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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simplifying aerosol size distributions modes simultaneously detected at four monitoring sites during SAPUSS" *by* M. Brines et al.

Anonymous Referee #2

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General comments:

The paper fits well into the scope of the ACP journal. It analyzes data on aerosol number size distributions collected at four sites in Barcelona and its vicinity using SMPS spectrometers to show the aerosol dynamics within an urban area. By a k-means cluster analysis collected size distributions are sorted into 9 clusters in three categories: traffic, background and special cases. Average particle size distributions are shown for each cluster with their characteristic modes and their significance. Number concentrations corresponding to individual clusters are further correlated with concentrations of gaseous pollutants. Mutual relationships between the clusters and their relation to

main meteorological parameters is studied as well.

The methods used in the paper are sound and chosen adequately. The references relate the paper to other studies on similar subject. The scientific results are presented clearly, structured reasonably and written concisely.

Specific comments:

There is one issue that is not touched in the paper and, in my opinion, needs to be answered: How the aerosol samples (analyzed by SMPS spectrometers) were treated concerning their relative humidity? It is indicated in chapter 2.2.1. that at the RB site the SMPS spectrometer was an EUSAAR IfT model, therefore it can be assumed that the RH inside the SMPS was kept under 40% to measure dry sample according to the EUSAAR standard. However, the other three SMPS systems deployed at the RS, UB and TC sites were combinations of different TSI DMAs and TSI CPCs. There is no more information on these systems in the paper, but I would assume that there must have been done some changes on these systems in order to incorporate aerosol driers into them to lower the RH below 40%. Otherwise, the size spectra measured at higher relative humidities might have been shifted towards larger sizes due to particles hygroscopic growth, so the spectra would not be directly comparable to the RB site. As can be seen in Figure S5, almost all samples were taken at ambient RH higher than 40%. I assume that the authors will be able to answer this question adequately. Failure to treat the RH of the samples adequately might have led to misinterpretation of the results.

It follows from the modal analysis of the cluster-averaged aerosol size distributions (Fig.1, Fig S1) that the accumulation mode has been found in only one of nine clusters (Regional Background 1). I consider this result rather surprising. Is it because the number concentration of particles under the accumulation mode was so low that the "peak-fitting procedure" found only one or two major peaks (corresponding to nucleation and Aitken modes) and failed to find the peak connected to the accumulation

mode? Could it be caused by the fact that the harmonized size spectra (2.2.1., line 18) ended at 228 nm and so the fitting procedure did not give enough weight to the rather flat accumulation mode that would otherwise continue further to larger sizes? I am asking because it is widely accepted in the aerosol literature that the accumulation mode is practically always present in the atmospheric aerosol.

Technical corrections:

Abstract, line 18: the harmonized SMPS size range was 15-228 nm, so the last paragraph makes a rather general statement that is not directly supported by the SMPS data presented in the paper.

1.Introduction, line 23: urban “agglomerations” instead of “agglomerates”

2.2.1, page 27394, lines 10-15: it would be useful for the reader to add here information concerning how the samples were treated concerning their relative humidity.

2.2.1., page 27395, line 2-3: the water-based TSI CPC might have been less sensitive to some freshly emitted particles, this model of CPC is more sensitive to aerosol composition than the butanol-based models. It would be helpful to the readers to explain how this might have influenced the results.

3.1., page 27397, line 26: In Table 3 and Fig S5 the North African air masses are further divided into East and West (NAF_E, NAF_W). The text here should be consistent with tables and figures.

3.1.1.-3.1.3.: Notation of Figs 2, a-j is shifted in the whole section by one letter, e.g. on page 27398 line 13, Fig 2a should be Fig 2b. This shift continues all the way down to page 27401.

3.1.2, page 27400, line 6: should be “15%” instead of “14%”

3.1.3., page 27401, line 9: should probably be “Table 4” instead of “Table 1”.

3.1.3., page 27402, line 9: formulation “the coarser mode” may mislead the reader who

expects the coarse mode particles to be well above one micrometer in diameter.

4.1, page 27403, lines 25-29: Why would nucleation mode particles evaporate and, at the same time, the Aitken mode particles grow by condensation? Should there not be a better explanation of the observed behavior?

4.2., page 27406, line 4: Should not be there UB1 instead of NITclus? (see Fig 1)

In several Tables and Figures the information is not well readable in the printed version: namely in Table 4, Fig.2, Fig.4.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 27387, 2013.