Poster #1-29

Preliminary Assessment of E3SM Land Model (ELM) in Northern High-Latitude Regions and Its Improvements by MODEX Approach

Fengming Yuan[1*], Benjamin Sulman[1], Amy Breen[2], Verity Salmon[1], Colleen M. Iversen[1], Jitendra Kumar[1], Shih-Chieh Kao[1], Peter Thornton[1], and Stan Wullschleger[1]

[1] Climate Change Science Institute and Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN;
[2] Scenarios Network for Alaska & Arctic Planning, International Arctic Research Center, University of Alaska, Fairbanks, AK

Contacts: yuanf@ornl.gov, thorntonpe@ornl.gov

BER Program: TES
Project: NGEE Arctic
Project Website: https://ngee-arctic.ornl.gov

In high-latitude Arctic, modeling land surface processes are of great challenge in Earth System, mostly due to highly heterogeneous surface across scales and lacking data in those remote and harsh regions. In this study, we present an offline land surface simulation using the newly developed Energy Exascale Earth System Model's (E3SM) Land Model (ELM) over northern high-latitude regions (>60oN) at half-degree spatial resolution. As a benchmark, ELM simulated vegetation and soil organic matters are evaluated. Further improvement aiming to high resolution modeling via model development and experiment data integration (MODEX) are explored in the Next Generation Ecosystem Experiment-Arctic (NGEE-Arctic) Intensive Study Sites. By using ILAMB tools and available datasets, it shows that ELM simulation of vegetation LAI and total soil organic matter (SOM) improved remarkably, compared to its precedent CLM, but still mismatch both spatially and temporarily. As demonstration, we collected model driving forcing data either from local meteorological station (Utqiaġvik, AK) or high-resolution DAYMET product (Kougarok, Seward Peninsula, AK) for two NGEE-Arctic field sites. Simulations are much more comparable to data. Plant physiological parameters and vegetation distribution from field surveys are also highly valuable to high resolution modeling, as shown by incorporating field measurements into ELM. Identifying and integrating those physical and physiological properties and featuring them in model frameworks appropriately with spatial resolutions, is critical to capturing biosphere-atmosphere exchanges at various scales. Further improvement may be achieved by incorporating 3-D reactive-transport model, e.g. PFLOTRAN, as demonstrated in this study as well, because of its much better representation of nutrient transport processes.