A Perennial Snowfield Melt Model

Synthesis of Climate, Field, and Remotely Sensed Data from the Brooks Range, Alaska

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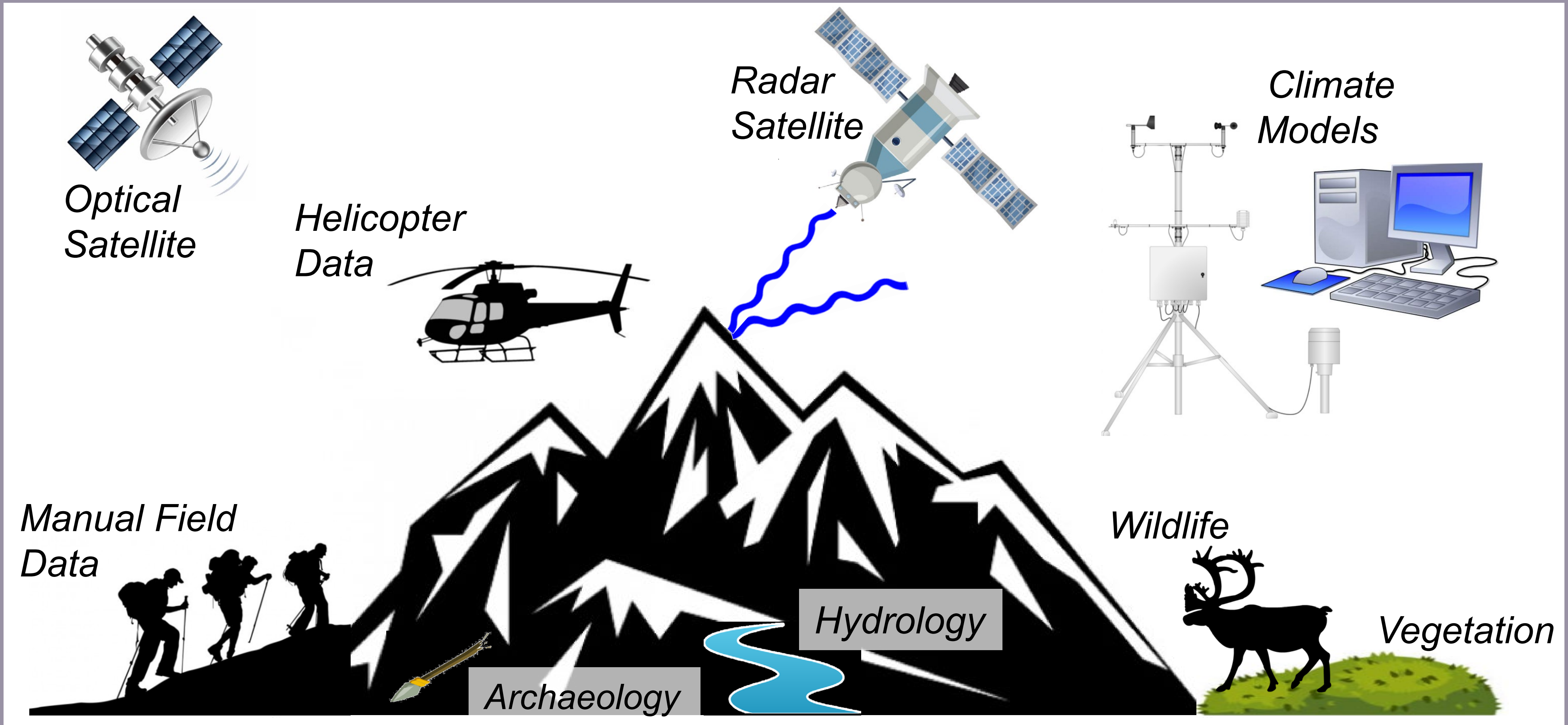
Brooks Range Perennial Snowfields

Why are perennial snowfields so important?

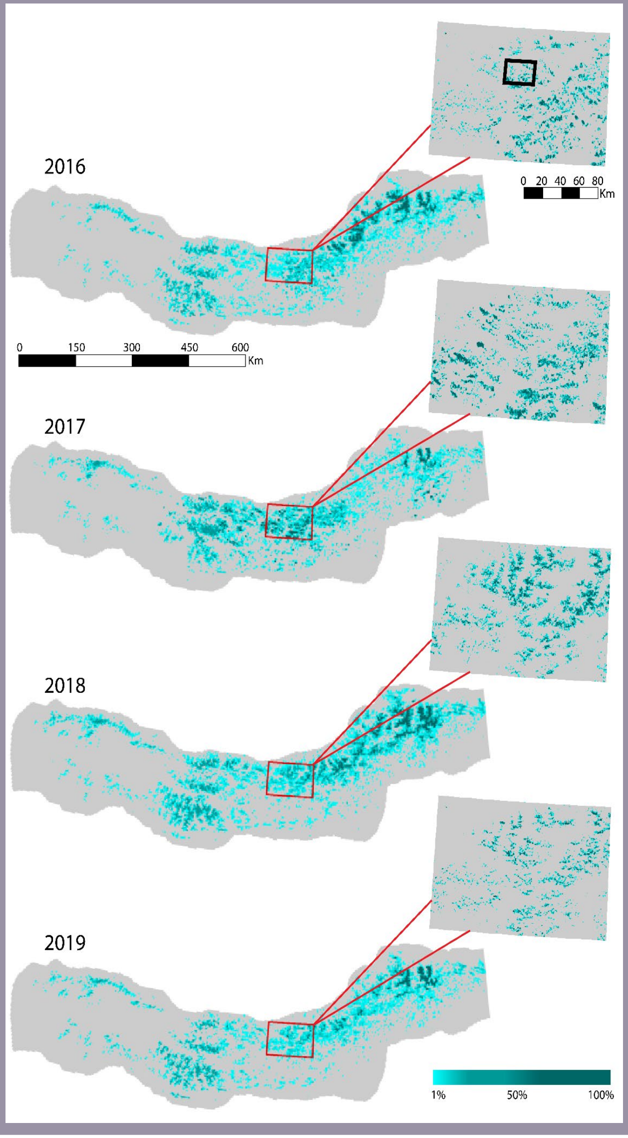
- Moisture for downslope vegetation
- Ecosystems for birds & mammals; caribou
- Subsistence hunting &access to food sources
- Archaeology & paleoecology
- Artifacts support cultural identity of Arctic people

Climate, Field, and Remotely Sensed Data Synthesis

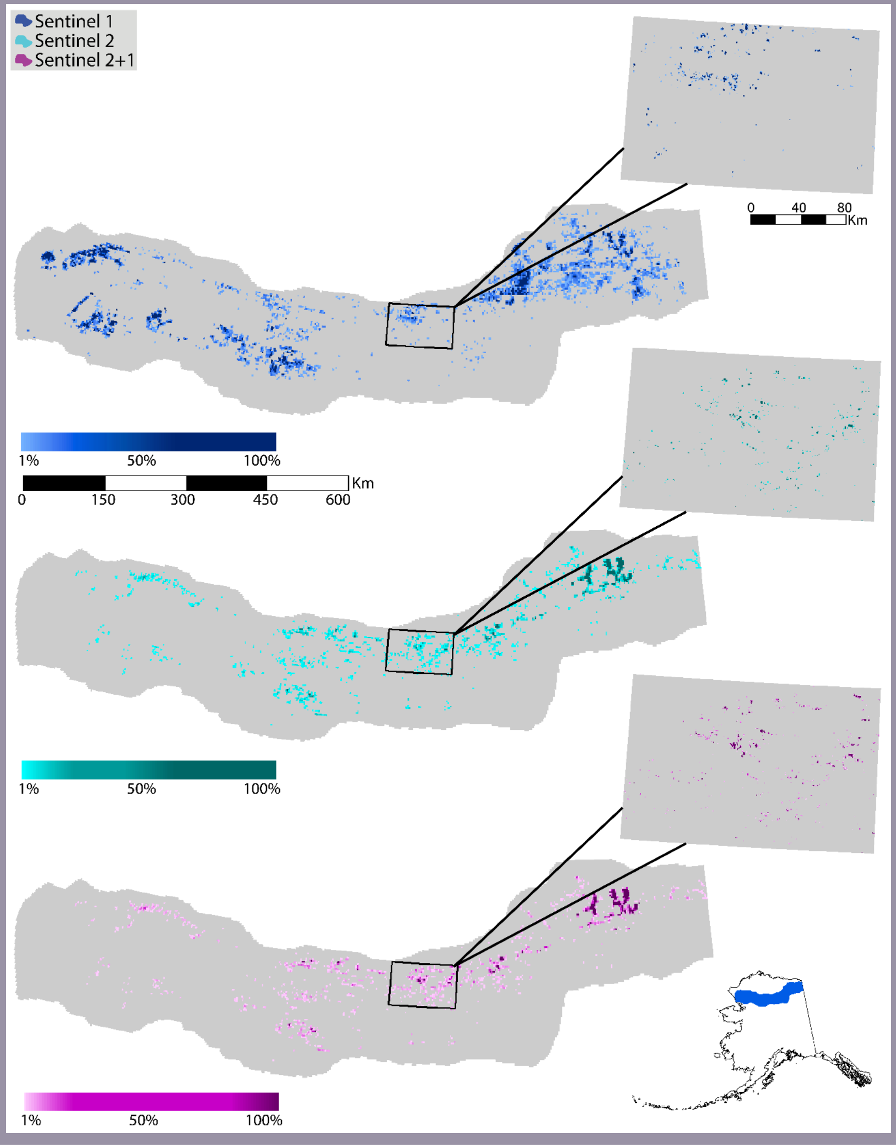


Annual Variability

NDSI Sentinel-2 Optical Imagery



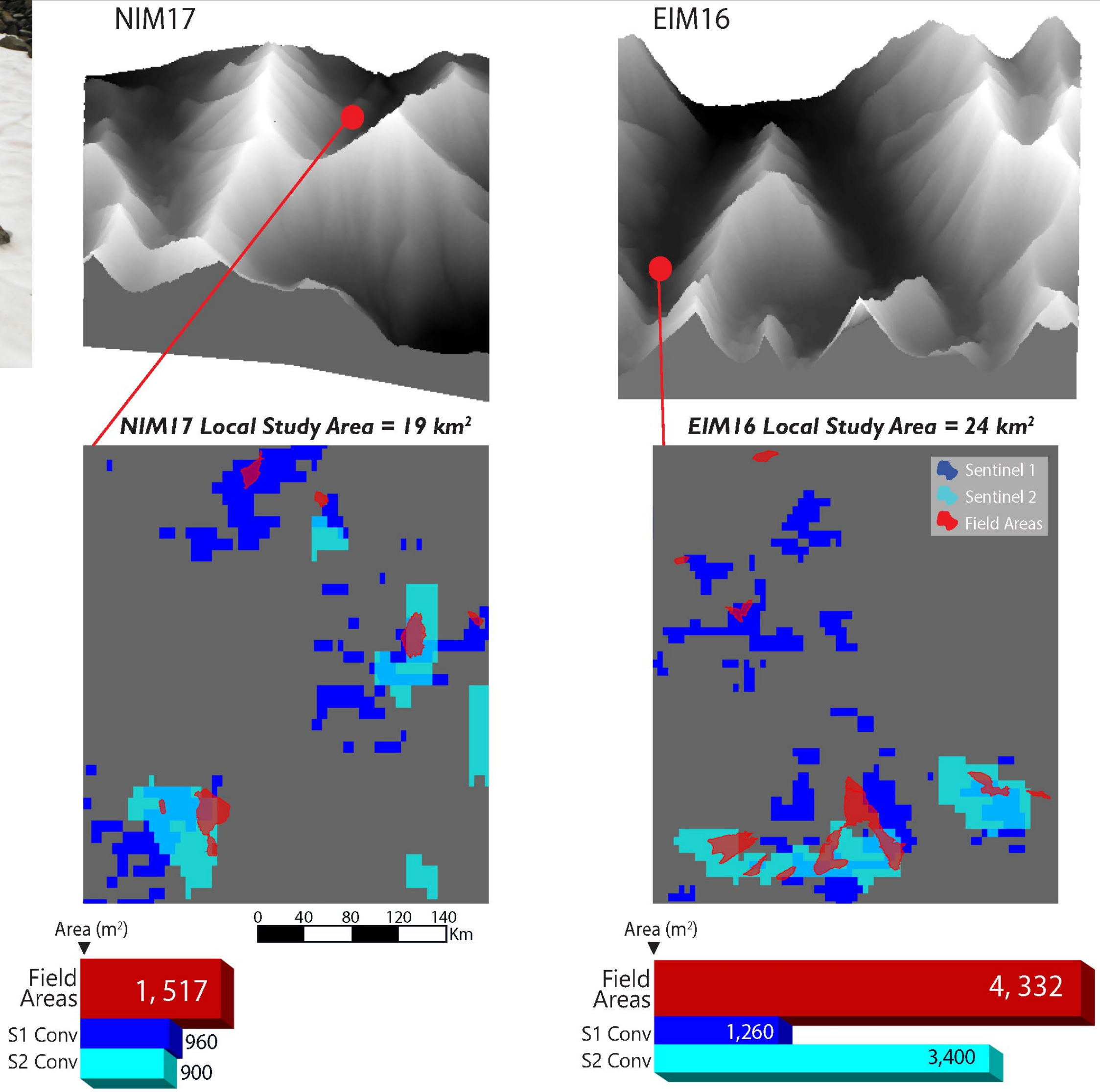
Perennial Areas



Backscatter Change Detection Sentinel-1 SAR

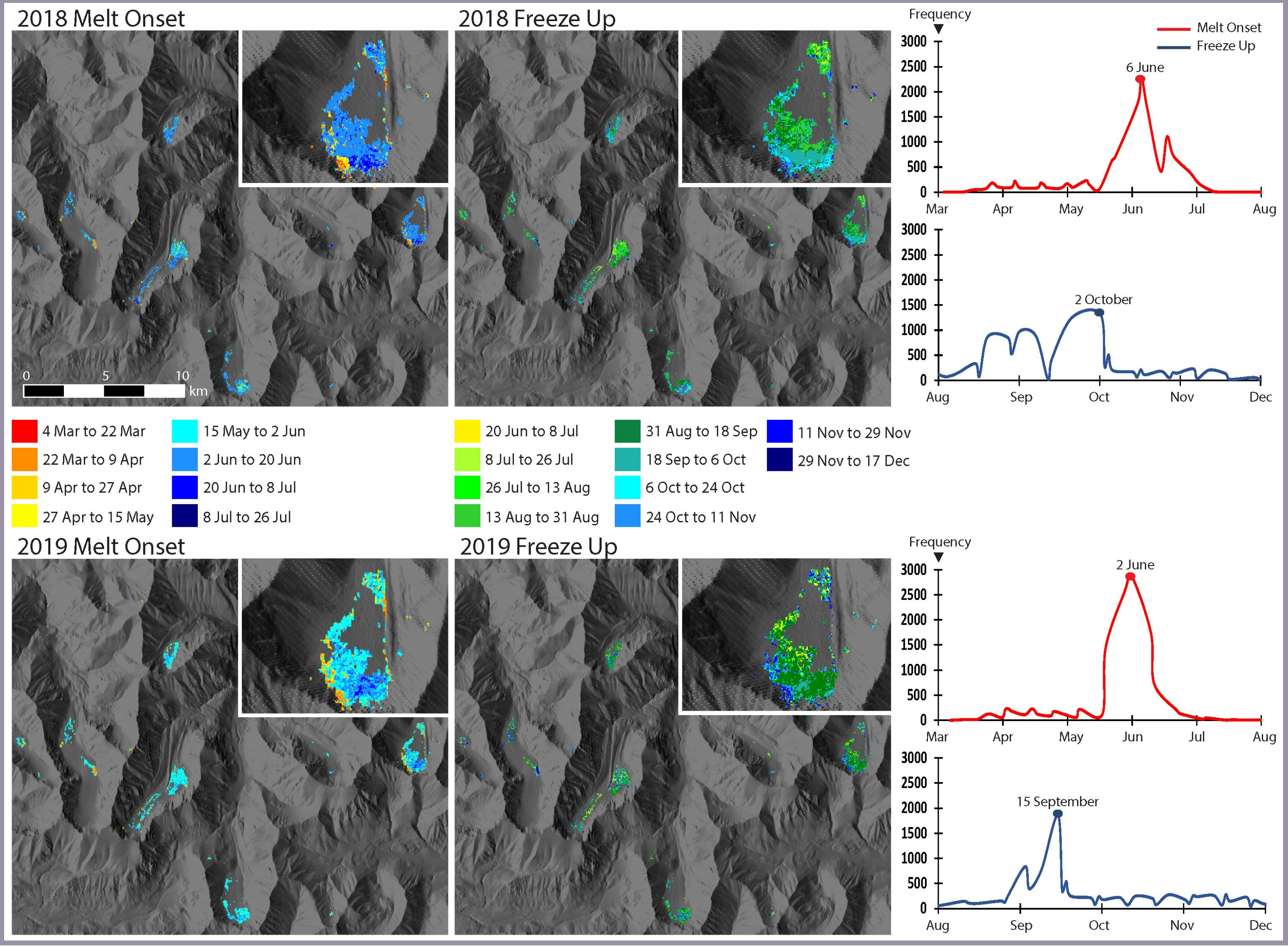
Field Evaluation






Melt Onset & Freeze-up Dates

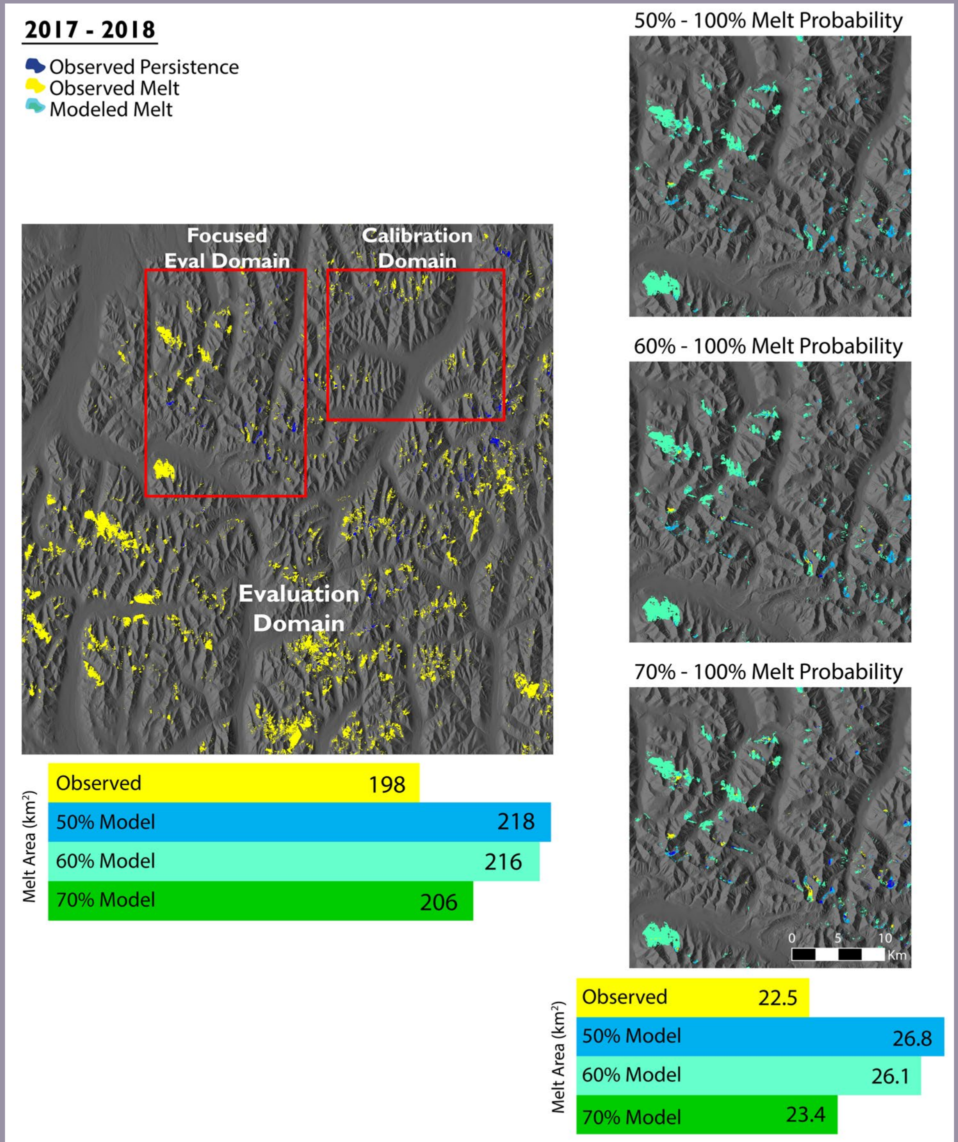
Onset = backscatter 3 to 4 dB below winter mean



Freeze-up = backscatter 2 dB or less below winter mean

Perennial Snowfield Melt Model

Observed Persistence 2017-2018
Observed Melt 2017-2018
Modeled Melt 2017-2018



$$\text{Melt} = (T_d - T_0) + (R \bullet \cos\theta \bullet C)$$

T_d = daily temperature

T_0 = temperature when melt starts

R = net solar radiation

θ = terrain and solar angles

C = cloud cover

$$\text{Probability} = 1 / (1 + e^{-b_0 + b_1 X_1})$$

b_0 = y intercept

b_1 = regression line slope

X_1 = temperature, radiation, clouds

I acknowledge that my work was done on the ancestral hunting grounds of the Nunamiut Iñupiaq people. I'm thankful for their centuries of stewardship of these lands.







I'm also grateful to the people of Anaktuvuk Pass for their kindness, hospitality, and interest in my research.

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