Factors Influencing Soil Moisture at Field Sites on the Seward Peninsula, Alaska

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Soil moisture plays a key role in Arctic ecosystems because it is a control on the carbon cycle, vegetation, and energy balance. Researchers in the DOE Office of Science Next-Generation Ecosystem Experiments (NGEE-Arctic) and the NASA Arctic Boreal Vulnerability Experiment (ABoVE) projects are collaborating on the development of regional soil moisture data products to improve and assess Earth System Model predictions. Here we present analysis of in-situ measurements of soil moisture and thaw depth collected during the Summer of 2017 coincident with NASA ABoVE airborne overflights of a P-band synthetic aperture radar (SAR) instrument called AirMOSS. At each in-situ soil moisture location, consistent measurement techniques were used including the establishment of multiple 100m by 100m plots designated for ground-truthing in accordance with ABoVE protocols to ensure a representative measure of soil moisture based on the resolution of the SAR instrument. Remotely sensed soil moisture is derived from the SAR imagery using a two-layer dielectric model within the active layer (Chen et al. 2018). Using a non-linear generalized additive model (GAM) we quantify the impact of topography, geomorphology, and vegetation on the SAR-derived soil moisture product across a large swath of the Seward Peninsula. These observations and analyses provide a unique benchmark dataset with which to test predictions of spatial variation and temporal evolution of soil moisture in local and regional permafrost models. Results of this study suggest that soil moisture on the Seward Peninsula is driven primarily by slope, vegetation type, and aspect.