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SWOT Early observations and future plans

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INTRODUCTION

The SWOT mission is pivotal in enhancing our understanding of ice dynamics in the Nordic environment. SWOT's data is invaluable for decision-makers across various sectors in the Nordic environment (transportation, infrastructure…..).

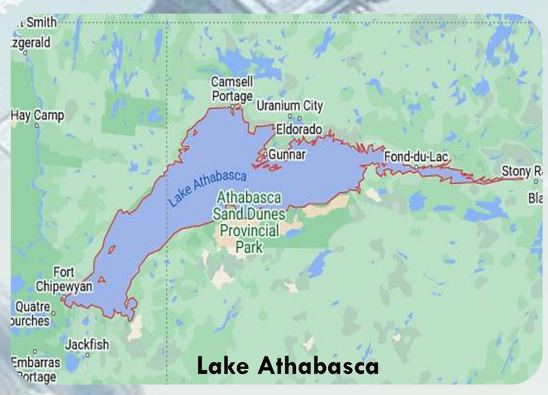
The integration of SWOT's high-resolution data with existing SAR imagery may enable a comprehensive understanding of ice and water conditions, contributing to more informed and strategic decision-making in managing and protecting Canada's Lakes and Rivers.

Environment and Climate Change Canada (ECCC) has been acquiring Synthetic Aperture Radar (SAR) imageries over key Canadian sites during the calibration and validation (rapid-repeat orbit) of SWOT between 29 March and 11 July 2023.

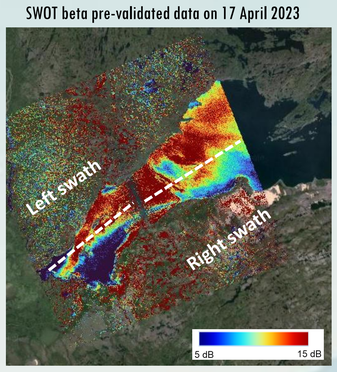
STUDY AREA & DATA

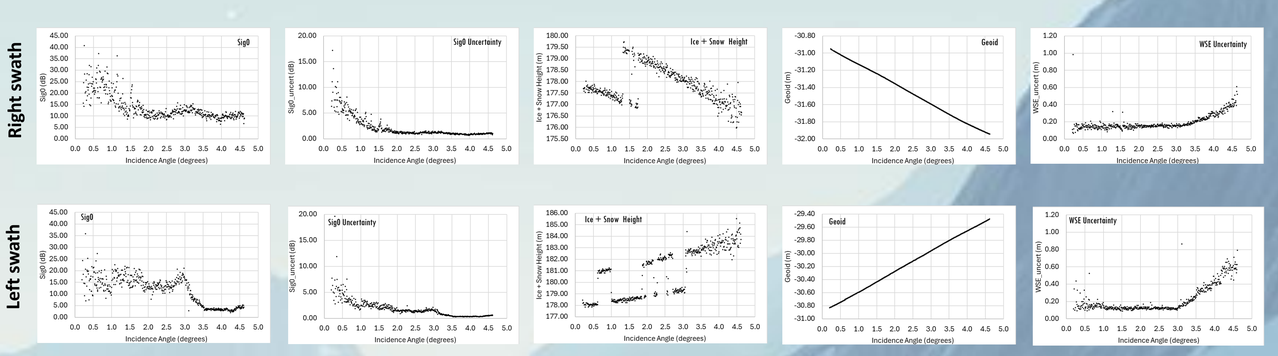
Deploy instruments/field observations – March 2023

- Water depth/level sensors (CGVD2013)
- Snow/ice surveys
- GNSS-IR
- Meteorological Towers
- GPS Ball
- Cameras



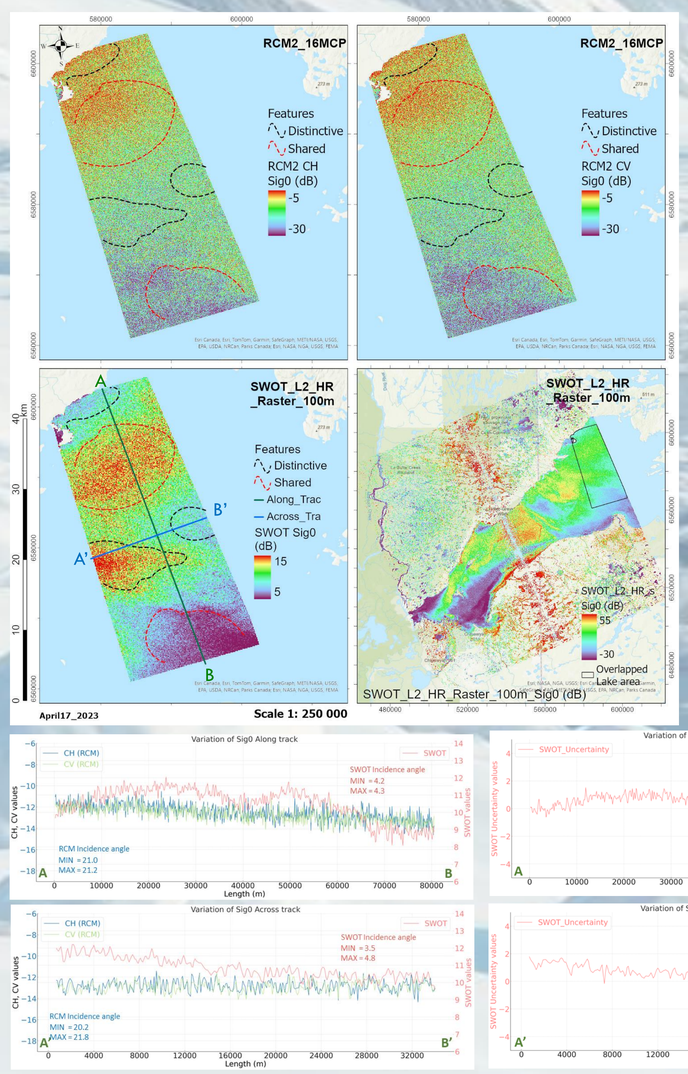
SWOT beta pre-validated data on 17 April 2023





PRELIMINARY RESULTS

SWOT and RCM backscattering comparison



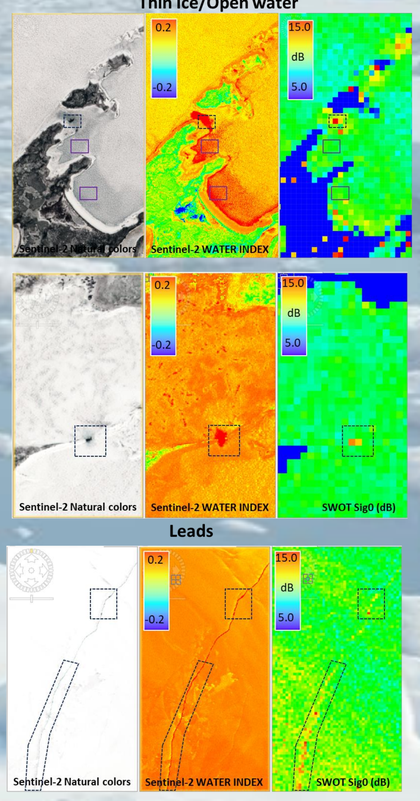
Coincident SWOT and RCM 16MCP2 on 17 April 2023 (20.18° – 23.01°).

- ❖ Similar patterns (red curves) of high and low backscattering appear in both SWOT and RCM.
- ❖ Other patterns (black curves) of high and low backscattering appear only in SWOT.
- ❖ Sig0 profiles along and across track for both SWOT and RCM (17 April 2023)

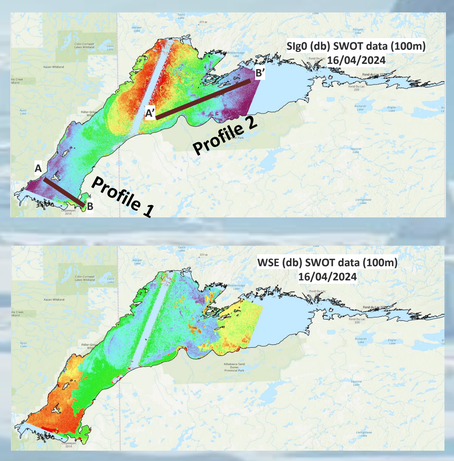
SWOT Sig0 from ice and open water

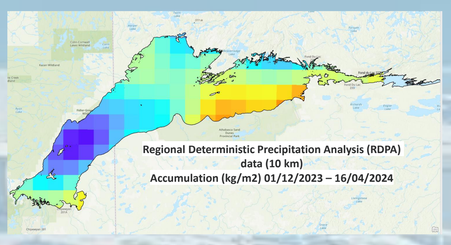
Coincident SWOT and Sentinel-2 on 16 April 2023.

- ❖ High values of the Sentinel-2 water index indicate open water areas.
- ❖ Very high SWOT returns from open water, as expected.
- ❖ High SWOT values from thin ice, as expected.

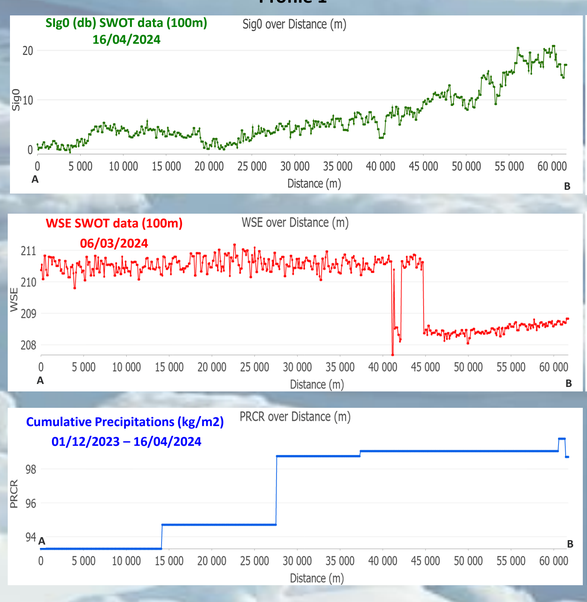


SWOT Level 2 Raster Image 100m Data Product, Version 2.0 – 2024 data

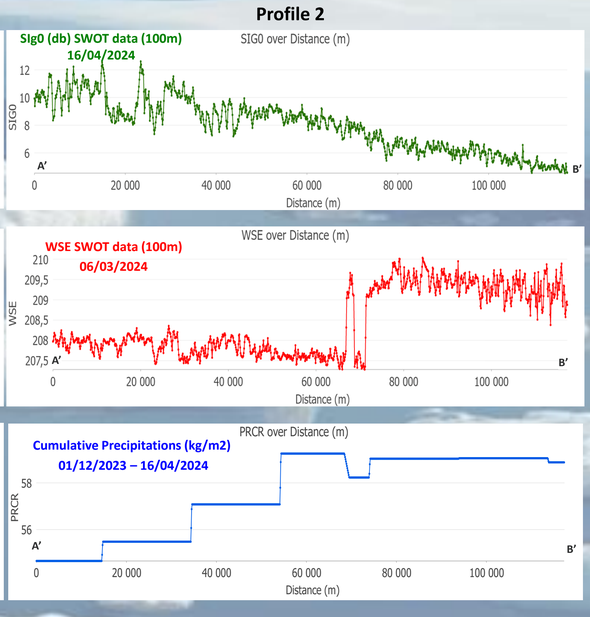




Profile 1



Profile 2



FUTURE PLANS

ice-SWOT (iSWOT) Project

Objectives:

- ❖ The influence of ice on SWOT observations in MIZs.
- ❖ SWOT capacity to measure ice elevation with and without snow cover in dry and wet ice conditions.
- ❖ The capabilities of SWOT Ka-band SAR imagery for ice characterization.

Strong science team:

- ❖ Government/public (ECCC, DRDC, UK NOC)
- ❖ Academia (INRS)
- ❖ Private (NOVELTIS Corporation, France)

ICENAV Expedition

ICENAV Expedition

- ❖ DRDC expedition in preparation (Chief scientist: Dr. José Lagunas-Morales at the Valcartier Research Center, DRDC).
- ❖ Primary objective support the safe navigation in the Canadian Arctic.

Characterise and measure several Arctic cryosphere elements.

SUMMARY

- ❖ SWOT data is promising, but uncertainties and errors are still issues.
- ❖ High uncertainties exist in SWOT sig0 for very strong returns, especially close to the nadir, as well as for weak returns (low SNR).
- ❖ A strong tendency of elevations across the SWOT track. EGM08 exhibits a tendency. Correct application of a geoid for Canada is necessary, along with accurate height cross-over correction.
- ❖ Radar backscattering from SWOT and RCM shows similarities, but also differences. These differences may indicate complementary ice/snow information. Confirmation is required once fully validated SWOT data becomes available.
- ❖ iSWOT is expected to help unlocking impacts and opportunities regarding SWOT and Ice.

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