



## **Are rainfall extremes increasing, and where? A large-scale trend analysis in Italy**

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Climate change and its impact on the extreme precipitation regime is a debated topic in the hydro-climatologic literature. On the one hand, several studies document a strong association between the increase of the air temperature and the intensity of extreme rainfall; on the other hand, the outcomes from observational-based studies do not seem to suggest a clear picture of change in wide regions. In this regard, Italy offers a concrete example of variety of climatic and orographic features, which possibly motivate the fact that many studies carried out at the regional level for detecting trends in the magnitude of extreme rainfall have provided conflicting outcomes. In addition, the administrative fragmentation of the Italian hydrological monitoring network has not allowed so far for a proper tackling of the challenges of climate change with a comprehensive national strategy.

With the aim of addressing a comprehensive characterization of the evolution of the rainfall extreme regime in Italy, this work exploits the potentialities of the I-RED, the first country-wide Italian up-to-date dataset of annual maxima for sub-daily durations, for exploring the presence of trends in the magnitude and frequency of extreme rainfall at the Italian national scale.

Consolidated methodologies for trend detection (e.g., Mann-Kendall and Sen's slope techniques) and advanced techniques aimed at accounting for the time-variable data availability (e.g., quantile regression, record-breaking analysis) are adopted. Results suggest that the presence of a uniform trend at the national level cannot be confirmed, both in the intensity and in the frequency of rainfall extremes. However, various spatial aggregations have been considered, in order to analyse the impact of the uneven distribution of the monitoring network and of the local morpho-climatic variability. The trend analysis on the obtained sub-regions provides evidences of both increasing and decreasing significant trends, in agreement with similar outcomes of recent literature works.