

## ***Interactive comment on “Simultaneous Measurement of Urban and Rural Particles in Beijing, Part II: Case Studies of Haze Events and Regional Transport” by Yang Chen et al.***

**Yang Chen et al.**

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Dear reviewer,

We are very grateful for your review of our manuscript. We appreciate your comments and suggestions, and they are precious for us in improving this study. We have prepared a detailed point-by-point response highlighted in blue or “Ans.”

Chen et al., The authors conducted two parallel studies at both urban and rural sites of Beijing, using the single-particle chemical composition as a tracing system to investigate the impact of heating activities and formation of haze events in the region.

C1

The authors argued that different types of particles were emitted between the urban central heating supply and the residential heating in the countryside. Interestingly, the authors proposed a hypothesis that the regional transport of particles could trigger heavy pollution. The study pictured the interactions of pollutants between urban and rural sites. The reviewer recommends publications when the following concerns are addressed. We appreciate your positive comments.

Major Issues:

1. Introduction. Can the authors describe the difference between the bulk and single-particle analyses? Are there any advantages of this work compared to those in the literature? The authors need to provide detailed information on the aim of the study.

Ans: We have enhanced the related literature review (lines 71-76):

“SPAMS has proven a useful tool for characterizing the single-particle chemical composition, mixing state, and processing of atmospheric particles (Chen et al., 2019a). Single-particle chemical composition and mixing state can be used as a tracing system to explore the sources and origins of unique particle types (Chen et al., 2019b; Li et al., 2016). For example, by combining meteorological parameters, we can determine the sources and transport conditions of specific particle types (Chen et al., 2018; Chen et al., 2020).”

The aims of the study have been expanded (lines 77-83):

“As mentioned in Part I (Chen et al., 2020), two SPAMSs were deployed simultaneously at Peking University (PKU) and Pinggu (PG) to monitor urban and rural particles in the Beijing region. In Part II, the resolved particle types are used to trace the evolution, transport, and formation of pollution events. The detailed analysis of haze events and effects of heating activities are addressed. Combining field measurements and model studies, the interactions between the two sampling sites, representing urban and rural eastern areas, are systematically analyzed.”

C2

2. The reviewer suggests analyzing the pollution events 2,3 and 4 because the detailed temporal trends are available; the missing information in E1 could misleading.

Ans: Do you mean the pollution event at PG? Yes, there is a 10 h gap in the temporal trends in E1\_PG, but this gap did not influence our analysis of particulate pollution. As shown in Figure 8, the temporal trends of major particle types were clear, and patterns can be found.

3. Sections 3.4 and 3.5. There is too much description in a single site, which causes difficulties in comparing the patterns of the pollution events. The reviewer strongly suggests illustrating E1 at both PKU and PG together, making the comparison much easier than the current form.

Ans: We appreciate the comments and have added a supplementary statement to the text (lines 284-292): "Both E1\_PG and E1\_PKU had patterns of transport and accumulation, but the transported particles were different; for example, at the PG site, the appearance of EC-Nit and EC-Nit-Sul, which came from the west, i.e., urban Beijing, was pronounced, while at PKU, particle types such as OC-Nit-Sul, K-Nit-Sul, K-Nit, NaK-Nit, and K-Nit-Sul increased dramatically due to transport. These particle types were emitted from residential heating in rural areas. In the accumulation stages at both sites, the concentrations of local particles rose, such as EC-Nit-Sul at PKU and NaK-Nit-Sul at PG. In short, the evolution of particles, including both transport and accumulation at both PKU and PG, were affected by the movement of air mass and local emissions."

4. Does any evidence suggest the OC-Nit-Sul formed locally? Ans: As we proposed in Part I (Chen et al., 2020), OC-Nit-Sul\_PKU had two origins. One was local formation during air stagnation along with no unique wind direction; the other was from the southwest.

5. The statement that the regional transport can trigger the pollution event should be clarified. The connection between wind speed with the events is not conclusive enough.

C3

Is there any additional evidence that could be provided to make a solid decision? If not, the statement could be strained base on the current data.

Ans: Please refer to Sections 3.1 and 3.4. We have discussed the influence of meteorological parameters and aerosol-radiation feedback. Combining the results from multiple studies, we conclude that. . .

6. The Implication part is more like a Discussion; please consider changing that. Ans: We decided to leave it as it is because the two paragraphs are a summary of what we need to mention after long Results and Discussion sections. But we did move the discussion of aerosol-radiation feedback and the evolution of PBL into Section 3.4 for greater coherence.

Minor issues

1. Typos need to be checked carefully, a proofread is need for revision.

Ans: Fixed.

2. Through the manuscript, terms like "fractions" and "ratios" are both used. Are they the same meaning? Please clarify and be consistent if possible.

Ans: We have uniformly used "fractions" to illustrate the relative changes of particle types. Thank you for the reminder.

3. Line 116, please tidy Table 1, which is messy at the end.

Ans: Fixed.

4. Line 138, why is there two Table 1? Please check. Ans: It was a typo, and we have fixed it.

5. Line 175: " control emissions from household emissions" fix the typo, please reword.

Ans: Fixed.

6. Figures 9 and 10, please label the Events on each panel.

C4

Ans: We have added descriptions in the Figure captions.

7. Careful proofreading is needed.

Ans: Fixed.

#### References

Chen, Y., Liu, H., Yang, F., Zhang, S., Li, W., Shi, G., Wang, H., Tian, M., Liu, S., Huang, R., Wang, Q., Wang, P., and Cao, J.: Single particle characterization of summertime particles in Xi'an (China), *Sci. Total Environ.*, 636, 1279-1290, 10.1016/j.scitotenv.2018.04.388, 2018.

Chen, Y., Tian, M., Huang, R.-J., Shi, G., Wang, H., Peng, C., Cao, J., Wang, Q., Zhang, S., Guo, D., Zhang, L., and Yang, F.: Characterization of urban amine-containing particles in southwestern China: seasonal variation, source, and processing, *Atmos. Chem. Phys.*, 19, 3245-3255, 10.5194/acp-19-3245-2019, 2019b.

Chen, Y., Cai, J., Wang, Z., Peng, C., Yao, X., Tian, M., Han, Y., Shi, G., Shi, Z., Liu, Y., Yang, X., Zheng, M., Zhu, T., He, K., Zhang, Q., and Yang, F.: Simultaneous Measurement of Urban and Rural Single Particles in Beijing, Part I: Chemical Composition and Mixing State, *Atmos. Chem. Phys. Discuss.*, 2020, 1-40, 10.5194/acp-2019-933, 2020.

Li, W., Shao, L., Zhang, D., Ro, C.-U., Hu, M., Bi, X., Geng, H., Matsuki, A., Niu, H., and Chen, J.: A review of single aerosol particle studies in the atmosphere of East Asia: morphology, mixing state, source, and heterogeneous reactions, *J Clean Prod*, 112, 1330-1349, 10.1016/j.jclepro.2015.04.050, 2016.

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