

Future Changes in Precipitation Patterns and Extremes in Major Coastal Cities of Bangladesh Using CMIP6 Multi-Model Ensemble

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Coastal cities in Bangladesh are increasingly vulnerable to climate change-induced hazards such as floods, tropical cyclones, and tidal inundation. Extreme weather events, such as urban flooding resulting from heavy precipitation, are becoming more frequent and severe. This study conducts a comprehensive spatiotemporal analysis, evaluating annual and seasonal variations in precipitation and extreme precipitation using extreme climate indicators. The study focuses on 22 coastal towns the government prioritizes for sustainable development, which are highly vulnerable to climate change. Future changes in precipitation patterns and extremes are analyzed using 13 bias-corrected GCMs using the Empirical Quantile Mapping (EQM) method. Historical trends and future projections are generated for high emission SSP3-7.0 and low emission SSP2-4.5 scenarios for the near future, NF (2026-2055) and far future, FF (2071-2100) to baseline (1985-2014).

Significant changes in precipitation patterns, with an overall wetter climate projected under the SSP2-45 scenario in NF as 11.57%(1.76% to 22.65) and an even wetter scenario under the SSP3-70 in FF as 29.50%(15.14% to 41.62%). The pre-monsoon season is projected to be driest under the SSP3-70 in NF at -27.73 (-58.95% to -14.31%), while the winter season shows substantial increases in precipitation, particularly under the SSP2-45 as 466%(241.14% to 677%) in FF. Monsoon precipitation increases significantly in FF under the SSP2-45 as -27.06%(-44.47% to -13.24%) and the SSP3-70 as 29.79% (20.32% to 38.15%). Similar increases in precipitation patterns are found for the post-monsoon under the SSP2-45 at 24.92% (2.17% to 37.43%) and the SSP3-70 at 30.25% (5.16% to 44.95%).