Disturbance-Carbon-Permafrost-Hydrology

- **Knowledge gaps:** many!
  - Data and attribution
  - ABoVE data for subsurface processes (below 0.5 m)
  - Post-disturbance C fluxes
  - Disturbance in models

- **Super sites!**

Gap 1: Data and fate attribution

Thaw slumps and fire: temporally episodic and spatially sparse

- **Data**: How to identify meter-scale disturbances?
  - Olefeldt et al. (2016) & Lewkowizc et al. (2019)
  - Canadian permafrost network
- Is the **frequency** of these disturbance events 'outside the natural cycle' or increasing?
- **UAVSAR** for frequency/size change – linked with drone and river discharge data?
- **Fate** of carbon from thermokarst?

Attribution: How much is burried in sediments? How much is released into the atmosphere?

Gap 2: ABoVE data for subsurface processes (below 0.5 m)

- Technological **limitations**
- Limited GPR and airborne electromagnetic (**AEM**) data → data need?
- Mehods to learn from/outlooks:

- **Vegetation** change as **proxy** of subsurface change
- Ground water detection at 3 m depth in CA Central Valley
- Bedfast and floating lake ice from SAR (Engram et al. 2018)
- Panarctic ALT from **NISAR**

Gap 3: Post-disturbance C fluxes in permafrost terrain

- **Longer-term** (decadal) **C dynamics** after (fire) disturbance in permafrost terrain?
- What is the **net C exchange**: GPP uptake and permafrost emissions?
- Anaktuvuk River fire well monitored, otherwise little known about **tundra fires**
- What could we learn from **chronosequences** (space for time) of radar data (e.g. soil moisture) over disturbance sites?

Gap 4: Disturbance and recovery in models

- Disturbance **crudely** (or not) represented in many models
- **Interactions** between disturbances (e.g. pest infestation-fire) not represented

Super sites!

- **Coincident** field, drone, airborne and spaceborne **measurements** to improve mechanistic understanding – already partly accounted for in airborne planning
- **Candidates**: Anaktuvuk river fire, Delta junction, Healy, Big Trail Lake, Utqiaġvik, YK delta, Bonanza Creek, Wolf Creek, Scotty Creek…

Super sites!

- Sites cover different ecosystems, yet not necessarily different disturbances and disturbance regimes
- Identify **ongoing/required measurements** per site
- Identify **disturbance history** per site
- How long do we need to measure to capture disturbance cycles? Is space for time substitution viable with limited number of sites?

Misc

- What is the impact of linear anthropogenic disturbance (oil/gas)?
- Reconcile methods of C emissions from fires (bottom-up & top-down) → emission factors of flaming and smoldering fires