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Atmospheric Measurement Techniques Discussions

Interactive comment on "Design and performance of a three-wavelength LED-based total scatter and backscatter integrating nephelometer" *by* T. Müller et al.

T. Müller et al.

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Reply to anonymous referee #2

Comment: So I wish you would also give a similar parameterization as A&O98. A first estimate you would get very easily from the data you present in Figure 4: just calculate the Ångström exponent of your simulated size distributions and use that as the x-axis and you get the correction factor as a function of Ångström exponent. The other question related to this is, could you estimate how big an error does it make, if the A&O98 truncation correction is used as such for the Aurora nephelometer?

Reply: The authors derived a parameterization similar to A&O98 for Aurora3000. The truncation correction was simulated for ranges of refractive indices and volume mean diameters. Plots with correction functions for both nephelometers are shown below. The authors will give results and a discussion in the revised manuscript. Figures are attached to the end of this document.

Comment: Lines 104 – 110. The formulas (8) and (9) are not quite the same as eq (12) of Anderson and Ogren (1998), you have the second quotient there as well. You do give a short explanation in lines 109 – 110 but I did not quite understand it.

Reply: This second quotient is implicit in the A&O98 paper when they state “To calculate C, it is necessary to take the gas calibration of the nephelometer into account. This is because an implicit effect of the gas calibration is to correct for angular nonidealities as long as nephelometer measurements are made on a Rayleigh-scattering medium”. The second term corrects for angular nonidealities during gas calibration. The true value is therefore the Rayleigh scattering value for the calibration gas used and the neph value is the scattering value the nephelometer has measured during calibration. and in equation (8) are with Mie theory calculated coefficients for “true“ scattering and “simulated” scattering with a non-sin angular function, respectively. is not the “measured” scattering coefficient of nephelometers, since the gas calibration factor is not included. The reviewer is right that equations (8) and (9) are not the same as equation (12) of Anderson&Ogren (1998). The authors will clarify this in the revised manuscript.

Comment: Lines 233 – 239 (section 4.2) I think here you have forgotten to show the results. Am I right? You mainly explain how good the calibrations have been in earlier papers but do not show any data or results of Aurora 3000. You just write that according to the manual the uncertainty is 2.5 %. Please show also your own results.

Reply We have not calculated the calibration uncertainty for the Aurora 3000 because we had only one instrument. The calibration uncertainty should be determined with a higher number of instruments to give statistical confidence. For example, the TSI

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3563's uncertainty has been calculated using the calibration data of 15 instruments.

Comment: Lines 244 – 255 (section 5.1.1) What is the size range of the OPC? Did you have an SMPS or DMPS as well?

Reply: The OPC range stated in the manufacturer's manual is 60 nm to 1 μm. We did not have neither a SMPS or a CPC for that experiment. The Mie calculations have been done using the OPC size distribution.

Comment: Lines 264 – 265. You write "Equations 12 and 13 can be used to adjust scattering and backscattering coefficients to any other wavelength". I know how this is done but I suggest you also show the formula.

Reply: This will be added it to the revised version.

Comment: Line 349. "Anderson and Ogren (1996)". The year should be 1998.

Reply: We will correct this in the revised version.

Comment: Lines 350 – 353 and Figure 8. Which wavelength pairs did you use for the comparison of the Ångström exponents?

Reply: We used 450 and 525 nm. This is stated in the summary, line 25 but we will state it more explicitly in the description of the figure 8, section 5.2.2

Comment: Figure 4. A small technical suggestion: change line type of either of the nephs to continuous line. Would make it faster to see from the figures which line belongs to which neph.

Reply: It will be changed in the revised version

Comment: Figure 8. What is the r2 of the regressions? Could be added in the subplots

Reply: The point of this figure is not to show a strong correlation but rather a tendency to decrease with size. The correlation (r2) between the ratios and the median volume diameter is poor. The important point of Figure 8 is that the fitted line is a function of

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the median volume diameter. The Authors will add the errors of the fit parameters to show that the slope significantly deviates from zero. For example, the fit parameters and errors of Y= A+ B * X are A = 1.1038 +/- 0.00717 and B = -0.6722 +/- 0.02226 for Figure 8 a).

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 4835, 2010.

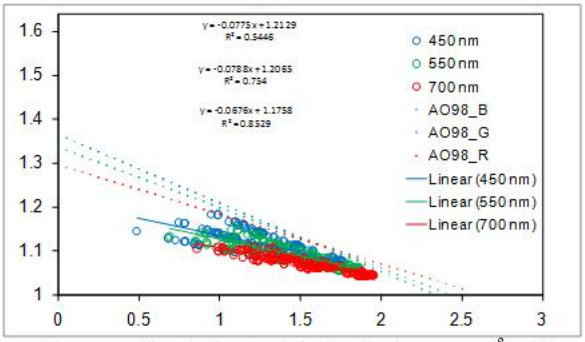

Figure: Truncation correction factor for total scattering versus Ångstöm exponent for sub micrometer particles.

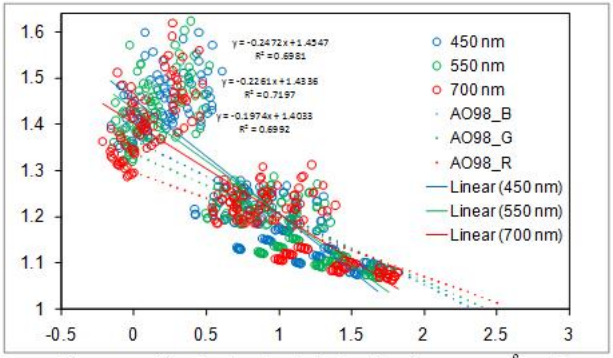

Figure: Truncation correction factor for total scattering versus Ångstöm exponent without size cut.

Fig. 1.

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Interactive Comment