Evolution, spatial, and inter-annual variability and trends in the Arctic's sea ice extent, age and thickness distributions, 1979-2005

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Evolution, spatial, and inter-annual variability and trends in the Arctic's sea ice area, age and thickness distributions are analyzed during 1979-2005, using SMMR/SSM/I, submarine, and ice motion data, neural network (NN) algorithms to estimate sea ice concentrations and thickness, and a reverse-chronology algorithm to estimate sea ice age. A 27-year (1979-2005) observational record of January multiyear (MY) sea ice distributions, derived from NN analysis of SMMR-SSM/I passive microwave satellite data, reveals dense and persistent cover in the central Arctic basin surrounded by expansive regions of highly fluctuating interannual cover. The most dramatic MY ice declines occurred in the East Siberian, Chukchi, and Beaufort Seas. Results show that the MY ice extent with ice age < 10years and with ice age >10 yeas declined with different spatial patterns, oldest ice decline is partially compensated by rise in extent of younger classes. The oldest ice retreats to an area north of the Canadian Archipelago. Noticeable mid-winter ice thickness variability and a weak linear decline were observed in 1982-2003 with different spatial patterns and a rise in 1982-1988, 1996-2003, and decline in 1988-1996. The thick ice is retreated to an area north of the Canadian Archipelago. Variations in sea ice thickness and decline are dependent from atmospheric forcing and thermodynamic conditions. Our studies contribute to an improved understanding of the integrated ocean-ice-atmosphere system. The International Arctic Research Center, University of Alaska, Fairbanks, supported this work.