P1.7 HISTORICAL VARIABILITY IN THE ARCTIC SEA ICE EXTENT

Roger Colony* and Inna Shapiro

Frontier Research System for Global Change, International Arctic Research Center, University of Alaska Fairbanks

The goal of this study is to gain a better understanding how sea ice extent and the processes of sea ice formation both reflect and influence climate changes in the Arctic region.

Until recently, the main exchanges between the Arctic and Atlantic oceans were thought to take place through Fram Strait between Greenland and Svalbard. However, recent studies (Rudels et al., 1994; Rudels 1995; Loeng et al., 1997) have suggested that periodic transport of North Atlantic water via the Barents Sea into the Arctic Ocean may also have a major effect on the climate of the Arctic region. Sea ice extent is linked to the input of warm, relatively saline Atlantic water, and this in turn influences the atmosphere and the climate. Hence this region is proving to be of increasing interest in the study of the relationship between sea ice and climate in the Arctic region.

This study uses the ACSYS (Arctic Climate System Study) Historical Sea Ice Chart Database constructed by the Norwegian Polar Institute. The measurements of the ice edge positions in this dataset came from a wide variety of sources. The data range from records of the ice edge recorded on vessels dating back as early as 1553, to the most recent ice edge observations by satellite. Data from the last 100 years provide almost weekly coverage from spring to autumn (e.g., Russian sea ice data from 1969, shown here in Figure 1); when satellites became available in 1966 there is continuous weekly coverage. The processing methods for these data sets to identify variations and anomalies are of critical importance. We are using these data to define a mean position for the ice edge across the geographical area of interest for each month of the year. Our approach for the statistical analysis of these data is to use the position of the mean monthly ice edge as the basis from which anomalies are calculated for any particular year. A typical illustration of the mean April ice extent and mean October ice extent is shown in Figure 2.

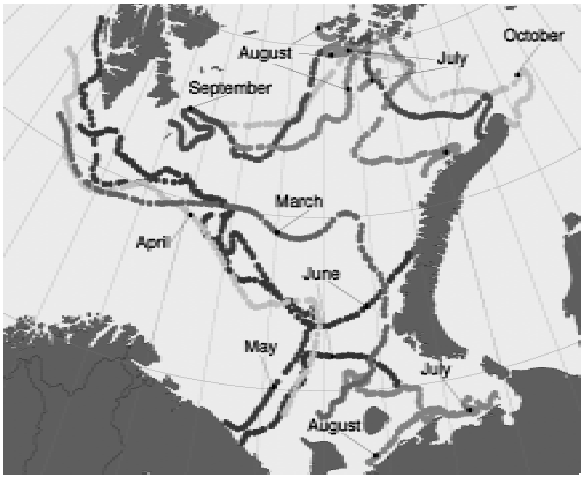

Figure 1. Russian sea ice data, 1969.

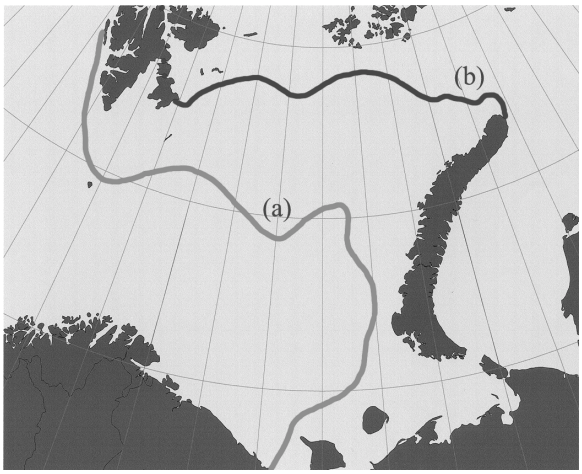

Figure 2. April (a) and October (b) mean ice extent.

* *Corresponding author address:* Roger Colony, Frontier Research System for Global Change, International Arctic Research Center, University of Alaska Fairbanks, 930 Koyukuk Drive, PO Box 757335, Fairbanks, AK 99775-7335; e-mail: rcolony@iarc.uaf.edu.

The mean ice edge is represented by a series of points x(s), were s is some arbitrary distance along the mean ice edge. One possible way to define the anomaly for a particular year is as the perpendicular distance of the mean ice edge x(s) to the observed ice edge y(r,t), where r is an arbitrary distance along the observed ice edge, and t denotes the year of observation. This represents the scalar quantity whose value is negative if the anomaly is directed towards the ice pack, and positive if directed towards the open ocean. This approach leads to a series of scalar quantities that can be analyzed for statistical properties.

REFFERENCES

Rudels, B., 1995: The thermohaline circulation of the Arctic Ocean and Greenland Sea. *Phil. Trans. R. Soc. Lond. A,* **352**, 287-299.

Rudels, B., E.P. Jones, L.G. Anderson, and G. Kattner, 1994: On the intermediate depth waters of the Arctic Ocean. In: *The Polar Oceans and Their Role in Shaping the Global Environment, eds. O.M. Johannessen, R.D. Muench and J.E. Overland, Geophysical Monograph* **85**, American Geophysical Union, Washington D.C.

Loeng, H., V. Ozhigin, and B. Adlandsvik, 1997: Water fluxes through the Barents Sea. *ICES J. Mar. Sci.,* **54**, 310-317.