



Kevin Schaefer

# Remotely Sensed Active Layer Thickness (ReSALT)

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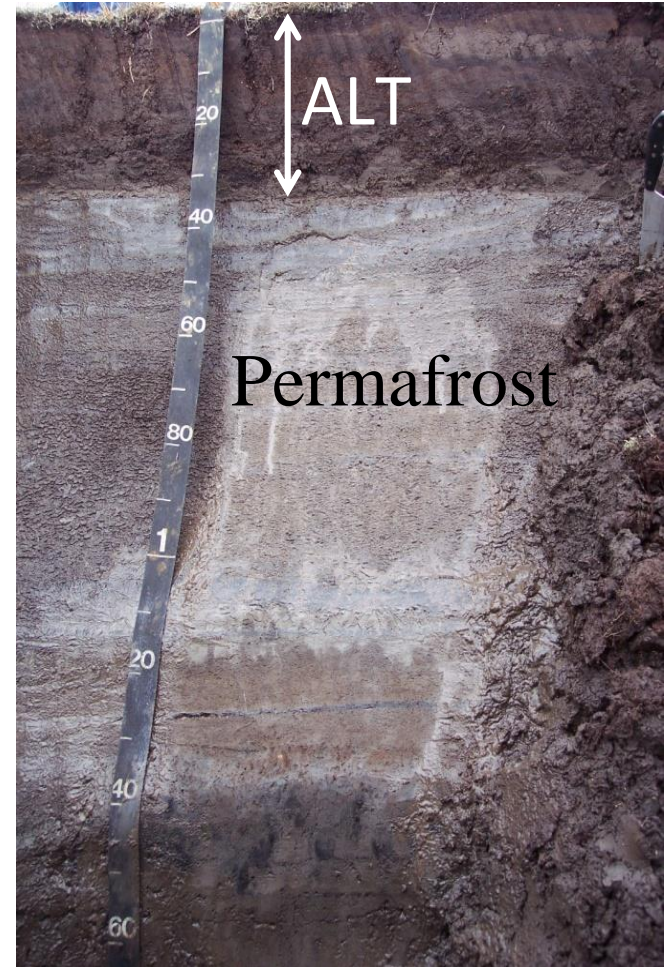
Elchin Jafarov (INSTAAR)

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Santosh Panda (University of Alaska, Fairbanks)

# And... but... therefore

- Active Layer Thickness (ALT) is an essential climate variable **and** difficult to measure
- **But** surface heaves as the active layer freezes
- **Therefore** we use InSAR to estimate ALT

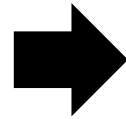
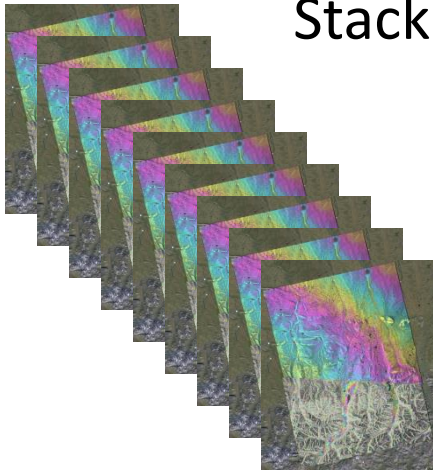


# Science Questions & Objectives

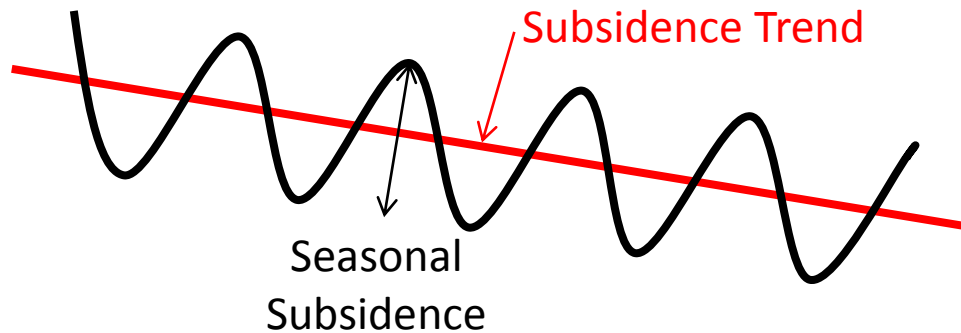
- T2 Questions
  - 3.3 (permafrost distribution)
  - 3.2 (disturbance impact)
- T2 Objective Ecosystem Dynamics: 1 (permafrost vulnerability)
- Pre-Above project
- Companion NSF project

# ReSALT InSAR Processing

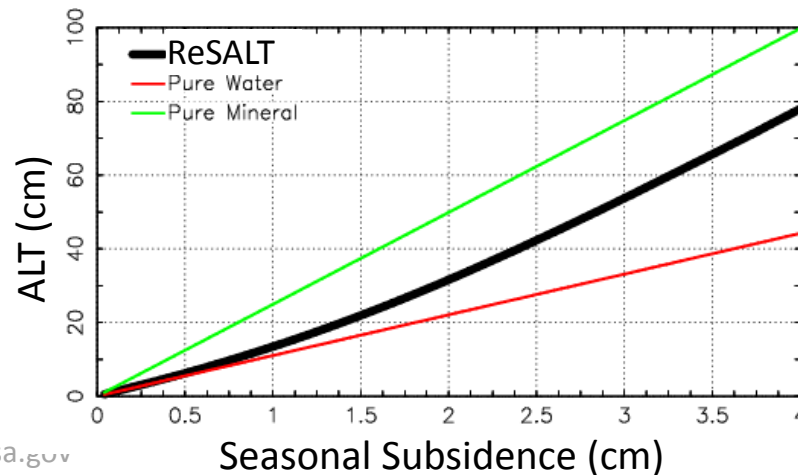
(1) Interferogram Stack



(2) Subsidence Forward Model

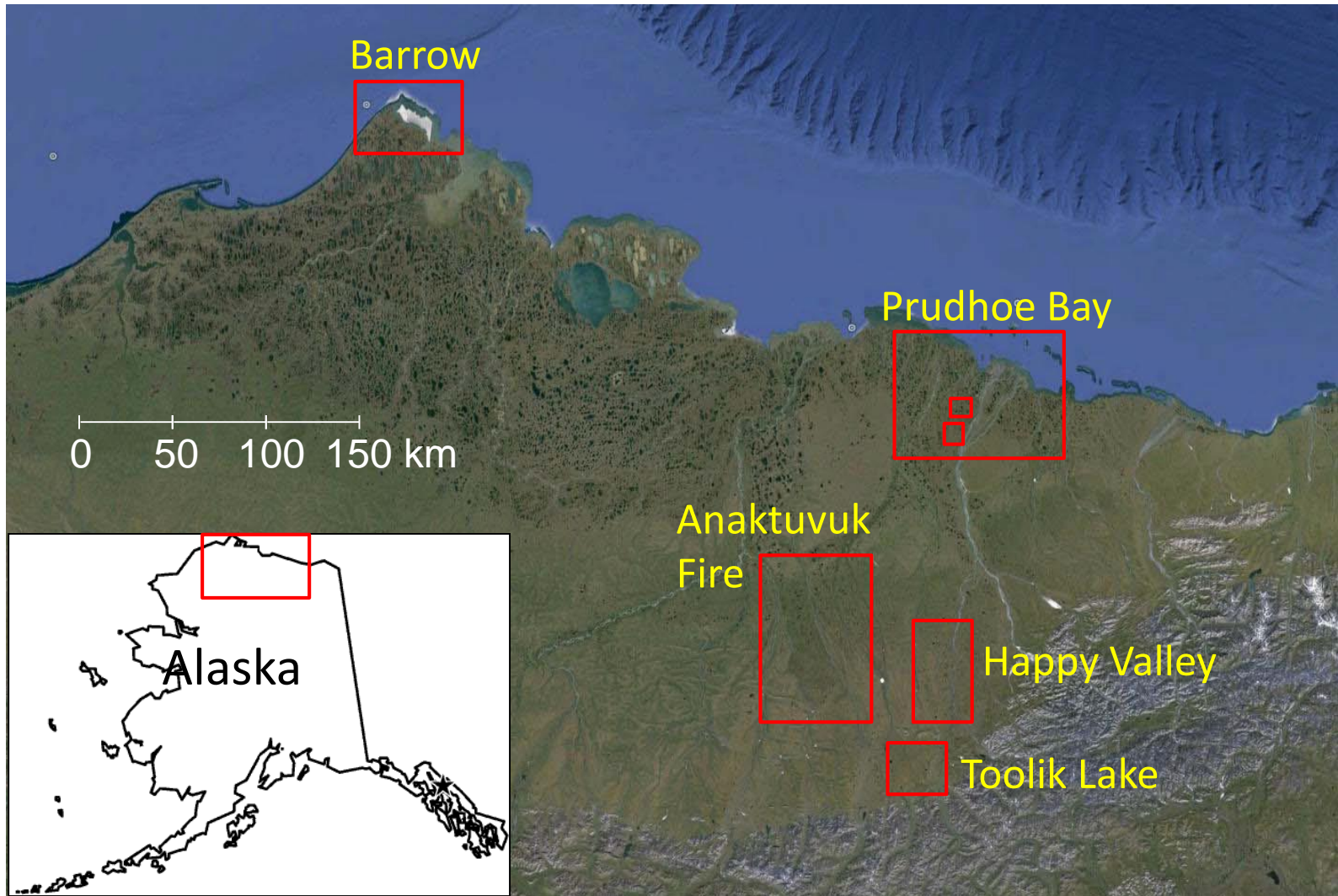


(3) Calculate ALT



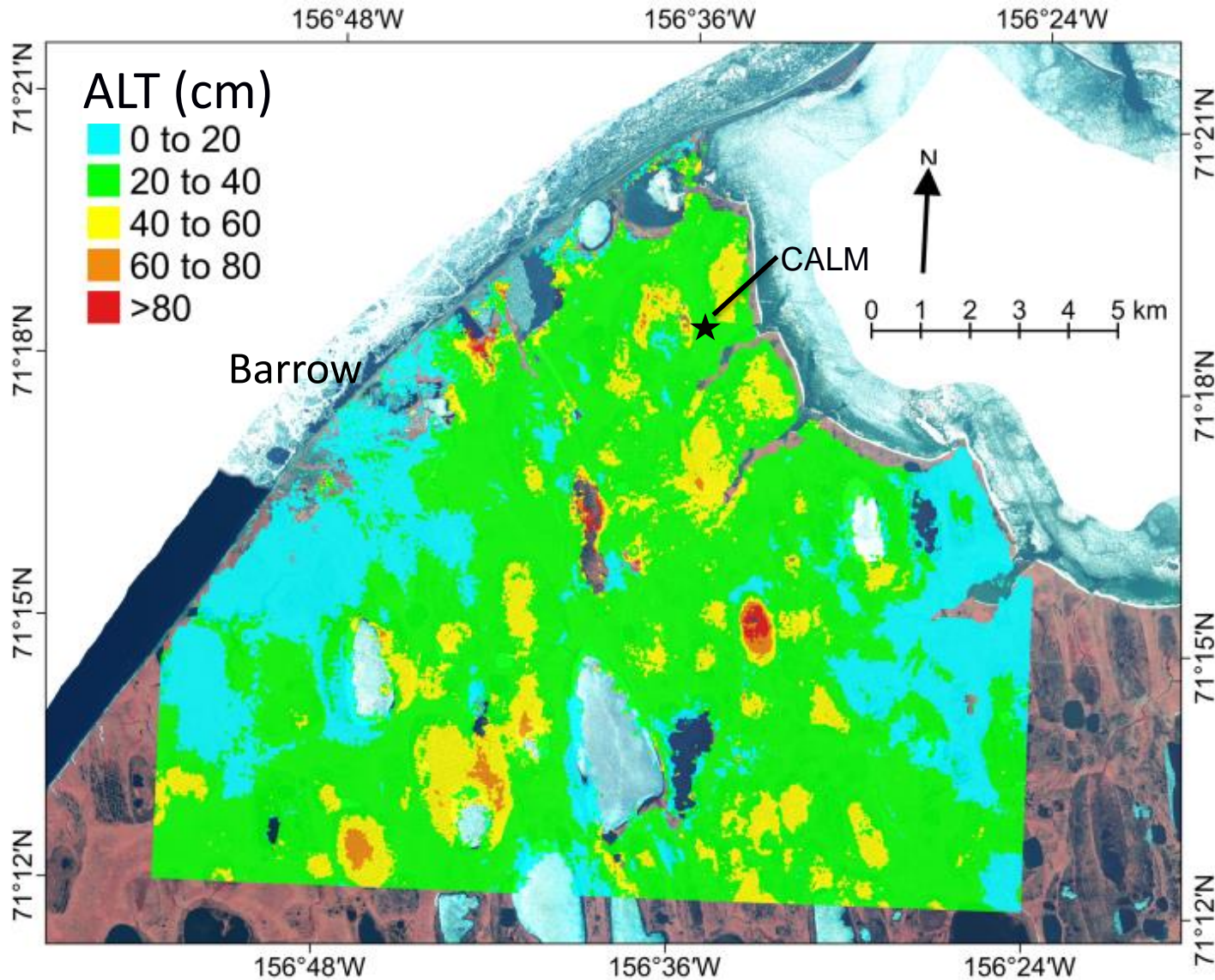


# ReSALT Products



Subsidence trends, seasonal subsidence, ALT, uncertainties

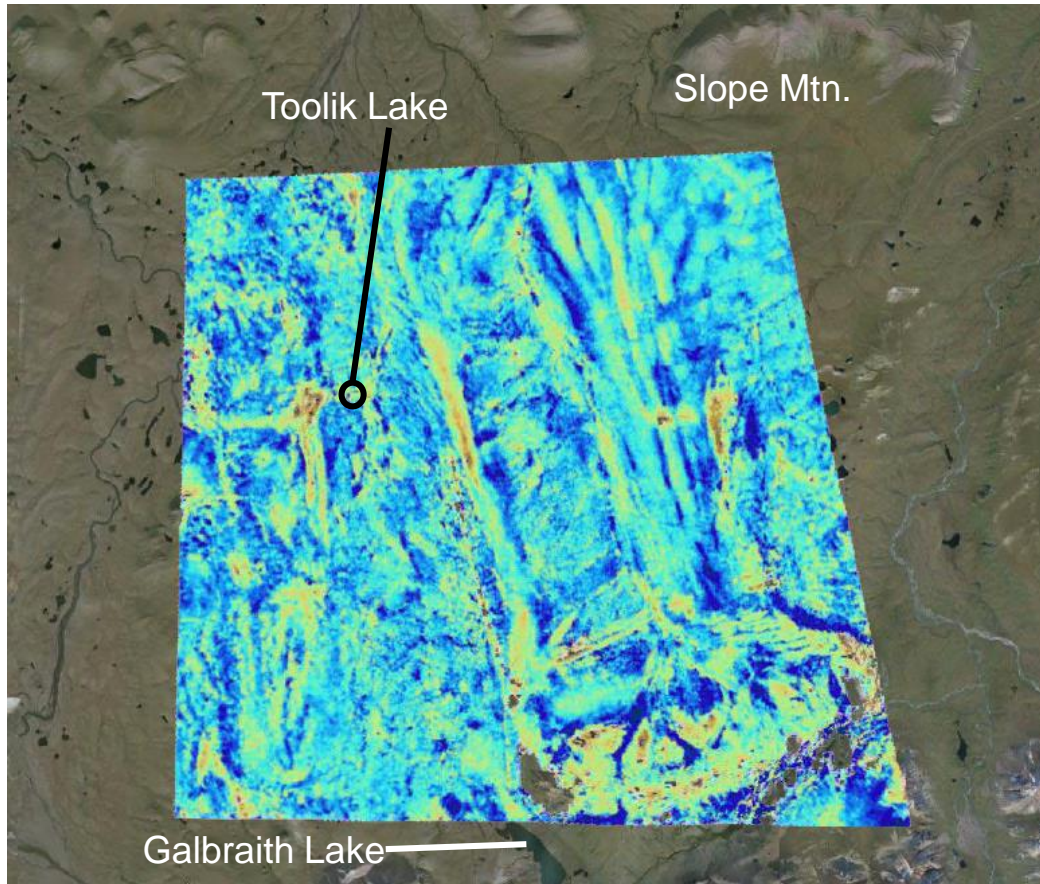
# Barrow ALT



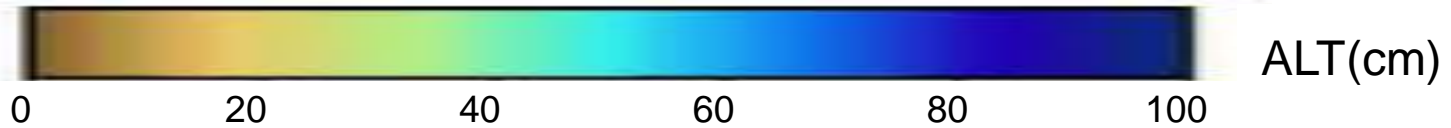
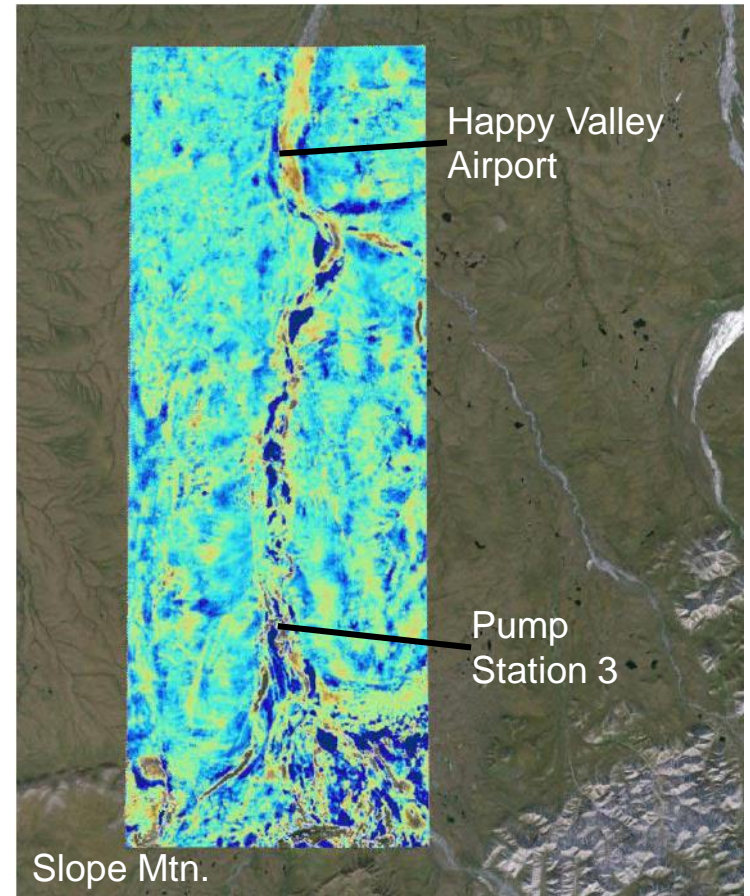


# Toolik Lake ALT

Toolik Lake



Happy Valley

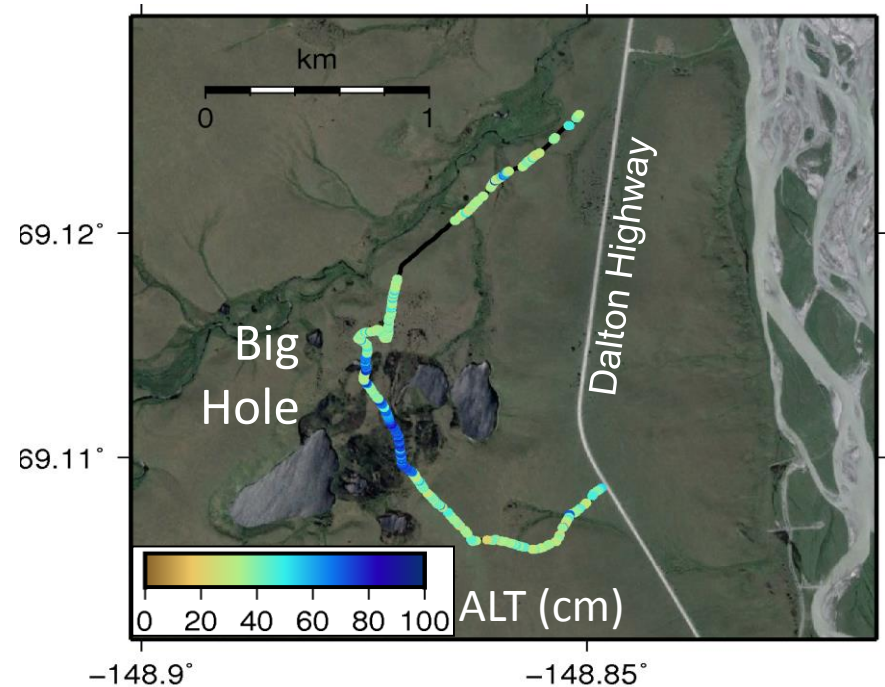


# ReSALT Validation Data

- Ground Penetrating Radar (GPR)
  - Barrow (15 km), Toolik Lake (15 km) Prudhoe Bay (7 km)



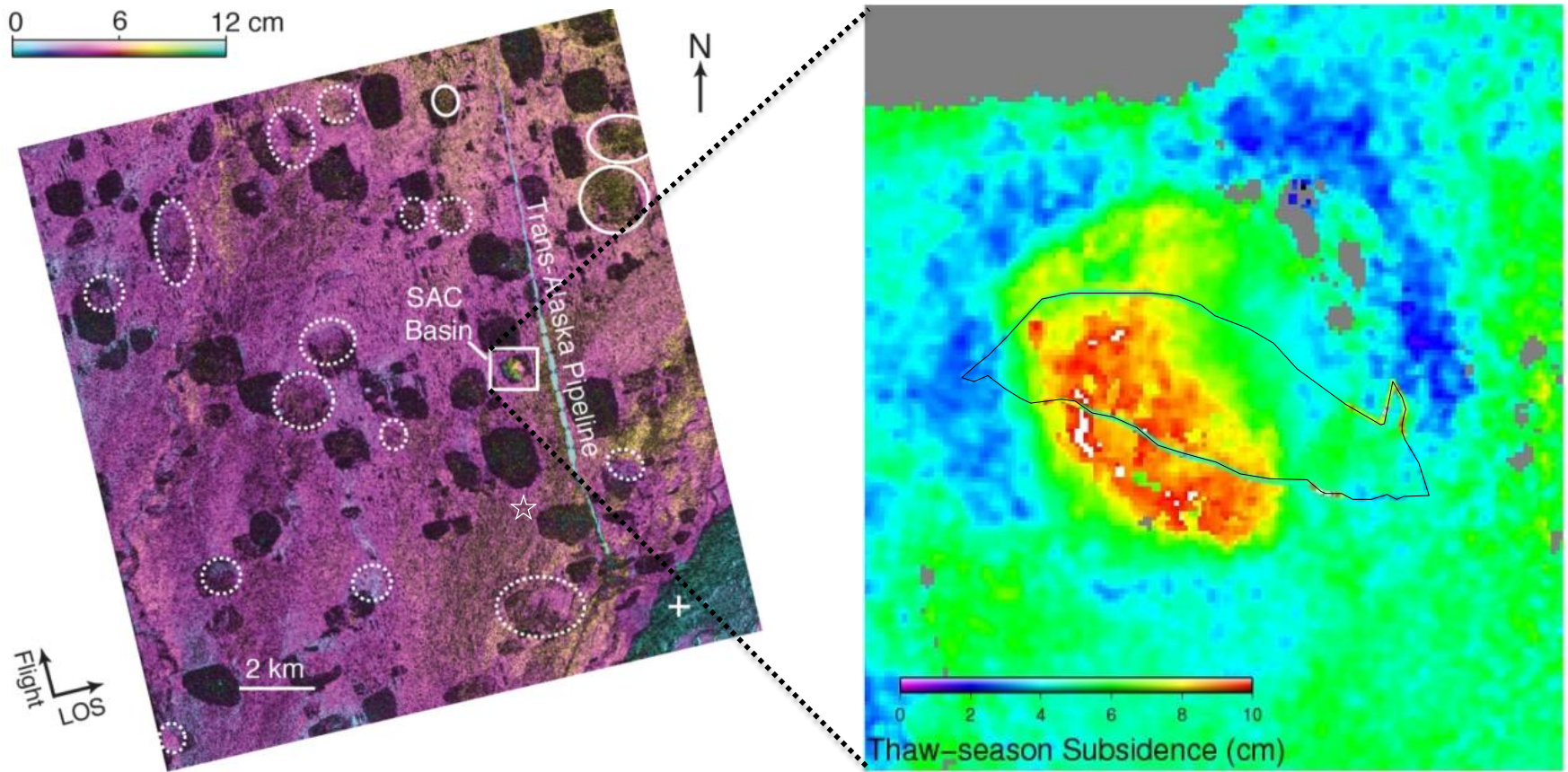
Dragging GPR at Toolik Lake



Big Hole transect near Happy Valley

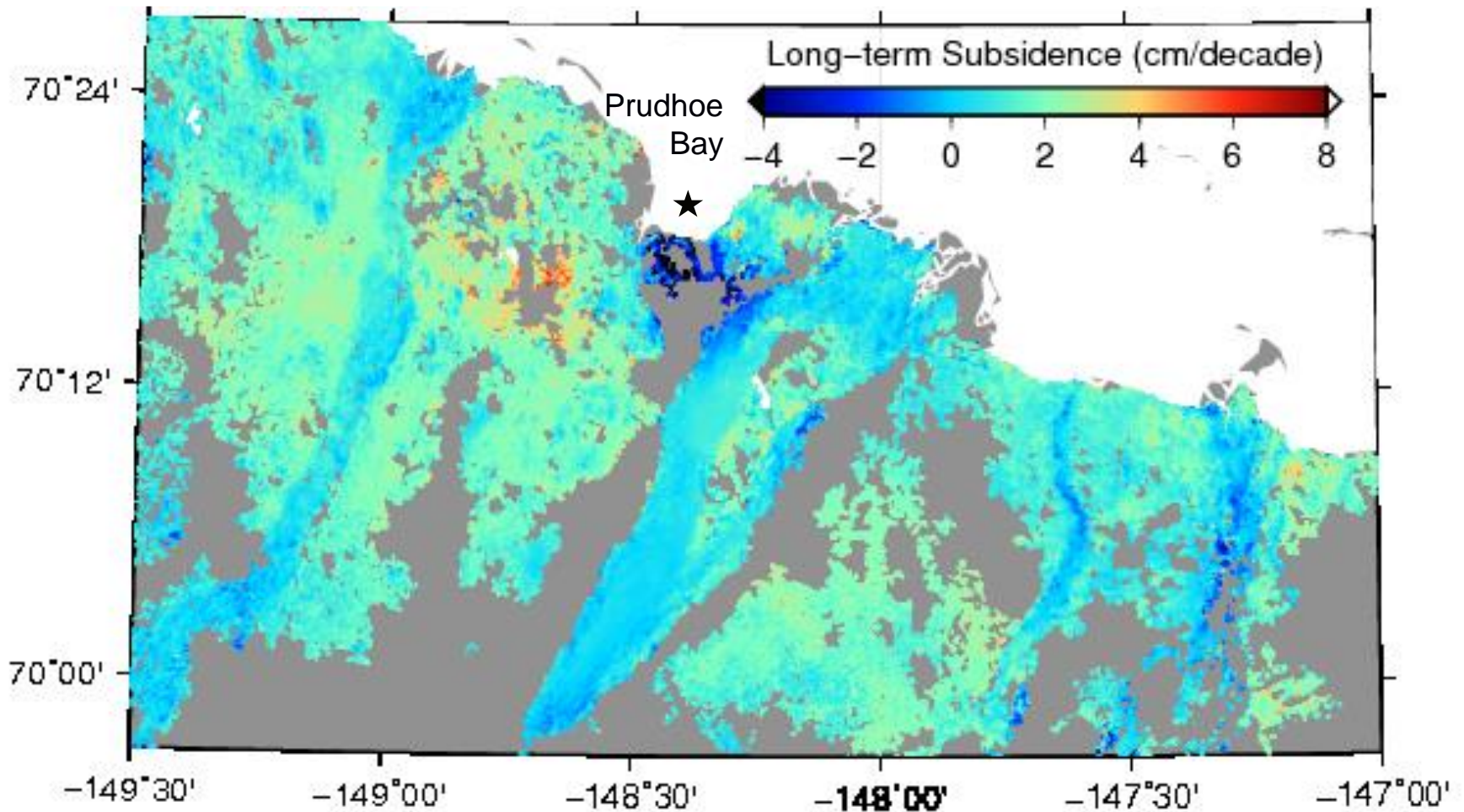


# Unexplained Drained Lake Subsidence



- Seasonal excess ground ice?

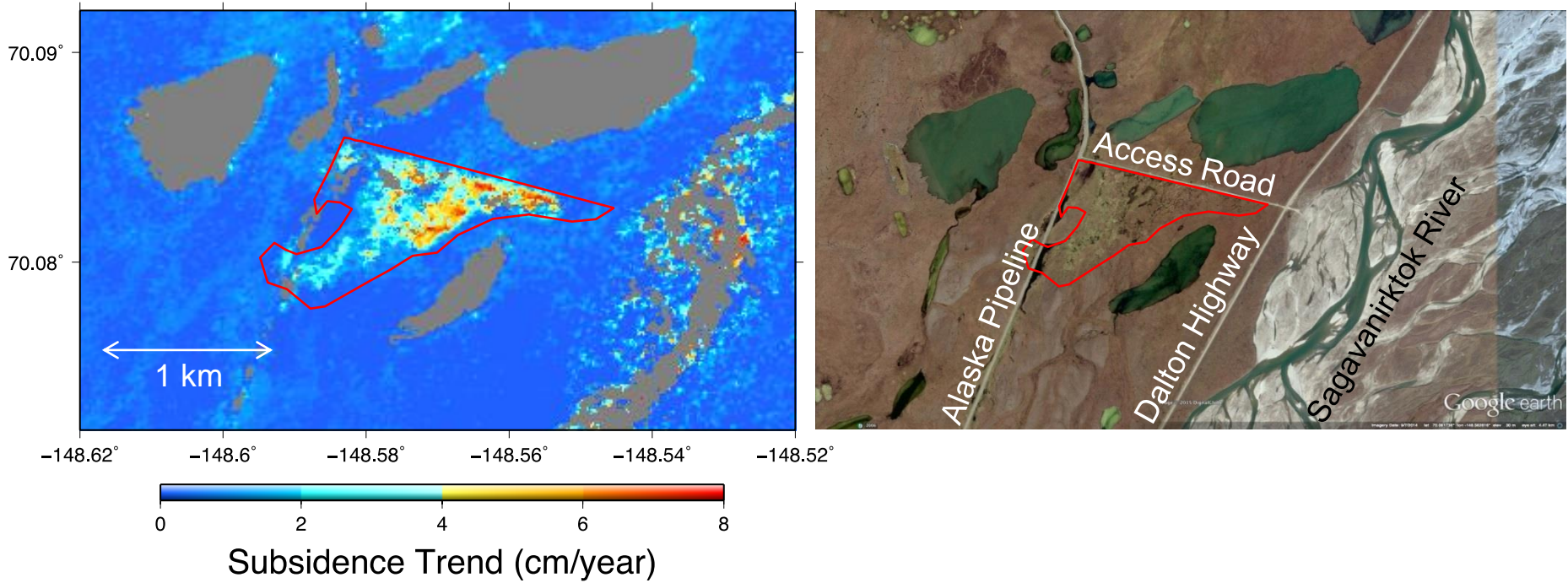
# Prudhoe Bay Subsidence Trends





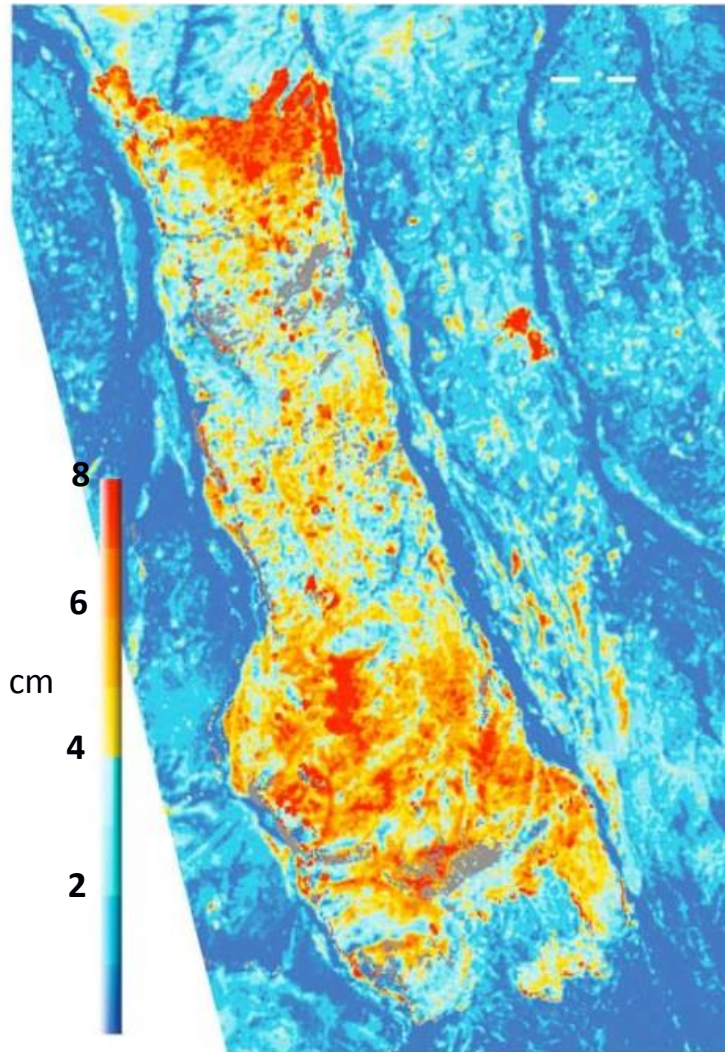
# Thermokarst Detection

## Pipeline Thermokarst

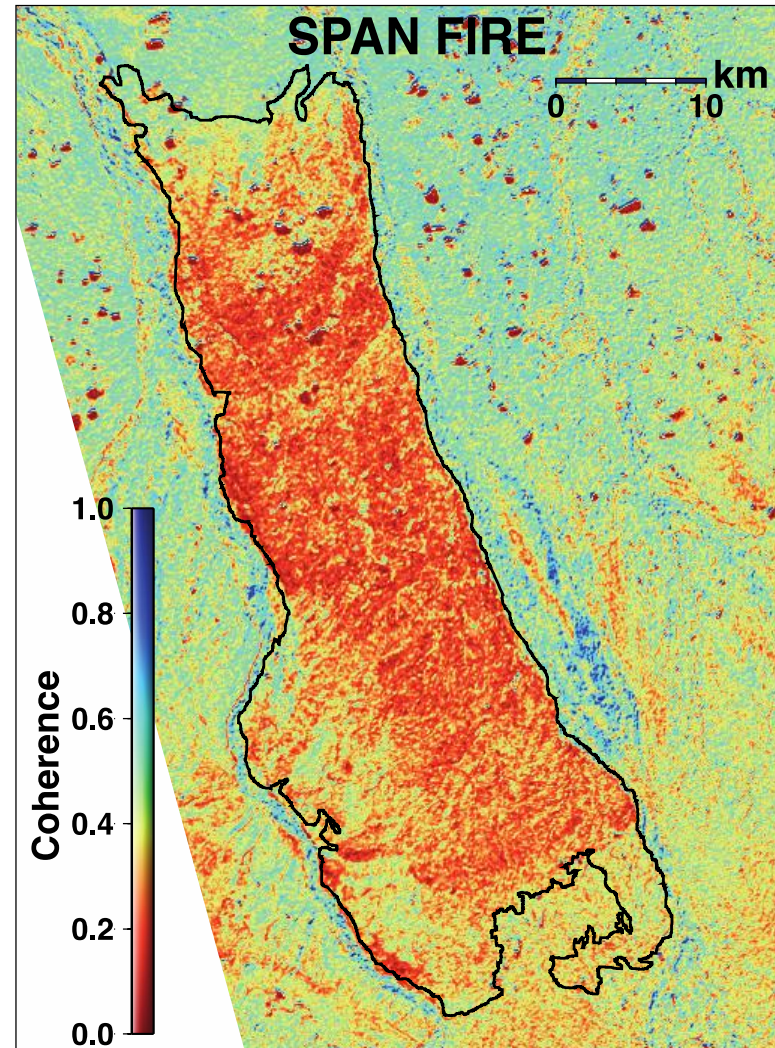




# Anaktuvuk Fire



Seasonal Subsidence after fire



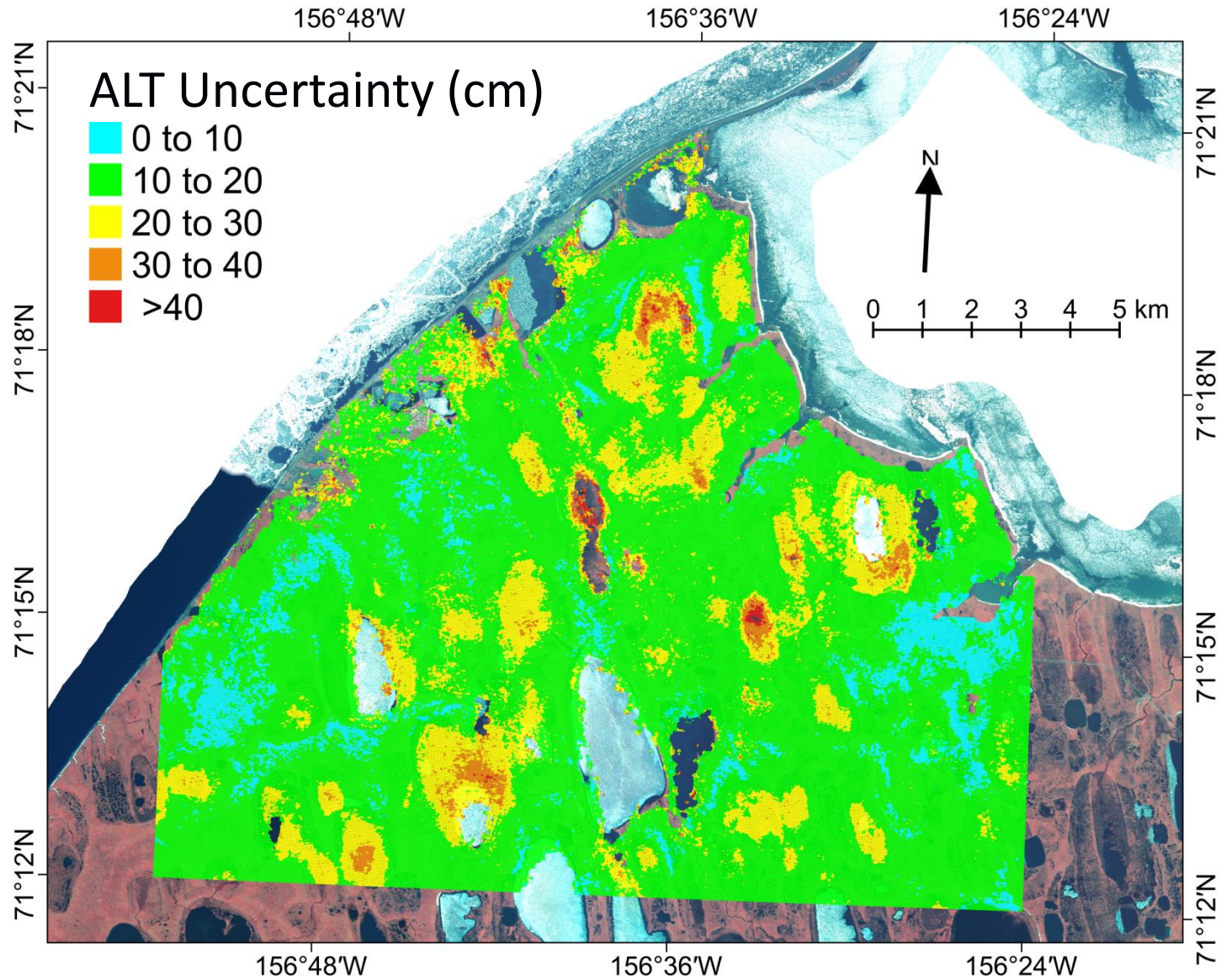
Coherence Loss

# Conclusions

- InSAR can measure ALT, and more...
- Products on ABoVE Science Cloud:
  - Barrow ReSALT
  - Prudhoe Bay ReSALT
  - Toolik Lake GPR
- Future Work: Yukon Flats?
  - Depends on where ABoVE teams go



# Barrow ALT Uncertainty





# Thermokarst: subsidence due to melting ground ice

