Modeling hydrologic processes in the Amazon: Comparison of hydrologic variability in a hierarchy of model simulations

Ruby Leung, Ethan Coon, Zhuoran Duan, Yilin Fang, Pieter Hazenberg, Hongyi Li, Jie Niu, Scott Painter, William Riley, Chaopeng Shen, Mark Wigmosta, Xubin Zeng

Water is essential for plants, which obtain most of their water through soil water uptake. Understanding and modeling the spatial and temporal variability of surface and subsurface water available to plants is thus essential for predicting how tropical forests will respond to climate change. Although hydrological processes may be reasonably well represented in models at their native spatial and temporal scales, significant challenges remain in rendering the effects of those processes at climate-relevant scales. Systematic benchmarking and process-based evaluation of key processes important for tropical forest may provide expedient ways of improving hydrologic modeling in Earth System Models. As part of the NGEE Tropics project, hydrologic modeling experiments have been designed to identify preferable modeling alternatives that can be readily adopted by Earth System Models for improving representations of surface and subsurface hydrology and identify remaining model development needs. In the first of a series of numerical experiments, simulations are performed over the Asu catchment in the Amazon where soil moisture, groundwater level and stream gauge measurements are available for model evaluation. A hierarchy of one-dimensional to three-dimensional models including the ACME Land Model (ALM), DHSVM, CLM-PAWS, CLM-ParFlow, CLM-PFLOTRAN, Amanzi/ATS, and h3D are applied to simulate hydrologic variability from hourly to interannual time scales. Preliminary results will be presented, with initial focus on seasonal and interannual variability, particularly contrasting the hydrologic response simulated by different models between wet and dry years.