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

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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

Diagram showing the layers of permafrost, active layer, and supralateral ground water.
Permafrost – why do we care?

Global Carbon storage in soils (GtC)

Other soils  Temperate soils  Tropical soils  Permafrost soils  Atmosphere

Ice- and carbon-rich permafrost
LAN1747 - integrated high latitude permafrost monitoring

Co-PIs and further team members

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  • Birgit Heim, Hugues Lantiut, Sina Muster, Jaroslav Obu, Sonya Antonova, Boris Radosavljevic

• University of Oslo, Department of Geosciences
  • Andreas Kääb

• 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

PAGE21 sites (x) and TSX archive data availability
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
Global network

- Primary international program for permafrost monitoring
- Managed by the AWI & the IPA under GCOS and GTOS
- Consists of TSP (temperature) and CALM (active layer)
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• Herschel Island
  • Dedicated ground surveys for Herschel Island
  • Archive data initially used for planning
Herschel Island

Herschel Base Camp
Relevance & schedule

- The project ties into activities of
  - 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)

- Scientific output will be distributed in 2015
Existing Data

• Satellite and Aerial Imagery
  • ALOS (2008)
  • Landsat
  • Geoeye (2012)

• LIDAR (2012 & 2013)

• Radar (LAN1747)
COastal Permafrost ERosion and Carbon Release
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?
Imagery
A First Look at the Data

Decrease of area with low backscatter

Increase of area with low backscatter

21.07.2010

14.09.2010
Landcover
Shallow Cores

Vegetation surveys
Soil carbon mapping
Soil moisture mapping
Soil Moisture Monitoring
Field Sampling Plan 2013

2 cut-throat flumes
- TOC, DOC
- Discharge rate

2 weather stations
- Wind speed
- Temperature
- Ground temperature

Photo: S. Weege
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!