

The Airborne Cryosphere-Observing Synthetic Aperture Radar System (CryoSAR): A Snow, Soil, Sea Ice, and Lake Ice Observing System

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ABSTRACT

The airborne Cryosphere-Observing SAR (CryoSAR) system is a Ku- and L-band polarimetric synthetic aperture radar (SAR) system designed to conduct observations of snow and ice on land and over water bodies. The CryoSAR system is designed as 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) and L-band (1.3 GHz) InSAR measurements of snow on land and water as tools 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 generally 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 on a 208 platform from inside and at specified look angles. In winter 2022, the first deployment of the system was planned in Ontario as part of a Canadian Space Agency-funded project. Flight paths were identified over the Haliburton Highlands and in Powassan. While Federal certification could not be completed in time, and the aircraft could not be deployed for flight overpasses, this presentation provides a description of the radar operation and what can be achieved. It also describes a snow field campaign that was conducted to support potential aircraft acquisitions. 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. Once federally-certified, the CryoSAR will be deployed in Ontario and Alberta in the 2022-23 winter season.

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