Importance of high-latitudes to global SWE

- The science plan identifies gaps in remote sensing of depth and SWE for boreal and tundra snowpacks
- These together represent most of the globe’s snow cover and SWE
- To be global, a future proposed snow measurement strategy must address high-latitude snow
- High-latitude terrains have unique and variable permafrost, water, and vegetation characteristics that change seasonally and annually

Links to science plan

- LiDAR, L-band InSAR and Ku-band radar are listed as “Mission Critical”
- SfM for snow depth has developed significantly since the science plan was written: likely component of our strategies going forward
- Gaps are specifically mentioned for how substrate affects these observations

How well do snow depth retrieval methods (e.g., lidar and SfM) work where “bare earth” surfaces fluctuate, due to the variable permafrost, water, and vegetation characteristics ubiquitous at high latitudes?

How abundant are void spaces between the snow and ground surfaces, and what are their impacts on remote sensing of boreal and tundra snow?

How do canopy succession and disturbance impact ground conditions, snow properties, and our ability to estimate SWE in boreal and Arctic landscapes?

How do vertical and horizontal canopy structures impact surface energy, thaw depth, snow properties (e.g., depth, density, moisture, grain type and size, conductivity), and snowmelt?

How are L-band InSAR SWE change retrievals affected by what lies beneath snow surface, via interferometric decorrelation?

How do model accuracy and scaling issues impact use of models to inform Ku-scattering retrievals?

Additional possibilities to advance other techniques such as C-band SAR.

Additional measurements such as TIR, FMCW radar, and passive microwave considered as beneficial to advancing measurement science

Measurement Science

- Snow-on and snow-off surface accuracies
- Radar scattering and land cover/permafrost
- Integrating datasets and models

Snow Science

- Snow grain size characteristics
- Vegetation-snow-permafrost interactions

Tools

- Core: Lidar, SfM (satellite to drone)
- Science Plan: L-band Interferometric SAR, X- and Ku-band SAR
- Advancing: passive microwave, gamma, FMCW, C-band, and TIR
- Ground Validation (time series and IOP)