

Stochastic Nuisance Flood Risk for Coastal Areas

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Abstract : The U.S. Federal Emergency Management Agency (FEMA) developed flood maps based on experts' experience and estimates of the probability of flooding. Current flood-risk models evaluate flood risk with regional and subjective measures without impact from torrential rain and nuisance flooding at the neighborhood level. Nuisance flooding occurs in small areas in the community, where a few streets or blocks are routinely impacted. This type of flooding event occurs when torrential rainstorm combined with high tide and sea level rise temporarily exceeds a given threshold. In South Florida, this threshold is 1.7 ft above Mean Higher High Water (MHHW). The National Weather Service defines torrential rain as rain deposition at a rate greater than 0.3-inches per hour or three inches in a single day. Data from the Florida Climate Center, 1970 to 2020, shows 371 events with more than 3-inches of rain in a day in 612 months. The purpose of this research is to develop a data-driven method to determine comprehensive analytical damage-avoidance criteria that account for nuisance flood events at the single-family home level. The method developed uses the Failure Mode and Effect Analysis (FMEA) method from the American Society of Quality (ASQ) to estimate the Damage Avoidance (DA) preparation for a 1-day 100-year storm. The Consequence of Nuisance Flooding (CoNF) is estimated from community mitigation efforts to prevent nuisance flooding damage. The Probability of Nuisance Flooding (PoNF) is derived from the frequency and duration of torrential rainfall causing delays and community disruptions to daily transportation, human illnesses, and property damage. Urbanization and population changes are related to the U.S. Census Bureau's annual population estimates. Data collected by the United States Department of Agriculture (USDA) Natural Resources Conservation Service's National Resources Inventory (NRI) and locally by the South Florida Water Management District (SFWMD) track the development and land use/land cover changes with time. The intent is to include temporal trends in population density growth and the impact on land development. Results from this investigation provide the risk of nuisance flooding as a function of CoNF and PoNF for coastal areas of South Florida. The data-based criterion provides awareness to local municipalities on their flood-risk assessment and gives insight into flood management actions and watershed development.

Keywords : flood risk, nuisance flooding, urban flooding, FMEA

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