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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.

Anonymous Referee #2

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General Comments:

This paper examines seasonal and spatial variations of ambient PM10 sources in Beijing by applying Positive Matrix Factorization. While this receptor models have been used worldwide to study source characteristics of PM10, this paper is very much similar to a companion paper Song et al. [AE, 2006, 40, 1526-1537] which was to apply PMF to a PM2.5 dataset in Beijing. Conclusion drawn in this paper shows little beyond our understanding based on the study of Song et al. Therefore, I feel the scientific significance of this paper in its current form does not satisfy the requirement of ACP. Major revision is recommended before this paper being accepted.

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Interactive Discussion
Discussion Paper

Before applying PMF for source analysis, it is good to give some details in the manuscript about some of the basic findings for PM10 in Beijing. What were the ranges of mass concentration of each species observed? What were the seasonal variations? What were the correlations between different PM species? How do these observations compare to those in other large cities around the world? Information like this would help the reader to appreciate the extent and quality of the data, as well as the differences and/or similarities with other regions of the atmosphere.

The most important thing of doing PMF is to select the number of sources that could best explain the measured pollutant concentrations. Although mentioning a number of parameters that could justify the PMF performance, it is not conveyed clearly at all how the seven source categories were determined and why they came up with the ones they did. Like many, the authors tend to over-interpret the factors found PMF. They keep increasing the number of factors as long as they could find some information in the publication pool to justify their results. With only 40 samples available, there is not enough variability present in so few data points to be able to pull out as many as seven factors. A good example of how to use PMF for atmospheric data sets, I believe, was described by Lanz et al. [ACP 2007, 7, 1503-1522]. These authors systematically increased the number of factors in a PMF analysis (of a particle composition data set) from 2 to 6 and showed the results from all the different analyses. As a result, the reader gets a good idea of (1) why so many factors were needed to describe the data, and (2) how robust the contribution from the major factors is as a function of the number of factors. Therefore, detailed information regarding the model performance is a must when reporting PMF results.

Therefore, it is not difficult to understand why there are many abnormal findings associated with the PMF results which the authors ignored to discuss. In source 2, significant amount of Na+ far larger than Al, Ca, and Fe is associated with the crustal soil, and this does not appear in Figure 4. Arsenic (As), a typical tracer for coal combustion, appears in the vehicle emission source rather than in coal combustion. In source 5, ion

ACPD
8, S523–S526, 2008

balance is apparently not reached with NH4 concentration around 1/100 of NO3 concentration. In source 7, OC concentration is almost ten times EC in vehicle emissions. Considering the typical OC/EC ratio of 1-2 in vehicle emissions in China (e.g. Cao et al. [AE, 2003, 37, 1451-1460]; Louie et al. [AE, 2005, 39, 1695-1710]), we may believe for sure that significant secondary OC is mixed in this source, etc.

Specific comments:

– Line13, pp577, K should not be included in the calculation of crustal elements. K, as measured by IC, is present in the ion form rather than element form in the particles.

– Line10, pp578, the reference Hua et al. 2006 is not present in the reference list.

– Line4, pp580, the fact that only 3-4% of waste in Beijing is treated y incineration does not necessarily indicate that the overall contribution from waste incineration is negligible. This source might be associated with significant PM emission intensity.

– Line8, pp580, it would be good if the authors could provide the percentages of fuel usage of gasoline and diesel in Beijing to justify their apportionment results.

– Line27, pp583, the reference Duan et al. 2004 seems to be quoted irrelevant to the preceding discussion. The main point here is that non-local biomass burning might be transported to Beijing together with crustal soil in March and April. As most of the crustal soil was blowing to Beijing by the northerly/northwesterly wind bypassing the dessert area to the N/NW of Beijing, those straw burning emissions in the provinces to the south of Beijing could not make any contribution to the ambient PM in Beijing at this time.

– As more and more attention is paid to the source characteristics of PM2.5 as it is more related to human health, a comparison of source contributions between PM10 in this study and PM2.5 in Song et al. 2006 is suggested, although the data are collected in different years. More in-depth understanding about source characteristics could be achieved through this comparison.

ACPD
8, S523–S526, 2008

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ACPD
8, S523–S526, 2008