

Year-Round Major Ion Measurements at Greenland Environmental Observatory, Summit (GEOSummit)

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Long-term, year-round surface snow and snow pit sampling at remote high latitude locations is essential to better understanding arctic geophysical processes. Research at the GEOSummit from 2003 to present includes high temporal resolution year-round ion chromatography (IC) measurements of surface snow and snow pit samples for Na, NH₄, K⁺, Mg²⁺, Ca²⁺, Cl⁻, NO₃⁻, SO₄²⁻, oxalate, MSA, acetate and formate. Many of these species exhibit annual cycles corresponding to source emissions. For example, Ca²⁺ exhibits a spring peak attributed to dust deposition, and formate exhibits a summer/fall peak associated with biomass burning. Monthly snow-pit major-ion sample measurements at 3-cm resolution indicate concentration variability of many species within the snow pack. Concentrations are generally consistent with prior ice-core concentrations. Concurrently measured snow-accumulation rates exhibited relatively uniform intra-annual accumulation (5.9 cm/month +/- 4.3 cm, 1 sigma) with significant inter-annual variability. Snow-pit density values also show consistent trends with time as snow accumulates. These baseline measurements at GEOSummit will continue through another 5-year period to better characterize major ion concentrations preserved in snow on annual to decadal scales, and connections with source apportionment and atmospheric transport pathways.

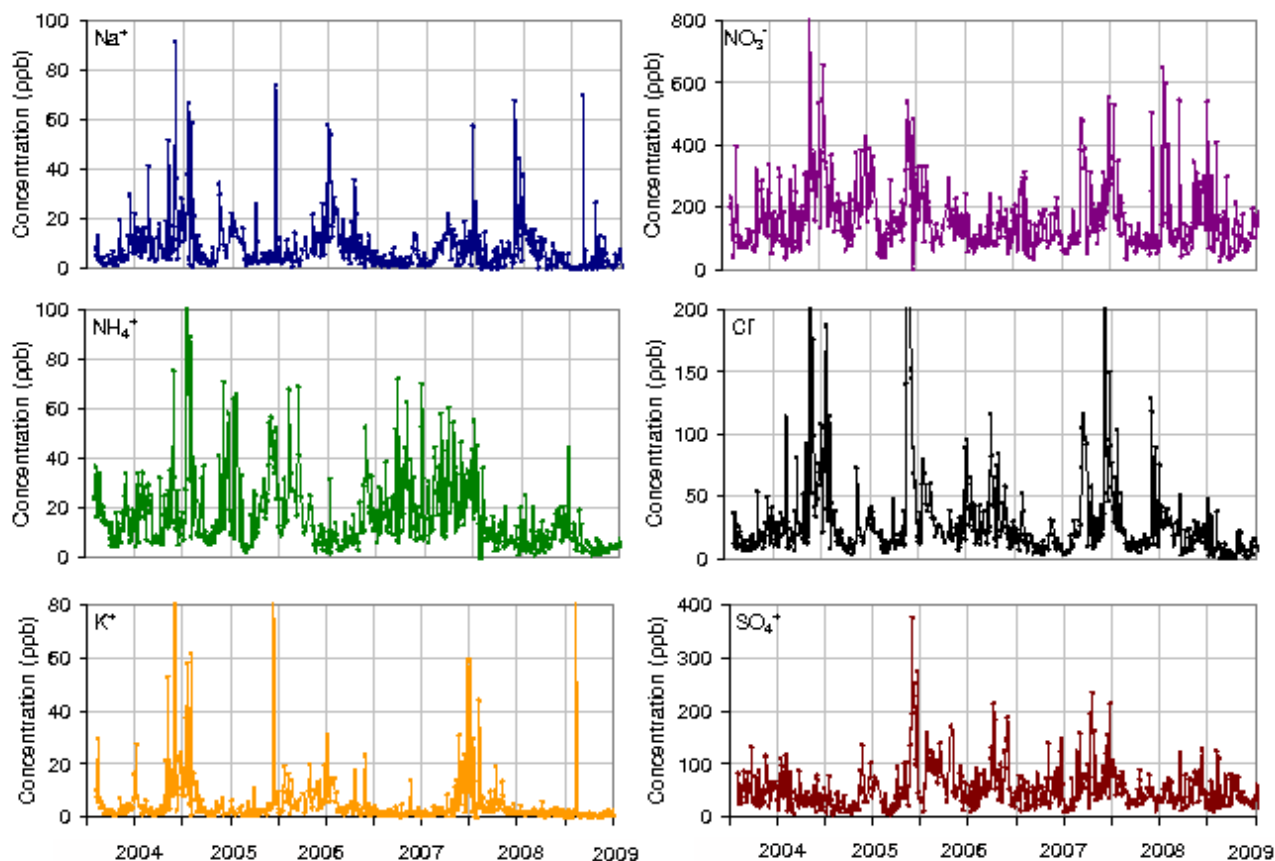


Figure 1. High resolution surface snow IC data. Many of these species exhibit seasonal cycles corresponding to source emissions.