



Spatial and temporal analysis of meteorological droughts in Thessaly Water Department, Greece

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In an effort to capture various aspects of drought, many indices have been suggested, based on one or more hydro-climatic parameters. In this paper the spatial and temporal characteristics of drought are analyzed in the water department of Thessaly for 42 hydrological years, relied on the hydro-climatic variables of precipitation and potential evapotranspiration (PET). More specifically the meteorological drought index SPI recommended by the WMO, and its enhanced version SPEI, have been selected as the most efficient indices for a regional drought assessment in Thessaly. The monthly precipitation and temperature data, covering the hydrological period 1960-2002, were used for the calculation of the considered indices at time scales: 1, 3, 6, 9 and 12 months. In order to obtain equal amount of precipitation and temperature data, the lapse rate method is applied, forming 78 meteorological stations. A time series analysis and a drought classification for all the stations are cited, presenting the main similarities/differences between SPI and SPEI. Additionally, a correlation analysis is conducted, displaying scatter plots and spatial patterns of the correlation values for the examined indices. It was ascertained that SPI and SPEI are more strongly correlated in the mountainous regions. In the last part of this study a Principal Component Analysis (PCA) is performed for both indices, at time scales 3 and 12. The outcomes show two similar homogeneous patterns for SPI and SPEI respectively, expressing the temporal evolution of drought in Thessaly. An orthogonal rotation of the axes is conducted, providing several distinctive small regions for our study area. The results suggest that the inclusion of PET, especially in the drought monitoring of low-altitude regions, is crucial for the identification of spatial drought patterns, indicating that the applicability of each index is closely related with the geomorphology and climate of the area.

Keywords

Standardized Precipitation Index (SPI); Standardized Precipitation-Evapotranspiration Index (SPEI); Principal Component Analysis (PCA); Drought Variability; Thessaly