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Reply to the Reviewer's comments

Dear Editor,

We thank the reviewers for their insightful comments. We have revised our manuscript according to the suggestions. In the following section we give our answer (text in blue) to each of the points addressed by the reviewers. New text applied to meet the requests of the review is highlighted in red in the manuscript.

Reviewer 1:

(1) The fraction of mineral dust seems too high for me, what caused the high number fraction? The data is not right for normal haze event except the dust event. The fine secondary aerosols or primary particles should be dominant number in any case during clean and haze events. Obviously, the fundamental analysis might be not correct for individual particles. I supposed that the authors missed many fine particles in the TEM analysis.

Reply: The number percentage of the mineral particles is about 18.1%, which is normal for the haze samples in Beijing area (e.g., 25% in a previous study by Wang et al., 2015). The value is much lower than the mineral contents in the dust storm sample, with the latter typically higher than 80% (e.g., 90% in a previous study by Li et al., 2012). In addition, the particles analyzed in this study were mostly larger than 100 nm, we have added the description in line 144-145 in the manuscript).

Wenhua Wang, Longyi Shao, and Zexi Li et al., (2015). Morphologies and sulfation characteristics of individual aerosol particles in the haze episode over the Beijing-Tianjin-Tangshan area in January 2013. Acta Petrologica et Mineralogica. In Chinses with English Abstract.

Weijun Li and Longyi Shao. (2012). Chemical modification of dust particles during different dust storm episodes. Aerosol and Air Quality Research.

(2) The lower magnification images should be provided to show differences. The authors didn't make notes in these two Figures. What are these aerosol particles? Could you add two low magnification images to show mineral particles.

Reply: We have added notes in these figures and showed the comparison of mineral particles.

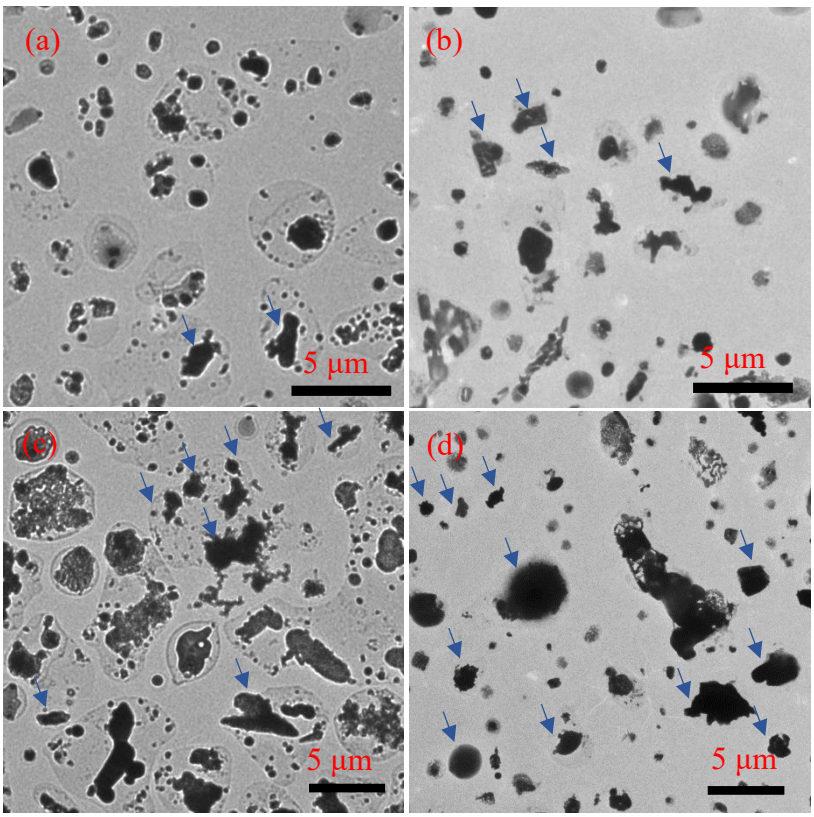

Fig. 5: Low magnification images of individual particles. (a) and (c) are particles above the mixed layer (MLH) at different size ranges. (b) and (d) are particles at ground level at different size ranges. More coated particles were found above the MLH. Arrows show part of the mineral particles.

(3) I noticed that the sampling time mainly at nighttime, when the MLH is the lowest. The authors missed samples at the daytime? Obviously, the potential readers are interested in the changes of particle types caused by the MLH change. Did the authors collect the samples in daytime? Then you can compare what differences when the MLH changed.

Reply: In this study, the particles were all collected in the morning and midnight when the MLH was the lowest and the height of the tower can reach the MLH at that time. Therefore, we can compare the particles at ground level and above the MLH. We have added some sentences in the manuscript in sample collection part. Please see line 121-123.

(4) If the authors can determine the particles above the MLH from the long-range transport or local surface emissions? More meteorological or models (e.g., HYSPLIT MODEL) should be added to indicate the particle transport.

Reply: we added a figure in the supplementary materials to show the long-range transport of particles. Air masses during haze periods in this study at 500 m height were mainly from the north and west. Please see line 297-299 and Fig. S4.

(5) L236, the R value seem same between 0.54 and 0.59 including the errors. This value could be same. Also, I might think that the authors should add more transportation data here.

Reply: We can clearly see in Fig. 6 that the value above the MLH was lower than at ground level. The average value 0.59 had a variance of 0.010 at ground level; the average value 0.54 had a variance of 0.015 above the MLH. There is a clear delineation between these two values. We have added a sentence to describe the transportation data. Please see line 98-99.

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	266	157.543	0.59227	0.00998
Column 2	272	146.593	0.53894	0.01462

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.38238	1	0.38238	31.0144	4.1E-08	6.68239
Within Groups	6.6085	536	0.01233			
Total	6.99088	537				

Table 1 shows that F value is larger than F crit at the significance level of 0.01.

(6) Section 4, the implication should base on your own data. Seemly, some discussion or implication don't have any data support. The previous study should be not supporting all your discussion. Again, the authors should add more data to give more support for this part.

Reply: Many thanks for this comment. Section 4 (summary and atmospheric implications) has been spilt into two parts, including 3.6 possible sources of organic particles and 4 conclusions. Part of the sentences have been placed to the part 3.5 aging of the particles. We cited some papers to support that coated particles can have important implications for the atmosphere and hope to attract more researcher's attention (Please see line 266-271). We have shorted these sentences of the citied data in the manuscript.

The paper has bad English writing. The authors should carefully revise it
Line 138, mass concentration of air pollutants
Reply: Changed. See line 147.

L182 Comparison of haze and non-haze individual particle at ground level
Reply: Changed. See line 190.

L183-184, as could not connect one sentence
Reply: Changed. See line 191-192.

L188, OPs should change to OM (organic matter).
Reply: Organic matter (OM) are all the organic materials in the atmospheric aerosol. It is always used to calculated the weight of organic aerosol. Organic particles (OPs) are used by number. We think OPs might be more more appropriate.

In this paper, there are many grammar mistakes. I didn't list all the English problem.
The present and past states often mixed in one sentence.
Reply: We have carefully changed the English grammar.