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Relationship between precipitation amounts, precipitation concentration and teleconnection patterns in the Mediterranean basin

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The relationship between daily precipitation concentration index (CI), annual precipitation 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 is investigated. To quantify the teleconnection–precipitation relationships over the Mediterranean basin, linear correlations are calculated between the annual teleconnection indices for the previous seven patterns and both annual precipitation and annual data for CI values in 233 meteorological stations in the Mediterranean basin during the last four decades (1975-2015). 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. The total annual precipitation amounts showed statistically significant positive correlations with SCAND over the Northwestern Mediterranean with a correlation coefficients ranging from 0.47 to 0.55, and up to 0.66 in many parts of the Iberian Peninsula and France. The WeMO and MO teleconnection patterns are well correlated with precipitation amounts and high positive correlation values have been detected over the Northwestern Mediterranean with a correlation coefficient higher than 0.64 in France. NAO, MO and EATL/WRUS teleconnection patterns are negatively correlated with annual rainfall and the highest statistically significant negative correlations are detected with these three patterns in Europe (Spain, Portugal and Croatia). A statistically significant negative correlation is also detected between SO pattern and annual rainfall in the southern Mediterranean (Syria and Israel). The correlation is low or not significant for other teleconnection patterns. On the other hand, only a few statistically significant correlations are detected for CI with teleconnection patterns. The WeMO is highly correlated with CI values and statistically significant negative relationships are found in 25% of total stations concentrated in France, northeast Spain, Croatia and Tunisia. In the same area, the EA pattern showed statistically significant positive correlations with annual values of CI, e.g. a correlation coefficient higher than 0.57 in France. This study has proved the importance of the simultaneous influence of several teleconnection indices on the Mediterranean rainfall, and these results can contribute to improve the study of the spatial and temporal variability of annual rainfall and CI, which is a useful tool to characterise the irregularity of the Mediterranean rainfall.