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From climate projections to action: A risk assessment framework for resilient economic zones in Africa

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Abstract

Climate change is intensifying risks to economic zones across sub-Saharan Africa, where rapid urbanisation, resource pressures, and climate variability intersect. This study presents a standardised climate risk assessment framework developed within the NatuReS II programme to support decision-making in selected economic zones in Zambia, South Africa, Tanzania, and Ethiopia. The approach combines climate modelling, contextual analysis, and risk synthesis to generate comparable, policy-relevant insights across diverse settings.

Daily temperature and precipitation projections from multiple CMIP6 global climate models were analysed using a multi-model ensemble approach to capture uncertainty and improve robustness. Data were processed into continuous time series and evaluated against a 30-year historical baseline (1985–2014), following World Meteorological Organisation standards. A set of indicators was derived to assess key hazards, including extreme precipitation, heatwaves, and drought conditions. These indicators were selected for their relevance to infrastructure, water systems, and economic activities within the study areas.

To translate climate hazards into actionable insights, the analysis integrates exposure and vulnerability through a structured hazard–exposure–vulnerability framework. This includes a desk-based assessment of hydrological conditions, socio-economic factors, and environmental characteristics specific to each economic zone. The resulting risk profiles identify key sectoral pathways through which climate impacts may materialize, such as disruptions to water supply, industrial productivity, and urban services.

Across all case studies, results indicate a consistent trend toward rising temperatures, increasing frequency of extreme heat events, and greater variability in precipitation, with implications for both flood and drought risk. While the magnitude and nature of impacts vary by location, common vulnerabilities emerge, particularly related to water security, infrastructure limitations, and rapid, often unplanned urban expansion.

The framework provides a transferable and scalable tool for climate risk assessment at sub-national level. By linking global climate projections with local context, it supports stakeholders in identifying priority risks and informing adaptation planning in economically critical regions.

Keywords: Adaptation planning, climate risk assessment, CMIP6, economic zones, extreme weather, multi-model ensemble, sub-Saharan Africa, urban resilience, vulnerability, water security