Variability of Summer Hydroclimate Extremes in Southwestern United States

Srijita Jana[1,2], Balaji Rajagopalan[1,2], Andrea J. Ray[3]
[1]Department of Civil, Environmental and Architectural Engineering, University of Colorado at Boulder
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder
[3]NOAA/ Earth System Research Laboratory, Boulder, Colorado

Abstract. Summer monsoon rains contribute substantially to the water resources in the semi-arid Southwest United States. While winter rain and snow contribute over half of the annual flow to these river systems, summer precipitation is important for ecosystems and fire. The Southwest is susceptible to hazardous and costly weather and climate events. Because of the region's proximity to the Pacific Ocean, proclivity for slow moving, multi-day storms that tap into moisture from the tropics and subtropics, and the varied topography, it is highly vulnerable to flooding. These floods associated with thunderstorms occur throughout the Southwest, many during the months of North American monsoon. Thus, understanding the variability of summer climate and its extremes is important for resource management and hazard mitigation. To this end, we perform a systematic analysis of spatial and temporal variability in the summer hydroclimate in the South Western US and its extremes. We compute 3-day maximum and monthly average precipitation during the early monsoon season (June-July) at each location and perform PCA and cluster analysis to identify the dominant spatial and temporal patterns, which are then related to large-scale climate variables such as Pacific and Atlantic sea surface temperatures, sea level pressures and winds. Similar analysis will also be performed in the late season rainfall and streamflow extremes. These analyses will provide insights into the mechanisms of moisture source and delivery that result in hydroclimate extremes in the region. We will also demonstrate modeling of the extremes at representative locations in the region with nonstationary Generalized Extreme Value (GEV) distribution.