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Evaluating the Feasibility of Using a Drought Index Based on the Actual Evapotranspiration

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The increase of drought events could be one of the most risk of climate change producing numerous environmental and socioeconomic damages, especially in vulnerable regions such as the Iberian Peninsula (IP).

In this context, it is widely known the importance of taking into account the temperature effects to evaluate the impact of the climate change in the increase of drought occurrences. In terms of drought indices, such effect can be evaluated through the application of the Standardized Precipitation Evapotranspiration Index (SPEI), since it is the result of applying a simple water balance, which is the difference between the precipitation and the potential evapotranspiration (PET).

However, the potential evapotranspiration could be inaccurate to evaluate projected changes of drought events in some cases. This occurs particularly in areas with transitional soil moisture regimes and in a context where the increase of temperature it is expected to be much higher than the global mean (e.g. the IP). For that reason, in this study we compare the SPEI current features with those obtained considering the Standardized Precipitation Actual Evapotranspiration Index (SPAEI), which uses the actual evapotranspiration (AET) instead of PET. In order to analyze the suitability of this last index, it is also compared with the results from the Standardized Precipitation Index (SPI), and different time scales are considered.

Current (1980-2104) climate fields were obtained by using the Weather Research & Forecasting model (WRF) over the IP. Thereby, a 35-years WRF simulation was carried out in a domain centered over the IP with 0.088º of spatial resolution (10 km approximately), which is nested in an outer domain configured under the EURO-CORDEX domain specifications at 0.44º of spatial resolution (50 km approximately).

In general, results suggest that the SPAEI is quite adequate to evaluate drought events with results more similar to the SPI than the SPEI, contrary to what was expected. This fact seems to show that in this type of transitional regimes, where the soil moisture is a key factor, drought events are better characterized by the precipitation. Results also show that the main uncertainties of the SPAEI could be associated with the model ability to simulate the AET. Additionally, this analysis shows that the climate regional modeling is a very useful tool to understand and evaluate the climate in a specific region, providing valuable information in terms of variables with scarce observations available such as the AET.

Key words: Droughts, Actual Evapotranspiration, WRF, SPEI, SPI, SPAEI.

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