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Flood analysis using HEC-RAS: The case study of Majalaya, Indonesia under the CMIP6 projection

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Flooding is a natural disaster with extremely wide-reaching impacts and is a recurring problem in Indonesia. Whilst possible impacts of climate change are expected to aggravate flood risk in already flood-vulnerable areas, many countries struggle to achieve the United Nations' (UN) 2030 Sustainable Development Goals (SDGs) to achieve a better and more sustainable future for all. Using the case study of Majalaya, Indonesia, the authors investigated the impact of climate change and climate variability on urban flood risk through science-based spatio-temporal flood simulations. Based on the ensemble of 17 General Circulation Models (GCMs) CMIP6, the near-future (2021 to 2050) flood projection under Shared Socioeconomic Pathways (SSPs) 2.6 (low forcing), 4.5 (medium forcing) and 8.5 (high end forcing) common to historical (1981 to 2014) was simulated. The area's future risk of flooding was then investigated and adaptation measures were suggested for reducing and mitigating worsening flood conditions. A numerical model was developed in HEC-RAS that represented the city of Majalaya and the results were combined with the ensemble of climate projections to enable the assessment of the effects of flooding due to the combined effect of climate change and urbanisation. The model was calibrated using historical stream gauge records and past extreme flood inundation boundaries. Using the model's output metrics (e.g. flood depth, velocity) and local demographic data, the project aims then to use a vulnerability assessment framework to quantify the impact of climate change on flood risk. The modelling results will allow for spatio-temporal mapping of the flood-prone areas in Majalaya, which will help reduce risk and vulnerability for disadvantaged populations. The development of flood vulnerability maps and future flood risk projections will assist the government in developing land-use and flood prevention management policies. This research area, drawing from the combination of flood modelling and the use of climate projections, allows for an assessment of future flood risk scenarios of the city of Majalaya and paves new avenues towards future research.