

# Ground Validation for TerraSAR-X imagery in the Western Canadian Arctic

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<sup>1</sup>Alfred Wegener Institute for Polar and Marine Research,

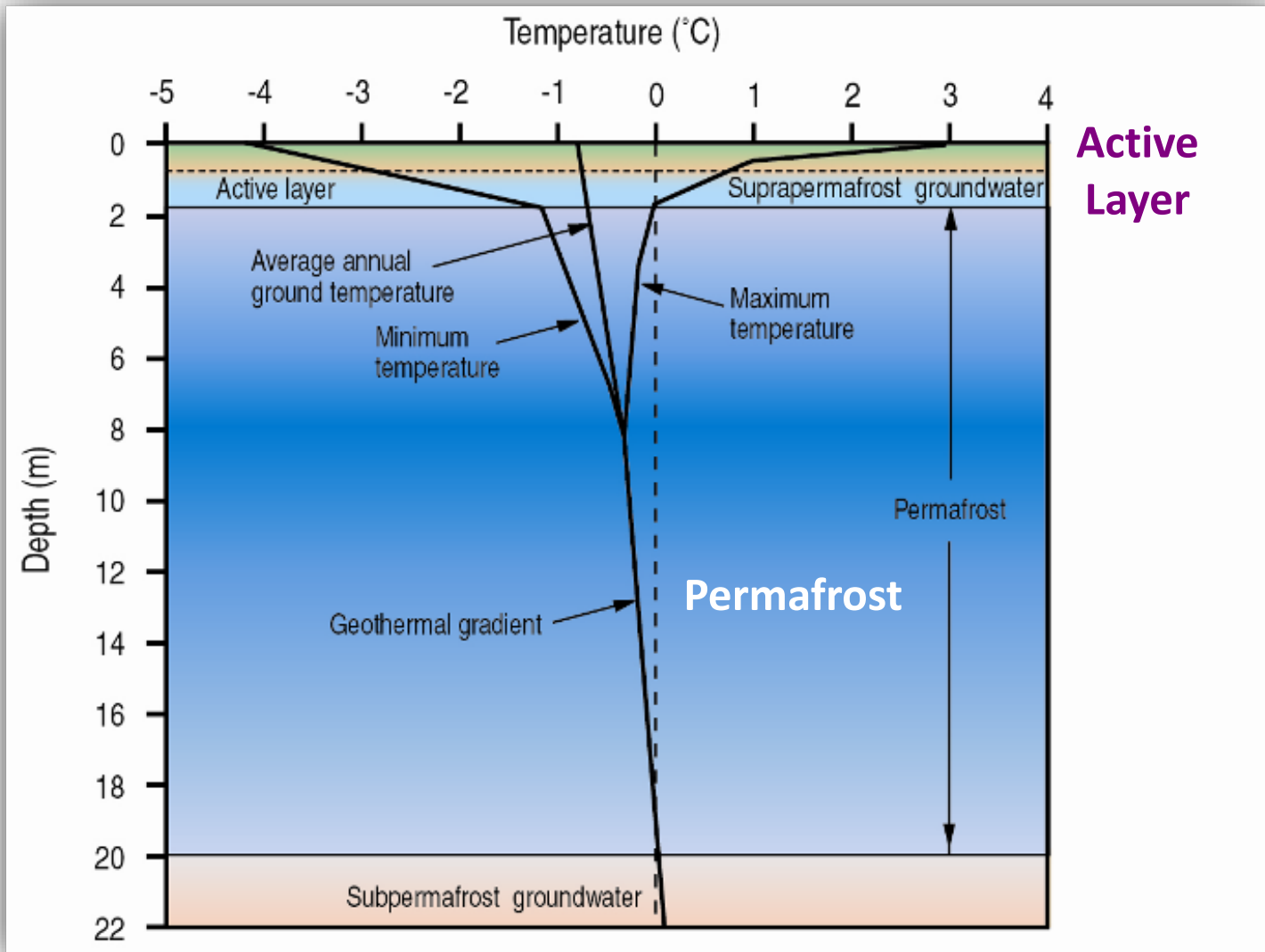
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# Outline



- Permafrost
  - what is it, why do we care?
- LAN1747
  - Application of TerraSAR-X data in polar regions using archived data
- Herschel Island
- COPER
  - Who we are, what we do
  - What we plan to do

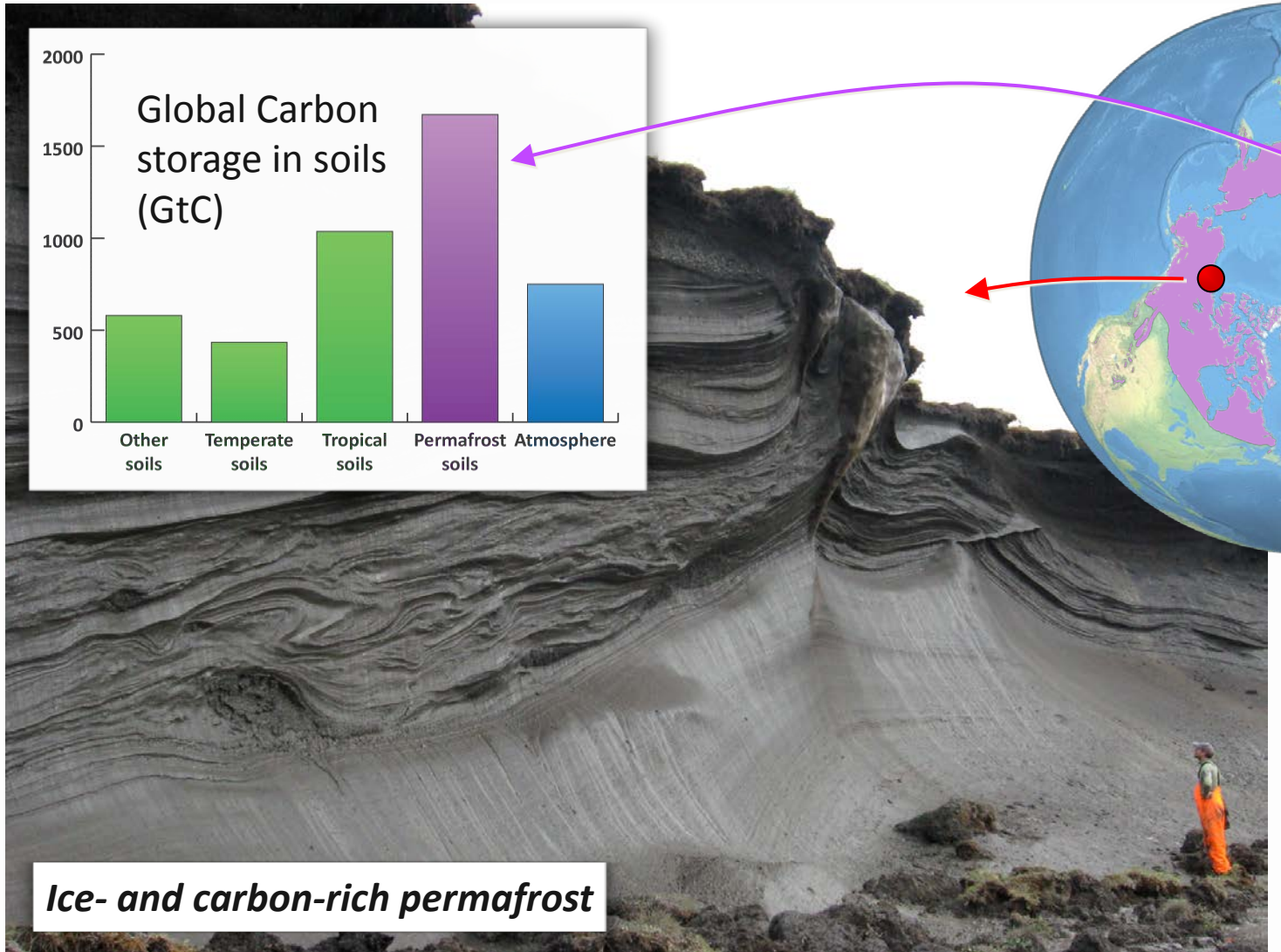
# Permafrost – a definition



Active Layer

Permafrost

# Permafrost – why do we care?



Permafrost

*Ice- and carbon-rich permafrost*

# LAN1747 - integrated high latitude permafrost monitoring

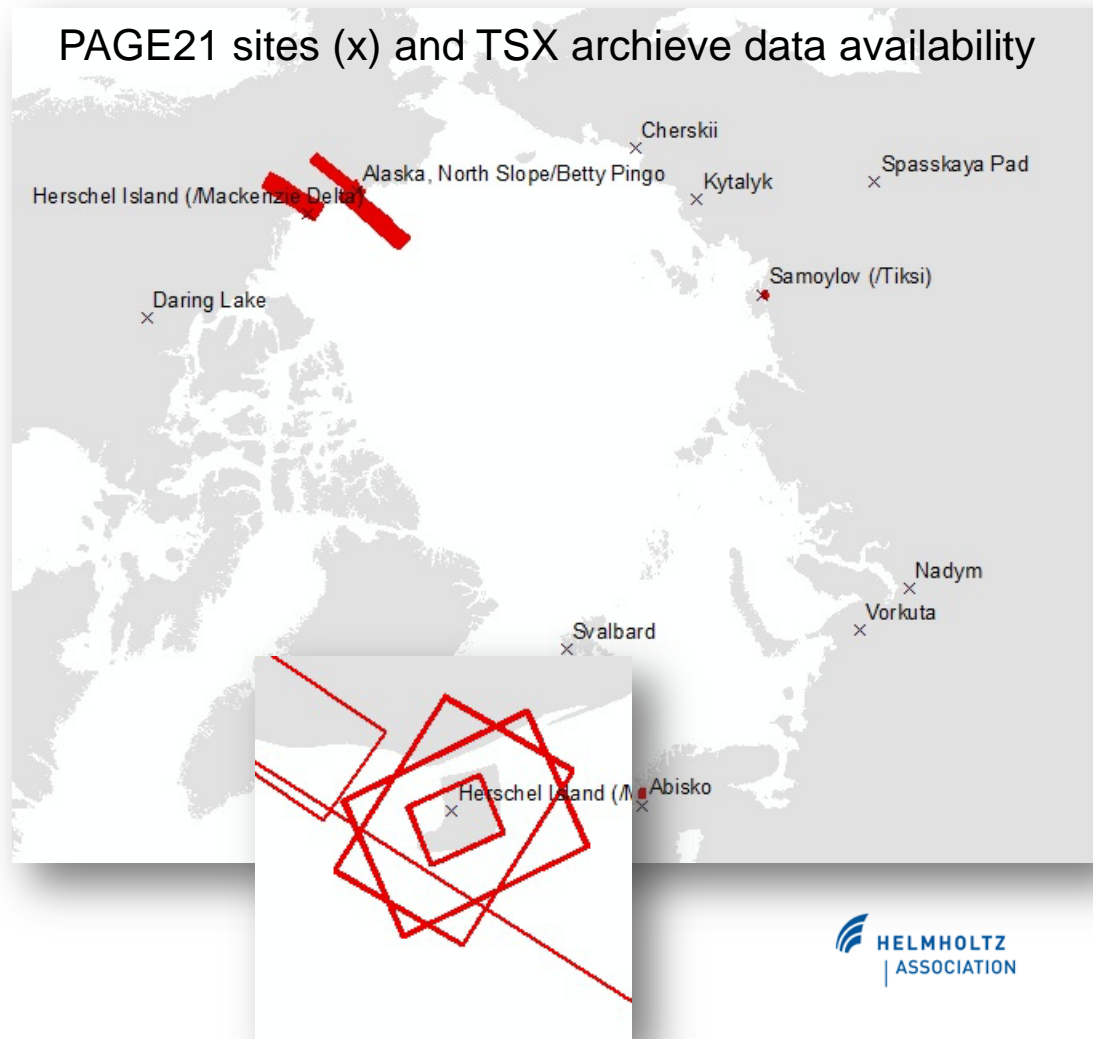
## Co-PIs and further team members

- Alfred Wegener Institute for Polar and Marine Research, Periglacial Research Group
  - Birgit Heim, Hugues Lantiut, Sina Muster, Jaroslav Obu, Sonya Antonova, Boris Radosavljevic
- University of Oslo, Department of Geosciences
  - Andreas Kääh
- University of Alaska Fairbanks
  - Guido Grosse
- Vienna University of Technology
  - Annett Bartsch (PI)
- University of Würzburg
  - Mathias Ullman



# TerraSAR-X archive data general availability

- PI agreement LAN1747 grants access for data acquired before June 2011
- Samoylov Island
- Herschel Island
- North Slope



# Scope

- Applicability of TerraSAR-X data to permafrost regions
  - detection, mapping and monitoring of disturbances in topography and vegetation, and surface change detection
- Complement long-term site monitoring (IPA GTN-P)
  - continuous measurements of temperature (air, soil, borehole)
  - grids of active layer and moisture measurements (late summer) together with meta data



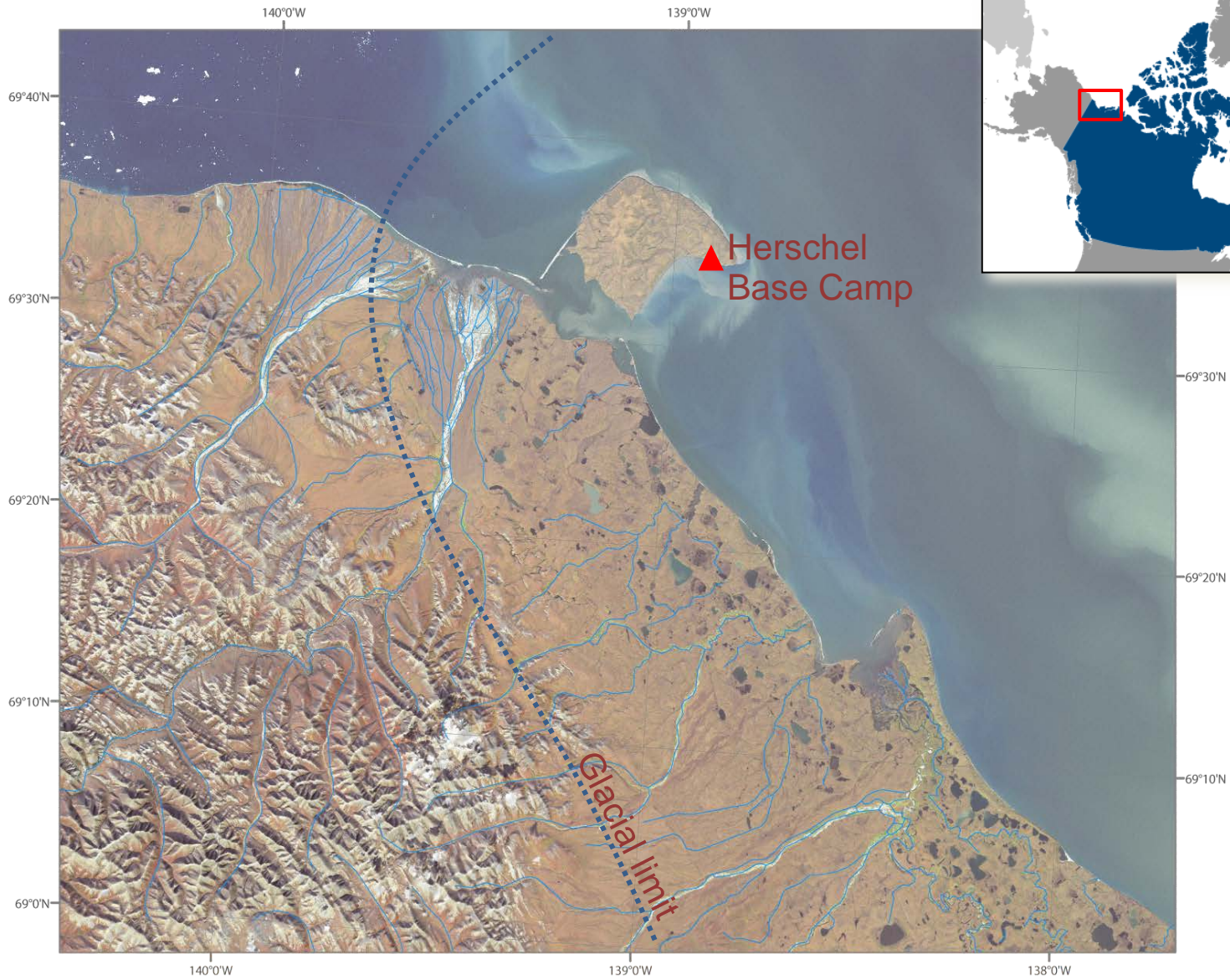




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- Herschel Island
  - Dedicated ground surveys for Herschel Island
  - Archive data initially used for planning

# Herschel Island



# Relevance & schedule



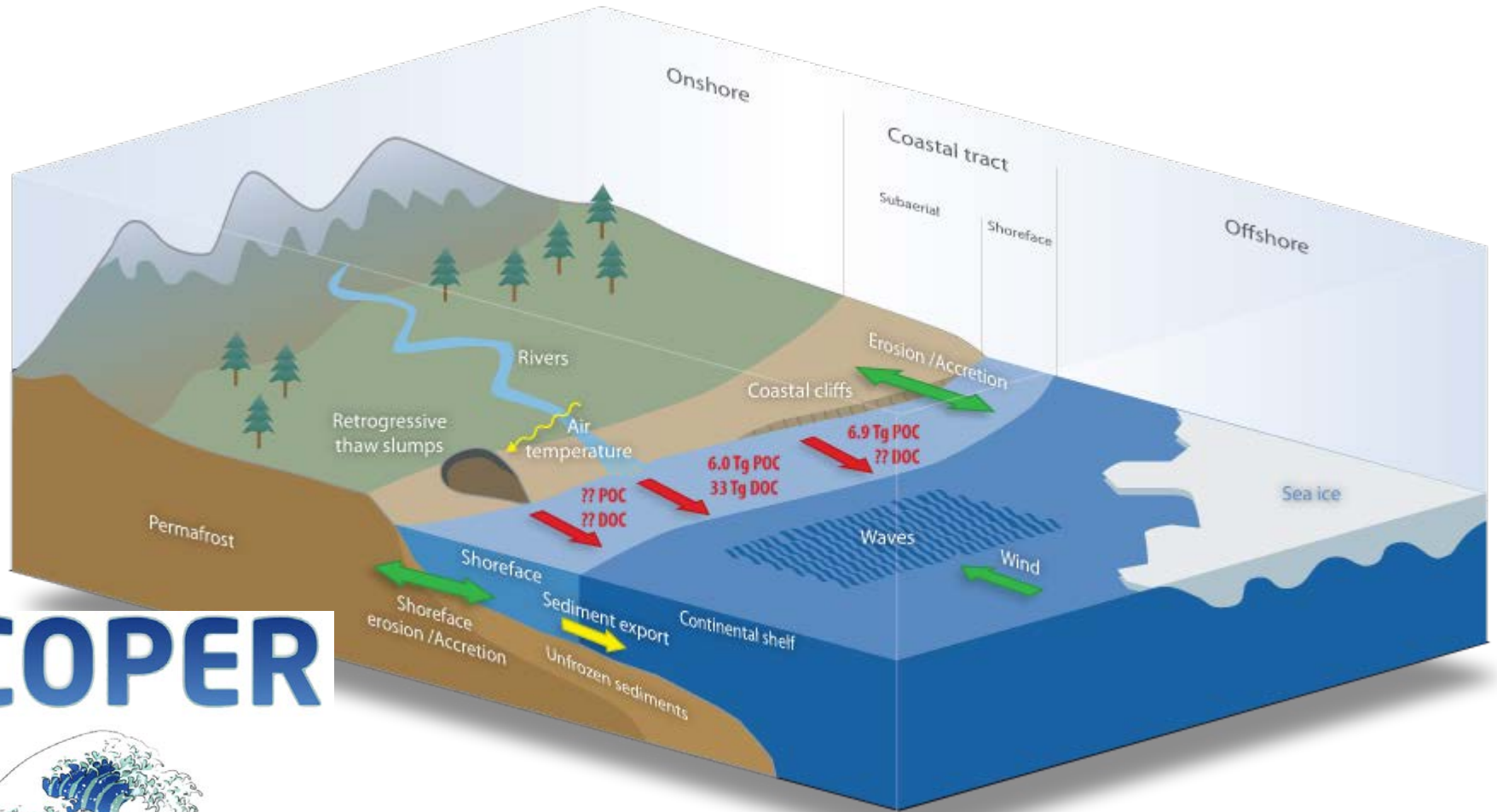
- The project ties into activities of
  - the FP7 Project Changing permafrost in the Arctic and its Global Effects in the 21st Century (PAGE21)(2011-2016)
  - The Helmholtz Young Investigator Groups
    - COPER - Coastal permafrost erosion, organic carbon and nutrient release in the Arctic near shore zone Dr. Hugues Lantuit (AWI)
    - SPARC - Sensitivity of Permafrost in the Arctic, Dr. Julia Boike (AWI)
  - The HGF Alliance: Remote Sensing and Earth System Dynamics, RESD. (AWI, Vienna University of Technology, Oslo University)(2012-2017)
- Scientific output will be distributed in 2015



# Existing Data

- Satellite and Aerial Imagery
  - SPOT (2002, 2006, 2007, 2009)
  - IKONOS (2001, 2004)
  - Aerial (1954, 1966, 1970, 1996)
  - ALOS (2008)
  - Landsat
  - Geoeye (2012)
- LIDAR (2012 & 2013)
- Radar (LAN1747)

# COastal Permafrost ERosion and Carbon Release

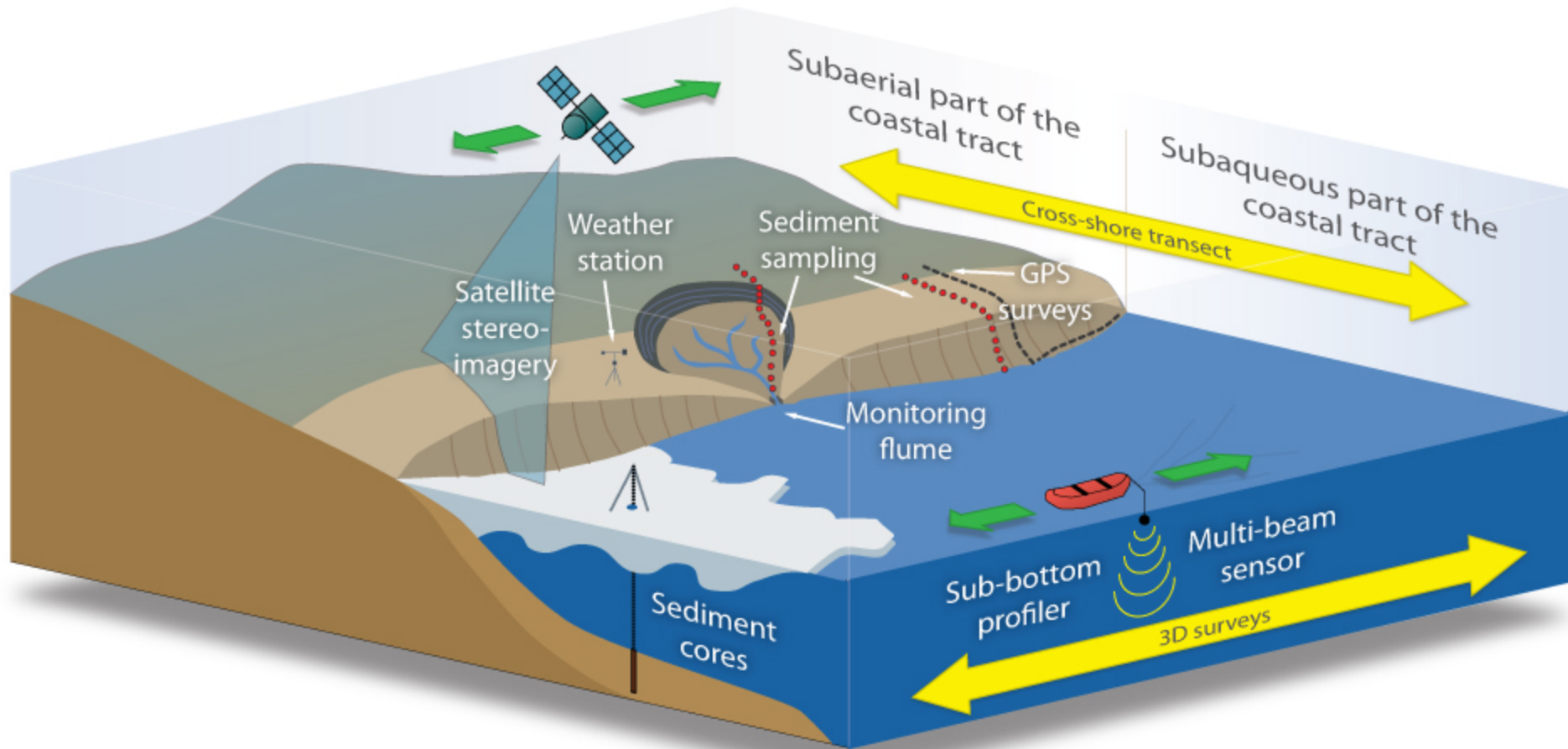


**COPER**



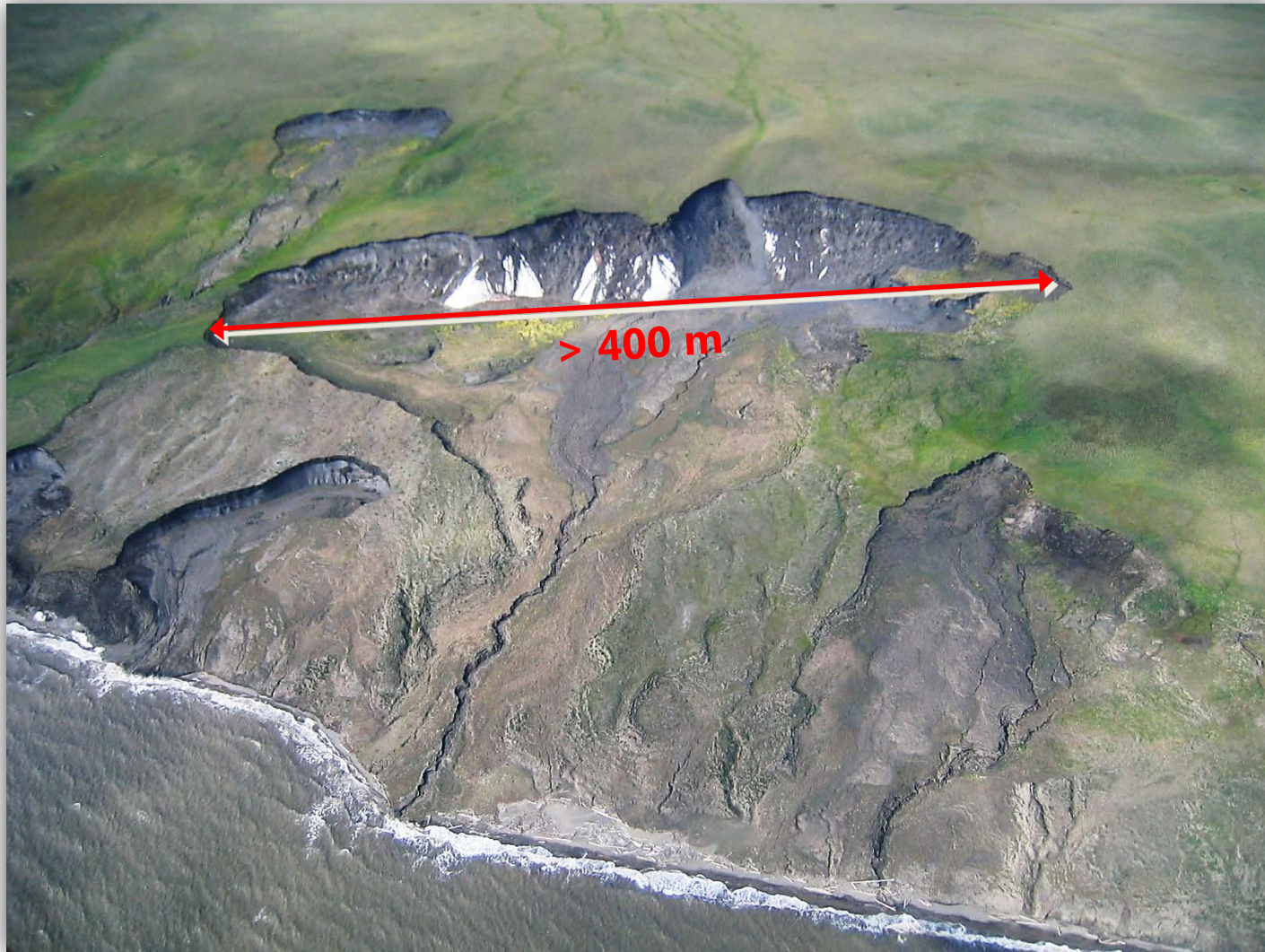


# Experimental setup





# Thermokarst – retrogressive thaw slumps

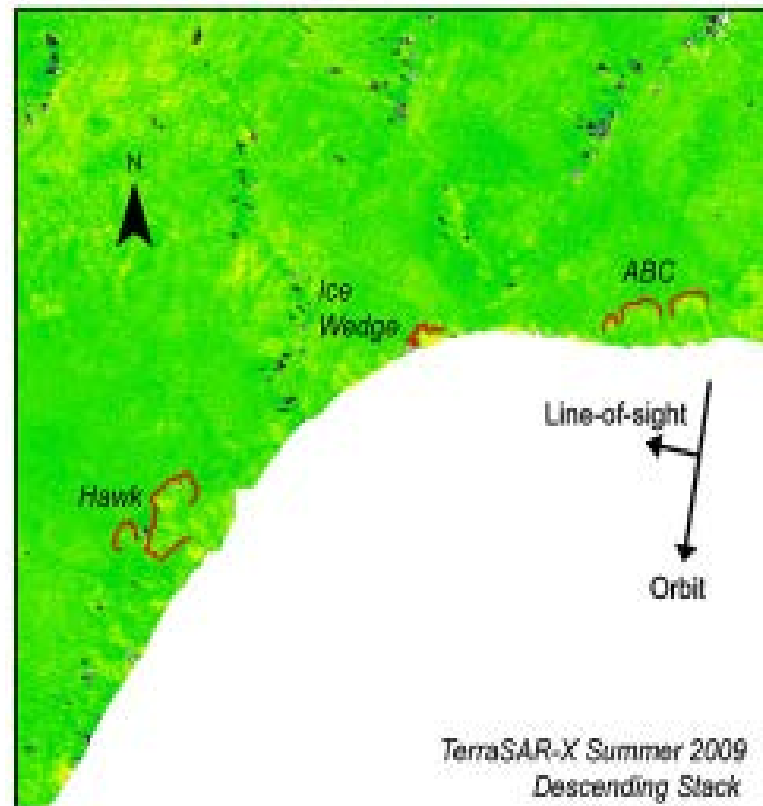


# InSAR during one summer season

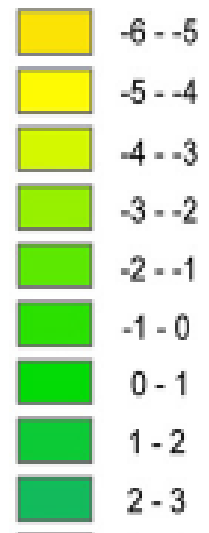
- Short et al. (2011):

- Thaw slump activity not consistently identified or quantified

- Investigation of backscatter intensity?

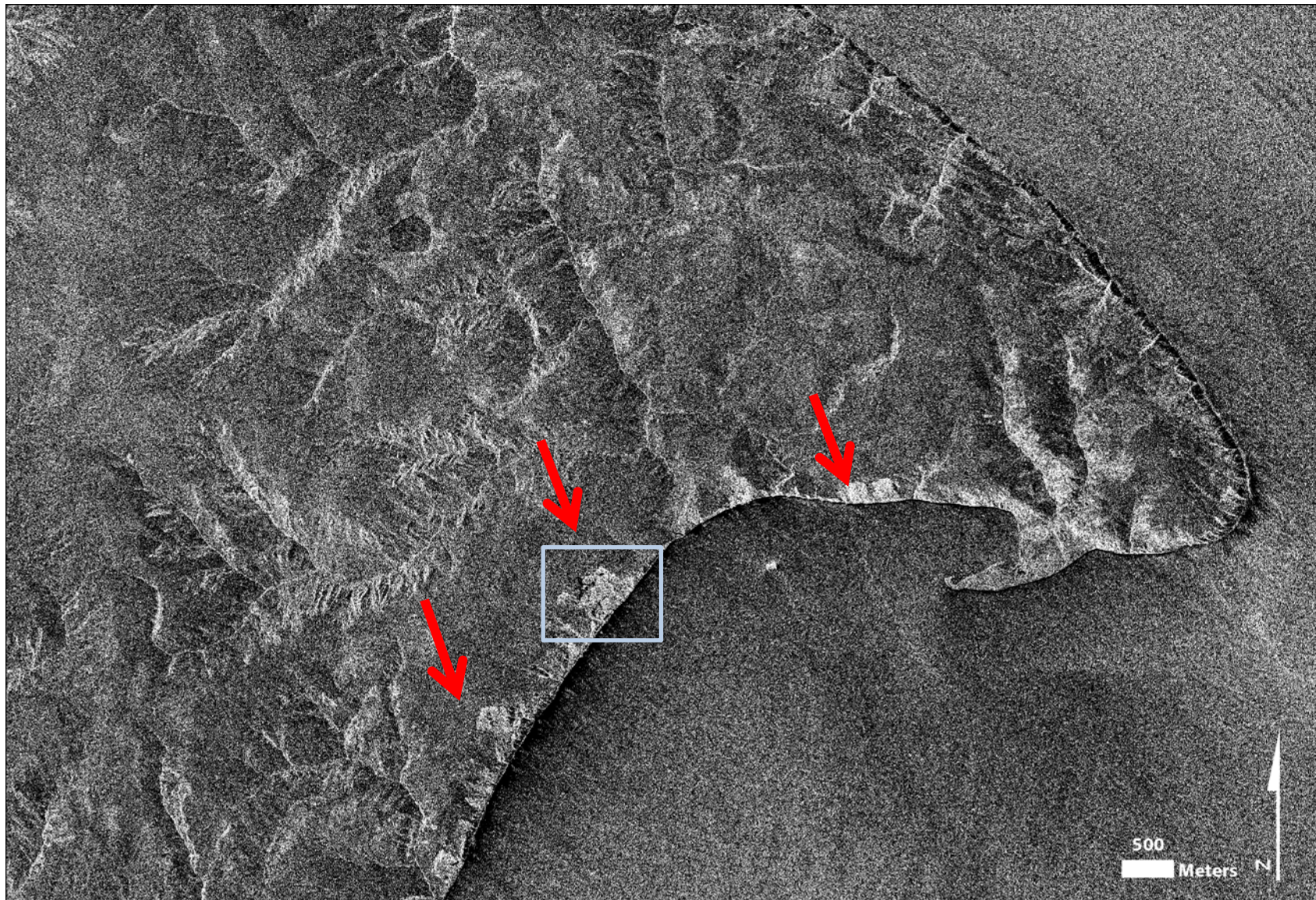


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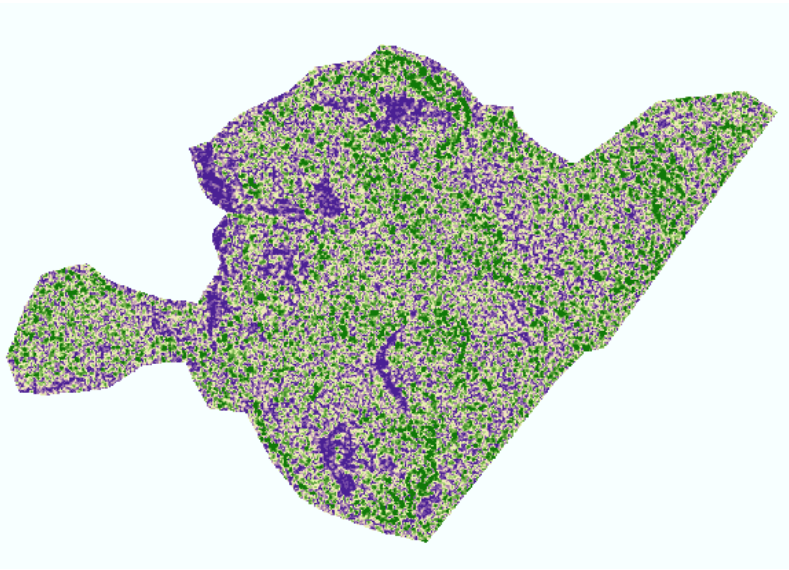


# Imagery





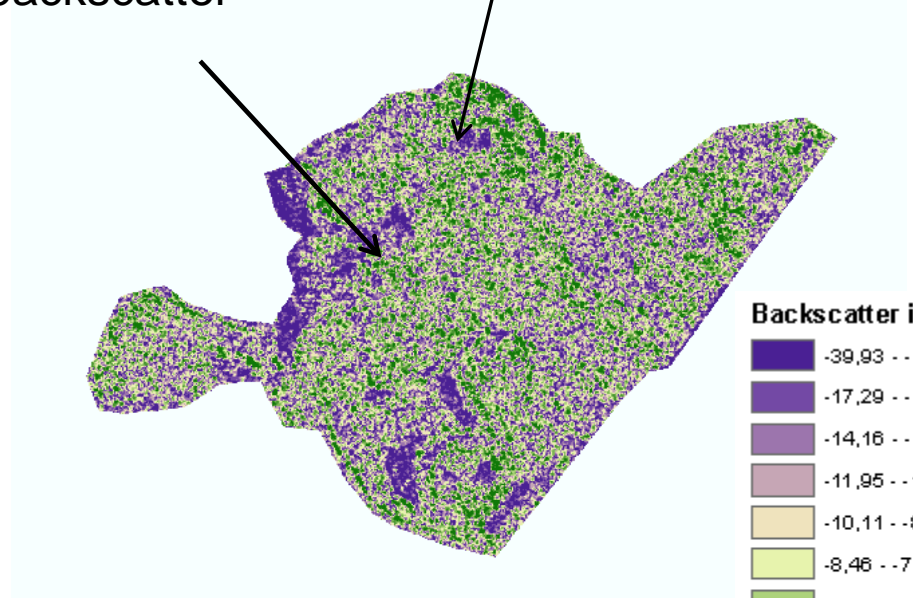
# A First Look at the Data



21.07.2010

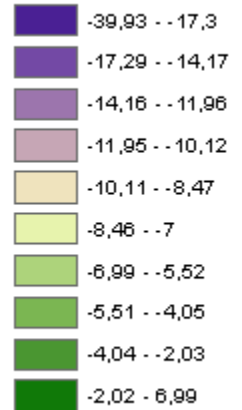
Increase of  
area with low  
backscatter

Decrease of area  
with low  
backscatter

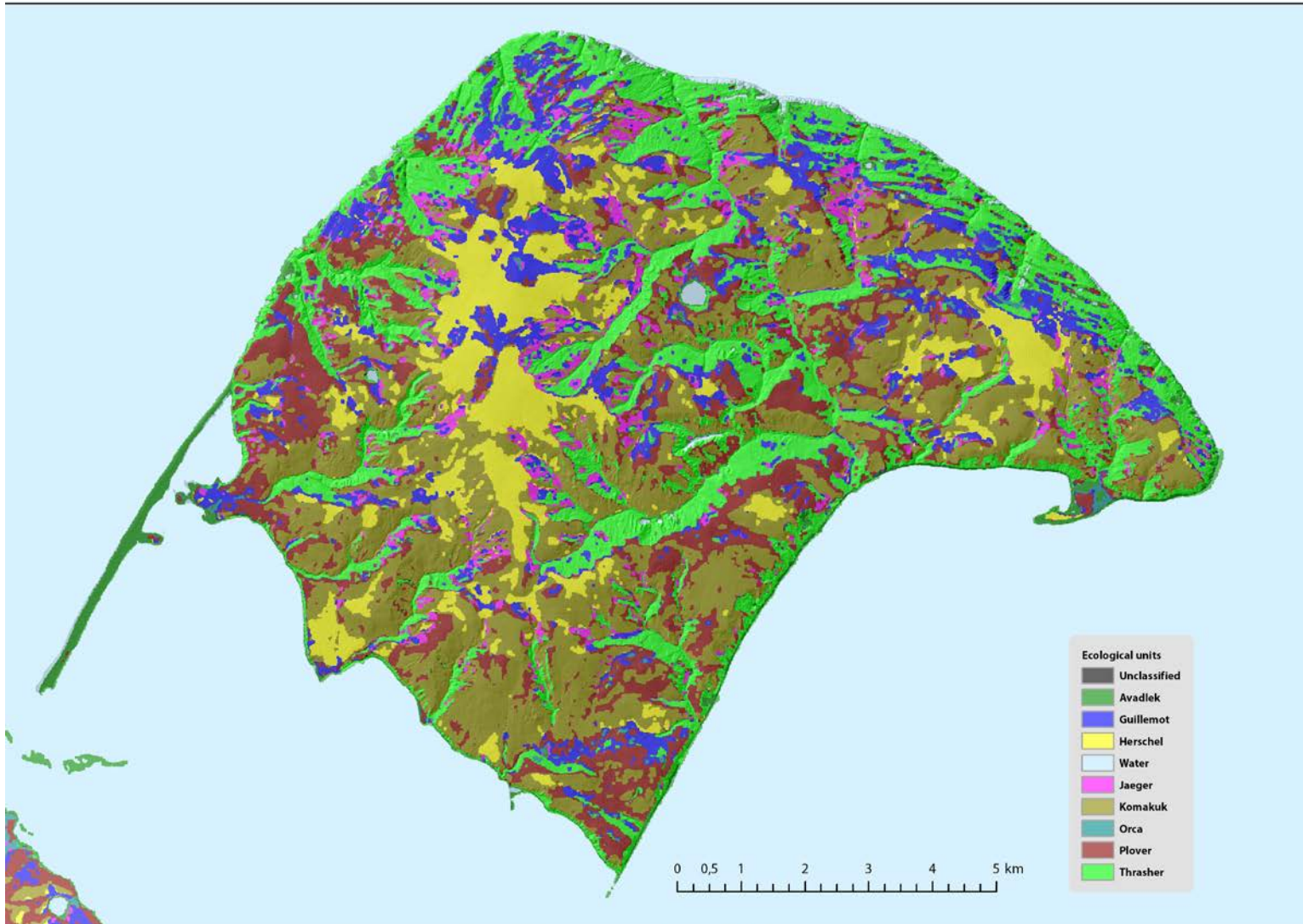


14.09.2010

Backscatter in dB

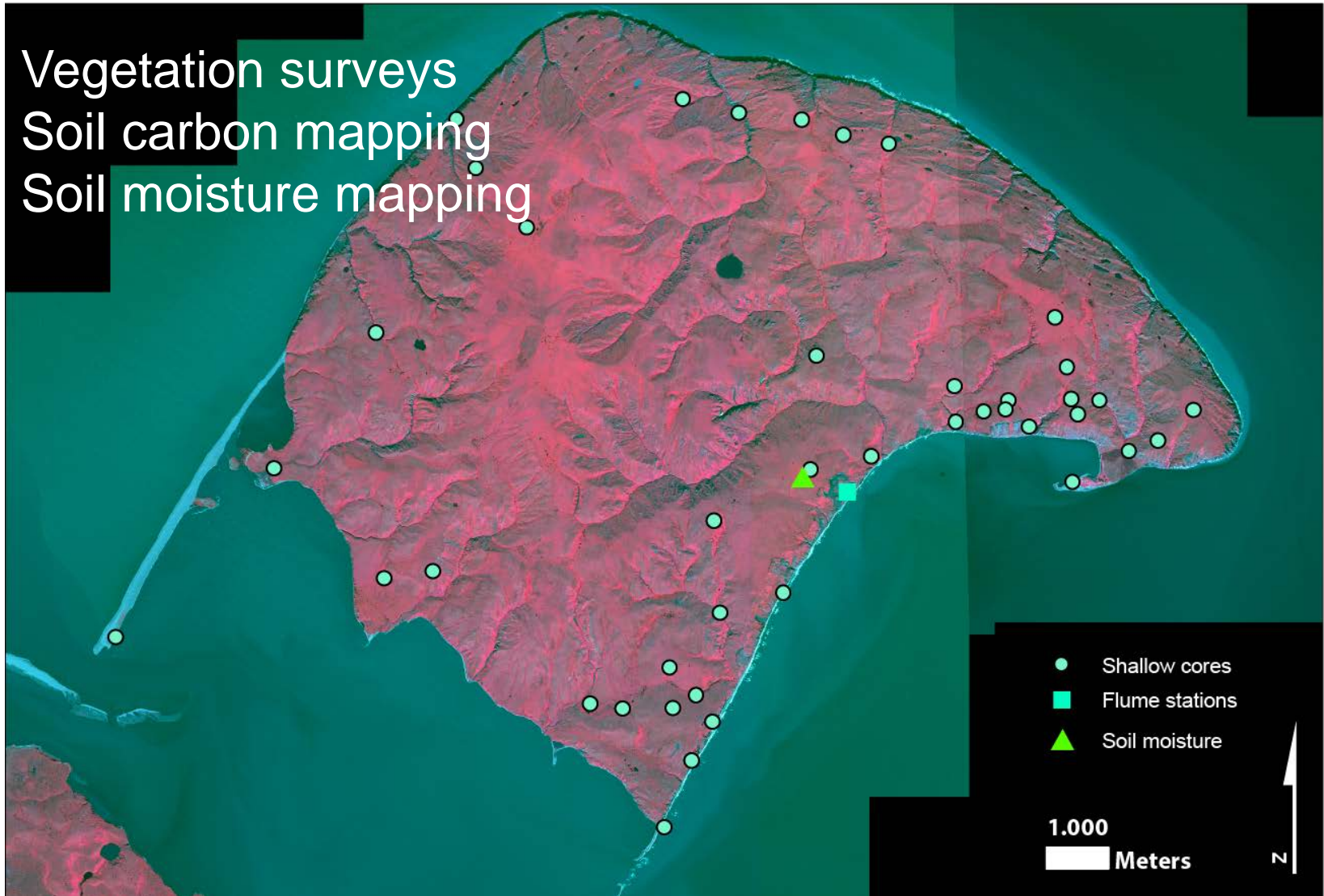


# Landcover



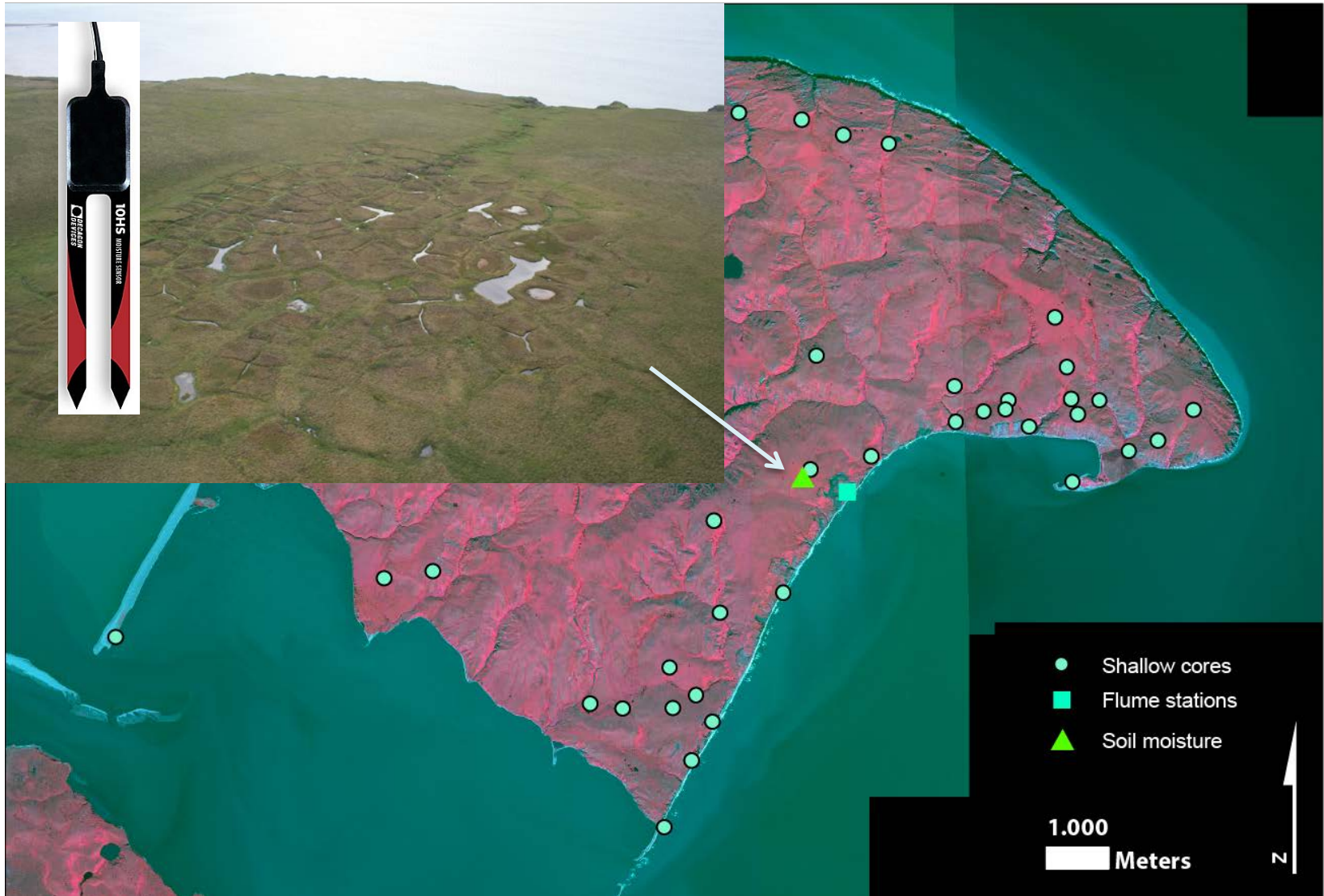
# Shallow Cores

Vegetation surveys  
Soil carbon mapping  
Soil moisture mapping

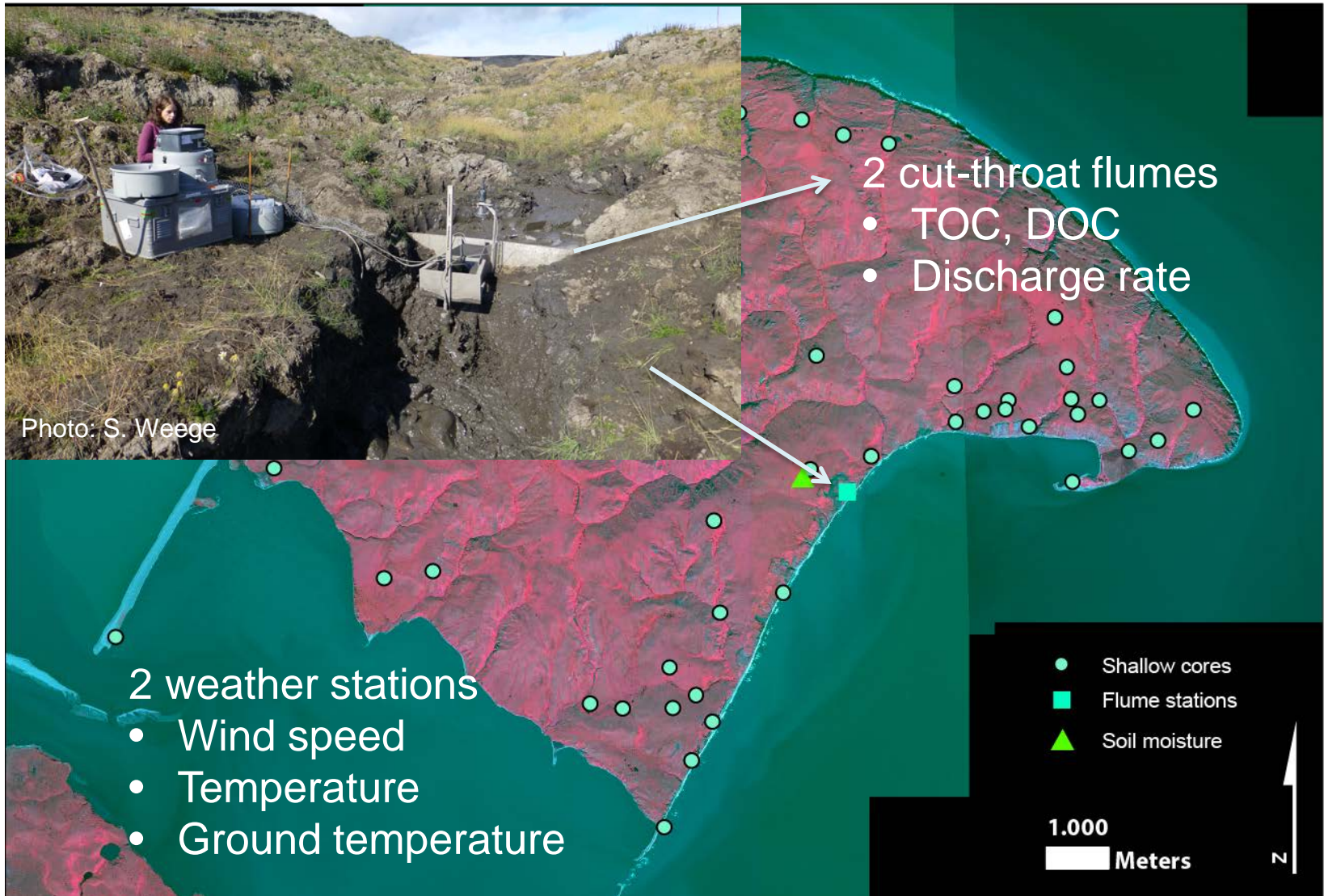




# Soil Moisture Monitoring



# Field Sampling Plan 2013



# Ground data collection planning

- Repeat photography with GPS
- DGPS surveys of retrogressive thaw slumps
- Moisture variations, vertical displacements, vegetation within slump area
  
- Aerial photography?
- LiDAR
- Shallow permafrost coring
- Soil temperature and soil moisture station



# Thank you!

