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Comment

Interactive comment on “A statistical analysis of North East Atlantic (submicron) aerosol size distributions” by M. Dall’Osto et al.

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Referee comments for Dall’Osto et al, Statistical analysis..., ACPD,11,21677-21711,2011

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The article uses relatively new methodology to find out 12 representative number size
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distributions from Mace Head coastal site, interpreting the results as a function of air mass origin and other parameters. In general I find the paper fitting from the subject matter to ACP. The results are not particularly surprising, but valid and I have no complaints about the overall methodology.

The presentation is acceptable, but improvements on the text and many small corrections are needed, as the document seems to have been submitted in a hurry.

General comments:

My main problem from the methodology side is the overall shortness of methodology, especially on clustering process. e.g. it is mentioned that the study uses K-means clustering. It would be useful to mention that the reason it was used, as Beddows et al (2009, EST) showed that such method gives better separation and more uniform clusters than other commonly used methods. Another thing unexplained is the meaning of Hopkins number. The number of selected clusters would also require explanation, especially as the interpretations mostly concentrate on the cluster types (3 cluster per type).

I would prefer a bit more introduction to the terminology and/or the method, so that a reader not familiar with clustering does not have to search Beddows et al (2009) or some textbook to figure out what are the main advantages and disadvantages. There should be more discussion on what the clusters actually represent, in addition to the text in the Introduction.

As a general comment, I think the article would benefit from instead of a long explanation of different cluster properties, some way to combine the properties into either one (large) picture or table, so that the reader do not have to either go through the 7 tables or read the list of cluster properties. This could also be done in cluster type level (e.g. Coastal N, Op. Ocean N. etc), to show which are the similarities of the differ-

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ent types in context of size distribution shape, airmass origin, times observed and key other parameters (high PM2.5 etc). This would work very nicely as a concluding table, in addition of making the overall results more approachable.

Question: Could one, based on the clusters presented here, use any measured size distribution in Mace Head (e.g. from earlier years) and based on some distance parameter of the clusters, select a most likely origin of the clusters. If so, could this method then be used as a Mace Head "airmass origin" filter if one wants to e.g. study only airmasses originating from open ocean?

Minor comments:

Overall, I would suggest the authors to proof-read the article one more time. I will not go through small (but numerous) small typos here.

I did not see any use for the nephelometer data in table 3. Is it used somewhere?

Table 1 has no indication on a) how are the modes defined in this context, and most importantly: what are the numbers? Diameters? Statistical parameters? What are the units? Reader is left confused.

In the text, there are many cases where properties are given with value+error estimate, eg. "...was found to be mP ($42 \pm 15\%$)". What are the error estimates, standard deviations? Or are they ranges? Same with figures 1, 4, 5

Wind direction averages are probably calculated as vector averages. Useful to mention, as otherwise quite southern-oriented averages could be though averaging.

Fig 2: EUCAARI

On figure 4, I would draw a coloured line on e.g 1E3 to highlight the size distribution function differences between clusters.

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Figure 5, please increase the axis scale text size. What are the lower limits of the "error bars"? As in other cases, are the error bars range or deviation? A box-whisker plot would fit the subject matter much better. Overall, could you please put the subfigure markers (a, b, etc) on the top left of each figure? Subfigure e) y-axis label is in Bars, I would guess it is (according to caption) mB (or, preferably in hPa)?, Subfigure f) legend is not explaining too well what is show there with just "%". Please use e.g. "fraction nighttime". Also, I would guess the solar radiation (is this global radiation measured in 10m?) is in W/m², not in J/m².

Correct all "aitken" with "Aitken"

One specific point: Why is "Cluster" written with capitalized C? It is at least consistent through the manuscript, but I would really write it as "cluster".

N3 and N10 could be more in line with the notation of some earlier paper, but $N_{D>10}$ are ok.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 21677, 2011.

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