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Annual and seasonal changes in extreme temperatures over the Mediterranean region of the Iberian Peninsula (1901-2005) and their relationships with large-scale forcings

J. Sigro, M. Brunet, E. Aguilar, and O. Saladie
Climate Change Research Group, University Rovira i Virgili, Tarragona, Spain

Here we analyse annual and seasonal changes of a set of percentile-based extreme temperature indices calculated for six Spanish Mediterranean stations and explore their relationships with atmospheric circulation modes of variability (North Atlantic Oscillation –NAO-, Western Mediterranean Oscillation -WeMO-) and Western Mediterranean sea surface temperatures (SSTs).

Daily maximum and minimum temperature data for Albacete, Alicante, Barcelona, Malaga, Murcia and Valencia, extracted from the Spanish Daily Adjusted Temperature Series (SDATS) developed by Brunet et al. (2006), have been employed in order to produce the following temperature extreme indices time series: maximum (Tx) and minimum (Tn) temperatures lower than the 2^{nd}, 5^{th} and 10^{th} percentiles and exceeding the 90^{th}, 95^{th} and 98^{th} percentiles. This has been done by employing the EMULATE software (Walther, 2004) and RClimDex software (Zhang and F. Yang, 2004) on a seasonal and an annual basis, respectively. Temperature change explained by a linear trend fit over the entire period (1901-2005) and several sub-periods of rising (1901-1949 and 1973-2005) and falling in temperatures (1950-1972) have been calculated on an annual and a seasonal basis. Relationships between the temperature extreme indices and the atmospheric circulation indices (the NAO Indices developed by Jones et al., 1997 and by Hurrell, 1995; the WeMO developed by Martin-Vide and Lopez-Bustins, 2006) and Western Mediterranean SSTs (Rainer et al. 2006) have been explored by using non-parametric Spearman correlations. A multiple linear regression between the statistically significant correlations found and the large scale forcings has

been carried out, in order to examine the variance explained.

Results on long-term changes in moderately temperature extreme indices (Tx and Tn $< 10^{th}$ percentile and Tx and Tn $> 90^{th}$ percentile) show significant reductions (increases) in both daytime and nighttime lower percentiles (daytime and nighttime upper percentiles) over the 1901-2005 period. The highest correlations between all extreme temperature indices and the atmospheric teleconnection indices have been found with the WeMO index.

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