



## **Development of a 24-year time series of ice cover phenology and thickness from Great Bear Lake and Great Slave Lake derived from SSM/I brightness temperature measurements**

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Lake ice cover phenology (freeze-up, break-up and ice duration) and thickness are sensitive indicators of climate variability and change. They also play an important role in weather and climate as the presence/absence of ice and seasonal ice growth affect heat and energy transfers across the lake-atmosphere interface. The poor spatial (point) and temporal coverage of ground-based observations in most countries of the Northern Hemisphere make remote sensing a desirable tool for investigating the role and response of ice cover in climate-lake interactions. The availability of relatively long time series (over 20 years) of passive microwave data provides an opportunity to develop ice cover retrieval algorithms to complement existing or replace lost ground-based observation sites for climate studies.

In this paper, we present new ice phenology and ice thickness retrieval algorithms developed using 19.35 GHz brightness temperature data from the Special Sensor Microwave Imager (SSM/I). H-pol is shown to be sensitive to the discrimination between ice and open water, and thus ice phenology, while V-pol is found to be useful for estimating ice thickness. The algorithms (H-pol: phenology and V-pol: thickness) have been applied to a 24-year SSM/I time series to analyze the historical response of ice cover phenology and thickness from Great Bear Lake and Great Slave Lake, Canada, to climate conditions. The satellite-derived time series was used to examine intra-/inter-annual variability and trends in ice cover on the two large northern lakes. Available ground-based ice cover observations and meteorological station data were used in support of the interpretation of the SSM/I-derived ice cover products. Work is ongoing to extend the time series to over 30 years starting in 1978 with data from the Scanning Multifrequency Microwave Radiometer (SMMR).