Newfoundland and Labrador wetland classification and water level monitoring using optical, PolSAR, and InSAR earth observation data

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ABSTRACT

A vast portion of Newfoundland and Labrador (NL) is covered by wetlands. Notably, it is the only province in Atlantic Canada that does not have a wetland inventory system. Funded by and partnered with multiple organizations including Environment and Climate Change Canada, and NL, Research and Development Corporation, this project aims at developing advanced remote sensing techniques for mapping and monitoring wetlands in NL. This study presents some of our methods and findings in object-based random forest classification of wetlands, InSAR monitoring of water level in wetlands and, a comparison of multi- frequency synthetic aperture radar (SAR) images in classifying wetland types in NL.

We have developed an object-based Random Forest classification framework based on the combination of SAR polarimetry and optical multispectral data that automatically classify wetlands into five major wetland types of bog, fen, marsh, swamp and shallow water. Our method have been tested on five large pilot sites, 700 sq. km each, across NL and results show high overall classification accuracies ranging from 81% to 92% for the pilot sites. Another objective of this project was to investigate on and develop a method for water level monitoring in marsh areas using InSAR technology. Results from both RADARSAT-2 and TerraSAR-X InSAR over the Avalon pilot site in NL were processed and promising results have been achieved. The full details will be presented in the conference.

In addition, investigation were conducted to evaluate the capability of multi-frequency SAR data including C-band, X-band, and L-band in classification of wetland types. This was also carried out on Avalon pilot site and some interesting results were achieved that will be used as the recommendations for future work for using SAR data in classifying wetland and other land cover types in northern latitudes.

Although the methods have been developed and tested on pilot sites in NL, they are applicable to other provinces’ wetland areas. Canada owns one-fourth of the total world’s wetland, but only 25% of Canada’s wetlands have been effectively mapped. This project introduces an advanced method for mapping and monitoring of Canada’s valuable wetland ecosystems in a timely, cost-effective, and semi-automatic approach.