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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Hygroscopic properties of water-soluble matter and humic-like organics in atmospheric fine aerosol" *by* M. Gysel et al.

Anonymous Referee #2

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This manuscript presents a study on hygroscopic properties of aerosols produced from extracted ambient PM1.5 samples as well as comparison with reference aerosols produced from aquatic Nordic reference fulvic and humic acids. The study is well done and clearly presented and contains new original scientific results. These results are valuable when investigating aerosol-water Úinteractions in atmospheric conditions. I recommend that this manuscript should be published in ACP. Some remarks and comments are presented in the following.

General comments

1. The accuracy of the experimental results needs more critical consideration. On page 4886 (first line) the authors state that the accuracy of the growth factor is +/- 0.003. There are, however, no clear arguments how this is obtained. In general, the

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accuracy of DMA measurements (and thus also TDMA measurements) is determined mainly by the accuracy of the volumetric flow rates inside the DMA. The improved technology certainly enables more accurate control of the DMA flows. However, it would be interesting to see the arguments in more detailed. This aspect is rather important in connection with discussion concerning the mobility correction factor as well as the restructuring of the particles at low RHŠs, as the reliability of these values (and the whole phenomena) depends clearly on the accuracy of the experimental data.

2. Related to the accuracy of the experimental data, it would be interesting to see how the experimental data compare with models when measuring well known inorganic salts. If these tests are performed, perhaps the authors like to comment on that.

3. This manuscript presents data that is obtained using four atmospheric aerosol samples: two summer samples and two winter samples. The representativeness of the data is therefore rather limited and one needs to be careful in making strong general conclusions e.g. on the differences of the aerosol properties between winter and summer (e.g. page 4894, lines 22-26). I see this manuscript more as a method paper together with detailed model vs. experimental data comparisons. The general comments related to differences between seasons should point this out.

Specific comments

1. Page 4884, line 4 from bottom: Is the drying sufficiently done if it is below 25%? Several figures indicate that interesting phenomena take place at RH close to 25%.

2. Page 4885: Timescales within the experimental setup should be discussed.

3. Page 4894, first four lines: Are these conclusions made based on the four samples investigated, or are there additional data used as well? Similar question is related to page 4895 first couple of lines.

4. Page 4894, line 12: It is not certain that the restructuring takes place due to dissolved material. Similar phenomenon is observed e.g. for pure NaCl aerosol in certain

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experimental conditions and is possibly related to restructuring of the crystal structure of the particle well before deliquescence. See e.g. Krämer L., U. Pöschl, and R. Niessner, (2000), Microstructural rearrangement of sodium chloride condensation aerosol particles on interaction with water vapor, J. Aerosol Sci., 31, 673-685 or Hämeri, K., A. Laaksonen, M. Väkevä and T. Suni (2001) Hygroscopic Growth of Ultrafine Sodium Chloride Particles, J. Geophys. Res.,106, 20,749-20,758.

5. Page 4898, first paragraph: The experiments presented in this study results (most probably) on internally mixed particles with an average composition of the compounds in the solution. The discussion here makes the same assumption. However, in many cases the atmospheric aerosol has two or more hygroscopic growth modes indicating that the aerosol population is externally mixed. This possibility needs to be commented.

6. Page 4899, first paragraph: The restucturing of the particles is very interesting. However, it does not necessarily indicate deliquescence (see specific comment 4.). Can the authors rule out any instrumental effect due to e.g. the accuracy of the experiments (see first general comment) or recidence time? Same question applies to page 4900, lines about 15-18.

7. Page 4899, second paragraph: Is the RH history of all the particles the same? If some particles see lower or higher RH than others, the standard deviation of the aerosol changes. This is possible e.g. in laminar flow, where the residence time for the particles travelling along the centerline is different to that of particles travelling near the tube wall. It would be interesting to get some details of the humidification process as well as comments on this question. In addition, what is the role of multiple charged particles in these experiments?

8. Page 4902, first paragraph: Can the values of gamma-parameter be compared with other studies?

9. Table 1: Some background information on the samples would be useful. E.g. the sampling period, meteorological situation.

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Technical corrections

1. Page 4891: The discussion on figures 6 and 7 appears before the fig 5 is discussed (first time at page 4894).

2. Page 4892, line 3 from bottom: The equation 9 is strangely written.

3. Figures 4-10 would benefit if multicolour.

4. Figure 8 could be made larger or split to separate figures.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 4879, 2003.