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TITLE: Response of Sea Ice to the Arctic Oscillation

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ABSTRACT:

Data collected by the International Arctic Buoy Programme from 1979 to 1998 are analyzed to obtain statistics of sea level pressure (SLP) and sea ice motion (SIM). The annual and seasonal mean fields agree with those obtained in previous studies of Arctic climatology. The data show a 3-hPa decrease in decadal mean SLP over the central Arctic Ocean between 1979-88 and 1989-98. This decrease in SLP drives a cyclonic trend in SIM, which resembles the structure of the Arctic Oscillation (AO). Regression maps of SIM during the wintertime (January-March) AO index show 1) an increase in ice advection away from the coast of the East Siberian and Laptev Seas, which should have the effect of producing more new thin ice in the coastal flaw leads; 2) a decrease in ice advection from the western Arctic into the eastern Arctic; and 3) a slight increase in ice advection out of the Arctic through Fram Strait. Taken together, these changes suggest that at least part of the thinning of sea ice recently observed over the Arctic Ocean can be attributed to the trend in the AO toward the high-index polarity. Rigor et al. showed that year-to-year variations in the wintertime AO imprint a distinctive signature on surface air temperature (SAT) anomalies over the Arctic, which is reflected in the spatial pattern of temperature change from the 1980s to the 1990s. Here it is shown that the memory of the wintertime AO persists through most of the subsequent year: spring and autumn SAT and summertime sea ice concentration are all strongly correlated with the AO index for the previous winter. It is hypothesized that these delayed responses reflect the dynamical influence of the AO on the thickness of the wintertime sea ice, whose persistent "footprint" is reflected in the heat fluxes during the subsequent spring, in the extent of open water during the subsequent summer, and the heat liberated in the freezing of the open water during the subsequent autumn.

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