



## Trends in rainfall time series in Sicily

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Following a consolidated practice in engineering, the derivation of design events, i.e. events corresponding to a fixed return period, is generally carried out by assuming stationarity for the underlying hydrological series. Similarly, assessment of available resources for planning purposes is usually performed by assuming historical series as representative of possible future scenarios. However, recently the stationarity hypothesis has been questioned by many authors, who claim that many hydrological series exhibit trends and/or jumps along time, due to climatic or environmental changes or to human activities, thus implying that statistical properties may change with time.

The aim of the study is to assess the presence of linear and non-linear trends in annual rainfall and annual maxima rainfall series of 1, 3, 6, 12 and 24 hours observed in Sicily. In particular, for each series, the Student's  $t$  test and the Mann-Kendall test, are applied for linear and non linear trend detection, respectively. The null hypothesis of no trend is tested by means of the traditional asymptotic distributions of the statistics, as well as by means of a bootstrap approach. Furthermore, the significance of the Theil-Sen statistic for linear trend is tested by means of bootstrap. The results indicate a different behaviour according to the time scale. In particular, for shorter durations (e.g. 1 hour), the investigated series generally exhibit increasing trends while as longer durations are considered, more and more series exhibit decreasing trends. At the annual time scale, most of the investigated series exhibit a decreasing trend.

The effect of trend on the assessment of the return period of a critical event is also analysed by estimating the parameters of a fitted probability density function on the basis of several sub-series extracted from the whole observation period. The corresponding confidence intervals on the estimated return periods have been computed by bootstrap, under the hypothesis of no trend. The results of such analysis confirm an apparent rainfall decrease in the last 30 years, especially for a duration of 24 hours.