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Atmospheric Measurement Techniques Discussions
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Interactive comment on "A novel single-cavity multi-wavelength photoacoustic spectrometer for atmospheric aerosol research" *by* Claudia Linke et al.

Anonymous Referee #1

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GENERAL

The paper describes the technical details of a multi-wavelength photoacoustic spectrometer and its application to laboratory and field measurements. There are not many photoacoustic spectrometers available, practically only one manufacturer so new instruments are more than welcome to the field. The paper is well written and there are no major mistakes so I can recommend its publication in AMT with a few minor revisions, most of which are just additional details.

In the introduction you should write something of PAS's problems, too, it is not a perfect method either. Especially, it is sensitive to high relative humidity, write something about that with some references (see, e.g., Arnott et al., JGR, 108, 4034,

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Discussion paper

doi:10.1029/2002JD002165; Raspet et al., J. Atmos. Oceanic Technol., 20, 685–695). And that absorbing gases, mainly NO2 have to be dealt with.

There is one piece of information that would add the value of the results: the size of the rBC core, the mass fraction of rBC, and the thickness of the coating. These affect the MAC and can be obtained from the SP-2 data. If it is not too much work, I would recommend you add this information to your tables and figs and discuss it a bit. Consider it, but it is ok also if you don't add it, after all this is an AMT paper showing methodological development.

DETAILED COMMENTS

P4,L2: "...in the near-UV ..." 445 nm is visible blue light, not UV by any definition.

P5, L12: "... aerosol flow of 1std. liter per minute.." How is this maintained? Mass flow controller or what? Is accurate flow actually important? It does not appear in Eq. (1) at all. How does the flow rate affect particle losses? Did you measure size-dependent particle detection efficiency? If you did, please report the main results.

Section 2. Is there a relative humidity sensor somewhere in the instrument? I did not find an info on such. Considering the sensitivity to RH, it should be measured.

P7,L38 " ... The TC, EC, and OC contents of the aerosol samples were determined from quartz fiber filters.." Describe the sampling method, now there is nothing. At least sampler, size range it is sampling, flow rate, filter type.

P8,L20-21 "... At the beginning and the end of each experiment, filter samples were taken for off-line OC/EC analysis". How stable were the concentrations according to the other instruments' data? This is relevant, since you only sampled at the beginning and end of the experiment. In the results show also time series plots of the chamber experiments and note there the times when the filter samples were taken.

P9, L36-37 "In order to avoid perturbation of the aerosol sampling during the optical measurements, no filter sampling was possible in parallel with the experiments." Why

would filter sampling disturb the experiment?

P10, L35-36 " A reliable SP-2 incandescence measurement at these high C/O ratios was found to be impossible..." Is this due to concentration below SP-2 detection limit or what?

P11,L17-29 " The rBC mass measured by the SP-2 incandescence method was compared to the off-line elemental carbon (EC) and total carbon (TC) analysis results that were obtained by the thermo-optical method." I don't find the results of this comparison. A scatter plot or the EC&OC concentrations in Table 1 would do it.

P11,L31-32 " ... due to the increase in the OC mass, the MAC of TC (MAC-TC) decreases with increasing C/O ratio ..." Where is this shown?

P14,L12 " The trend of the nephelometer data ... " The concept of "trend" is something else. Trend is when something increases or decreases over a longer period of time, here you only show 24 hours of data. Rephrase the sentence.

P14,L14 "...while there is no correlation with the number concentration of rBC-free scattering particles..." This is not quite true. The correlation coefficient sure is lower but when I look at the time series in Fig 8, after about 10:00 the light blue line varies actually fairly nicely the variations of the scattering coefficients. How about adding also the total number concentrations measured with the CPC in the figure? Now you don't use the CPC data anywhere.

In the Tables you have used the symbol sigma for the mass absorption coefficient but MAC in the text. Change either of them to be consistent. And in Table 1, were the mass absorption coefficients calculated from rBC or EC concentrations? Whichever they were, the other could be added there as well, just like in Table 2. Are the results in Table 1 from SOOT11 or SOOT15 or both? Show that somehow in the table.

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