

***Interactive comment on “Atmospheric aerosol compositions in China: spatial/temporal variability, chemical signature, regional haze distribution and comparisons with global aerosols” by X. Y. Zhang et al.***

**Anonymous Referee #4**

Received and published: 12 November 2011

Overall

This paper presents a two-year data set that describes chemical composition of PM<sub>10</sub> from 16 monitoring stations in China. Quantified components include water-soluble inorganic constituents, mineral dusts, and OC/EC. This data set is valuable for evaluating spatial and temporal variations of atmospheric particles in China.

However, this manuscript is not well prepared. 1) The manuscript is poorly written with a lot of grammar mistakes. Many grammar mistakes such as “long-rang transport”

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(on page 7, line 10) can be avoided by careful proofreading. Some grammar corrections are listed in the “Technical corrections” section below. 2) The contents of the manuscript are not well organized, making it very difficult to follow. For example, there is only one sub-section (3.3.1) in section 3.3. This sub-section is not necessary if it is the only one. Breaking section 3.3 into two or more subsections is suggested. In sections 3.1 and 3.2, each component (sulfate, nitrate, etc.) is discussed individually. This seems redundant. It is better to group them into “primary” and “secondary” components, and discuss each group separately. It is more clear this way and easier to follow. Another example is that the urban/rural difference of ammonium is discussed in again in the “Aerosol acidities” section. This part should go with section 3.1, where the urban/rural differences are discussed. 3) Many arguments are presented without sufficient explanation or evidence. For example, high OC is found in rural China, urban S. Asia and High Asian Area (on page 8, the last paragraph), the reason is ascribed to open biomass burning, but no evidence or references are shown to prove it. More examples are given in the “Specific comments” section below. A lot more work needs to be done in order to meet the high standards of ACP.

### Specific comments

1. Page 2, line 17: what is “surface visibility”? This term is not defined in this paper. Is it the visibility measured on the ground? If yes, what is the height of the measurements?
2. Introduction part: previous studies on the haze events in China should be summarized here, since this is one of the focuses of this paper as indicated by the title.
3. Page 4, line 24: “on a one day in every three day basis” – it is not clear how the samples were collected.
4. Page 5, line 18: “with certain concentration”, what is the concentration? Please specify. Is there a reference?
5. Page 6, line 18: it says the high concentration of mineral particles in China is because

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of “Asian desert sources”. This is too broad. Use back trajectories analysis to identify specifically which desert source is most important.

6. Page 6, line 19-23: it says some high mineral concentrations are “evidently” caused by urban emissions. However, the no evidence is shown in the analysis. How are the “urban mineral” and the “desert mineral” separated?

7. Page 7, line 10: it says “long-range transport of Asian dust” affects the comparison of urban/rural mineral aerosol concentration, how does this work?

8. Page 8: need to explain the OC concentration difference between China and S. Asia.

9. Page 9, the second paragraph: comparison of NO<sub>x</sub> inventory in China to the global NO<sub>x</sub> inventory does not help explain the high nitrate concentration in HBP, SCB in China.

10. Page 9: It says ammonium is from coal combustion. This is not correct. Ammonium is formed secondarily by reaction of ammonia and sulfate/ nitrate.

11. Page 10, line 1: I don't think EC can also be called LAC, because “brown carbon” can also absorb light but it is not EC.

12. Page 13, “deltaC” and “S” are not discussed in the paper. So equations (3) and (4) are not necessary.

13. Page 14, line 17: “depleting K by SO<sub>4</sub>” is not clear. This phenomenon is not discussed earlier in the text.

14. Page 15, the last paragraph: OC/EC is lower in urban areas is explained by the dominance of primary emission in urban. This lower ratio in urban areas can also be explained by the lower biomass burning emissions in urban areas, which is discussed in the next paragraph.

Technical corrections

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1. Page 2, line 5: change “with global aerosol” to “with global aerosol measurements.”
2. Page 2, line 9: grammar mistake of this sentence.
3. Page 2, line 13: delete “also”.
4. Page 2, line 17: delete “somewhat”.
5. Page 2, line 18: delete “also”.
6. Page 2, line 19: change “plus” to “and”.
7. Page 5, line 2: “raised above the surrounding ground level”, reword.
8. Page 5, line 1: delete “by”.
9. Page 5, line 5: define “BST”, is it Beijing time?
10. Page 5, line 9: change “using” to “being used”.
11. Page 5, line 23: change “the details protocol” to “the detailed protocol”.
12. Page 6, line 12: change “accounting ~35%” to “accounting for ~35%”.
13. Page 6, line 19: change “hands” to “hand”.
14. Page 7, line 17: delete “(ug/m3)”. The unit should be specified in the figures or figure captions.
15. Page 9, line 22: reword this sentence.
16. Page 13, line 16: change “with a few urban and rural difference” to “with a few urban and rural differences”.
17. Page 14, line 15: “showing somewhat degree combination”, reword.
18. Page 14, line 21: change “significant different” to “significantly different”.
19. Figure 2: specify number of points for each species.

20. Figure 4: replace the numbers on the x-axis with the components “Mineral”, “SO<sub>4</sub>”, etc.

21. Figure 7: It seems that there are two figures and the one on the right is cut.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26571, 2011.

ACPD

11, C11810–C11814,  
2011

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