

## **Enhancing flood forecasting in the Nilwala river catchment: A HEC-HMS approach**

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Flooding is a major risk in tropical regions, with Sri Lanka especially vulnerable due to its vast river network. The present study examined the Nilwala River catchment in the Southern Province, a region experiencing recurrent flooding intensified by climate change and rainfall variability. To enhance flood forecasting, we developed a model using Hydrologic Modelling System (HEC-HMS version 4.11), incorporating daily rainfall and runoff data. The model was calibrated with 2017 data and validated using 2012 and 2019 datasets. Key methodologies included the Deficit and Constant methods for loss estimation, the Clark Unit Hydrograph for transformation, and Muskingum routing for flow dynamics. Performance metrics demonstrated model robustness, achieving a Nash-Sutcliffe Efficiency (NSE) of 0.67, Percent Bias (PBIAS) of 4.75, Standard Deviation Ratio (RSR) of 0.66 and Coefficient of Correlation ( $R^2$ ) of 0.62 during calibration. Validation results showed consistent predictive capabilities, though extreme flood events were slightly underestimated. Predictions closely aligned with observed data at the Pitabaddara gauging station, effectively identifying peak flood occurrences. To improve flood management, we recommend detailed flood frequency analyses and installing a river gauge at the river's mouth for real-time data collection. This study underscores the model's potential to improve flood forecasting in the Nilwala River catchment, contributing to more effective flood risk management amid changing rainfall patterns. These advancements align with Sustainable Development Goal 11: Sustainable Cities and Communities, promoting resilience and sustainability in flood-prone regions.

**Keywords:** Flood forecasting, HEC-HMS, Rainfall variability, Nilwala River, SDG-11.

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