Title: Simultaneous observations of peroxyacetyl nitrate and ozone in central China during static management of COVID-19: Regional transport and thermal decomposition.

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Manuscript number: egusphere-2024-575

Dear Editor

Thank you very much for your time and effort in revising this paper. We apologize for the issues that were not addressed in the revised manuscript. We checked each comment carefully and strive to provide a satisfactory answer. Changes made in response to these comments are marked in yellow in the highlighted copy of the revised version. Our own minor changes are highlighted in red.

We are not sure if we fully understand your meaning. If there are any areas where the modifications are not reach the designated position, we hope you can provide further guidance. Your help was very much appreciated.

The following is a point-by-point response to each comment.

Reviewer #1:

First, while the section describing the influence of meteorology (3.1) is easier to read, the analysis was not made more quantitative in this revision as requested. I believe the fundamental concern here is that no effort has been made to calculate, quantitatively, how much the higher pollution in Case 2 could be due to meteorology rather than increased emissions. The current analysis brushes off any meteorological differences as minor, even though the higher wind speed and temperature and lower humidity might all contribute to a buildup of gas phase pollutants. For example, given that the wind speed in Case 2 is 25% lower than in Case 1, in a simple box model the pollutants could be expected to build up to levels [1/(1-.25)-1] = 33% higher just due to the lower ventilation, which is enough to account for much of the concentration differences of some pollutants between the periods. The influences of temperature and humidity may be more complex, but still, a quantitative estimate of their impact would be useful, or at least an acknowledgment of their potential importance. In cases where this fundamentally changes the conclusions that can be drawn from the analysis -- for example, if the difference in wind speed is indeed sufficient to explain some appreciable portion of the difference in pollutant concentrations -- that should also be noted in the conclusions and abstract.

Response:

We would like to express our gratitude for your contributions to the discussion. Due to technical and methodological limitations, we are unable to quantitatively analyze the impact of meteorological factors on pollution at present, which will be studied in the future. However, we have reviewed the literature and expanded our description of the relationship between meteorology and pollutants, affirming the importance of meteorological factors in pollution formation according your suggestion.

Prior research has indicated that low WS and high RH are associated with elevated $PM_{2.5}$ concentrations in Zhengzhou during the winter season. As indicated in our manuscript, the RH in Case 2 is 12% lower than that in Case 1. This difference in meteorological conditions is indicative of a greater propensity for pollution in Case 1. However, the discrepancy in wind speed (0.3 m/s) between Case 1 and Case 2 is deemed to be of negligible magnitude during the observation periods, and the actual impact is inconsequential.

To illustrate the important effect of meteorological conditions on pollution generation, we included a comparison of the difference in meteorological parameters between clean and polluted days. In this study, the WS on clean days (1.4 ± 0.8 m/s) was higher than that in Case 1 (1.2 ± 0.9 m/s) and Case 2 (0.9 ± 0.7 m/s), while the RH was 26.2% and 12.5% lower compared to Case 1 and Case 2, respectively. Therefore, adverse meteorological conditions play a significant role in the occurrence of pollution during the observation period.

At the same time, we have made appropriate modifications to the content and added descriptions and analyses in the manuscript to affirm the importance of meteorological conditions in pollution formation. (Lines 261-268)

Lines 261-268: In this study, the WS on clean days (1.4 ± 0.8 m/s) was higher than in Case 1 (1.2 ± 0.9 m/s) and Case 2 (0.9 ± 0.7 m/s), while the RH was lower by 26.2% and 12.5% compared to Case 1 and Case 2, respectively. These findings indicate that high RH and low WS significantly influence the occurrence of pollution during the observation period.

Reviewer #2:

Second, the interpretations about source apportionment in the VOC ratio analysis section (3.2) remain more conclusive than the data allow. I think the edits to Figure 3 have improved its usefulness. However, it is not true that the measured ratio, for example, of isopentane to n pentane "indicates that pentane is influenced by a combination of emissions from LPG and fuel evaporation". The same mean ratio could be reached through a linear combination of emissions from coal combustion and vehicle exhaust, for example. The statements attributing emissions to particular sources in this section should be hedged accordingly, acknowledging that other interpretations of these data can't be ruled out.

Response:

Thank you for your comments. We realize that the conclusions here are not rigorous enough, and we must admit that alternative interpretations of these data cannot be ruled out. We have revised this part of the manuscript. (Lines 334-339)

Lines 334-339: The isopentane/n-pentane concentration ratios of 0.6-0.8 represent mainly coal combustion emissions, ratios of 0.8-0.9 represent LPG emissions, 2.2-3.8 represent vehicle exhaust emissions, and 1.8-4.6 represent fuel evaporation (Conner et al., 1995; Liu et al., 2008; Li et al., 2019). The sources of isopentane and n-pentane in this study were intricate and multifaceted. The mean isopentane/n-pentane ratio was 1.4, with the majority of data points (99%) falling within the range of 0.1-4.6, with a notable concentration in the 0.8 to 1.8 interval. This indicates that pentane is susceptible to a combination of LPG emissions and fuel evaporation. It should be noted that this analytical approach is not without limitations. For instance, the proportionality of pentane may be influenced by a combination of LPG emissions and fuel evaporation. Consequently, an in-depth examination of the sources of VOCs was conducted using the PMF model in the next section.