Synthesis of Research and Comparative Methodologies for Extreme Flood Frequency Analysis in Morocco under Climate Change (Oral)

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ABSTRACT

This paper presents an evaluation of current flood frequency analysis practices within the hydro-climatic context of Morocco, where estimating rare hydrological events is essential for infrastructure resilience. The core issue involves the challenges posed by environmental changes, which may limit the applicability of the traditional stationarity hypothesis and affect the frequency and intensity of extreme events. Standard statistical models often encounter constraints in accurately characterizing distribution tails, where catastrophic risks are concentrated, potentially leading to inaccurate design quantiles for critical hydraulic structures. Thereafter, I propose a comprehensive synthesis of methodologies rooted in Extreme Value Theory (EVT) specifically adapted to the specificities of Moroccan gauging networks. This synthesis systematically compares the Block Maxima (BM) approach, using the Generalized Extreme Value (GEV) distribution, with the Peaks Over Threshold (POT) approach, utilizing the Generalized Pareto Distribution (GPD). It further evaluates parameter estimation methods, highlighting the robustness of L-moments for limited historical samples and the flexibility of Maximum Likelihood Estimation (MLE) for incorporating non-stationary climate covariates. What distinguishes this work is its integrative focus on the entire modeling chain within the specific context of Morocco's national flood risk management strategy. It provides a scientifically grounded comparison of frameworks to help manage hydrological risks in an evolving environment. By prioritizing physically consistent climate indices over simple temporal trends, this synthesis offers a more transparent methodology for informed engineering decisions regarding the Kingdom's hydraulic heritage.

Keywords: Extreme Value Theory (EVT); Non-stationary modeling; Flood frequency analysis; Climate change adaptation.