# 4.024 Sources and Removal of Springtime Arctic Aerosol.

Early Career Scientist

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Abstract:

The sources, chemical transformations and removal mechanisms of pollution transported to Arctic regions are key factors in controlling the impact of short-lived climate forcing agents on Arctic climate, but insufficient knowledge of these factors limits our predictive capability. We present vertically resolved observations of aerosol physical and chemical properties in High Arctic springtime. While much previous work has focused on characterizing episodic events of high pollutant concentrations transported to Arctic regions, here we focus on measurements made under conditions consistent with chronic Arctic Haze, which is more representative of the pollution seasonal maximum observed at long term monitoring stations and possibly more indicative of the High Arctic troposphere in general. On six flights based at Alert and Eureka, Nunavut, Canada (largely north of 80°N), we observe evidence for systematic vertical changes in both aerosol sources and removal mechanisms. With support from model calculations using FLEXPART-ECMWF, we show evidence for sources of partially neutralized aerosol with higher organic aerosol (OA) and black carbon content in the middle troposphere, compared to lower

tropospheric aerosol with higher amounts of acidic sulfate. Our observations suggest that surface-based long term monitoring has underestimated the contribution of OA to aerosol transported to the High Arctic troposphere. Further, we show evidence for aerosol depletion relative to carbon monoxide, both in the mid-to-upper troposphere and within the Arctic Boundary Layer (ABL). Dry deposition, with relatively low removal efficiency, may be responsible for aerosol removal in the ABL while ice or liquid-phase scavenging was likely responsible for aerosol removal at higher altitudes during transport. Overall, we find that the vertical dependence of both regional and remote aerosol sources, and removal mechanisms, combine with long aerosol residence times to drive the properties of springtime Arctic aerosol.