



Climate Extremes Workshop

May 16-17, 2018

Lecture: *Employing a Multivariate Spatial Hierarchical Model to Characterize Extremes with Application to US Gulf Coast Precipitation*

Speaker: Brook Russell

Abstract:

Over a seven day period in August 2017 Hurricane Harvey brought extreme levels of rainfall to the Houston area, resulting in catastrophic flooding that caused loss of human life and damage to personal property and public infrastructure. In the wake of this event, there is growing interest in understanding the degree to which this event was unusual and estimating the probability of experiencing a similar event in other locations. Additionally, we investigate the degree to which the sea surface temperature in the Gulf of Mexico is associated with extreme precipitation in the US Gulf Coast. This talk addresses these issues through the development of an extreme value model.

We assume that the annual maximum precipitation values at Gulf Coast locations approximately follow the Generalized Extreme Value (GEV) distribution. Because the observed precipitation record in this region is relatively short, we borrow strength across spatial locations to improve GEV parameter estimates. We model the GEV parameters at US Gulf Coast locations using a multivariate spatial hierarchical model based on coregionalization; for inference, a two-stage approach is utilized. Spatial interpolation is used to estimate GEV parameters at unobserved locations, allowing us to characterize precipitation extremes throughout the region. Nearby locations may experience extreme precipitation from the same event, resulting in dependence between annual maxima that previous spatial models of this sort have ignored. Our model incorporates dependence of this type and uses the nonparametric bootstrap to estimate its effect.