

Response to Editor and reviewers

Dear Professor Xavier Querol:

Thanks so much for providing us a chance to revise and resubmit our manuscript. In the past weeks, we have fully revised the manuscript according to all the general and detailed comments raised by the reviewer.

Please feel free to contact us if additional revisions are requested and we are more than willing to conduct further revisions.

The very best

Ziyue

To Reviewer 1:

The document has been significantly improved, and considering the authors' emphasis on methodology, I have carefully reviewed the manuscript. Changes should be made, especially in how the results of sections 3.1 and 3.3 are presented. As a reader, there are instances where the described results are not found, making it difficult to locate or contradictory to what is stated. I also suggest making minor changes.

R: Thanks so much for your encouragement and providing us another chance to further improve this manuscript. We have advised this manuscript fully according to your constructive comments. We are more than willing to conduct further revisions if you have additional comments.

Thanks again for your time and help.

Issues regarding results and their comprehension:

-In section 3.1.

- It would be helpful to add the percentage of cities in Table 4 (if applicable) when referring to "a third of cities" in line 139. Additionally, indicating the total number of cities again in the same table or adding percentages to all the cities listed would be beneficial.

R: Thanks so much for this comment. The city percentage has been added to Table 4. Specific percentages have also been added in the corresponding sections of the text.

- Regarding line 140, "From the seasonal scale... was higher than that in spring in summer," it is advisable to provide a specific number from the tables or reference the table once again. Alternatively, consider highlighting the relevant numbers in the table. Currently, when referring to the tables, it becomes challenging for the reader to understand which specific table is being referenced.

R: Thanks so much for this comment. It's a very good suggestion and we have corrected it accordingly in the revised manuscript.

- Throughout the text, no numbers from the tables are mentioned. It is recommended to include these numbers in the text to help the reader follow the authors' indications.

R: Thanks so much for this comment. It's a very good suggestion and we have corrected it accordingly in the revised manuscript.

- The paragraph in line 151, "at the 3h scale, for O₃..." refers to Table 1. It is necessary to re-reference Table 1 in this context. It would be helpful to highlight the relevant information in the table, using bold or shading. Similarly, when mentioning PM_{2.5} and PM₁₀, which are in the other table, I suggest employing the same approach.

R: Thanks so much for this comment. It's a very good suggestion and we have corrected it accordingly in the revised manuscript.

"As a comparison, at the 24h scale, for O₃, PM_{2.5}, and PM₁₀, the number of cities with temperature as the dominant influencing factor was largest in spring, which was consistent with previous studies (Wang et al., 2018; Yang et al., 2021), while the number of cities with precipitation was largest in winter." For ozone, I see 59 cities in spring compared to 58 in autumn. For PM_{2.5}, there are 61 cities in autumn versus 44 in spring. Hence, spring seems to be the dominant season for PM_{2.5}?. Regarding PM₁₀, there are 36 cities in winter compared to 34 in summer, indicating a similar distribution between the seasons.

R: Thanks so much for your comment. Yes, as you pointed here, we did not clearly and correctly explained the pollutant-meteorology association in different seasons. We have fully revised this part according to your comment.

Again, thanks so much for pointing this out.

- The sentence starting at line 159, "For both the 3h and 24h... majority of cities," lacks specific information. I suggest removing this sentence.

R: Thanks so much for pointing this out. This sentence has been deleted.

- The following sentence, "the consistency of dominant factors between two temporal scales remained less than 50%," is unclear. It is unclear what it is referring to or if there is a specific data point in the table.

R: Thanks so much for this comment. Actually, when the extracted dominant factor at the 3h and 24h scale was the same, then we say it was consistent. Then as shown in Table 4, the number of cities with the same meteorological dominant factors at both 3h and 24h was less than 50% of the total number of cities. Therefore, we mentioned the consistency was less than 50%.

- The sentence that follows, "This may be attributed... could not be revealed," is difficult to understand. It is unclear what is being conveyed in this statement.

R: Thanks so much for this comment. The study identified the dominant meteorological factors through CCM according to the ρ value. While ρ of the dominant meteorological factor was largest, it may be just slightly larger than ρ of other meteorological factors at 24h (3h) scale, and may be smaller than ρ of another factor, which led to the change of dominant factor, at 3h (24h) scale. In this case, if we simply consider the difference between qualitative output (just the dominant meteorological factor with the largest ρ) revealed at 3h and 24h scale to reveal the temporal effects of pollutant-meteorology association, the analysis was not complete. Therefore, we also presented the detailed ρ value between all available meteorological factors and these three pollutants acquired 3h and 24h scale.

Thanks so much for your comment. We have corrected

-In section 3.2.

- The statement in line 175, "indicating that meteorological influences on particulate matters and gaseous pollutants were different," is evident and already known. It should be highlighted only if the authors have discovered some valuable additional insights or if it is the first time they confirm it for a specific case.

R: Thanks so much for this.

- When discussing the influence of temperature on O₃, it would be relevant to mention any previous findings that also identify a connection with wind (which is later mentioned in the spatial distribution and conclusions) when referring to O₃ transport. Could these areas be downwind of major emission sources?

R: Thanks so much for this. Regarding factors that were not considered in the study regarding these areas and emission sources, the study directly used observation data from atmospheric pollutant monitoring stations.

- If the seasonal variations in precipitation intensity are evident in the table, it should be explicitly mentioned in the text.

R: Thanks so much for this comment. It's a very good suggestion and we have corrected it accordingly in the revised manuscript.

- The sentence "This may be attributed to the existence of the Asian monsoon system, which includes the strong southeast and southwest summer monsoon in China" should only be included if there are references to dispersion studies that confirm this claim. It is important to provide supporting evidence for such statements.

R: Thank you for pointing out this point. It has been revised accordingly.

-In section 3.3.

- The order of the figures should be adjusted so that PM2.5 is Figure 2, as it is currently mentioned first.

R: Thanks so much for pointing this out. We have corrected it accordingly in the revised manuscript.

- Since various regions of China are discussed, it would be helpful to add a map indicating these regions in addition to the existing maps. The regions mentioned, such as the Shandong Peninsula, Beijing-Tianjin-Hebei, Yangtze River Delta, Sichain Basin, Shenzhen, etc., can be marked with circles or another legend on the maps. The added legend to the maps is not clear at all.

R: Thanks so much for this. This is a good suggestion. Accordingly, we have added a location map to the revised manuscript to demonstrate the locations of all mentioned regions. Meanwhile, we use unified borderlines with different colors to demonstrate these regions in

relevant maps. Thanks again for this valuable comment, which make the findings of this research much clearer.

- In Figures 2, 3, and 4, it is important to provide a detailed description of what the concentration represents, at least in the figure caption. This could include specifying that it is the average of the data used.

R: Thanks so much for this comment. It really helps. The required information has been added to these figures.

- I still recommend using consistent color scales across the figures for each pollutant. Currently, there is a difference of only 1-2 micrograms in the upper and lower ranges of some figures. It would be more effective to use a scale that is consistent with the specific pollution issue being addressed and the relevant control metrics associated with it.

R: Thanks so much for pointing this out. Yes, we fully agree with you that a consistent color bar would be better. However, as you noticed that, in some figures, the range was simply 1-2 micrograms. We have tried the mapping strategy you suggested. If we use a unified color bar, then the 1-2 micrograms presented nearly no difference and thus the entire background would seem a plain color without any differences. In this case, we have to use different color bars for different seasons and pollutants. Actually, this issue occurred before, and thus we had to use different color bars in many of our previous publications (e.g.)

Chen, Z., Chen, D., Zhao, C., et al., 2020. Influence of meteorological conditions on PM_{2.5} concentrations across China: A review of methodology and mechanism. Environment International 139:105558.

Chen, Z., Li, R., Chen, D., et al. 2020. Understanding the causal influence of major meteorological factors on ground ozone concentrations across China. Journal of Cleaner Production. 242, 118498.

Chen, Z., Xie, X., Cai, J. et al, 2018. Understanding meteorological influences on PM_{2.5} concentrations across China: a temporal and spatial perspective, Atmospheric Chemistry and Physics. 2018, 18(8):5343-5358)

So again, thanks so much for pointing out this valuable comment and we fully understand and agree with you. And please understand that it may cause some mapping issues if the unified color bar is employed to different maps.

In section 4, after "...variation of specific meteorological factors (e.g., Temperature) exerted a stronger influence on PM and O₃ than the daily variation," the authors should include a comment related to pollutant transport since it is mentioned in the conclusions (line 333). This would help provide a more comprehensive understanding of the findings and their implications.

R: Thank you for pointing out this point. It has been revised and improved.

Minor suggestions:

-The term "complicated exosystems" appears again when I believe the authors intended to use "complex" in other contexts (line 94). Please confirm if this is the case.

R: Yes, this is a very good comment. We have revised all "complicated" to "complex" in the revised manuscript according to your comment.

-In the last sentence of the introduction (line 66), it seems to be missing some words such as "emission-cut policies," for example. Please provide the specific addition or clarification needed.

R: Thanks so much for pointing this out. We have corrected it accordingly in the revised manuscript.

-In line 112, when enumerating t, E, and b, it would be advisable to maintain the same order as previously described.

R: Thanks so much for pointing this out. We have corrected it accordingly in the revised manuscript.

-The beginning of the third paragraph in section 2 (line 135), "We obtained the 3h meteorological data sources from China Meteorological Administration," should be moved to section 2.1, which is the Data Sources subsection.

R: Corrected. Thanks so much for pointing this out.

-In line 306, "On the other hand?"

R: Corrected. Thanks so much for pointing this out.

-In line 323, it should be "Results..."

R: Corrected. Thanks so much for pointing this out.

-In line 329, it is recommended to rephrase "the secondary reaction of which was relatively low" as it sounds awkward in English. Please provide an alternative phrasing or clarify the intended meaning.

R: Thanks so much for this comment. It's a very good suggestion and we have corrected it accordingly in the revised manuscript.

List of all relevant changes made in the manuscript:

Line 66: 'emission-cut' → 'emission-cut measures'.

Line 90: 'complicated' → 'complex'.

Line 94: 'complicated' → 'complex'.

Line 99: 'complicated' → 'complex'.

Line 103: 'complicated' → 'complex'.

Line 115: 'We obtained the 3h meteorological data sources from China Meteorological Administration.' has been removed.

Line 139: 'a third of cities' → '31.68% ~ 61.29%'.

Line 140: 'From' → 'As can be seen from Table 1, Table 2 and Table 3, from'.

Line 142: 'For example, temperature, precipitation, etc., O₃, PM_{2.5}, and PM₁₀ were mostly more dominant in autumn and winter than in spring and summer.' has been added to the revised manuscript.

Line 153: 'At' → 'As can be seen from Table 1, at'.

Line 154: 'with 43 cities,' has been added to the revised manuscript.

Line 155: '; For' → ', with 64 cities, 78 cities, and 75 cities, respectively; As can be seen from Table 2 and Table 3, for'.

Line 156: 'O₃, PM_{2.5} and PM₁₀,' → ', O₃,'.

Line 157: 'with 59 cities, and for PM_{2.5} and PM₁₀, the number of cities with temperature as the dominant influencing factor was largest in autumn, with 61, 55 cities, respectively,' has been added to the revised manuscript.

Line 160: ', with 47, 35, and 36 cities, respectively' has been added to the revised manuscript.

Line 164: 'For both the 3h and 24h scale, we could see temperature and precipitation exerted strong influences on O₃, PM_{2.5} and PM₁₀ in the majority of cities.' has been removed.

Line 165: 'The study identified the dominant meteorological factors through CCM according to the ρ value. While ρ of the dominant meteorological factor was largest, it may be just slightly larger than ρ of other meteorological factors at 24h (3h) scale, and may be smaller than ρ of another factor, which led to the change of dominant factor, at 3h (24h) scale. In this case, if we simply consider the difference between qualitative output (just the dominant meteorological factor with the largest ρ) revealed at 3h and 24h scale to reveal the temporal effects of pollutant-meteorology association, the analysis was not complete.' has been added to the revised manuscript.

Line 170: ‘This may be attributed to the fact that the extraction of dominant meteorological factor amongst several factors was relatively qualitative and thus some subtle differences between different meteorological factors could not be revealed.’ has been removed.

Line 210: ‘The eastern region of China is affected by summer monsoon in summer and autumn, there is a lot of precipitation; In winter, China receives less precipitation due to the influence of winter winds.’ has been added to the revised manuscript.

Line 220: ‘This may be attributed to existence of the Asian monsoon system, which includes the strong southeast and southwest summer monsoon in China.’ has been removed.

Line 229: ‘As shown in Figure 2, all the locations of the mentioned regions have been marked.’ has been added to the revised manuscript.

Line 230: ‘The seasonal concentration of air pollutant data for each city is calculated using the average of hourly concentration data measured by all available local observation stations.’ has been added to the revised manuscript.

Line 236: ‘O₃ (Figure 2)’ → ‘O₃ (Figure 5)’.

Line 278: ‘Figure 5 inserted here.’ has been added to the revised manuscript.

Line 298: ‘(e.g. Temperature)’ → ‘(e.g. Temperature, Wind speed)’.

Line 299: ‘The concentrations of PM and O₃ largely depend on wind conditions. High O₃ concentrations in different cities usually occur in the presence of strong wind speed, but are independent of wind direction, while high PM is often accompanied by weak wind speed, poor dispersion conditions, and sometimes occurs in strong northerly or southerly winds. The regional transport of air pollutants between cities is common (Li et al., 2019).’ has been added to the revised manuscript.

Line 312: ‘complicated’ → ‘complex’.

Line 319: ‘complicated’ → ‘complex’.

Line 326: ‘On the other’ → ‘On the other hand’.

Line 343: ‘The result’ → ‘Results’.

Line 349: ‘the secondary reaction of which was relatively slow’ → ‘the secondary reaction was relatively mild’.

Line 418: ‘Li, X., Hu, X., Shi, S., Shen, L., Luan, L., Ma, Y.: Spatiotemporal variations and regional transport of air pollutants in two urban agglomerations in northeast china plain, Chin. Geogr. Sci. 29, 917–933, <https://doi.org/10.1007/s11769-019-1081-8>, 2019.’ has been added to the revised manuscript.

Line 470: Figure 2 has been revised.

Line 474: 'Figure 2: The dominant meteorological factor for O3 concentrations across China at 3h and 24h scale.' → 'Figure 2: The dominant meteorological factor for PM2.5 concentrations across China at 3h and 24h scale.'.

Line 476: Figure 3 has been revised.

Line 479: Figure 4 has been revised.

Line 482: Figure 5 has been added.

Line 483: 'Figure 5: The dominant meteorological factor for O3 concentrations across China at 3h and 24h scale.' has been added to the revised manuscript.