# Evaluation of black carbon measurements in the Arctic

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## Abstract

Long-term measurements of light absorption coefficient ($b_{abs}$) values have been reported by previous studies using particle soot absorption photometers (PSAP) for Barrow and Ny-Ålesund in the Arctic. However, the effects on $b_{abs}$ of other aerosol chemical species co-existing with black carbon (BC) have not been critically evaluated. Furthermore, different mass absorption cross-section (MAC) values have been used to convert $b_{abs}$ to BC mass concentration ($M_{BC} = b_{abs}/MAC$). We used a continuous soot monitoring system called COSMOS, which uses a heated inlet to remove volatile aerosol compounds, to measure $b_{abs}$ ($b_{abs}$ (COSMOS)) at these sites for 3 years. Field measurements and laboratory experiments have suggested that $b_{abs}$ (COSMOS) is affected on average by about 9% by sea-salt aerosols. $M_{BC}$ values derived by COSMOS ($M_{BC}$ (COSMOS)) using MAC obtained by our previous studies, agreed to within 9% with elemental carbon concentrations at Barrow measured for 11 months and to within 3% with $M_{BC}$ measured by a single particle soot photometer (SP2) near Ny-Ålesund during the spring ACCACIA aircraft campaign. These results indicate that the accuracy of $M_{BC}$ (COSMOS) was high at both

sites. $b_{abs}$ (PSAP) was systematically higher than $b_{abs}$ (COSMOS), by 22% at Barrow ($PM_1$) and 43% at Ny-Ålesund ($PM_{10}$). Using $b_{abs}$ (COSMOS) as a reference, we derived ($M_{BC}$ (PSAP) from $b_{abs}$ (PSAP) measured since 1998. $M_{BC}$ (PSAP) values derived at Barrow for 1998-2015 decreased by about $-1.0\pm0.72$ ng $m^{-3}$ $yr^{-1}$ in winter and spring. We also established the seasonal variations of $M_{BC}$ at these sites.