Poster #1-8

Remote Sensing of the Spatial and Temporal Patterns of Arctic Plant Traits and Ecosystem Function

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The inadequate representation of plant trait variation across space and time in terrestrial biosphere models, including many that underlie the land-surface component of Earth System Models, is a key uncertainty in model projections of terrestrial carbon, water, and energy fluxes and storage. This is particularly relevant for biomes with historically sparse observational data, such as high latitudes of the Arctic where uncertainty in the modeling of carbon uptake and associated processes has been attributed to plant properties that regulate these processes. An approach is needed to bridge the scales between detailed ongoing *in-situ* observations of Arctic vegetation in remote locations and the larger, landscape context needed to inform models on parameter variation in relation to climate, soils, topography, perturbations and other edaphic conditions. Remote sensing data, particularly spectroscopy and imaging spectroscopy (IS), high resolution imaging, and thermal infrared (TIR) thermography, represent important observational datasets capable of scaling plant properties and capturing broad-scale spatial and temporal dynamics in many important vegetation properties, offering an important and direct data constraint on model projections or as critical benchmarks against prognostic model predictions. Here we extend the approaches developed for temperate ecosystems to derive scaling algorithms for a broad range of plant traits across the high Arctic, including biochemical, morphological and physiological leaf traits from the leaf to landscape scales. We focus on the linkages between a range of plant species and remote sensing data within our core study areas within the Barrow Environmental Observatory (BEO), Barrow (recently renamed Utqiaġvik), and Nome Alaska regions. We coupled measurements of leaf chemistry and physiology, including leaf-level gas exchange, with measurements of full range (i.e. 0.3 to 2.5 microns) leaf optical properties (reflectance and transmittance), TIR, and optical imagery from near-surface (leaf, tram) to unmanned aerial system (UAS) platforms. We show how leaf-level spectra-trait models for Arctic vegetation, developed using data collected in the BEO during the 2014-2017 growing seasons, are comparable with existing models from other biomes. In addition, tram and UAS platforms show a strong capacity to scale traits to the larger landscape and capture patterns through time. We then tested the capacity to map traits by leveraging IS data collected at the Council study site as part of the NASA ABoVE airborne campaign. Our preliminary analyses indicate that our existing approaches can be used with ABoVE imagery to map traits across larger region and provide maps of key traits across the Arctic.