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**Research Article**

# Comparative comparison of SWMM and SMADA models to estimate flood hydrograph (case study: Zendan catchment area - Hormozgan province)

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# Extended Abstract

## Introduction

Flood prediction and hydrograph simulation in rivers or streams are among the most complex processes in hydrology. Accurate flood forecasting is essential for mitigating the devastating impacts of floods, which often result in significant loss of life and property. In Iran, floods have caused extensive damage over the years, highlighting the need for effective flood management strategies. Hydrological models such as SWMM (Storm Water Management Model) and SMADA (Surface Water Modeling and Data Analysis) are widely used to simulate rainfall-runoff processes and predict flood hydrographs. These models utilize meteorological data, watershed characteristics, and drainage network information to simulate hydrological processes.This study aims to compare the performance of SWMM and SMADA models in simulating flood hydrographs in the Zendan watershed in Hormozgan Province, Iran. The goal is to identify the more suitable model for flood management in this region. The study focuses on dividing the watershed into smaller sub-basins, simulating each sub-basin as a nonlinear, and routing the hydrograph to the outlet. The results provide valuable insights into the effectiveness of these models in flood prediction and watershed management.

## Materials and Methods

The study area, the Zendan watershed, is located in Hormozgan Province, Iran, characterized by a hot and arid climate with an average annual rainfall of 188 mm. The watershed was divided into 11 sub-basins, and the physical characteristics of each sub-basin, including area, slope, and drainage network, were determined. Meteorological data, such as rainfall intensity and evaporation rates, were collected and used as input for the models. The SWMM model simulates each sub-basin as a nonlinear reservoir, calculating the unit hydrograph and routing it to the outlet using kinematic wave routing. The SMADA model, on the other hand, uses the Santa Barbara Urban Hydrograph (SBUH) method to simulate flood hydrographs. Both models were calibrated and validated using observed flood events. The performance of the models was evaluated using statistical indices such as the Nash-Sutcliffe efficiency (NSE), coefficient of determination ($R^2$), and root mean square error (RMSE).

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**Results and Discussion**

The results indicate that the SWMM model performed better than the SMADA model in simulating flood hydrographs. The SWMM model achieved an average NSE of 0.81 and an $R^2$ of 0.88, indicating a good fit between observed and simulated hydrographs. In contrast, the SMADA model had an average NSE of 0.31 and an $R^2$ of 0.60, suggesting lower accuracy. The SWMM model accurately predicted peak discharge and flood volume, with discrepancies of less than 10% for most events. However, the SMADA model tended to overestimate peak discharge, likely due to its reliance on older empirical relationships and simplified assumptions. The differences in model performance can be attributed to the SWMM's ability to incorporate detailed watershed characteristics and its robust calibration algorithms. The study also highlighted the importance of accurate input data and model calibration. Errors in rainfall and flow measurements, as well as uncertainties in watershed parameters, can significantly affect model performance. The SWMM model's flexibility in handling complex watershed processes makes it a more reliable tool for flood prediction in the Zendan watershed.

**Conclusion**

The SWMM model demonstrated superior performance in simulating flood hydrographs in the Zendan watershed compared to the SMADA model. Its ability to accurately predict peak discharge and flood volume makes it a valuable tool for flood management and watershed planning. The study recommends the use of SWMM for flood prediction in similar arid and semi-arid regions, particularly in upstream areas of dams where accurate flood forecasting is critical.

The findings also emphasize the need for further research on model calibration and the integration of advanced data sources, such as remote sensing and GIS, to improve flood prediction accuracy. Effective flood management requires a comprehensive approach that considers the entire watershed, including land use changes, climate variability, and human activities. By leveraging advanced hydrological models like SWMM, policymakers and water resource managers can develop more effective strategies to mitigate flood risks and protect vulnerable communities.

**Keywords**: SWMM, SMADA, Flood hydrograph, Zendan Basin