

Columbia University

Department of Physics Colloquium



“Mechanisms of persistent North American droughts, past, present and future”

Drought are amongst the most expensive and disruptive natural disasters to occur in North America. The causes of persistent, multiyear droughts will be examined using observations, climate model simulations and tree ring records of past climate. Persistent droughts in western North America are closely linked to naturally occurring variations in tropical sea surface temperatures with the Pacific playing the leading role and the Atlantic a supporting role. The atmospheric dynamics that link tropical ocean temperatures to drought-inducing circulation anomalies over North America will be explained. However, unlike for other droughts, the severity and location of the 1930s Dust Bowl cannot be explained solely in terms of ocean temperature variations. Model simulations will be used to make the case that poor farming practices, crop failure and dust storms intensified an ocean-induced drought and shifted its location northward. Tree ring records will be presented to show the existence of a series of multidecadal megadroughts in the West during the Medieval period and mechanisms for the occurrence of megadroughts discussed. Further, climate change induced by rising greenhouse gases is now causing southwestern North America to transition to a more arid climate as part of a general drying and poleward expansion of the subtropics. The dynamics of this transition to increasing aridity will be discussed and contrasted with the mechanisms of naturally-occurring drought. Implications for regional water resources will also be considered.

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