



Spatial and Temporal Analysis of Rainfall Concentration over the Mediterranean according to two different indices

Shifa Mathbout (1), Joan Albert Lopez Bustins (1), Dominic Royé (2), and Javier Martín -Vide (1)

(1) Climatology Group, Department of Geography, University of Barcelona, Barcelona, Spain, (2) Department of Geography, University of Porto. Department of Geography, University of Santiago de Compostela

This study addressed the spatial and temporal distribution of the daily rainfall concentration across the Mediterranean. Daily Concentration Index (CI) and ordered version of the N index (NI) were used to reveal the structure of precipitation accumulation derived from the number of precipitation days. Our database is formed by daily rainfall data during 1975- 2015 from 233 meteorological stations throughout the Mediterranean provided by the European Climate Assessment & Dataset (ECA & D) and the daily Global Historical Climatology Network (GHCN-Daily). The data quality was checked and tested against the presence of multiple inhomogeneities. All the statistical analyses, calculations, graphs and illustration of the results were achieved using the R (3.2.2) statistical environment. The annual values range from 0.57 to 0.70 for CI and 0.49 to 0.71 for n index. Both indices present the same relative areas of high and low concentration. The results showed higher values in both indices in the western part Mediterranean along the Spanish and French coasts. High values (>0.63) of NI were more detectable in the Eastern Mediterranean across the western coasts of Turkey and Israel indicating strong annual precipitation irregularity. The lowest annual precipitation CI values occurred in Turkey and inland areas of France and Spain. The strongest gradient in CI and NI values occurred between west and south Spain, the north and southern coastlands of France and more detectable by CI between north and south Tunisia. The results demonstrated a high correlation between CI and NI ($r = 0.70$; $p=0.05$). In general, the application of the Mann–Kendall test for investigating the possible trends revealed spatially non-uniform significant patterns in both CI and NI trends across the Mediterranean. Trend analysis demonstrated mostly non-significant decreasing trends for both indices (about 40% of total stations) which reflect a clear tendency toward a weaker seasonality of the rainfall distribution. According to CI and NI, only 7.3 % and 3.1% of stations over the Mediterranean basin have returned a statistically significant negative trend during 1975-2015, while 30.1% and 9.1% of the stations have detected a statistically significant positive trend during the study period, respectively. The statistically significant CI increasing has been mainly found in south France, northern coastlands of the Iberian Peninsula, Greece and Tunisia, whereas the statistically significant decreasing has been observed in Italy, northern coastlands of Algeria, Turkey and in the southern parts of the Eastern Mediterranean (e.g. Israel, Syria and Lebanon). Latitude and the distance from the sea might be the most important variables that affect the spatial distribution and variations in daily precipitation concentration which was more evident according to CI. These results should be taken into account next decades for a better water resources management and full environmental risks understanding.