

Understanding, Modeling and Mitigation of Flood Risk over India

Extreme rainfall during summer monsoon season causes severe floods in many parts of India, annually. The floods in Kerala in 2019, Chennai during 2015 and Uttarkhand in 2013 are some of the major floods in recent years. With high population density and weaker infrastructure, even moderate flood events result in substantial loss to life and property. The magnitude, severity and spatial extent are an intricate combination of atmospheric configuration, antecedent land conditions and topography. The mitigation of flood risk involves efficient land and water resources management informed by skillful forecast of extremes at short (i.e. event scale) and long (i.e. seasonal and multi-year) time scales. To this end, this research aims to understand and model the space-time flood risk over India. Seasonal extreme rainfall over India will be analyzed to identify the space-time modes of variability and their dynamical connections to large-scale climate and land controls. A spatial hierarchical model will be developed incorporating appropriate covariates (i.e. predictors) from the identified controls. Consequently, time varying spatial estimates and maps of various return levels will be generated – shedding insights on the space-time variability of rainfall extremes over India. Risk estimates of extreme rainfall from this framework will be computed for a suite of flood events and compared with observations. Using these estimates, a similar modeling approach will be developed to model the time varying return levels and flood risks of river flow, which is important for flood mitigation. Ideas of flood mitigation using couple of recent flood events as examples will be offered, to complete the presentation.