

Assessment of the precipitation characteristics and identification of urban flooding hotspots for an Indian satellite town

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The rapid urbanization and population explosion have become major issues all around the world. Several satellite towns are developed to accommodate the ever-increasing population of metropolitan cities around the world. Gurugram, a prominent satellite city in the national capital region (NCR) of India, has faced frequent urban floods in recent years. Urbanization, besides having adverse impacts on hydro-climatic conditions, has led to a rapid increase in the impervious area. This seals the upper soil layers and thus generates excessive surface runoff causing urban floods. The problem of flooding has impacted public health and society as well as resulted in economic losses. Keeping this in mind, the present study makes an attempt to assess the extreme precipitation characteristics and identify the hotspots in Gurugram from the urban flooding point of view. The trend analysis of 1-day maximum rainfall series has been carried out for a period of 63 years (1951-2013) using the non-parametric Mann-Kendall (MK) test. The hotspots are identified through the rainfall-runoff modelling using the storm water management model (SWMM) developed by the Environmental Protection Agency (EPA), considering the criteria of the discharge rate, flooding hours and volume of flood. In order to initiate actions for its management, the prioritization of the potential hotspots is suggested through the multiple criteria decision analysis (MCDA) technique of choosing by disadvantage (CBD). The MK test results indicate an increase in the high-intensity rainstorms in recent years, leading to frequent urban floods. Further, it has been noticed that the urban drainage problem gets aggravated due to silting and choking of the Najafgarh and Badshahpur drains which ultimately joins the river Yamuna in the northern part of Delhi. This study will be helpful to devise effective planning and management strategies for the Gurugram town under the rapid urbanizing scenario.

Keywords: urbanization, precipitation, urban flooding, hotspots