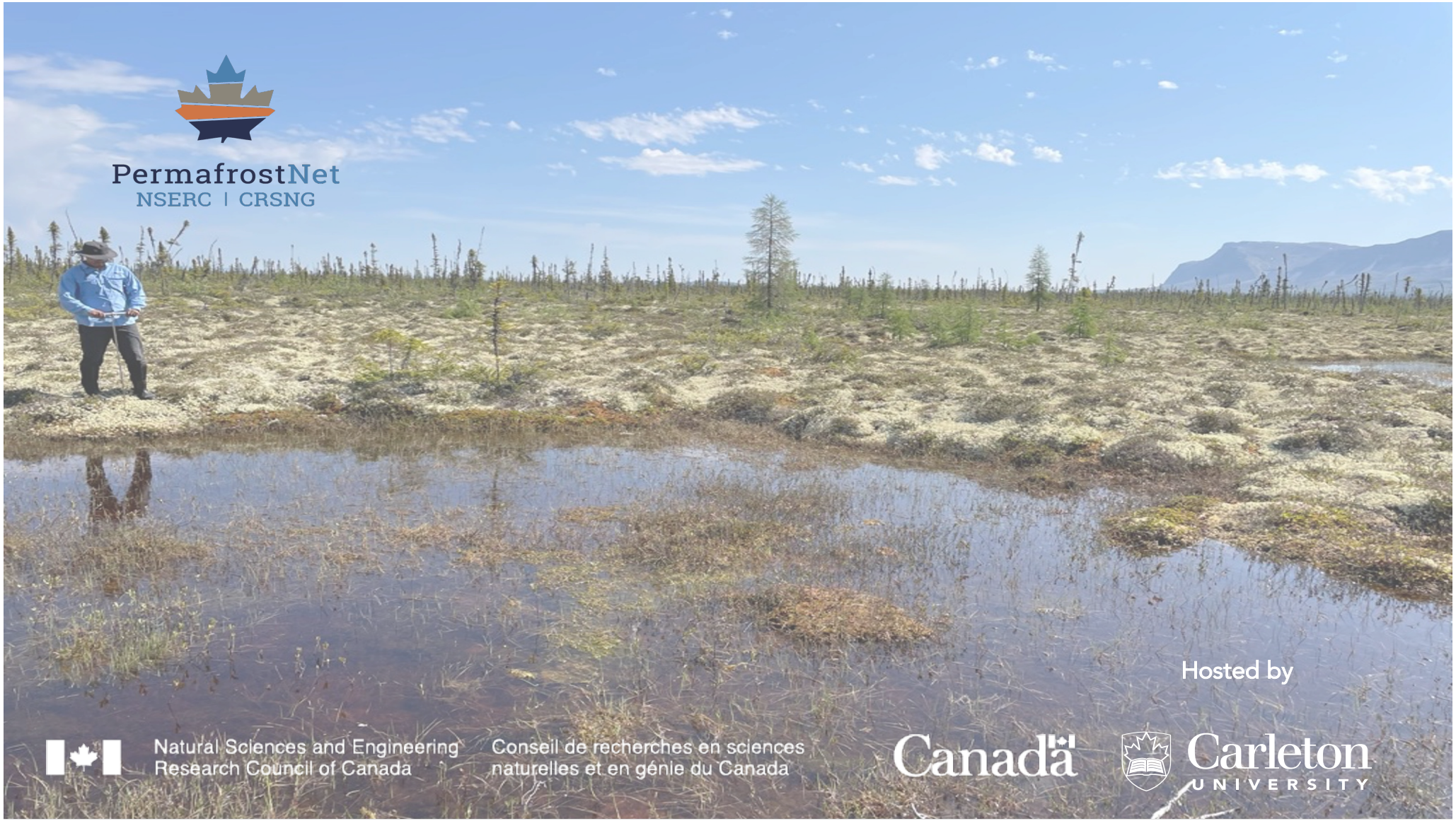


PermafrostNet AGM
Tree of Peace Friendship Centre, Yellowknife

We acknowledge that we are located in Chief Drygeese territory, the traditional land of the Yellowknives Dene First Nation. We respect the histories, languages, and cultures of all other Indigenous Peoples including the North Slave Métis, and all First Nations, Métis, and Inuit whose presence continues to enrich our community and partnerships.

Themes

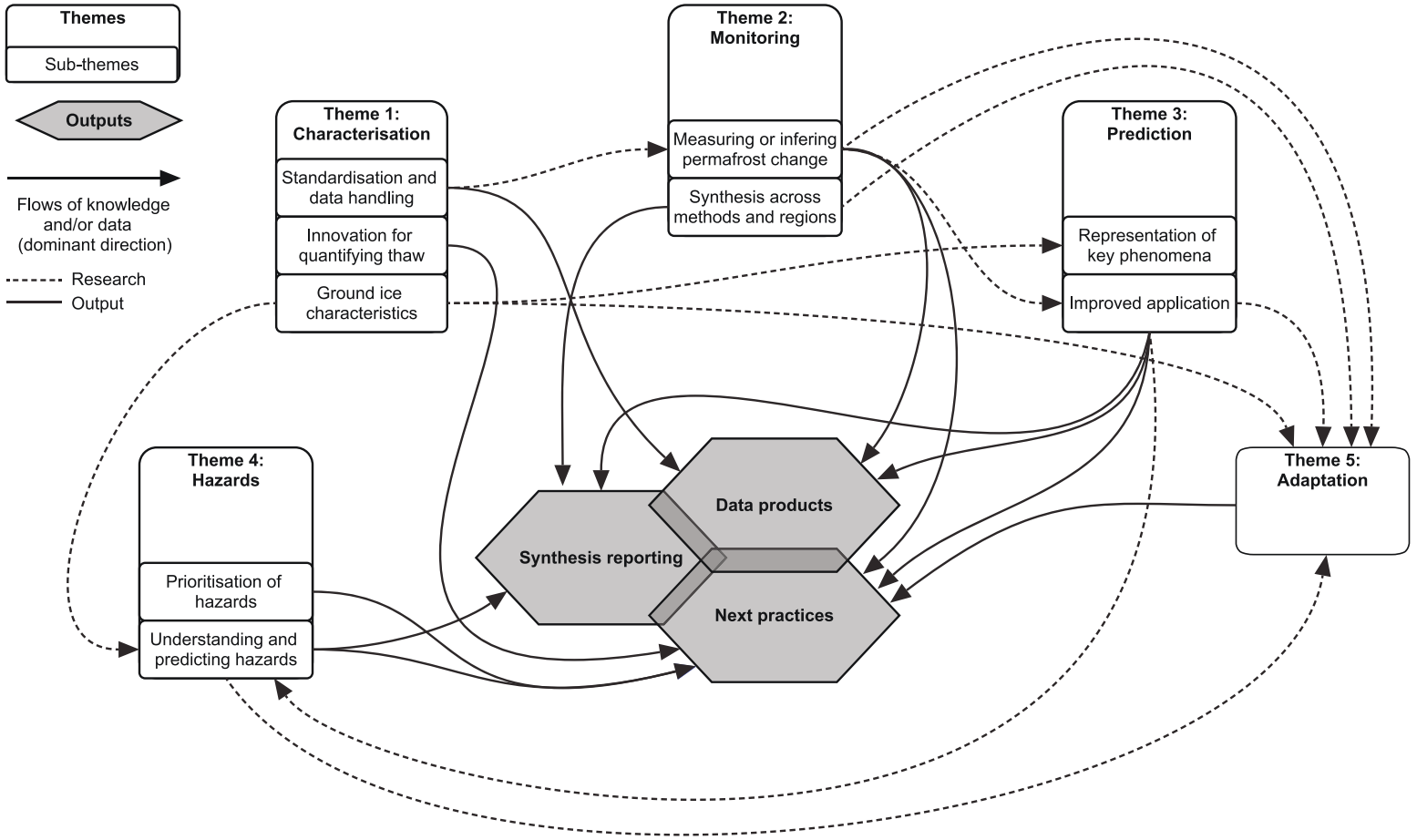
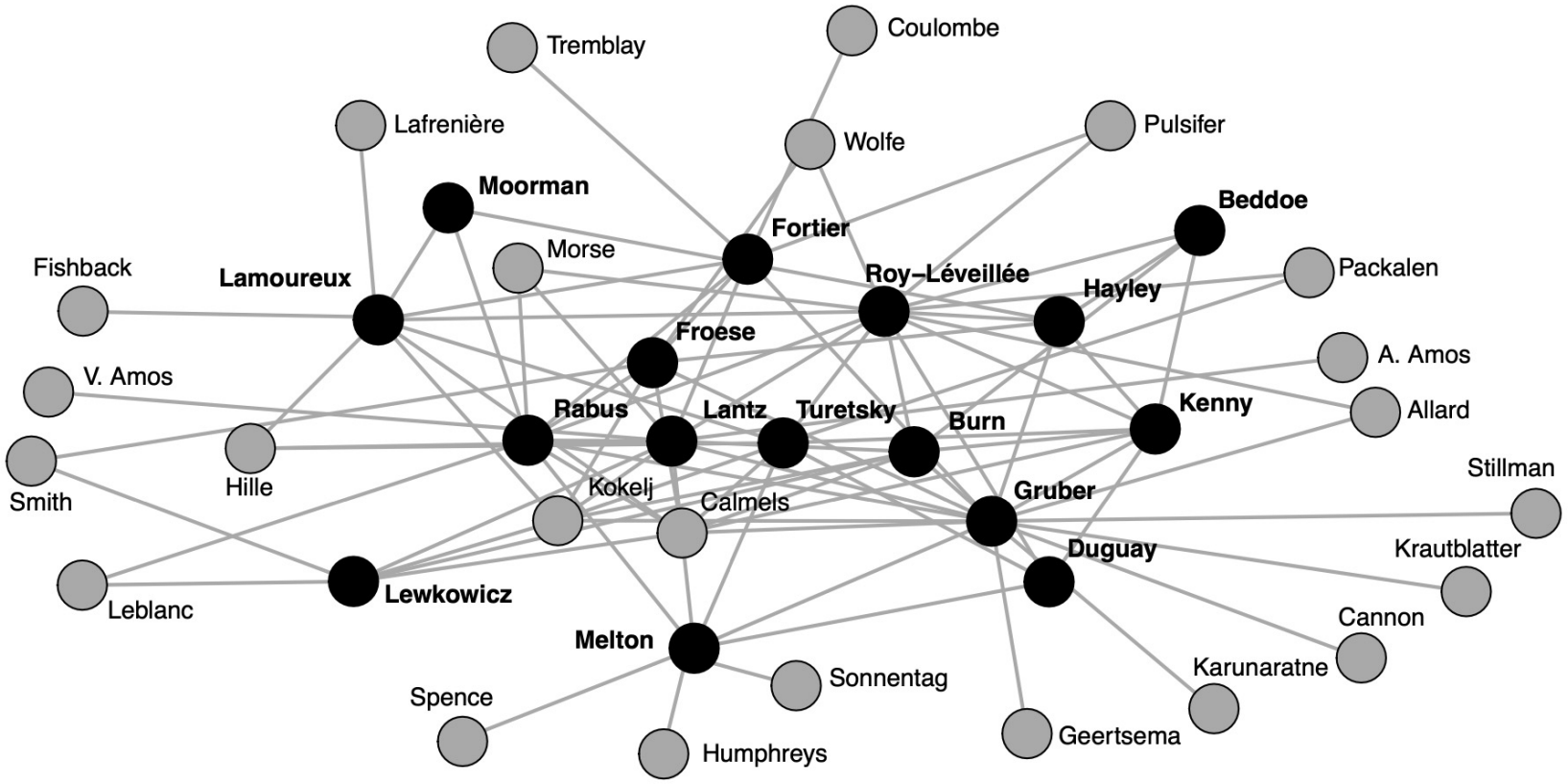


Figure 3. Network themes and their contribution to outputs. Arrows show the predominant direction in which data or knowledge flow but naturally represent interactions that imply learning on both sides. The linkages between individual HQP projects are described later in the proposal.

Network Investigators and Partners



Network Outputs and Outcomes

- **Data Products–** *PINGO database, Regional compilations, Ground Ice Potential maps, Community*
- **Next Practices**
- **Synthesis reporting-** Observed and anticipated permafrost change

- **Next generation science and engineering**
- **Partnerships**

AGM 2022 Program

- **Vision and Strategy–** *David Moore GNWT and Stephan Gruber PermafrostNet*
- **Knowledge co-production and Partnerships–** *Kumari Karunaratne and Steve Kokelj NTGS*
- **Theme Updates**
  - *Breakout discussions focusing on progress and timelines, data sharing, linkages between themes*
- **Syntheses and Next Steps**

Ice rich permafrost, central Mackenzie valley

Theme 1: Permafrost characterization and ground ice potential

PermafrostNet 2022 AGM

Yellowknife, NWT

November 14, 2022

Theme 1: Characterization of permafrost.

Objective:

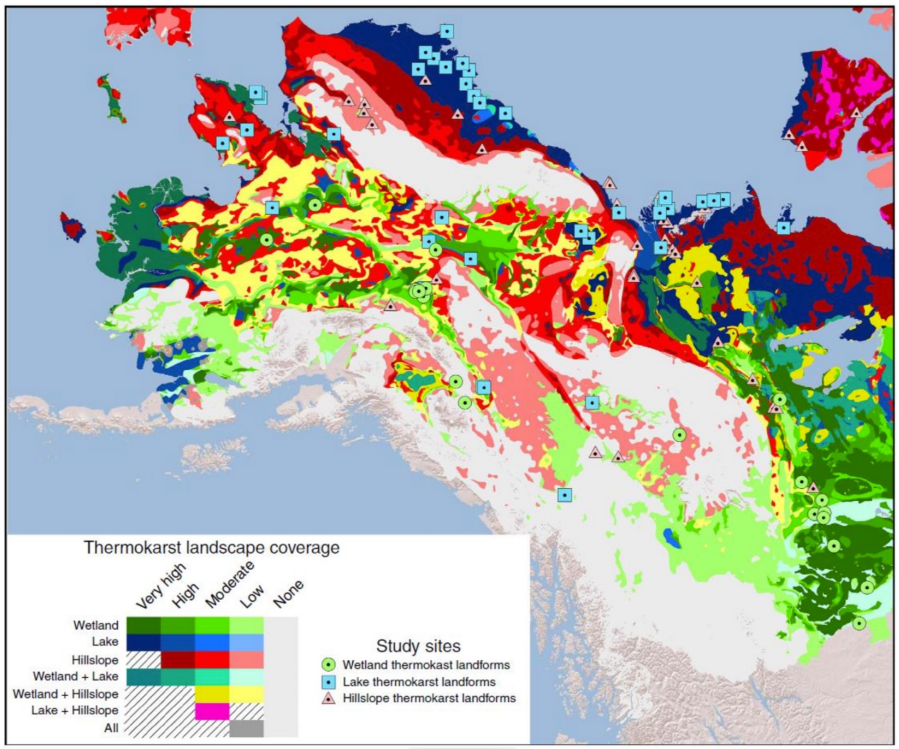
To improve the understanding of ground-ice loss and its consequences though better ***characterization of permafrost*** *in the* ***field*** *and in* ***laboratories*** *so that* ***prediction*** *can better represent* ***processes during thaw*** *and have relevant subsurface input such as* ***ground-ice content****.*

Develop the databases, field and laboratory data, to develop and test the GRIP (Ground Ice Potential and Geotechnical permafrost base map)

PermafrostNet
NSERC | CRSNG

Specific objectives:

1. Develop and implement a system for handling permafrost data *that can support prediction, evaluation of prediction and analysis of permafrost change* (PINGO)– the database and field data
2. Evaluate and apply methods to predict and measure thermal, hydrologic geochemical and geomechanical behaviour of frozen soil during thaw to support improved simulation
3. Develop a framework for the spatial and stratigraphic syntheses of geotechnical and geological data to *support the ground ice map products*



Olefeldt et al. 2017

Projects– 6 co-investigators

***Proposed*:**

3 PDF

6 PhD

2 MSc

Filled

2 PDF 1 Currently unfilled

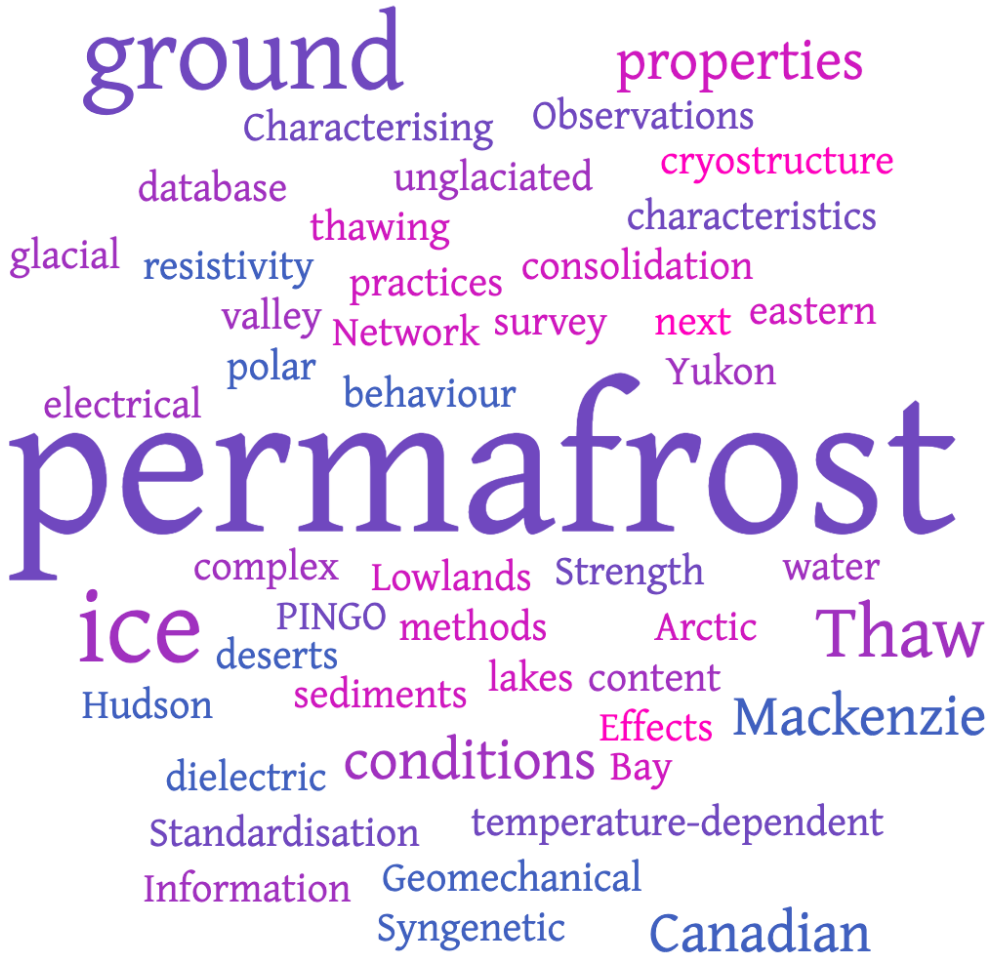
4 PhD

2MSc→ Both converted to PhD

Present

2 PDF

6 PhD



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Co-investigators

Daniel Fortier (Montreal)
co-lead Theme 1
PDF1, PhD6

Duane Froese (Alberta)
co-lead Theme 1
PDF2, PhD1, PhD5, MSc2

Jocelyn Hayley (Calgary)
co-lead Theme 1
PhD3, MSc1

Pascale Roy-Léveillée
(Laval)
PhD4

Toni Lewkowicz
(Ottawa)
PDF3

Stephan Gruber
PhD2

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Partners

Steve Kokelj
NTGS
Yellowknife

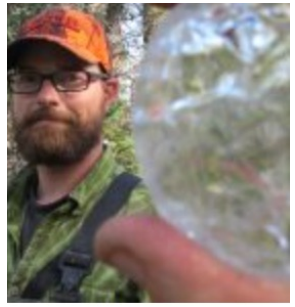
Stephen Wolfe,
GSC Ottawa

Sharon Smith
GSC Ottawa

Fabrice Calmels
Yukon University

Ashley Rudy
NTGS
Yellowknife

Brendan O'Neill
GSC Ottawa

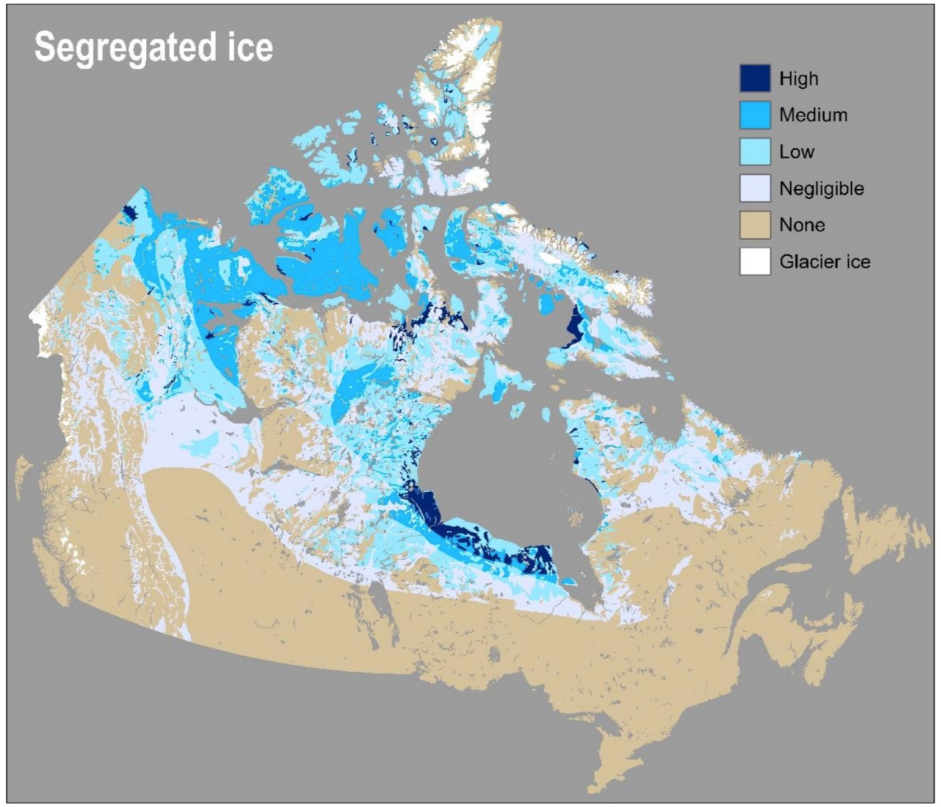


Peter Morse
GSC Ottawa

Chris
Stevens
SRK/Indepen
dent

Progress

1. PINGO Database structure, fields draft complete
   - *Michel Paquette, Samuel Gagnon, Nick Brown*
2. Ground Ice Map of Canada
   - Databases– Yukon, Mackenzie Valley, Inuvik-Tuk, Nunavik
   - Abundance of GWC (50,000+)
   - Some paired VIC-GWC (300-400) Challenges of getting to excess ice
3. Regional studies
   - Hudson Bay Lowlands– **Tabitha Rahman**
   - Mackenzie valley corridor- **Alexandre Chiasson**
   - Mackenzie Mountains and subarctic hillslopes and landslides- **Joe Young**
   - Polar Desert- ***Withdrew***



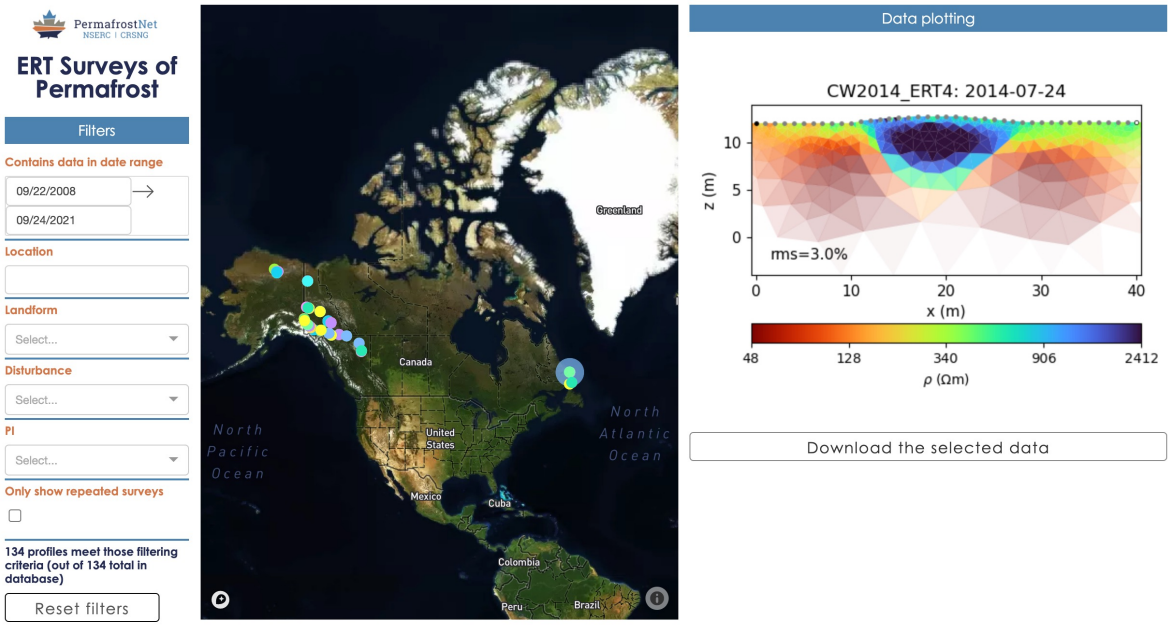
O'Neill et al. 2018

Progress– Next practices

4. Permafrost characterization
   - Non-destructive and digital archives
     - Computed tomography- *Mahya Roustaei and Joel Pumple*
     - Multi-sensor core logging- *Joel Pumple, Mahya Roustaei PACS Lab*
   - Dielectric methods -- *Hosein Fereydooni Started 2022*
   - Geomechanical properties– *Khatereh Roghangar and Zakieh Mohammadi*
5. Electrical resistivity *Teddi Herring*

Teddi Herring, PDF: Electrical resistivity best practices

Coded an interface to query and plot surveys



Established standards

- Metadata fields
- Data processing
- Database architecture
- Data policy

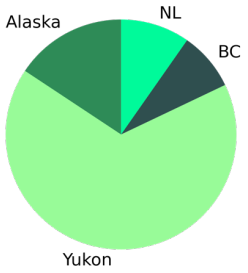
Created a website

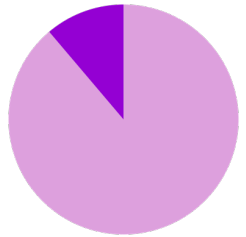
- Map of surveys
- Data processing info
- How to contribute data

data.permafrostnet.ca/cpers

Populating the database

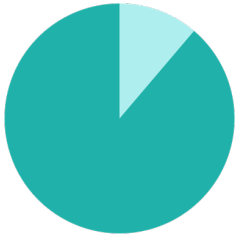
134 unique profiles





15 (11%)
are monitoring profiles

205 surveys



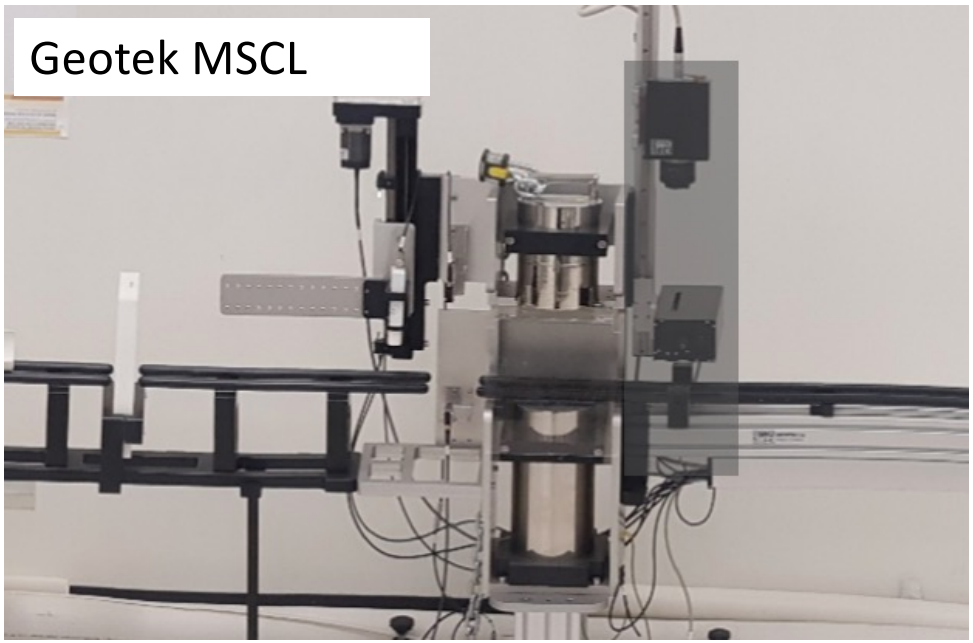
182 (89%)
include raw data

86 (42%)
are repeated surveys

Mahya Roustaei and Joel Pumple Theme 1 CT and MSCL

Non-destructive methods – Industrial Ct Scanner- (VIC, EIC, ρ, ρ_s)

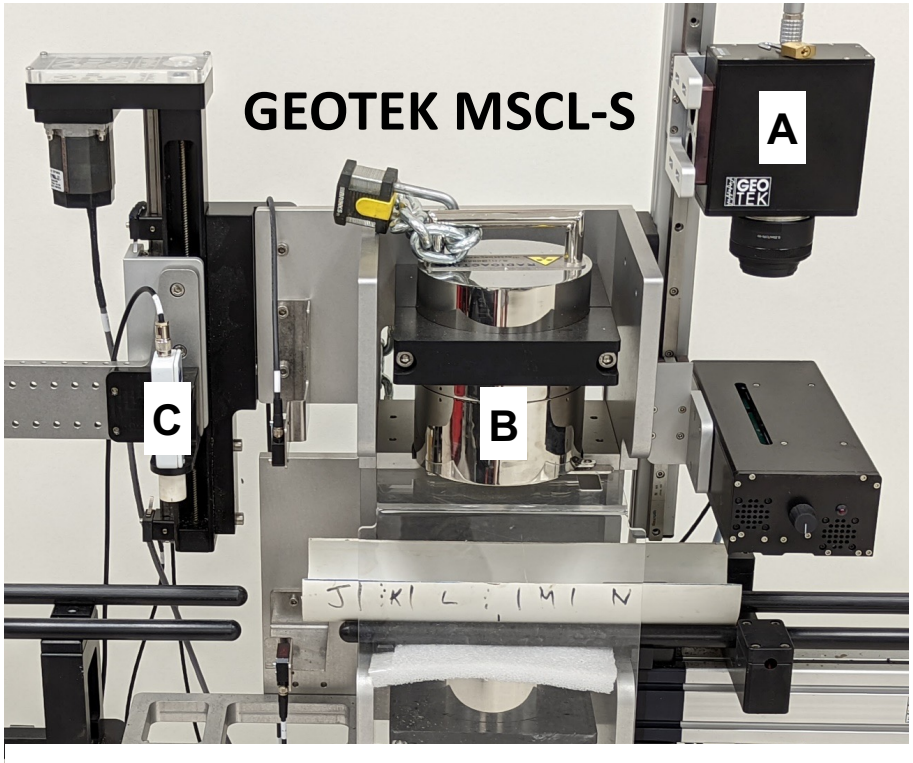
- Superior x-ray penetration (225 kv peak voltage)
- Better resolution (10 cm core ~60 um pixel size)



- Collects multiple rapid non-destructive data
- High resolution core images
- Bulk density (137 Cs gamma source)
- Magnetics
- Legacy Permafrost data

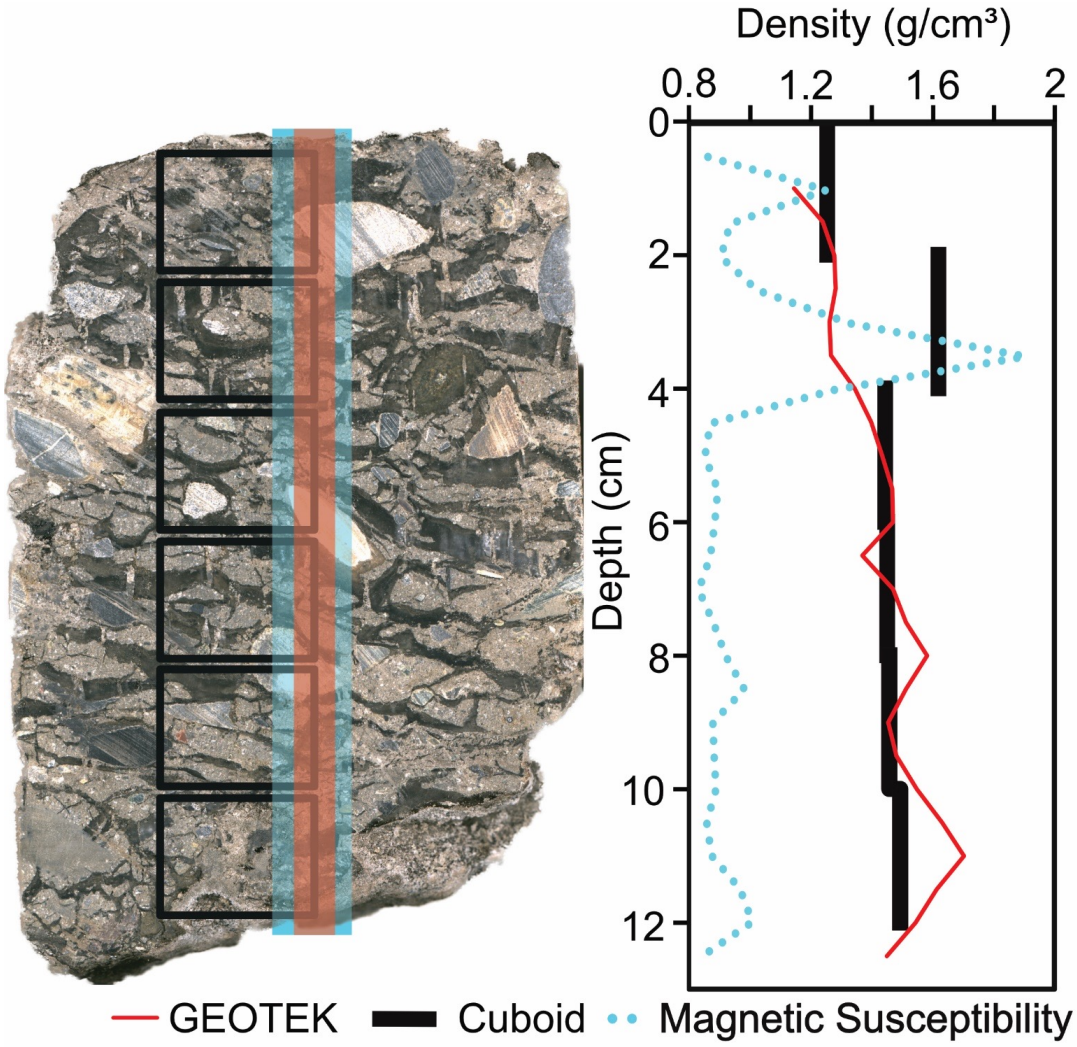
Mahya Roustaei and Joel Pumple Theme 1 CT and MSCL

Non-destructive methods – GEOTEK (visible ice and ρ)



Multiple rapid non-destructive results

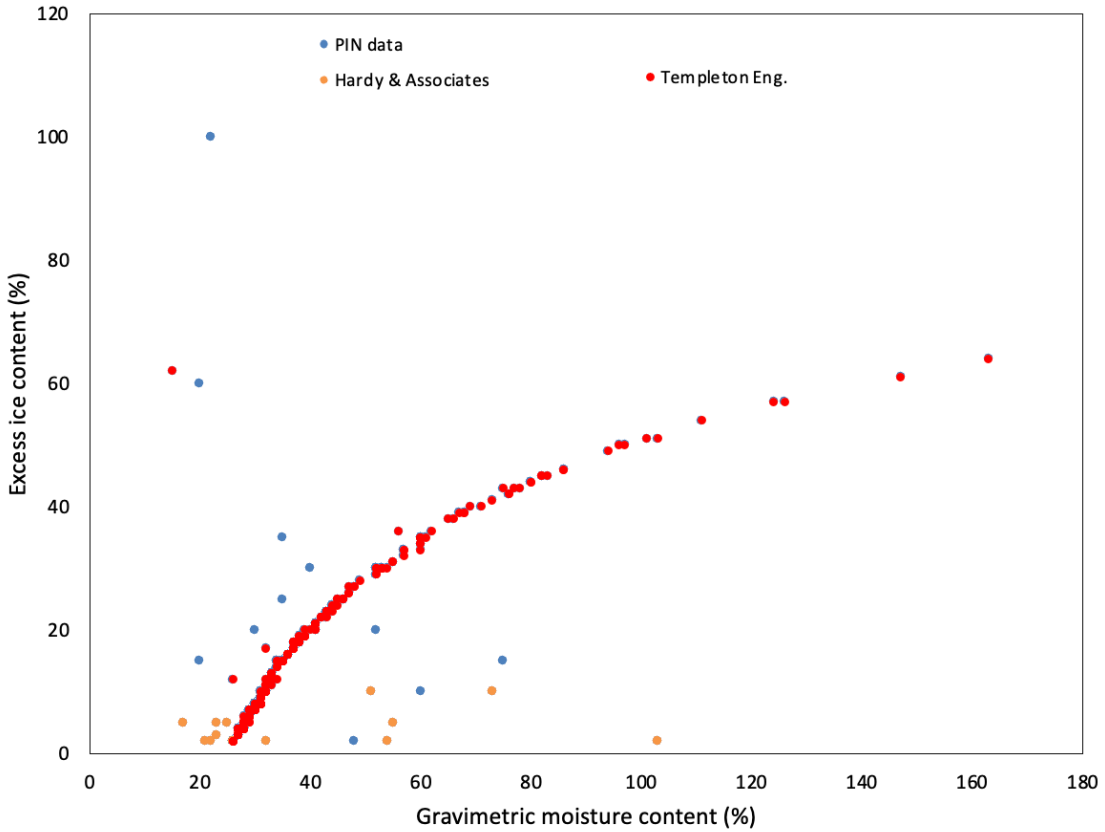
- **A** High resolution core images
- **B** Bulk density (137Cs gamma source)
- **C** Magnetics

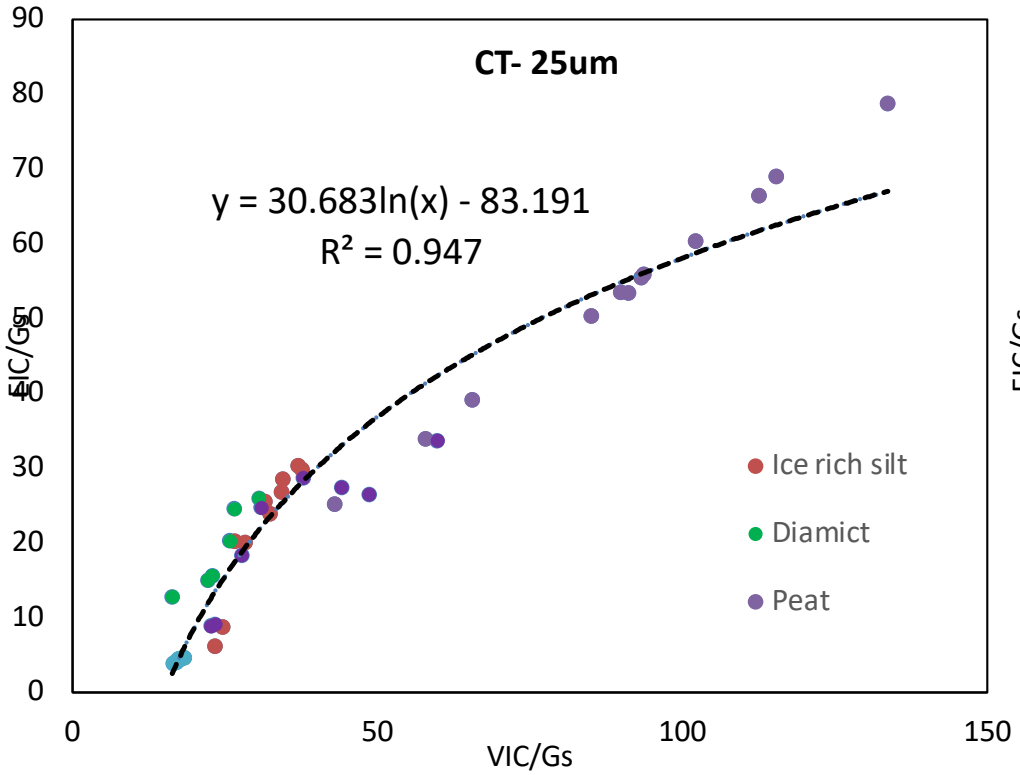


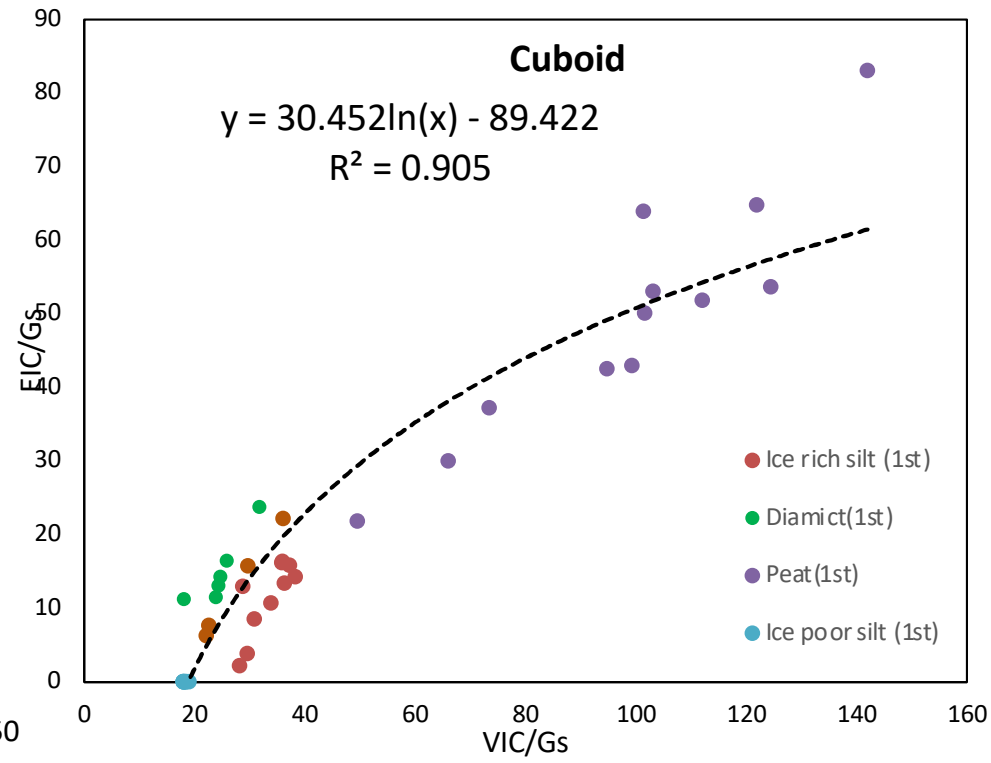
Ground ice database– progress

1. Databases– Yukon, Mackenzie Valley, ITH, Nunavik
   - Abundance of GWC. (50,000+)
   - Some paired VIC-GWC (350 or so)
     - Challenges of getting to volumetric ice content and excess ice

1. New analyses from Multi Sensor Core Logging and CT to develop high quality relations between GWC and VIC and EIC



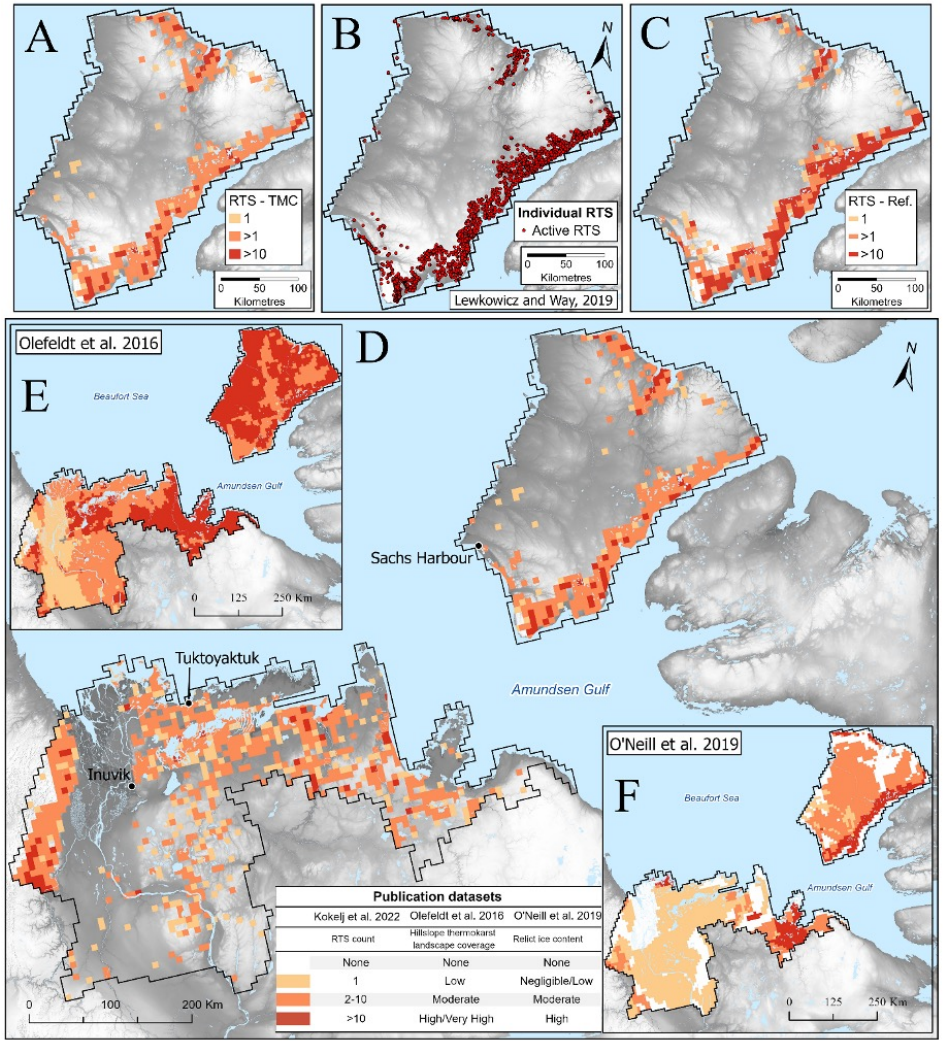

CT- 25um
y = 30.683ln(x) - 83.191
R² = 0.947
EIC/Gs
VIC/Gs
Ice rich silt
Diamict
Peat
0
10
20
30
40
50
60
70
80
90
0
50
100
150


Cuboid
y = 30.452ln(x) - 89.422
R² = 0.905
EIC/Gs
VIC/Gs
Ice rich silt (1st)
Diamict(1st)
Peat(1st)
Ice poor silt (1st)
0
10
20
30
40
50
60
70
80
90
0
20
40
60
80
100
120
140
160

Partnerships

- NWT Geological Survey– Thermokarst Collective Mapping Synthesis papers
  - Kokelj and Rudy led papers forthcoming engaged several network investigators and graduate students-

- Geological Survey of Canada
  - Wolfe and O'Neill engaged with network investigators and graduate students– Canadian thermokarst database and MS for the last 16,000 years



Training and Progress

- Student projects proceeding well and training aspects are being met or exceeded

- Ground Ice Map– Progressing well in terms of testing and modifying heuristics

- Area of greatest concern for Theme 1 given loss of PDF 1 and converting database to useable ground ice measurements to populate Ground Ice Potential and derivative map outputs

Output timelines

- Ground ice maps synthesis paper 2023 *All ground ice maps are wrong…*
- Regional tests to be complete in early 2023 *Improving O'Neill et al. maps*
- Ground ice map with vertical ice contents mid 2023