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Interactive comment on "Prompt deliquescence and efflorescence of aerosol nanoparticles" *by* G. Biskos et al.

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Comments by Hämeri and Laaksonen on paper "Prompt deliquescence and efflorescence of aerosol nanoparticles" by G. Biskos et al.

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This paper presents new findings concerning deliquescence and efflorescence of nanoparticles. The results indicate that the deliquescence phenomenon of ammonium sulfate is prompt. The intermediate values of hygroscopic growth factor as presented earlier by Hämeri et al. (2000) are discussed to result from the experimental conditions being thus an artifact. These arguments are supported by new experimental data which gives qualitatively similar results compared with those of Hämeri et al. However, there are several issues that need further clarification and commenting in the paper.

1) Assuming that the explanation given by the authors is a correct one, one would expect qualitatively similar behaviour for all hygroscopic materials. However, the picture is rather different for sodium chloride nanoparticles (Hämeri et al., 2001; Biskos et al., 2006a,b). For NaCl nanoparticles the deliquescence behaviour is much more prompt with the experimental setup giving non-prompt results for ammonium sulphate, even if some intermediate points were obtained. 2) The gradual deliquescence was previously obtained only for particles with diameter 30 nm or smaller. Qualitative change in behaviour takes place roughly between 30 and 50 nm. This may owe to different trajectories and consequently different residence times of particles in various regions inside the DMA or different type of DMA. 3) The effect, that aerosol flow RH is smaller that the sheath flow RH should influence, not only the deliquescence behaviour, but also adsorption of water onto the particle surface at RH below deliquescence value. The effect should be seen as somewhat smaller growth due to adsorption. However, careful look at Figure 4 at RH between about 40% and 80% shows systematically opposite behaviour. This can be seen both for the datasets by Hämeri et al (2000) and the data by the authors. This is very confusing. Such systematic difference is not likely to be just coincidental and is larger than the uncertainty as reported both in this paper and by Hämeri et al. 4) We note also, that while operating both aerosol flow and sheath flow RHs at same value may reduce some problems, it also reduces the accuracy of the obtained DRH value. If the RH in aerosol line is lower that the final RH inside the DMA it is not likely that aerosol population has experienced higher RH conditions within the instrument than what is measured for the excess air of DMA and thus the accuracy of

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DRH is roughly as good as your RH-sensor measuring the excess air. However, if RH set point for aerosol line is the same as that of sheath air the RH experienced within the aerosol line may be higher than that measured in the excess air (within the accuracy of the aerosol line RH-sensor). 5) Finally, as a minor point, the authors refer to two of their earlier papers (Biskos et al., 2006a,b) discussing possibility of contamination as an explanation for non-prompt experimental results. The role of possible contamination was actually first discussed in a paper by Russell and Ming (2002).

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