6.033 Geographical and Temporal Differences in NOAA Observed Surface Ozone in the Arctic.

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Abstract:

The Arctic region is rapidly gaining interest and support for scientific studies to help understand and characterize the processes, sources, and chemical composition of the Arctic environment. In order to understand the Arctic climate system and the changes that are occurring, it is imperative to know the behavior and impact of atmospheric constituents. Surface level ozone in the Arctic is variable in both time and space and plays an essential role on the oxidation capacity of the atmosphere. NOAA Global Monitoring and Physical Sciences Divisions maintain continuous measurements and long-term records of ground-level ozone from Barrow, Alaska (since 1973), Summit, Greenland (since 2000), and Tiksi, Russia (since 2009). Measurements are quality checked and investigated with regards to wind conditions and aerosol loading. These quality controlled data are used to develop seasonal climatologies, understand diurnal variation, and analyze differences in stations specifics by addressing spatial variability in the Arctic. Once typical ozone behavior is characterized, anomalies in the record can be defined and investigated. Increased ozone events associated with transported pollution and photochemical production of ozone, and ozone depletion episodes related to sea-ice halogen release and chemical destruction of ozone are the primary processes which lead to deviations from expected ground-level ozone conditions. The measurements taken from Barrow (Alaska), Summit (Greenland), and Tiksi (Russia) are critical observations of ground-level ozone to provide fundamental understanding of the behavior and trends of ground-level ozone in the Arctic. The surface ozone and wind data are compared against Community Earth System Model (CESM1) CAM4-chem to assess model's ability to simulate surface ozone in the Arctic. An improvement agreement between observations and the chemistry-climate model hindcast is found when the model is forced with the reanalysis winds. Results are assessed by season, wind direction and impact of the local pollution.