Investigating drought areal extent through Severity-Area-Probability curves

Brunella Bonaccorso[1], David J. Peres[2], Antonino Cancelliere[2]

[1]Department of Civil, Computer, Construction and Environmental Engineering and Applied Mathematics, University of Messina, Italy

[2]Department of Civil Engineering and Architecture, University of Catania, Italy

Abstract. Drought is a natural phenomenon that exhibits spatial and temporal variability. The assessment of probabilities and/or return periods of areal extent of drought events of different severities over a region is of primary interest for an appropriate water resources management as well as for an effective drought preparedness and mitigation planning. In this study probabilistic characterization of the relationship between meteorological drought severity (computed in terms of Standardized Precipitation Index, SPI) and areal extent, expressed as Drought severity-Area-Probability (SAP) curves, is carried out through an analytical methodology. In particular, analytical expressions of SAP curves describing the proportion of the total area of the region of interest where the SPI values are below a fixed threshold are derived. The proposed methodology accounts for the spatial correlation of the SPI field, and the analytical form of the derived curves enables to draw general conclusions about the effect of spatial dependence on areal extent of droughts. Furthermore the derived SAP can be adopted to characterize a given drought event in a region, by estimating the probability of occurrence of severity-Area curves exceeding the one observed. The methodology is validated by investigating the spatio-temporal features of drought occurrences over Sicily, Italy.