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# SWOT Hydrology for Canada phase 1 - team

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## **Canadian Hydrology Team**

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**Robert Saint-Jean – Canadian Space Agency**

## **University Collaborators**

**Robert Leconte, Ing., University of Sherbooke**

# Background

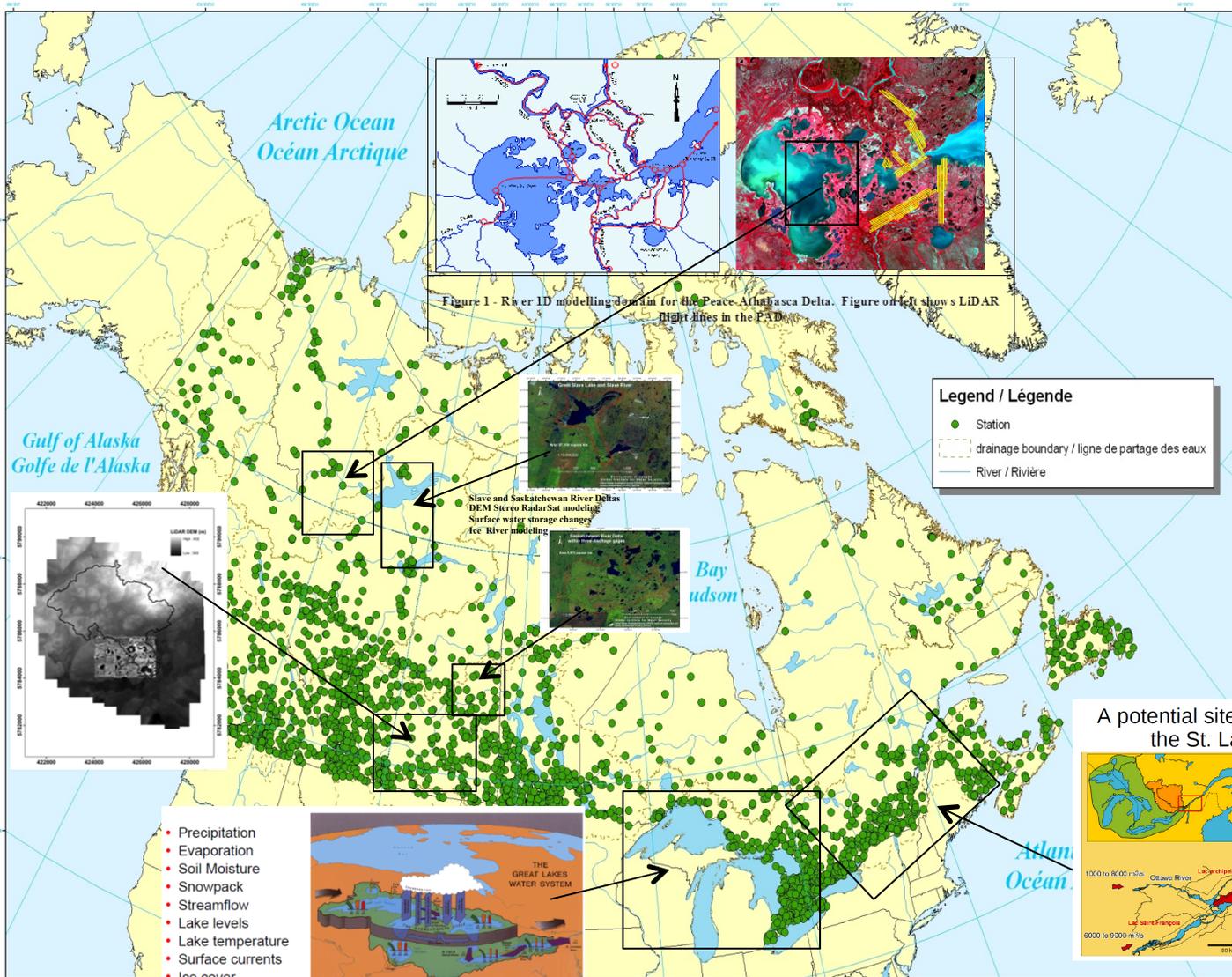
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- Canadian SWOT-Hydrology team formed 2013
- CSA submitting for federal funding
- Led by Environment Canada
  - Science Team focused on site-specific applications
- The Government of Canada has approved CSA to allocate ~17M\$ for the SWOT-C project until 2024.
  - ~13M for the EIKs
  - ~4.5M to support 'new' Science
  - MOUs with ECCC (Hydrology) and DFO (Oceanography)
  - Research Grants to academia.





# National Hydrometric Program Programme national de relevés hydrométriques



**Legend / Légende**

- Station
- - - drainage boundary / ligne de partage des eaux
- River / Rivière



PROVINCE or TERRITORY PROVINCE ou TERRITOIRE	Number of Active Stations ** Nombre de stations en activité **
Alberta	463
British Columbia / Colombie-Britannique	450
Manitoba	290
New Brunswick / Nouveau Brunswick	55
Newfoundland and Labrador / Terre-Neuve-et-Labrador	99
Nova Scotia / Nouvelle-Ecosse	29
Nunavut	36
	88
	571
	10
	215
	281
	50
	2637

A potential site for SWOT Cal-Val:  
the St. Lawrence River

- Large river
- Strong tides
- Partial ice cover
- Well monitored and modelled
- International border upstream of Montreal

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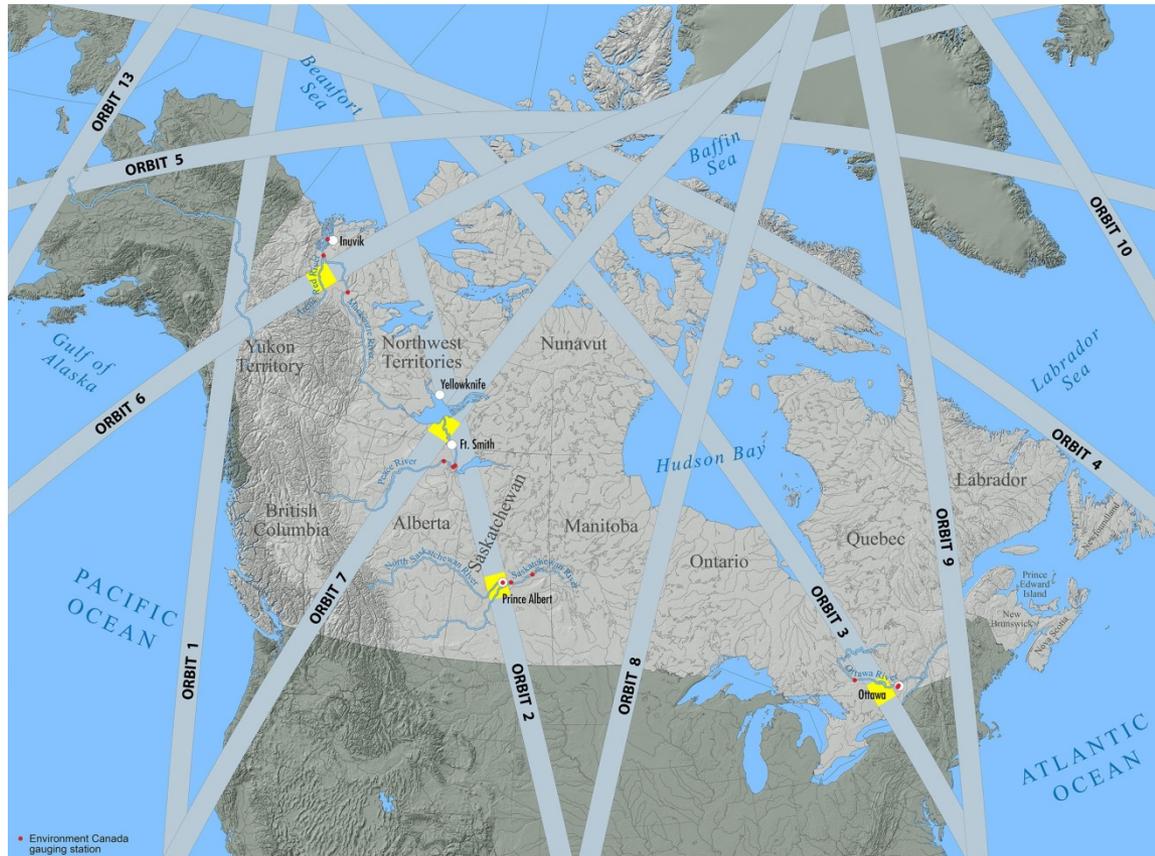
# Phase II begins April 2017 for 4 years

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- Seeking CSA funding for phase II
  - Significant direct and in-kind funding from WSC
- Partnering with UCLA (Smith) and Gleason(UMass) on Permafrost transect for science and Cal/Val
- Seeking Partnership with Pavelsky and Durand on discharge algorithms and cal/val
- Seeking Partnership with USGS on cross-agency collaboration
- Participating on the cal/val team
- Outreach to WMO



# Calibration and Validation Opportunities



Courtesy of Larry Smith and Colin Gleason



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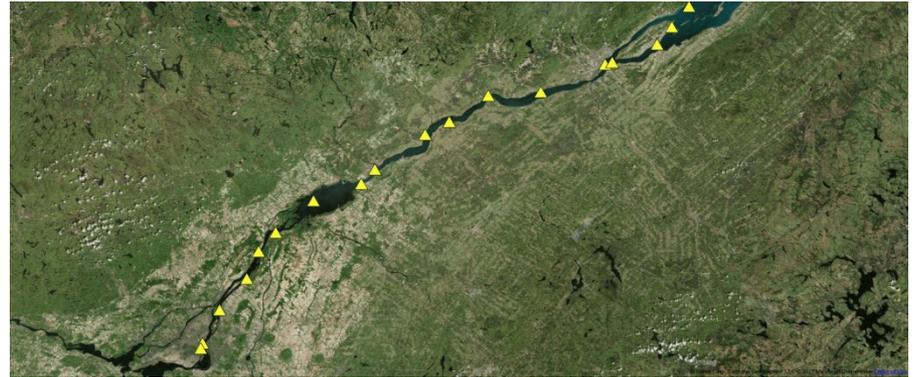
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# St. Lawrence River

## Existing Products:

- LiDAR DEM
- Permanent hydrometric stations
- Maps
  - Emerging ,aquatic and shore vegetation
  - Substrate
  - Macro-roughness
  - Ice
  - Manning's n estimates
- Operational 2D Hydrodynamic model
- Hydrological model for total tributary inflow to the whole basin





# Other Possible Cal/Val Sites: Slave, North Saskatchewan, Arctic Red, Yukon

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## Pre and post-launch Work:

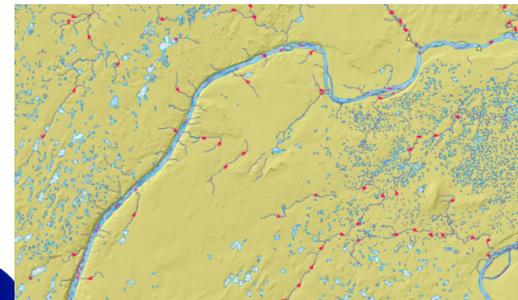
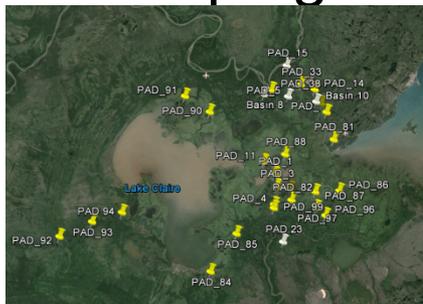
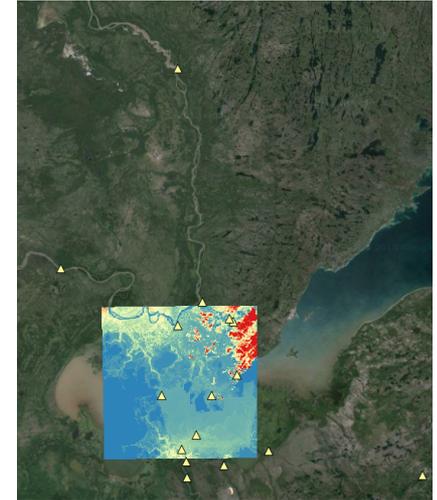
- Site and logistics assessment needs to be completed
- Instrumentation of the river with pressure transducers with GOES transmitters to provide near real time level and discharge measurements.
  - Possibility to install seasonal instruments.
  - High precision GNSS surveys on all sites to provide high accuracy level data and easy conversion between geoid-based vertical datum.
- Possibility of Bathymetric surveys
- Radarsat-2 derived imagery of water extent.
- ADCP installation possible
- Ground-based survey (maintenance or ad-hoc demand)
- 2D Hydrodynamic model in development on the Athabasca



# Science Sites: Peace-Athabasca Delta

## Existing products:

- Lidar to <30m DEM
- Permanent hydrometric level stations
- Pressure Transducers
- Landsat-based landcover
- Historic water extent from Landsat/Radarsat
- Corner reflectors
- Developing 2-D model on Athabasca River



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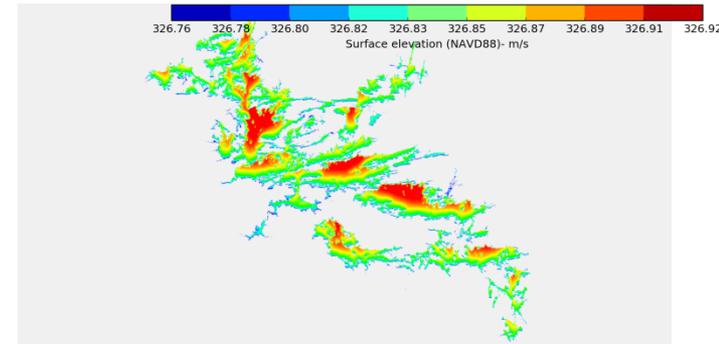
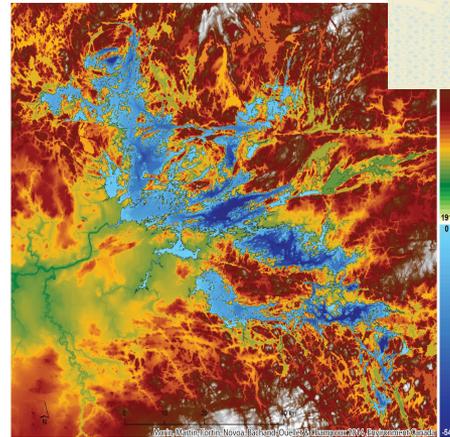
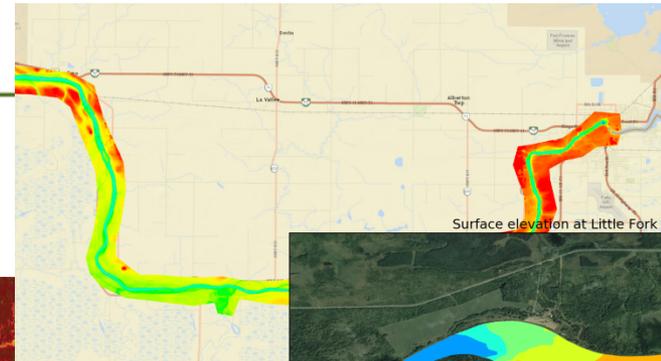
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# Other Models Available (1D,2D,3D, wave)

- Rainy River
- Rainy-Namakan Chain of Lakes
- Great Lakes



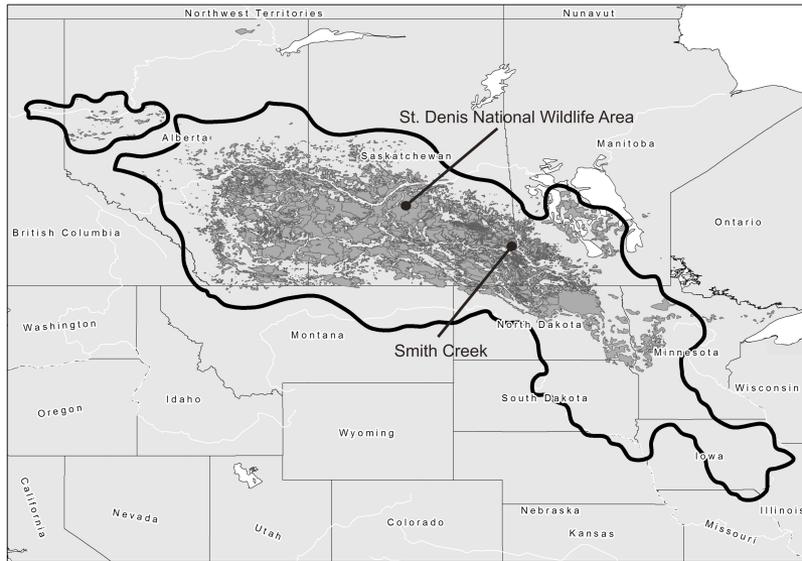
# Summary

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- Canada has operationlized 2D and 3D models for some point of interest in the GLSLB
- Operationalized hydrology predictions for tributaries (in experimental mode) with SVS land surface model for GLSLB.
- 2-D model is be available for Rainy-Namakan(1-D) lakes
- 2-D model being derived for Athabasca river in the PAD
- Potential river cal/val sites have been identified
  - We will work with SWOT internationally to see what works and what is needed
  - Developing internal expertise for SWOT simulator
  - Expectation is phase I research program will end spring 2017 with one SWOT simulations for SL and pehaps GL.
    - Initial setup in August for 1 permanent cal/val site



# Prairie Potholes and Shield - TBD



The Main Research Questions in this region:

- Using a combination of Radarsat and SWOT information, what size and type of prairie potholes and river-connected wetlands are discernable and can an area-volume relation be used to estimate the values of storage in the water bodies?
- Can SWOT discern Canadian Shield lake levels that can be used to estimate detention storage, hydrological connectivity, and contributing area?
- Can time-series of SWOT estimation assist in closing the prairie hydrological water budget?

No systematic measurements

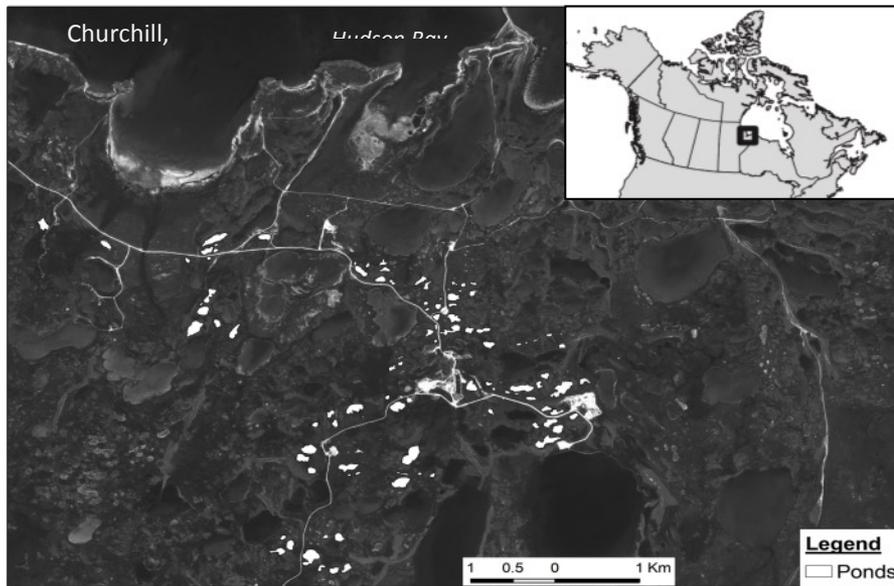


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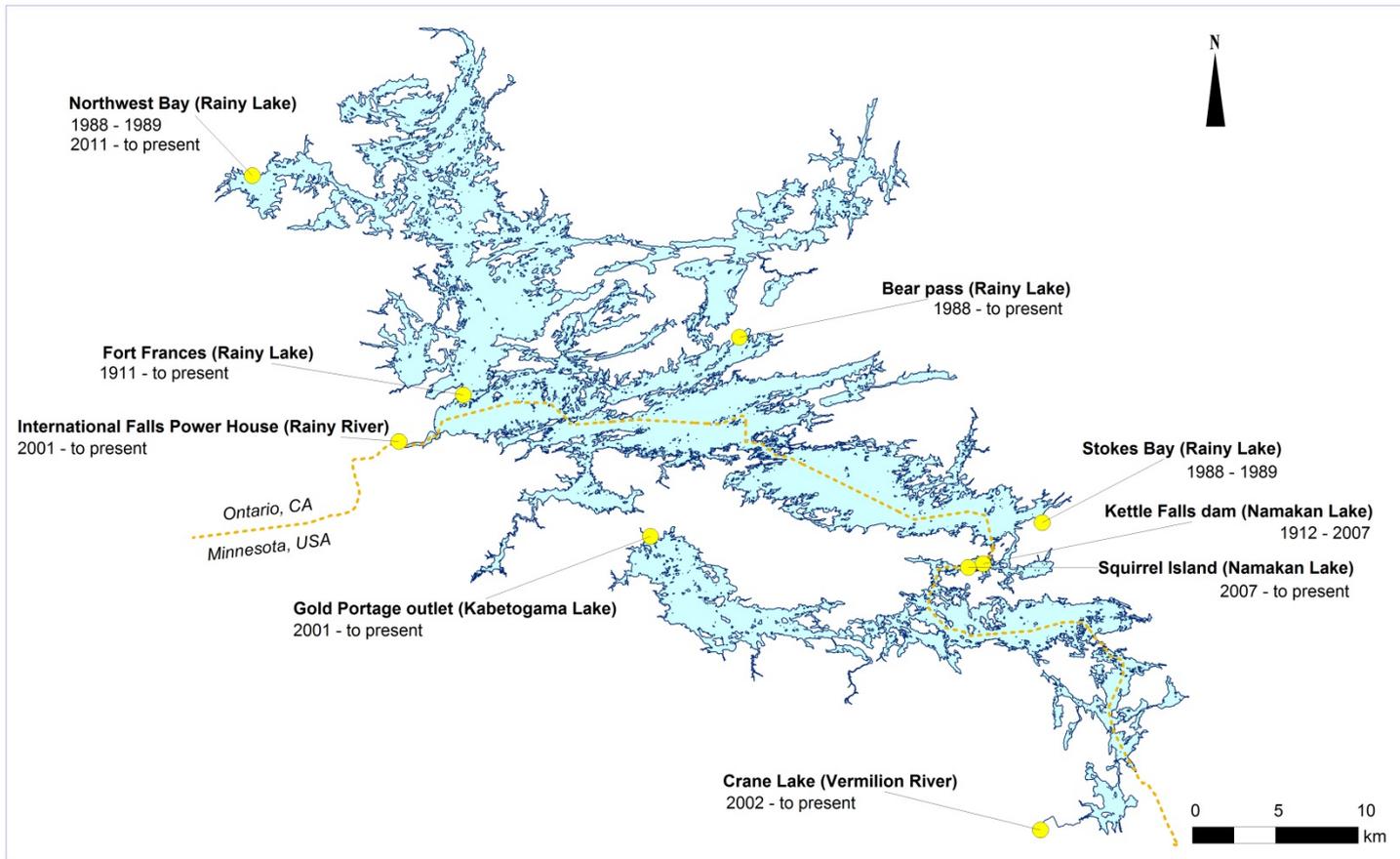
# Subarctic Lakes - TBD



- The primary goal of this research is to assess the potential of SWOT data for monitoring the seasonal evolution of water levels and on-ice snow depth on shallow (generally less than 4 m) subarctic/arctic lakes.
- Specific objectives are:
  - to improve current estimates of lake water storage for climate studies; and
  - to investigate the sensitivity of Ka-band to snow depth on lake ice, and the possibility for the development of a retrieval algorithm prior to the launch of the SWOT mission.



# Rainy - Namakan



# Hydrology/Hydraulic systems

