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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dominant Patterns of Summer Ozone Pollution in Eastern China and Associated Atmospheric Circulations" *by* Zhicong Yin et al.

Anonymous Referee #2

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Summary This manuscript aims to analyze the dominant patterns of summer ozone over China in recent years, and associated circulations. While the topic is of importance to the field, the conclusions drawn from the study are not convincing to me. The methods in general lack novelty. The general patterns of ozone pollution and the association with meteorology have been reported in previous papers. The authors need to clarify the novelty and scientific contribution of this study. The presentation of this paper is also confusing. I had a hard time following the manuscript. The authors presented 14 figures, but most of them are quite confusing without clear explanations. There are a number of issues that should be addressed in order to make this paper suitable for publication. I have the following major comments and some minor comments.

Printer-friendly version

Discussion paper

Major Comments: 1. The spatial and temporal patterns of ozone could also be driven by anthropogenic emissions. The manuscript gave me an impression that ozone pattern in China is purely driven by circulation, which is not true. It's possible that the North-South pattern is mainly driven by emission variations. Also, the inter-annual variability in ozone may also be related to the emission changes in past years. The authors need to discuss how emission variations would affect their analysis.

2. The authors use ground-based observations of ozone describe the general patterns of ozone, but the distribution of ground-based sites is uneven. Most sites in China are urban sites, and there are few rural sites. There is no information how the authors infer spatial distribution of ozone (i.e. Figure 1) from limited sites.

3. The study relies on EOF analysis, but there is almost no explanations of how the EOFs are constructed, and why the first two patterns are indicative of the dominant patterns of ozone pollution. Only 37% variance can be explained with the first two EOFs ($\sim$ 20% for the first EOF), which is even less than half. I think it's necessary to explain the limitation of this statistical approach.

4. The authors included a lot of figures, but some seem to be redundant. For example, Figures 2 and 3 seem to be repetitive. Most of the figures are not very clear, yet the authors only spend one or two sentences explaining these figures. None of these figures is labeled clearly. There is even no unit for the numbers presented, which is unacceptable to me. I'd recommend the authors only keep those most important figures (e.g Figures 7 and 8), and expand their discussions on these figures.

5. Overall, the language of the manuscript should be further polished. There are several grammatical errors, which should be edited carefully.

Specific comments:

1. Line 70: It's not clear what 'sub-daily' means here. If it's four-hour data, which composites did you select?

2. Please double check the subscripts and superscripts of units and chemical names.

3. Lines 95 - 100: How did you calculate ozone levels in each province? Are the ground-based measurements spatially representative?

4. Line 125: How did you compose atmospheric circulations? This is an important step, but there is almost no explanation of the method.

5. Line 189: 2105 -> 2015

6. Line 200: The conclusion that atmospheric circulation accelerated ozone formation in YRD but weaken in NC is interesting, but this does not agree with ground-based observations, which do not show any enhancement of ozone in YRD in 2016 (nor decreased ozone in NC, Figure 6).

7. Line 205 - 201: The figure numbers are wrong?

8. Line 210: How did you draw the conclusion that positive MDA8 anomalies are observed in 2018? This conclusion seems to be inconsistent with Figure 6.

9. Figure 1, 7, 11: missing units.

10. Figures 2, 3, 8, 12: Missing y label.

11. Figure 4: The authors need to explain how they construct spatial and temporal EOFs, and what the figures show here. What do the numbers represent?

12. Figure 5: It's not clear why it is necessary to composite to positive and negative patterns. How does this help explain the results?

13. Line 202: Where is Figure 10d?

14. Figure 14 not referenced in the manuscript.

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