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Climate change scenarios of temperature extremes evaluated using extreme value models based on homogeneous and non-homogeneous Poisson process

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The study compares statistical models for estimating high quantiles of daily temperatures based on the homogeneous and non-homogeneous Poisson process, and their applications in climate model simulations. Both types of the models make use of non-stationary peaks-over-threshold method and the Generalized Pareto distribution (GPD) for modelling extremes, but they differ in how the dependence of the model parameters on time index is captured. The homogeneous Poisson process model assumes that the intensity of the process is constant and the threshold used to delimit extremes changes with time; the non-homogeneous Poisson process assumes that the intensity of the process depends on time while the threshold is kept constant (Coles 2001). The model for time-dependency of the GPD parameters is selected according to the likelihood ratio test. Statistical arguments are provided to support the homogeneous Poisson process model, in which temporal dependence of the threshold is modelled in terms of regression quantiles (Kysely et al. 2010). Dependence of the results on the quantile chosen for the threshold (95-99%) is evaluated. The extreme value models are applied to analyse scenarios of changes in high quantiles of daily temperatures (20-yr and 100-yr return values) in transient simulations of several GCMs and RCMs for the 21st century.

References:
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