



Cross-Disciplinary Approaches to
Advancing Sustainable Arctic
Infrastructure

RATIC/T-MOSAiC Community Meeting
Arctic Science Summit Week 2022

**Mapping, Modeling and Monitoring
Panel Discussion**

Transformation of *Big* Imagery into Arctic Science-Ready Products



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Permafrost Discovery Gateway (PDG)



Navigating the new Arctic tundra
through big data, artificial intelligence,
and cyberinfrastructure

Anna Liljedahl (lead PI), Woodwell Climate Research Center

Chandi Witharana, University of Connecticut

Kenton McHenry & Aiman Soliman, University of Illinois

Matt Jones & Amber Budden, Arctic Data Center

Ben Jones & Jennifer Moss, University of Alaska Fairbanks

Michael Brubaker, Alaska Pacific University

Jason Cervenec & Aaron Wilson, Ohio State University

Guido Grosse & Ingmar Nitze, Alfred Wegener Institute

Galina Wind, NASA

Hosted by the Arctic Data Center

Permafrost Discovery Gateway

IMAGERY VIEWER FLUID EARTH ABOUT CORE TEAM NEW

Discovery and knowledge-generation from big imagery permafrost products

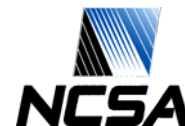
The Permafrost Discovery Gateway is an online platform for archiving, processing, analysis, and visualization of permafrost big imagery products to enable discovery and knowledge-generation.

Mission

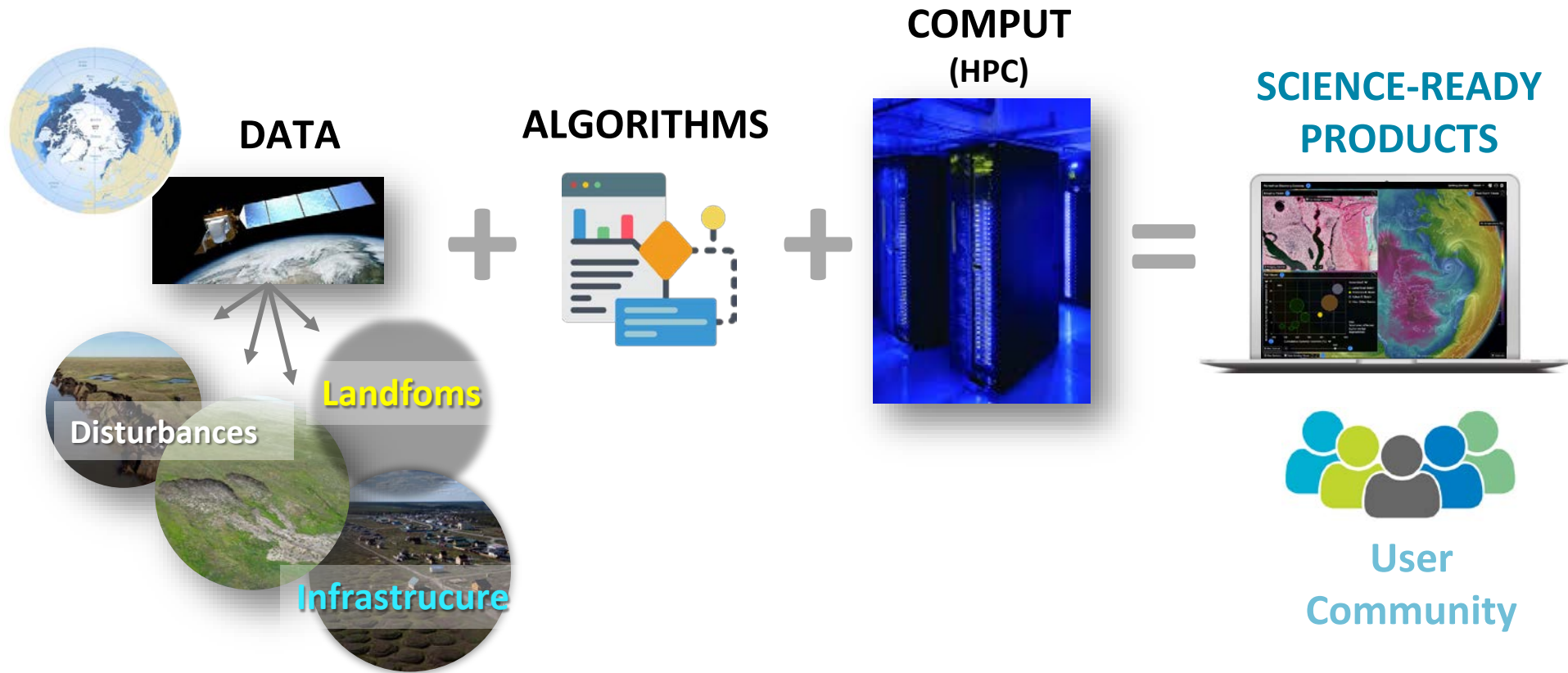
To create an online platform for archiving, processing, analysis, and visualization of permafrost big imagery products to enable discovery and knowledge-generation. The new online scientific gateway will make information of changing permafrost conditions available throughout the Arctic by providing access to very high resolution satellite imagery and new visualization tools that will allow exploration and discovery for researchers, educators, and the public at large.

Pan-Arctic Big Imagery

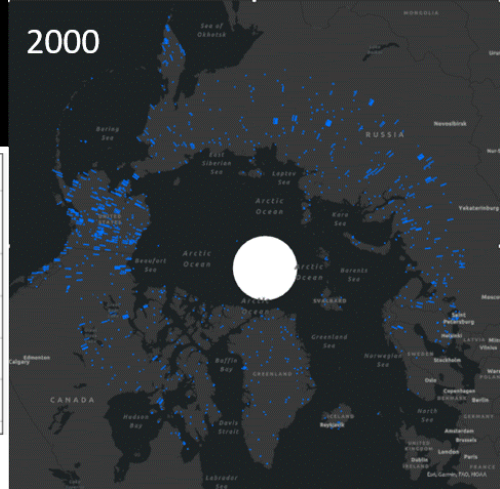
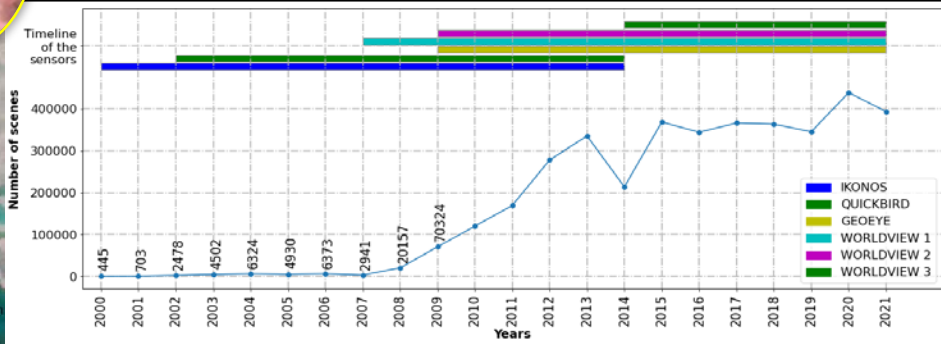
The Permafrost Discovery Gateway will be informed by products derived from Polar Geospatial Center, Planet (3m), Sentinel (10 m), Landsat (30 m), and MODIS (250 m) pan-Arctic geospatial datasets of interest to its users such as the ArcticDEM and historical and future model projections of climate and permafrost. New pan-Arctic permafrost products include lake change, retrogressive thaw slumps, wattle areas, ice-wedge polygons, coastal erosion, and surface water. The Permafrost Discovery Gateway will also provide the computation infrastructure for the remote sensing research community to support the execution of machine and deep learning classification models across the entire Arctic.



Developing permafrost big imagery products & making them discoverable for knowledge-generation

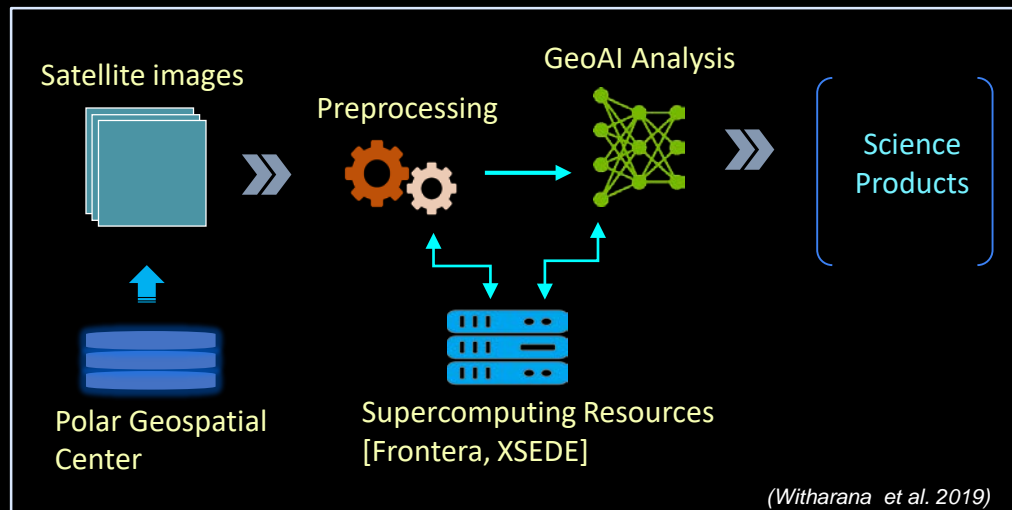


Pan-Arctic Coverage of Maxar Commercial Satellite Imagery



Mapping application for Arctic Permafrost Land Environment - MAPLE

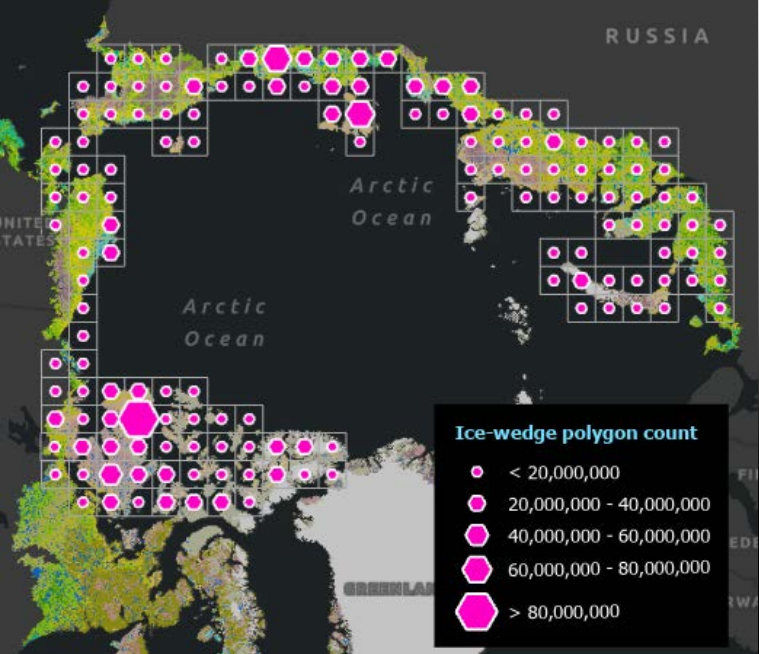
- Operational-scale GeoAI pipeline
- Translation of **big** commercial imagery into science-ready products
- Production of first pan-Arctic ice-wedge polygon map
- Transferability across image data and targets of interest
- Scalability and interoperability across heterogenous computing resources



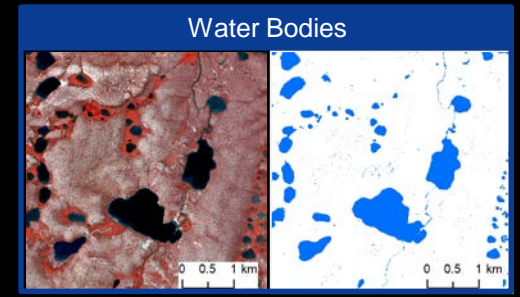
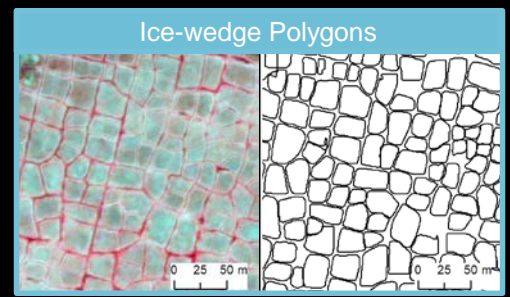
(Witharana et al. 2019)

Automated Recognition of Ice-wedge Polygons from Maxar Imagery

So far, we have mapped **> 1 billion** individual ice-wedge polygons...



Our Pan-Arctic sub-meter resolution products



We have demonstrated the extensibility of our GeoAI pipeline for other high-res Pan-Arctic mapping applications

