

Potential Response of Mangroves to Climate Projections (SSP245 and SSP585) in West African Coastal Areas: Case of the Mono–Bouche du Roy Biosphere Reserve

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ABSTRACT

Mangroves are vital ecosystems because of their key role in supporting biodiversity, maintaining coastal ecological functions, and their significant ability for carbon sequestration in the context of climate change. This study aims to evaluate the potential response of mangroves and to analyze how future climate conditions may affect their health and regenerative capacity within the biological reserve of the *Aire Communautaire de Conservation de la Biodiversité (ACCB) of Bouche du Roy*. To achieve this, thirteen (13) climate models were used for precipitation analysis and five (05) for temperature, under the SSP245 and SSP585 scenarios. Model performance was assessed with statistical metrics (RMSE, MAE, KGE, among others), combined with a weighting approach and graphical analyses, including Taylor diagrams and evaluations of seasonal and interannual variability. These methods helped identify the most reliable models. Additionally, several bias correction techniques—such as Quantile Mapping (QM), Delta Quantile Mapping (DQM), Linear Scaling (LS), and Variance Scaling (VS)—were applied using ERA5 data as a reference. To analyze future climate variability in the area and its effects on mangrove ecosystems, relevant climate indicators were calculated, especially climate anomalies for 2025, 2030, 2040, and 2050 in relation to the 1981–2010 baseline period. Furthermore, key climate indices like CDD, CWD, Rx1day, PRCPTOT, and TX90p were used to describe hydroclimatic changes and assess their potential impacts on mangrove dynamics. These indicators facilitated the connection between water stress (CDD, decrease in PRCPTOT), flood risk (Rx1day, Rx5day, CWD), and salinization risk (CDD, TX90p). The results highlight significant biases between simulated and observed precipitation data, while temperature shows smaller discrepancies. The multi-model ensemble (MME) approach emerges as the most effective, displaying fewer deviations compared to ERA5 data. The Linear Scaling (LS) method appears to be the most efficient bias correction technique for both temperature and precipitation. Overall, climate projections suggest a gradual increase in temperature within the reserve, roughly +0.028 °C/year under SSP245 and +0.031 °C/year under SSP585. Relative to the baseline period (1981–2010; 26.22 °C), the annual mean temperature is projected to rise by about +0.34 °C by 2025, +0.45 °C by 2030, +0.74 °C by 2040, and +0.96 °C by 2050 under SSP245. Under SSP585, the increase is more significant, reaching approximately +0.44 °C, +0.49 °C, +0.85 °C, and +1.18 °C for the same horizons.

Keywords: Mangroves, Climate change, West Africa, ACCB Bouche du Roy, Mono