



Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

Science Objectives

1. Develop sophisticated radar scattering models adapted for Alaska and Western Canada permafrost landscapes that account for multilayer soils with a surface organic layer and vegetation roots, and intervening tundra and taiga vegetation.
 - Use Lidar observations to parameterize above-ground vegetation structural properties.
 - Limited but judicious ground sampling is planned for this phase of the project.
2. Apply the model developed under Objective 1 to develop a regionally refined inverse algorithm to retrieve permafrost properties using dual-frequency P-band and L-band radar imagery; and
3. Use combined airborne radar remote sensing from AirMOSS and UAVSAR to retrieve and map belowground biomass, soil moisture profile, and active layer thickness (ALT), and assess the retrieval error and uncertainty using ground truth observations.



Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

Impacts on ABoVE Science

- This work directly responds to the Terrestrial Ecology Program's seeking to "strengthen the theoretical and scientific basis for measuring Earth surface properties using reflected, emitted, and scattered electromagnetic radiation."
- No other remote sensing observation is expected to provide the proposed set of products, especially the root biomass, the information which is scarce in the Arctic.



Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

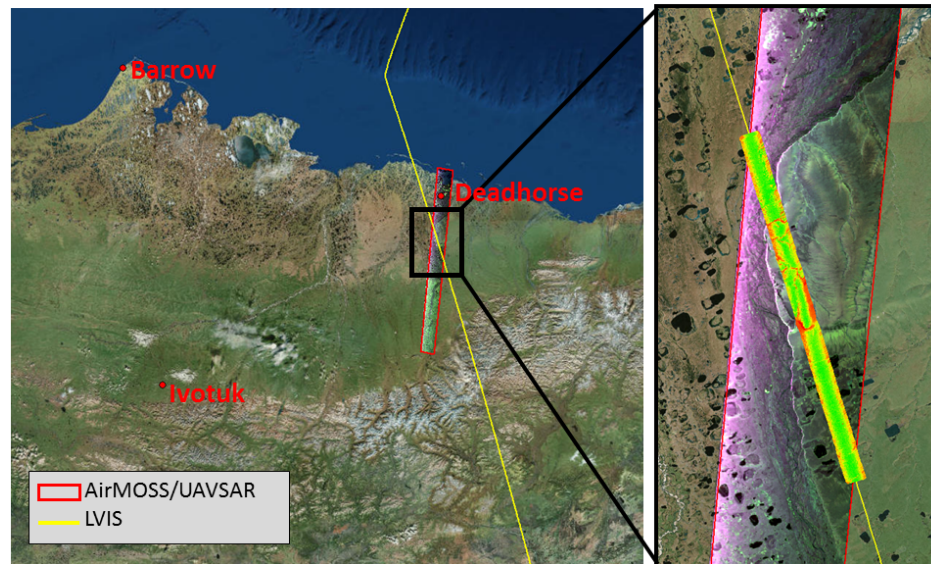
PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

Sensor/Platform Summary

- AirMOSS
- UAVSAR
- LVIS

LVIS images and field work data will be used for

- parametrization
- algorithm development
- error assessment





Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

Fieldwork Sites





Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

Flight Line and Timing Priorities

AirMOSS/UAVSAR deployments

- 1- An early-June flight
- 2- A late-August flight, which would be during our planned field work
- 3- An early-October flight
- 4- A late-October flight
- 5- A mid-July flight

Needs for AirMOSS/UAVSAR deployments

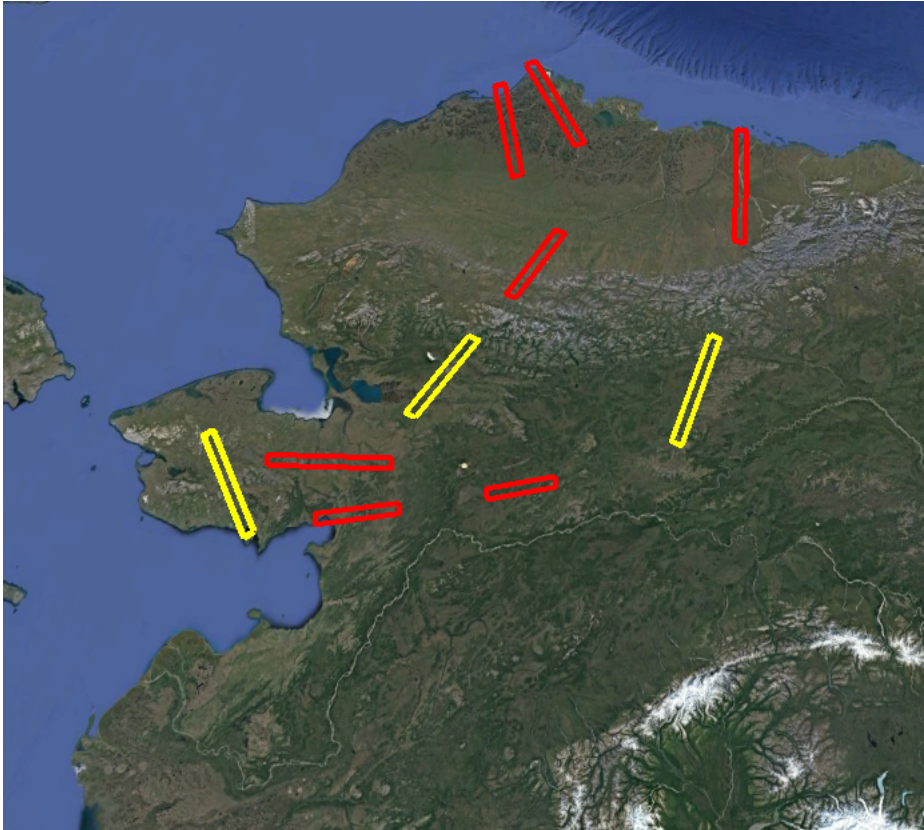
- Spatially overlapping and temporally as close as possible
- Spatial overlaps with LVIS flight lines to support parametrization over representative vegetation types
- Spatial coverage to span AK and Canada circuits as proposed in airborne whitepaper with overlaps (as much as possible) with the current IDS AirMOSS/UAVSAR transects to support further time-series analysis



Estimation of Belowground Biomass and Permafrost Active Layer Properties Using Radar and Lidar Measurements

PI: Alireza Tabatabaenejad, CoI: Mahta Moghaddam, University of Southern California

AirMOSS/UAVSAR/LVIS Flight Lines



- Yellow lines indicate where LVIS would ideally cover. These are the areas with significant vegetation presence for the radar model.