

ABSTRACT

Baseline and Future Hydrologic Response Assessment of the Cavite River Basin Using Proxy Streamflow Data for SWAT Model Calibration and Scenario Analysis

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Hydrologic modeling in data-scarce regions presents a challenge for accurate watershed planning and management. This study addresses that gap by applying the Soil and Water Assessment Tool (SWAT) to simulate the baseline and future hydrologic response of the Cavite River Basin in the Philippines, composed of seven ungauged watersheds, namely Zapote, Imus, Rio Grande, Timalan, Labac-Alemang, Cañas, and Maragondon. Global CHIRPS/CHIRTS datasets were used for weather input, while streamflow calibration and validation were performed using proxy data from the GEOGloWS ECMWF Streamflow Forecasting Service. The service provides retrospective simulations of river streamflow, which served as a proxy where observed records were unavailable. All models achieved acceptable deterministic performance, with NSE values ranging from 0.62 to 0.64. Uncertainty analysis showed low P-factor values for Zapote, Timalan, and Labac-Alemang, although their R-factor and NSE scores remained acceptable for scenario-based assessments.

Baseline simulations captured expected seasonal variation in rainfall, surface runoff, evapotranspiration, and water yield, with peak rainfall and runoff observed during the southwest monsoon season. Future scenario modeling incorporated 2050 LULC change projections using the GeoSOS-FLUS model and mid-century (2031–2060) climate projections based on CMIP6 scenarios downscaled via the CLIRAM tool of DOST-PAGASA. Across watersheds, climate change alone caused variable hydrologic outputs, while land-use changes introduced spatial variation in surface runoff and evapotranspiration depending on the balance of urban and vegetative coverage. These

findings support the applicability of globally available proxy datasets for hydrologic modeling and provide a baseline for future studies on flood risk, land-use and water resource planning under climate change in Cavite's rapidly changing watersheds

Keywords: hydrologic modeling, ungauged watersheds, GEOGloWS, SWAT