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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.

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General comments

This evaluation of the Aurora 3000 nephelometer in comparison with the TSI nephelometer is a concise analysis of the critical parameters and performance metrics, i.e. noise thresholds, truncation angles and particle size sensitivity. The close agreement between the two instruments with respect to the total scattering coefficients, at all wavelengths, and agreement in angstrom coefficients derived from the total scattering is gratifying given the difference in types of illumination. The reader is left somewhat

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puzzled, however, and perhaps a bit unsettled, with the backscatter comparisons where the regression coefficients for the Aurora versus TSI go from a slope of 0.93 to 1.11 as the wavelengths change from blue to red. This in turn leads to large differences in the backscatter derived angstrom coefficients. Given the importance of backscatter in understanding radiative fluxes, it would be beneficial to understand these differences. The truncation errors normally have the largest impact on the forward scattered light, especially with larger sizes, so I wonder if the differences are more related to how the backscatter measurement is implemented in the two systems. Could the authors at least venture a hypothesis as to why these differences exist?

Secondly, aside from this being a nice study that shows that the Aurora agrees well with the TSI, as a scientist who may wish to acquire a nephelometer for my research, how can I use this evaluation to select the best instrument for my application? I think it would be very beneficial to include a table that lists the specifications for both instrument, including things like physical dimensions, weight and power consumption, along with the noise levels (determined over the same averaging times, please) and truncation angles. Understandably the authors do not want to be seen as promoting one commercial instrument over the other, given that two of the co-authors are employees of Ecotech. There is nothing unethical, however, with table such as I suggest.

Specific questions/comments

Page 6, Line 15 Does this sentence mean that the LED was introduced for the first time in an Ecotech instrument? Radiance Research has used an LED for a long time in their nephelometer.

Page 9, Line 11 “The illumination functions agreed well” Between total and back?

Page 9, Line 18 I think that it is very important to put in the summary the emphasis that there is currently no method to verify truncation angles. I would list this as a recommendation for fture development as the correction factors are dependent on knowing these angles.

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Page 9, Line 20 Are the parameterizations based upon the Figure 2? If so, state this explicitly. Are beta 1 and beta 2 for total scattering the same as for backscatter? I don't understand the max and min function. Please clarify.

Page 10, Line 25 The noise levels are determined with 5 minute averaging for the TSI and only one minute for the Aurora and yet the Aurora S/N is lower than the TSI. This is a very important point but the same averaging time need to be used or the S/N needs to be adjusted to compare the two.

Page 13, Line 5 The differences in the backscatter is quite large even though the correlation is high. Some discussion is needed to try and explain and why the relationship changes with wavelength.

page 14, Line 7 Are these size distributions simulated or measured? Are these just examples? Please clarify a bit more in this section what you are trying to do. My understanding is that the simulations are necessary to calculate correction factors but it took me a while to understand the point of this exercise, i.e. estimating the imaginary component, etc.

Page 16, Line 4 The scatter plots in Figure 8 are not very insightful and fitting a curve to data with such poor correlation is not very meaningful. Perhaps plotting the angstrom coefficients against one another with the markers color coded by median volume diameter would offer a better perspective of when the coefficients agree or not.

There is no discussion of the potential impact of light reflection from the walls of the sample chamber. I understand that these are black but there is always some reflection. Is that a factor?

Minor corrections

Page 5, Line 2 know -> known

Page 4, Line 1 instruments -> instrument

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Page 4, Line 15 scattering -> light scattering

Page 7, Line 9 what -> which

Page 8, Line 10 angels -> angles

Page 9, Line 14 Beside -> besides

Page 9, Line 21 sin -> sine

Page 10, Line 10 what -> which

Page 12, Line 23 with -> within

Page 14, Line 1 what -> which

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