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Analysis of changes in drought occurrence over the Mediterranean Basin using multiple time scales SPI index

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Drought is a recurrent feature of climate and can affect areas with different climate regimes; its impacts depend on the duration, intensity and extent of precipitation deficiency.
Current climate change projections suggest an increase in frequency of drought episodes, strongly influencing the vulnerability of areas affected by recurrent climate extremes.
In this study the Standardized Precipitation Index (SPI) multiple time scales (3, 6, 12 months) is used in order to evaluate trends of drought events in the Mediterranean Basin, an area interested by an increasing reduction of available water resources.
This index is particularly suitable both because it requires only precipitation data and the standardization of the values permits a comparison between areas climatically and geographically different.
To obtain a spatiotemporal homogeneity of the SPI, the analysis is carried out using daily Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) quasi-global gridded dataset that integrate satellite rainfall estimates with gauges data. The dataset has a resolution of 0.05°and a time span covering the period from 1981 to near-present.
A frequency computation of the SPI classes for each time scale gives information on the spatial distribution of drought extreme events over the Basin and allows highlighting the most vulnerable areas. In order to fit water resources planning typical requests we calculate at annual and interannual level the frequency of the three negative SPI classes (moderately, severely and extremely dry) over sub-periods of 10 years and, considering the occurrences as a Poisson distribution, we perform a trend analysis applying the method introduced by Cox and Lewis (1966) using t-test for parameters and F-test for residuals.
The analysis of interannual time scale (SPI 3 months) is crucial for assessing if this intensification is focused on seasons of groundwater recharge, thus becoming an effective tool to support water management decision making processes.