



20th century trends of drought conditions in the Mediterranean: the influence of large-scale circulation patterns.

Pedro Sousa (1), Ricardo Trigo (1,2), and Ricardo Garcia-Herrera (3)

(1) University of Lisbon, CGUL, IDL, Lisbon, Portugal, (2) Universidade Lusófona, Departamento de Engenharias, Lisbon, Portugal, (3) Universidad Complutense de Madrid – Department of Earth Sciences II

Here we have used the Self Calibrated PDSI (scPDSI) proposed by Wells et al (2004) as a more appropriate approach to characterize drought conditions in the Mediterranean area. The scPDSI has been shown to perform better (than the original PDSI) when evaluating spatial and temporal drought characteristics for regions outside the USA (Schrier et al, 2005). Seasonal and annual trends for the 1901-2000, 1901-1950 and 1951-2000 periods were computed using the standard Mann-Kendall test for trend significance evaluation. However, statistical significance obtained with this test can be highly misleading because it does not take into account the low variability nature that dominates the seasonal evolution of scPDSI fields. We have now improved these results by employing a modified Mann-Kendall test for auto-correlated series (Hamed and Ramachandra, 1997), such as the scPDSI case. This development allowed for a better definition of the Mediterranean areas characterized by significant changes in the scPDSI, namely the largely negative trends that dominate the Mediterranean basin, with the exceptions of parts of eastern Turkey and northwestern Iberia, since initially these areas were overestimated. The spatio-temporal variability of these indices was evaluated with an EOF analysis, in order to reduce the large dimensionality of the fields under analysis. Spatial representation of the first EOF patterns shows that EOF 1 covers the entire Mediterranean basin (16.4% of EV), while EOF2 is dominated by a W-E dipole (10% EV). The following EOF patterns present smaller scale features, and explain smaller amounts of variance. The EOF patterns have also facilitated the definition of four sub-regions with large socio-economic relevance: 1) Iberia, 2) Italian Peninsula, 3) Balkans and 4) Turkey. Afterwards we perform a comprehensive analysis on the links between the scPDSI and the large-scale atmospheric circulation indices that affect the Mediterranean basin, namely; NAO, EA, and SCAND (Trigo et al., 2006) and where we have also taken into account once again the effect of autocorrelation. Some of these links were obtained with 3 or 6 months lagged relationships, while others were achieved with instantaneous (no lag) links. This analysis was performed for the entire Mediterranean region as a whole, but also for each considered sub-domain. Finally, a stepwise regression model was developed to reproduce summer scPDSI series during the 1951-2002 period, using these large scale indices as predictors in the model. This procedure results in positive Skill Score values against the persistence model.

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