Meteorological analysis of 1874 Santa Tecla's flash floods in NE Iberian Peninsula

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The highly destructive Santa Tecla's floods took place in many catchments throughout the eastern part of the Ebro River basin (Figure 1) the night of 22-23 September 1874, killing at least 600 people.

This event has been already hydraulically and hydrologically reconstructed, that is, we have calculated its peak flows and the rainfalls in different locations (Table 1; Balasch *et al*. 2010).

The next step in this flood reconstruction is to understand the meteorological processes that caused the rainstorm.

The meteorological processes at the time of the 1874 flood have been analysed and compared to those of the well-known catastrophic 1962 flood event, with the aid of 850 hPa temperature maps and of pressure indices.

The rainstorm that caused 1874 Santa Tecla's floods took place when a mass of hot air at 850 hPa (approx. 1500 m a.s.l.) withdrew (Figure 2), thus letting very wet and warm winds blowing from the Mediterranean to rise and transform into huge rain clouds when they hit the coastal mountain ranges.

It is the same process that caused the equally destructive 1962 floods in a nearby area.

This similarity is furthermore confirmed by the fairly parallel behaviours of three different pressure indices the days around the floods (Figure 3).

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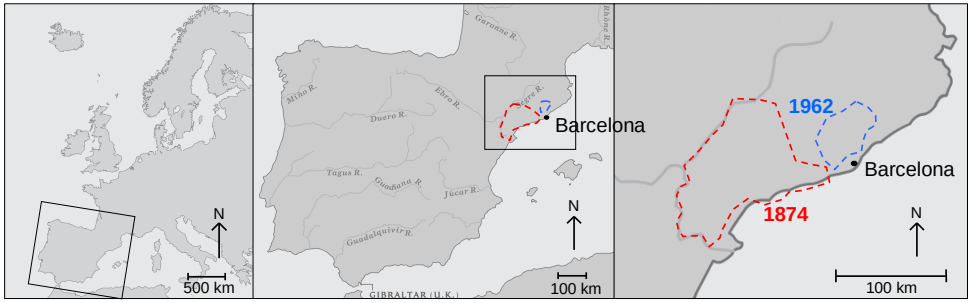

Figure 1. Areas affected by 1874 (in red) and 1962 (in blue) floods. Own elaboration on maps by the National Geographic Society, Washington D.C, Copyright (c) 2009

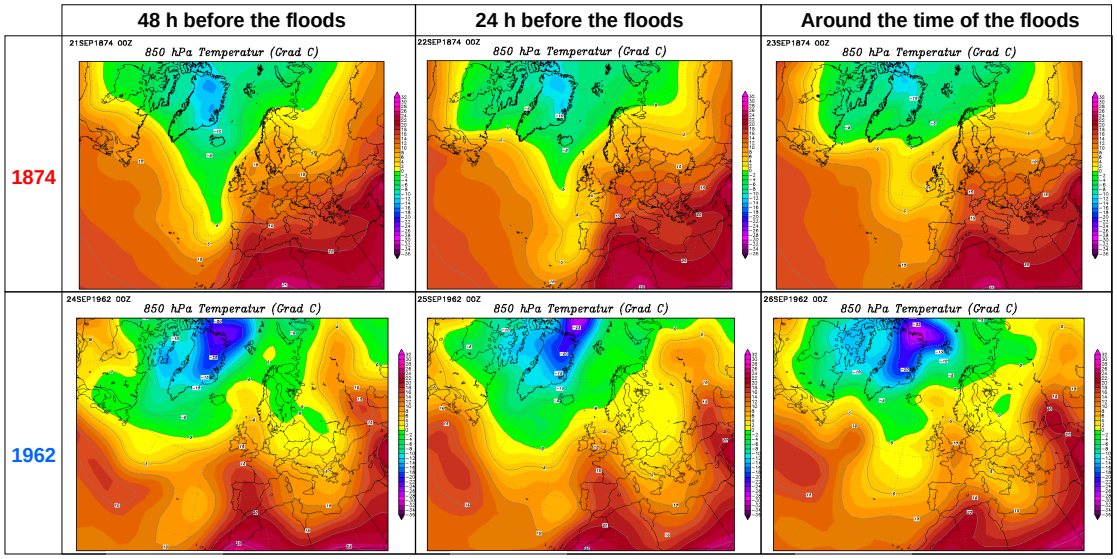

Figure 2. Air temperature (in ºC) at a height of 850 hPa (approx. 1500 m) the days around 1874 and 1962 floods. **Notice the hot air mass (in dark red) crossing the Iberian Peninsula from West to East in both cases.** Source: Wetterzentrale.de with data from NOAA's 20th Century Reanalysis

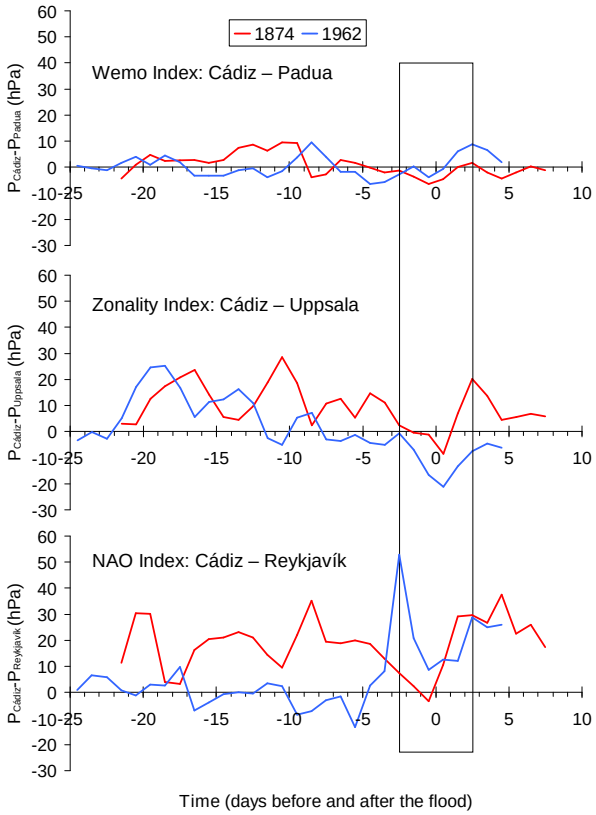

Figure 3. Three atmospheric pressures indices the days around 1874 (in red) and 1962 (in blue) floods. **Notice the parallel V-shaped behaviours of the three indices 2,5 days before and after the floods (inside the box).** Source: Own elaboration and Martín-Vide & López-Bustins (2006)

Table 1. Comparison of 1874 and 1962 floods in two selected locations. Source: Own reconstruction (Balasch *et al*. 2010) and Llasat (1990)

Year	1874	1962
Maximum specific peak flow ($m^3 \cdot s^{-1} \cdot km^{-2}$)	10	18
Maximum rainfall (mm)	155	250
Maximum hourly rain intensity ($mm \cdot h^{-1}$)	68	250
Return period of the rainfall (years)	500	100-250
Deaths	575	c. 800

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