Flash heat and flash cold phenomena in the Iberian Peninsula since 1900

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Outline

1. Motivation: What is a flash heat/cold event? Why to study these type of events?

2. Methodology used

3. Analysis of FH

4. Analysis of FC

5. Conclusions
1. Motivation: What is a flash heat?

HEAT WAVE:

i) WMO

*a phenomenon in which the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5°C with respect to the period 1961-1990.*

ii) AMS

*a period of abnormally and uncomfortably hot and usually humid weather, which should last at least one day, but conventionally it lasts from several days to several weeks.*
HEAT BURST:

AMS

*a rare atmospheric event characterized by gusty winds and a rapid increase in temperature and decrease in humidity, with a scale of few minutes that affect a local area.*

(associated to downwind of thunderstorms)
<table>
<thead>
<tr>
<th>Heat wave</th>
<th>From 2 consecutive days to several weeks</th>
<th>Meso $\alpha$ (200 – 2000 km)</th>
<th>General atmospheric circulation dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat burst</td>
<td>Few minutes</td>
<td>Micro $\beta, \gamma$ (&lt; 2 km)</td>
<td>Thunderstorms, local Föhn effect</td>
</tr>
<tr>
<td>FLASH HEAT</td>
<td>1-24 hours</td>
<td>Meso $\beta, \gamma$ (20-200 km)</td>
<td>Regional Föhn effect, regional circulation</td>
</tr>
</tbody>
</table>

Glossary AMS (2014): Discrete period of abnormal warming, nominally lasting more than an hour but less than a day (...). Flash heat events last longer than heat bursts but are too short to be considered heat waves and are associated with some atypical physical mechanism (...).

Reference:
Barcelona city center 27th August 2010 AWS from MeteoCAT

39.3°C: historical record

19% !!

Less than 24 hours

FH could be a hazards in several fields: agriculture, human health, wildfires, energy demand, ...
NCEP Reanalysis of temperature at 850 hPa (color contour) and at sea level (line contour) at 00 UTC
What is a flash cold?

In a similar way than FH events, here we propose to name FC as:

FC: Discrete period of abnormal cooling, nominally lasting more than an hour but less than a day (...). Flash cold occurs during a too short period to be considered a cold wave. It can be associated to rapid northern advections, as well as a fast and sudden soil cooling.

Our goal:

To analyze the trend of FH and FC in the Iberian Peninsula in two periods: 1900-2000 and 1970-2000
2. Methodology

DATABASE AVAILABLE

1) DB1: Daily maximum and minimum temperatures (1900-2000) from 22 cities in the Iberian Peninsula (Brunet et al., 2006, 2008)

2) DB2: Interpolated array from 2000 stations (0.1° resolution, 1971-2010)

From max/min daily temperature series, a FH / FC has been considered when:

\[
T(\text{Day-1}) < T(\text{Day D}) + N > T(\text{Day+1})
\]

\[
T(\text{Day-1}) > T(\text{Day D}) + N < T(\text{Day+1})
\]

N = 5°C Type 1
N = 7°C Type 2
N = 9°C Type 3

FH / FC analysis
LOCATION OF ANALYZED DAILY TEMPERATURE SERIES (1900-2000) of DB1

INTERPOLATION FROM AEMET NETWORK (1971-2000) of DB2

(Brunet et al., 2006, 2008)

22 stations with daily data

2000 stations with hourly data
FH per decade (1900-2000)
Accumulated number of FH-1 @ DB2 (1971-2000)

Domain of the African ridge over S IP, with a rapid and brief shift northwards?
Intensity of FH

- FH1: 4 FH1/dec
- FH2: 3.5 FH2/dec
- FH3: 2 FH3/dec

All types increases: FH3 a lower rate.
FH1 and FH2 decrease; FH3 are constant.
FH1 decreases; FH2 are constant. No FH3 are observed.
4. FC ANALYSIS @ DB2 (1900-2000)
FC @ DB2 (1971-2000)
TREND OF FH and FC @ DB1
5. Conclusions

A. FH

1. The absolute average number of FH per decade shows a spatial distribution along the IP:
   
   i) Increasing from S-N
   ii) Increasing from W-E
   (except for NE and NW extremes of IP shows)

2. A different trend between the North and South exist concerning to the type of FH during the last 40 years.

<table>
<thead>
<tr>
<th></th>
<th>FH1</th>
<th>FH2</th>
<th>FH3</th>
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<tbody>
<tr>
<td>North</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>South</td>
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</table>
3. The interpolation method used in DB2 shows lower number of FH than DB1.

B. FC

4. Few FC events are detected affecting the IP in both DBs. The cases are lower in DB2 than DB1.

5. In all stations, FC events decrease during the last 40 years. There is a maximum during the period 1940-1970

6. In the north area, FC are constant during the last 40 years with less than 10 cases, while in the south no cases are found.

Thank your for your attention.

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