CANADIAN EXPERIMENT FOR FROZEN/THAW RETRIEVAL

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with the collaboration of

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Centre - Eau Terre Environnement

INRS
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MOTIVATION (1/2)

- The Soil Moisture Active Passive satellite NASA mission is scheduled for 2014.
- To support algorithm development and validation, SMAP Cal/Val needs more observational data sets.
- Airborne flights and field campaigns are necessary to:
  - Develop and validate algorithms for F/T products.
  - Focuses on the freeze-thaw component of the mission
  - Oriented on the radar and combined products due the importance to get UAVSAR data.
- INRS is a member of the Center for Northern Studies (CEN):
  - Develop and validate the algorithms for snow, ice and permafrost monitoring from SAR sensors.

MOTIVATION (2/2)

- NASA need to establish core validation sites for SMAP.

- Canadian Space Agency and Environment Canada are committed to :
  Participate in SMAP Environment Canada coordinates the Canadian SMAP effort.
  Support Cal/Val experiments in Canada.

- Environment Canada is:
  Interested to provide L-band passive microwave Aircraft data sets that simulate the SMAP
  L-band observations.

OBJECTIVES

- Algorithms development and validation for the SMAP mission to monitor Freeze/Thaw at high resolution (1km and 3 km) over the Tundra and the Boreal Forest in Canada using L-band SAR data.

- Algorithms development and validation for the SMAP mission to monitor Freeze/Thaw at medium (9 km) and low resolution (40 km) over the Tundra and the Boreal Forest in Canada using both passive microwave and SAR L-band data.

- Algorithms development and validation for Freeze/Thaw using time series of radar observation.

- Support development and validation algorithms for Freeze/Thaw using time series of concurrent radiometer and radar observations scaled.

- Develop and test open water fraction algorithm (?)

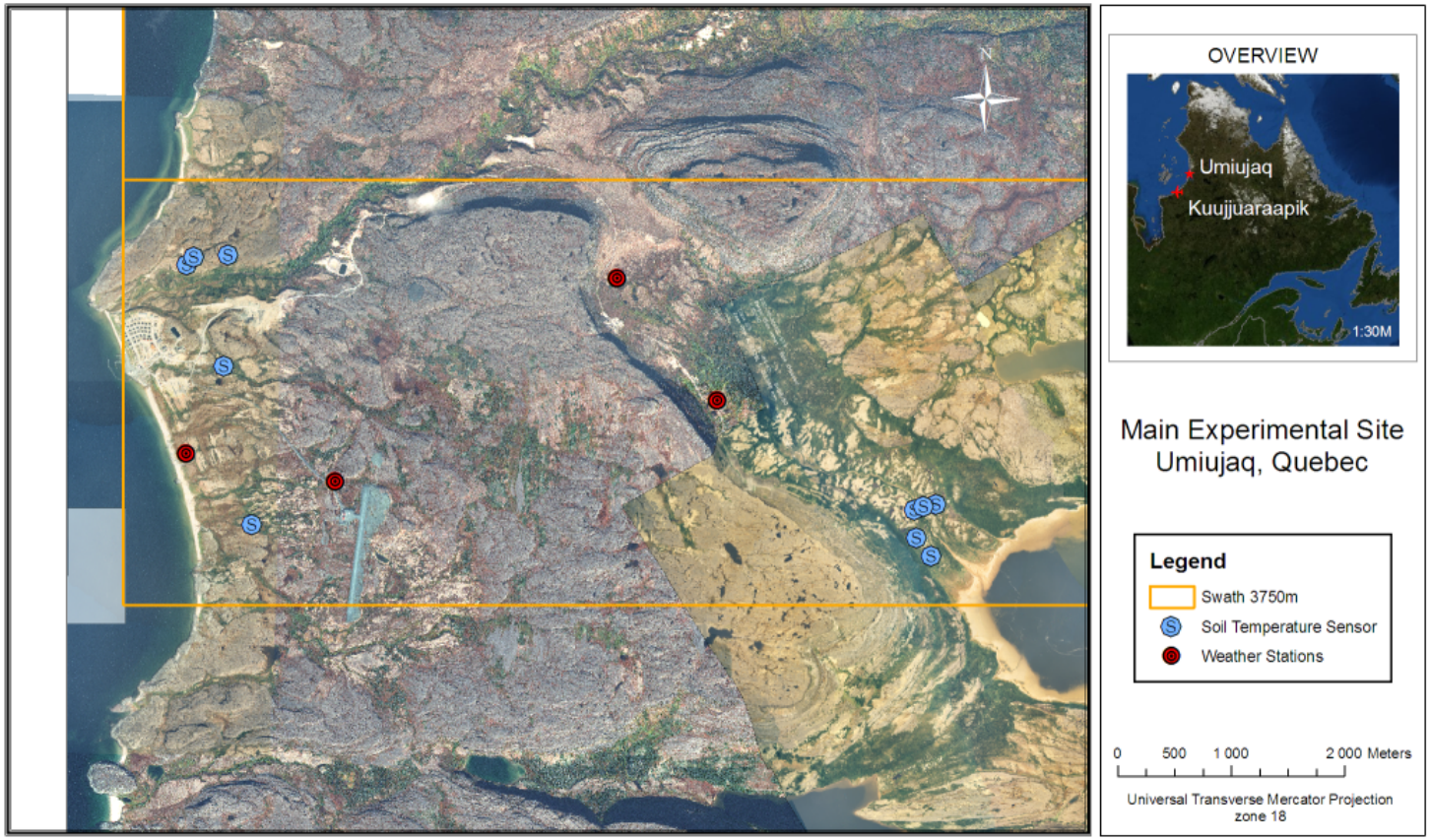
PARTICIPANTS

- **INRS-ETE , CEN**
  - M. Bernier: Coordination field campaign, Algorithms development
  - P. Kalantari: Algorithm development for F/T Product, Field work
  - J. Poulin: Logistics, field work
- **Environment Canada (EC)**
  - A. Walker: Aircraft and instruments
  - S. Belair: SMAP program coordination
- **SMAP**
  - T. Jackson: UAVSAR, coordination
  - K. McDonald:

DESIGN

- **Time period**
  - October 2011
- **Location**
  - In situ networks over study sites near Hudson Bay, Canada
  - Local host support: Bernier (INRS-ETE, CEN)
- **Radiometers**
- **UAVSAR**
- **Satellite data**

Repartition of the meteorological stations (red dots) and the soil temperature probes (blue dotes) under the first flight line near Umiujaq (Hudson Bay area) in Northern Quebec, Canada.



FIELD MEASUREMENTS CAMPAIGNS

Experimental site location

- Near the village of Umiujaq, Hudson Bay (56.55º N, 76.55º O).
- A zone of discontinuous permafrost located at the tree line limit.

❖ Land Cover

- Sparse tundra vegetation in coastal environment,
- Shrubby vegetation with sparse black spruce trees in the valley where the graben of Guillaume-Delisle.

❖ Lake and River cover the north of the area

- Sheldrake River watershed, Thermokarst lakes and hollows

FIELD MEASUREMENTS CAMPAIGNS

Experimental site

❖ **Scientific meteorological stations location**:

- Two near the Umiujaq village,
- Two others, in the Guillaume-Delisle valley to monitor the permafrost,
- One in the Sheldrake watershed, near a lithalsa which is monitored for more than 10 years,

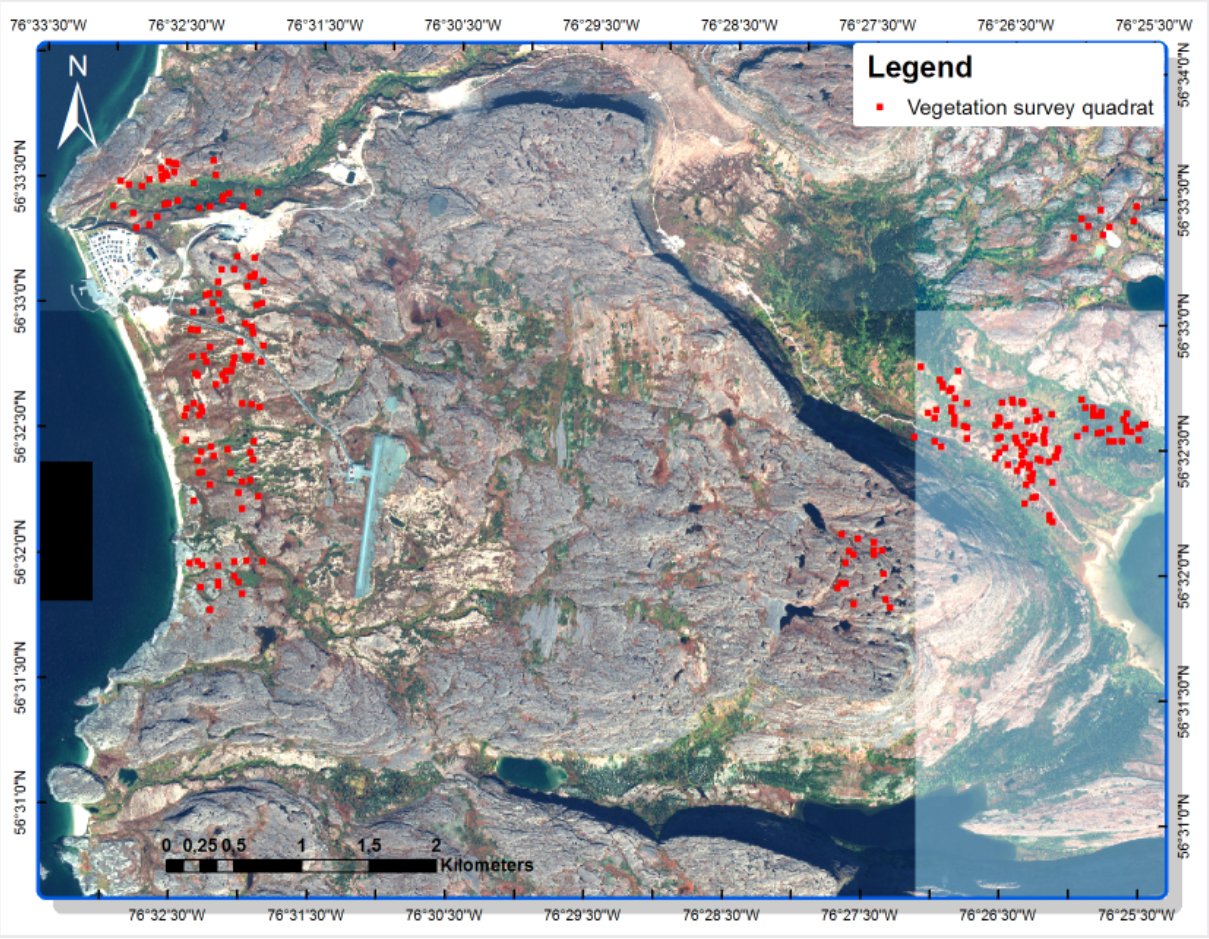
Others sensors and data set

- Additional soil temperature sensors to monitor the annual cycle of soil surface temperature (from summer 2010 to summer 2012),
- A vegetation survey in summer 2008 and 2009, by INRS collaborators from UQTR (CEN).

Umiujaq : September 7-9 2010

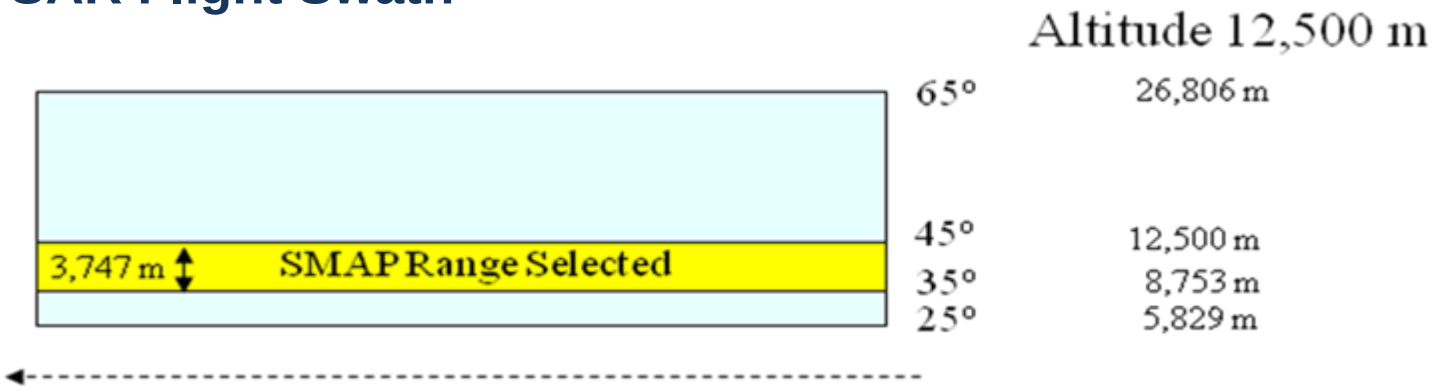
- Transmit data since Sept. 8 2010

Repartition of the vegetation survey quadrats made in summer 2008 and 2009 (red dots) under the first flight line near Umiujaq (Hudson Bay area) Northern Quebec, Canada.



GULFSTREAM UAVSAR-3

UAVSAR Flight Swath



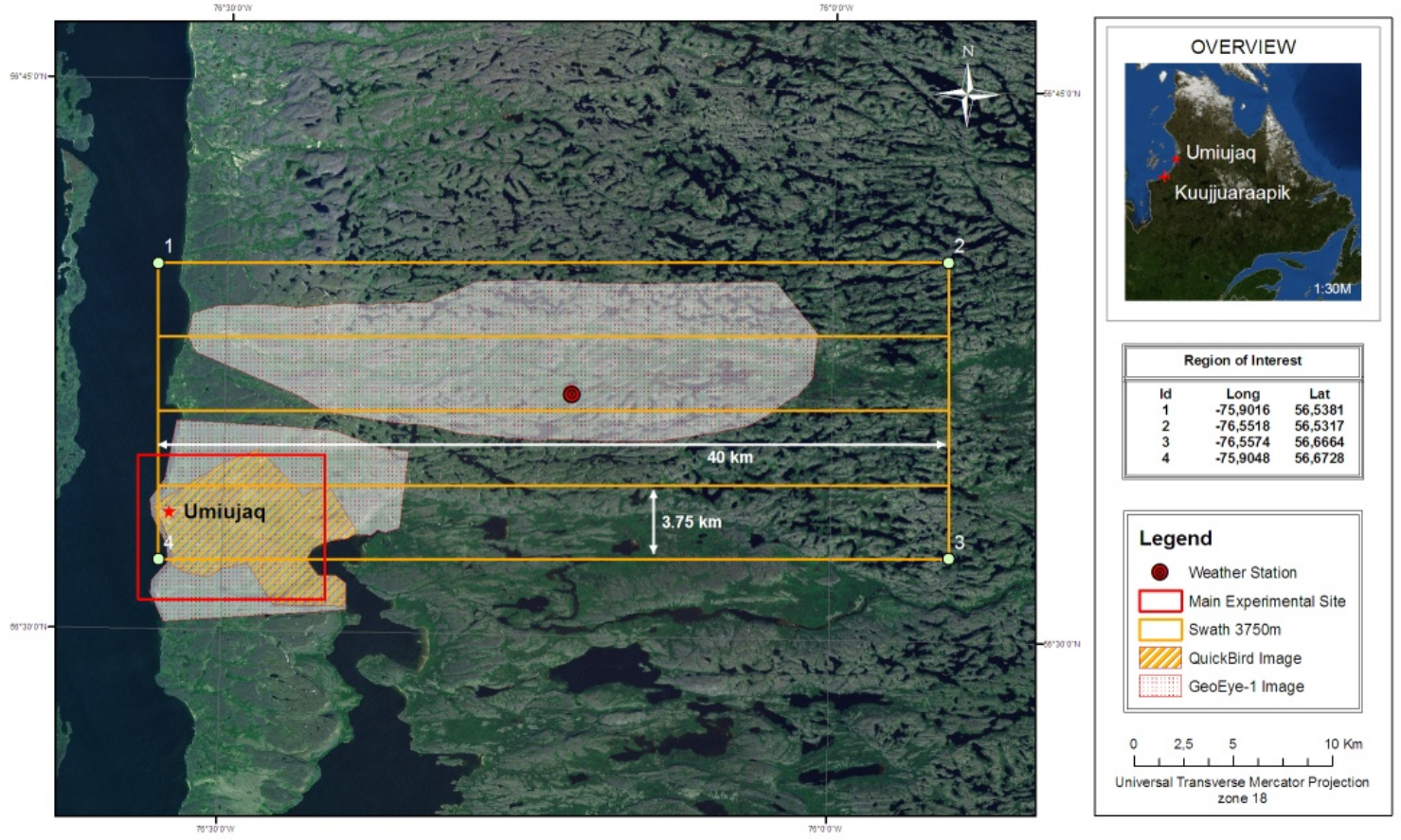
	Incidence Angle	Polarimetric	Spatial Posting	Swath	Speed
UAVSAR-G3	25-65degrees , fully	L-Band	~ 6 m	~22 km	~13 km/min

GULFSTREAM UAVSAR-3

	Incidence Angle	Polarimetric	Deployment Time (DT)	Flights/ DT	E-W Line	Area Cover
UAVSAR-G3	**35-45 degrees**	**L-Band**	**1-2 weeks**	**4**	**4**	**15 X40 Km^2**

The ground truth date acquisition will be coordinated by INRS-ETE and the overall Freeze Thaw Mission by Environment Canada.

UAVSAR proposed flight lines over Umiujaq area and the basin of the Sheldrake River (Northern Quebec, Canada)



L- BAND PASSIVE MICROWAVE

COMMENTS!
QUESTIONS?