Analysis of the stationarity of flood peaks in the U.S.

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Abstract

Annual peak discharge records from USGS stations with “long “ records are used to investigate distributional properties of US flood peaks. Two central issues are nonstationarities of annual peak records and “upper tail” properties of flood peaks. We include analyses of flood peak records from: 1) 50 stations in the continental US with at least 100 years of observations, 2) regional networks from the eastern and central US with records longer than 75 years and 3) nested networks of stream gages from large drainage basins. Abrupt changes in the mean and variance of flood peak distributions are examined through change-point analyses and temporal trends in the flood peak records through non-parametric tests. Abrupt changes, rather than slowly varying trends, are typically responsible for nonstationarities in annual flood peak records. Trend analyses for the analyzed US gaging stations provide little evidence at this point (2009) for increasing flood peak magnitudes associated with human-induced climate change. A special focus of the analyses of the upper tail properties of flood peak distributions concerns the role of landfalling tropical cyclones. It is shown that tropical cyclones play a central role in determining upper tail properties of flood peak distributions in much of the eastern US. We also present analyses of long-term trends in counts of landfalling tropical cyclones for the eastern US and assess the potential for trends in flood peak magnitudes associated with changes in frequency of Atlantic basin tropical cyclones.