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Atmospheric Measurement Techniques Discussions

Interactive comment on "Measurements of atmospheric aerosol vertical distributions above Svalbard, Norway using unmanned aerial systems (UAS)" *by* T. S. Bates et al.

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We thank reviewer 2 for their helpful comments. We detail our responses below.

The MCPC was calibrated with 60 nm particles because we could generate a wide range of concentrations at this size. It is true that the Arctic Haze has a dominant accumulation mode. To test the MCPC in the Arctic we ran it along side a laboratory CPC and demonstrated its performance (Figure 3).

The agreement between with MCPC and the electrometer (Ioner Model 5030) was independent of concentration. We have clarified that in the manuscript.

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Interactive Discussion

Discussion Paper

We have revised the paragraph describing the ABS to address the issue of RH and errors in the measurements as follows:

The ABS provides real-time measurements of the aerosol light absorption coefficient at 450, 525, and 624 nm. The ABS transmits light from a LED source through a sample filter and a reference filter. The filter transmission, Tr, is the ratio of the signals from the two filters. The light absorption coefficient is proportional to the rate of decrease of light transmittance divided by the flow rate of air through the filter [Bond et al., 1999]. The temperature in the instrument payload was on average 20°C warmer than ambient which reduced the RH at the ABS filters to a very low level. The raw data were averaged into 60 s values for calculations of the rate of decrease of light transmittance. The minimum detectable level, MDL, defined as the peak-to-peak noise with the instrument running particle free air, was 0.2 Mm-1. The error in the ABS measurement can be attributed to noise in the measured Tr value, instrument drift in the measured Tr value, uncertainty in the measured flow rate, and uncertainty in the measured filter spot area [Anderson et al., 1999]. The data were not corrected for light scattering by particles that could bias the values by up to 10% [Bond et al., 1999]. Data from the optical particle counter (not flown during STADS) would have provided a direct correction for light scattering. A quadrature sum of these errors yielded a relative uncertainty of ±33% for an absorption coefficient of 1.0 Mm-1.

The measurement uncertainties will not affect the comparisons other than to confirm that the measurements from the two instruments were within the uncertainty of the measurements. The differences in the concentrations below the inversion and aloft are still significant. The choice of an averaging time is a trade off between instrument noise and natural variability in the ambient concentration. We did not find that an increased averaging time yielded a lower noise level.

The purpose of this paper was to demonstrate and document an aerosol measurement platform and technique. Additional vertical profiles do not add to this purpose. All the data are available at the referenced web site.

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We have added addition POLERCAT references of airborne measurements. Larger platforms do offer more comprehensive information. The UAS is not a substitute for these platforms, it is simply another tool to study aerosol vertical profiles.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2483, 2013.