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Title: Secondary aerosol formation under a special dust transport event: impacts from unusually enhanced ozone and dust backflows over the ocean

### General comments

This study reports a dust event with high relative humidity and low wind speeds occurred in Shanghai during the period of October 29-November 2, 2019. The dust event was divided into three obvious stages, of which the first stage was a dust invasion stage, the second stage was a dust development period, and the third stage was a dust backflow period. Meanwhile, chemical characteristics of aerosols in the three stages were investigated, and a simplified method was deployed to identify and estimate the amounts of major aerosol species from transport and secondary formation. The study method is reasonable, data is reliable, and conclusion is credible. But there existed a lot of aspects to be revised and improved in the manuscript. Written language and logical relationship need to be improved. I suggest to consider the paper for publication after a major revision.

### Specific comments

1. In abstract, L28, the phrase “by **with** high concentrations of particulate matters but relatively short duration” should be changed to “by high concentrations of particulate matters but relatively short duration”.
2. In introduction, L121, the sentence “In contrast, this study **aims** to depict an atypical dust event **was** observed in Shanghai, a coastal mega-city in Eastern China.” is error.
3. In section 2.2, all the online instruments used in this study should be normally calibrated so as to guarantee data quality, therefore, normal calibrations of these monitoring instruments should be added in the section.
4. In sections 2.3 and 2.4, the models used in this study should be detailed.
5. In section 2.5, the sentence “Initially, the quasi-first-order reaction rate constant for heterogeneous conversion from  $\text{NH}_3$  to  $\text{NH}_4^+$  ( $k_{\text{het}}$ ,  $\text{s}^{-1}$ ) is calculated according to **(Liu et al., 2022)**.” is incomplete. In addition, the two formulas should be numbered. All the formulas in this study should be numbered in turn.
6. In section 2 methodology, sampling duration should be supplemented.
7. In section 3.1, L216-218, the sentence “From October 25 to 28, the mean wind speed remained relatively low of  $0.9 \pm 0.72 \text{ m/s}$  with a peak value of  $3.1 \text{ m/s}$ , and predominantly blowing from the northwest.” is suggested to be changed to “From October 25 to 28, the mean wind speed was  $0.9 \pm 0.72 \text{ m/s}$  with a peak value of  $3.1 \text{ m/s}$ , remaining relatively

low, and predominantly blowing from the northwest.”

8. L218, the sentence “The mean concentration of PM<sub>2.5</sub> and PM<sub>10</sub> was 34.7 and 44.2 μg/m<sup>3</sup>, respectively.” should be revised to “The mean concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> were 34.7 and 44.2 μg/m<sup>3</sup>, respectively.”

9. L214-228, in this paragraph dust and non-dust periods should be identified, but authors did not give related discussion.

10. In Figure 1, P1, P2 and P3 should be put in Figure 1d and separated with vertical lines.

11. What did aerosol depolarization ratio was used to explain? Please explain correlation between the depolarization ratio values and the dust event and impacts of relative humidity on the depolarization ratio.

12. L237-244, “In this study.....non-dust period”, please supply specific start and end time.

13. Huang et al., 2010a and Huang et al., 2010b were the same reference. Please check the reference.

14. L337-342, in “Firstly, ..... ~1 ppbv/h (Wang et al., 2020).”, related explanation is lack of logic. Please think it over and revise the explanation. In the text, there are many similar logical problems need to be further checked and revised.

15. L345, Figure 5b here should be Figure 4b.

16. In correlation heatmaps, please explain the meaning of dot size.

17. L494, how to understand the sentence “both SO<sub>4</sub><sup>2-</sup> and NO<sub>3</sub><sup>-</sup> showed moderate to significant correlations with Na<sup>+</sup>.”

18. The mean states of P2, P3 and NDS illustrated in Figure 7c were unclear, hope to better present these states.

19. In section 3.5, in the formula  $TPPD,i = AVLYG,i \times (1-k)$ , please explain the meaning of “1-k”.

20. The conclusions need to be further condensed.