Google.org

# Permafrost Discovery Gateway

A free map toolbox to empower all Alaskans
Bringing big geospatial information

Anna Liljedahl & Team PDG
Woodwell Climate Research Center

AK Geosummit 11 April, 2025

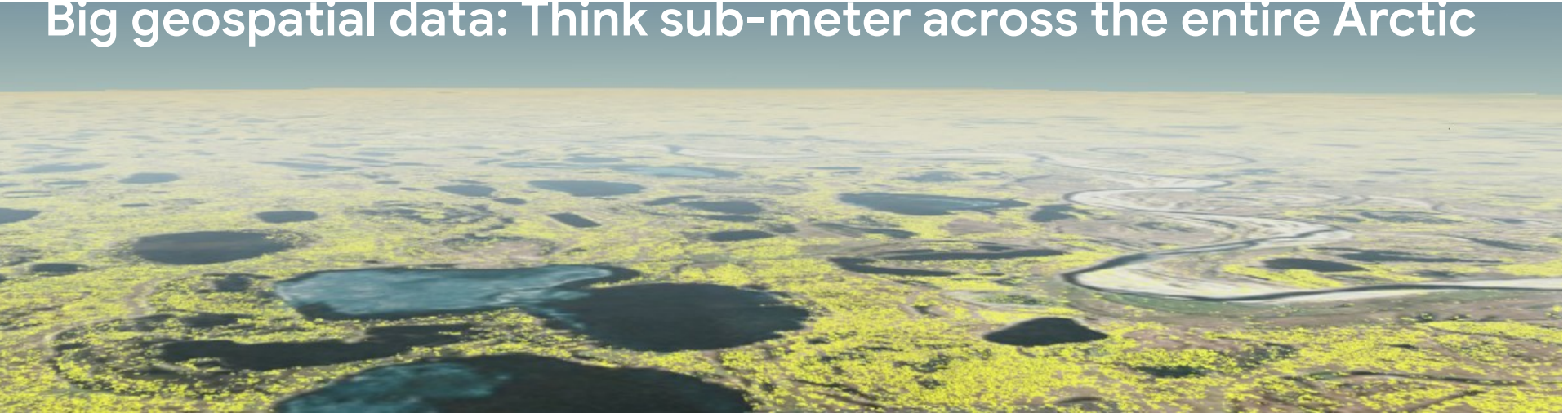
# Permafrost Discovery Gateway

**A free online platform, available via a regular internet browser, where people *_no matter their technical or financial resources_* can access, explore, and use big geospatial data.**

permafrost.arcticdata.io

# Permafrost Discovery Gateway

## Big geospatial data: Think sub-meter across the entire Arctic



# Collaborating 8 organizations:

UCONN
UNIVERSITY OF CONNECTICUT

Chandi Witharana

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Michael Brubaker, Sarah Yoder

NCSA

Kenton McHenry, Luigi Marini

NSF Arctic Data Center

Matt Jones

ASU Arizona State University

Wenwen Li

UAF UNIVERSITY OF ALASKA FAIRBANKS

Helene Genet, Ben Jones & Jennifer Moss

AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Guido Grosse, Ingmar Nitze

Google.org Fellows
Jan-Jun 2024


Permafrost Discovery Gateway

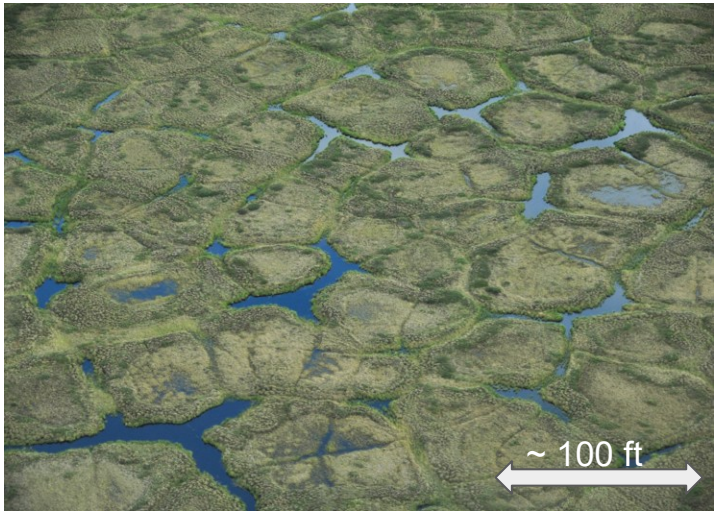
# Permafrost:
## Ground that remains below 0°C for at least two consecutive years


Source: International Permafrost Association, 1998. Circumpolar Active-Layer Permafrost System (CAPS), version 1.0.

Permafrost Discovery Gateway

# Ice-rich permafrost

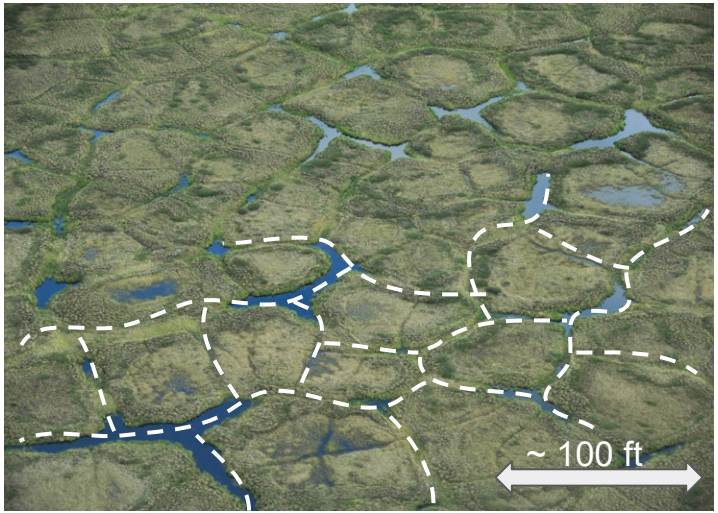
More water than the soil (if thawed) can hold.




Permafrost Discovery Gateway

# Ice-rich permafrost

More water than the soil (if thawed) can hold.





Permafrost Discovery Gateway

## 5 million people
live on permafrost in the Arctic

## 50% of Arctic infrastructure
is at risk of permafrost thaw damage within the next 25 yrs

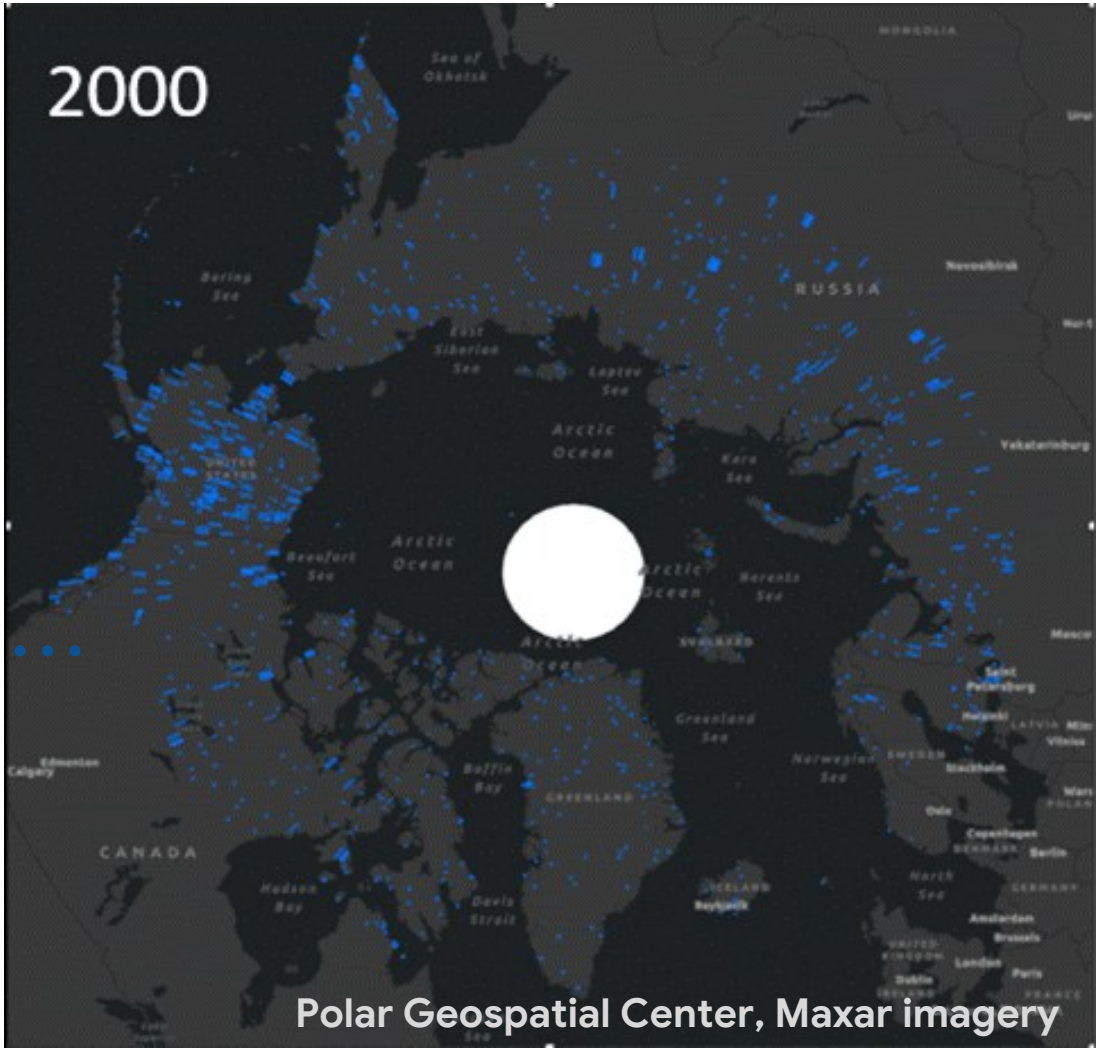
Hjort et al., 2022, Nature Reviews


B. Jones et al., *Infrastructure and Permafrost Degradation in Point Lay, Alaska. ARCUS.*

Permafrost Discovery Gateway

# Alaska's *D*⁻ in geospatial information readiness.

Yet, we have more data than ever.

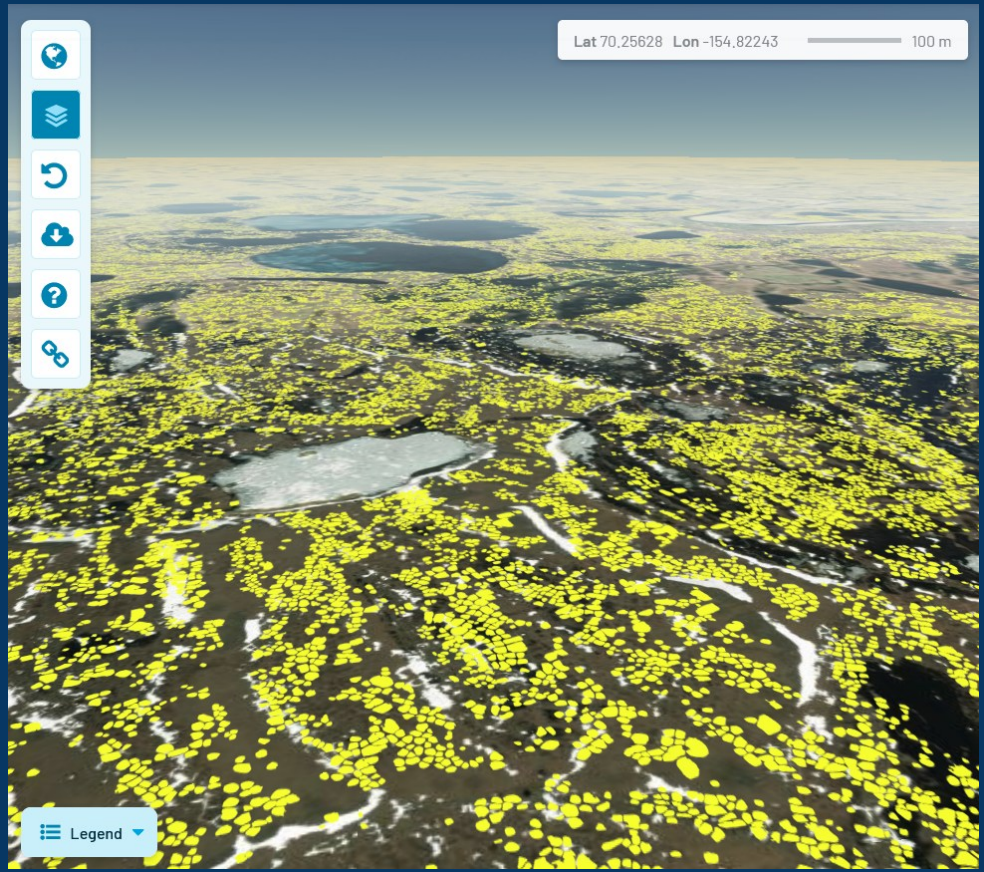



Permafrost Discovery Gateway

Permafrost Discovery Gateway

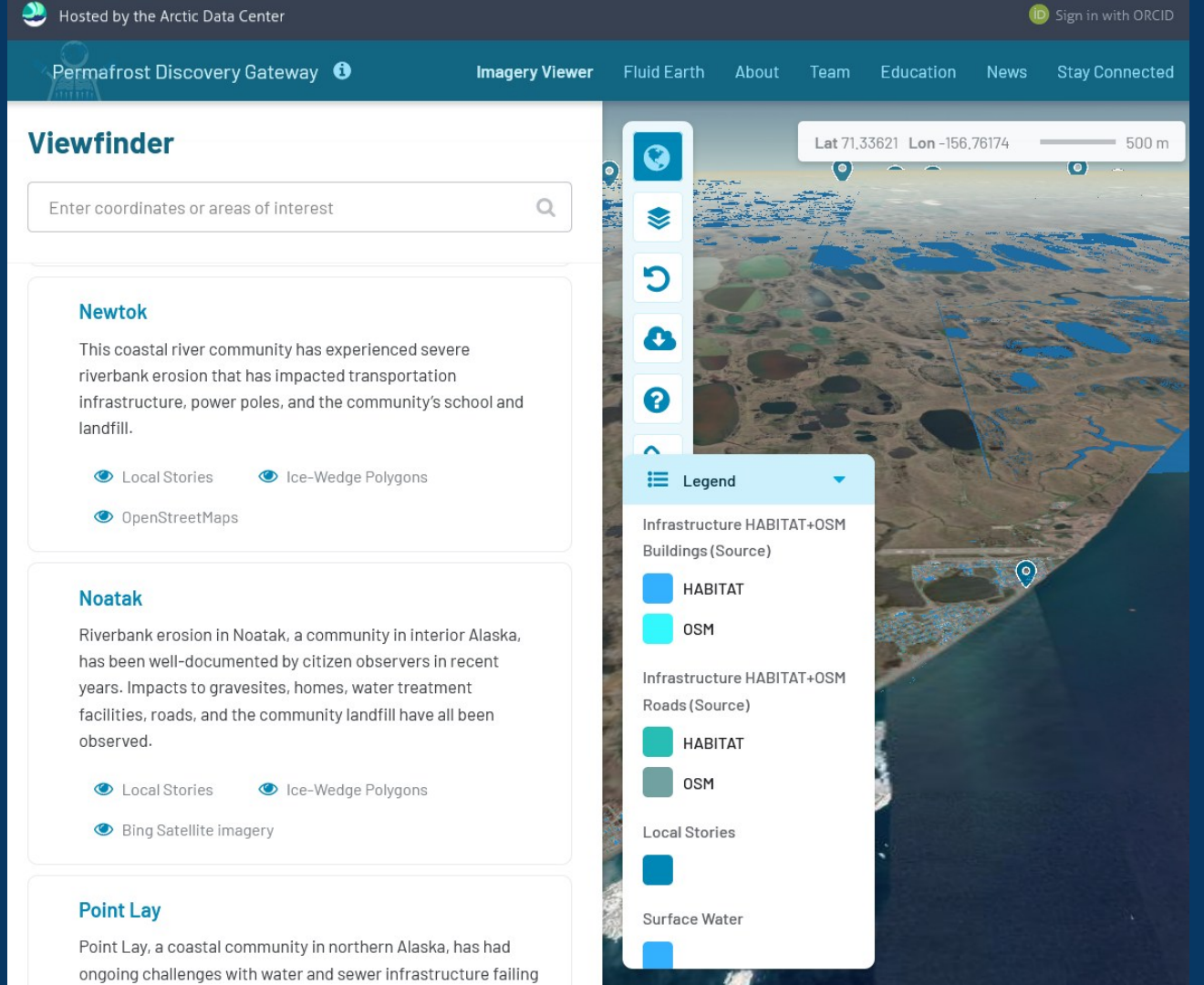
1. Discovery
2. Creation

permafrost.arcticdata.io



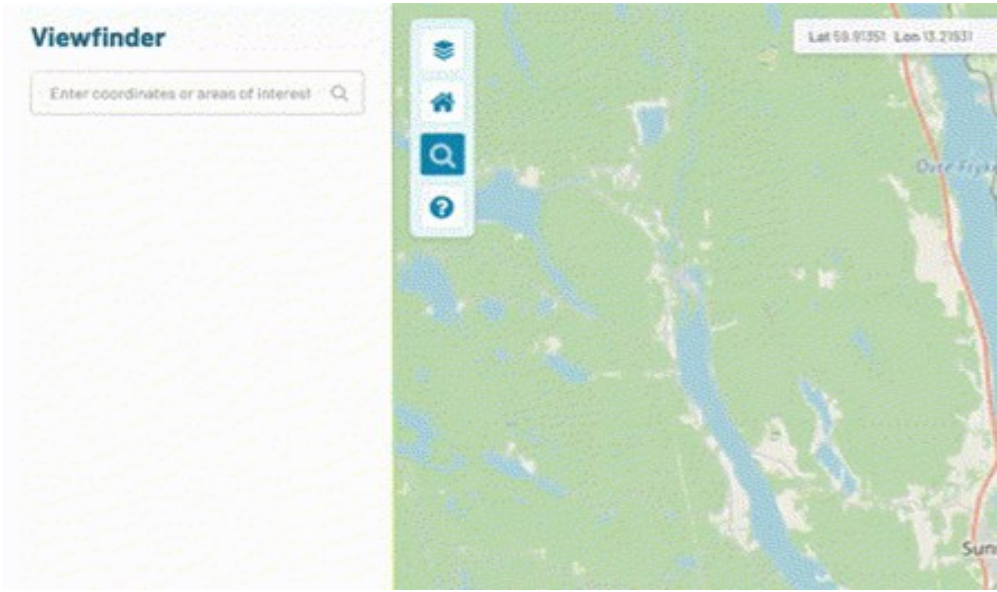
# Discovery tools for big geospatial data

- Enable data **access**
  - Remove technical & $$-barriers
- Deliver **“freshness”** of info
- More science **collaboration**
  - Connect data = connect people
- Increase science **usefulness**



## Location Search

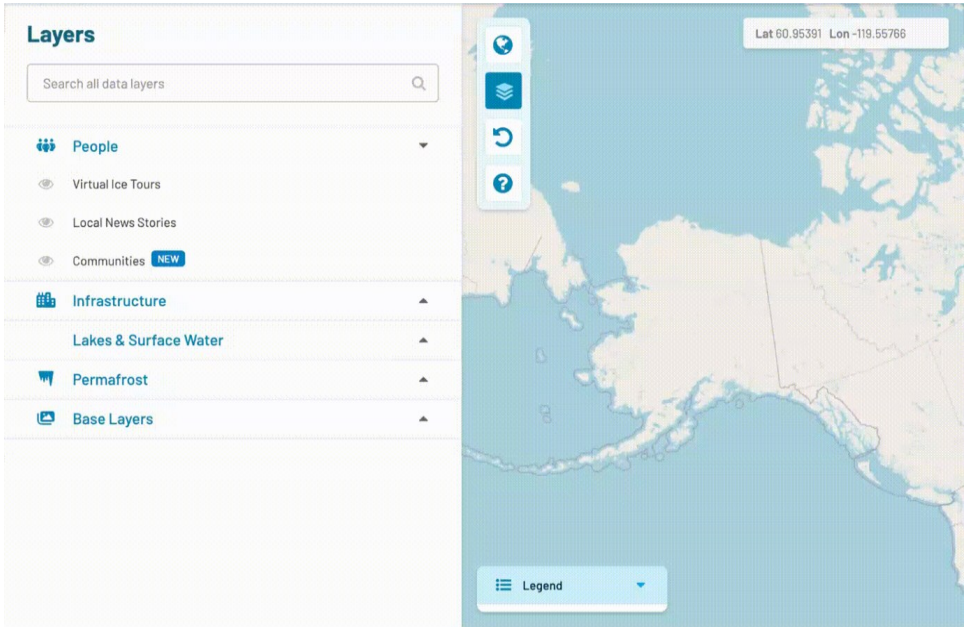
We’ve introduced place name, area of interest, and lat/long coordinate-based search functionality.




Permafrost Discovery Gateway

## Legend Design

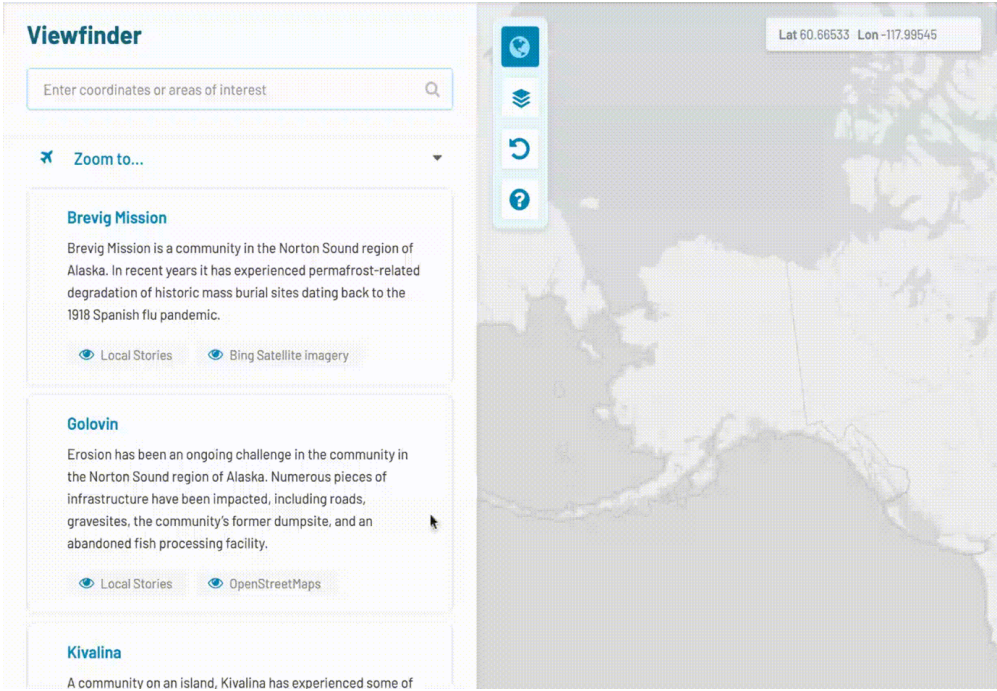
Legends are inside the map, including palette info of all visible layers.




Permafrost Discovery Gateway

## Zoom to & Storytelling

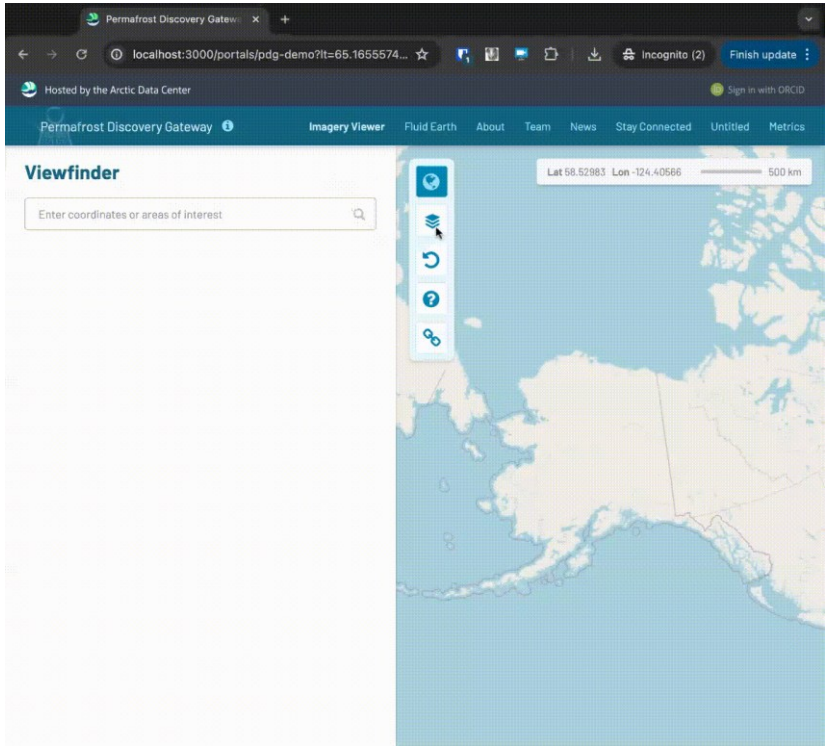
With the zoom to feature, we've incorporated a storytelling element in the user interface that showcases and zooms in on communities, making it easier to discover, explore, and derive meaning from the data.




Permafrost Discovery Gateway

## Shareable URL

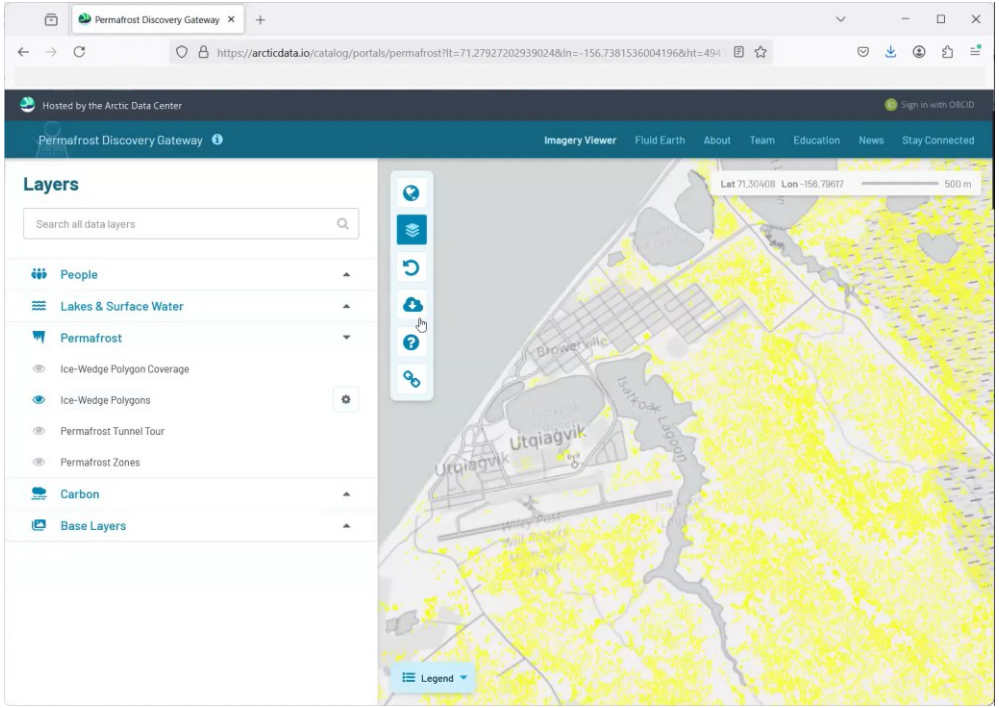
Users can now share a url that saves the current location and data layer configuration. The PDG map resets any time the browser window is closed, but with the new share url feature users can easily return to a previous configuration.



## Partial download of big data

With the partial download feature, we've enabled the user to download portions of the big dataset, making it easier to use and apply the big data for local assessments.

- Geotiff
- PNG
- WMTS
- Geopackage

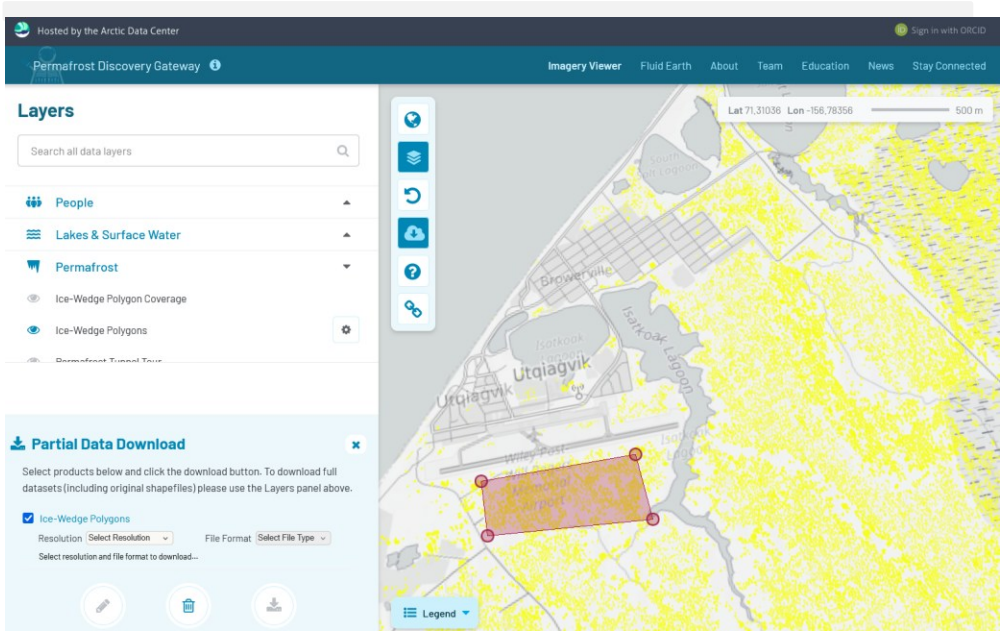



Permafrost Discovery Gateway

## Partial download of big data

With the partial download feature, we've enabled the user to download portions of the big dataset, making it easier to use and apply the big data for local assessments.

- Geotiff
- PNG
- WMTS
- Geopackage

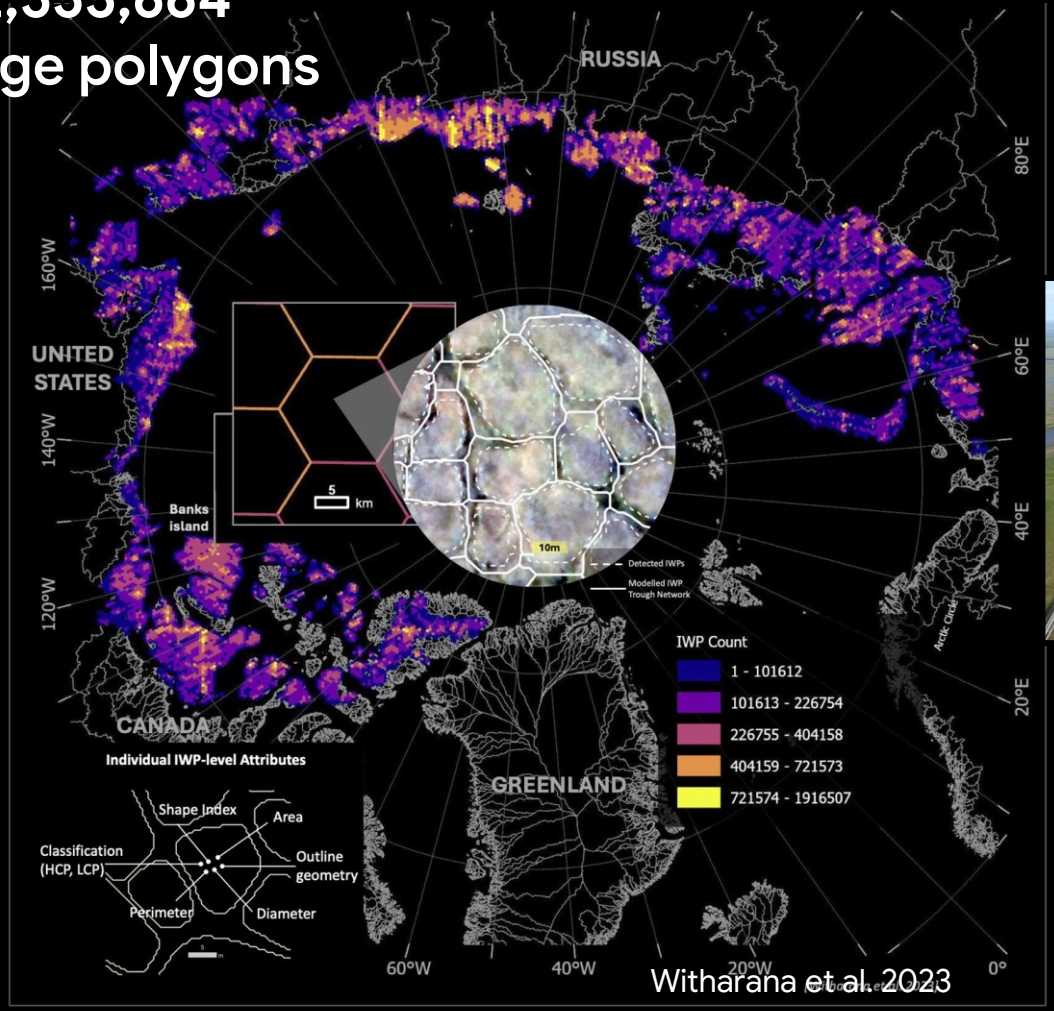


Permafrost Discovery Gateway

# Big map data

## Monitor permafrost across the Arctic

# 1,812,555,664 ice-wedge polygons



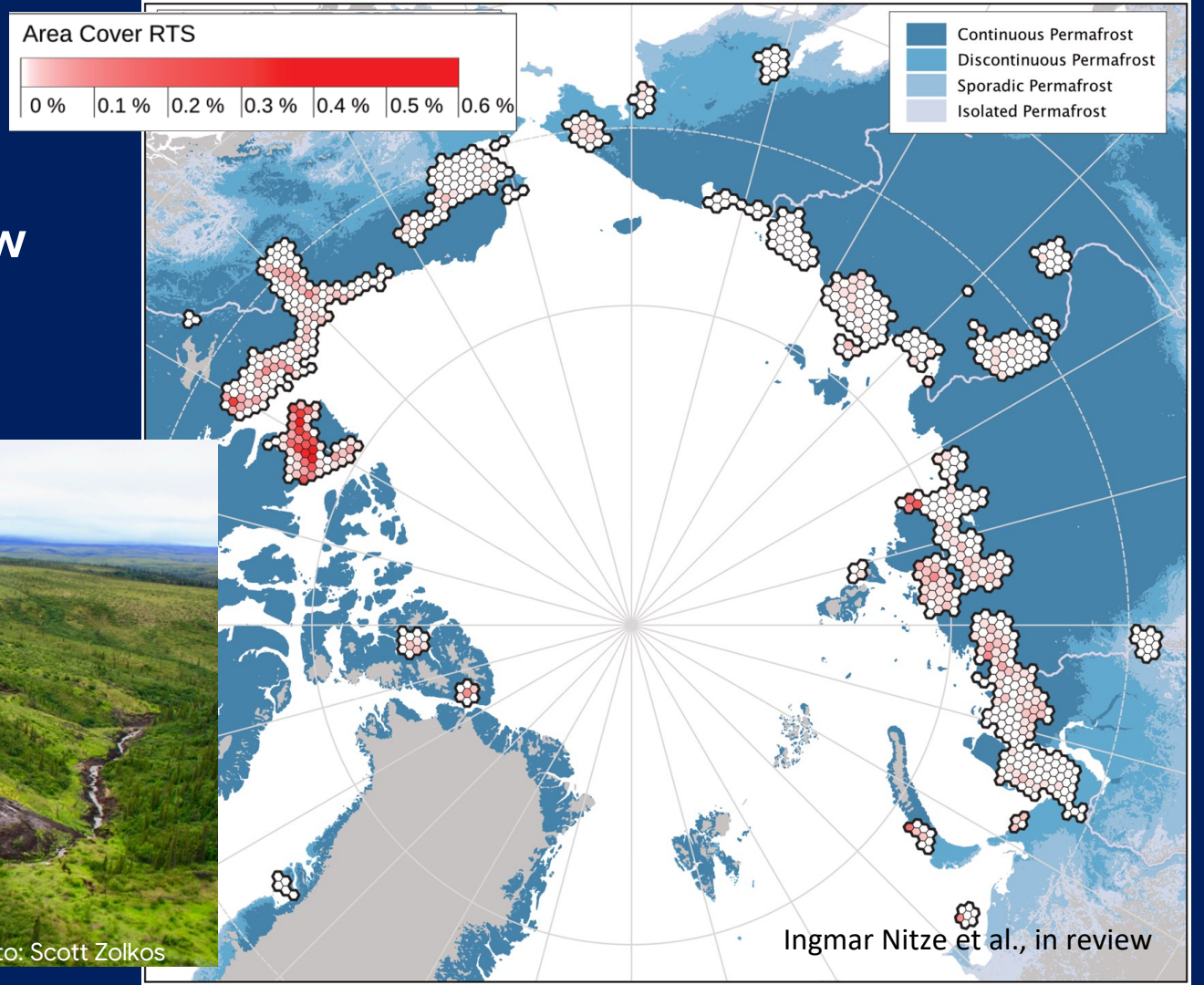


Witharana et al. 2023

Permafrost Discovery Gateway

# 2,901 retrogressive thaw slumps in Alaska

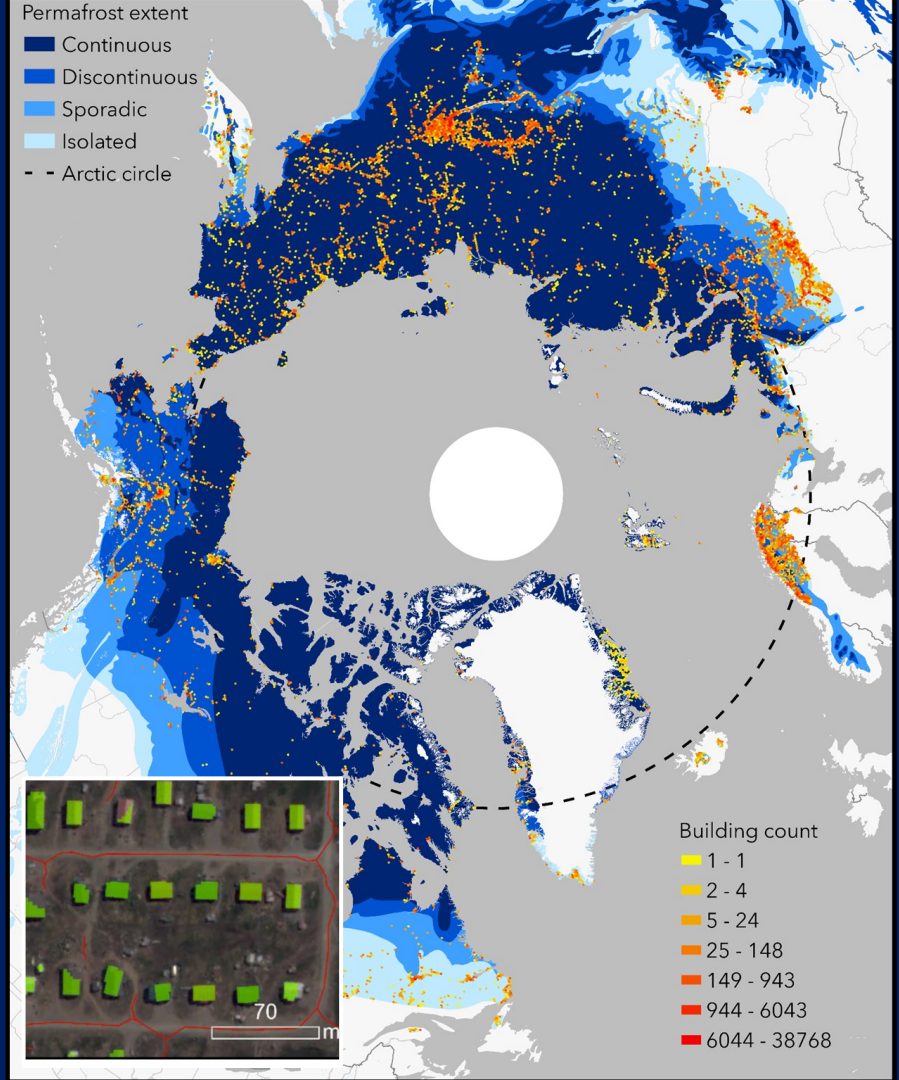
Photo: Scott Zolkos




Ingmar Nitze et al., in review

# 1,282,376
# buildings on permafrost

Alaska version: *Manos et al. 2025, Nature Com. Earth & Env.*


Permafrost Discovery Gateway

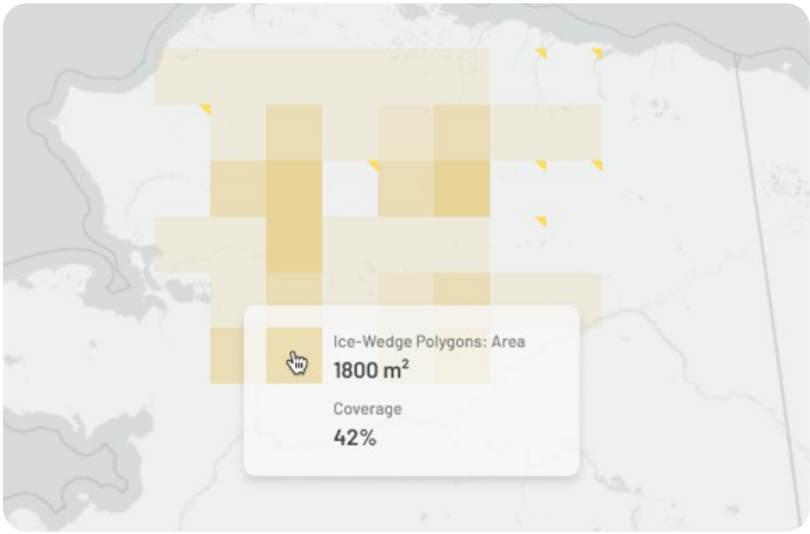
# Summary statistics of the big data

## Problem

The size of large geospatial datasets makes them difficult to understand at the regional or global levels.

## Solution

We are creating summary layers to make the data easier to understand at any zoom level.




Permafrost Discovery Gateway

# Connect big data to the real world

LEO NETWORK

Integrating local environmental observations and remote sensing to better understand the life cycle of a thermokarst lake in Arctic Alaska

Benjamin M. Jones, Susan Schaeffer Tessier, Tim Tessier, Michael Brubaker, Mike Brook, Jackie Schaeffer, Melissa K. Ward Jones, Guido Grosse, Ingmar Nitze, Tabea Rettelbach, Sebastian Zavoico, Jason A. Clark & Ken D. Tape

Permafrost Discovery Gateway

Take a virtual tour of the CRREL Permafrost Tunnel

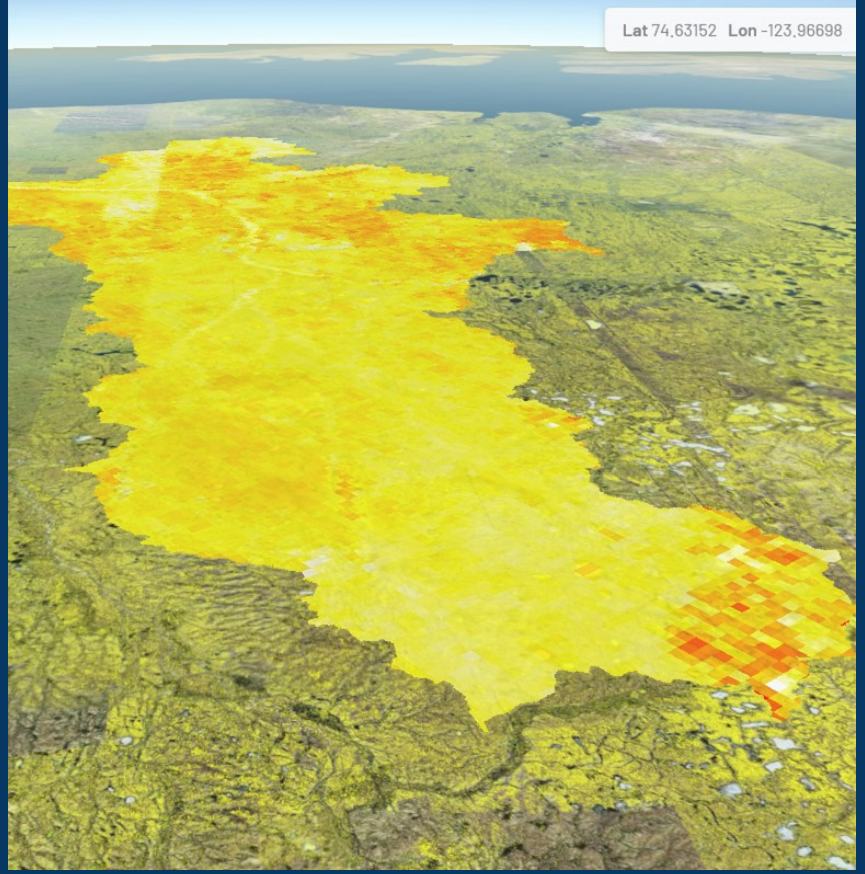

Permafrost Discovery Gateway

# Thank you

Permafrost Discovery Gateway

permafrost.arcticdata.io

→ Booth 7




Google.org

Google.org

NSF