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Apportionment of Marine Biogenic and Non Marine Biogenic non-Sea Salt Sulfate in the Arctic: Pre-Industrial versus Modern-Day Sulfate and its Role in Climate Forcing

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Aerosol sulfate in the remote environment plays an important role in radiative forcing at global scales through both the direct (scattering incoming short wave) and indirect (changes in cloud properties) effects. Polar regions, where constraints on vertical aerosol distributions as well as precipitation formation are less well documented, are more susceptible than mid-latitudes and equatorial regions to global warming. Feedback dynamics relating atmospheric sulfate to cloud and precipitation formation processes may be key to understanding factors contributing to radiative forcing and these feedbacks may be amplified in the Arctic in, and below, mixed phase clouds. Biogenic versus non biogenic non sea salt sulfate are resolved in modern and pre-industrial ice core records using a high resolution ice core record. Sulfate in precipitation and dry deposition from ~1700 m on the Prince of Wales Icefield on Ellesmere Island in the Canadian Arctic archipelago are described. Isotope source apportionment was performed to quantify the amount of sulfate from sea salt, as well as marine biogenic and non-marine biogenic sulfate at sub-seasonal resolution from the late 1990's. Less resolved intervals were derived for sulfate sources for sections of the ice core record representing pre-industrial periods. Insights on the relationship between the ice core sulfate record and sulfate characteristics in snow and aerosols collected more recently in the Arctic at surface level from remote locations will be discussed with respect to their potential impact on climate.