



Nonstationary precipitation intensity-duration-frequency curves for infrastructure design in a changing climate

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Extreme climatic events are growing more severe and frequent, calling into question how prepared our infrastructure is to deal with these changes. Current infrastructure design is primarily based on precipitation Intensity-Duration-Frequency (IDF) curves with the so-called stationary assumption, meaning extremes will not vary significantly over time. However, climate change is expected to alter climatic extremes, a concept termed nonstationarity. Here we show that given nonstationarity, current IDF curves can substantially underestimate precipitation extremes and thus, they may not be suitable for infrastructure design in a changing climate. We show that a stationary climate assumption may lead to underestimation of extreme precipitation by as much as 60%, which increases the flood risk and failure risk in infrastructure systems. We then present a generalized framework for estimating nonstationary IDF curves and their uncertainties using Bayesian inference. The methodology can potentially be integrated in future design concepts.