

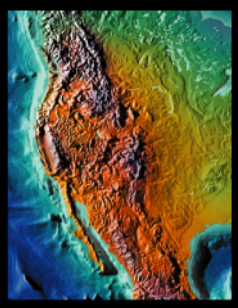


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Frontiers in Geoscience Colloquium

Monday, February 13, 2017
3:00pm – 4:00pm
Physics Auditorium (TA-3, Bldg 215)

Watershed Responses to Hydrologic Disturbances: Local, Regional, and National Perspectives

Dr. Ben Livneh

University of Colorado - Boulder

This presentation will explore several aspects of land cover change and climate impacts on hydrology. We'll start by addressing the question: *What makes watersheds sensitive to forest disturbance?* Despite a long appreciation of the significance of forests to water supplies, watershed sensitivity to forest disturbances remains difficult to predict. Yet, forested watersheds supply water to more than 180 million people in the US. An analysis of a national-scale watershed database together with high-resolution forest disturbance imagery demonstrated that disturbance has caused significant changes (both increases and decreases) in water yield and streamflow timing. Watersheds exhibiting post-disturbance increases or decreases in water yield were found to be distinct from each other ($p<0.05$) and regional patterns of sensitivity appear to be driven largely by differences in edaphic (soil) characteristics.

The second part of this presentation offers a land-surface perspective on both flooding and sediment transport in the Upper Missouri River Basin and Colorado Front Range. Gauge records reveal a sharp increase in the Upper Missouri River Basin's year-to-year streamflow variability since about 1970 with the coefficient of variation of annual streamflow in the 20-year period 1993-2012 having roughly doubled relative to the 20th century. Yet commensurate changes in the variability of precipitation and temperature have not been observed. Here we attempt to diagnose the causes of the streamflow changes, focusing on the relationship between land surface physics and the evolving characteristics of the meteorological forcings. Model calibration issues will be discussed, followed by a description of several experiments including an ensemble streamflow experiment designed to isolate the role of initial conditions versus meteorological forcing in the three largest events in recent decades. Outcomes of this research are relevant for recent concerns over intensification of the hydrological cycle. The last part of the presentation will explore hydrologic uncertainties on the Colorado Front Range. In particular, the development of a sediment modeling system sensitive to changes in climate and land cover. Future uncertainties in hydrological extremes challenge drinking water utilities' ability to treat water to meet regulatory and public health protection goals. This work is part of a larger project linking water treatment, decision support and hydrologic extremes, with the goal of aiding in water treatment facilities amidst challenges posed by climate change.

Host: Katrina Bennett, EES-16, 664-0698

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