

Interactive comment on “Instrumentational operation and analytical methodology for the reconciliation of aerosol water uptake under sub- and supersaturated conditions” by N. Good et al.

N. Good et al.

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We thank the reviewer for their supportive general scientific comments and the opportunity to clarify the manuscript as suggested.

General comment on the manuscript style:

"In general, the manuscript is well structured. A few comments on the restructuring are found below. In any case, the reviewer thinks that the language looks sometimes a bit "irritating", meaning the introduction to a relative clause with "that" is missing or sentences are starting with "To". As the authors are native speakers, the reviewer

C1260

will only mention this issue in general and motivate the editor to take special care concerning this comment."

The language in the manuscript has been modified throughout in order to improve the style. Care has been taken to address the specific grammatical issues highlighted.

Detailed scientific comments and comments on the manuscript style:

Introduction

Page 360, line 13, 14, 18: Avoid the repetition: "require"
2 instances of require replaced to avoid repetition.

Page 360, line 20: Write: "particle populations"
Corrected

Page 361, line 7: Write: "of the columns' walls"
Corrected

Page 361, line 19: Write: "with the aim"
Corrected

Page 361, line 24: Write: "long-term"
Corrected

Page 361, last two sentences: I do not understand your statement. Can you reformulate this paragraph and clearly state what you mean!

The centreline supersaturation is inferred from the observed CCN activity of aerosol of known composition with respect to a reference thermodynamic model. It is not derived from the temperatures measured around the column. This statement is added to clarify the paragraph.

Experimental configuration

Page 364, line 14: Write: "this may limit the certainty"

We have modified the phrase to read "lead to erroneous interpretation of the data", which better describes the situation when you have similar fractions of different charged particles in a TDMA which cannot be inverted. The reference to Gysel et al 2009 provides an explanation of the limitations of dealing with multiply charged particles when using a HTDMA.

Page 364, line 18: Write: "is calculated"

Corrected

Page 364, second paragraph: You should add here, that the problem of multiply charged particles leads to a measurement of HGF of larger particles, which - even if the same chemical composition is present- may have different HGFs because of the Kelvin term. Describe here, where the problem is to be found!

A sentence is added stating that multiply charged particles can have different growth factors due to their size (Kelvin effect) and differing composition.

Page 365, line 3: Write: "multiply charged particles"

Corrected

Page 365, line 6: Write: "by a DMA as a"

Corrected

Page 365, line 5, 10, 12: Avoid the repetition: "ensure"

Corrected

Page 367, line 14: Write: "distributions are measured"

Corrected

Page 367, last sentence of this section: I find the temperature descriptions here confusing. If you state that one temperature is higher than another, you have to denote what T , T_1 , and T_3 is. What is then T_2 . Describe the locations of the different points, say how they are connected (like $T_1 > T_2 > T_3$ or so) and give an example during

C1262

operation.

The descriptions of T_1 , T_2 and T_3 were given the previous section " CCNc - principle of operation". To clarify we add that $T_3 > T_2 > T_1$ in this section as suggested and also introduce the nomenclature T_{inlet} to denote the temperature the sampled aerosol is initially conditioned to in the CCNc. Instrument calibration

Page 368, line 4: Avoid repetition: "ensure"

Corrected

Page 368, line 10: Use better English: "with over sampling around the peak"

Corrected.

Page 368, line 19: Write: "one of the limitations of these calibrations"

Corrected

Page 369, line 6: Write: "and also to define"

Corrected

Page 370, line 8: Write: "the critical supersaturation S_c "

Corrected

Page 370, line 9: D_0 is not a function of S_c as I understand

Corrected (this was a typographical error)

Page 370, line 14: Write: "for F_A values around"

Corrected

Page 370, line 17: Write: "there may be"

Corrected

Page 370, line 18: Write: "from their calibrations"

Changed to "the calibrations"

Page 371, line 18: Write: "ammonium sulphate calibrations"

Corrected

C1263

Page 372, line 7: Write: "reaches its equilibrium size"

This sentence becomes somewhat imprecise so we replace it with: " Assuming the inorganic salt test aerosol reaches its equilibrium size in the HTDMA ADDEM can accurately predict the hygroscopic growth factor within the instrument resolution. ADDEM can also be used to calculate the critical supersaturation of the test aerosol. Therefore the supersaturation setpoint at which 50% of the particles of known size activate can be calibrated to this value across a range of calibration particle diameters with critical supersaturations covering the operational range of the CCNc. "

Data analysis

Page 372, line 21: Write: "of the HTDMA data analysis"

Corrected

Page 372, line 24: Write: "can be corrected for"

Corrected

Page 375, line 6: Write: "of singly charged particles"

Corrected

Page 375, line 13: Write: "used to calculate"

Given this method is not analytical we prefer to use derive rather than calculate.

Page 375, line 20: Say of which sample!

Added (MAP cruise data)

Page 376, line 6: Say of which sample!

Added (MAP cruise data)

Page 375, line 12 – Page 376, line 6: In my view, this section does not state two methods to calculate S_c , it rather more states one method to determine $S_c(D_0)$ and one method to determine $D_{50}(S)$. It is somehow written in a confusing way and I would very much like the authors to clear what can be derived by the data analysis.

C1264

Really one methods calculates $F_A=0.5$ when $D_0=const$ and S is "free", the other $F_A=0.5$ when $S=const$ and D_0 is free. But they are only useful quantities because we say they define S_c . In the revised manuscript the fact the we use D_{50} to define S_c for $D_0=D_{50}$ is more clearly described.

Page 376, line 18: Write: "required for"

Corrected

Page 376, line 18: Write: "of sizes typically sampled"

OK

Page 377, line 14: Write: "analysis approach must be"

Corrected

Page 377, line 16 - 27: I feel this paragraph must be placed earlier in the manuscript as you used this information on how particles are detected as droplets during all the calibrations.

This section is slightly reworded and moved to the CCNc calibration section of the paper. Example of operation in the field

Page 378, line 8: Write: "aerosol is formed"

Corrected

Page 378, line 8: Write: "a ship-borne platform"

Corrected

Page 378, line 12: Write: "as well as during some periods"

Corrected

Page 378, line 17: Use the acronym instead of "per cubic centimetre"

Corrected

Page 378, line 18: Write: "is similar and the resulting"

C1265

Page 378, line 20: Use the acronym instead of “per cubic centimetre”
Corrected

Page 378, line 22: Write: “are particles observed during”
Corrected

Page 378, line 25: Write: “The size-resolved CCN activation”
Corrected

Page 379, line 25: Start this paragraph one sentence earlier.
This has been done

Page 380, line 3: Write: “to calculate”
Corrected

Page 380, line 3: Write: “two methods outlined”
Corrected

Page 380, line 4: Write: “to derive”
Corrected

Page 380, line 10: Write: “operational range”
Corrected

Page 380, line 11: Write: “is substantially below” Corrected

Page 380, line 13: Write: “the CCNc calibrations are valid the operational conditions”
Corrected

Page 380, line 16: Write: “295.3K)”
Corrected

Page 380, line 25 – page 381, line 17: You list several good explanations for the discrepancies found in the data. In addition, use the wording non ideal solution, which you describe, but do not use by now.

C1266

Added term

Page 381, line 9: Write: “may not be accurately”
Corrected

Discussions and conclusions

Page 381, line 25: Write: “to obtain measurements of size-resolved”
Corrected

Page 381, line 19 - 23, page 381 - 382, line 24 - 3: These two paragraphs contain lots of repetitions in terms of information given in the text. Summarize!
The two paragraphs are combined with repetitions removed.

Page 382, line 21: Write: “two test aerosols were”
Corrected

Tables

Table1: List the surface tension parameters you have used for your calculations.
Surface tension assumption is now stated in the legend

Figures

Figure 1: Use a better colour/symbol code for the upper figure!
Double and triple charge more clearly differentiated.

Figure 3: Use a quadratic plot and show the 1:1 line!
In response to referee 2's comments Fig 3 is replaced with a table.

Figure 4, figure caption: State the name of the field study, where the calibration is carried out!

C1267

Corrected

Figure 5f: Use a quadratic plot and show the 1:1 line!

1:1 line added

Figure 5, figure caption: State the name of the field study, where the calibration is carried out!

Corrected

Figure 6: Use a quadratic plot and show the 1:1 line!

1:1 line added, but we do not agree that a quadratic plot is required.

Figure 6, figure caption: State the name of the field study, where the calibration is carried out!

Corrected

Figure 7, figure caption: State which sample is investigated and which S was used!

Added

Figure 8, figure caption: State which sample is investigated!

Added

Figure 9, figure caption: State which sample is investigated and which S was used!

Added

Figure 10, figure caption: Write: "illustrate the difference"

Corrected

Figure 12: Would it not be more convenient to plot $dN/d\log D_p$ in the coloured graph?

The present plot gives more visual information due to the large differences in number during the campaign.

Figure 13, figure caption: State which sample was investigated and put the caption into one sentence!

Added

C1268

Figure 15, figure caption: Write: "Time series of D50 at...." Write: "the theoretical D50" State which sample/field study is investigated!

Added

Figure 16, figure caption: State which sample/field study is investigated! You probably might use the same order of colours from bottom to top as in Figure 15.

Added and changed

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 359, 2010.

C1269