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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spatiotemporal variations of ambient PM_{10} source contributions in Beijing in 2004 using positive matrix factorization" *by* S. Xie et al.

S. Xie et al.

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We greatly appreciate the comments and suggestions by referee #1, the responds by authors are as below:

1. Are data available for smaller size fractions? Is it possible from current data to draw a link between PM10 and PM2.5? Although this was not the focus of this study, a distinction when determining the overall importance of dust aerosols vs. anthropogenic sources, for example vehicle emissions (conclusion section).

In order to assess the overall aerosol characteristics in Beijing, it is indeed necessary to consider the characteristics of fine particles. Therefore in this study PM2.5 were sampled along with PM10 observation. This paper focused on discussing PM10, and

we cannot depict the link between PM10 and PM2.5 here with the PM10 data set in it. According to observations over many years in Beijing, the annual average daily PM10 concentration was as high as 165ug m-3, which was mainly from anthropogenic sources such as coal combustion, vehicle emission, biomass and municipal incinerations, and contributions from crustal and urban fugitive dust were also as high as accounting for 40% of the total PM10 mass.

2. What is the reason for "missing values" ? (p. 575)

In PMF analysis, "missing values" are often treated using methods by Polissar et al. (1998). Missing values were replaced by the arithmetic mean concentration of that species and four times of this mean value were assigned as the corresponding uncertainties. In fact we did not have missing values in our data set.

3. What were typical detection limit values? For the trace metals?

We mainly used TCP-MS to measure elements in this study. The statistics of detection limits are presented below.

element DL(ppt) Li 27.00 Be 7.60 Sc 16.00 V 16.00 Cr 35.00 Co 15.00 Cu 25.00 Zn 167.00 Ga 4.60 Rb 3.50 Sr 5.80 Y 3.90 Zr 88.80 Nb 2.90 Mo 12.00 Sn 74.00 Cs 0.60 Ba 164.00 La 8.00 Ce 12.00 Pr 0.17 Nd 4.80 Sm 0.90 Eu 0.30 Au 0.50 Pt 1.00 Pd 1.00 Ti 5000.00 Mn 20.00 Ni 20.00 Pb 67.00 Tl 4.20 B 833.00 Ag 10.00 Na 2000.00 Fe 2500.00 Cd 15.00 Mg 2000.00 Sb 15.00 Al 55.00 Si 15200.00 K 4500.00 Zn 115.00 Ca 7500.00 As 40.00 Se 150.00

4. Were possible artifacts in measuring organic carbon on quartz filters considered? (see, for example, Kirchstetter and Novakov, Atmos. Environ., 35, 1663-1671, 2001)

We did not consider possible artifacts in measuring organic carbon on quartz filters.

5. What daily variation was observed in concentrations of organic and inorganic species?

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Daily variations of concentrations for OC, EC, and other species can be acquired from our observation data at six sites in 2004. We can only briefly portrait such variations since we cannot submit a reply with figures. OC, EC concentrations, for example, at six sites displayed different daily variation patterns. Daily fluctuations for OC are greater than those for EC, and they all displayed similar patterns with PM10. OC concentrations in summer are much lower than those in other months, but EC displayed no obvious monthly difference. Considering our main point as PM10 source apportionment, we did not discuss daily variations for each species in detail in our paper.

6. Was an ion balance done? How consistent was this throughout the study?

We calculated the ion balance using the methods by Christoforou et al. (2000). The results showed that most sums of the measured species concentrations accounted for 70-120% of the measured PM10 mass concentrations, along with very few samples reaching 150% or 50%.

7. Do the various sampling locations of this study allow insight into atmospheric processing times and conditions?

The six sampling sites in our study, covering various kinds of areas in Beijing, were selected based on ambient aerosol concentration distributions over Beijing obtained by automated online observations. The results indicated that these six sites basically reflected the ambient PM10 concentration distributions in Beijing and were influenced by the same PM10 sources, the strengths of which were determined by the distances between source and site, as well as transport conditions (Yuan et al., 2006). Therefore, it is reasonable to use information from these six sites for discussing spatiotemporal distributions of PM10 source contributions over Beijing and to get insight into atmospheric processing times and conditions.

8. The "unknown" category (i.e., Figure 2) should be specifically addressed or explained since this can comprise up to 20% of the total mass.

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It is in April of 2004 that the unknown category in Figure 2 reached 20%, when the monthly PM10 mass was as high as 295ug m-3, mainly influenced by the frequent dust storms in this season. Since the measured crustal elements might be lower than their actual values due to errors in using ICP-MS to measure such high concentration samples, this 20% unknown category might be crustal elements.

References

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 569, 2008.