

Poster #1-14

Factors Affecting the Spatial Pattern of Snow Distribution at the NGEE Arctic Teller and Kougarak Watersheds

Min Chen¹, Cathy Wilson^{1*}, Lauren Charsley-Groffman¹, Julian Dann¹, W. Robert Bolton², Robert Busey², and Stan Wullscheger³

¹Los Alamos National Laboratory, Los Alamos, NM

²University of Alaska, Fairbanks, AK

³Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

Contact: cjw@lanl.gov

BER Program: TES

Project: NGEE Arctic

Project Website: <https://ngee-arctic.ornl.gov/>

Snow cover plays an important role in the climate, hydrology and ecological systems of the Arctic due to its influence on the water balance, thermal regimes, vegetation and carbon flux. However, the spatial distribution of snow depth and density are poorly represented for arctic regions where high-resolution snow data is limited. Researchers with the DOE Office of Science Next Generation Ecosystem Experiment, NGEE Arctic project, are collecting end of winter snow distribution data at high spatial resolution, and developing approaches to more accurately represent event-based snow redistribution processes. These new approaches are being tailored for application in catchment to regional scale models in order to assess the role of snow spatial variability as it interacts with permafrost hydrology and ecosystem function. We use data from two small catchments in the southern Seward Peninsula to identify key factors that control snow distribution and quantify the relative impacts of those factors. At the NGEE Arctic Teller study area, intensive snow depth surveys (1 to 10 meters scale) were conducted in 2016, 2017 and 2018. These data are being co-analyzed with 2018 survey data from the NGEE Arctic Kougarak study area. In 2017, snow density was measured at about 60 selected intensive snow sampling sites, about 200 meters apart across the Teller study area. The snow water equivalent (SWE) calculated from snow depth and snow density, are correlated with vegetation factors, spatial locations, wind factor and topographic factors at different spatial scales to identify the key factors impacting the spatial distribution of snow. A linear mixed model of fixed and random effects is used to quantify the impacts of different external factors on snow distribution and to describe the spatial autocorrelation of snow distribution. Initial results from the Teller data show that snow spatial distribution was similar between 2016 and 2017; SWE has stronger correlation with the impacting factors than the snow depth; there is strong spatial autocorrelation in SWE distribution at two distinct scales, 16.6 m and 154.5m. SWE distribution was significantly impacted by the following factors in the order of importance: vegetation distribution, micro- topography, macro-topography, sun radiation and wind factor. We expect that our empirical statistical model for end of winter SWE will be used to inform an event-based snow redistribution model for the two study watersheds, and to ultimately estimate seasonally dynamic snow coverage and properties for the Seward Peninsula and pan-Arctic regions.