Synthesis and Integration of Recent Research Characterizing the Carbon Cycle of Northern Eurasia

PROJECT SUMMARY

Northern Eurasia is characterized by large carbon storages and seasonal fluxes, through both sinks and sources, and is thought to be particularly susceptible to climatic change. In recent decades the region has experienced warming and attendant change in carbon cycling, with further alterations likely to convey positive feedbacks to global greenhouse gas forcing. The carbon cycle of the Arctic drainage region of northern Eurasia is tightly linked with surface water and permafrost dynamics that, in turn, are influenced by the extensive network of lakes and wetlands across the region. We propose to synthesize the results of recent projects, focused on the carbon cycling of the Arctic basin draining the North Eurasian Earth Science Partnership Initiative (NEESPI) region, within a set of linked models to estimate the magnitude, potential future changes, and associated uncertainties in carbon sinks and sources. The modeling constructs central to this project have been developed to simulate CH_4 emissions from sources such lakes and wetlands, as well as other CO_2 sources/sinks. They also leverage remote sensing data for characterization of surface water and forest/boreal dynamics. Lake methane emission data and satellite-derived net primary production, both to be drawn from recent projects will be used in a synthesis analysis of the region's carbon cycle and for integration within the modeling framework. Fields derived from remote sensing from AMSR-E, MODIS, QuikScat and Landsat satellites include the inundation water fractions, landcover type, and net primary production. A unique aspect of our modeling synthesis and integration centers on the use of these remote sensing data to capture key water and carbon cycle processes operating on relatively fine spatial and temporal scales. The overarching goals of the study include quantifying carbon cycle dynamics from the terrestrial land surface, estimating the potential associated responses to continued warming, and gaining an improved understanding of the controlling physical processes governing the region’s carbon cycles.

This study addresses goals of the U. S. Carbon Cycle Program and the U. S. Global Change Research Program, and follows several NASA Roadmaps though our efforts to document and understand how the global carbon cycle and terrestrial ecosystems are changing, quantify carbon fluxes; and provide useful projections of future changes in carbon cycling.