1D + H2O –> OH) which is competed by reaction with N2 and O2 (O1D+M–>O), the yield of OH is often around 10% of the photolysis rate of O3 depends on the H2O concentrations.

10. Figure 12, daytime average, please specify the exact time span of the hours

11. Figure 13, the O3 loss rate reached up to 20 ppb/h, what are the major reactions for that?

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