



Detection of spatiotemporal patterns and trends in drought occurrence in the South of Portugal

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This paper analyses yearly changes in precipitation from 1940 to 1999 on local and regional scales over the southern region of continental Portugal, which has large areas threatened by desertification. The Standard Precipitation Index (SPI) time series with the 12-month time scale is calculated for 40 rainfall stations. Most of the previous studies analysing the SPI in southern regions of Portugal focus on the stochastic properties of the time series for predicting drought class transitions using Markov chains and loglinear models in a few monitoring stations scattered over the region. In this study, we propose a geostatistical approach to evaluate the temporal dynamics of the spatial patterns of precipitation. The spatial continuity of the SPI is evaluated for each decade. Afterwards, a geostatistical simulation algorithm (direct sequential simulation) is used to produce 100 equiprobable maps of the SPI for each year. This gridded dataset (6000 maps with 800 m x 800 m grid cells) is then used to produce yearly scenarios of the SPI from 1940 to 1999, and uncertainty evaluations of the produced scenarios. The linear trend of SPI values over the sixty years period is calculated at each grid cell of the scenarios' maps using a nonparametric estimator. Severe drought frequency patterns are found in a few areas of the centre and southeast regions, while moderate drought conditions occur more frequently over the study region, except in the northwest coast. A trend towards drying occurs in the centre region and in the northeast, while areas of increasing wetness are found in the west along the Guadiana river, which supplies the Alqueva reservoir and irrigation water for much of the western region. Considering the amount of water consumption and irrigation already required in some municipalities, water shortage due to drought is a viable threat in the centre of the region. However, in areas of increasing precipitation trend, in the west, it is unclear if it signifies an increase in water availability as recent studies project decreases in the Guadiana stream flow.