

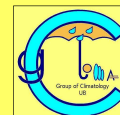


TORRENTIAL RAINFALL IN CATALONIA: SYNOPTIC PATTERNS AND WeMO INFLUENCE

J. Martin-Vide⁽¹⁾, A. Sanchez-Lorenzo⁽¹⁾, J.A. Lopez-Bustins⁽¹⁾, A. Garcia-Manuel⁽¹⁾, J.M. Raso⁽¹⁾ and M.J. Cordobilla^(1,2)

⁽¹⁾ Group of Climatology, University of Barcelona, Catalonia, Spain (email: jmartinvide@ub.edu)

⁽²⁾ Barcelona Regional, Catalonia, Spain



ABSTRACT: This study shows a synoptic patterns catalogue of torrential rainfalls (≥ 100 mm/day) in Catalonia (north-eastern Iberian Peninsula), which were obtained by applying a T-Mode Principal Components Analysis (PCA) at sea level pressure (SLP). The final catalogue (304 days selected) is composed by 9 circulations patterns. Equally, we studied the relationship between the synoptic patterns obtained and the Western Mediterranean Oscillation. The results showed a clear association between the negative phases of this teleconnection pattern and the torrential rainfall in Catalonia.

DATA and METHODOLOGY

- The analysis was carried out using the 304 days which recorded ≥ 100 mm in one or more stations over Catalonia (Fig. 1) throughout the 1950-2005 period.
- The circulations patterns were obtained by applying a T-Mode Principal Components Analysis (PCA) to a daily data grid (NCEP/NCAR reanalysis) at sea level pressure (SLP) over Western Europe. We rotated (Varimax criterion) the first 6 components, and each day was assigned to the PC with the absolute maximum loading. These clustering enables the days to be classified into 9 patterns (only showed 7 below).
- We computed the mean value of the Western Mediterranean Oscillation index (WeMOi) (<http://www.ub.edu/gc/English/wemo.htm>) averaging all the days grouped in each circulation pattern.

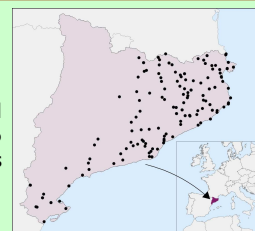
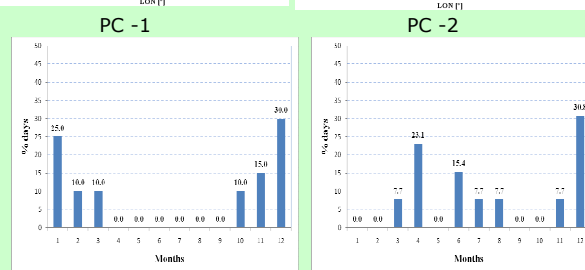
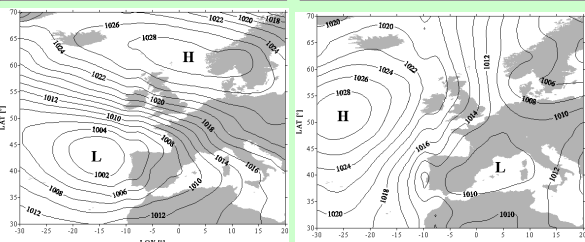
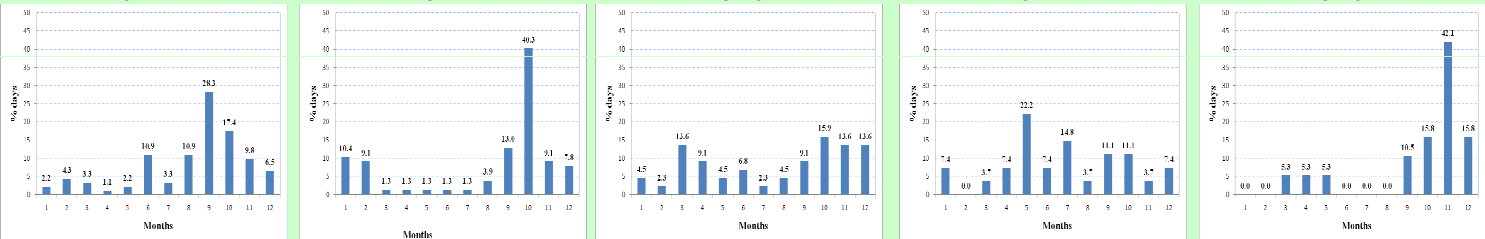
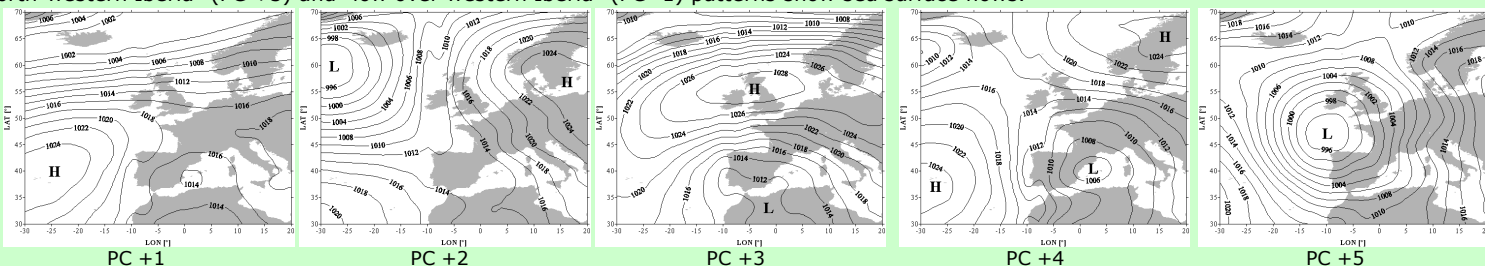


Figure 1. Location map

RESULTS AND DISCUSSION

Synoptic patterns catalogue

The "weak low over eastern Iberia" (PC +1) and "low pressure area" (PC -2) patterns show a weak pressure gradient in a high percentage of days. The "blocking" (PC +2) pattern is one of the most typical meteorological situation with a high risk of intense precipitation. The "easterly advection" (PC +3) pattern is associated with a diffult blocking situation. The "low centered" (PC +4) pattern has a lot of cases. The "low over north-western Iberia" (PC +5) and "low over western Iberia" (PC -1) patterns show sea surface flows.



Patterns	+1	+2	+3	+4	+5	+6	-1	-2	-4	All	PC	Name	Flow over Catalonia	Low pressure position	High pressure position	Calendar
Jan	2	8	2	2	0	0	5	0	0	19	PC+1	Weak low over eastern Iberia	E	Balearic Sea	Azores	Maximum in September
Feb	4	7	1	0	0	0	2	0	0	14						
Mar	3	1	6	1	1	0	2	1	0	15						
Apr	1	1	4	2	1	0	0	0	3	0	PC+2	Blocking	SE	N Atlantic	Scandinavia-Central Europe	Maximum in October
May	2	1	2	6	1	1	0	0	0	13						
Jun	10	1	3	2	0	0	0	0	2	0	PC+3	Easterly advection	E	N Africa	Britain Islands	Maximum in spring and autumn
Jul	3	1	1	4	0	0	0	1	0	10						
Aug	10	3	2	1	0	0	0	1	0	17	PC+4	Low centered	Variable	Catalonia	Azores and Scandinavia	Maximum in May
Sep	26	10	4	3	2	2	0	0	3	50						
Oct	16	31	7	3	3	1	2	0	2	65	PC+5	Low over north-western Iberia	S	NW Iberian Peninsula	-----	Maximum in November
Nov	9	7	6	1	8	1	3	1	1	37						
Dec	6	6	6	2	3	1	6	4	0	34						
Year	92	77	44	27	19	6	20	13	6	304	PC-1	Low over western Iberia	SE	W Iberian Peninsula	North Sea	Maximum in winter
WeMOi	-0.67	-1.51	-1.98	-0.48	-2.52	-1.44	-2.41	-0.70	-1.64	-1.33	PC-2	Low pressure area	-----	Western Mediter.	N Atlantic	Maximum in December

Temporal and synoptic characteristics of the 7 most frequent circulation patterns

The Western Mediterranean Oscillation (WeMO) and the torrential rainfall in Catalonia

The WeMOi mean value of the all days with torrential rainfall for the 1950-2000 period is clearly negative (-1,33). The number of days with torrential rainfall and a positive WeMOi is lower than 15%.

We can affirm that in a day with a WeMOi higher than +2 is impossible to record ≥ 100 mm.

Finally, all the WeMOi value means of each pattern are negative.

CONCLUSIONS

- More than the 60% of the torrential rainfall days take place during the last four months of the year.
- The most outstanding synoptic characteristics are the predominance of sea surface flows and the existence of low pressure areas over the northern and north-western Iberia.

Acknowledgments: This research was supported by the Spanish Ministry of Education and Science (MEC): IPIBEX (CGL2005-07664-C02-01) and RIMARC (CGL2004-21663-E) projects. The second and fourth authors were granted predoctoral scholarships by the same MEC. The NCEP/NCAR reanalysis data was obtained from the CRU web page, and Dr. Ian Harris kindly helped us.