

Ku- and L-band SAR Observations of Terrestrial Seasonal Snow and Lake Ice in Ontario during Winter 2023 using the CryoSAR Airborne System

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ABSTRACT

The Cryosphere-Observing SAR (CryoSAR) system is a Ku- and L-band synthetic aperture radar (SAR) system designed to conduct observations of snow and ice on land and water bodies, and soil moisture status. The CryoSAR system is a fully polarimetric SAR with the capability to conduct single or repeat pass observations for interferometric SAR (InSAR) applications. There is significant interest in the Ku (13.5 GHz) polarimetric response and L-band (1.3 GHz) InSAR measurements of snow on land and water to estimate snow water equivalent, a key variable in water resource management applications and in climate change studies. The CryoSAR radars can be operated independently or together. They can also be deployed on a relatively small aircraft, such as a Cessna 208, which is widely available across North America, Europe, and beyond, making the system relatively agile in its deployment. An adjustable mounting system has been designed to enable the instrument to be installed from inside and aircraft and at specified look angles. In fall 2022 and winter 2023, a season-long deployment of the system was conducted in Ontario as part of a Canadian Space Agency-funded project and in support of the Terrestrial Snow Mass Mission. Flights were conducted over selected sites in Ontario including the Haliburton Highlands and Powassan. Field campaigns were also conducted on the ground to provide correlative ground reference data. A combination of traditional field observations of snow properties, and detailed state-of-the-art measurements of microstructure properties were made to quantify the snowpack bulk and stratigraphic characteristics of the snow at the different field sites. This paper presents the initial observations made with the CryoSAR system at Ku- and L-band and correlative field measurements. Results focus on the polarimetric responses from snow on land and on lake ice and demonstrate its applicability for terrestrial snow monitoring.

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