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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Highly time-resolved measurements of element concentrations in PM_{10} and $PM_{2.5}$: Comparison of Delhi, Beijing, London, and Krakow" *by* Pragati Rai et al.

Anonymous Referee #1

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In this paper, size segregated (fine and coarse fraction) and highly time resolved (from 30 to 120 minutes) measurements of aerosol elemental composition are presented for some European and Asian cities (Krakow, London, Delhi, and Beijing). As outlined by the authors, the study of aerosol elemental composition is of interest since some elements contribute to adverse health effects (e.g. transition metals); moreover, elements are recognized as effective markers for source apportionment studies. Nevertheless, highly time resolved data - that are particularly important to trace source emissions - of the elemental composition given by online instrumentation (such as the Xact used in this work) are not widespread in the literature. Thanks to the high time resolution, average diurnal patterns of elements are presented and they can add interesting infor-

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mation to the literature. The work is centered on the use of average crustal enrichment factors (EFs) and average PM2.5/PM10 ratios to derive qualitative information about emission processes. The method is not totally original, since it is well known that EFs and information about particle dimensions can be used to gain qualitative knowledge of natural/anthropogenic emission sources; anyway, its application to very different sites allows an interesting analysis of similarities and differences among them.

Since the method proposed aims to provide "a robust and useful framework for categorizing elements and assessing site-to-site differences" (line 282), my main concern regards the concept of "systematic shifts" (lines 273-278) for the Group 5 (and perhaps for Group 4, as reported in Section 4), that is not presented in a quantitative way, and I do not think it is very clear from Fig. 2. If the authors want to introduce this concept in the paper, it should be made more quantitative in order to be replicated in other papers in the future. For example, it would be better to underline the fact that the y-axes have a logarithmic scale, which means that graphical "vertical" shifts represent differences higher than the same graphical "horizontal" shifts. Then, differences in the values of PM10el EF for the same element for the different sites can be reported, in order to test if Group 5 present systematic higher differences.

Specific minor points to be addressed:

- Lines 29-30: I would suggest to move the sentence "Hourly maximum concentrations of [. . .] at the other sites." at the beginning of line 26, before introducing the methodology. Information on concentrations of Pb and Zn is not related to the methodology, and it sounds a bit confusing to me in this position.

- Line 38: the word "concentration" is missing after the parenthesis containing the definition of PM2.5.

- Lines 59-61: It is true that the methodology proposed in this paper does not require a full source apportionment (SA) analysis, but I think it is worth to specify that the full SA analysis is still necessary if more quantitative information (e.g. impact of each

source/category of sources) is desirable. For example, I suggest to modify the first part of the sentence: “When the aim of the analysis is not to obtain quantitative information, this method was proved particularly useful since it does not require a full source apportionment (SA) analysis [. . .]”.

- Line 63: I think it is more appropriate to replace “campaigns” with “sampling sites”.

- Lines 121-122: the comment about the good data quality sounds a bit redundant after all the explanation given about differences between the two instrumentations (Xact and AMS).

- Line 140: Since no statistics about the average values is reported in the text, I suggest to clarify that it can be found in Fig. S2a.

- Lines 142-143: Since Fig. 4 and S2b represent all the sites (not only Delhi), I suggest to underline it for sake of clarity at the beginning of the sentence, e.g. “For the four sites PM10 diurnal cycles, and PM10el and PM2.5el time series, are shown in Fig. 4 and S2b, respectively. The total PM10el (and PM2.5el) concentrations in Delhi [. . .]”.

- Line 161: the part of the sentence “where EFs»1 indicate strong anthropogenic influence” should be moved before the introduction of the corresponding PM2.5 and PM10 ratios. Moreover, I suggest to delete “In addition” and to explain a bit better what type of information the PM2.5/PM10 ratio can give, e.g. “The mass ratio PM2.5/PM10 for an element gives rough indication of the particle size distribution, that reflects the corresponding emission processes and can provide insight into specific sources.”

- Line 163: I would say “abrasion processes (e.g. mineral dust resuspension and brake wear).

- Lines 178-179: It is difficult to me to understand the use of “consistently” and “consistent” in this sentence. I think that it is correct to say that “Elements associated with this group are typically of crustal origin.”.

- Line 181: “representative” is missing in the sentence: “Si is selected as the Group 1

representative element.”.

- Lines 184-185: I agree that most of the dust deposited on the road surface derives from road abrasion and vehicle abrasion; but it is not clear to me why dust from construction activities or agricultural soil are also dominant. Is there any literature work highlighting this connection? Why should deposition from other activities (e.g. biomass burning) be less important?

- Lines 238-245: I think that this discussion should be supported by some literature works regarding the separation considered for elements present in primary components and elements present in secondary ones.

- Lines 246-249: The correlation between Xact Cl and AMS-derived Cl- is good (from Fig. S1, R = 0.97 and 0.98 for Beijing and Delhi, respectively), but for Beijing the absolute concentration values from Xact are clearly higher (slope of 1.9); this difference has been discussed in Section 2.2. I think that in this case these measurements are not enough to assure the lack of Cl from sea/road salt from. Please explain better the sentence “Because the kinetics of secondary aerosol [. . .] with the partial exception of Cl”; why are surface area and volume introduced, before speaking of PM2.5/PM10 ratio?

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