

Flood Inundation mapping and mitigation options in data-scarce region of Beledwayne town in the Wabi Shebele River Basin of Somalia

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SUMMARY

Somalia has experienced extreme flash floods in recent years across the arid regions causing tremendous loss of lives and properties. However, the flood magnitude, depth, and frequency of occurrence are not yet quantified. This is mainly due to scarce datasets in the area. . In this study, integration of observed and Climate Hazards Infrared Precipitation (CHIRP) satellite rainfall products and remote sensing raster data were used to improve hydrological model simulation outputs. The Hydrologic Engineering Center namely HEC-HMS and HEC-RAS models were used to simulate the rainfall-runoff processes and flood inundation, respectively. The land use, soil, slope and Digital Elevation map (DEM) were used to set-up the models and generate outputs. The HEC-HMS model calibration results depict that the model is able to reproduce the observed streamflow The simulated flows generated by the model predicted good agreement with the observed flow with values of 0.79, 0.74, 0.78, and 0.78 evaluated through the Nash and Sutcliffe Efficiency (NSE), Runoff Volume Error (RVE), coefficient of determination (R²), and percentage error of peak flow (PEPF), respectively. The HEC-RAS model result indicates that the maximum flood depth and velocity were obtained at the floodplain area. The peak flood at 50, 100, and 200-year return period using General Extreme Value (GEV) distribution revealed 384m³s⁻¹, 409m³s⁻¹, and 434m³s⁻¹, respectively. The 100-year peak flood discharge in a specific part of the river revealed a flood depth of 7.53m. The provision of Levees as mitigation measures revealed reduction of the flood extent by 35% and suggested as possible flood protection measures for the study area.

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