

Factors controlling seasonal cycles in Arctic aerosol, cloud and precipitation properties

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Abstract

It is well known that aerosol change cloud properties by serving cloud condensation nuclei, and that clouds themselves wash out aerosol through precipitation. Using measurements from NOAA GMD and DOE ARM ground-based sites near Barrow, Alaska, we have obtained seasonal cycles in Arctic aerosol, cloud and precipitation properties. These results show that interactions between aerosols, clouds and precipitation depends on the aerosol mode considered. A nucleation mode is produced locally, and a larger-sized haze mode originates from long-range pollution transport. Only haze mode aerosol are closely linked with cloud and precipitation properties. Cloud droplet size is a minimum, and number is a maximum, in winter and spring when haze aerosol concentrations are highest. Conversely, haze aerosol concentration is lowest in summer, precipitation rates are highest. However, precipitation is not the only controlling factor of Arctic haze concentrations. The efficiency with which mid-latitude pollution is transported to the Arctic also plays an important role.