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Interactive comment on “Closure between measured and modelled particle hygroscopic growth during TORCH2 implies ammonium nitrate artefact in the HTDMA measurements” by M. Gysel et al.

Anonymous Referee #3

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Review of the manuscript "Closure between measured and modeled particle hygroscopic growth during TORCH2 implies ammonium nitrate artifact in the HTDMA measurements" by Gysel et al.

General comments A central observation and thus issue in the paper is the deviation between experimental / measured hygroscopic growth and modeled hygroscopic growth as calculated with the ZSR concept, which has its base in the measured composition. Measurements of the hygroscopic growth are made with a HTDMA. A main flaw of the manuscript is that the assumed reason for the deviation between measured

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and calculated hygroscopic growth is not presented earlier. The possible reason, viz., volatilization of (part of the) ammonium nitrate is brought as the last hypothesis in a long series of possibilities (Pg 12522). In the discussion the suspense is being built up. My main objection, however, is that the issue of volatilization could and should have been addressed in a much more quantitative way than presented here. First of all the volatilization can be appropriately studied with artificial aerosol and this effort should certainly have been done, since artificially produced ammonium nitrate is used as a calibration component in the second instrument used here for the compositional analysis, viz., the AMS.

Furthermore the indicated relation between volatilization and temperature in the HTDMA and/or sampling lines and the warming of air and aerosol in the lines and instrument is only alluded to with reference to fig. 1. A solution is provided in that figure, namely to lower the temperature in the laboratory, or the site at which the HTDMA is/was located, so that volatilization is sharply reduced. It is noticeable from fig. 1 that the outside temperature allowed for that.

Given these remarks and the following it is the opinion of this reviewer that the paper merits edition as a technical note. Specifically the rather large number of figures is not warranted, given the issue of the non-ideal measurements.

Another issue is that the calculated growth also deviates from the measure growth in case of non-neutralized, or as it is called “acidic” aerosol. Since in this case only sulfate can be present the deviation can not be attributed to volatilization of ammonium nitrate. However it should be made clear that indeed in the case of an acidic acid there is full absence of nitrate. One could even speculate that when the acidic aerosol contains nitrate it would mean that this form of nitrate would be different from ammonium nitrate and that the nitrate is then responsible for the deviation rather than the volatilization of ammonium nitrate. For this reason I would ask for an evaluation of the presence absence of nitrate in situations with acidic aerosol and thus also a better definition of what is meant with acidic.

Specific items

Pg 12508 In 8 e.f.

The HTDMA is so well-known that even a shorter summary suffices

Pg 12510 In 2

NR should be specified as: Non-Refractive but it would be wise to explicitly indicate what aerosol fraction is included or what compounds are excluded. In view of the growth it might be good to know what hygroscopic compounds may be missed by the analysis with the AMS.

Pg 12522

Last item in list should be the first and also the discussion should start with most plausible explanation and then address the less likely causes for a deviation.

References:

A. Khlystov, A. Even and H.M. ten Brink "Effect of temperature, ammonia concentration and flow rate on under-sizing of ammonium nitrate aerosol in DMPS/SMPS" J. Aerosol Sci. 28, S59-S60

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12503, 2006.

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