Source Identification and Apportionment of Finnish Arctic Aerosols

James R. Laing,[1] Philip K. Hopke,[1] Eleanor F. Hopke[1], Liaquat Husain,[2,3]
Vincent A. Dutkiewicz,[2,3] Jussi Paatero,[4] Yrjö Viisanen[4]

[1]Center for Air Resources Engineering and Science, Clarkson University, Potsdam, NY 13699, USA
[2]New York State Department of Health, Wadsworth Center, Empire State Plaza, Albany, NY 12201-0509, USA
[3]Department of Environmental Health Sciences, School of Public Health, SUNY, Albany, NY 12201-0509, USA
[4]Finnish Meteorological Institute, Helsinki, Finland
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Presenting author email: laingjr@clarkson.edu

The Arctic aerosol has been studied since the early 1970s, but there are few available long-term datasets of the particulate chemical composition. There have been significant changes in the Arctic in the past half century. Long-term trends in aerosol chemical composition, specifically sulfate and black carbon, can provide a better understanding of the changes in these climatic forcing particles that have occurred. Changes in anthropogenic and natural sources can also be determined.

Week-long historical filter samples collected at Kevo, Finland from 1964 to 2010 have been analyzed for various chemical species. Major ions and methane sulfonate (MSA) have been analyzed by ion chromatography (IC), trace elements by inductively coupled plasma - mass spectrometry (ICP-MS), and BC by light transmission. Positive Matrix Factorization (PMF) and Potential Source Contribution Function (PSCF) analysis will be applied to the 47-year data set to determine possible source areas.

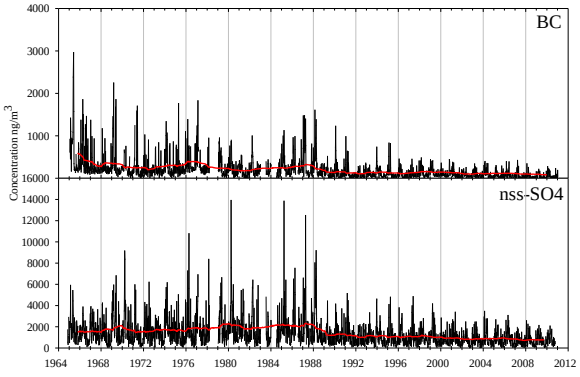

Figure 1. Black carbon and non-sea salt sulphate time series with 1-year moving average.

Time-series trend analysis will be performed to evaluate the evolution of sources over time. Black carbon and nss-SO_4 concentrations have decreased over the past five decades, most dramatically around 1990 coinciding with the fall of the Soviet Union (Figure 1). This decrease matches global inventories of anthropogenic emissions (Bond, 2007; Smith, 2011). Concentrations of lead have steadily decreased as a result of bans and regulations on the use of leaded gasoline.

Forest and agricultural fires have recently been shown to be a major source of Arctic BC during the spring/summer (Stohl, 2007; Warneke, 2010). It has been predicted that climate change has increased forest fires in central Canada and Russia (Stocks 1998). This prediction will be assessed and source areas of forest fires will be determined (Figure 2).

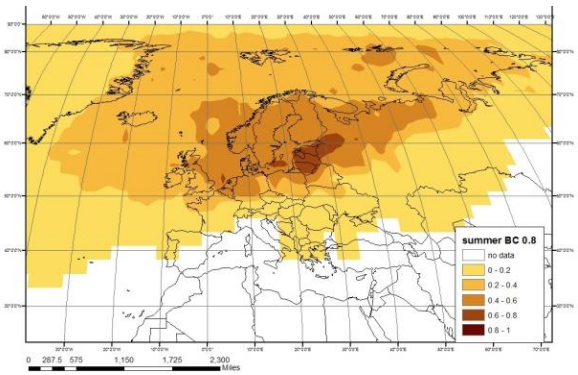

Figure 2. PSCF plot of BC during summer months.

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