



Extreme torrential episodes in eastern Spain and its relationship with the Western Mediterranean Oscillation (1950-2016)

Óliver Meseguer-Ruiz^(1,2), Joan A. Lopez-Bustins⁽²⁾, Laia Arbiol-Roca⁽²⁾, Javier Martin-Vide⁽²⁾, Javier Miró⁽³⁾, and María José Estrela⁽⁴⁾

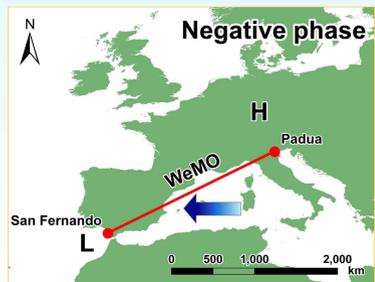
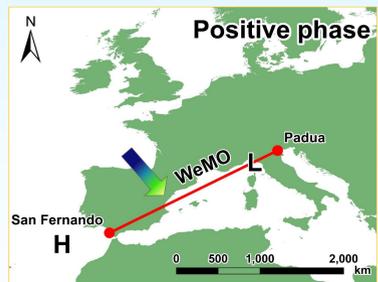
⁽¹⁾ Departamento de Ciencias Históricas y Geográficas, Universidad de Tarapacá, Arica (Chile) (omesequer@academicos.uta.cl)

⁽²⁾ Climatology Group, University of Barcelona (UB), Barcelona, Spain

⁽³⁾ Departament de Física de la Terra i Termodinàmica, Universitat de València, València (Spain)

⁽⁴⁾ Departament de Geografia, Universitat de València, València (Spain)

Phases of the Western Mediterranean Oscillation index (WeMOi)



The WeMOi is a regional teleconnection index defined within the western Mediterranean basin. WeMOi values are computed using surface pressure data from San Fernando (SW Spain) and Padua (NE Italy) weather stations. The reference period considered is 1961-1990.

WeMOi calendars

We computed daily WeMOi values for the 1950-2016 study period and constructed a WeMOi calendar (intraannual variability) based upon the mean values obtained for 10-day periods.

The lowest (most negative) WeMOi values are detected in autumn, during the second 10-day period of October (from the 11th to the 20th of October).

We also constructed WeMOi calendars for two subperiods: 1950-1983 (34 years) and 1984-2016 (33 years), observing an overall decrease in WeMOi values, particularly as from the second 10-day period of November to the second 10-day period of December.

We added the frequency of the torrential episodes to the WeMOi calendars in order to detect intraannual changes in these events.



Selection of the extreme torrential episodes in eastern Spain

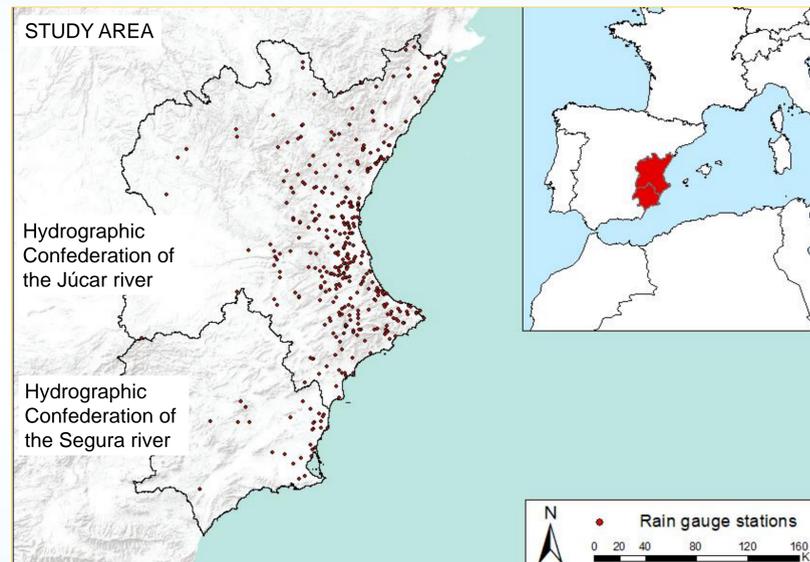
We selected the extreme torrential episodes (≥ 200 mm in 24 hours) that had taken place over the Hydrographic Confederation of the Júcar and Segura rivers (E and SE Spain) during the 1950-2016 study period (67 years).

Data are from AEMet data base (State Meteorological Agency) and from the IVIA-SIAR data base (Valencian Institute for Agronomic Research – Agroclimatic Information System for Irrigation) and from both automatic and manual weather stations. The pluviometric 7-7 UTC period is considered along the whole study period.

During the 1950-2016 period, 239 episodes (dates when the threshold ≥ 200 mm was registered in some point of the whole study area) were detected (3.6 cases per year).

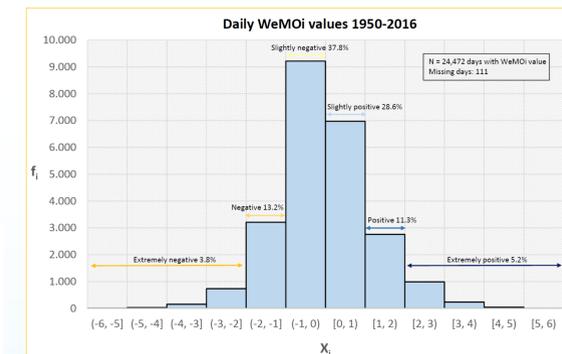
The highest rainfall amount in 24 h ever recorded (estimated according to Miró *et al.*, 2017) in the study area is 1,111.3 mm. It occurred in Vilallonga (la Safor) on 3rd Nov 1987.

Daily WeMOi values follow a Gaussian distribution. Most days (66.5%) of the 1950-2016 study period showed a neutral (-1, 1) WeMOi value. We considered the threshold of $WeMOi \leq -1$ (13.2% of the days) and $WeMOi \leq -2$ (3.8% of the days) to detect a negative and extreme negative WeMO phase, respectively, at daily resolution.



The "Pantana de Tous" occurred the 20th October 1982 affecting the Hydrographic Confederation of the Júcar river. Source: <http://125aniversario.aguasdevalencia.es/portfolio/aguas/pantanada/>

Histogram of daily WeMOi values considered in this study



Main results and discussion

26.3% of the episodes took place in an extreme (≤ -2) WeMOi value. 37.5% of the episodes occurred in a negative (-2, -1) WeMO phase, and 28.3% of the events took place in a slightly negative (-1, 0) WeMOi value. Only 7.1% of the events occurred in a slightly positive phase [0, 1), and 0.8% in a positive phase [1, 2). No events took place in an extreme positive phase (≥ 2) in the study area.

In this region, the frequency of extreme torrential events is higher than 4 cases per year. The east and southeast littoral is a territory characterised by a high temporal concentration of precipitation, where these episodes are the most frequent in the Iberian Peninsula, with several episodes ≥ 500 mm/24 h. These events are less frequent in the inland.

The wettest month in most of the study region is October, when the lowest WeMOi values of the year are recorded (humid easterly flows from the Mediterranean Sea are usually expected). In consequence, the highest accumulation of extreme torrential episodes is from 1st to 20th October.

Referring to the calendars by subperiods, we observed an overall decrease in WeMOi values throughout the year, but no increase of the number of episodes was detected. However, a sharp drop in the WeMOi is observed at the very end of autumn, which might indicate an expansion in seasonality of the extreme torrential period from Sep-Oct to Aug-Nov.

The present research confirms the use of the WeMOi at daily resolution as an effective tool for analysing the occurrence of episodes of torrential rainfall over eastern and southeastern Spain.

Acknowledgements

This research was conducted within the framework of the WEMOTOR Project (CSO2014-55799-C2-1-R, 2015-2017) funded by the Spanish Ministry of Economy, Industry and Competitiveness, the Climatology Group UB (2014 SGR 300, Catalan Govt.) and the Water Research Institute (IdRA-UB).

Reference

Miró JJ, Caselles V, Estrela MJ (2017) Multiple imputation of rainfall missing data in the Iberian Mediterranean context, Atmospheric Research, 197: 313-330. doi: 10.1016/j.atmosres.2017.07.016