Hydrologic Interactions Across Multiple Scales: Drought, Disturbance and Responses.

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ABSTRACT

This presentation will be comprised of two stages. In the first stage, research into the fundamental physics of Great Plains drought will be presented. The US Great Plains experienced a severe drought in 2012; symptoms of which included severe rainfall deficits and record setting high temperatures. An outstanding question is the relationship between the precipitation deficits and the heat wave in 2012, and their mutual effects on soil moisture conditions. Land surface model simulations are presented to demonstrate the combined and separate effects of rainfall deficits and air temperature on soil moisture. The effects of antecedent conditions are also assessed, and implications for drought prediction are discussed. A further question to be addressed is the role of human-induced climate change on future Great Plains drought. Results are presented of the land surface responses to plausible scenarios for precipitation and temperature change. Applying an understanding of the fundamental physics of drought, we seek to better understand the sensitivity of deep soil moisture in a significantly warmer world that can inform discussions on risks for unprecedented future drought conditions in the Great Plains.
In the second stage of the talk, the overview of several emerging projects will be presented. Among these is an attribution experiment in partnership with scientists at NOAA and the US Army Corps of engineers investigating the causes for a sharp increase in the Upper Missouri River Basin's year-to-year streamflow variability. While the coefficient of variation of annual streamflow in the 20-year period 1993-2012 has doubled relative to the 20th century, comparable changes in the variability of precipitation and temperature have not been observed. The approach involves a physically based modeling framework in combination with statistical analyses into changes in the seasonality of water delivery and changing antecedent conditions in the basin. Lastly, new projects into the hydrologic impacts of forest disturbance and sediment transport along the Front Range will be presented. Attendees of this talk will gain a clearer understanding of land surface hydrology as it interacts with the atmosphere and vegetation.