

# PRECIPITATION EPISODES AND THEIR ASSOCIATION TO WEATHER TYPES OVER MAINLAND PORTUGAL



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## Introduction

A study for a large number of rainfall episodes over 16 weather station scattered over Portugal mainland has been performed over the time period of 2010-2010. In here, the definition of episode is a consecutive number of days with precipitation apart at least by a 24 hour dry period. This procedure yield several rainfall episodes with different characteristics of intensity (RRint), duration (RRdur) and total rainfall amount (RRtot). After, the rainfall episodes were classified with a method elaborated by the authors and then associated the weather regimes as base of classification.

## AREA OF STUDY AND DATA

Located on the south-western part of continental Europe (Fig. 1), Portugal's precipitation regime is highly irregular both at the intra-annual time scale and at the spatial scale (Fig. 2).

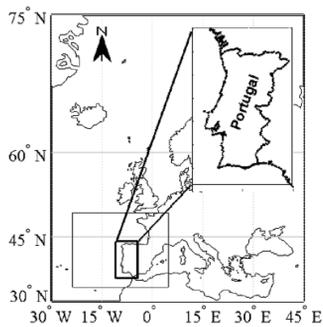


Fig. 1. Location of study area in Europe.

This high irregular precipitation regime (Fig. 2) can be explained by the large-scale circulation features. In wintertime the disturbances associated with the polar front predominated while in summertime the Azores high moves poleward being the prevailing system. Along with the seasonal variability, there is a spatial asymmetry that divides the north region from the south, with the last being drier giving to precipitation a relevant spatial variability.

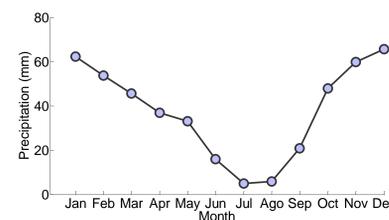
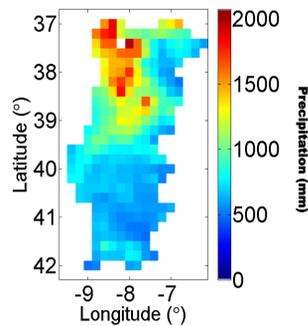


Fig. 2 Upper: Spatial distribution of the annual precipitation over Portugal Mainland averaged for the time period of 1950-2003. Bottom: Temporal Variation of the month precipitation averaged for the time period of 1950-2003. The data was provided by IPMA ([www.ipma.pt](http://www.ipma.pt)).

## Data

The observational daily data used in this study came from a network of stations scattered unevenly over Portugal Mainland. The data was provided by the Instituto Português do Mar e da Atmosfera (IPMA, <http://www.ipma.pt/>) (Fig. 3)

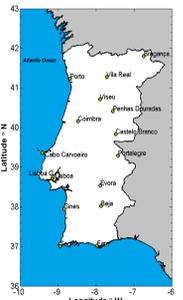


Fig. 3. Available weather stations over Portugal Mainland, during the 2001-2010 time period..

- Daily precipitation from 16 location over Mainland Portugal

- Time period: January 2001 to December 2010

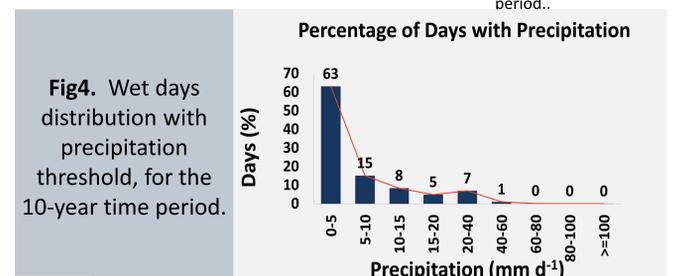


Fig4. Wet days distribution with precipitation threshold, for the 10-year time period.

## RESULTS

### WET EPISODE DEFINITION

- Grouped consecutive days with precipitation.
- Those groups of wet days are defined as one rainfall episode so long they apart each other for more than 24 h.

This procedure yield several rainfall episodes, for the 16 locations, with different characteristics of :

- intensity (RRint)
- duration (RRdur)
- total rainfall amount (RRtot).

### Wet Episode Characteristics

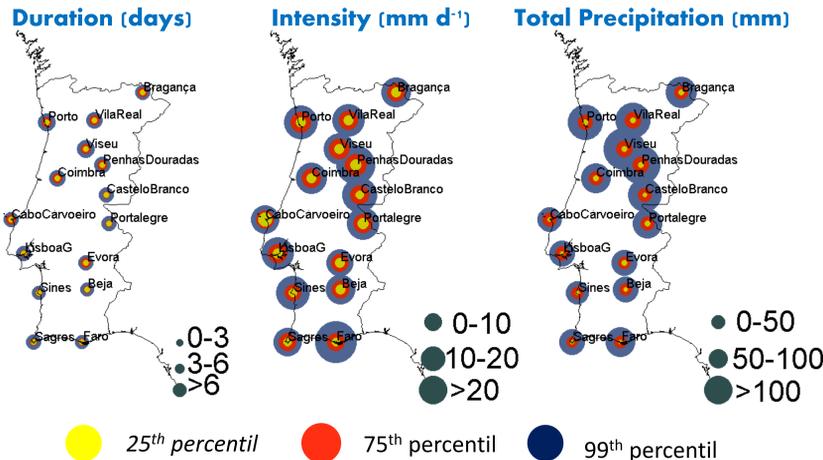


Fig. 5 The 25<sup>th</sup>, 75<sup>th</sup> and 99<sup>th</sup> percentiles for the three different wet episode's characteristics (RRdur, RRint and RRtot) for each location.

### Probability Density Functions (PDF)

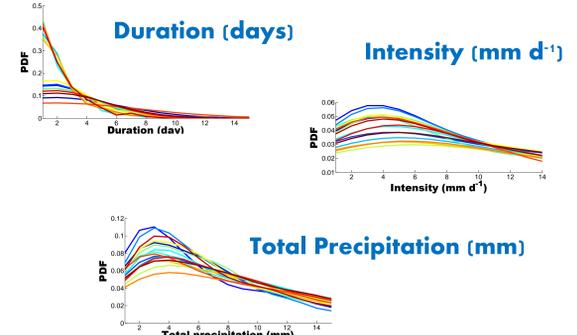


Fig. 6 Probability density function for the wet episodes characteristics for each location (color lines). The grey lines represent the respective 25<sup>th</sup> and 75<sup>th</sup> percentiles for duration (UPPER), intensity (MIDDLE) and wet episode total precipitation (BOTTOM).

### Classification of the Wet Episodes

To classify the wet episodes the authors used the weather types (WT) definition, which represents typical patterns of atmospheric synoptic circulation in a region.

Here, the WT calculation described by Santos et al (2005) was applied.

For Portugal, five weather types were identified plus a sixth one derived from one of the regimes:

- The cyclone regime (C) associated with a high density of cyclonic features,
- the Westerly associated with westerly and north-westerly winds (NW),
- the R regime linked with the negative phase of the North Atlantic Oscillation (NAO),
- the AA regime linked with positive phase of NAO
- the Easterly (E) regime associated with a high pressure system over the western .

### Application Example to one Location

1 - For each day of the rainfall episode was associated a weather type (WT) as described by Santos et al. (2005). There are six different of WT.  $WT_i, i=1, \dots, 6$

Ambiguities arise when one WT must be associated with a wet episode longer than one day, because more then one WT may be involved in it (due to different characteristics of the synoptic situation).

2- How to proceed? the most frequent WT in the period was used.

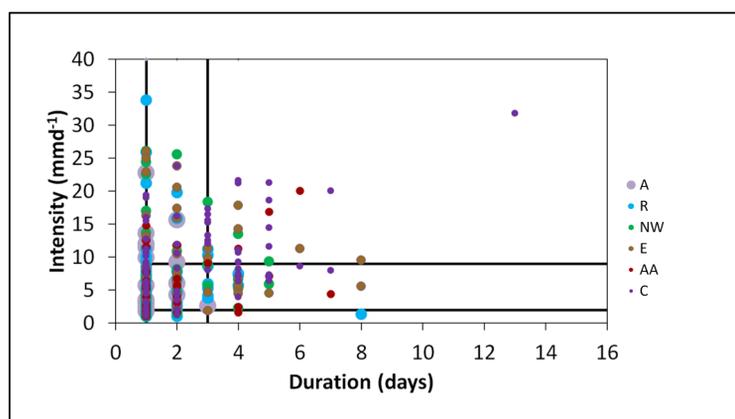


Fig. 7. Wet episodes classified with the WT as function of intensity by number of days. The black horizontal and vertical lines represent the 25<sup>th</sup> and 75<sup>th</sup> percentiles.

## FINAL REMARKS

Higher percentiles for the episodes duration may be found in the NW and central meteorological stations of Portugal. However, the high percentiles for the total wet episodes were encountered in the interior central part as well as in the southern region of Portugal. Regarding the three precipitation related parameters observed in this work, the precipitation 75th percentile of the wet episodes shows higher variability. According to the classification presented, the crossing information regarding wet episodes intensity and duration shows that more intense and longest episodes are associated with the cyclonic regimes, NW and AA (Positive NAO phase) WT. However Easterly WT is also present on both higher percentiles (above the 75th) for duration or intensity.

## IN DEVELOPMENT

- Narrow down the number of episodes as function of precipitation threshold
- Classify the episodes with other techniques
- Extend the analysis to other atmospheric variables

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