Impact of Ocean Ice Extent and Atmospheric Transport on Biogenic Aerosol Sulfur in the Arctic

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Biogenic aerosols formed from the oxidation of dimethyl sulfide (DMS) can impact Arctic clouds and radiative forcing. The recent decline in ice cover over the Arctic Ocean, particularly over the western Arctic Ocean affects the sea-ice-atmosphere exchange of DMS and the biogenic aerosol products formed from its atmospheric oxidation, such as methanesulfonic acid (MSA). Measurements of MSA from 1980 to 2009 at Alert (82°N, 62.5°W), Nunavut, Canada and from 1997 to 2008 at Point Barrow (71°N, 156.6°W), Alaska, USA are used to look for evidence that changes in ice cover have influenced changes in MSA. At Alert, there is declining tendencies in MSA concentrations in the 1980s (April-May & July-Aug), MSA remained relatively low during the 1990s and showed increasing tendencies during the springtime (April, May & June; Figure 1). Increasing trends during the springtime and summertime MSA are also apparent at Barrow since 2000. The decadal changes in MSA at Alert may be related to the changes in the source strengths in the MSA source regions (Figure 2) and to a lesser extent to the atmospheric transport. Increase in MSA at both sites since 2000 coincides with the northward migration of the marginal ice-edge zone, which is known to be enriched in DMS. The relationship between MSA and sea-ice extent will be discussed.

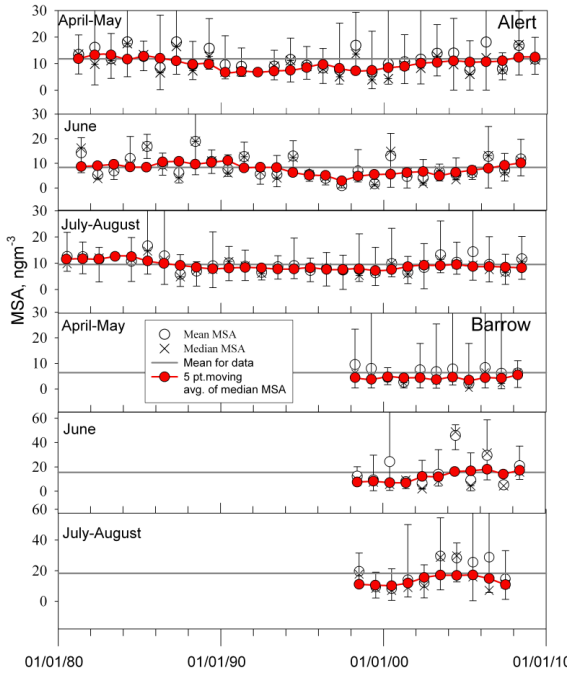

Figure 1. Monthly mean (open circle), median (x) and 5 point moving average (red circles) of MSA concentrations for April-May, June and July-August for Alert from 1980-2009 and for Barrow from 1997-2008. Increasing MSA concentrations are evident at both sites since 2000. The bars represent the maximum and minimum range.

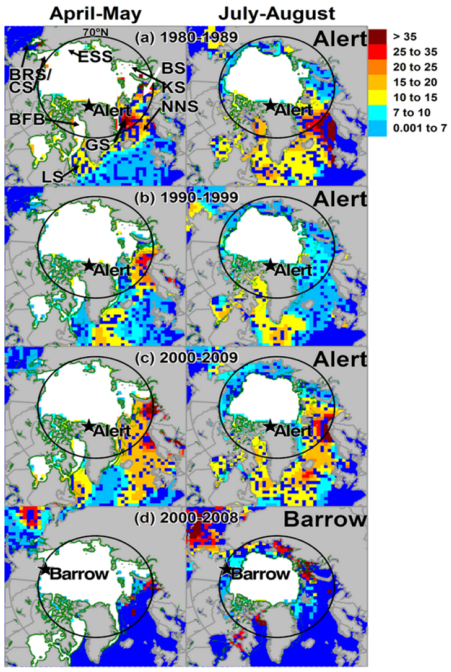

Figure 2. Seven-day back trajectory weighted MSA concentrations (weighted Seibert et al. 1994 analysis plots) for April-May & July-August.