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Interactive Comment

Interactive comment on "Source apportionment of the particulate PAHs at Seoul, Korea: impact of long range transport to a megacity" *by* J. Y. Lee and Y. P. Kim

J. Y. Lee and Y. P. Kim

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Thanks for the elaborate review and we have accommodated most comments. We will try to put more data interpretation and revise the manuscript extensively. Responses on the specific comments are:

1. P 4. A discussion of sampling artifacts and impaction of these to the results: As the reviewer pointed out, sampling artifacts for particulate PAHs have been widely recognized. The degree of the artifacts might be dependent on various ambient conditions. Thus, high sampling artifacts for particulate PAHs are generally shown in summer when temperature is high. Sampling artifacts of particulate PAHs are classified by positive and negative artifacts. Positive artifact of particulate PAHs is occurred by gas adsorp-

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tion in the filter, but, quantifying positive artifact by the sorbent system downstream of the filter is difficult. The sorbent system downstream of the filter can quantify negative artifacts due to evaporation of PAHs from particles. According to a study by Simcik et al.(Environmental Science and Technology, 31, 2141-2147, 1997) who have used a backup filter to quantify negative artifacts during sampling, the negative artifacts were small, about 5% (n=11) of the measured particulate PAHs concentration. In this study, though we did not carry out correction for the sampling artifacts, we think the uncertainties value we have assigned in the CMB modeling process for the ambient concentrations “15% of the concentration for individual PAH compounds” is enough to account for them. Thus, in our option, the CMB modeling result is still valid even though we did not quantify the sampling artifacts. This point will be added to the revised manuscript.

2. P 5. A discussion about the major assumptions used in CMB and impaction of results from the assumptions in CMB: One of the major assumptions used in CMB is species included are not reactive. However, PAH compounds are subject to photochemical reactions. Generally, two methods for correction have been used in CMB applying PAH compounds to correct this effect. One is applying the first-order reaction concept and the other is BeP normalization for individual PAH compounds. In this study, to account for the loss of PAHs concentrations due to photodegradation, the concentrations of individual PAHs compounds were normalized to that of BeP since photodegradation and ozonolysis of BeP is low compared to other compounds. For example, half-live of BeP under the simulated atmospheric condition was one order higher than that of BaP and Anthr (Katz et al., 1979 in the manuscript). Application of the first-order reaction concept might be difficult due to the various distances of sources from receptor. Another major assumption used in CMB is the compositions of source emissions are constant. Source profile of particulate PAHs might be different by emission conditions and/or each country. However, at present, fully developed local source profiles for Seoul and Northeast Asia are not available. Thus, in this study, the available estimates of the source profiles from previous studies in worldwide were used. We will clarify this point in the revised manuscript.

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3. P 6&7. For the needs of the discussion about time trends in emissions and associated figures: In these pages, we tried to explain why we selected seven sources for particulate PAHs. However, following the reviewer's suggestion, we will make the explanation of time trends in emissions short and remove Figure 2 and 3 in the revised manuscript.

4. The validity of use of the word "transport": The authors will make modification of transport to transportation in the revised manuscript as suggested.

5. Presentation of the results by a time series of contributions throughout the year and detailed investigation of days which are unusual for the using meteorological conditions and back trajectory analysis: We agree with the reviewer's comment. Thus, we will show a time series of contributions for CMB modeling results. In addition, the differences in fall and winter will be explained in relation with the differences in backward trajectories in fall and winter compared to spring and summer. For example, the contribution of coke oven is only shown in fall and winter and this result might be explained by different route of air parcels in fall and winter. Furthermore, the trajectories of the unusual days showing large contribution of coke oven were not different from normal days. More detailed explanations for this result will be added in the revised manuscript.

6. Showing maps of trajectory endpoints for each season: The authors agree reviewer's comment. Thus, we will change the figure for the back trajectory in the revised manuscript.

7. The correction of Table 1: The authors have removed 4 PAH compounds in Table 1 in the revised manuscript.

8. Difference of degree value between Table 2 and text: The degree value in Table 2 means average+/-standard deviation, but, in text the range of degree was shown. Thus, as reviewer commented, the values of degree seemed to be shown differently. The authors will the degree values by the range in Table 2 in the revised manuscript.

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