The Role of Landscape Structure on Arctic Ecosystem Response

DOE BER Terrestrial Ecosystem Science Program
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A fundamental goal of the Next-Generation Ecosystem Experiments (NGEE-Arctic) project is to improve climate prediction through process understanding and representation of that knowledge in Earth System models. Geomorphological units, including thaw lakes, drained thaw lake basins, and ice-rich polygonal ground provide the organizing framework for our scaling approach for the coastal plains of the North Slope of Alaska. Process studies and observations have been undertaken in and near the Barrow Environmental Observatory, BEO, across nested scales to understand and quantify the interactions between geomorphic landscape features, hydrology, soil temperature, biogeochemistry, vegetation patterns, and energy exchange in order to initialize and evaluate a suite of models within the NGEE hierarchical modeling framework. In-situ, ground based geophysical, airborne and satellite based observations are carried out across gradients of micro-topographic features (polygon rims, centers and troughs) and polygon types (high centered, low centered and transitional) that are nested within a landscape comprised of drained thaw lake basins of varying ages and structures. Our studies are showing clear correlations between geomorphic features, and the dynamics of soil moisture, soil temperature and surface inundation patterns across the landscape, as well as soil biogeochemistry, vegetation patterns, and carbon and energy fluxes. Our data and findings are now being used to initialize and evaluate fine, intermediate and global scale models which will be soon be used to simulate the evolution of a warming and thawing Arctic landscape and its feedbacks to the global climate system.