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DOE Projects Announced to Better Understand Amazon Regional Climate

Green Ocean Amazon 2014, sponsored in part by the U.S. Department of Energy, is an interagency, international campaign with the overarching goal of advancing the understanding of how land-atmosphere processes affect tropical hydrology and climate within the Amazon Basin.

Washington, D.C. – The U.S. Department of Energy is awarding $1.9 million this year for six research projects as part of a collaborative effort with two Brazilian research organizations to better understand atmospheric and ecological interactions within the Amazon Basin in order to advance climate predictability, both regionally and globally across the tropics.

"The Amazon Basin plays a vitally important role in determining its regional climate and we need to better understand how it functions so we can improve our ability to predict how changes to this ecosystem could affect climate," said Gerald Geernaert, division director for climate and environmental sciences in DOE's Office of Science.

The Amazon Basin's water cycle serves as one of the primary heat engines of the Southern Hemisphere, and more data about how it functions in its natural state and in states affected by regional and global human activities is needed to improve the accuracy of climate modeling.

Some climate models predict that parts of the Amazon may convert from rain forest to savannah, but the potential regional impacts of that shift cannot be accurately modeled with existing data. The three-year projects announced today will seek to gather the needed data to better predict extent and impacts of this shift both within the region as well as globally. Research projects will be able to exploit high-resolution field observations to be collected by the DOE Atmospheric Radiation Measurement Climate Research Facility that will be deployed to the central Amazon from January 2014 through December 2015.Total investment for the research projects will be $5.6 million over three years, pending Congressional appropriations.

Research conducted by Brazilian organizations is being funded by the Fundação de Apoio à Pesquisa do Estado do Amazonas, or Amazonas Research Foundation and Fundação de Apoio à Pesquisa do Estado do São Paulo, or São Paulo Research Foundation.

The principal investigators, their institutions, three-year funding amounts allocated to their projects' participants and brief descriptions of their projects are listed below:

Brazil-USA Collaborative Research: Modifications by Anthropogenic Pollution of the Natural Atmospheric Chemistry & Particle Microphysics of the Tropical Rain

Scot Martin, Harvard University ($1,349,999)
Description: This project seeks to investigate the possible modification of the natural atmospheric chemistry and particle microphysics of the Amazonia forest by present and future anthropogenic pollution. Several objectives are identified, including how the anthropogenic pollution affects the secondary organic aerosol formation in Amazonia forest; how anthropogenic pollution affects new particle formation (NPF) in Amazonia forest and evaluation of the hypothesis that NPF under natural conditions may be produced as a result of evaporation of primary particles emitted by fungal spores; and understanding how the aerosol number-diameter distribution affects the local climate using microphysical modeling and satellite observations.

Bridging Land-Surface Fluxes and Aerosol Concentrations to Triggering Convective Rainfall

Marcelo Chamecki, Penn State University ($854,311)
Description: This project will investigate the secondary organic aerosol lifecycle in pristine vs. polluted environments, and the impact of such aerosols on cloud formation and precipitation. The distinctive aspects of the proposed research include explicit consideration of the transport and atmospheric transformation issues in the Amazon environment, including transport and energy flux in the rainforest canopy and the distinctive meteorology of the atmospheric boundary layer of the region.

Collaborative research on ecophysiological controls on Amazonian precipitation seasonality and variability

Jung-Eun Lee, Brown University ($975,300)
Description: This project seeks to understand how vegetation influences climate variability and precipitation over Amazonian rainforests, with an emphasis on plant physiological controls on deep convection along a geographical water stress gradient. A dominant source of uncertainty regarding Amazonian climate and its future evolution is the role of land-vegetation-atmosphere coupling, especially interactions and feedbacks between vegetation and precipitating deep convection occurring during the late dry season/early wet season when land-vegetation-atmosphere coupling has been shown to be stronger. Quantitative understanding of this coupling is critical since forest productivity is sensitive to the duration and intensity of the dry season.

Understanding the Response of Photosynthetic Metabolism in Tropical Forests to Seasonal Climate Variations

Dennis Dye, U.S. Geological Survey ($1,049,906)
Description: The project seeks to understand factors controlling the response of photosynthesis in Amazonian forests to seasonal variations in climate. Despite scientific efforts to advance understanding of photosynthesis in recent years, current Earth system models and remote sensing data cannot accurately predict photosynthetic responses in tropical forests. The question of photosynthetic seasonality in tropical ecosystems is fundamentally important given its relation to plant strategies for resource acquisition and allocation. This response has significant implications for long-term vulnerability of tropical forests to changing climate.

Multi-scale processes driving tropical convection and influence of the aerosol

Carlos Mechoso, University of California, Los Angeles ($722,973)
Description: This project focuses on improving the parameterizations of cloud and aerosol effects by gaining more knowledge of the processes that drive tropical convection and of the aerosol influences on these deep convective processes. Improvements in these parameterizations will also enable a better prediction of diurnal cycle of convection in both regional and large scale earth system models.

Understanding the Causes of the Biases that Determine the Onset of the Rainy Season in Amazonia in Climate Models Using the Green Ocean Amazon-CHUVA Measurements

Rong Fu, University of Texas ($711,158)
Description: The Amazon has had two major droughts in the past 20 years. In addition, the length of the dry season has increased by about one month. However, current global climate models appear to underestimate the past variability, and they project no change in the onset of rainy season over the Amazon. The goal of this effort is to focus on the understanding of these errors in climate models by: examining the relationship of convection to aerosols and land surfaces, and address the inadequacies of the modeled oceanic variability, land surface processes, and their coupling to the atmosphere.

The Department's Office of Science is the single largest supporter of basic research in the physical sciences in the United States and is working to address some of the most pressing challenges of our time. For more information, visit http://science.energy.gov/about. For more information about the Green Ocean Amazon project, visit http://campaign.arm.gov/goamazon2014/.

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