

Interactive comment on “Synergistic effect of water-soluble species and relative humidity on morphological changes of aerosol particles in Beijing mega-city during severe pollution episodes” by Xiaole Pan et al.

Xiaole Pan et al.

panxiaole@mail.iap.ac.cn

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The authors appreciate the anonymous reviewer very much for providing insight comments on the manuscript, we would like to revise the context on the basis of suggestions and advises carefully. The specific replies are as follows:

1. Until now there are lots of literatures introduced change of dust morphology during long-range transportation due to mixture with other substances over the past decades, not only based on on-line measurements (e.g., lidar remote sensing), but also in the

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laboratory analysis (e.g., SEM/TEM). In this paper, the authors should more clearly point out the key point of current study. It will be easier for readers to understand if the authors briefly summary some related studies in section Introduction.

Reply: We will briefly summarize the advances in morphological studies of particles using LIDAR and electro-microscopy in introduction section.

2. Previous studies generally use volume depolarization ratio from lidar measurements to distinguish dust aerosols from others. Of course, POPC have its remarkable advantages. However, it should be noted that there is uncertainty when size of individual particles is estimated from POPC based on forward scattering signal at 60-degree, especially for non-spherical particles (like dust aerosols). So, the authors should discuss and/or introduce the uncertainty of particle size. And it is suggested that the authors should select two large interval sizes when discuss difference of DR at different size.

Reply: We agree with the comments of reviewer, and the uncertainty of measurement in size of particle will be introduce in the revised manuscript. As suggested, dfference of DR for two large interval size will be discussed.

3. DR not only depend on shape of the particle, but also its size. In this study, authors discuss the difference of DR at different size, to prove change of dust morphology when they mix with other aerosols under high moisture condition. As shown in Fig. 4, it seems there is an obvious peak of DR between 3-5 μm during the period of field campaign. So, in my opinion it should be careful to conclude.

Reply: As suggested, the DR value of particles are critically depend on their size. Larger particles have larger DR value, consistent with the model simulation. We will carefully conclude this point in the revised manuscript.

4. Page 1 line 20: please delete “of” from “February of 2017”.âĀĀ

Reply: The word “of” in “February of 2017” will be deleted in the revised manuscript.

5. Page 4 line 99: change “Februarys” to “February”.âĀĀ

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Reply: The misspelling will be corrected in the revised manuscript.

6. Page 6 line 87: change “in January29, 2017” to “on January 29, 2017”.

Reply: “in” will be changed to “on”.

7. Page 17 line 85: add “(b)” at the end of the sentence.

Reply: “(b)” will be added.

8. Aspect ratio is a key parameter for evaluating radiative effects of particles. The authors are encouraged to estimate this parameter from POPC observation in the future.

Reply: We will estimate the aspect ratio of the particle according to T-matrix simulations.

9. Page 6 line 87: change “in January29, 2017” to “on January 29, 2017”.

Reply: “in” will be changed to “on”.

10. Figure 6: it seems that backscattering coefficient is show in the upper panel according to the order of magnitude in colorbar. Please check carefully what is it. Besides, it is better to add volume depolarization ratio of aerosols from lidar measurements in the figure, so that the readers will be easier to understand the results.

Reply: We confirmed that the upper panel shows the vertical profile of extinction coefficient determined by Lidar. We will add depolarization ratio information in the revised manuscript.

11. A paper about the effects of sulfuric acid and ammonium sulfate coatings on dust aerosols (Eastwood M. et al., 2009) was published in *Geophys. Res. Lett.*. Please reference this paper to increase reader understanding of interaction between dust and other aerosols. Furthermore, real-time transformation of dust aerosols morphology studied based on ground-based polarization-Raman lidar measurements (Huang Z. et al., 2018, *Remote Sensing*), will be very useful for readers to understand importance

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of depolarization ratio for aerosols investigation.

Reply: The relevant literatures will be cited in the revised manuscript.

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