

## ***Interactive comment on “Assessing recent measurement techniques for quantifying black carbon concentration in snow” by J. P. Schwarz et al.***

### **Anonymous Referee #3**

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This study evaluates two recent methods (SP2 and ISSW) applied to determining BC concentrations in liquid samples. The SP2 is being used by an increasing number of research groups for liquid samples, but relatively little has been published related to the methodology. This manuscript provides valuable information on differences in particle nebulization efficiency with size for the SP2, and evaluates the accuracy and uncertainties of the two methods in determining BC concentrations in samples with BC, dust and PSLs. With increasing interest in quantifying the amount of BC in snow, and all methods having issues and uncertainties, this paper is a valuable contribution.

Specific comments P3773 The focus of this paper is on assessing recent BC measurement techniques, but no mention is made of thermal-optical measurements. While the thermal optical method isn't a recent development, it is the method that has been mostly widely used and ideally would have been included in this study. If possible, it would be very valuable to include some samples that are analyzed by all three methods. This may be beyond the scope of the current study, but at a minimum I would expect that the authors would acknowledge other methods that are in use for determining BC in liquid samples.

p. 3775 The SP2 was calibrated with fullerene soot, but the band ratio of BC in liquid samples agrees more closely with Aquadag than fullerene soot.

p. 3775 Since BC particles tend to be larger in liquid, it would have been preferred to run the calibration selecting particles to as large of a size range as possible ( $\sim 700$  nm). Numerous laboratories are beginning to use the SP2 to measure BC in liquid, and will likely be using the current paper to guide their methodology. As much information that can be included on what ideally should be done is helpful.

p. 3775 In. 9. Please expand/clarify. It appears that the authors are using results from M&K2010 to extrapolate BC mass greater than 350nm, but more details on how this was done would be helpful. At a minimum, reference specifically to what is being referred to in M&K2010.

p. 3776 Were the liquid samples agitated during analysis? For samples with high impurity load this can make a large difference in measured concentration.

p. 3777 In. 7 clarify 'nebulization efficiency'. Based on these two sentences, it isn't entirely clear if the authors are addressing the amount of liquid that is actually nebulized vs. the particle size dependent nebulization.

p. 3778 In 7 Please provide more details on what was done here, and better define particle stopping distance.

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p. 3779 ln. 9 It would be interesting to include the freeze-thaw size distribution data.

p. 3779 ln 17 "... followed by additional testing". This is vague. Clarify.

p. 3780 ln 2. Were the samples agitated during analysis (e.g., magnetic stir bar during the measurement)?

p. 3780 ln. 21. Define 'high' concentrations, and put in the context of ambient concentrations. How is particle coincidence avoided at these concentrations? Increased air flows?

p. 3781 I'm happy to see this point being made about the importance of size distributions in standards relative to the sample- this is important!

p. 3782 ln 26. Doherty 2010 reports filter undercatch up to 30%; the numbers reported here use the lower estimate of 15%, resulting in an underestimate of uncertainty.

p. 3784 ln. 1 How were the samples stored between analyses for the SP2 samples? Cool or room temp?

p. 3784 ln. 7 How is undercatch being quantified with the 0.2um filter? I assume that particles less than 0.2um aren't being captured, which would increase the 38% reported.

p. 3784 ln. 18. Do the authors know what is happening to the BC in liquid to cause the BC to be predominantly bare? Are the coatings being removed from the particles when in liquid?

Fig. 3 Point out the different scale in the caption, or put the two graphs on the same scale so difference in methods is apparent.

Minor comments P3772 l. 23- term 'impurities' is generally preferred in the field over 'contaminants' P3772 l. 23- references should be included for studies that address the factors affecting snow albedo (need not be comprehensive, but example studies should be identified). P3773 Not all references are included in the reference list- go through

manuscript and make sure all papers are included. p. 3776 ln. 10. This pump rate should be expressed as volume/time. p. 3779 ln 17 “the the” p. 3779 ln 27 “sonewhat” p. 3780 ln 10 “showin” p. 3787 ln 14 omit ‘have’

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Interactive comment on Atmos. Meas. Tech. Discuss., 5, 3771, 2012.

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