

The unusual sequence of storms leading to precipitation records and floods in southern Iberia in December 1876

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Abstract

The first days of December 1876 were characterised by extreme weather conditions that affected the south-western sector of the Iberian Peninsula (IP), leading to an all-time record flow in both large international rivers running from Spain to Portugal, Tagus and Guadiana causing serious flood damage. These events resulted from the continuous pouring of precipitation registered between 29 November and 7 December, due to the consecutive Atlantic low-pressure systems and their associated frontal systems that reached the Iberian Peninsula. However, the floods were amplified by the occurrence of anomalously wet October and November months, as shown by recently digitised time series for both IP countries.

For two recently digitised stations in southern Portugal (Lisbon and Évora), the values of precipitation registered during the first week of December 1876 was so remarkable that when we computed daily accumulated precipitation successively from 1 to 10 days, the episode of 1876 always stood as the maximum precipitation event, with the exception of events in February 2008 in the Lisbon precipitation (Fragoso et al., 2008) and October 1944 in Évora (in both cases for daily precipitation only).

Based on different data sources, including historical Portuguese and Spanish newspapers, meteorological data recently digitised from several stations in Portugal and Spain and the recently available 20th Century Reanalysis (Compo et al., 2011), it was possible to assess the damage and the atmospheric circulation conditions associated with this event. The synoptic conditions were represented by 6 hourly fields of complementary variables, namely; 1) precipitation rate and mean sea level pressure (SLP); 2) precipitation rate and CAPE; 3) wind speed intensity and divergence at 250 hPa, 4) wind speed intensity and divergence also at 850 hPa; 5) air temperature at 850 hPa and geopotential height at 500 hPa; 6) wind speed barbs and specific moisture content at 850 hPa. Movies with all these variables were obtained for the 10-day sequence that spans between 29 November and 7 December.

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