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Atmospheric Measurement Techniques Discussions

Interactive comment on "Intercomparison study of six HTDMAs: results and general recommendations for HTDMA operation" *by* J. Duplissy et al.

J. Duplissy et al.

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Responses to Referee Comments

First, we would like to thanks both referees for their constructive comments. The revised manuscript has been prepared including the reviewers's suggestions and comments. A point by point response to their concerns can be found (italics) below.

Responses to Anonymous Referee 2 Comments

Title: The title in the present form does not reflect the entire content of the paper. The aspect of recommendations for an optimal design for a HTDMA is not included. One alternative could be: Intercomparison study of six HTDMAs: results and recommenda-

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tions.

We agree and changed the title to the referee's recommendation: "Intercomparison study of six HTDMAs: results and recommendations"

P128, L 2-5: "... and were never intercompared." - Does this statement refer particularly to the HTDMAs that were used in the study presented here or to HTDMAs in general? In case it refers to the former the sentence should be: "... and they were never intercompared." If it refers to the latter, it is a contradiction to the statement on P129, L7: "... very few intercomparisons have been reported."

This statement refers to the HTDMAs that were used in this study and the sentence has been modified as suggested. Therefore the sentence P129, L7 is not in contradiction.

P128, L 9-11: Here, in opposite to the title the aspect of the recommendations for the HTDMA operation is missing.

As proposed, the new title does not include the word "HTDMA operation" anymore.

Chapter 2 (Experimental section): The experimental section should be exclusively restricted to description of the used instruments and description of the performed experiments. Therefore I suggest that recommendations and necessary explanations for the recommendations should be presented in a separate chapter (e.g. the consideration to required temperature stability (P132, L 11-24), required residence time (P134 L 5 - P135, L 11), requirements for the measurements of the relevant RH (P135, L 13-P136 L 12), etc.).

We agree with the referee that parts of the Sections 2.2.2, 2.2.4 and 2.2.5 go beyond just describing the design of the HTDMAs used in this study, in so far as also the reasoning for chosing a certain design option is discussed. Such discussion could in principle go along with the list of recommendations provided in Section 5. However, in order to keep the recommendations concise we leave any detailed discussion in previous sections of the manuscript, while providing references to the relevant text

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passages along with the recommendations.

Furthermore, in the experimental section should be explicitly stated which instruments took part in which experiment.

The paragraph 2.2 in the experimental section has been modified to clarify this point. "Six instruments, originating from five research groups from Australia, France, Great Britain, Italy and Switzerland participated in the two HTDMA intercomparison workshops conducted at the Paul Scherrer Institute (PSI), Switzerland, during summer 2006 and winter 2007. The Swiss group provided two HTDMAs, one of which (HTDMA1) was present during both campaigns. Technical specification and literature references for each HTDMA (named HTDMA1 through HTDMA6) are given in Table 1."

Has been replaced by:

"Six instruments, originating from five research groups from Australia, France, Great Britain, Italy and Switzerland participated in the two HTDMA intercomparison workshops conducted at the Paul Scherrer Institute (PSI), Switzerland, during summer 2006 and winter 2007. Technical specification and literature references for each HTDMA (named HTDMA1 through HTDMA6) are given in Table 1. HTDMA1 was present during both campaigns whereas HTDMA 2 and 3 were present only during the first and HTDMA4, 5 and 6 only during the second intercomparison."

P130, L 6: The value $<$15% contradicts to the value stated at P148, L 26 (approx. 33%). Please state the RH in DMA1 for every single HTDMA used in this study taking into account only the dryer implemented in instrument and include that in Table 1.

The sentence on page 148, lines 25-26 "The GF values for HTDMA4 in the top panel of Fig. 7 are too low because the RH in DMA1 was high (approx. 33% instead of $<$15%)." has been replaced by "The GF values for HTDMA4 in the top panel of Fig. 7 are too low because the RH in DMA1 was too high during this particular experiment (approx. 33% instead of $<$15% as during all other experiments)."

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P139, L 5-19: A detailed description of hysteresis is not necessary. It would be sufficient to state an appropriate reference.

We think it is important to describe the hysteresis phenomenon in detail because measurements of the deliquescence transition of e.g. ammonium sulphate can reveal temperature gradients in DMA2, see corresponding discussion in Section 4.1.4.

Chapter 4.1.1: In addition to the sizing stability the sizing offsets should be considered that are stated in Table 1.

The following statement has been added at the end of Section 4.1.1: "High reproducibility of the sizing is a key factor for accurate growth factor determination. Accurate size selection by DMA1 is less important. If DMA1 was to have a sizing offset of +5%, then the instrument would measure the properties of particles with a dry size of e.g. 105nm instead of 100nm. This causes only minimal errors unless the aerosol composition is extremely size dependent. Nevertheless, correct size selection by DMA1 should be tested with certified PSL spheres."

P148, L 10-11: "In experiment 3 (Fig. 7)..." - Please correct this sentence.

This sentence has been corrected to: "In experiment 3 (Fig. 7) HTDMA1 measured a slightly lower growth factor than in experiments 1 and 2."

P148, L 13-19: These two sentences contradict each other. Please clarify. What does this mean for the interpretation of the results?

This has been addressed with the above answer to the first referee commenting on the same paragraph.

P149, L 2-3: Could you explain in more detail why the value RH$<$15% is recommended in particular. Is the value an outcome of detailed studies?

A maximum RH of 15% in DMA1 is indeed an arbitrary choice for the trade-off between minimizing the amount of residual water during dry size selection and keeping the

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technical effort reasonably low. The sentence on page 149, lines 2-3 has been replaced by: "As a consequence the RH in DMA1 has to be monitored continuously in order to ensure dry conditions at all times. A RH of less than 15% in DMA1 is recommended as a trade-off between minimizing the amount of residual water during dry size selection and keeping the technical effort reasonably low"

P149, L 20-22: Could you explain in detail why the value 10s is recommended in particular. Is the value an outcome of detailed studies? The statements in the passage P149, L 27 - P150, L6 indicate that no clear evidence could be found for an influence of the residence time at the final RH on the growth factors in this study.

The recommended value of 10 seconds is an outcome of a detailed study conducted by of Sjogren et al. (2007) where the residence time effects in HTDMAs were investigated. (Sjogren et al. Hygroscopic growth and water uptake kinetics of two-phase aerosol particles consisting of ammonium sulfate, adipic and humic acid mixtures. J. Aerosol Sci., 38, 157-171, 2007). This reference is already given in the manuscript.

Chapter 4.2/4.3: I would recommend that chapter 4.3 should be included in chapter 4.2.

We prefer to keep Section 4.3 separated from Section 4.2 in order to put emphasis on the remaining discrepancies found for the hygroscopicity of SOA. The first sentence of Sect. 4.3 has been rewritten: "The order of magnitude of the hygroscopic growth of SOA derived from photo-oxidation of α-pinene is well known, even though discrepancies between measurements made by different HTDMAs remain an open issue, which could not be resolved during the limited number of direct intercomparison experiments conducted so far."

P151, L 25: The value 0.7% is in discrepancy to the value 0.6% stated earlier.

This value has been corrected to 0.6%

Figure 2: I would recommend to shorten the figure description. "In example of Panel a,

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..." should be implemented in the Text.

The figure description has been adapted according to the comments by reviewer 1.

Interactive comment on Atmos. Meas. Tech. Discuss., 1, 127, 2008.