Atmos. Chem. Phys. Discuss., 5, S2655–S2658, 2005
www.atmos-chem-phys.org/acpd/5/S2655/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size-resolved source apportionment of ambient particles by positive matrix factorization" *by* J. S. Han et al.

J. S. Han et al.

Received and published: 15 September 2005

Authors' response to comments made by reviewers on "Size-resolved source apportionment of ambient particles by positive matrix factorization" by J. S. Han et al.

Response to Anonymous Referee #1

General comments:

This paper shows the application of positive matrix factorization method to surface aerosol sample analysis in Gosan, Korea. It considers not only the element compositions, but also size distributions. This information is useful and meaningful. However, this paper focuses on mathematical method, and it does not clearly explain how the samples show that variation and why. For examples, the paper presents Figure 6

which shows strong temporal variation, but there is little discussion about this figure. It would be better if the paper could include scenario analysis.

: For the specific cases which show strong temporal variation in Figure 6, episodic analyses using meteorological information and backward trajectory model (HYSPLIT 4) results have now been included with a new Figure 7. Source categories have been adjusted as:

(a) continental aerosol, (b) soil dust,

The difference between continental aerosol and soil dust was definitely observed in the backward trajectory analysis using HYSPLIT4 (Draxler, 2004). Figure 7a and 7b respectively shows the back trajectories in 3 hr intervals observed when the intensities of continental aerosol and soil dust source were independently higher than other periods as shown in Figure 6. The trajectories reveal that continental aerosol was transported from further regions including northeastern China than soil dust.

(c) biomass/biofuel burning,

Figure 7c shows that the backward trajectories from 9 to 11 May and at 16 May 2002 when the intensity of biomass/biofuel burning source was relatively high. The trajectories passed by not only the cultivated regions in central China but also the forests and grassland located in northeast China and North Korea. Therefore, it is inferred that this source includes field combustion of agricultural residues as well as biofuel combustion.

(d) ferrous metal source (coarse), (e) ferrous metal source (fine),

As shown in Figure 7d and 7e, the difference of trajectories when they respectively have high intensities also supports the separation of two ferrous metal related sources. The source in coarse size range was estimated to be transported from southern industrial regions in South Korea while fine aerosol source regions related to the steel industry could be mainly located in major industrial areas in northeastern China.

(f) volcanic emission

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Finally the volcanic emission source, containing large amount of Al, Si, K, Ca, and Fe, was resolved in the fine size range (0.56˜0.75um) when the trajectories passed around Kyushu Island in which there are several active volcanoes as shown in Figure 7f.

Specific comments:

1. P 5231. Biomass burning that includes wild forest fire is NOT an anthropogenic source. You should change this source to be biomass/biofuel combustion because biofuel burning usually has similar signal to biomass burning.

: "Biomass burning" has been changed to "biomass/biofuel burning" in the revised manuscript.

2. P 5231. The source classification needs to be defined more clearly. What is Chinese aerosol? Does it include or exclude soil dust, coal combustion, oil-fired boiler et al.? If it includes other sources, this paper should clarify the overlap. If it excludes other sources, it should be "other Chinese aerosol". I suggest remove this mixed source category.

: "Chinese aerosol" has been changed to "continental aerosol" throughout the revised manuscript. Generally, the composition of soil is considerably different depending on the geochemical characteristics of source region. Differences between soil composition measured in China and Korea have been already studied in previous works. In this study, the soil dust originated from distance sources, especially in continent, was separated from local source by PMF analysis. The former is called "continental aerosol" and the latter "soil dust" in this study.

(Reference)

Liu, C. L. et al. (2002) Spatial and temporal variability of trace metals in aerosol from the desert region of China and the Yellow Sea, J. Geophys. Res., Vol 107 (D14), doi: 10.1029/2001JD000635.

Sun, J (2002) Provenance of loess material and formation of loess deposits on the

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Chinese Loess Plateau, Earth and Planetary Science Letters 203, 845-859.

Han et al. (2004) Soil chemical properties in Asian Dust source region in northern China (in Korean), Journal of Environmental Impact Assessment, Vol. 13 (6), 277-284.

* Volcano emission has been also corrected to “volcanic emission”. Captions of Figure 4, 5, 6, 9, 10 have been corrected. (Chinese aerosol-> continental aerosol, volcano emission->volcanic emission, biomass burning-> biomass/biofuel burning)

3. P 5231-5232. Figure 6 shows many interesting features, like the peak of ferrous metal related source (fine) around 06/05 and the strong temporal variation of soil dust and biomass/biofuel combustion. Unfortunately the authors did not present enough discussion.

: Episodic analyses using meteorological information are added to this paper using backward trajectory model (HYSPLIT 4) with Figure 7 as is stated above. Figure numbers are corrected

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 5223, 2005.