4.066 Seasonal variation of the wet deposition of black carbon at Ny-Ålesund, Spitsbergen.

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Abstract:

Deposition (wet and dry) of black carbon (BC) in the Arctic lowers snow albedo, thus possibly contributing to warming in the Arctic. Wet deposition by snow and rainfall in the Arctic also influences BC concentrations in ambient air. We measured the size distribution of BC in snowpack and falling snow using a single particle soot photometer combined with a nebulizer. We sampled snowpack at two sites (11 m and 300 m above sea level) at Ny-Ålesund, Spitsbergen, in April 2013. The BC size distributions did not show significant variations with depth in the snowpack, suggesting stable size distributions in falling snow. The number and mass concentrations (C_{NBC} and C_{MBC}) *at these sites agreed to within 19% and 10%, respectively, despite the sites' difference in snow water equivalence. This indicates the small influence of the amount of precipitation on these quantities. We also sampled falling snow near the surface during the same snow accumulation period. Average* C_{NBC} in snowpack and falling snow agreed to within 15%. From the comparison of C_{NBC} and C_{MBC} in snowpack and falling snow, we estimated the relative contribution of dry deposition to total deposition to be about *22±6%.* C_{NBC} and C_{MBC}*in falling snow and BC concentrations in ambient air were highest in winter. We also sampled falling snow and rainwater near the surface during the extended period of 2012-2017.* The C_{NBC} and C_{MBC} values in falling snow and rainwater showed significant seasonal variations. These variations, together with ambient BC concentrations, simultaneously measured, will be useful to improve the understanding of the processes of wet deposition of BC in the Arctic. The data will also be useful in constraining climate models used to estimate the effects of BC on the climate in the Arctic.