

***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 #1

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Review to "Closure between measured and modelled particle hygroscopic growth during TORCH2 implies ammonium nitrate artefact in the HTDMA measurements" by Gysel et al.

General comments

The paper by Gysel et al. presents a closure study of measured hygroscopic growth using a HTDMA and the modelled hygroscopic growth calculated using the ZSR mixing rule, based on the chemical aerosol composition measured with an AMS. The authors

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find best agreement between the HDTMA measurement and the AMS/ZSR results when the measured nitrate is ignored, and therefore conclude that the HDTMA suffers from severe nitrate evaporation. This is a very important finding that may lead to the re-examination of many previous HTDMA measurements and results. However, before going ahead and declaring all previous HTDMA measurement wrong, the authors should answer the following questions:

1) The calculated growth factors from the ZSR mixing rule use the sulphate partitioning between H_2SO_4 , $(\text{NH}_4)_2\text{SO}_4$, and NH_4HSO_4 . Could it be that one achieves the correct growth factor when this partitioning is altered? That in cases of high nitrate (and therefore also high NH_4) the partitioning of sulphate is incorrectly estimated? The explanation in the paper how the partitioning is obtained is not satisfactory to me (section 3.3). Are there other possible systematic AMS errors, e.g., overestimation of nitrate due to the higher collection efficiency during high-nitrate-episodes?

2) The nitrate loss in the HTDMA can be studied in the lab by using an AMS or a filter sample before and after the HTDMA to measure the nitrate mass concentrations. Has this been done, and if not, why not? Will the almost complete nitrate evaporation occur in all HDTMA systems or is it just a problem of their specific setup?

Specific comments

Abstract, page 12504: Explain acronym "ZSR" when it is used the first time

Section 4, page 12523 What are "cast-iron" measurements?

Fig. 7: I suggest skipping Fig. 7, since the separation of organics into HOA and OOA is not a focus of this paper, and it doesn't show give important information. It is sufficient to mentions the findings in the text.

Technical corrections:

Fig 4: legend: replace "period" with "periods"

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