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The orography and teleconnection patterns as determinant of precipitation in the southern Iberian Peninsula

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The recent research literature suggests a widely recognized decrease in winter precipitation (WPCP) over a large part of the Iberian Peninsula (IP) since 1980's. Instead a wet trend was observed on the eastern coast since 1985. Several works pointed to the high connection between the changes in the WPCP and the variability of the teleconnection patterns (TP), specially with the increasing North Atlantic Oscillation index (NAO) and decreasing West Mediterranean Oscillation index (WeMO) on winter. The main objective of this work in to correlate the WPCP with the TP and to quantify the change in the WPCP attending the rain shadow effect as determinant modulate to distribution of precipitation in the southern region of IP.

The data of WPCP, come from (descargasrediam.cica.es) with a high spatial resolution grid (1 km), and TP were retrieved from (cpc.ncep.noaa.gov). The studied area is Andalusia, the main southern region of the IP and the temporal period covers 1951-2010. The relationship between WPCP and TP was established using correlation during 1951-2010 and the change in the WPCP was quantified between two periods (1951-1980 and 1981-2010).

Rainfall spatial variability show a west-east dipolar structure: i) the western and central part is governed by NAO variability bringing westerly winds from the Atlantic Ocean, ii) the eastern part is determined by WeMO index when easterly winds bring water vapor from the Mediterranean Sea. The northeast-southwest orientation of the Baetic system acts as a barrier for these two directions of the flow forcing uplifts in both slopes. On the other hand, the changes in the WPCP were negative to the western and central territory, around -25%, while positive changes of up to 80% were observed to the eastern. In addition, the results showed a very strong relationship between the WPCP-NAO correlation and the change in the WPCP (R2 = 0.93) and intense correlation between the WPCP-WeMO and the WPCP correlation (R2 = 0.82). In conclusion, they suggest a determining role of the topography in the WPCP-TP correlation, which points to considerable consequences of the rain shadow effect in the distribution of precipitation within the studied region.

The regional approach used for the analysis of the temporal correlation between the WPCP and the TP, at high resolution, could be very useful in different fields of knowledge such as hydrological planning, for greater regional climate knowledge, and in knowledge tasks, adaptation and mitigation of climate change.

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