



Spatio-temporal variability of dry and wet periods in mainland Portugal and its relationships with teleconnection patterns

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Large-scale atmospheric circulation patterns and their persistence are known to drive inter-annual variability of precipitation in Europe, although depending on geographical location; this includes precipitation extremes and their trends. The vast range of time and space scales involved leads sometimes to precipitation deficits and surpluses which might affect in a different way the society, the environment and the economy at the local and regional scales, depending on specific conditions. In addition, changes in the climate are expected to affect the occurrence of extreme weather and climate events that might influence significantly the distribution, availability and sustainability of regional water resources.

The location of mainland Portugal on the Northeast Atlantic region, in South-western Europe, together with other geographical features, makes this territory vulnerable to extreme dry/wet hydro-meteorological events, driven by the strong variability in precipitation. In our study we discuss, for this territory, the relation between the spatio-temporal variability in those events, including their persistence at different scales, and the variability in several modes of low frequency variability; special attention is dedicated to the North Atlantic Oscillation (NAO) and Scandinavian pattern (SCAND). Some of these dry/wet episodes affect different aspects of the hydrologic cycle and are likely to lead to drought and soil wetness/saturation conditions that can enhance flood events. Such episodes were categorized here using the Standardized Precipitation Index (SPI), which was calculated at short (3 and 6-month) and long (12 and 24-month) time scales from monthly precipitation data recorded in the 1941-2012 period (72 years) at 50 precipitation stations scattered across the study area. Moreover, because SPI is a normalized index, it is also suitable to provide spatial representations of these conditions, allowing the comparison between areas within the same region. Thus, indices were interpolated for the whole territory using deterministic and geostatistical methods, and the zonal statistics results were mapped; the spatial interpolation, analysis and mapping were implemented in ArcGIS. Results confirm that the precipitation in this region is strongly influenced by the NAO and SCAND, in particular in the wettest months. Moreover, the annual SPI shows a significant increase in the extent of dry extremes and a non-significant decrease in the extent of wet extremes. For shorter time scales, the behaviour depends on the season. We discuss the observed SPI trends and the uncertainties for the precipitation regime in the southern and western parts of the Iberian Peninsula, which includes mainland Portugal. Results underline potential applications of SPI for water resources management, which is discussed in the context of the regional hydrological conditions and increasing demand for water for different uses.