4.052 Changing Conditions in the Arctic: An Analysis of Trends in Observed Surface Ozone Conditions.

Early Career Scientist

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Abstract:

The Arctic is a region which has been experiencing rapid changes in the environmental and atmospheric conditions and is likely to continue to be influenced by climate change. In order to understand the implications of drastic changes to the Arctic climate system, it is imperative to understand the expected behavior and associated impacts of different atmospheric constituents. As an important greenhouse gas, tropospheric ozone contributes to Arctic surface temperature and drives the photochemical oxidation properties of the atmosphere. Formed from the reaction of volatile organic carbons (VOC's), oxygen, and nitrogen oxides in the presence of UV radiation, ozone has an integral role in the chemical composition and behavior of the atmosphere. In addition, at high levels surface ozone has a negative impact on ecosystem functioning and public health. Surface ozone has been monitored in the Arctic since 1973 (Barrow, Alaska) and measurements have expanded spatially since to the current 8 Arctic ozone measuring locations used for this investigation. Some measurement stations, such as Barrow, show a 12% increase in observed ozone mixing ratios over the 45 year measurement period, with the dominant increases occurring during the spring months – driven by the loss of sea-ice and associated reduction in ozone depletion events. Ozone conditions in the Arctic are strongly influenced by long-range transport of pollutants from populated regions of the northern mid-latitudes, sea-ice extent, meteorological conditions, and relative amounts of precursor species. Co-located measurements of temperature, wind direction, carbon monoxide, and aerosol composition are used in addition to climate models, back-trajectory analysis, and satellite imagery to interpret the dominant causes for observed trends in surface ozone conditions across the Arctic. The analysis of trends and seasonal distribution of ozone across the Arctic provides a valuable opportunity to

investigate the spatial and temporal extent of detected trends in the region.