

## ***Interactive comment on “Decadal trends in aerosol chemical composition at Barrow, AK: 1976–2008” by P. K. Quinn et al.***

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We thank the reviewer for their kind comments and have addressed their concerns as follows below.

1) The Mann-Kendall test used here for detection of a monotonic increasing or decreasing trend and determination of the significance level does not take into account uncertainties associated with the measured concentrations. We have added the following sentence to the last paragraph of Section 2 (lines 109 – 112):

“The reported significance levels do not take into account uncertainties associated with measured concentrations or inter-annual variability. Hence, significance levels may be higher than those reported for the trends derived from the combined 1976 – 1977 and

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1997 – 2008 data sets.”

2) We have changed SENS slope to Sen’s slope in the captions for Figures 4 and 5.

3) We have taken the reviewer’s suggestion and now include recommendations for further work in the conclusions. The conclusions now read as follows:

“A comparison of the aerosol chemical composition at Barrow, AK measured during the winter and spring of 1976-1977 and 1997-2008 indicates that the mass concentrations of species contributing to Arctic haze have decreased markedly over the past 30 years. In addition, it appears that while emissions have decreased, the source regions of Arctic haze are the same now as 3 decades ago. Further work is required to assess additional factors that may be contributing to decreasing aerosol concentrations observed at Barrow during the Arctic haze season including changes in the frequency of transport of pollution to the Arctic and removal during transport. In addition, accurate emission data for all species that undergo long range transport to the Arctic during the haze season would improve the understanding of the observed trends. Measurements of concentrations of aerosol inorganic ions at Barrow over the past decade reveal an increase in the Cl<sup>-</sup> deficit associated with sea salt aerosol. This increased release of HCl and perhaps other additional reactive Cl-containing gases has implications for halogen chemistry in near surface air at Barrow including changes in the lifetimes of ozone, methane, DMS, and other species. In addition, summertime concentrations of MSA<sup>-</sup> and nss SO<sub>4</sub><sup>=</sup> at Barrow have increased over the past decade. These increasing trends may be a result of a changing climate in the Arctic (e.g., warmer SST and reduced sea ice extent) and, if maintained, may affect the radiative balance within the Arctic through enhanced particle production. Further work is required to link the observed trends in summer time aerosol at Barrow to changing environmental factors.”

4) We have changed AK to Alaska in both the title and the abstract.