

## ***Interactive comment on “An Evaluation of three methods for measuring black carbon at Alert, Canada” by Sangeeta Sharma et al.***

### **Anonymous Referee #2**

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#### GENERAL

The paper presents a comparison of methods for measuring BC in the high Arctic and the retrieved estimation of the MAC of BC. The methods are completely different: filter-based attenuation (aethalometer and PSAP), incandescence (SP2) and thermal desorption (EC) so they complement each other. The paper is well written and it discusses also the uncertainties in a detail so it is an important and useful work. I found some points in it, however, that I wish the authors would address before publishing it in ACP. The most important question is that there is no scattering correction for the Aethalometer data. Was the PSAP data corrected for scattering according to Eq. (4)? If so, you must have scattering data. If not, absorption coefficients from the PSAP are overestimated. It has been well known for a long time that both the aethalometer and

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the PSAP give a signal even for purely scattering aerosol, so called apparent absorption (eg., Arnott et al. 2005, Collaud Coen et al., 2010). When you are measuring aerosol at high SSA and low absorption coefficient, this effect definitely becomes important. It may sometimes even be possible that the whole absorption is apparent and thus also EBC. The high EBC-to-rBC ratio might be explained by this kind of an artifact. Did you have a nephelometer there or could you estimate scattering by any method? You should discuss this somehow.

Detailed comments

P1, L3 use the same amount of significant numbers

P3, L9 "The light absorption is converted ..." No, the aethalometer converts attenuation coefficient into EBC.

P6, L14. What is ECCC?

P9, L17: dATN cannot be > 2 if you use the definition of ATN in Eq. (1) – the manufacturer presents TN in percents.

P10, L9 "Equation 7 is rewritten in Eq. 6" Should this be "Equation 4 is rewritten in Eq. 7"?

P1, L20, Eq. 9. I don't understand how you get the numbers 0.02, 1.44 and 0.24. Please explain.

P10, L25, Weekly zeroes – how long time?

P11, L1-17. The uncertainty analysis of the SP2 is very short compared with that of the PSAP. The numbers are simply given. Can you give any more details? Is, for instance the number 19% the uncertainty of the slope?

P13, L13-14. "... a factor of 3 higher for all data..." Why is this ratio so different from the slopes ~1-2 presented in Table 2?

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P15, L8, L10. What is "rate of thickness increase" and "thickness rate"?

P16, L6. What do you mean by "events"?

P16, L12-L17. Also somewhere earlier: could you estimate the mass or volume fraction of BC in the size range where you do have the coating data?

P16, Section 4.1.1 EBC. Here you should give some kind of an estimate of uncertainty due to scattering. See my general comments.

P17-18, Section 4.1.3 rBC You fit a single lognormal mode. Fine, I would also. However, do you have any info on whether there might be larger, coated BC particles?

P21, L7. MAAP measures at 637 nm, see Müller et al.

Table 2. In some columns there is lin.reg. Are the associated numbers slopes? Why don't you give the slope and offsets and their uncertainties – regression codes give them.

Fig 6. The y axes start from  $< 0$  which implies negative thickness. Can't be true.

Fig 8. In the legend there are several lines but in the figure only one...

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