



Identification of drought events and their correlation with teleconnection patterns across the Mediterranean

Shifa Mathbout, Joan Albert Lopez-Bustins, Dominic Royé, and Javier Martin-Vide

University of Barcelona, Q-0818001-J U00400025 U00400025, Geography, Barcelona, Spain (shifamathbout@yahoo.com)

This research analyses the spatiotemporal patterns of meteorological drought and its correlation with atmospheric teleconnection patterns over the Mediterranean (MR). The drought events are identified using the Standardised Precipitation Index (SPI) at various time scales (1, 3, 6, 9, 12, 24 and 48 months). Furthermore, the correlations between the SPI and seven teleconnection patterns -North Atlantic Oscillation (NAO), Mediterranean Oscillation (MO), Western Mediterranean Oscillation WeMO), East Atlantic (EA) pattern, East Atlantic/West Russia (EATL/WRUS) pattern, Scandinavia (SCAND) pattern and Southern Oscillation (SO)- at annual time scales in the Mediterranean basin was explored. The Spearman's rank correlation test was applied as a measure of the strength of the association between the variables, and the Student's t-test was used to evaluate the statistical significance of this analysis. Monthly precipitation data of the European Climate Assessment & Dataset (ECA&D) of the Royal Netherlands Meteorological Institute (KNMI) has been used, and also the monthly Global Historical Climatology Network (GHCN-Monthly) dataset for 300 meteorological stations with a mean length of 43 years (1975-2018) in the MR. The Results have suggested sever and extreme drought periods in the 20th century with a significant inflection point around 1998, after which the frequency of drought increased sharply. Spatially, the occurrences of moderate and extreme drought have become more frequent during the last two decades especially in the eastern Mediterranean (EM) with a continuous increase of the Mediterranean areas prone to drought from the early 1980s to the early 2011s. Atmospheric circulation drivers vary between the time scales, with NAO and EATL/WRUS types variation associated most frequently with SPI-3 and SPI-6 droughts in winter and the WeMO associated with both SPI-3 and SPI-6 in winter, spring and autumn with high significant correlation at 40% of the total stations. Negative anomalies of EATL/WRUS pattern after 2008 contributed to persistent and prolonged extreme and heavy droughts in the EM. The SCAND pattern showed statistically significant positive correlations with SPI-3 and SPI-6 in autumn and winter. The study also identified a significant relationship between the extreme and severe droughts over the EM and the prevailing positive phase of NAO after 2008. In winter, the SO is highly correlated with SPI values at all time scales and statistically significant negative relationships are found at 55% of total stations concentrated in the western Mediterranean, particularly in France, Spain, Croatia and Tunisia. The WeMO, SCAND and EA patterns have indicated the highest correlation coefficients with the annual time series of SPI at all time scales. This study can provide a new insight into both the identification of Mediterranean-wide drought and patterns of large-scale climate variation associated with SPI drought index.