



Intensity – Duration – Frequency Curves for U.S. Cities in a Warming Climate

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Current infrastructure design procedures rely on the use of Intensity – Duration – Frequency (IDF) curves retrieved under the assumption of temporal stationarity, meaning that occurrences of extreme events are expected to be time invariant. However, numerous studies have observed more severe extreme events over time. Hence, the stationarity assumption for extreme analysis may not be appropriate in a warming climate. This issue raises concerns regarding the safety and resilience of infrastructures and natural slopes.

Here we employ daily precipitation data from historical and projected (RCP 8.5) CMIP5 runs to investigate IDF curves of 14 urban areas across the United States. We first statistically assess changes in precipitation extremes using an energy-based test for equal distributions. Then, through a Bayesian inference approach for stationary and non-stationary extreme value analysis, we provide updated IDF curves based on future climatic model projections. We show that, based on CMIP5 simulations, U.S cities may experience extreme precipitation events up to 20% more intense and twice as frequently, relative to historical records, despite the expectation of unchanged annual mean precipitation.