



PermafrostNet
NSERC | CRSNG

Creating a database of geoelectrical surveys of permafrost to assess changing permafrost conditions in Northern Canada

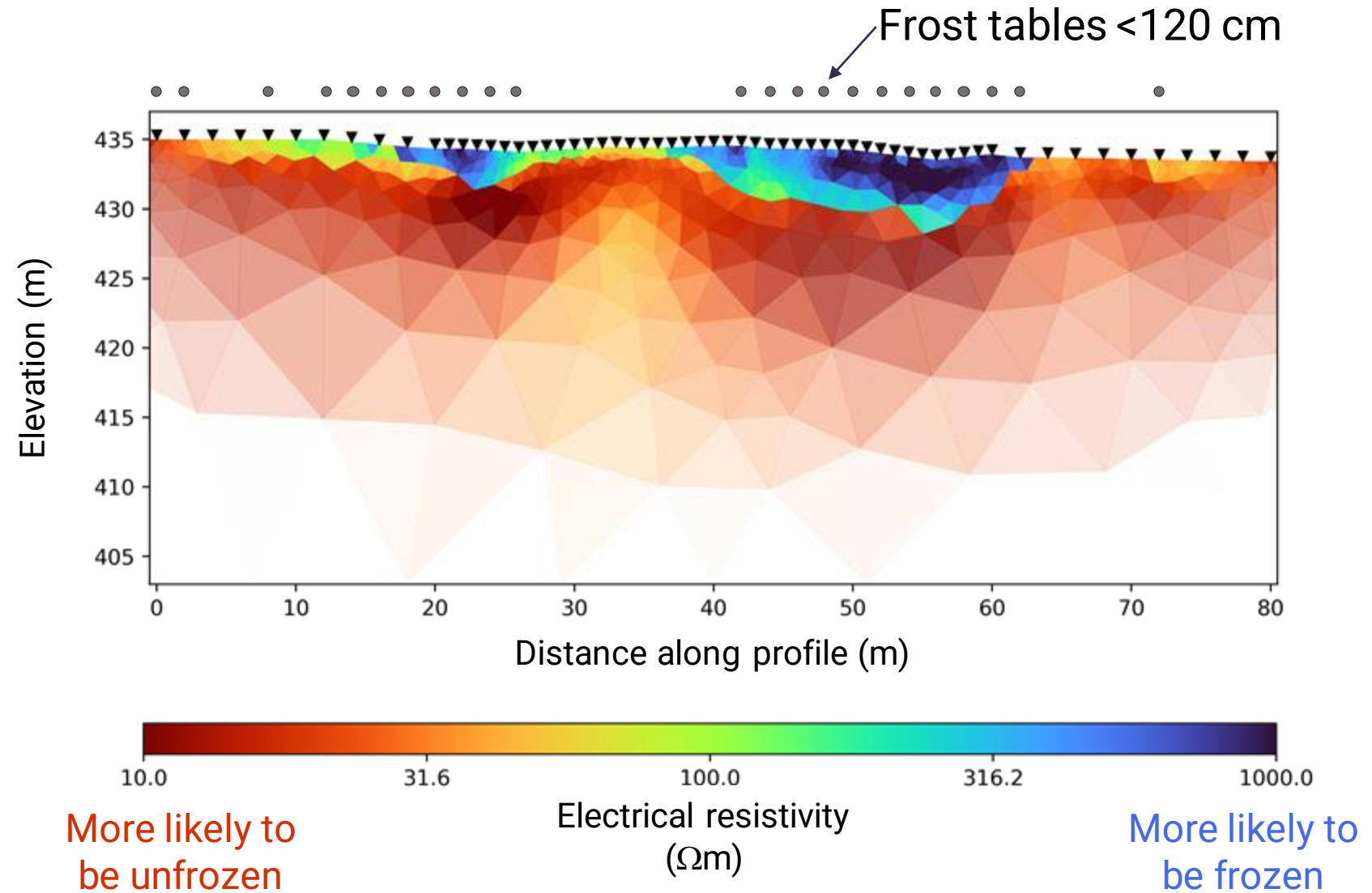
Teddi Herring & Antoni Lewkowicz
University of Ottawa

Introduction



- Teddi Herring (she/her)
- PhD in geophysics from the University of Calgary
- Expertise: electrical resistivity tomography (ERT)
- Currently a postdoc with NSERC PermafrostNet
- Project: creating a database to store ERT surveys of permafrost

Electrical resistivity tomography (ERT)



The need for a database



Data submission



IPA Action Group: towards an international database of geoelectrical surveys of permafrost

Metadata

A		G	
1	IDGSP Meta Data - CANADA V10		
2			
3	necessary field		
4	optional field		
5			
6	Site characteristics		
7	Site name		School
8	Site unique ID (3 digits)		D05
9	Country code		CA - Canada
10	Province/territory		YT - Yukon
11	Municipality (optional)		Dawson
12	Project1		Dawson Climate Change Hazards
13	Authorship list for project		A. Lewkowicz and A. Bevington
14	Project2 (optional)		
15	Publication1 (optional)		andscape hazards: Geoscience mapping for clir
16	Publication2 (optional)		
17	How many boreholes exist at the site? If borehole(s) present, fill out "Borehole Info" sheet.		0
18	Additional data collected at the site (optional)		Surface cover
19			
20	PI information (responsible person)		
21	PI Last name		Lewkowicz
22	PI First name		Antoni
23	PI institution		University of Ottawa
24	PI email		alewkowi@uottawa.ca
25			
26	Profile characteristics		
27	Survey type		2D ERT
28	Profile name (your original profile name)		School
29	Profile unique ID (3 digits)		L01
30	Profile position relative to the landform		
31	Number of electrodes		41
32	Minimum electrode spacing [m]		2
33	Main landform class		Flat terrain (undifferentiated)

ERT measurements

#	a	b	m	n	r
1		37		13	25
2		38		14	26
3		39		15	27
4		40		16	28
5		41		17	29
1		31		11	21
2		32		12	22
3		33		13	23
4		34		14	24
5		35		15	25
6		36		16	26
7		37		17	27
8		38		18	28
9		39		19	29
10		40		20	30
11		41		21	31
1		25		9	17
2		26		10	18
3		27		11	19
4		28		12	20
5		29		13	21
6		30		14	22
7		31		15	23
8		32		16	24
9		33		17	25
10		34		18	26
11		35		19	27
12		36		20	28

Topography

#	x	y	z
0		320	0
2		320	0
4		320	0
6		320	0
8		320	0
10		320	0
12		320	0
14		320	0
16		320	0
18		320	0
20		320	0
22		320	0
24		320	0
26		320	0
28		320	0
30		320	0
32		320	0
34		320	0
36		320	0

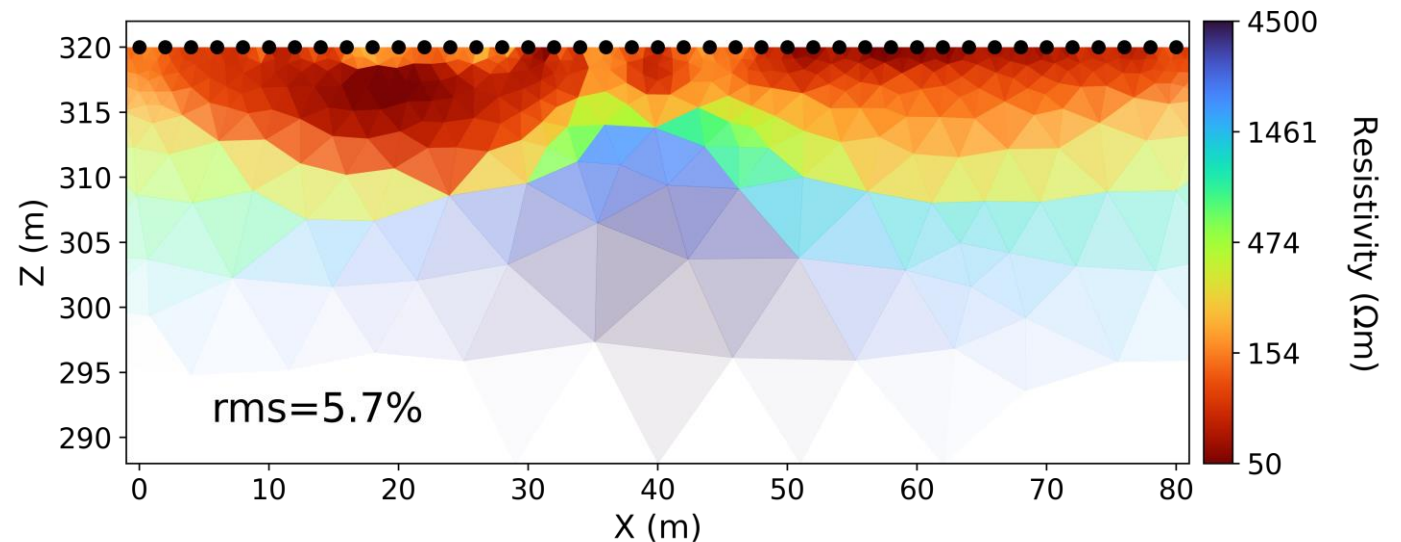
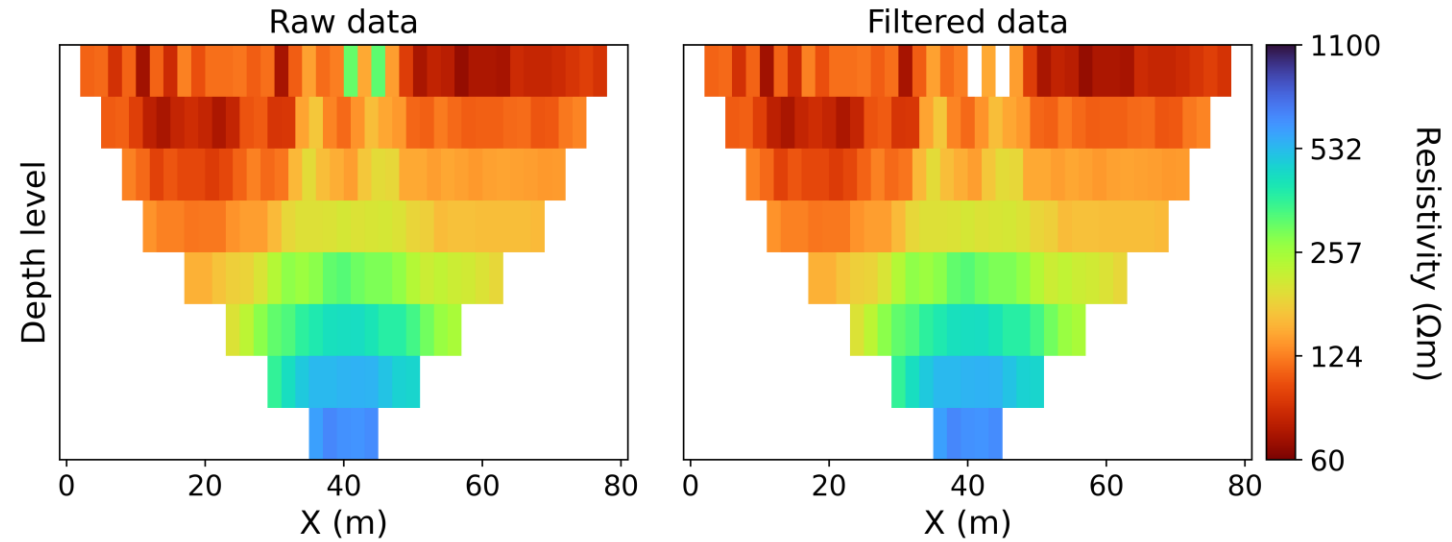
Data processing

Filtering

- Automated filtering removes data that are:
 - Physically unrealistic or low quality
 - Outliers relative to the rest of the data
 - Outliers relative to their neighbours
 - Collected with “bad” electrodes
- If too many data are filtered, don't invert

Inversion & plotting

- Invert using PyGIMLi
- Use L1 “blocky” model norm
- Save rms error
- Use model coverage as opacity filter

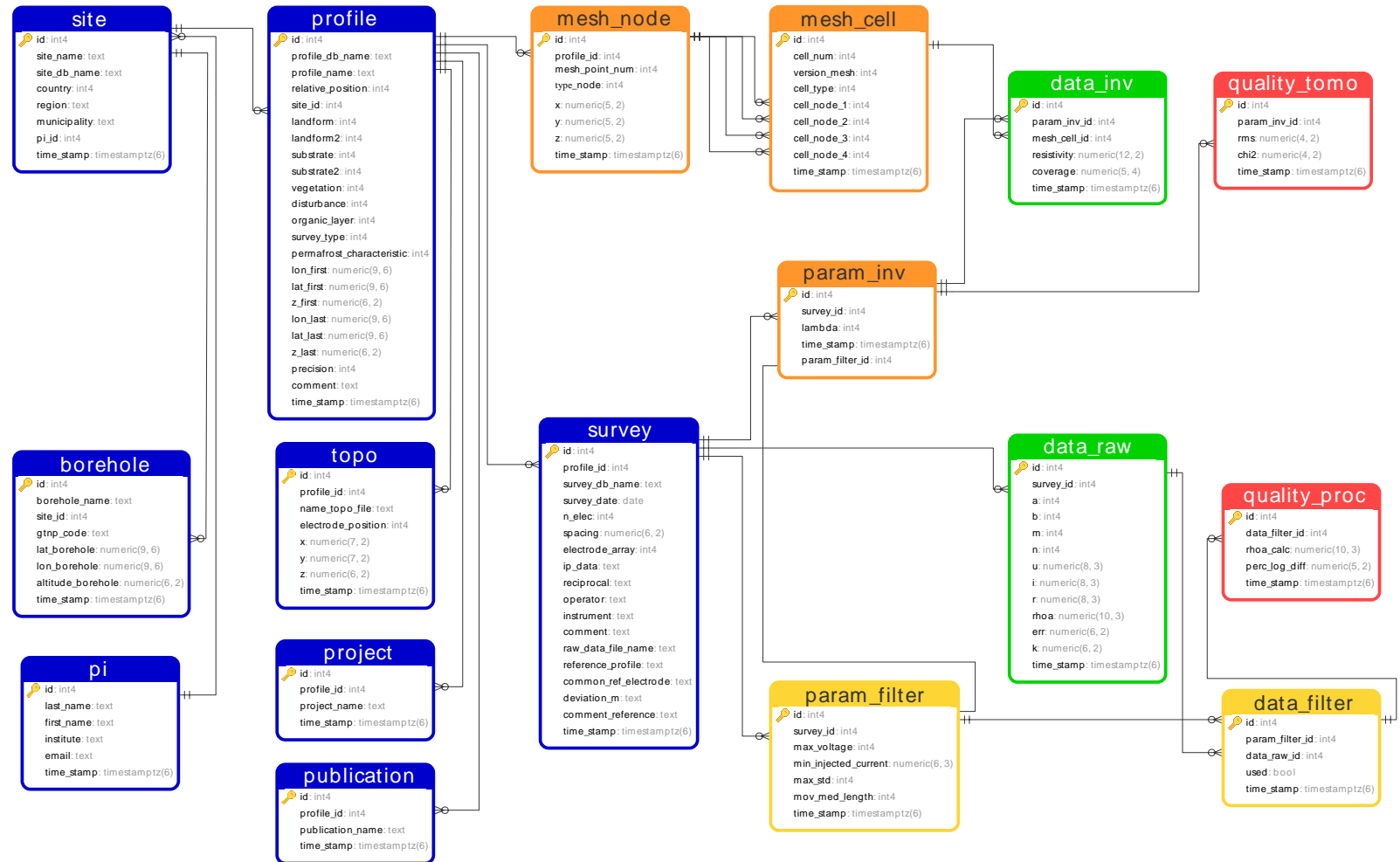


Upload to database



IPA Action Group: towards an international database of geoelectrical surveys of permafrost

```
fillTable_metadata_CAN.py x
36
37 def update_tables(sql, sql_data):
38     """
39     Add entries for database with
40     sql: string of database command
41     sql: list with the data entries as strings
42     """
43     conn = None
44     try:
45         # read the connection parameters
46         params = config()
47         # connect to the PostgreSQL server
48         conn = psycopg2.connect(**params)
49         cur = conn.cursor()
50         # insert data
51         print(sql, sql_data)
52         cur.execute(sql, sql_data)
53         # close communication with the PostgreSQL databas
54         cur.close()
55         # commit the changes
56         conn.commit()
57         # Confirm
58         print('Added ', sql_data, 'to database', '\n')
59     except (Exception, psycopg2.DatabaseError) as error:
60         print(error)
61     finally:
62         if conn is not None:
63             conn.close()
64
```



Access via interface



ERT Surveys of Permafrost

Filters

Contains data in date range

09/22/2008 →

09/24/2021

Location

Landform

Select... ▼

Disturbance

Select... ▼

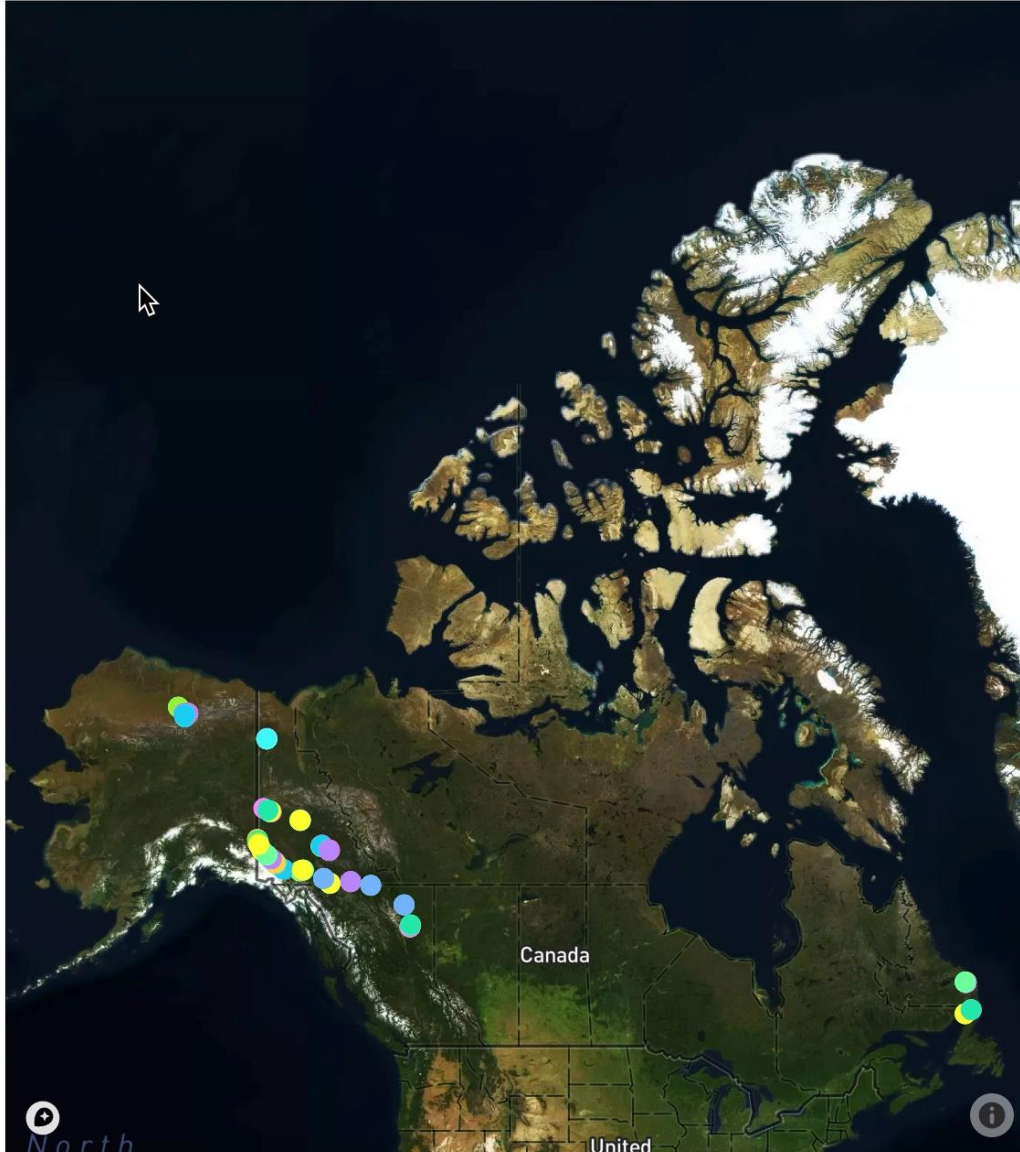
PI

Select... ▼

Only show repeated surveys

134 profiles meet those filtering criteria (out of 134 total in database)

Reset filters



Data plotting

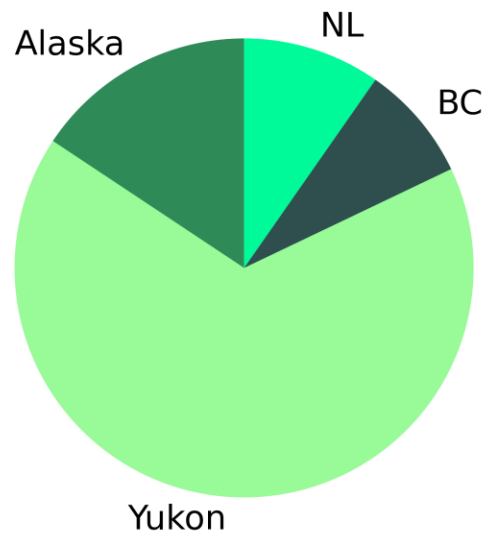
Select a survey on the map to view data

Terms of use

- Data will be published with Nordicana D
- In order to use the data, one must:
 - Contact the data contributor(s) to request permission to use the data
 - Discuss with the data contributor(s) the appropriate level of collaboration/attribution, e.g. co-authorship
 - If co-authorship is not selected, invite the data contributor(s) to review your work
 - Include a formal citation to the data publication

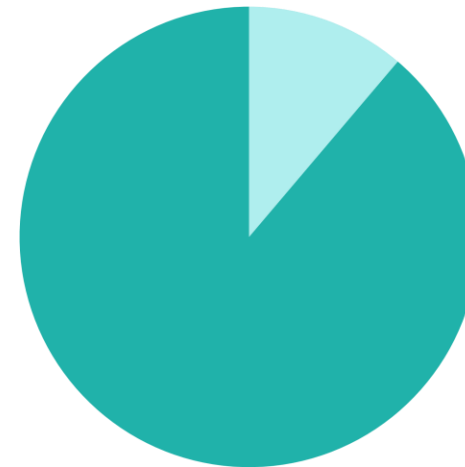
Inventory of surveys

134 unique profiles

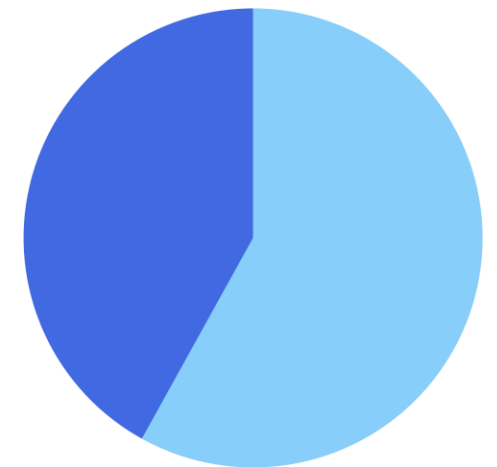


15 (11%)
are monitoring profiles

205 surveys



182 (89%)
include raw data




86 (42%)
are repeated surveys

Applications: Landforms & hazards

Lower active layer detachment

Number of surveys: 1
Date(s) of survey(s): 2014-08-18
Country: CA - Canada
Region: YT - Yukon
Municipality: Old Crow
Permafrost extent: Continuous
Landform: Active layer failure
Landform2: n/a
Survey type: 2D ERT
Relative position: vertical
Precision: measured (GPS)
Substrate: Fine soil (clay-silt)
Substrate2: n/a
Vegetation: mixed forest
Organic layer: in places
Disturbance: Stabilized thermokarst
Comment: Gravel road at base of slope failure which occurred in 2010
Other data collected: Frost tables and surface cover
Boreholes at site: 0
PI: Antoni Lewkowicz (alewkowi@uottawa.ca)
Publication: Benkert, B.E., Kennedy, K., Fortier, D., Lewkowicz, A., Roy, L.-P., de Grandpré, I., Grandmont, K., Drukis, S., Colpron, M., Light, E., Williams, T. 2016. Old Crow landscape hazards: Geoscience mapping for climate change adaptation planning. Northern Climate ExChange, Yukon Research Centre, Yukon College. 136 p. and 2 maps.

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ERT Surveys of Permafrost

Filters

Contains data in date range

09/22/2008 →
09/24/2021

Location

Landform

Active layer failure ×

Disturbance

Select...

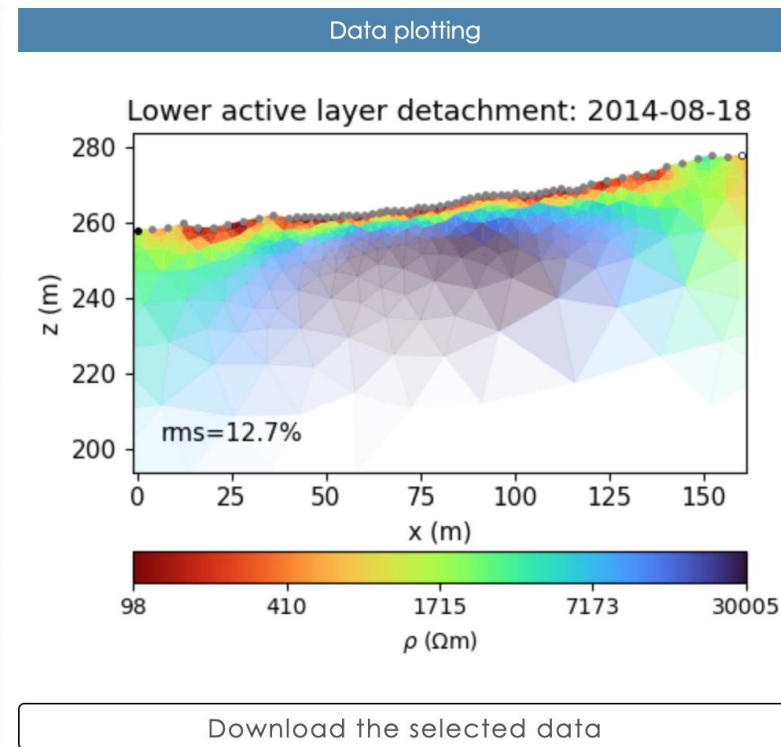
PI

Select...

Only show repeated surveys

2 profiles meet those filtering criteria (out of 134 total in database)


Reset filters



Applications: Disturbance & thermokarst

Lacustre

Number of surveys: 1
Date(s) of survey(s): 2013-10-01
Country: CA - Canada
Region: YT - Yukon
Municipality: Ross River
Permafrost extent: Discontinuous
Landform: Flat terrain (undifferentiated)
Landform2: n/a
Survey type: 2D ERT
Relative position: n/a
Precision: measured (GPS)
Substrate: Coarse soil (sand-gravel)
Substrate2: n/a
Vegetation: mixed forest
Organic layer: yes
Disturbance: Active thermokarst
Comment: Some anthropogenic disturbance as well as natural thermokarst
Other data collected: Frost tables and surface cover
Boreholes at site: 0
PI: Antoni Lewkowicz (alewkowi@uottawa.ca)
Publication: Benkert, B.E., Fortier, D., Lipovsky, P., Lewkowicz, A., de Grandpré, I., Grandmont, K., Turner, D., Laxton, S., Moote, K., and Roy, L.-P., 2015. Ross River Landscape Hazards: Geoscience Mapping for Climate Change Adaptation Planning. Northern Climate ExChange, Yukon Research Centre, Yukon College. 116 p. and 2 maps

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ERT Surveys of Permafrost

Filters

Contains data in date range

09/22/2008 →
09/24/2021

Location

Landform

Select...

Disturbance

Active thermokarst ×

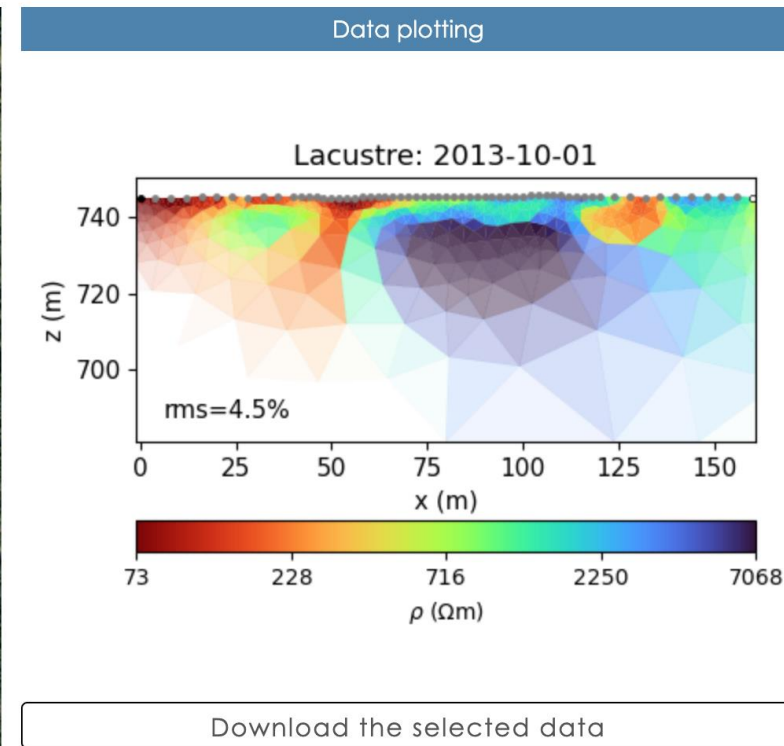
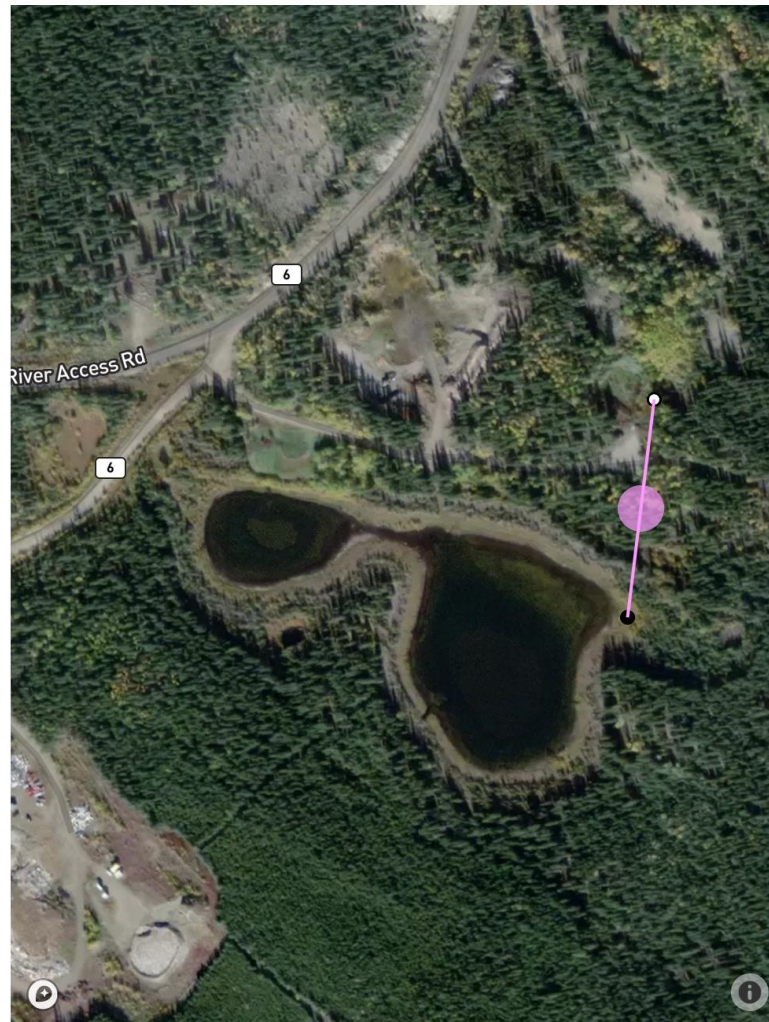
PI

Select...

Only show repeated surveys

18 profiles meet those filtering criteria (out of 134 total in database)

Reset filters




Applications: Changing permafrost

MP 681 array

Number of surveys: 12
Date(s) of survey(s):
 2010-08-11, 2011-03-11, 2011-05-14,
 2011-06-09, 2011-07-04, 2012-08-11,
 2013-09-01, 2014-08-10, 2015-08-05,
 2016-08-15, 2017-08-09, 2021-09-16

Country: CA - Canada
Region: YT - Yukon
Municipality: n/a
Permafrost extent: Discontinuous
Landform: Flat terrain (undifferentiated)
Landform2: Peatland
Survey type: 2D ERT
Relative position: n/a
Precision: measured (GPS)
Substrate: Organic material
Substrate2: Fine soil (clay-silt)
Vegetation: coniferous forest
Organic layer: yes
Disturbance: No external disturbance
Comment: n/a
Other data collected: Frost tables, surface cover, photos
Boreholes at site: 0
PI: Antoni Lewkowicz (alewkowi@uottawa.ca)
Publication: n/a


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ERT Surveys of Permafrost

Filters

Contains data in date range

09/22/2008 →

09/24/2021

Location

Landform

Select...

Disturbance

Select...

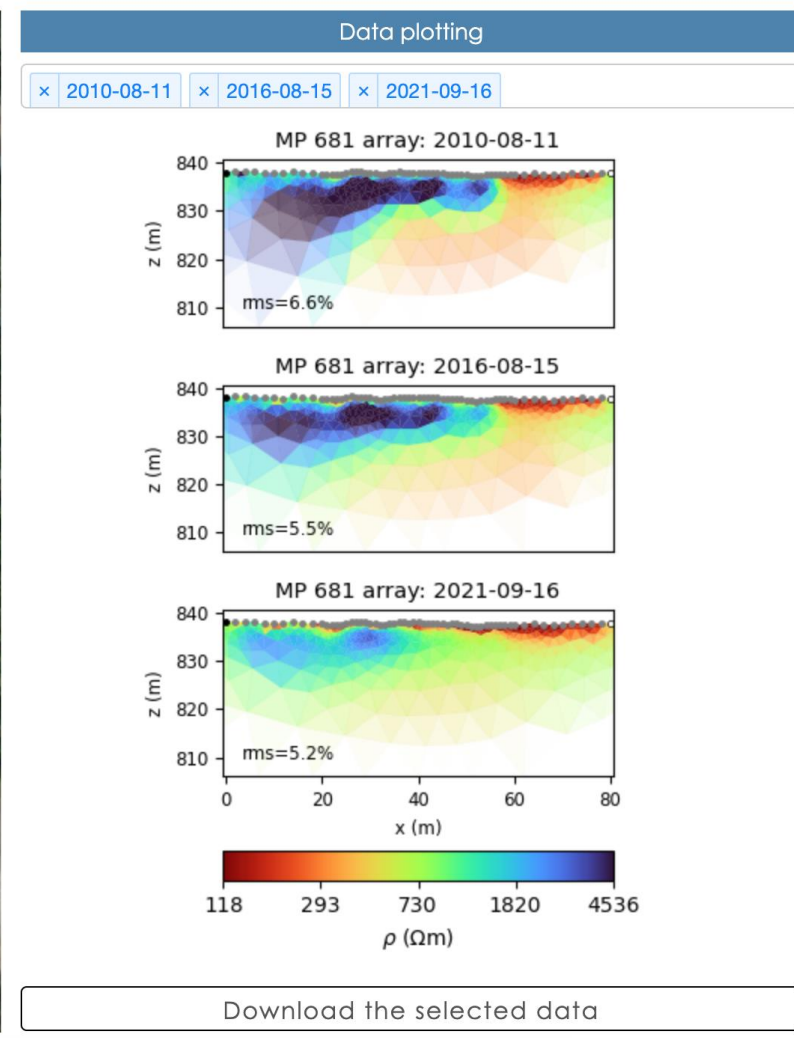
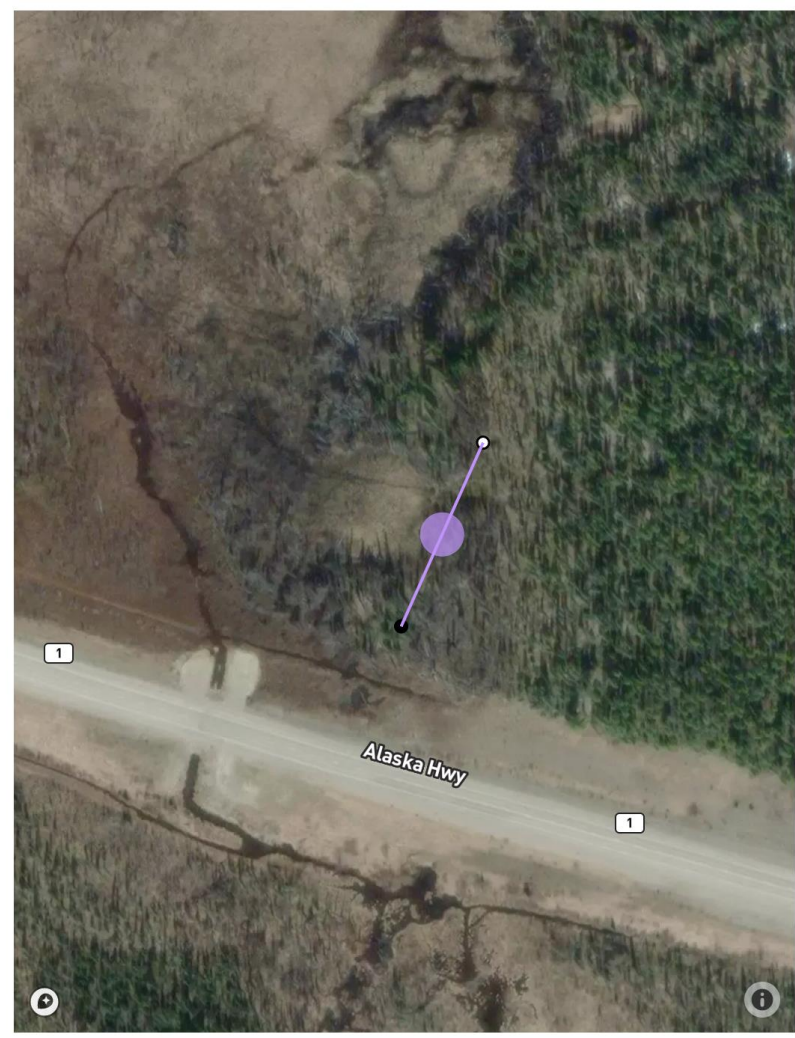
PI

Select...

Only show repeated surveys

15 profiles meet those filtering criteria (out of 134 total in database)

Reset filters



Visit the website

The screenshot shows the website data.permafrostnet.ca/cpers/. The header features the PermafrostNet logo (NSERC | CRSNG) and the text "Canadian permafrost electrical resistivity survey next practices and database (CPERS)". The main content area is titled "ERT Surveys of Permafrost" and includes a "Version 1: Metadata" section. A "Filters" sidebar on the right allows users to refine search results based on date range (09/22/2008 to 09/24/2021), location, landform, disturbance, and PI. A checkbox for "Only show repeated surveys" is currently unchecked. A summary indicates that 134 profiles meet the filtering criteria. A "Reset filters" button is located at the bottom of the filter sidebar. The map on the right shows the geographical distribution of survey locations across Canada and the United States, with various colored dots representing individual survey profiles. A "North" arrow is visible in the bottom left corner of the map.

- Explore map of surveys
- Learn more
- Contribute data



data.permafrostnet.ca/cpers

Acknowledgements

- Indigenous groups who have allowed data collection on their land
- NSERC PermafrostNet
- Collaborators and network partners Nick Brown, Fabrice Calmels, Greg Oldenborger, and Anne-Marie Leblanc
- IPA action group “Towards an international database of geoelectrical surveys on permafrost (IDGSP)”, especially Coline Mollaret
- CPERS data contributors
- Digital Research Alliance of Canada

A photograph of the Aurora Borealis (Northern Lights) over a forest at night. The aurora is a vibrant green, shimmering band of light that stretches across the sky, with some darker, more turbulent sections. The background is a deep, dark blue night sky filled with numerous small, bright stars. The foreground shows the dark silhouettes of evergreen trees and a forest ridge. The overall scene is serene and awe-inspiring.

Questions/feedback?