Hydrology & Permafrost Synthesis Activities

John Kimball, David Butman (HPWG leads), Torre Jorgenson, Tamlin Pavelsky, John Mallard, Mahta Moghaddam, Go Iwana, Peter Kirchner, Neil Pastick, Oliver Sonnentag, Kevin Turner, Nancy French, Bruce chapman, Laura Bourgeau-Chavez, Tom Douglas, Mike Rawlins, Michelle Walvoord, Abhishek Chattergee, Bill Quinton, Olivia Carpino, Laura Chasmer, Ryan Connon, Christopher Hopkinson, Kristine Haynes, Cathy Wilson

HPWG Science Focus Area

Three synthesis activities identified from WG Phase I/II activities:

- Patterns, trends, & drivers of thermokarst in Alaska & Northwest Canada [T Jorgenson].
- Temporal & spatial variations of active layer properties over foundational flight lines & upscaling to the ABoVE domain [M. Moghaddam, J. Kimball].
- A changing understanding of hydrologic connectivity in boreal rivers, lakes, & wetlands of Arctic-boreal North America (T. Pavelsky, J. Mallard].

Synthesis activities address HPWG science [1]priorities to clarify:

- Processes controlling changes in PF distribution & properties, & their impacts
- Nature, causes & consequences of hydrologic changes, Incl. water storage, mobility & distribution
- Water, carbon, energy cycle & ecosystem linkages

Crosscutting with other WG activities, including:

- Snowscapes, Disturbance, Modeling, & Carbon dynamics

Activities still in early implementation stages; contact WG or synthesis leads for participation!

[1]ABoVE Implementation Plan

Thermokarst Patterns and Processes

Team: T. Jorgenson [lead], Go Iwana, Neal Pastick, Oliver Sonnentag, Kevin Turner

Objectives:

- Characterize thermokarst landforms from hydrology perspective;
- Quantify extent & decadal trends of dominant thermokarst features
- Synthesize key thermokarst drivers & integrate into conceptual models
- Review assessment & monitoring methods;
- Identify & communicate priorities for effective monitoring at a range of scales;
- Showcase ABoVE projects & data

Crossover synergy: Water cycle Trends [T. Pavelski], Permafrost-Vegetation Disturbance [H. Epstein], Multidisturbance synthesis [A. Foster]

Deliverables:

- Publication(s), Incl. literature review; Geodatabase of thermokarst locations, integration of major analyses & products from ABoVE

Active Layer Properties & Upscaling

Team: M. Moghaddam, J. Kimball [leads], C. Wilson, G. Iwana, N. Pastick, P. Kirchner, Y. Yi, R. Chen, D. Nicolsky, B. Quinton, O. Carpino, L. Chasmer, R. Connon, C. Hopkinson, K. Haynes

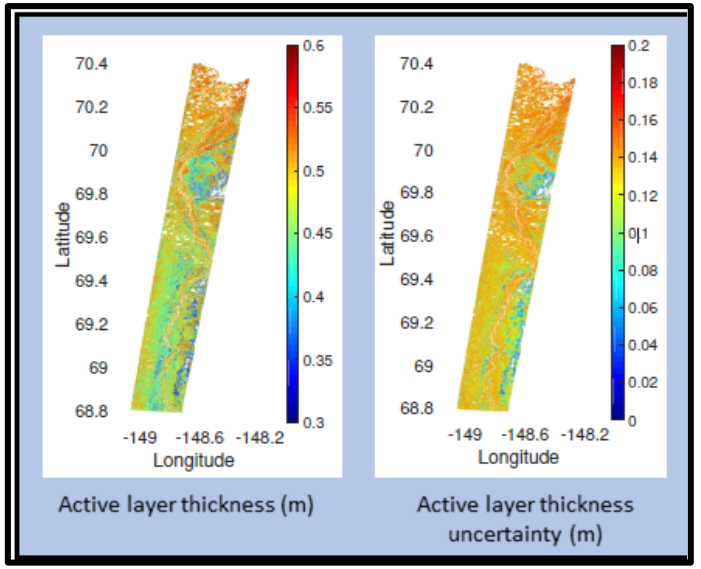
Objectives:

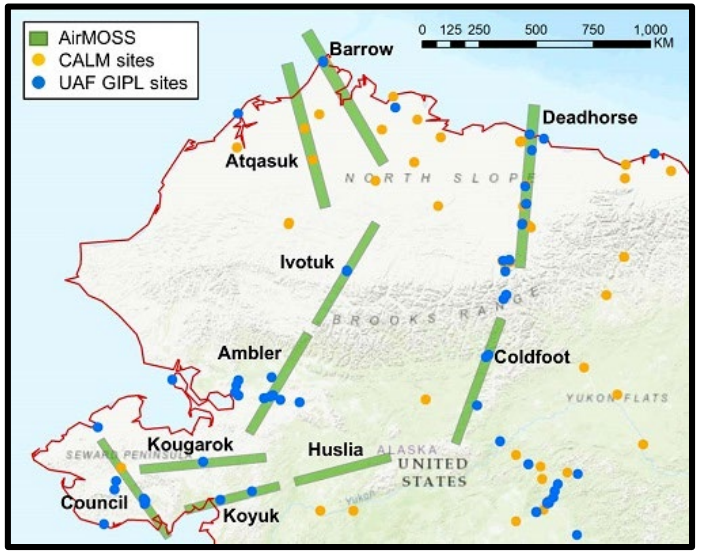
- Link dynamic observations from diverse field measurements, complimentary airborne snapshots & continuous satellite observations, & static landscape geospatial layers, for upscaling active layer properties
- ID key drivers & controls affecting active layer trends
- Develop organizational protocols for optimal upscaling

Crossover synergy: SAR active layer validation [L. Bourgeau-Chavez, K. Schaefer], Modeling [J. Fisher], Veg. structure & function [P. Montesano]

Deliverables:

- Publication: theoretical basis, past research, & new opportunities for deriving active layer properties from multi-frequency & multi-mode radar (polSAR, InSAR)
- Publication: machine-learning based active layer (ALT) upscaling activity, identifying key predictors & control factors affecting ALT heterogeneity
- New AK geospatial data on upscaled active layer properties.





Chen et al., 2019. https://doi.org/10.3334/ORNLDAAC/1657

River, Lake & Wetland Connectivity

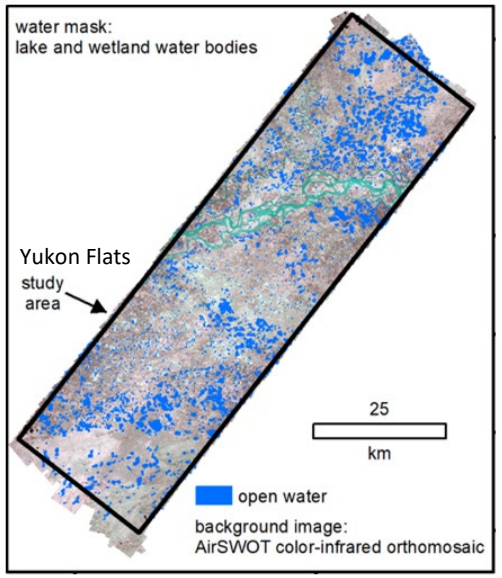
Team: Tamlin Pavelsky, John Mallard [leads], David Butman, Larry Smith, Michelle Walvoord. Others TBC Incl: Nancy French, Bruce Chapman, Neil Pastick, Laura B-C, Mike Rawlins, Abhishek Chattergee, Oliver Sonnentag, Kevin Turner, etc.

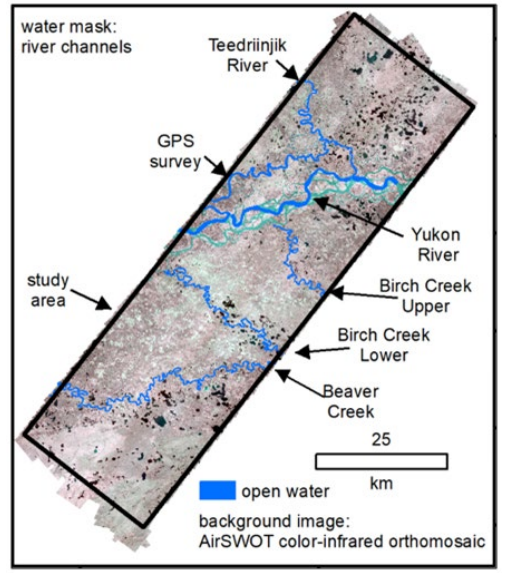
Objectives:

- Review literature on how physical characteristics of Arctic rivers, lakes, & wetlands are changing
- Synthesize results of past studies to draw conclusions about how connectivity of different reservoirs is changing
- Assess how past & future changes in connectivity are likely to impact the nature of arctic rivers, lakes, & wetlands.

Crossover synergy: Thermokarst [T. Jorgenson], Modeling [J. Fisher], Carbon Dynamics [A. Chattergee]

Deliverables: Publication synthesizing current understanding of connectivity among lakes, rivers, & wetlands of boreal North America, & how that connectivity has changed & is likely to change in the future.





Pitcher et al., 2019. https://doi.org/10.3334/ORNLDAAC/1655

Iposters highlighting HPWG synthesis activities

Elder, Thompson, Thorpe, Hanke, Hasson, James, Minsley, Pastick, Olefedt, Walter-Anthony, Miller. Remote sensing links methane emission hotspots to abrupt permafrost thaw, implications for emission source attribution.

Yi, Chen, Moghaddam, Kimball, Miller. A joint retrieval algorithm for organic soil properties using SMAP radiometer and P-band radar in Arctic tundra.

Carpino, Chasmer, Connon, Craig, Devoie, Haynes, Hopkinson, Quinton. Scotty Creek Basin in Transition: Climate driven hydro-ecological changes within a long-term research site in NWT, Canada.

Iwahana et al., Characteristics of ground surface displacement caused by ground freeze/thaw and thermokarst at intact and disturbed tundra on the North Slope, Alaska.

LaDouceur et al., Geochemical characteristics of the frozen active layer and near-surface permafrost in the Anaktuvuk River Fire scar, Alaska.

Pierrat, Nehemy, Roy, Magney, Parazoo, Laroque, Pappas, Sonnentag, Köhler, Bowling, Stutz. Remote Sensing of the Onset of Spring Photosynthesis in the Canadian Boreal Forest.

Orcutt, Magney, Euskirchen, Florian, Gosselin, Helbig, Ikawa, Kobayashi, Metzger, Pavlick, Rocha, Schulze, Sonnentag, Zona, Frankenberg. The Impact of Spatial and Temporal Aggregation on SIF vs. GPP using Airborne Data.

Turner. Integrating remotely sensed and in-situ data to track hydroecological responses of a drained thermokarst lake to 13 years of drastic catchment change.