



## Trends in extreme daily precipitation indices in Northern of Portugal

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The variability and intensity of precipitation in short periods of time are crucial in the study of precipitation regimes, since both may act as triggering factors of disasters like flash floods, urban floods, landslides or destruction of crops. This study is focused on the spatial and temporal variability of selected extreme daily precipitation indices in Northern Portugal. The mean annual precipitation in the study region ranges between 500 mm at the Douro river valley and 3000 mm at Peneda-Gerês mountain system. Data from 39 precipitation gauge stations with daily precipitation series in the period 1950-2000 were collected accessing the website of SNIRH (National Information System for Water Resources) of the Water Institute (INAG, Portugal). Tests of homogeneity (e.g. Van Neumann ratio test and standard normal homogeneity test, SNHT) were performed for all the data collected from the gauge stations, in order to identify and select the useful stations to time variability analysis. After these procedures, five daily indices of precipitation extremes were computed: the maximum 5-day precipitation amount (Rx5day); number of days with precipitation amount  $\geq 50$  mm (R50mm); maximum precipitation amount in consecutive wet days with  $RR \geq 1$ mm (CWD); very wet days, with  $RR > 95$ th percentile (R95p); and total precipitation in wet days ( $RR \geq 1$ mm (PRCPTOT)). The software used to calculate these indices was RCLimindex 1.9.0, developed and managed by Xuebin Zhang and Feng Yang, from the Meteorological Service of Canada (Zhang, X., Yang, F., 2004; Zhang, X., et al, 2005). RCLimindex allows compute all the basic indices of climate extremes recommended by research team from the CCI / CLIVAR for Climate Change Detection Monitoring and Indices (ETCCDMI) (Easterling, D. R., et al, 2003).

Different tests were applied to detect long term (1950-2000) trends in the aforementioned indices of extremes, e.g. fitting linear regression (parametric test for trend) and computing non-parametric tests like Mann-Kendall and Spearman's Rho tests (Serrano, A., et al, 1999; Haylock, M., et al, 2000; Rodrigo, F. S. et al, 2007).

The results show that between 1950 and 2000, there was a small increase of the quantity of the maximum 5-day precipitation, number of days with precipitation  $\geq 50$  mm, maximum precipitation amount in consecutive wet days with  $RR \geq 1$ mm, very wet days, with  $RR > 95$ th percentile and total precipitation in wet days ( $RR \geq 1$ mm). However, this trend is not always statistically significant.

### References

- Easterling, D. R., Alexander, L. V., Mokssit, A., Detemmerman, V., (2003): CI/CLIVAR workshop to develop priority climate indices, *Bull. Am. Meteorol. Soc.* 84: 403– 407.
- Haylock, M., Nicholls N. (2000) - Trends in extreme rainfall indices for an updated high quality data set for Australia, 1910–1998. *International Journal of Climatology*, 20: 1533–1541.
- Rodrigo, F. S.; Trigo, Ricardo M. (2007) - Trends in daily rainfall in the Iberian Peninsula from 1951 to 2002. *International Journal of Climatology* 27: 513–529.
- Serrano, A., Mateos, V. L. & García, J. A. (1999) - Trend analysis of monthly precipitation over the Iberian Peninsula for the period 1921-1995. *Phys. Chem. Earth (B)* 24 (1-2), 85-90.
- Zhang, X.; Yang, F. (2004) RCLimDex (1.0) User Guide. Climate Research Branch Environment Canada. Downsview (Ontario, Canada), 2004, 22p.
- Zhang, X., et al (2005) - Trends in Middle East climate extreme indices from 1950 to 2003, *Journal of Geophysical Research*, vol. 110, 12p.