



## Synoptic aspects of large floods in the south of Catalonia (Spain)

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The aim of this study is to analyze the large scale atmospheric circulation modes (PCA) and the synoptic atmospheric patterns (ST) connected with the most severe floods events affecting Tortosa, at the low course of the Ebro river (NE of Iberian Peninsula).

PCA's and ST's were inferred from the monthly Sea Level Pressure (SLP) of the 20th Century V2 Reanalysis Project, provided by NOAA/OAR/ESRL PSD. The flood database of Tortosa was used to determine the major floods episodes (peak flow > 3000 m<sup>3</sup>/s) from 1871 to present. We restrict our analysis by using the PCA and ST to the period including the day of the flood and the three previous days. Monthly SLP anomalies to calculate the PCA's, and daily SLP anomalies to determine the ST's were obtained. Finally, the Pearson's correlation coefficients between PCA's and ST's were calculated to explain the synoptic features of large floods.

The results show that the atmospheric variability linked to severe rainfall in the area is characterized by low-pressure systems that advect warm and wet air at the low levels of the troposphere from the Mediterranean Sea. Predominant flows are, first, from the south to southeast and, second, from the east, enhancing severe convective events. Furthermore, the stagnation of the synoptic configuration due to the presence of the high-pressure system over Europe favors long-lasting rainfall.

Temporal evolution of atmospheric configurations shows a possible change in the flood pattern over the last 140 years. During what we call the cold period (1871-1940), well-defined negative phases of the North Atlantic Oscillation (NAO) prevailed. During this period, the synoptic configuration is characterized by an anticyclonic blocking over the Scandinavian peninsula with a pronounced wave in the jet-stream and low-pressure systems affecting the south of Catalonia. On the contrary, the warm period (1940-2010) is characterized by an advection of warm air from low latitudes, with southerly flows over Catalonia and weak negative or even slightly positive NAO indices. Additionally, during the two periods the floods mainly occurred at different seasons. While during the cold period the floods were more likely to occur between November and April, in the warm period flooding is most likely from May to October.