Suspended sediment connectivity on the Mackenzie Delta: the first-order importance of channel–lake exchange

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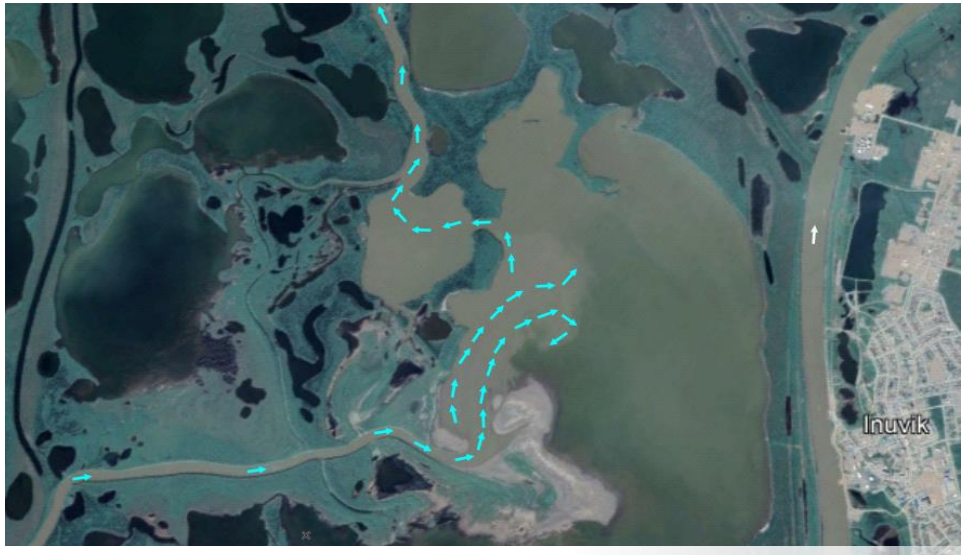
Introduction to the Project

This research project will investigate how climate change influences water and sediment flow in the Mackenzie River Delta, in relation to connectivity of channels and lakes, with the goal of preserving key transport routes for the local community for the local community and for natural environment. The results will directly benefit the Inuvialuit people by supporting their culture, economy, and environment.

This raises several fundamental questions:

- How will sediment delivery to the Beaufort Sea (Arctic Ocean) change in the future?
- How will sediments retained in the delta reshape the low-lying tundra landscape and impact the communication isolation of local communities?
- How can local communities adapt to changing environmental and hydrological conditions?

East Channel and connected lakes during summer



Big Lake in Inuvik as an example of a no-closure lake

Expected Outcomes

- **Lake-River Dynamics:** Illustrates seasonal water exchange between lakes and rivers in the Mackenzie Delta, highlighting the impact of spring thaw and summer flow patterns on sediment transport.
- **Sedimentation Challenges:** Depicts sediment build-up in river channels, emphasizing how ice breakup and permafrost thaw increase sediment loads, reducing the navigable depth and complicating water transportation.
- **Transportation Impacts:** Highlights the difficulties faced by cargo vessels due to sediment-laden channels, leading to increased maintenance costs and a shortened navigation season (June-September).

Project plan

Field data

Satellite data

Precipitation

Climatic variables

Temperature

Sediment transport patterns

Identify risk zones in ice road routes

Connectivity of channels and lakes

lakes disappearance forecast

Preserving key transport routes

the degree of transformation of the low-lying tundra landscape

Planning and maintaining waterways

Prevent Community Isolation

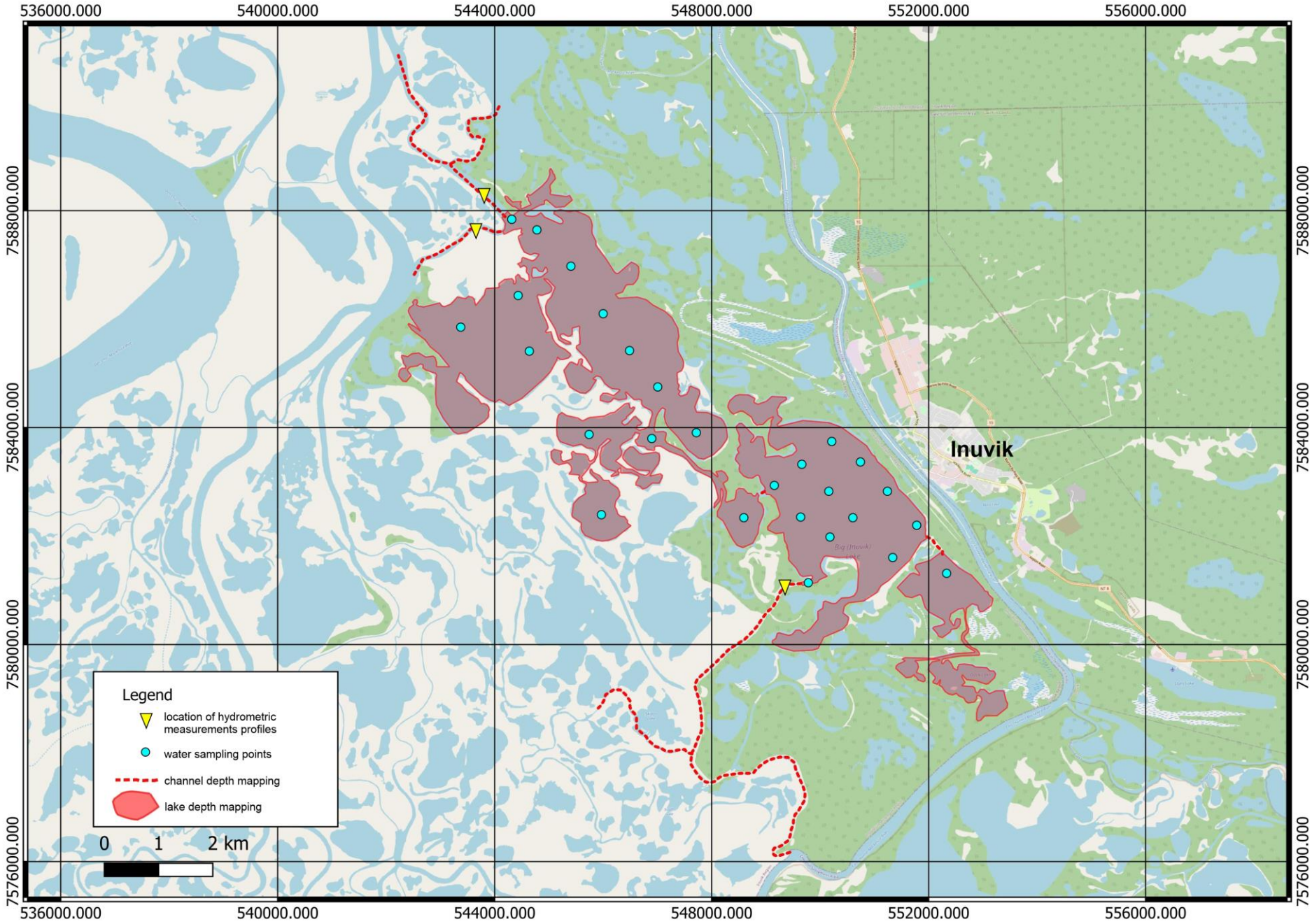
Adaptation to permafrost degradation

Stakeholder involvement

Empowering local decision making

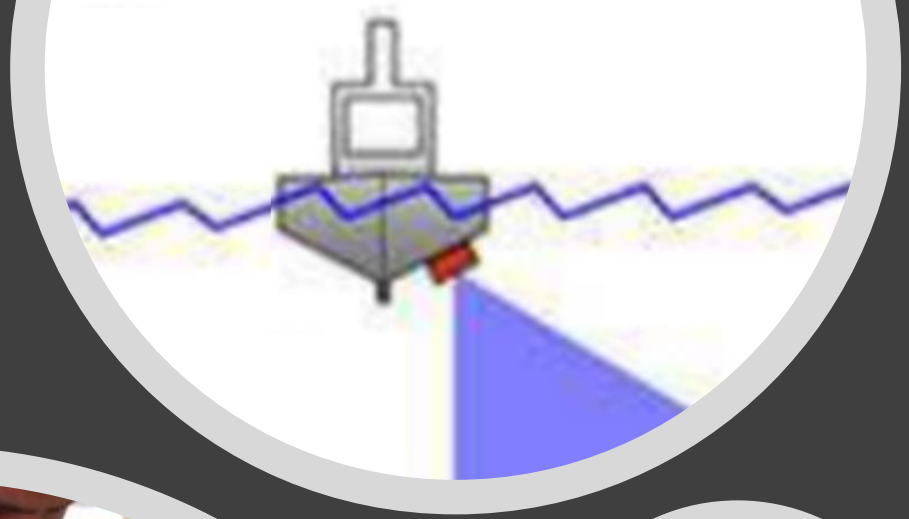
Strengthening Community Resilience

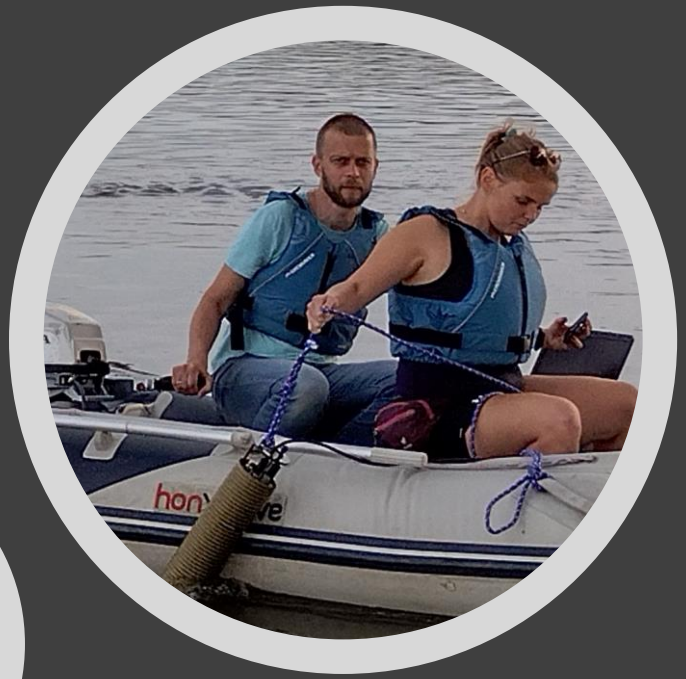
Area Selected for Project Investigation

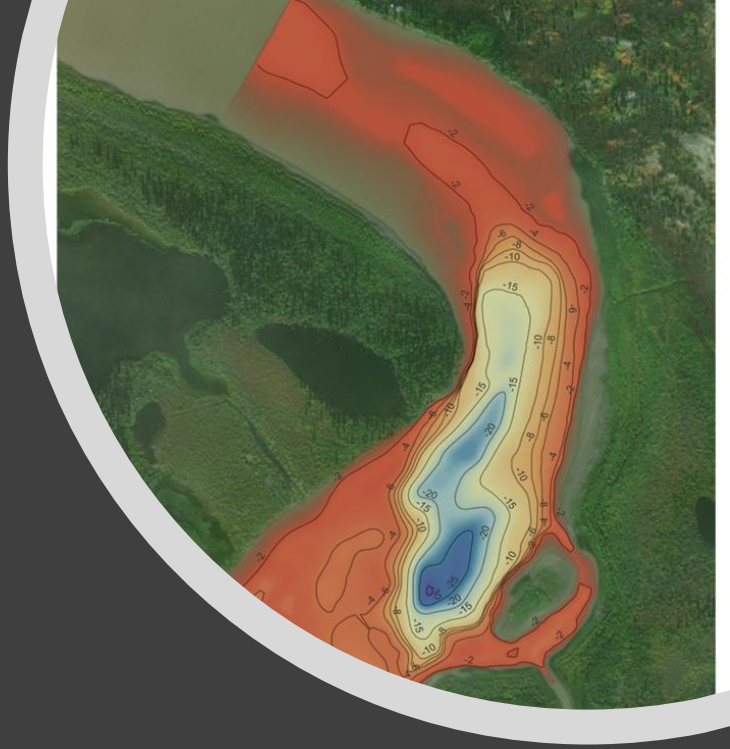


Water bodies on the Mackenzie River Delta (Canada,NWT), including:

1. Connected lakes west of Inuvik, including Big Lake.
2. Distributary channels: Kalinek Channel, Middle Channel, and East Channel







Field Investigations

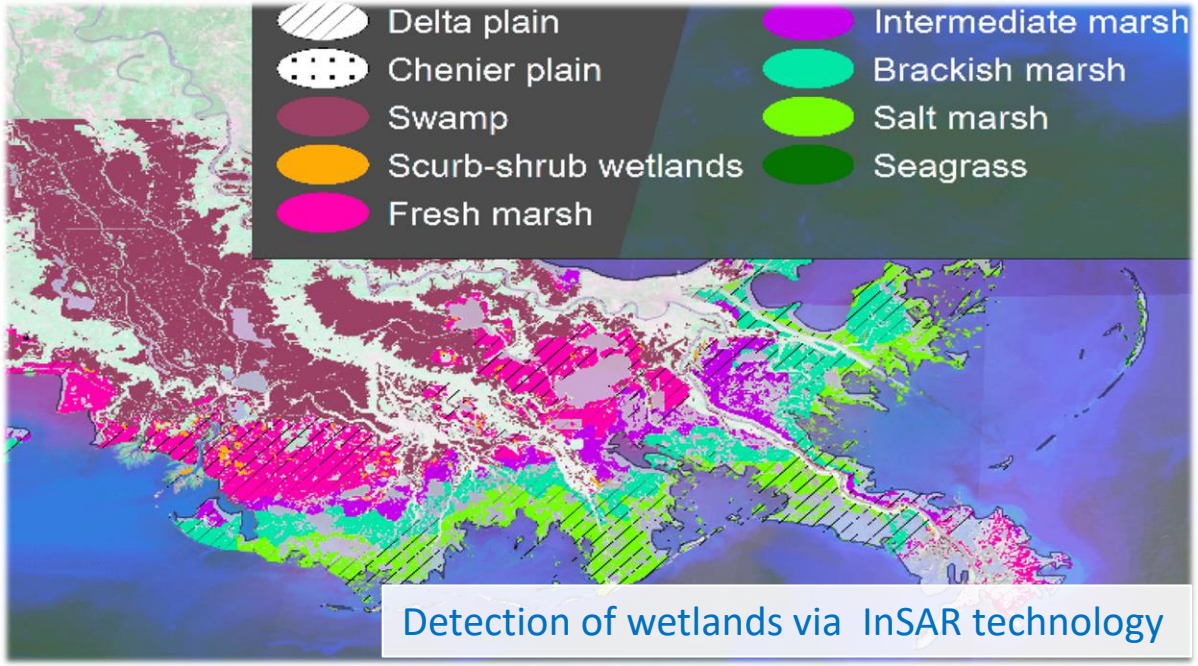
<u>Sample Collection.:</u>Collection of water and sediment samples from various depths in channels and lakes.

<u>On-Water Measurements:</u>

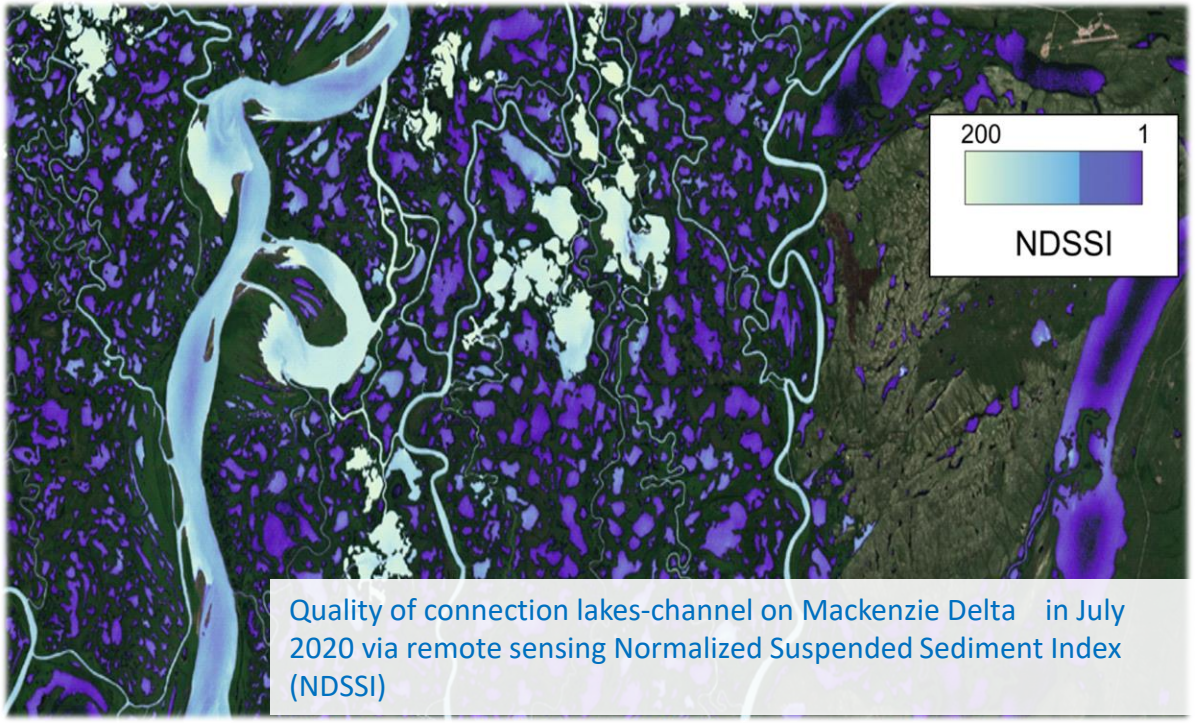
- Suspended fine sediment concentration using a laser sensor.
- Acoustic scanning of channel and lake beds using an echo sounder.
- Water flow velocity measured with an Acoustic Doppler Current Profiler (ADCP) measured from a boat.
- Geodetic water surface elevation measurements using GNSS equipment (all measurements from a boat).

Remote Sensing Investigations

It is planned to implement satellite technology to generate high-resolution images of hydrological connectivity in the Mackenzie Delta ecosystems



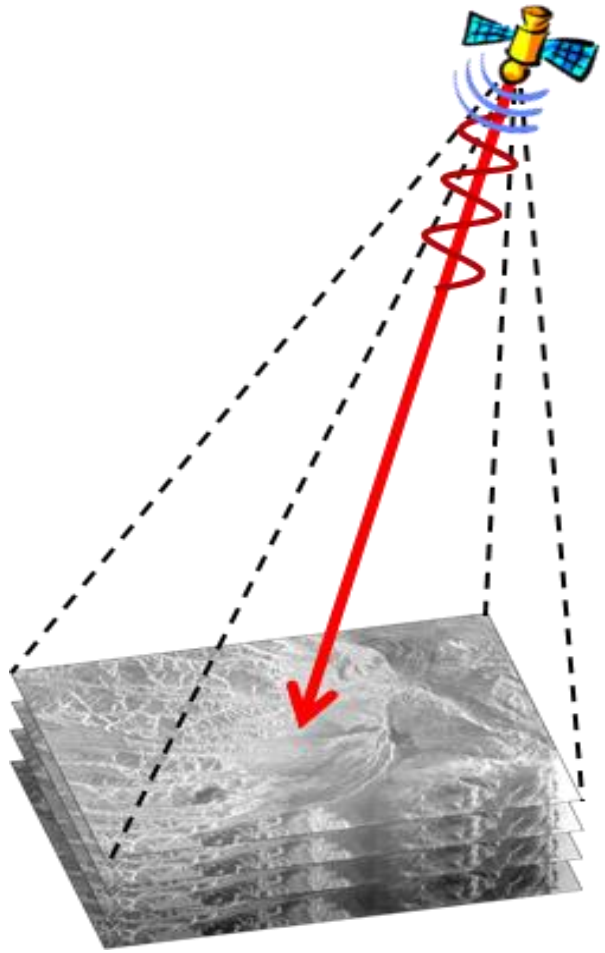
Detection of wetlands via InSAR technology



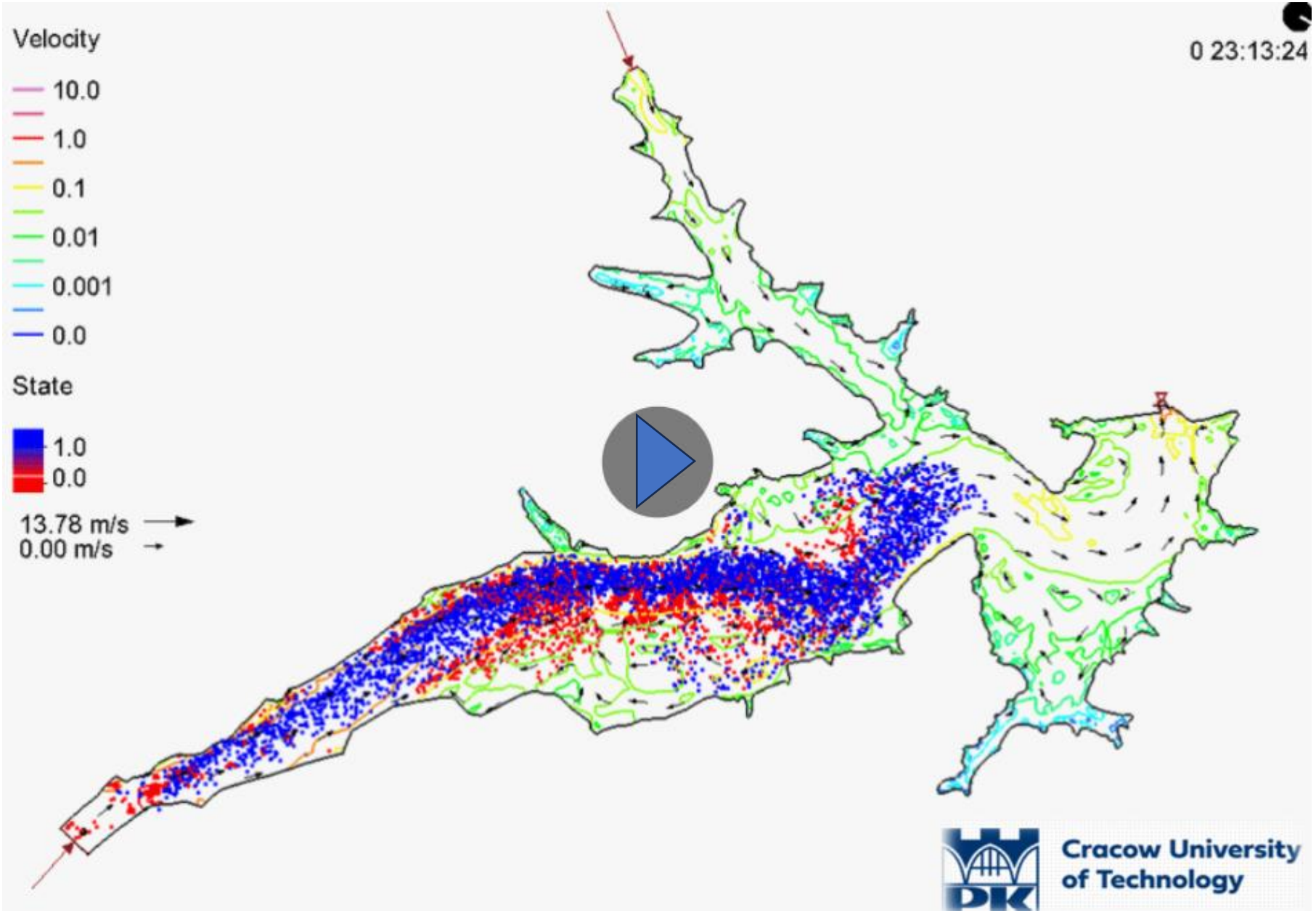
Quality of connection lakes-channel on Mackenzie Delta in July 2020 via remote sensing Normalized Suspended Sediment Index (NDSSI)

SARscape®
The Earth Observation information gateway

We will help understand the impact of climate change on sediment dynamics in the channel–lake network by examining how permafrost thaw and changes in hydrodynamics influence sediment transport, including sediment retention



Hydraulic Modelling Of Sediment Transport



Sediment Particle Tracking Model

Sediment Particle Tracking Model Framework is to be adapted for the Big Lakes and other connected lakes of Inuvik

Link to the Video

https://youtu.be/jBTjc3of1TU

Objectives of The Project

- **Protect Transportation and Navigation Routes** – Identify and monitor changes in sediment accumulation and water flow to ensure continued access to supplies and essential services along key barge and ice road routes.
- **Prevent Community Isolation** – Map zones at risk of disconnection from shallow channels and lakes, to assist local communities in planning navigable safer routes.
- **Support Sustainable Resource Management** – Provide clear insights on sediment transport patterns to help local stakeholders and decision-makers manage land and water resources effectively and prevent long-term impacts on the delta.
- **Preserve Inuvialuit Culture and Economy** – Ensure continued access to traditional waterways that are essential for hunting, trapping, fishing, and trade, supporting local livelihoods and cultural heritage.

Anticipated benefits from this Project

Securing Waterway Access

- Strategies for maintaining navigable channels can mitigate supply shortages and better connect local communities.
- Ensuring year-round mobility for communities to access essential goods and services despite environmental changes.

Strengthening Community Resilience

- Provision of scientific solutions for adapting to permafrost degradation due to climate change, which is hampering community mobilization.
- Solutions will be provided through designated communication plan invoving transparency, engagement, and collaboration with stakeholders and local communities

Empowering Local Decision-Making

- Provision of valuable data for planning and maintaining waterways, thus optimizing resource allocation and enabling informed decision-making.
- Training sessions will be provided to the Inuvialuit community members on interpreting the data, which will be made available on a dedicated website to ensure easy access.

Impact Of The Results On The Local Community

- Better understanding of Sedimentation issues which finally impact on water transportation during the period when road transportation becomes blocked.
- Awareness will be raised within the Inuvialuit community regarding hydrological risks that could limit access to waterways and lakes in the Mackenzie Delta.
- Practical research results will be provided to benefit the community in the form of better preparedness for potential environmental changes.

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INFORMATION

About project

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Click on me to get the website link to get all the details *or* *Scan Me*

Research Team

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Thanks for your attention !

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