Trends and Properties of Tropospheric Aerosols That Undergo Long-Range Transport to the North American Arctic

P. Quinn[1], G.E. Shaw[2], T.S. Bates[1], K. Schulz[1], A. Jefferson[3], J.A. Ogren[3] and J.F. Burkhart[4]

[1]NOAA Pacific Marine Environment Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115; 206-526-6892, E-mail: patricia.k.quinn@noaa.gov
[2]University of Alaska, Fairbanks, AK 99775
[3]NOAA Earth System Research Laboratory, Boulder, CO 80305
[4]Norwegian Institute for Air Research, Kjeller 2027, Norway

Tropospheric aerosol particles undergo long range transport from the mid-latitudes to the Arctic each winter and spring. Once in the Arctic, aerosols may impact regional climate in several ways. Aerosols can affect climate directly by scattering and absorbing incoming solar radiation and indirectly by acting as cloud condensation nuclei and altering cloud properties. In addition, absorbing aerosol that is deposited onto ice and snow can lower the surface albedo and enhance the ice-albedo feedback mechanism. Measurements of aerosol properties relevant to climate forcing (chemical composition, light scattering, and light absorption) have been made by NOAA at Barrow, AK (71.3°N) for over a decade. In addition, for much of this same time period, measurements of aerosol chemical composition have been made at the three more southern Alaskan sites of Poker Flat (65°N), Denali National Park (63.5°N), and Homer (59.7°N). Measurements of sulfate at Barrow reveal a decreasing trend over the past decade of about 1.6% per year for the month of April. This decrease is similar to what has been observed for aerosol light scattering over the same period. Concentrations of sulfate during the Arctic Haze season are highest at Barrow as the Brooks Range hinders transport to the more southerly sites. During the summer, however, concentrations are highest at Homer as a result of biogenic activity. Trends in other species also will be presented and compared for the four sites. In addition, aerosol properties measured at Barrow will be compared to those measured in the European Arctic during the ICEALOT cruise in spring of 2008.

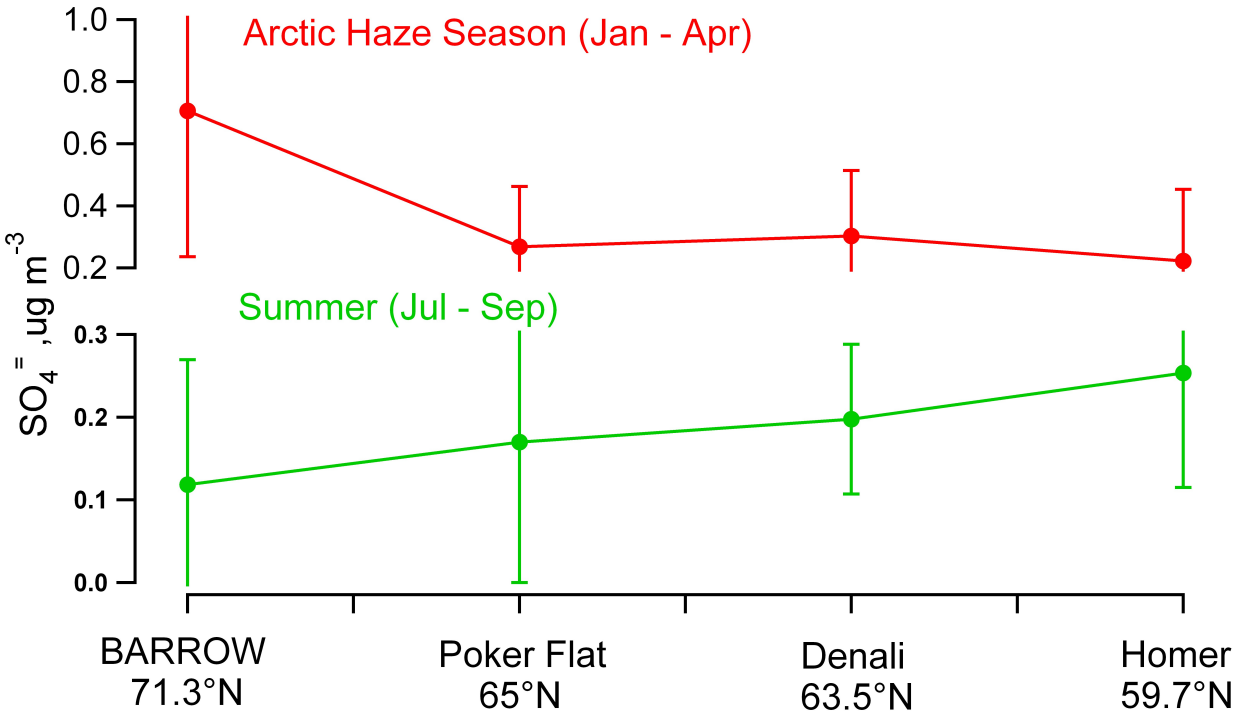

Figure 1. Measurements of non-sea salt SO_4 at four sites in Alaska for the Arctic Haze season (Jan – Apr) and Summer (Jul – Sep).