JOHNS HOPKINS
Center for Environmental & Applied Fluid Mechanics

Weekly CEAFM Seminar: Fall 2011

Friday, December 2, 2011
11:00 a.m. – 12:00 p.m.
Gilman 50 (Marjorie M. Fisher Hall)

"Mechanisms of Land-Atmosphere Feedback During Drought"

Presented by
Dr. Ben Zaitchik
(JHU | Earth and Planetary Science)

Abstract: Severe regional drought is among the costliest and most deadly of natural disasters, affecting tens of millions of people every year. To the first order, these droughts are understood to be a product of variability in the global climate system, most notably patterns of sea surface temperature and associated large scale atmospheric circulations. In many drought-prone regions, however, strong land-atmosphere coupling on the regional and sub-regional scales can act to moderate or enhance a dry anomaly triggered by large scale phenomena. In these regions, improved understanding of land-atmosphere interactions and better representation of these processes in climate models has the potential to contribute to seasonal drought prediction and to projection of drought risk under changing climate and land use conditions. In this seminar I will describe hypothesized mechanisms for drought-enhancing land-atmosphere feedbacks, review observational and modeling studies that have identified regions prone to such feedbacks, and resent results of an ongoing study on land-atmosphere feedbacks in the U.S. Southern Great Plains (SGP) and their representation in a coupled regional climate model. The SGP study demonstrates the significance of soil moisture memory in the evolution of seasonal drought in this region, as simulations that include seasonal soil moisture memory outperform limited memory simulations with respect to in situ observations during the severe SGP drought of 2006. Specifically, soil moisture memory was found to affect precipitation processes through two dominant mechanisms: reduced evaporative fraction due to low soil moisture and reduced surface energy due to increased surface albedo. Importantly, the standard Weather Research and Forecasting (WRF) regional climate model captures only the evaporative fraction effect, while our results indicate that increased albedo may be the more significant mechanism for regional drought enhancement in the SGP.

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