Public justification (visible to the public if the article is accepted and published):

Dear authors,

Please address the issues reviewer 2 raised, which I have also copied below:

"Although the authors addressed most of the concerns raised by the reviewers, I was not convinced that they fully revised the manuscript. I suggest the authors to update the line-by-line responses to the review comments so that 1) reviewers can understand how the authors tried addressing the concerns, and 2) how the authors revised the manuscript for addressing the individual points. I am unable to suggest acceptance of the manuscript in its current form.

For instance, the response to the comment on Figure 3 by the reviewer #1 is not satisfactory. The authors only tried to change some expressions, and did not seem to put efforts on checking the data carefully for addressing the concern.

the comment by reviewer #1 on line 492 was not addressed in the revised manuscript.

It is not clear how the authors addressed the comment #2 by reviewer #3 (comment about precipitation).

I was unable to identify how the authors revised the manuscript for addressing the comment #12 (comment about line 474-477) by reviewer #3. I might have missed the update. At least, it is not clarified in the line-by-line response to the review comments."

Kind regards,

Dantong Liu

Responses to editor's comments

We thank the editor for the detailed, helpful, and overall supportive comments. We have revised the manuscript to account for each comment. Responses to the individual comments are provided below. Reviewer comments are in **bold**. Author responses are in plain text. Modifications to the manuscript are in *italics*. Line numbers in the response correspond to those in the revised manuscript text file.

1. (Figure 3) Do the authors have BC and CO concentration data? Both these chemical species are emitted from incomplete combustion. Their emission ratios depend on types of sources. If the authors could provide these data, it may help supporting the conclusion that the major emission source of BC during the LD period was different.

Thank you for your insightful comment. The observed changes in CO concentrations and BCc classifications provide strong evidence that the major emission sources of BC during the ALD period were different from those during the LD period. The increase in vehicle emissions and changes in fuel usage patterns as economic activities resumed are key factors contributing to these changes.

We have updated the text, and the revised version is as follows:

Line 369-376: *"During ALD ($PM_{2.5}$: 26.7 μg m^{-3}, NO_x: 27.9 μg m^{-3}, TVOC: 76.0 μg m^{-3}), the number fraction of BC-fresh particles rose from 28% (LD) to 31% (ALD), while the fraction of VE particles also increased from 3% (LD) to 12% (ALD) (**Figure 7a**), coinciding with a 16% rise in CO concentration (**Figure 3**). Both BCc and CO are by-products of the incomplete combustion of carbon-based fuels and are often correlated in urban areas (Han et al., 2009). The increased CO levels, which align with the resurgence of vehicle emissions, suggest a shift in fuel usage patterns and the contribution of BCc emission sources as economic activities resumed (Wang et al.,* *2015, Zhou et al., 2009).”*

2. (Line 492) Could condensation also contribute to the process? Or, do the authors have a strong support to demonstrate that the process was dominantly occurring by aqueous or heterogeneous reactions?

Thank you for the thoughtful comment. We have updated the text, and the revised version is as follows:

Line 478~490 : *“According to Surdu et al.*(2023)*, condensation involves the direct deposition of gas-phase molecules onto the surface of particles, driven by the difference between the condensable gases concentration (C_g) and its equilibrium particle-phase concentration (C_{eq}), which is negatively affected by RH. In our study, the average RH was relatively high during all three periods (>75%), but the condensable vapor concentration decreased during the lockdown period due to strict lockdown measures, making the difference between C_g and C_{eq} smaller during LD compared to the other two periods. Additionally, we observed a larger mode peak (600 nm, Dva) and higher Daged/Dfresh ratios (1.11) compared to BLD (510 nm, 1.03) and ALD (500 nm, 1.02) (Figure 6). Therefore, we conclude that condensation was likely inhibited during the LD period. Instead, the conditions likely favored aqueous-phase and heterogeneous reactions, which played a more important role in the evident growth of BCc particles, converting partially coated particles into fully thickly coated BCc during the LD period.”*

3. During the observation period, precipitation occurred intermittently (Figure 2b), and the author only mentioned “the data collected during the precipitation were excluded from the analysis” in Section 3.1. This method is obviously not enough to eliminate the impact of precipitation. Additionally, the maximum daily precipitation at the observation site does not exceed 10 mm (Figure 2b), however, the author has repeatedly mentioned heavy precipitation. How is the degradation of precipitation defined?

Following the latest editor's suggestion, we replaced the reanalysis precipitation data with data obtained from a local weather station near the sampling site, which can reflect the actual conditions experienced at the site. According to the definition provided by the China Meteorological Administration, a rainstorm is typified by substantial precipitation, usually falling within the range of 50 to 100 mm per day. On July 28, the daily precipitation amounted to 150 mm, indicating that it reached the threshold for a rainstorm event. So, we chose to exclude data collected during precipitation events to eliminate the potential impact of precipitation on the observed variables. This approach allowed for a more precise comparison between different lockdown periods. This adjustment helps prevent distortion of the results due to extreme weather conditions and ensures that our analysis is based on relative consistent meteorological data.

We have updated the text, and the revised version is as follows:

Line 173~174: "*Precipitation (PCP) data was obtained from the Yangzhou Meteorological Bureau.*"

Line 232~235: "*Notably, significantly reductions in $PM_{2.5}$, NO_x, and SO_2 were observed at the end of BLD due to a high precipitation event, with a peak hourly precipitation reaching 37 mm, and the data collected during this event were excluded from the analysis*."

4. (Line 474-477) "As shown in Figure 9, BCc particles with ~400 nm Dva exhibited significant diurnal fluctuations in the OC/Cn and SNA/Cn ratios, during the LD period. Moreover, there was a noticeable increase in the proportion of BC-SNA particles during nighttime when RH was relatively high". Compared with the LD period, BCc particles exhibited more significant diurnal fluctuations in the OC/Cn and SNA/Cn ratios during the ALD period. What is the reason?

Thanks for the comment. We have added the analysis about the more significant diurnal fluctuations in the OC/Cn and SNA/Cn ratios during the ALD period , as outlined below:

Line 470~476 : *"The more significant diurnal fluctuations in the OC/Cn and SNA/Cn ratios of BCc particles during the ALD period, compared to the LD period, can be attributed to increased primary emissions from resumed society activities, more complex atmospheric chemistry involving reactive gases, and the reinstatement of typical diurnal emission patterns, with higher nighttime RH further enhancing secondary aerosol formation."*

References:

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