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A spatial distribution of the daily rainfall extremal index over the Iberian Peninsula

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The extremal index (θ) is an important parameter measuring the degree of clustering of extremes in a stationary process. It takes values in the interval $[0, 1]$. It is a crucial parameter for determining the distribution of extreme values when a point process of exceedances times over a high threshold is considered. $\theta = 1$ involves asymptotic independence between clusters and as $\theta \to 0$ the dependence increases because there are large observations cluster together.

In this study, 40 daily rainfall series from observatories distributed as regularly spaced as possible over the Iberian Peninsula were used. In order to perform a better analysis, a common period is selected for all observatories from 1958 to 2004. Also, all the observatories chosen have no missing data in this period.

To define extreme events, a time-varying threshold $u(t) = med(t) + 95th$ percentile was chosen, being $med(t)$ the monthly median of each observatory.

The extremal index is defined from the inter-arrival times between threshold exceedances (T_i)

$$\theta(u) = \frac{2[\sum_{i=1}^{N-1}(T_i - 1)]^2}{(N-1)\sum_{i=1}^{N-1}(T_i - 1)(T_i - 2)} \quad (1)$$

The distribution of the extremal index over the Iberian Peninsula indicates lower values of θ in the western area of the Peninsula ($\theta \sim 0.6$) and values close to 1 (upper limit of the extremal index) near the Mediterranean Sea. Lower values of the extremal

index indicates consecutive days in which the threshold is exceeded and could be associated with cold fronts causing intense and persistent rainfall. On the other hand, near the Mediterranean Sea, the value of the extremal index increases close to 1, therefore, near the asymptotic independence. This result seems to be related to the fact of the rainfall is more convective in this area and usually take place isolated days.