Great Lakes Ice Cover Mapping with RADARSAT-2 SAR Data

George Leshkevich¹ and Son V. Nghiem²

¹NOAA Great Lakes Environmental Research Laboratory, Ann Arbor, MI 48108
²Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Abstract

The objectives of this project are to use RADARSAT-2 data to continue the development of advanced algorithms to classify and map ice cover on the Laurentian Great Lakes started using synthetic aperture radar (SAR) data from ERS-1, ERS-2, and RADARSAT-1. NASA JPL and NOAA GLERL, together with support from the US Coast Guard, have carried out field experiments on the Great Lakes that have resulted in a comprehensive C-band fully polarimetric backscatter signature data set up to 60 degrees incidence angles for various ice types together with “ground truth” data. This unique data set is directly applicable to RADARSAT-2 data (same frequency, all polarizations, and incidence angles) to continue development using its dual polarimetric and fully polarimetric (Quad-Pol) capabilities. Since imagery was not available during winter 2007-08, RADARSAT-2 Quad-Pol data was obtained over western Lake Superior during GLAWEX09 (Great Lakes Winter Experiment 2008-09) coincident with data collection from the icebreaker USCGC Alder. One of the main goals of the experiment was to determine if multi-polarization data can be used to identify ice and open water without the ambiguity that can be caused by variability in wind speed and direction over water using single polarization, single frequency data (Leshkevich and Nghiem, 2007). Providing greater discrimination and less ambiguity than single band, single polarization data, dual polarization and Quad-Pol data at large incidence angles may improve ice type discrimination and mapping that are robust over a wide range of wind speed and direction. At small incidence angles and with a single polarization, RADARSAT-2 results show that ice and water can be discriminated over Lake Superior. After identifying ice and open water, our polarimetric library of C-band backscatter signatures of different freshwater ice types (Nghiem and Leshkevich, 2007) was applied to the imagery to classify and color-code the ice types. Once fully developed, this algorithm can be used in an automated procedure to obtain ice concentration, ice type, and ice mapping of importance to operational ice breaking and winter navigation as well as winter ecology, fisheries recruitment, and ice cover modeling efforts.

REFERENCES
