

## ***Interactive comment on “Water content of aged aerosol” by G. J. Engelhart et al.***

**G. J. Engelhart et al.**

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*1. The manuscript presents interesting comparisons of how the amount of particulate water can be investigated. Generally, the manuscript is worth for publication in ACP, but I would like the authors to address the very detailed scientific comments, which have been published by other referees. Comments on the use of AMS data were beyond my level in this area and seem to open up new questions. In any case, even if the uncertainties of AMS results will be difficult to quantify in this context, I will encourage the authors to add an extra paragraph to the manuscript summing up the weakness of the approach used.*

We have done our best to address the detailed scientific comments of the other referees (please see the corresponding responses). We have added two paragraphs summarizing the uncertainty of the DAASS water measurement and the issues regarding

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the water quantification by the AMS.

**2.** *Page 21654, line 25: This does not influence effects on visibility, but rather visibility itself. Please make this more clear. Page 21654, line 26: This is a repetition. Please make the structure of the whole paragraph more clear.*

This paragraph has been substantially rewritten and shortened to increase clarity and reduce redundancy.

**3.** *Page 21656, line 9: Please mark that the drying in H-TDMAs may also lead to evaporation of certain species of the aerosol sample – as a disadvantage!*

This has been added.

**4.** *Page 21656, line 29: The fact, that the DAASS measures water content in PM0.5, PM1, etc. is not an advantage, but rather more a disadvantage compared to the detailed data from H-TDMAs (detailed size information, state of mixture, etc.). I see the advantage of the DAASS more in the integral information of certain size fractions, which is delivered with high time resolution. Please comment!*

We have revised this section placing more emphasis on the features of these systems. For different applications these features can be either advantages or disadvantages as the referee suggests. We actually believe that because of these differences they are quite complimentary in characterizing the hygroscopicity of ambient PM in sub-saturated conditions.

**5.** *Page 21657, line 10: Which state do you mean?*

This refers to liquid or solid and has been amended in the text.

**6.** *I generally recommend to shorten the introduction.*

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We have done our best to reduce the length of the introduction while addressing all of the comments regarding specific queries for the introduction.

*7. I like to encourage the authors to estimate the uncertainty, which is related to the VGF retrieved from the DAASS system. Is the uncertainty mostly defined by the described sampling bias or by the stability of the control RH, flows, etc. . . . ?*

Stanier et al. (2004) have discussed the uncertainty of the DAASS water measurements and the factors affecting it in the original paper discussing the development and testing of the method. These authors estimated an uncertainty of around 15 percent in VGF based on their measurements with model aerosols. We have added a reference to the above paper and also summarized the sensitivity of our calculations to our major assumptions about the aerosol in Finokalia (internal mixture, low water uptake at 10 percent RH, additivity of density, etc.).

*8. Page 21663, line 6: What do you mean with high, give a certain value! The comparison between the DAASS water measured and AMS water measured is in my view not reasonable. As discussed by another referee, the systems were measuring under different conditions, while those of the AMS are not detailed documented. The paper can clearly show, that experimental results from the AMS and experimental results from the DAASS (by using the AMS chemistry) can be verified by model results independently. The combination of these two systems may be a future way to monitor ambient particulate water.*

We have replaced the term “high RH” with “RH exceeding 70 percent”.

The correlation between the water measurements of the two instruments is a critical point for the paper that apparently requires additional explanation (see also our response to Comment 2 of Reviewer 1). The RH values at which the DAASS and the AMS measured the atmospheric aerosol water concentration were different. As the referees suggest, the DAASS measurement was performed close to the ambient RH

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while the AMS at the corresponding indoor RH (the RH for the ambient absolute water vapor concentration and room temperature). Figure 6 shows that the two water concentrations were correlated. The correlation was mainly due to the aerosol itself; for example during high sulfate periods both the DAASS and AMS measured high aerosol water concentrations. Of course, some of the correlation is due to the fact that both measurements are in the absolute water vapor concentration. This is now explained in the revised paper.

The important result is the comparison of the DAASS and AMS water concentrations and AIM at the RH of the corresponding measurements. This is shown in Figure 7 for the DAASS (the comparison is at the DAASS measurement RH which is close to ambient), and Figure 9 for the AMS (which is at the “indoor” RH of the AMS measurements). The final conclusion here is that the AMS provides valuable information about the aerosol water concentration at the indoor RH. This is now explained in the abstract, main text, and conclusions of the paper.

We agree that combination of the two systems in future studies may provide valuable information about our ability to monitor ambient particulate water. Clearly a lot of additional work is needed before the AMS can be used to measure particulate water. This point is now made in the conclusions of the paper.

**9.** *Page 21667, line 9: This sentence stands alone without any concluding remarks!*

We have added some text at this point discussing the implications of this finding.

**10.** *Page 21653: Write “Patras”!*

Changed.

**11.** *Page 21654, line 8: Write “periods”!*

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The text has been edited to “measurement campaign” versus “measurement period” as it is confusing as to whether FAME-08 was one period or several periods of measurement.

**12.** *Page 21654, line 15: Write “during” instead of “of”!*

Corrected as suggested.

**13.** *Page 21658, line 14: Write “sheath to aerosol flow ratio”!*

We have made the recommended change.

**14.** *Page 21658, line 15: Write “particle measurements”!*

Updated as suggested.

**15.** *Page 21658, line 23: Write “sheath air line”!*

Changed “sheath air” to “sheath air line”.

**16.** *Page 21659, line 23: Write “sheath air flow rate”!*

Corrected.

**17.** *Page 21662, line 26: Write “downstream” instead of “after”!*

Changed “after” to “downstream of”.

**18.** *Page 21663, line 6: Write “short” instead of “brief”!*

Updated as suggested.

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