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A multiscaling model of an intensity-duration-frequency relationship for extreme precipitation

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Rainfall intensity-duration-frequency (IDF) curves are one of the most commonly used tools in water resources engineering. They give an idea of how return levels of extreme rainfall intensities vary with duration over a range of return periods. The simple scaling property of extreme rainfall intensities determines the form of IDF-relationships. It is assumed that the annual maximum intensity follows the generalized extreme value (GEV) distribution. As well known, the resulting location- and scale-parameter of the GEV-distribution possess the simple scaling property.

Although, the simple scaling hypothesis is commonly used as a reasonable working assumption, the multiscaling approach provides a more general framework. We present a new IDF-relationship that is formulated on the basis of the multiscaling property. It turns out that the GEV-parameters (location and scale) have a different scaling exponent. The new model has thus one additional parameter compared to the simple scaling IDF model.

Next, we apply a Bayesian framework to estimate the IDF-models, and to choose the most appropriate model. It is shown that the model performance is increased when using the multiscaling approach. The new model for IDF-curves reproduces the data very well, and has a reasonable degree of complexity without overfitting on the data.