Research Challenge

The increased frequency and severity of droughts and their regional consequences have highlighted the potential vulnerability of the Amazon Basin region to heat- and drought-induced stress. This study seeks to understand what controls the response of biodiverse tropical rainforest regions to heat and drought-induced water limitation.

Methods & Codes

Root water uptake has been coupled with the Department of Energy’s massively parallel flow and transport model (PFLOTRAN) to simulate water uptake for individual trees. Using these tools, we are exploring how tree roots contribute to forest drought resilience in areas of the Amazon rainforest during the recent 2015–2016 El Niño drought event.

Results & Impacts

Model simulations are able to compute water uptake for upwards of 1500 trees per hectare—comprising the largest simulations of three-dimensional root water uptake ever attempted. Blue Waters is being used to run a large number of simulations, testing the contributions of individual traits to individual and community drought resilience. These results will help us understand how to improve the next generation of earth system models and the increase our understanding of below-ground processes.

Why Blue Waters

Blue Waters is critical to the ongoing success of this project. Simulations of this complexity and scale require the computational power of this system to make meaningful analyses. Not only are the simulation domains complex, multiple simulations are needed to account for system uncertainty. Blue Waters will allow this analysis to be done with a much larger domain and much higher diversity of species than has been previously possible.