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# Multi-hazard stress testing framework for quantifying climate-related Value at Risk for water utilities

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Water utility assets are particularly vulnerable to the impacts of climate change, from multiple climate-related hazards including droughts, floods and hurricanes. There are increasingly calls for disclosure and reporting of physical climate risks to companies, but dependable probabilistic risk estimates are challenging for companies whose asset networks extend over large areas and are subject to multiple hazards. Here we examine the financial impact of present and future (mid-century projections under RCP2.6, 4.5 and 8.5 warming scenarios) climate extremes on the national water supply utility in Jamaica. The potable water supply system is stress tested with a large set of spatially coherent hurricane, drought and pluvial and fluvial flood events, combining observed events with synthetic statistical and model-based events. The water utility's assets (reservoirs, pumping stations, treatment works, etc.) are embedded in a system model, which also represents water usage for municipal use, loss through leakage and major storage dynamics in the supply network. For each disruptive event, the number of water users impacted is computed. The financial loss incurred by the utility is estimated as the sum of cost of disruption (cost of tankering water and lost tariffs during disruptions/periods of asset reconstruction post event) and the expected cost of asset reconstruction. An expected Value at Risk (VAR), both at present and in future scenarios, is estimated by integrating over the probabilistic event set. The calculation is an extension of the established framework for catastrophe loss modelling used by insurers. We show how climate-induced, widespread water supply disruptions translate into the VAR of a utility's balance sheet. As water utilities are largely state-owned enterprises, these impacts impose a major burden on the fiscal budget. Therefore, the framework presented provides a basis for identifying interventions that promote both water infrastructure and fiscal resilience.