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Improving assessment of flood inundation of Navsari (India) via open-source data and HEC-RAS model

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Flooding seems to be the most widespread and common catastrophe in a tropical country such as India. Efficient rainfall, industrial development, huge population, the effect of the tide, and urban growth are actual reasons for flooding in urban coastal regions. Navsari, the city of Gujarat, located 19 km upstream of the Arabian Sea. The city has experienced a devastating flood on 4th August 2004. Flash flooding and maximum discharge estimated at the Mahuva gauge station of about 8836 m³/sec were responsible for a disaster that resulted in massive damage to property and lives. A two dimensional (2D) flood simulation model is carried out to assessment of flood inundation in an urban coastal area. HEC-RAS is one of the most popular open-source hydraulic software having 2D capabilities including GIS features. In the present study, the distance between the Mahuva gauge station to the Arabian sea was considered for flood inundation assessment, whereas the SRTM 30 m DEM was used for grid generation for Navsari city. The inflow hydrograph was used as the upstream boundary condition, and normal depth was used as the downstream boundary condition during the 4th August 2004 flood event. The unsteady flow simulation was performed and validated for the year of 2004 flood event. The simulated outcomes show that major areas such as Viraval, Kachiawad, Jalalpore, near Railway station, Kaliawad, Tavdi village, and Near TATA School were flooded with 2-4 m depth. Furthermore, the simulated result demonstrates that, if the discharge exceeds 8836 m³/sec in the area of a floodplain, it may take 11 to 13 hours to make the city inundated. The R² value for the model is 0.9679, which shows that the observed value is the best match with the simulated value. The research study illustrates the accurate flood inundation assessment in the urban coastal area using open-source 2D HEC-RAS model. The present study described the applicability of open-source data and model in flood inundation assessment. The study will fill the gap of flood assessment through 2D HEC-RAS model worldwide areas, which are situated nearby coastal region, accompanied by the benefits of open-source dataset and model.