SEA ICE/CLIMATE STUDIES

by

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The objectives of this work are to determine and analyze the annual cycle of sea ice extents in the Arctic Ocean and peripheral seas and bays over the period 1973-1986, looking in particular for any long-term trends; to examine the relationship between local sea ice covers and the surrounding atmosphere and ocean; and to examine sea ice as a potential early indicator of climate change. The work, which is being done partly in collaboration with D. J. Cavalieri, involves creating regional and hemispheric time series of sea ice variables from satellite passive microwave data and analyzing these through various intercomparisons amongst themselves and with oceanographic and atmospheric fields.

Time series have been generated of monthly averaged sea ice extents from 1979 through 1986 for the Northern Hemisphere and for each of eight subregions, using the data of the Nimbus 7 Scanning Multichannel Microwave Radiometer (SMMR). These 1979-1986 data are being compared with ice extents for 1973-1976 previously calculated from the data of the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR). Yearly averages and trend lines have also been generated (see figure), as well as plots of the year-to-year changes in each month. There are no strong long-term trends indicated for the Northern Hemisphere as a whole or

for any of the eight subregions. However, although not strong, the trend lines are upward for the Arctic Ocean, Bering Sea, and Baffin Bay/Davis Strait, and are downward for the Sea of Okhotsk, Greenland Sea, and Kara and Barents Seas. The facts that the region with the strongest upward trend, Baffin Bay/Davis Strait, had a decreasing ice extent over the last 3 years of the data set and the region with the strongest downward trend, the Kara and Barents Seas, had an increasing ice cover over the last 2 years (see figure) reemphasize that none of the regions shows a convincing long-term trend.

Because passive microwave technology allows routine monitoring of global sea ice distributions, marked changes in the global sea ice cover can be readily determined. This is not the case for many climate variables and is a characteristic suggesting the potential of sea ice as an early indicator of climate change. However, the natural variability of sea ice is not yet well enough known so that a climate signal could be clearly distinguished from the background noise. This is a central reason for the current research effort to examine sea ice variability, an effort which is covering regional, seasonal, and interannual variations.

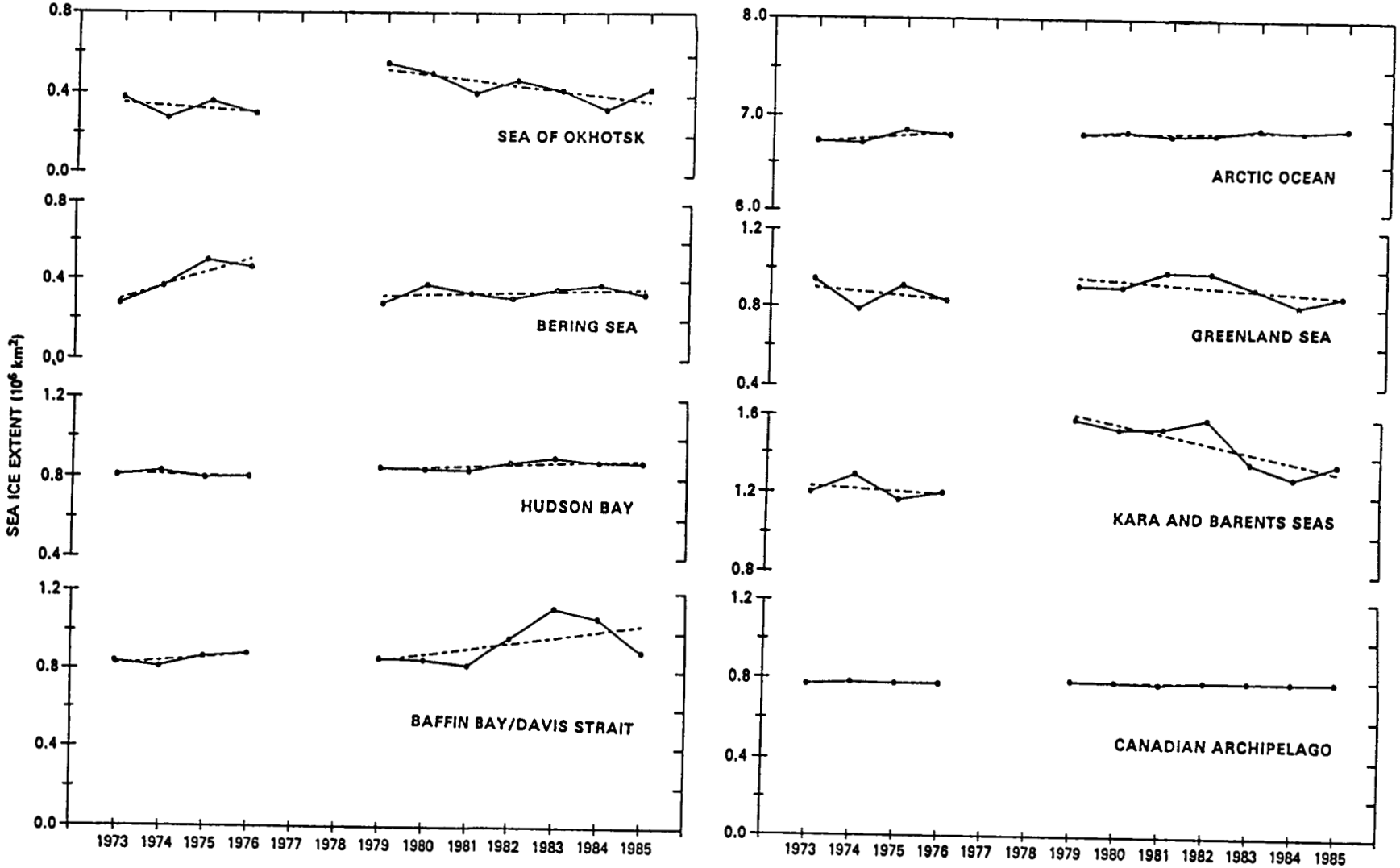

Figure 1. Time series of yearly averaged sea ice extent for each of eight regions in the Northern Hemisphere polar waters, along with lines of least-squares fit. The values for 1973-1976 derive from the data of the Nimbus-5 ESMR, whereas the values for 1979-1985 derive from the data of the Nimbus-7 SMMR.