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SPI-based probabilistic analysis of drought areal extent in Europe

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Drought is a natural phenomenon, exhibiting spatial and temporal features whose knowledge is fundamental for a correct water resources management. In particular, the assessment of probabilities and return periods of areal extent of droughts of different severities over a region can provide useful information for drafting drought management plans.
In this study, a methodology to characterize probabilistically the relationship between drought severity (computed in terms of Standardized Precipitation Index, SPI) and areal extent, expressed as Drought
severity-Area curves, is proposed. In particular, a Drought severity-Area curve describes the proportion of the total area of the region under investigation where the SPI values are below a fixed threshold. Then the probability of observing a given curve is derived analytically. This enables to characterize a given drought event in a region, by computing the probability of occurrence of Drought severity-Area curves exceeding the one observed.
The developed methodology is applied to investigate the areal extent of drought occurrences over Europe by using the CRU TS3.10 gridded monthly precipitation dataset for the period 1901-2009. Furthermore, the validity of the derived probabilities is verified by means of a Monte Carlo procedure.