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Simulating the Surface Runoff for the Urbanized Watershed of Mula-Mutha River from Western Maharashtra, India

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Abstract : Mula-Mutha basin is one of the speedily urbanizing watersheds, wherein two major urban centers, Pune and Pimpri-Chinchwad, have developed at a shocking rate in the last two decades. Such changing land use/land cover (LULC) is prone to hydrological problems and flash floods are a frequent, eventuality in the lower reaches of the basin. The present research brings out the impact of varying LULC, impervious surfaces on urban surface hydrology and generates storm-runoff scenarios for the hydrological units. The two multi-temporal satellite images were processed and supervised classification is performed with > 75% accuracy. The built-up has increased from 14.4% to 34.37% in the 28 years span, which is concentrated in and around the Pune-PCMC region. Impervious surfaces that were obtained by population calibrated multiple regression models. Almost 50% area of the watershed is impervious, which attribute to increase surface runoff and flash floods. The SCS-CN method was employed to calculate surface runoff of the watershed. The comparison between calculated and measured values of runoff was performed in a statistically precise way which shows no significant difference. Increasing built-up areas, as well as impervious surface areas due to rapid urbanization and industrialization, may lead to generating high runoff volumes in the basin especially in the urbanized areas of the watershed and along the major transportation arteries. Simulations generated with 50 mm and 100 mm rainstorm depth conspicuously noted that most of the changes in terms of increased runoff are constricted to the highly urbanized areas. Considering whole watershed area, the runoff values 39 m^3 generated with 1'' rainfall whereas only urbanized areas of the basin (Pune and Pimpari-Chinchwad) were generated 11154 m^3 runoff. Such analysis is crucial in providing information regarding their intensity and location, which proves instrumental in their analysis in order to formulate proper mitigation measures and rehabilitation strategies.

Keywords : land use/land cover, LULC, impervious surfaces, surface hydrology, storm-runoff scenarios
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