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Comment

## ***Interactive comment on “Number size distributions and seasonality of submicron particles in Europe 2008–2009” by A. Asmi et al.***

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First of all, many thanks for constructive and useful comments on the manuscript. We believe the document is now greatly improved.

Referee: *Site classification - It is not clear what the point is of the detailed comparison to Henne (2010). Similarly, what is the point of figure 12. What would “agreement” or confirmation of Henne’s classification scheme look like, in general, and in the context of figure 12? It seems the point is to ask whether Henne’s classification scheme can predict the groupings that arise from the descriptive statistical analysis on the size distributions. But it is not clear to me what figure 12 would look like if Henne’s scheme*

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*did apply. I believe more thought can be given to carefully describing in the text (a) why we may or may not expect the Henne (2010) classification to apply to Aitken and accumulation mode particles; (b) a rationale for the method of comparison and guiding the reader to what good comparison vs. poor agreement looks like; and (c) the result of the comparison.*

Answer: We have now re-structured corrected this section explaining the motivation and expected results of the comparison. In short:

a) The site classification could work also for particles, if the particle behaviour would be sufficiently similar to O3. Using similar classification with modifications could also be of use in the future, if some parts of the classification can be shown to work.

b) The method of comparison is to first check are some of the main aerosol properties well correlated with Henne categorization. On our opinion, a very representative site should have relatively low variability and would have a single-mode histogram for the properties studied. This test did not seem to support current Henne categorisation for several stations. Then we tested the two main parameters of their categorization to see if there is a systematic aerosol behaviour related to them. For the source parameterization such trend can be seen (particle numbers seem to increase with increased source parameter), but for the sink parameter no clear trend can be seen.

c) The conclusion is that using non-aerosol-pollutant classification for aerosol representability is dangerous and should be considered carefully. The aerosol sink terms in particular are different from many other pollutants. However, such categorization could be done in the future using some of the methods from their study, and would be beneficial for data analysis (and modelling) as we would have better idea what the aerosol measured at the station actually represents.

Referee:

*Uncertainty - In a few places in the paper there are discussions of uncertainty. For*

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*example, line 16 on page 8993 in Appendix B. But it is not clear what it means for a monitoring instrument to “reproduce the same concentrations.” If this were a laboratory experiment, the meaning would be clear. But I believe what is meant in this paper is that there is a lack of agreement between the monitor SMPS or DMPS system and the “gold standard” reference instrument. Without the reader going to the uncertainty article Wiedensohler (2010) is it difficult to establish the meaning. My suggestion is that (1) a longer summary of the uncertainty and QA method be given in the method section and (2) sections of the text referring to uncertainty have their wording clarified, to something referring to discrepancies with the reference instrument, rather than difficulty reproducing*

Answer: We have now included a longer summary on section (2.2.1) for uncertainties in the instrumentation. This section should also better summarize the two kinds of uncertainties from the instruments (between instruments and measurements of the same instrument).

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We have also corrected the typos and awkward sentences mentioned by Referee 2. The size distribution figures now have a dotted line showing the edges of the shaded area, which seems to improve readability. The figure 12 will be improved if presented in larger format (i.e. ACP full page figure), if the text size is still too small, we will increase it to readable scale. This is dependent on how the technical editing for the ACP pages will go (if the corrections are accepted and the paper is going to ACP, of course).

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 8893, 2011.

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