Poster #1-42

Next-Generation Ecosystem Experiments (NGEE)–Tropics Overview

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Tropical forests cycle more CO_2 and water than any other biome and are critical to Earth's energy balance. Yet processes controlling tropical forest carbon cycling are not well established, and large uncertainties in observational estimates and Earth system model (ESM) projections of net carbon fluxes remain unresolved, contributing significant uncertainty to climate projections. In support of BER's mission to advance a predictive understanding of Earth's climate and environmental systems, the Next Generation Ecosystem Experiments (NGEE)-Tropics aims to develop an improved predictive understanding of tropical forests and Earth system feedbacks to changing environmental drivers over the 21st Century. A strong synthetic coupling of modeling and experiment-observational methods (i.e. ModEx) is our fundamental approach toward attaining this goal, with our grand deliverable a representative, process-rich tropical forest ecosystem model, extending from bedrock to the top of the vegetative canopy-atmosphere interface, in which the dynamics and feedbacks of tropical ecosystems in a changing climate can be modeled at the scale and resolution of a next generation ESM grid cell.

Phase 1 research focused on developing an improved understanding and model representation of key tropical forest processes including: responses to changing temperature, precipitation, and atmospheric CO_2; disturbance and land-use change; and heterogeneity in belowground processes. NGEE-Tropics developed a transformational, process-rich model framework called the Functionally Assembled Terrestrial Ecosystem Simulator (FATES), which was integrated into DOE's Energy Exascale Earth System Model (E3SM), and further model development and measurement activities were integrated at pilot study field sites in Puerto Rico, Brazil, and Panama. A data synthesis and management framework was developed and continues to provide data products via a community portal.

Phase 2 will further develop and strengthen our use of FATES within E3SM as the central modeling framework that integrates our research. Process representation in FATES will be organized across three scales: processes at the scale of individual plants (cohorts), processes at the scale of competitive interactions among cohorts (landscape), and large-scale coupled processes (regional).