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Interactive comment on "Assessment and application of clustering techniques to atmospheric particle number size distribution for the purpose of source apportionment" *by* F. Salimi et al.

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General comments: This manuscript provides valuable information about different clustering methodologies that can be applied to particle number size distributions (PNSD). It analyses the performances of 4 different clustering techniques using the Dunn index and the Silhouette width. The k-means clustering technique is chosen and thus applied to the data set, resulting in 5 clusters. They are further classified in 3 categories: regional background particles, photochemically induced nucleated particles and vehicle

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generated particles.

The paper is well written and structured and the references to other studies on similar subject are accurate.

Specific comments: There are two issues that are not touched in the paper, and in my opinion are relevant. First, it would be interesting to investigate the relationships between clusters and air masses during the sampling period, as well as wind speed and wind direction. Although this is a complex study including 25 sites, an estimation of the influence of these parameters would be appreciated.

Response: Measurements were conducted at 25 sites but the data were collated and analysed altogether. Since the local wind speed/direction at each site varied from each other and the local traffic sources were located at different directions in relation to the sites, analysing the wind parameters would oversimplify the situation and mask the impact of local sources. To have meaningful results, investigation of more complex interactions of local and regional sources would be required, which is outside the scope of this paper.

Second, in Figure 4 a very high density of local peaks is observed for all clusters in the lower sizes. What is the error associated to the method used (GAM) for these sizes, and in general?

Response: The high density of local peaks in the lower size was not related to the modelling but was identified in the. Since GAM is a smoothing model, it does not introduce any additional local peaks but it reduces the number of peaks.

Page 15270 lines 5-8: a 20 nm shift in the PNSD from Cluster 5 to Cluster 4 should not be directly attributed to the influence of biomass burning particles (100-200 nm in size). A log-Normal fitting of these two clusters PNSD should be performed in order to confirm this hypothesis. Ideally a 100-200 nm mode should be found in Cluster 4 that would be attributed to biomass burning aerosols.

Response: We used GAM and proposed it as a replacement to log-normal fitting. The results of the GAM were shown and particle peaks around 100 nm can be seen in Figure 4. For more clarification the following sentence has been added (page 11, lines 26-27):

"In addition, peaks at diameters larger than 100nm were present with higher normalised concentration compared to Cluster 5 indicating the effect of biomass burning aerosols (Figure 4)."

Page 15270 from line 19 until the end of the manuscript: this should be a new Conclusions section.

Response: "Conclusions" section has been added (page 12, line 7).

Technical corrections: Page 15264 line 5: what does FAQ stand for?

Response: It was written by mistake, has been removed now.

Page 15266 lines 20-21: should probably be Figs. 3, 4 and 5 instead of 1 and 2

Response: It has been fixed accordingly.

Page 15267: references to Table 1 in the description of Cluster 1 and 2 are misleading

Response: The references to Table 1 in the descriptions of clusters have all been removed and the following sentence has been re-written to refer to the Table 1 (page 8, line 25). "Characteristics of each cluster and the associated sources are summarised in Table 1 and explained in the following sections, based on Figures 3, 4 and 5."

Page 15268 line 19: "less" should be substituted by "lower"

Response: It has been fixed accordingly.

Page 15270 line 5: "higher" should be substituted by "larger"

Response: It has been fixed accordingly.

Page 15270 line 10: "occurrence" should be substituted by "prevalence", as traffic emissions also occur during the biomass burning period, although the PNSD might be dominated by biomass burning particles

Response: It has been fixed accordingly.

Page 15270 line 23: "Clusters 3 and 5" should be "Clusters 4 and 5"

Response: It has been fixed accordingly.

Page 15279: Caption of Figure 3: abbreviation of solar radiation (SR) should be included

Response: It has been fixed accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 15257, 2014.