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Assessment of precipitation deficits and surpluses in mainland Portugal using the Standardized Precipitation Index

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Change in the climate is expected to affect the temporal and spatial distribution of precipitation. The consequences to the environment and regional development can be different, depending on local conditions. The increased understanding of recent climatic fluctuations and variability of local dry/wet conditions is useful for improving environmental and water resources management and the characterization of risk of meteorological/climatological hazards.

In this study we use the Standardized Precipitation Index (SPI) to evaluate the variability of dry/wet conditions in mainland Portugal over the period 1941-2007 (i.e. 67 years). The monthly precipitation data are from 75 observation stations scattered across the area. The SPI is a probability-based indicator that describes the degree of departure of the precipitation accumulated on a specific period from the average state. It can be used to detect and monitor drought and to identify wetter than normal conditions. An advantage of the method is that it can be calculated at various time scales (frequently, 3, 6, 12 and 24 months) on which precipitation deficits/surpluses can affect different aspects of the hydrologic cycle, reflecting the natural lags in the response of different water resources, which could be of interest in different meteorological, agricultural and hydrological perspectives.

The SPI series investigated here were calculated at multiple time scales: we have studied the frequency of occurrence of dry and wet periods and trends in the dry and wet conditions across mainland Portugal. Results for the 3-month SPI show marked differences at the seasonal scale. In the spring all stations have decreasing SPI trends (statistically significant at the 5% level for about two-thirds of the stations) and increasing SPI trends in the autumn. Correspondingly, in the spring there is an increase in the fraction of the area that exhibits severe and extreme drought conditions, whereas in the autumn there is a decrease in the fraction of the area that shows evidence of very and extremely wet conditions. Statistically non-significant decreasing trends in 3-month SPI are also identified in summer and winter. For the scale of 12 months, results also indicate a downward trend in the SPI, thus, drier conditions: 80% of the stations show negative trends that are statistically significant at the 5% level for 20% of the stations.