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An integrated approach towards vulnerability assessment of climate-change induced sea level rise along the Kenyan coast

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Abstract

Currently, 48% and 71% of the infrastructure for Mombasa and Lamu respectively falls within the Low Elevation Coastal Zones (LECZ) of less than 10m thus highlighting their extreme vulnerability under the pessimistic sea-level-rise (SLR). Based on the primary objective of assessing the impacts of climate-change-induced SLR for the two island cities, this study finds that by the end of this century, close to 50% of Mombasa Island and almost 71% of Lamu Island fall under threat of inundation from SLR enhanced storm surges of a one storm surge in 100 years. The study objectives were to assess initial SLR vulnerability levels for the Kenyan coast, analyse status quo vulnerability perceptions and awareness, co-produce mitigation and adaptation policy options and produce an integrated vulnerability assessment atlas and manual for SLR along coastal cities, with participatory processes as a key component. SLR scenario modelling using GIS techniques (and guided by Intergovernmental Panel on Climate Change - IPCC) under two SLR scenarios of Regional Concentration Pathways (RCP 2.6 and RCP 8.5), was applied to estimate the spatial extent, population, and infrastructure under threat. Participatory Action Planning (PAR) based on a mini-charrette was used to analyse status quo perception and awareness of SLR and related impacts followed by co-creation of adaptation and mitigation strategies. Under RCP 2.6 (optimistic-scenario) the simulation findings indicate that exposure level to the 1:100 storm surge for Mombasa County at 4m elevation falls between 433,300 and 2.5 million people and over US$9.1 billion in assets exposed by 2090. Under RCP 8.5 (pessimistic-scenario) for Lamu, the exposure level of between 37,200 and 480,400 people and over US$ 648 million in infrastructure/assets is exposed by 2090. Under increased urbanization, vulnerability for both Mombasa and Lamu increases to over 2.6 million inhabitants and US$ 14.5 Billion and US$ 1.2 Billion respectively by 2090 under RCP 8.5. The participatory process showed improvement in the awareness of SLR impacts by participants in both islands and thus constituted the basis of co-production of adaptation and mitigation strategies as well as finalisation of the vulnerability atlases of the island cities.

Keywords: Sea-level-rise, vulnerability assessment, climate change, Kenyan coast and coastal planning.