

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2022-818-RC1>, 2023
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Comment on acp-2022-818

Anonymous Referee #1

Referee comment on "The role of temporal scales in extracting dominant meteorological drivers of major airborne pollutants" by Miaoqing Xu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-818-RC1>, 2023

The article shows an innovative methodology to evaluate the effect of meteorological temporal scales on the pollutant-meteorology association. The collection of a large amount of data on measured pollutant concentrations and meteorological variables makes its results relevant and interesting to address the problem of air pollution in China, more specifically where most of its population is concentrated. The methodology is also interesting for the rest of the scientific community as it is a methodology applicable to other regions.

Although the innovative part of the methodology is clear, it is not clear what is the innovative value of the results obtained. Some of the results seem somewhat obvious or certainly expected, for example, the relationship of temperature with the pollutants analyzed, or a greater association of ozone to the temporal scale of 3h, given its dependence on temperature and solar radiation (in this article not studied as already mentioned by the authors), or the high relationship in winter with precipitation (due to higher frequency of bad weather?). However, the results are no less important for being obvious, but they are shown as if it were a mere descriptive report and there is a lack of greater depth in the analysis of the results and their possible applicability in future strategies for air quality control.

In order to improve this analysis, I propose a series of improvements for the authors to consider:

The reference year studied should appear in the abstract: 2020.

The structure of the article could be clearer if section 2 were titled Methodology, and 2.2. Advanced Causation Model.

Following the latter, it would be clearer to join section 3 and section 4, since the way the article is presented, it is difficult to follow the relationship between the results and the authors' discussion of them. It would be advisable to make the discussion at the same time as the results are shown.

In the introduction, the sentence starting on line 46 "Zhai et al. (2019) estimated... for PM_{2.5} variations" is not understood.

The introduction should briefly mention why the 3h time scale was chosen and not another. This question is also not addressed in the methodological part of the article. It would also be advisable to add in the introduction what the purpose of this study is, beyond evaluating the methodology and its results, what future applicability it has, or why this study's results are interesting or innovative.

Regarding the first paragraph of section 2.1. Data sources: Why was the year 2020 selected, is it a question of data availability? Since an annual seasonal study is conducted, how did the emissions change over the year due to the lockdown? This should be stated clearly. Additionally, when analyzing or grouping stations, have any criteria been used to discard any stations?, for example, some with high industrial character or downwind of an industry, or less exposure to the population, or have all of them been taken into account?

How are the location of the 101 cities relevant? Are they the ones shown on the maps in the figures? Do they have any geographic biases that might be relevant to the study, such as different climate zones influencing the results?

It is understood that data used is based on hourly measurements, but they are not mentioned until line 78, is that so?

In section 3.1., moving on to the results, the tables are referenced all at once, they must be referenced one by one as the specific results of each of them are discussed. How relevant are the results shown in this section? The influence in winter is discussed, is winter one of the seasons of concern in terms of pollution problems? And if so, what do these results imply?

In section 3.2. it is mentioned that the relationship between PM and O₃ is different, and likewise for the meteorological variables, have the authors identified any dominating meteorological driver that might not be expected or so obvious?

In section 3.3. the spatial distribution of the dominant meteorological variables is discussed, as in section 3.1., it is necessary to reference each figure and to highlight the relevant results of each one of them.

In line 189 of section 3.3, "heavily polluted summer" is mentioned, does this happen for the whole territory? and is it supposed to be in the areas where a higher concentration of ozone has been plotted? Line 194 talks about "not severe and homogeneous", where readers can observe this?

Section 3.3. should be accompanied by an indication on the map of "Yangtze River Delt" and "Shandong Peninsula" locations.

Regarding section 3.3., the figures (maps) associated with this section are not in the same color scale (for concentrations), nor do they indicate what these concentrations are, the hourly average for each season?

In the first paragraph of Section 4, the limitations of the method are mentioned, it would be more advisable to mention it in the methodology. Lines 211 to 213 reinforce the potential of the study that should have been mentioned previously.

The sentence starting on line 225 is not understandable.

Line 235 talks about "heavily polluted and less polluted seasons", but at no point does it mention which is which.

The sentence starting on line 237 and ending in 240 should be included into results.

The paragraph starting on line 248 could go to the introduction or part to the method, it does not add value to the discussion of the results.

The conclusions in Section 5 are succinct and the results here exposed are clear, although there is no mention of the spatial distribution of the results. This section may be a reference for the authors to improve sections 3 and 4 and to highlight or develop these relevant aspects that are mentioned here.

In line 289 "the secondary reaction of which was relatively slow" is not understood.

Some comments on the wording:

-In "extracted pollutant-meteorology", what is meant by "extracted"?

The h in 24 is missing: 24h

What does the "composite" of "composite airborne pollution" mean?

Line 87, the authors mean "complex ecosystems"? Instead of "complicated ecosystems"

Line 87, what does casual influence mean?, do the authors mean causal influence?

Line 92, what does "mirage" correlation mean?

Line 103, there is a typo.

The figures are in low resolution, and some symbols are less visible than others, for example the one for temperature.