

# **Extreme events of precipitation over Italy and their probability of occurrence.**

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Daily precipitation totals measured at 70 Italian stations over 1951-2004 are used as an input dataset. An assessment of extreme events' distribution is proposed.

Statistical extreme value method, based on selection of all values exceeding a defined threshold ( $u$ ) requires to check the hypotheses that exceedances are identically distributed and stationary. Extreme value sub-series are declusterized considering the most intense event and excluding those which might be sprung by a common meteorological phenomenon. Moreover, according to Italian precipitation framework, data are divided into 4 three-months blocks (DJF/MAM/JJA/SON) in order to avoid any kind of seasonal cycle. Under these conditions, the parameters of Generalised Pareto Distribution (GPD) can be estimated by maximum likelihood method. On the contrary, the probability of an extreme event under non-stationary conditions depends on the rate of change of the parameters of the distribution as well as on the rate of change of the frequency of their occurrence. Assuming that dates of events over a given threshold ( $u$ ) follow a non-stationary Poisson process, extremes can be equally interpreted as a realization of a Generalised Pareto Distribution (GPD) distributed random variable but with a time-dependent scale parameter. Referring to a study we have recently carried out on the same dataset over 1951-2000, we have that precipitation due to extreme events has increased despite the fact, that total precipitation has decreased. This can be attributed to a change in the shape parameter of the distribution while a shift of maximum probability over time is closely related to a changing scale parameter.

At first step, 100-year return levels are computed according to the assumption of stationarity. Then, a variation of extremes' intensity and frequency over time is investigated. Consequently, 100-year return levels are computed through the identification of a trend dependence on series length, taking into account that under non-stationary conditions, the value of the return level is strictly dependent on the extrapolated period of consideration.