Role of dimethyl sulfide on the formation and growth of aerosols, and its impact on liquid clouds in the Arctic summer

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Atmospheric dimethyl sulfide, DMS, is the main biogenic source of sulfate particles in the Arctic atmosphere. Sulfate particles have a net cooling effect, which can partially offset Arctic warming from absorbing aerosols, such as black carbon. As efficient cloud condensation nuclei (CCN), sulfate particles are also able to influence the cloud's microphysical properties.

DMS production and emission to the atmosphere increase during the Arctic summer, due to a greater ice-free sea surface area and higher biological activity. In the model simulation of a field campaign conducted over the Canadian high Arctic during the summer of 2014 (NETCARE; Abbatt et al. 2019), the inclusion of DMS in the model, GEM-MACH, resulted in a significant increase, up to 100%, in the modelled atmospheric \( \text{SO}_2 \) in some regions of the Canadian Arctic. Analysis of the modelled size-segregated aerosol sulfate indicated that DMS has the most significant impact on particles in the size range of 50 – 200 nm in this case. Simulations have shown that localized regions of high seawater DMS can have a significant impact on atmospheric concentrations.

Further investigation of DMS impact on the Arctic summer cloud microphysics was carried out by using a fully coupled version of GEM-MACH. Overall, the model simulations show that the inclusion of DMS in model leads to an increase in cloud droplet number concentrations (CDNC) and a decrease in droplet mean mass diameters (MMD), and has no significant effects on liquid water content (LWC). The impact of DMS on Canadian weather forecasts will be evaluated using operational forecast tools.