



Non-stationary frequency analysis with climatic covariates of heavy rainfall events in the French Mediterranean region

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Heavy rainfall events often occur in the French Mediterranean region during the fall season, leading to catastrophic flood events. In the present study, a non-stationary peaks-over-thresholds (POT) model with climatic covariates for heavy rainfall events during the fall season in southern France is proposed.

First, a correlation analysis has been conducted in order to identify the most relevant covariates to be included in the model. The occurrence of heavy rainfall events exceeding the threshold of 100 mm during the fall season appear to be associated with the occurrence of southern-type circulation patterns, identified from the EDF-2006 synoptic weather classification. Significant correlations also exist between the sea surface temperatures in the Western Mediterranean sea and the occurrence of heavy rainfall events, at the seasonal scale. In addition, the magnitude of the heavy rainfall episodes is correlated with the monthly air temperature over the region, indicating higher rainfall amounts during warmer months.

Second, a non-stationary POT model has been developed, using as covariates: 1- the occurrence of southern circulation patterns for the Poisson distribution parameter and 2- air temperature for the Generalized Pareto distribution scale parameter. According to the Deviance statistical test, the non-stationary model with covariates proposes a better fit to the data than a classical POT model. Such a model, by incorporating climatic variables instead of time as covariates, allows the use of GCM or RCM outputs of future climate to produce future scenarios for the heavy rainfall distribution.