TRENDS OF SPATIAL AND TEMPORAL PATTERNS OF SEA ICE CONCENTRATIONS IN HUDSON BAY REGION OVER THE PERIOD 1971TO 2004

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Introduction

Previous research and observations suggested that climate warming have affected the extent and stability of sea ice in Hudson Bay's marine environment. Due to multiple factors such as prevailing wind direction, ocean current, and the bay basin shape, the annual sea ice freeze-up and break-up processes vary in Hudson Bay region. The long-term trends of these variations are unclear. In this poster we present our recent research results from a GIS based spatial analysis of sea ice concentration data over the period 1971 to 2004 for the sub-arctic Hudson Bay and adjacent ocean region.

Research Objectives

The objectives of this project were:

(i) to examine dynamics of the sea ice freeze-up and break-up processes in Hudson Bay and adjacent region and their trends from 1971 to 2004; and (ii) to identify long-term trends of spatial distribution patterns and temporal variability of the sea ice concentrations in Hudson Bay and adjacent region during the past 34-year period.

Data and Methods

Weekly and monthly sea ice concentration averages and anomalies were spatially computed at different spatial scales (cell sizes) for the same region. For each of the geographic locations (the cells), a time series profile of sea ice concentration anomalies from the weekly average of sea ice concentrations between 1971 and 2004 was calculated and presented for each week for the 34 years of the spatial data set acquired from the Canadian Ice Service (CIS). We calculated slopes of the least squares best fit line from each pixel in the spatial data sets of weekly anomalies of sea ice concentration (June - November, 1971 - 2004) using the spatial analyst extension of ArcGIS (v. 9.1) and the GRID program in ESRI's ArcInfo Station software.

Result 1: Spatial Patterns of the Sea Ice Concentration

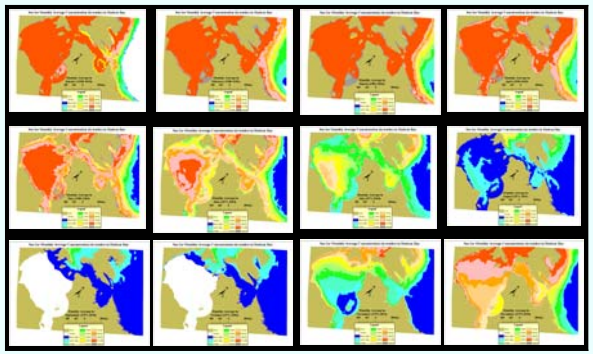

Figure 1. Monthly average sea ice concentrations in Hudson Bay and adjacent region, 1971 - 2004.

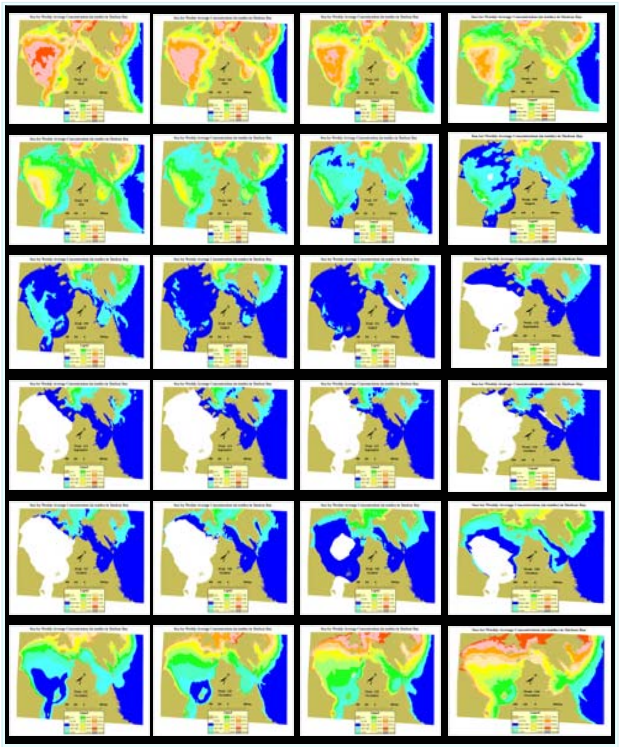

Figure 2. Weekly average sea ice concentrations in Hudson Bay and adjacent region, during the ice break-up (June) and freeze-up (November) period from 1971 - 2004.

Result 2: Slopes of Weekly Anomalies of Sea Ice Concentrations

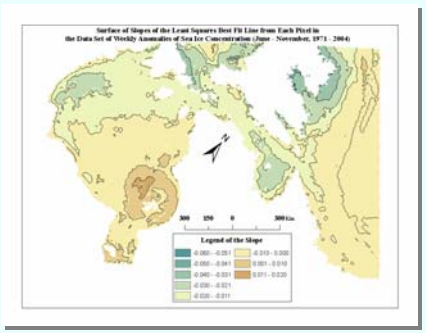

Figure 3. Long-term trends of the sea ice freeze-up and break-up expressed as slopes of the least squares best fit lines from each pixel of the weekly anomalies of sea ice concentrations in Hudson Bay and adjacent region from June to November 1971 - 2004.

Result 3: Seasonal Changes and Spatial Patterns of the Slopes

Figure 4. The slopes show the trends toward positive and negative sea ice concentration anomalies as a function of spatial location over the period 1971 to 2004.

Conclusions

Our results clearly illustrated that there is a stronger trend towards negative anomalies in northern part of Hudson Bay and northwest part of the study region, which suggests a trend of decreasing sea ice concentrations in these areas. The results also suggests that there is a tendency for an increase towards positive concentration anomalies in the south of Hudson Bay over the 34-year series, and with the maximum of the positive trends appears at north of the Belcher Island. This pattern suggests that drifting of increased fragmentized sea ice by prevailing wind function as one of the factors responsible for the positive slopes (i.e. increasing positive concentration anomalies) over the past 34 years. Significance of these trends and the spatial and temporal sea ice patterns may be implicated to impacts on polar bear population and terrestrial ecosystems of the Hudson Bay Lowland Eco-region and to the ability of ship navigation in Hudson Bay during sea ice melting/freeze-up periods in future.

Acknowledgements

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