Next-Generation Ecosystem Experiments (NGEE Arctic)

Project Abstract

Characterized by vast amounts of carbon stored in permafrost and a rapidly evolving landscape, the Arctic has emerged as an important focal point for the study of climate change. These are sensitive systems, yet the mechanisms responsible for those sensitivities are not well understood and many remain uncertain in terms of their representation in Earth System models. Increasing our confidence in climate projections for high-latitude regions of the world will require a coordinated set of investigations that target improved process understanding and model representation of important ecosystem-climate feedbacks. The Next-Generation Ecosystem Experiments (NGEE Arctic) seeks to address this challenge by quantifying the physical, chemical, and biological behavior of terrestrial ecosystems in Alaska. Initial research will focus on the highly dynamic landscapes of the North Slope where thaw lakes, drained thaw lake basins, and ice-rich polygonal ground offer distinct land units for investigation and modeling. The project will focus on interactions that drive critical climate feedbacks within these environments through greenhouse gas fluxes and changes in surface energy balance associated with permafrost degradation, and the many processes that arise as a result of these landscape dynamics. The overarching goal of the NGEE Arctic project is to reduce uncertainty in climate prediction through improved representation of Arctic tundra processes. A focus on scaling based on process understanding and geomorphological units will allow us to deliver a *process-rich ecosystem model, extending from bedrock to the top of the vegetative canopy, in which the evolution of Arctic ecosystems in a changing climate can be modeled at the scale of a high resolution Earth System Model grid cell (i.e., 30x30 km grid size).* This vision includes mechanistic studies in the field and in the laboratory; modeling of critical and interrelated water, nitrogen, carbon, and energy dynamics; and characterization of important interactions from molecular to landscape scales that drive feedbacks to the climate system. A suite of climate-, intermediate- and fine-scale models will be used to guide observations and interpret data, while process studies will serve to initialize state variables in models, provide new algorithms and process parameterizations, and evaluate model performance. The NGEE Arctic project will also develop innovative communication and data management strategies as we work both within a multi-disciplinary team environment and with the larger scientific community to chart a course for an improved process-rich, high-resolution Arctic terrestrial simulation capability.

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