Adaptation of Radar Based River Ice Mapping to the Nunavik Context

Yves Gauthier, Monique Bernier (INRS)
Martin Tremblay (Kativik Regional Government)
Chris Furgal (Trent University)

Arctic Change 2008 (Quebec City, December 2008)
International Polar Year

IPY Program of the Canadian Government

"Variability and Change in the Canadian Cryosphere: A contribution to State and Fate of the Cryosphere"
Work Package 1: Adaptation of Radar Based River Ice Mapping to the Nunavik Context

Is a contribution to:

“Climate Change in Northern Québec: Access to Land and Resources”
Kativik Regional Government

and

“Communities and Ice:
Bringing Together Traditional and Scientific Knowledge”
Martin Tremblay, Christopher Furgal, Violaine Lafortune, Caroline Larrivée, Jean-Pierre Savard, Michael Barrett, Tuumasi Annanack, Noat Enish, Peter Tookalook and Betsy Etidloie
• Residents of Inuit communities developed an extensive trail network to access fishing and hunting grounds;

• During winter, large sections of these trails are on frozen lakes and rivers;
CONTEXT

• Climate change is strongly affecting the Arctic;
• Changes also occur to the lakes and river ice regime;
• Traditional knowledge of the ice cover behavior is not as reliable as before;
• Increase of risk to local communities when traveling on lakes and rivers.
OBJECTIVES

• To adapt to this context, the methodology developed by INRS for river ice mapping from satellite radar images;

• To provide communities with a tool to better monitor the river ice cover;

• To contribute to the ongoing ice watch program (KRG);

• To contribute to the establishment of the Canadian cryosphere snapshot for IPY
BACKGROUND

The FRAZIL project (2005-2009)

• Integrated effort to develop a GIS-based system in support of winter river flow modeling, in a context of ice-related flood forecasting, dam management and navigation control.

• FRAZIL output #3: A processing routine to produce an ice cover map from a radar image
ADAPTATION TO NUNAVIK

What do we mean by adapting the radar ice maps?

➢ ‘When is it safe to travel?’

• Can we provide useful information?
• Can we provide the necessary coverage?
• Can we provide timely information?
• Can we reach the intended users?
• Can we get a feedback?
ADAPTATION TO NUNAVIK

The study site: Kuujjuaq area

The Koksoak River: 130 km long, 400m to 3km wide
Flowing from south to north
Tidal action in Kuujjuaq
METHODOLOGY

1. Meeting the locals (September 2007)
   • To better know the river and the Inuit perception of its ice cover
   • To identify the trail network and areas of interest
   • To determine the critical dates / frequency
   • To learn Inuktitut terms used to describe the ice cover
   • To discuss information transfer
   • To discuss validation
METHODOLOGY

2. Digitizing the trail network and areas of interest
3. Planning the RADARSAT-1 and RADARSAT-2 image acquisition schedule
   • Early November to end of January (Freeze-up)
   • Late April to Early June (Break-up)
   • Weekly maps

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METHODOLOGY

4. Producing the ice maps

- Posted on KRG Website
- Paper version distributed in town
- GPS file for hunters
5. Producing longitudinal ice profiles

Earlier break-up in 2008
METHODOLOGY

6. Analyzing temporal changes where trails cross rivers and lakes
VALIDATION

1. Ground photos (Kuujjuaq)

   Nov.9, 2007

   Dec.2, 2007

   March 1, 2008

2. 2nd Meeting with local people
   (March 5th, 2008)
VALIDATION

3. Installation of a Webcam

[Image of a webcam and map indicating 1km inland]
VALIDATION

4. Aerial surveys

- March 6th, 2008
VALIDATION

GPR measurements

- March 6th, 2008

- Frequency: 900 MHz
- Sampling: 2048 pts
- Scan rate: 40 ns
- Speed: 10 km/h
- ~300m section
- Middle of channel

Direct coupling
Snow/Ice interface
Ice/Water interface

~35 cm of snow
~1m of ice
VALIDATION

QUICKBIRD image

RADARSAT Classification

May 4th 2008
VALIDATION

Shallow Water Ice Profiler (SWIPS)

- Installation in spring 2009
- Collaboration Makivik Society
- Important crossing site for locals
- Long term installation
VALIDATION

Implication of teacher and students

- Presentation in the class
- On-site photos and observations during satellite acquisitions
- Participation to field work
- Inuktitut glossary of ice terms
CONCLUSION

Successful adaptation?

- Can we provide useful information?
  - Still improving our knowledge of the river
- Can we provide the necessary coverage?
  - Standard mode is satisfactory for the Koksoak River and main lakes
- Can we provide timely information?
  - Good frequency, acceptable turn around
- Can we reach the intended users?
  - Improvement with the implication of the students
- Can we get feedback?
  - A final workshop is planned
- Can we continue?
  - Find partners for long term implementation
Thank you!