



## **Analytical derivation of Severity-Area-Frequency curves for characterizing drought areal extent**

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The assessment of probabilities and return periods of areal extent of droughts of different severities over a region is fundamental for an appropriate water resources management and for planning drought management measures. In this study, an analytical methodology to characterize probabilistically the relationship between meteorological drought severity (computed in terms of Standardized Precipitation Index, SPI) and areal extent expressed as Drought severity-Area-Frequency (SAF) curves, is proposed. In particular, analytical approximations of SAF curves describing the proportion of the total area of the region of interest where the SPI values are below a fixed threshold for a fixed exceedence probability are derived, assuming the underlying SPI field distributed according to a multivariate normal distribution. The proposed methodology accounts for the spatial correlation of the SPI field, and its analytical form enable to draw general conclusions about the effect of spatial dependence on areal extent of droughts. Furthermore the derived SAF can be adopted to characterize a given drought event in a region, by computing the probability of occurrence of SA curves exceeding the one observed. The methodology is validated through the investigation of the spatio-temporal features of drought occurrences over Sicily, Italy, for the period 1923-2006.