Manabendra Saharia

Accounting for rainfall spatial variability in prediction of flash floods

msaharia@ou.edu

Authors

Manabendra Saharia, School of Civil Engineering and Environmental Science, University of Oklahoma,
Pierre-Emmanuel Kirstetter, Advanced Radar Research Center, University of Oklahoma,
Humberto Vergara, Advanced Radar Research Center, University of Oklahoma,
Jonathan J. Gourley, Cooperative Institute for Mesoscale Meteorological Studies,
Yang Hong, School of Civil Engineering and Environmental Science, University of Oklahoma,

Flash floods are a particularly damaging natural hazard worldwide in terms of both fatalities and property damage. In the United States, the lack of a comprehensive database that catalogues information related to flash flood timing, location, causative rainfall, and basin geomorphology has hindered broad characterization studies. We follow a large-scale approach involving rainfall variability indices to get an unprecedented insight into the impact of precipitation variability on flash-floods. A representative and long archive of more than 20,000 flooding events during 2002-2011 is used to analyze the spatial and temporal variability of flash floods. Basin characteristics that influence flood response are derived with a large number of spatially distributed geomorphological and climatological parameters such as basin area, mean annual precipitation and basin slope. For the same period, the National Severe Storms Laboratory (NSSL) has produced a decadal archive of Multi-Radar/Multi-Sensor (MRMS) radar-based precipitation rates at high spatial (1-km) and temporal (5-min) resolution. This provides an unprecedented opportunity to analyze the impact of precipitation variability on flooding using a big data approach. The impact of rainfall spatial variability on flooding is analyzed with indices such as the first and second scaled moment of rainfall computed over the basin from the MRMS dataset. Flooding rise time, lag time, and peak discharge are linked to geomorphologic, climatologic, and rainfall indices to identify the precipitation and basin characteristics that drive flash floods. These findings are compared using the National Weather Service storm reports and a historical flood fatalities database. This analysis framework will serve as a baseline for evaluating distributed hydrologic model simulations such as the Flooded Locations And Simulated Hydrographs Project (FLASH) (http://flash.ou.edu). The outputs from this analysis will be used to predict flash floods over the continental U.S. specifically over regions poorly covered by hydrological observations.