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## Analysing the Return Period and Risk under the Influence of Physical Covariates on Hydrological Extreme

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For sustainable water resources planning and management, it is necessary to redefine the concept of return period, risk, and reliability of hydrologic extreme under non-stationary condition. Thus, the present study aims to examine the return period, risk introducing physical based covariates in the location parameter of the generalised extreme value (GEV) distribution. The study is performed over the Godavari River basin, India. The expected waiting time (EWT) approach is used to make comparison of return period, risk between stationary and non-stationary approaches. From the analysis, it is found that 50% of the gauging stations are impacted by large scale modes/oscillations and regional hydrological variability, primarily by Indian Summer Monsoon Index (ISMI) and precipitation. The EWT interpretation estimates that the non-stationary return period, risk, and reliability are significantly different from stationary condition. Hence, it is concluded that return period analysis and risk assessment using non-stationary approach can be beneficial to water managers and policy makers in order to devise sustainable and resilient water resources infrastructure under climate change scenario.

**Keywords:** Extreme value analysis; Return period; Risk; Non-stationarity; Uncertainty