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Atmospheric Measurement Techniques Discussions

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Interactive Comment

Interactive comment on "Spectral Aerosol Extinction (SpEx): a new instrument for in situ ambient aerosol extinction measurements across the UV/visible wavelength range" *by* C. E. Jordan et al.

Anonymous Referee #2

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Summary of the Work

This paper describes an instrument to measure aerosol extinction from 300 – 700 nm. It uses a Xenon arc lamp, White cell with 40 m path length, and a grating spectrometer with CCD. The authors measure spectra of NO2, polystyrene latex spheres, and a variety of aerosol types. They find agreement of their measurements with literature NO2 cross sections and calculated extinction for PSL. The authors determine the detection limit using an Allan deviation plot.

This work builds on a previous results by Chartier and Greenslade (2012).

This paper is well-written and well-organized. It represents the next step toward deploying the wavelength-resolved White cell as a field instrument.

Comments

- Determining weak wavelength-dependent absorption from extinction spectra is very difficult, and the paper seems to over-promise this potential in a few places:

Pg 6471 lines 12-14: “SpEx can more accurately distinguish the presence of brown carbon from other absorbing aerosol due to its 300 nm lower wavelength limit compared to measurements limited to visible wavelengths.”

Pg 6475 lines 5-7: “However, in the UV, particularly at wavelengths as short as 300 nm, the absorption term may be expected to influence the shape of the extinction spectrum such that differences among these groups may be determined.”

I would recommend softening these statements a bit. As an example, for an ambient extinction of 100 Mm-1 at 300 nm and a single-scattering albedo of 0.95, the absorption is 5 Mm-1. In the ambient atmosphere, 70% or more of that absorption may be due to black carbon. The actual brown carbon absorption signal that you are looking for would be 1.5 Mm-1. This is beyond the current detection limit of the instrument.

- Is the Xenon lamp temperature-controlled? What is the part number for the Xenon lamp?

- What is the wavelength resolution of the grating spectrometer, determined using a narrow reference line source (such as a Hg or Ne penray lamp)? There is a mention of an offset in the wavelength calibration on pg. 6484, but no description of calibrating the wavelength using a standard.

- What is the wavelength resolution in terms of nm/pixel on the CCD?

- Pg 6479 lines 17-19: How was the optimum path length determined? It is unclear in

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the text.

- Pg. 6479 lines 24-25: “Since the spot is larger than the fiber diameter (600 um)…” Are the authors using a lens to collect and focus the light into the optical fiber? That would improve the light collection.

- How were the 100 ppb NO_2 concentrations generated? One can use either a cylinder of NO_2 in N_2 or generate NO_2 continuously by adding excess NO to a measured concentration of O_3. It isn't clear what was done in this case, or why the flow was not continuous during the NO_2 measurements.

- Pg. 6484 line 21 – It would be better to consistently refer to the PSL diameters as 600 and 903 nm, instead of 600 and 900 nm, since those are the mean diameters given by the manufacturer.

- Pg. 6484 line 22 – Quantify “excellent agreement” in the text. - Pg. 6486 line 4 – Quantify “low noise” in the text.

- Figure 3 states that the GOME-SCIAMACHY NO_2 spectrum was averaged to 1 nm resolution. The more correct approach is to convolve the reference spectrum with the instrument lineshape of the spectrometer. The lineshape is determined using a narrow reference line source.

- Figure 4 - This data is very nice.

- “Coarse” and “fine” are unclear. Change to “low resolution” and “high resolution” throughout. It would also be useful to give an example of the wavelength range you mean when you first mention each, since ideas of “high resolution” vary.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 6469, 2015.