

Canadian lakes experiments

or Accuracy and sensitivity to **ice, snow, wind, and vegetation**



Is the air temperature really -25°C ? Luckily, water temperature is 4°C !

Mélanie Trudel, Sylvain Biancamaria, Daniel Peters, Élisabeth Cauvier-Charest and others



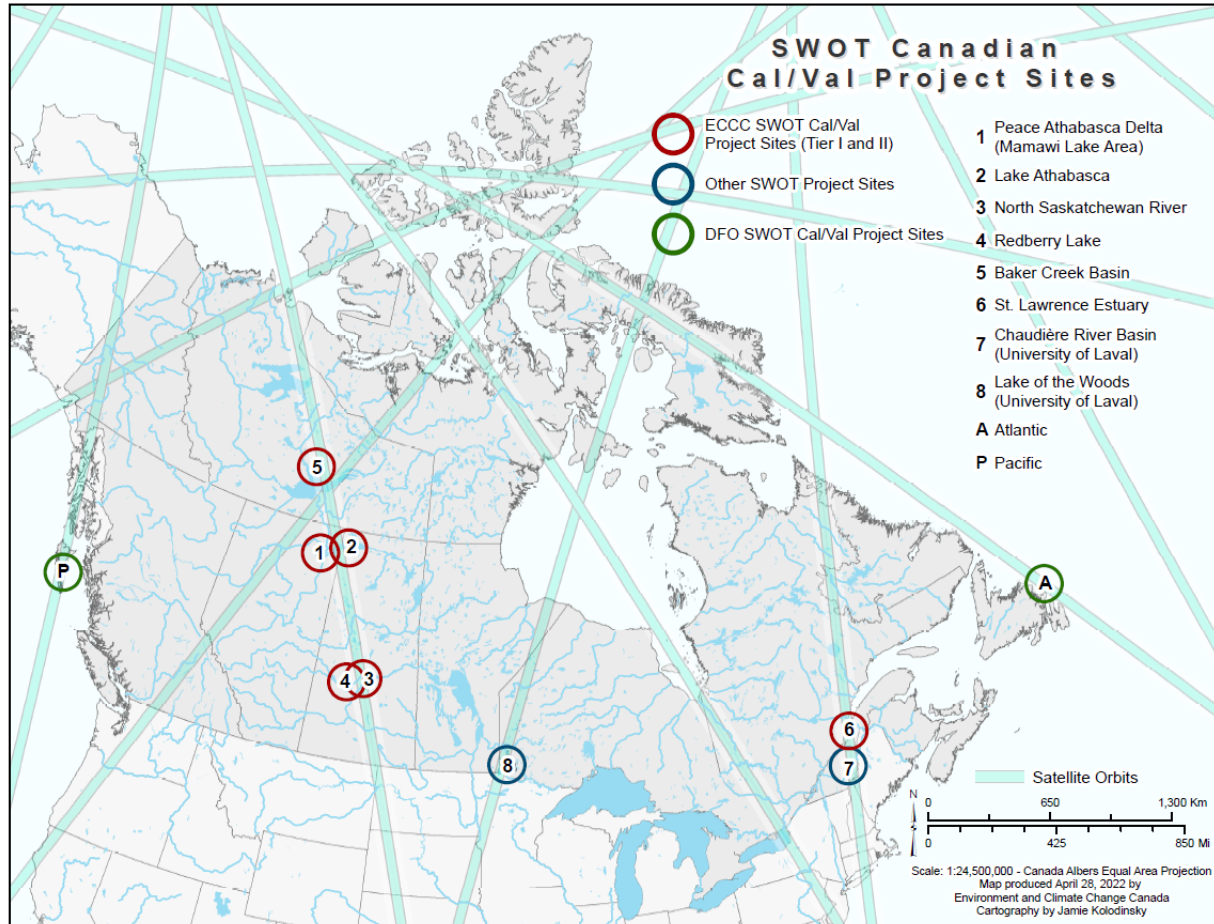
Environment and
Climate Change Canada
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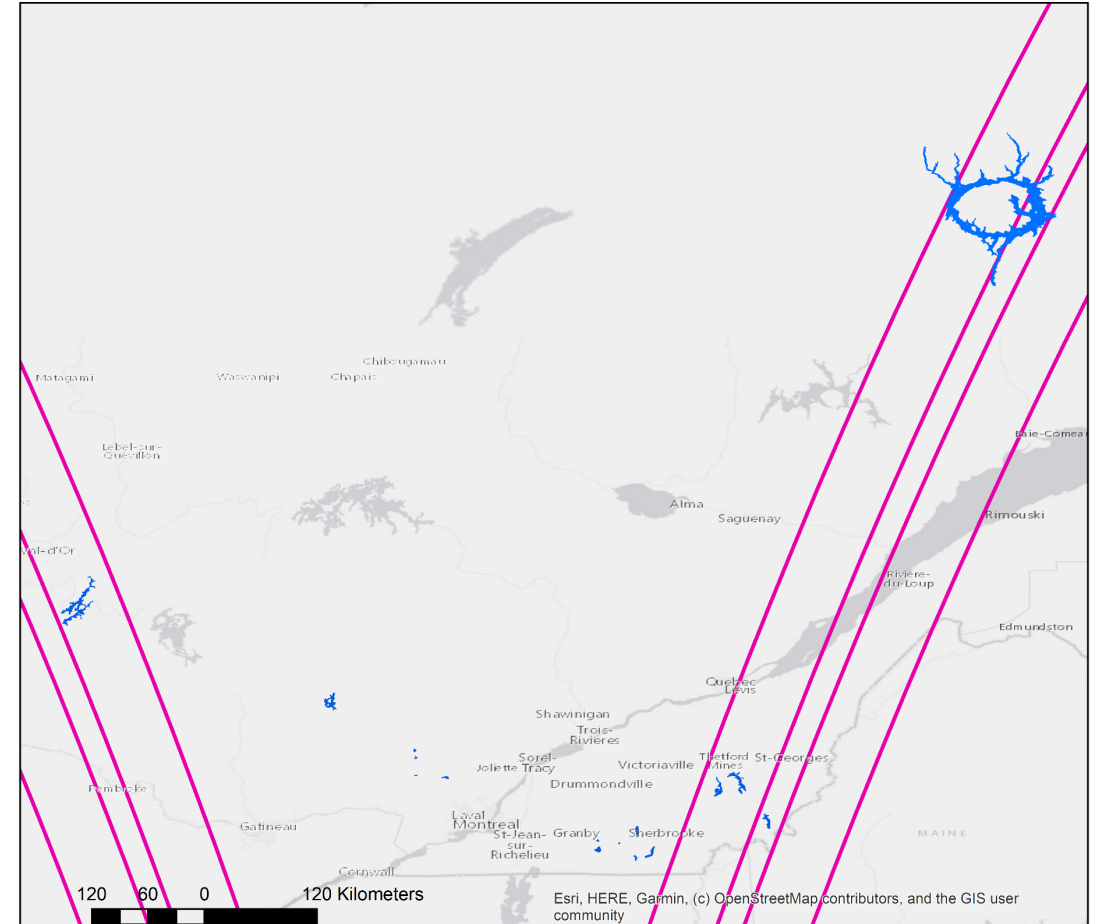
CAL/Val activities in Canada

Canada has more than one million lakes larger than 10 ha corresponding to about 60% of the world's lake area.

Environment Canada sites



SNORKS sites



Peace-Athabasca-Delta (PAD) - Alberta



- Peace-Athabasca Delta (6000 km²) – rep. of a complex deltaic floodplain (lakes, wetlands, channels)
- Lake Athabasca (7800 km²) – representative of a large, deep, cold regions lake

Peace-Athabasca-Delta (PAD) - Alberta

Lake Athabasca

- 1D/2D hydraulic models
- SWOT-like simulations
- Remote sensing
- Fieldwork (Feb-Oct 2023)
 - Hydrometric network
 - Cameras
 - Meteorological stations
 - GNSS-R
 - Ice/Snow/Level surveys

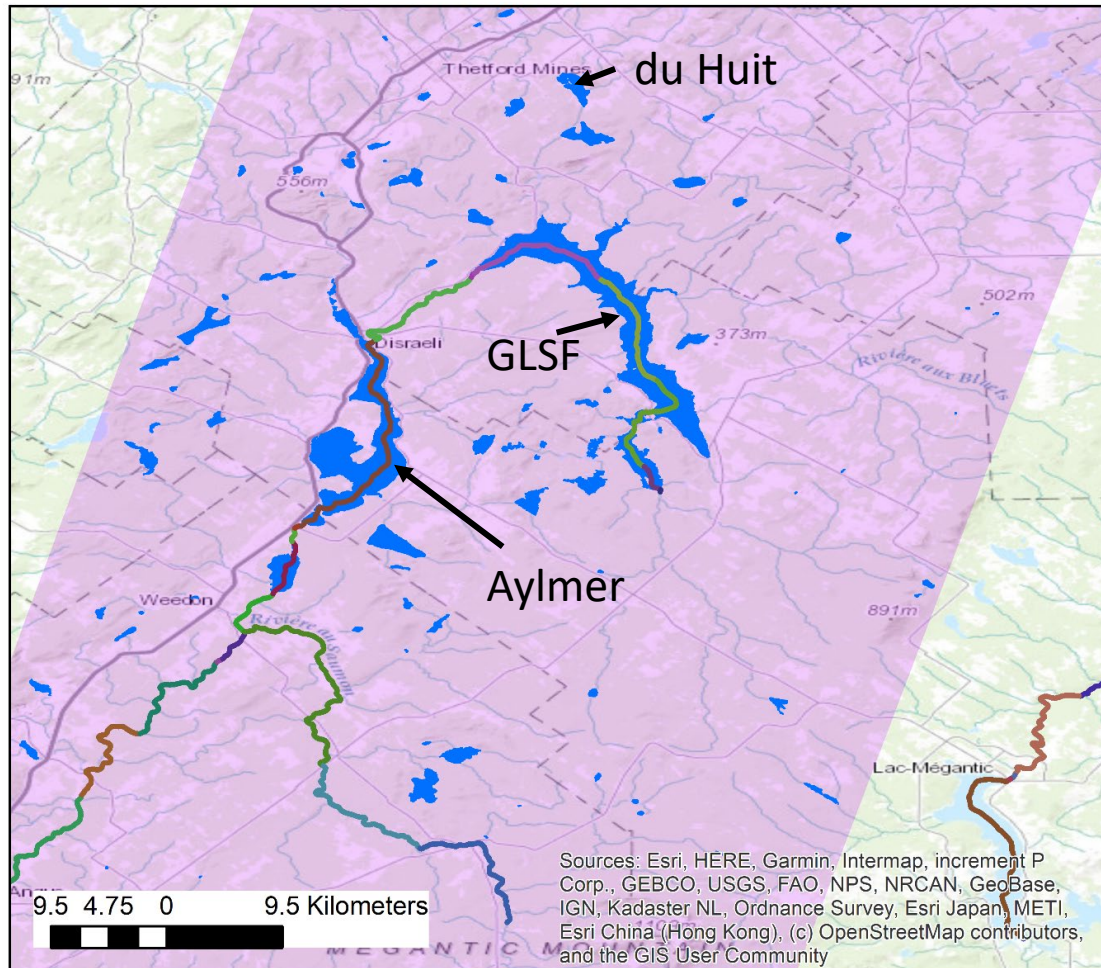


PAD

- 1D/2D hydraulic models
- SWOT-like simulations
- Validation of the effect of vegetation on SWOT
- Instrumentation 2023 open water period for follow-up cal/val of SWOT products
 - Build upon AirSWOT 2017 work
 - Instrument 30+ wetlands/lakes

Desrochers, N. M., Trudel, M., Biancamaria, S., Siles, G., Desroches, D., Carbonne, D., & Leconte, R. (2021). Effects of Aquatic and Emergent Riparian Vegetation on SWOT Mission Capability in Detecting Surface Water Extent. *IEEE JSTARS*, 14, 12467-12478.

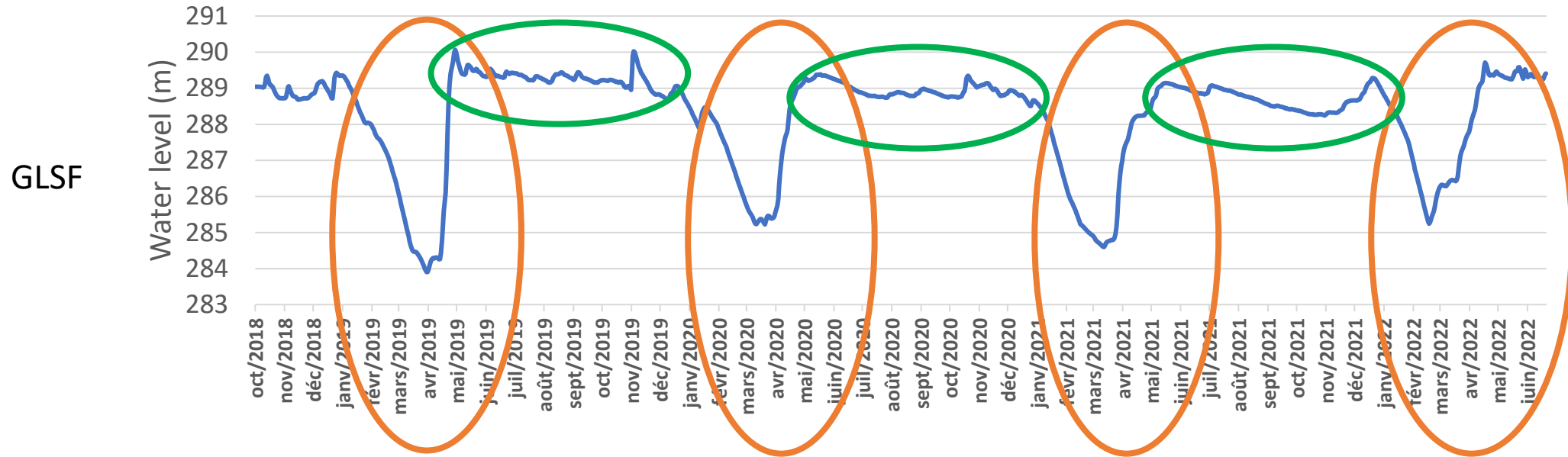
St-François River watershed (near Sherbrooke)



- Many lakes (> 50) in cal/val orbit
- Different size (6 to 5000 ha), shape, orientation and position in the swath (near and far range)
- Three dams, many small levees, and beaver can affect water level of lakes in this region
- Covered by ice at the beginning of the CAL/VAL
- Also ~ 15 SWORD reaches

St-François River watershed (near Sherbrooke)

Reservoirs are regulated to mitigate flooding in spring and maintain constant water level during summer for recreational activities.



During the CAL/VAL orbit : for a given lake : variations of water level/water extent : same swath (incidence angle)

During the Science orbit : for a given lake : same water level/water extent during the summer : different swath (incidence angle)

Goals for the lakes CAL/VAL

- Ice

- Lakes will be covered by ice at the beginning of the CAL/VAL orbit
- Thickness measurements,
- Camera,
- Sentinel-1,2 and Radarsat Constellation Mission,
- GNSS-R,
- UAV-GPR

Lake Aylmer : Sentinel -2 from Earth Engine



March 3, 2020



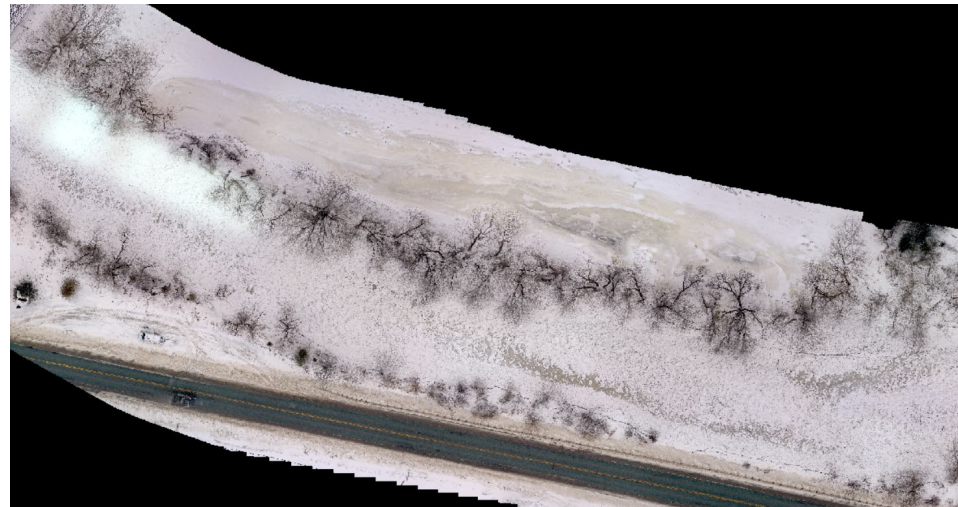
April 7, 2020



May 7, 2020

Goals for the lakes CAL/VAL

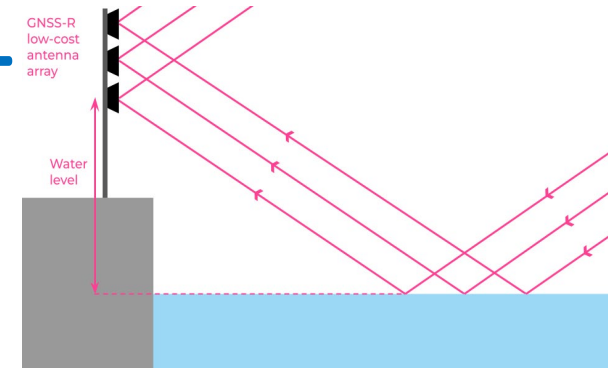
- Ice
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 - GNSS-R,
 - UAV-GPR



Goals for the lakes CAL/VAL

- Water level

- Pressure transducer (Solinst),
- GNSS-R,
- GNSS (on the shore and on boat),
- UAV-LiDAR



- Discharge

- ADCP
- Gauges



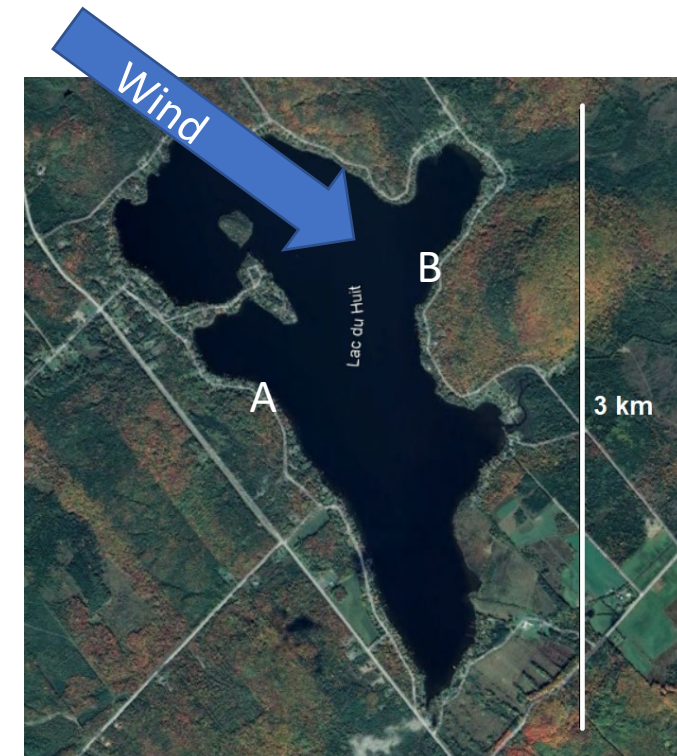
- Water extent

- Sentinel-1, 2
- Radarsat Constellation Mission (RCM),
- UAV-SfM



Goals for the lakes CAL/VAL

- Dark water :
 - Its depend on time of acquisition. Calm water is observed on lake early in the morning or late in the evening. **Need to know the time of acquisition of SWOT.**
 - Can vary a lot in the same lake depending of the direction of the wind and configuration of the lake (mountain, bays)
 - Camera (also by citizens), UAV-SfM, UAV-LiDAR, pressure transducers, RCM



Lake du Huit, 2022 June 17, pictures taken at 15 min interval