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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hygroscopic growth of urban aerosol particles in Beijing (China) during wintertime: a comparison of three experimental methods" *by* J. Meier et al.

Anonymous Referee #1

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General comments: This paper compares three different methods of evaluating particle hygroscopicity as a function of size in a polluted urban environment. As all three methods are frequently used in one way or another in the scientific community, a comparison study like this is welcome. Not surprisingly, the methods show both similarities and differences, changing with time and particle composition, and the paper tries to analyze and summarize these issues.

The HTDMA is the only one of the instruments that directly measures the hygroscopicity of aerosol particles, and one would assume that this instrument would have been the main reference in the paper, but this is not the case. Now the paper assesses

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uncertainties between two methods (CHGF and DHGF) by comparing them to each other although both methods have their own problems. The HTDMA data is given very little room and is not nearly used to its full potential in the paper. This is the biggest limitation of the paper.

The structure of the paper and the presentation of the data are adequate, but please see the specific comments below concerning some of the figures and tables. The general comment concerning the figures is to use more colors instead of line and marker styles that are hard to distinguish.

Having a native English speaker read through and reformulate some of the text would also benefit the paper as a whole.

I recommend the paper be accepted after revisions listed here.

Specific comments:

Page 6895, line 20. ”the deliquescence point of common inorganic salts.”

Section 3.1: When calcualting the DHGF, the authors state “We are aware that the assumption of homogeneously mixed particles is not true in atmospheric aerosols, since they tend to be externally mixed (Swietlicki et al., 2008). However, the procedure is assumed to yield trustworthy results as long as no dramatic changes occur in terms of the external particle mixture with particle diameter.” The HTDMA is the best instrument to measure the mixing state of the aerosol. Yet the authors do not use, or even mention, this information. If they really want to make a good comparison, and try to explain differences between the three methods, this is certainly of great importance.

Section 3.2. If the data for the different hygroscopic groups are not presented in the paper, there is no need to first divide the data into three groups and then average them back. This is a completely redundant step and should be removed, both from the analysis itself, and from the paper since it only serves to lengthen and complicate the text.

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6899,18. I assume that it is NH4 and [2*SO4 + NO3] that correlate.

6900,3. Add some motivation to why you select 1.7 as the average density of the particles. On line 22 you say this is "based on chemical data". Which chemical data? To me 1.7 sounds high for the overall density. How sensitive are your results to this number? And how much could you improve the result by varying the assumed GF=1.0 for the "non-soluble" fraction? It is known that oxygenated organics have a GF>1.0.

6901, 2 and 6902,4. I realize that the measurements were conducted in one of the most polluted places on the planet, but I suggest to reformulate "relatively clean" describing the air masses, since 200 ug/m3 can not be considered clean, even though it is the least polluted period of your measurements.

6901,12. Was the max. wind really as low as 0.12 m/s? This is not the case according to figure 1.

6902, 14: remove "events"

6902,24. I only count nine. In figure 7 l2, there are two data points below 100 nm and in figure 3 you have the lowest range at 100 nm. Please explain/correct.

Table 2. All the information in this table is found in figure 6, and thus table 2 can be removed.

Figures 1, 5 and 7. The plots are hard to read. Use more colors to make it easier to distinguish between data.

Fig 1. Also add the times of the impactor samples.

Fig.5. In A3 the DHGF below 40 nm is higher for RH 55% than for 77%. This should be noted in the text, and explained. If nothing else, it is a good marker for the uncertainty in the summation technique or the error in RH. The last sentence says that "error bars indicate the measurement errors". In the text these are explained as the uncertainty based on RH variability. These are not the same thing and should be clarified.

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6906, 6-8. The authors have presented no data on GF of less or more hygroscopic particles, and thus this statement can not be verified. Only if all your particles were classified as “more hygroscopic” would this statement be correct. If there is some mix of less or non-hygroscopic material in the particles, the GF might even seem high. The most reliable measurements are still the HTDMA data, and those are around 1.4.

6909, 20. Also spell out the C in CHGF.

Technical corrections:

As mentioned, to improve the paper, have a native English speaker read through it. Currently the language is not very good, whether it be due to the authors’ ability to write in English or only due to careless finishing. Below are some grammatical corrections.

6891, 18. I expect you mean “rise”.

6891, 27. “regionally emitted combustion particles”?

6900, 22. of -> a

6905, 10. “probably due to because of” should be corrected

6906, 24. “show a partly agreement” should be corrected

6910, 2. Remove “That”.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 6889, 2009.