What is CISDA?

The CISDA is a comprehensive sea ice data set derived from weekly ice charts. The data is more accurate and provides more detail, particularly in the interior regions of the Canadian Arctic Archipelago, than the latest useful polygon (LUP) derived sea ice concentration data. There are three types of ice charts:

1. Regional Ice Charts (RICs) are published weekly and depict the current ice condition. RICs are produced at the end of each operational season specifically for climatology (e.g., October 1) under the auspices of the Arctic Ice Charts Working Group (AICWG) that covers the Arctic and were based on ice reconnaissance flights assigned to gather climatological information (e.g., Figure 1). All data is digitized with the exception of the HCS charts which are currently being prepared for digitization.

As part of the IPY, the Canadian Ice Service focused on extending this record and data homogenization in the CISDA; the data can now be used for climatological studies in support of interdisciplinary Arctic research.

CISDA data quality and climate studies

Sea Ice Regime Regions & Data Quality Index

The CIS Ice Regime Regions (CISIRR) were defined as regions and boundaries using the CIS and SSM/I data. These regions are characterized using a data quality index (DQI) developed to portray the variability in data quality over space and time. The data quality index is calculated using weekly ice charts for the regional chart database. The DQI chart enables the detection of changes in the amount of data available in a region and in specific years. Data quality index thresholds have been set for the regional chart database. The right hand plot shows that the addition of the historical charts increases the data quality in most regions (bottom), which is especially true in the Northern Hudson Bay region (Figure 7) and in the regional chart database.

Addition of Historical Charts Extends Period for Trends

The addition of historical charts extends the recent period for trend analysis back 50 years to 1968 in some areas. These areas are generally located along shipping routes. The DQI chart for Hudson Bay (Figure 8) shows the improvements in data quality. For example, the northern part of the Northwest Passage route is shown to have a much improved data quality index (DQI) threshold in 1968. The improved data quality allows for the detection of trends that would be missed with only satellite data.

Assessment of Potential Bias: Changing Sensors over Time

The introduction of Radarsat-1 in 1995 is the most notable change in sensor data in the CIS since the introduction of the first Operational Interferometric Radarsat (SAR) sensor in 1991. Additional Radarsat SAR data has been made available via the Canadian Ice Service Digital Archive - Gridded Series (CIS-SSMI). The most significant area of concern is for the coastal portion of the northern Canadian Arctic Archipelago. The Radarsat-1 sensor is known to experience systematic biases in sea ice concentration data at coastal ice edges. The Radarsat-1 SAR data has a high concentration bias at coastal ice edges, which can be observed in chart presentation. However, this bias is not significant for all ice types and coastal and mid-year ice coverage.

Trends in Summer Sea Ice 1968-2008

The data revealed that between 1968 and 2008, summer sea ice cover has decreased by 4.8% ± 2.1% per decade in Hudson Bay, 3.9% ± 1.2% per decade in the Canadian Arctic Archipelago, 4.9% ± 1.1% per decade in Baffin Bay, and 0.2% ± 2.4% per decade in the Beaufort Sea. In general, these reductions in sea ice cover are explained by increases in early summer sea ice temperature (SAT). Within the Canadian Arctic Archipelago and Baffin Bay, the El Niño-Southern Oscillation (ENSO) index correlates well with multiyear ice coverage (positive correlation) and first-year ice coverage (negative correlation) suggesting that El Niño episodes precede summers with more multiyear ice and less first-year ice. Extending the trend calculations back to 1960 along the major shipping routes through the Canadian Arctic revealed significant decreases in summer sea ice coverage ranging between -11% and -15% per decade along the Arctic Bridge and -4% and -10% per decade along the southern route of the Northwest Passage. No significant trends were found along the western Arctic Channel route of the Northwest Passage.

The addition of the historical charts extends the period of study for trend analysis back 50 years to 1968. The data quality index (DQI) threshold in 1968 is shown to have a much improved data quality index (DQI) threshold in 1968. The improved data quality allows for the detection of trends that would be missed with only satellite data.

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