

Soot Surveys in the Air and Snow During PAMARCMIP 2011 and DOSA Campaigns

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Particulate black carbon (BC) in the Arctic atmosphere and its deposition onto snow and ice surfaces contributes to atmospheric warming and a reduction in the surface albedo. However, the increase in absorption of solar radiation and its impact on the ice melt rate is unknown. Latitudinal and vertical gradients in soot were observed in the Arctic during the 2011 Polar Airborne Measurements and Arctic Regional Climate Model Simulation Project (PAMARCMIP) campaign. This collaborative effort with the Alfred Wegener Institute for Polar and Marine Research (Bremerhaven, Germany) conducted surveys between Barrow (Alaska), Alert (Canada) and Svalbard (Norway). Figure 1a illustrates the latitudinal and vertical gradients in the aerosol equivalent BC inferred from light absorption coefficient measurements made from 3-wavelength Continuous Light Absorption Photometer. A specific attenuation coefficient of $10 \text{ m}^2\text{g}^{-1}$ was assumed to convert light absorption coefficient to Equivalent Black Carbon (EBC) mass. Figure 1b shows averaged vertical gradient of EBC for the entire campaign indicating higher EBC levels in the layer 2 to 3 km than at the surface.

At Alert, we extended the *in situ* measurements from aerosol light absorption derived BC/ aerosol scattering to include elemental carbon by Thermal Optical Transmittance as well as refractory black carbon by Single Particle Soot Photometer (SP2, DMT). Several vertical aircraft profiles were conducted over Alert with an effort to compare the surface based measurements of light absorption carbon to the levels aloft.

In the Deposition of Soot in the Arctic (DOSA) 2011 study, we employed micrometeorological methods (gradients, eddy covariance) to directly measure the dry deposition rate of BC onto an Arctic snow surface at Alert, Canada, over 20 days in April 2011. BC was quantified at high frequency with a SP2. Deposition rates were also obtained by daily snow / diamond dust collection on Teflon sheets for subsequent lab analyses. Preliminary results of this study will be disseminated.

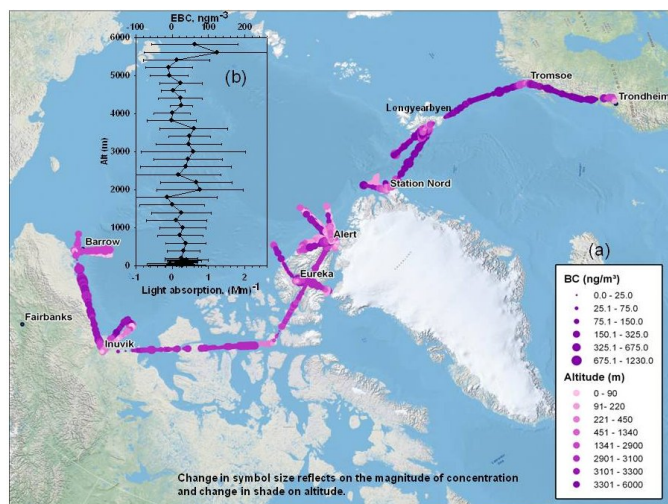


Figure 1. a: Latitudinal and vertical distribution of EBC. b: Vertical gradient (Average \pm 1sd) in the light absorbing carbon during PAMARCMIP from April 2 to May 5, 2011. Elevated levels of EBC are observed between 2 to 4 km altitude. Light absorption conversion to EBC mass by using $10 \text{ m}^2\text{g}^{-1}$.