# The challenge of extreme events in a warming world

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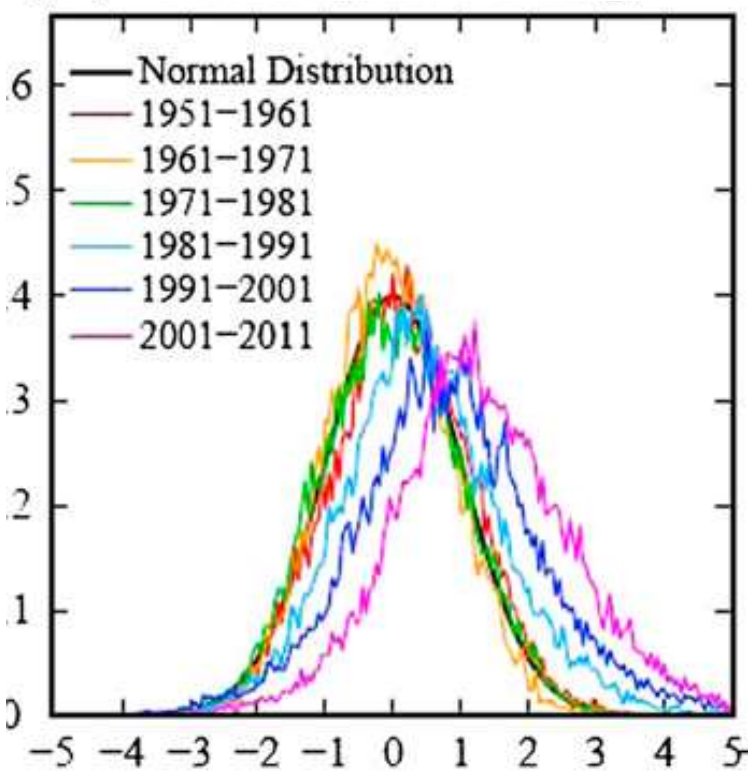
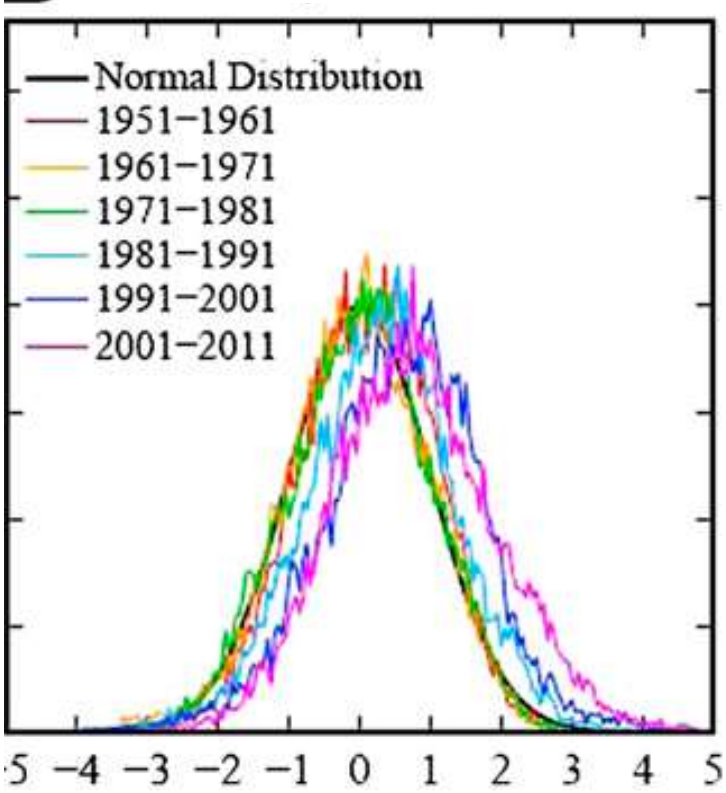
# Evolution of N.H daily temperature anomalies between 1951 and 2011 (Hansen 2012, PNAS)

A **Summer (H.N)**

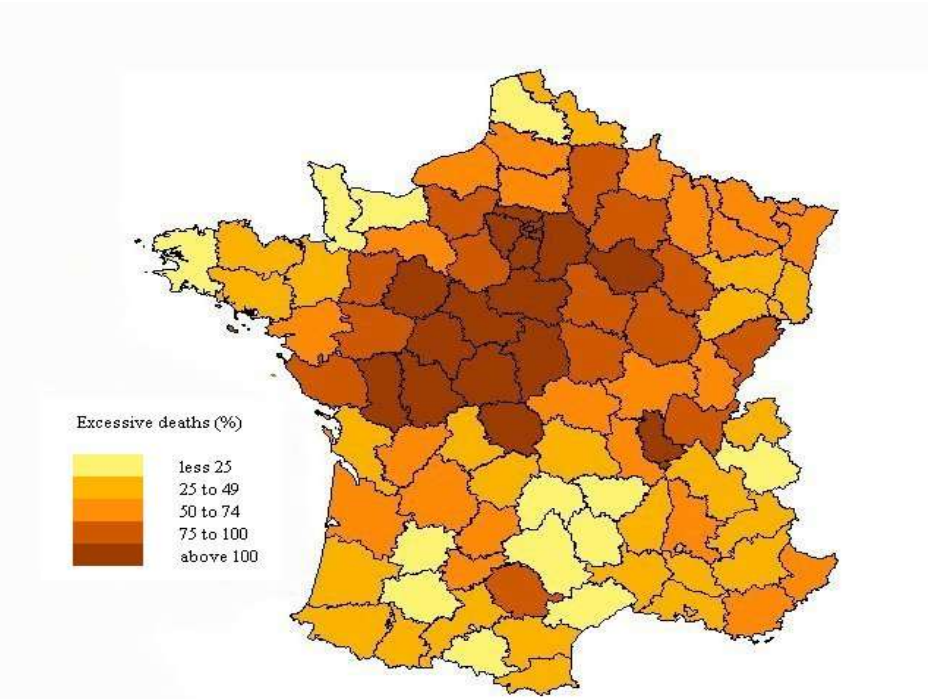



D **Winter (H.N)**




Much higher probability of **extreme summer temperatures!**

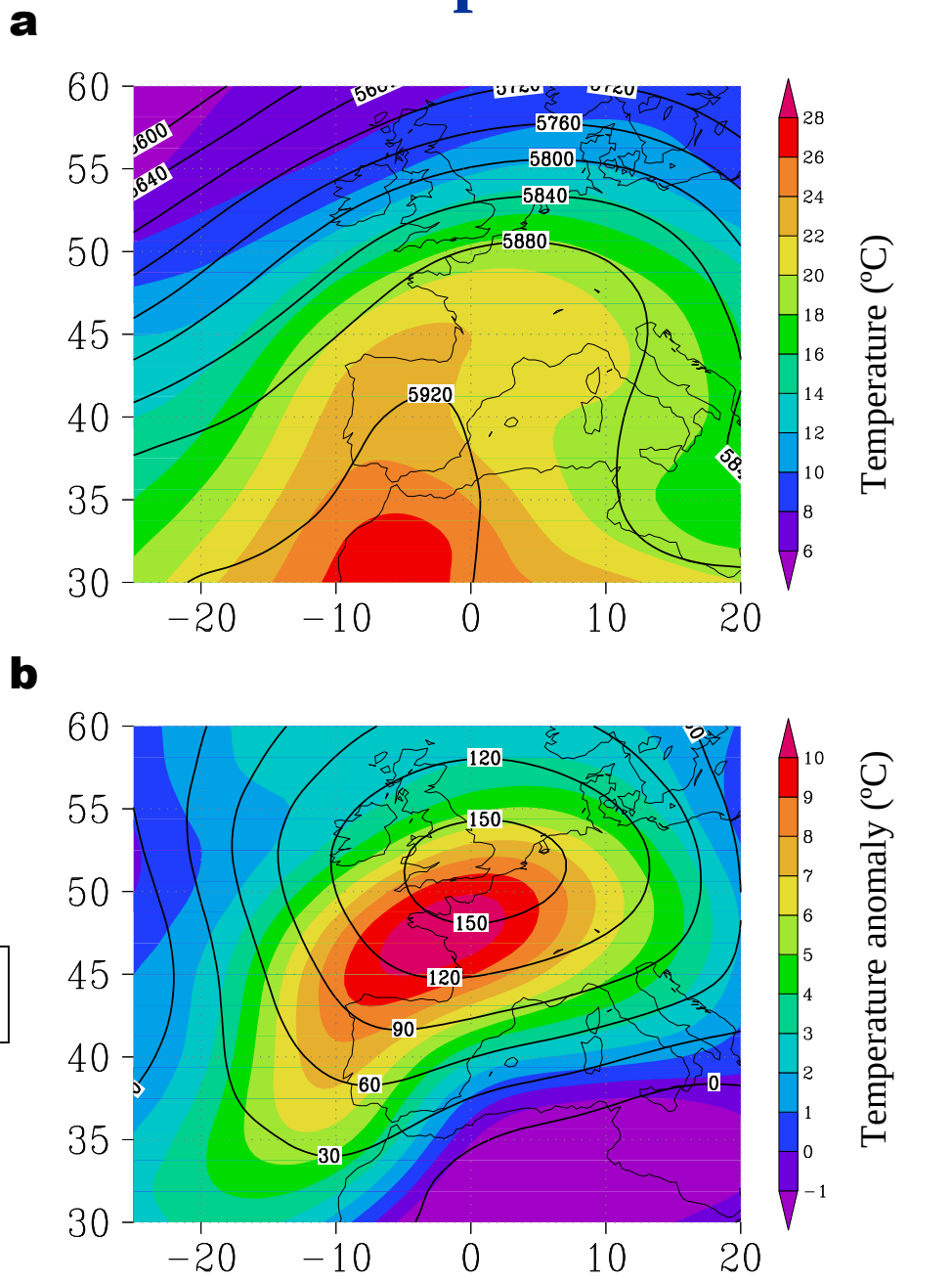
# The 2003 heatwave over western Europe




Excessive mortality 1-15 August
(vs 2000-2002 average)

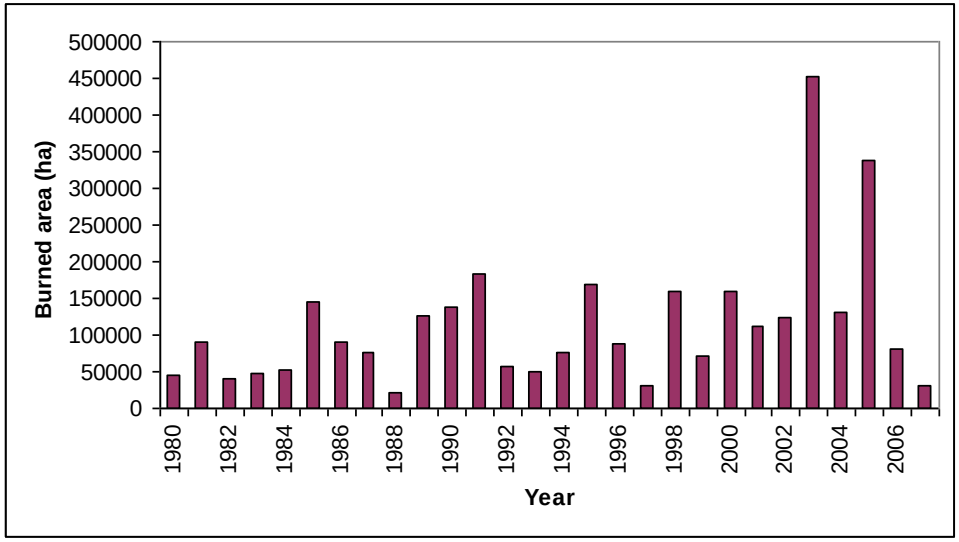
Anomaly

(**Trigo et al., 2005, GRL**)



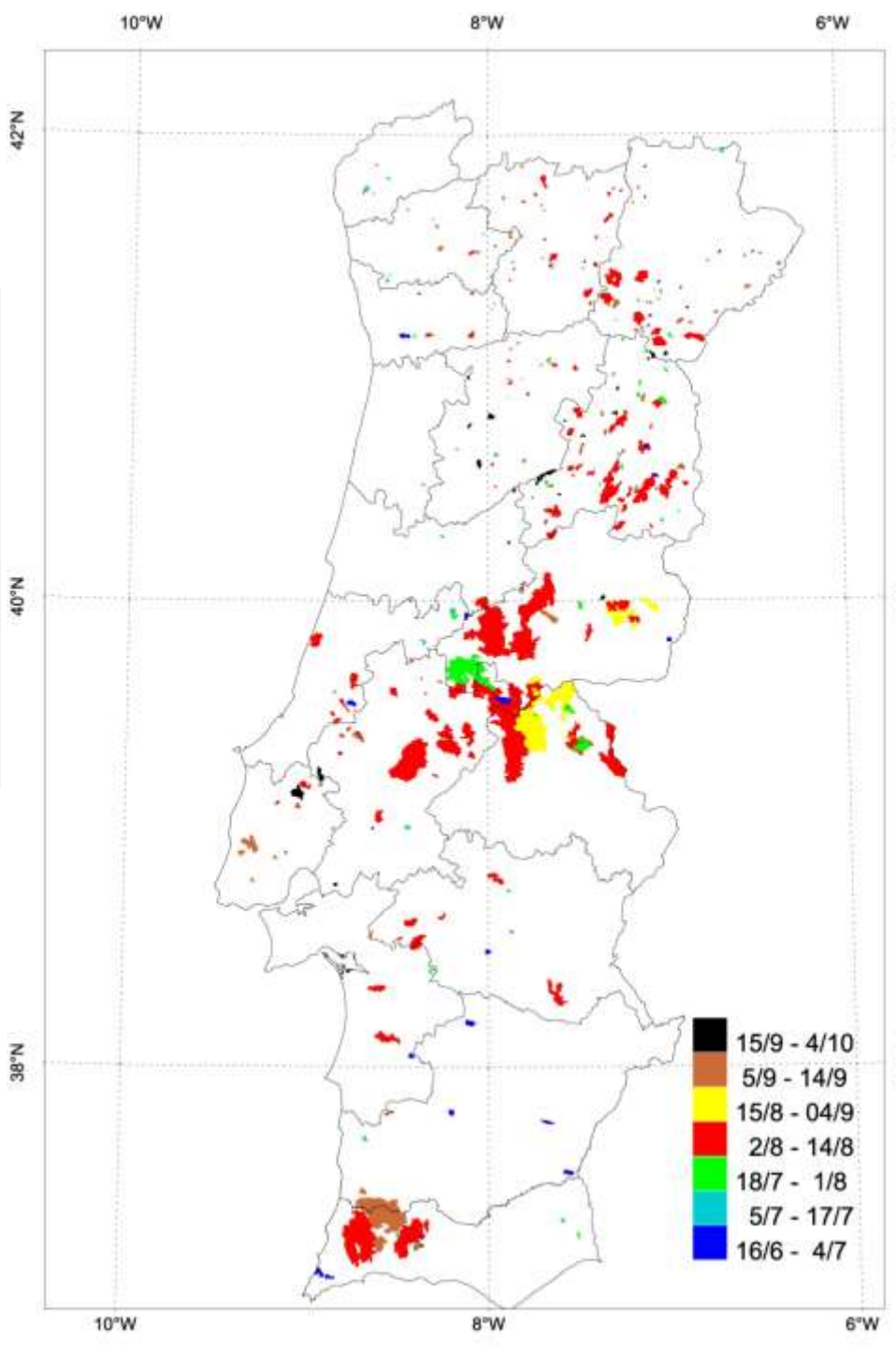
# Record burned area in Portugal

Total burnt area**: 450.000 ha**

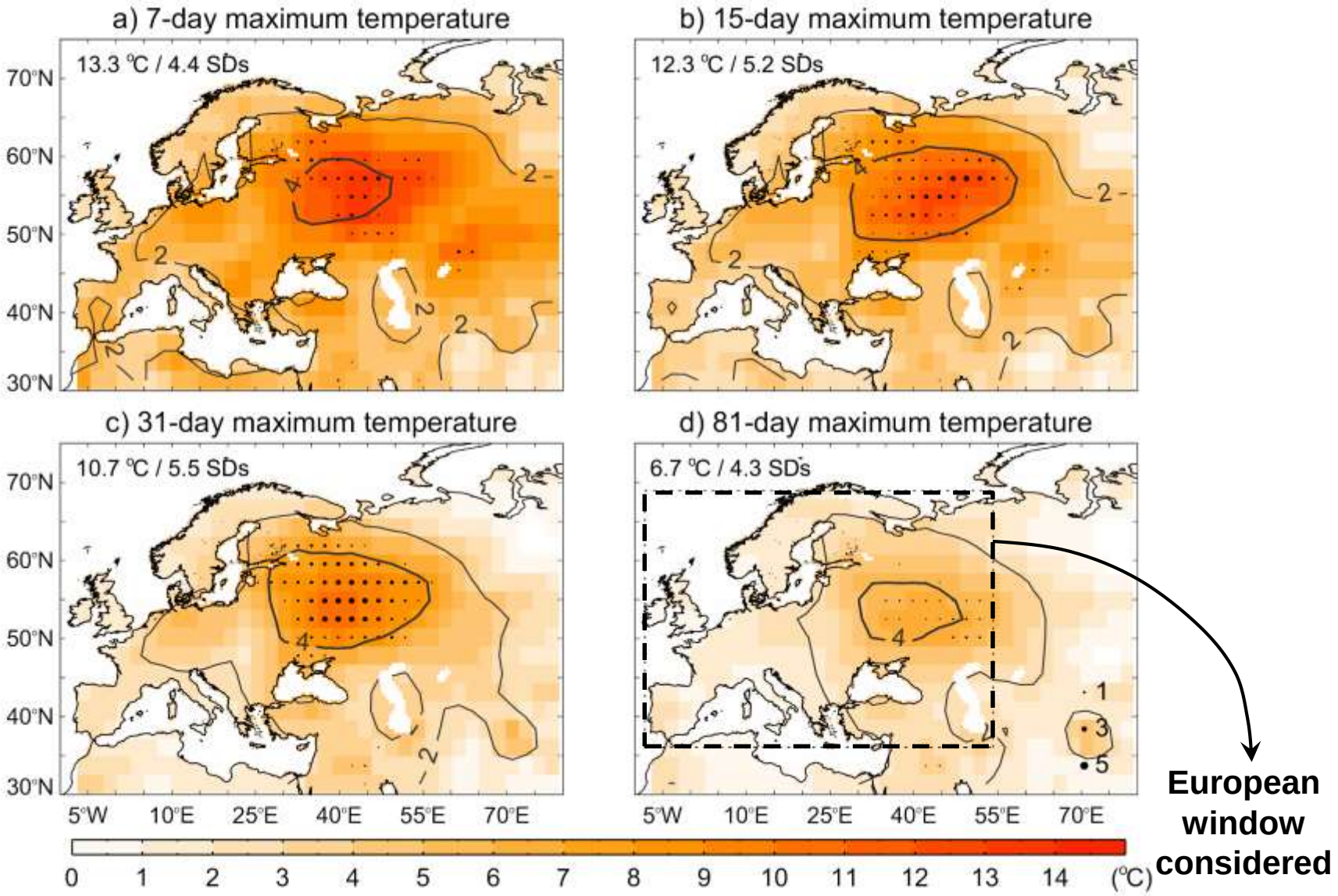



Mostly during the **first 2 weeks of August (red colour)**

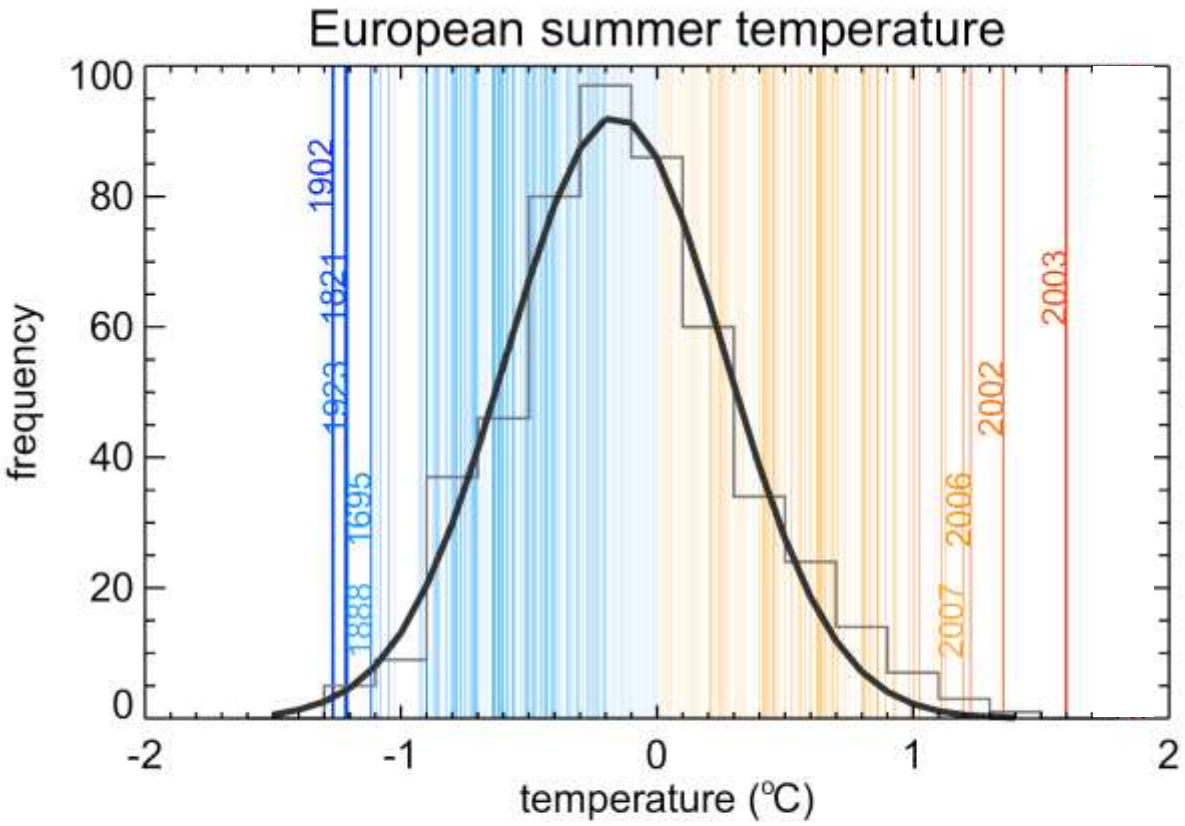
**Garcia-Herrera et al. (2010)**



# The 2010 heatwave at different temporal scales



# The impact of summer 2010 heatwave in Europe




Frequency distribution of European summer land temp. anomaly (ºC) for the 1500-2010 period (vertical lines).

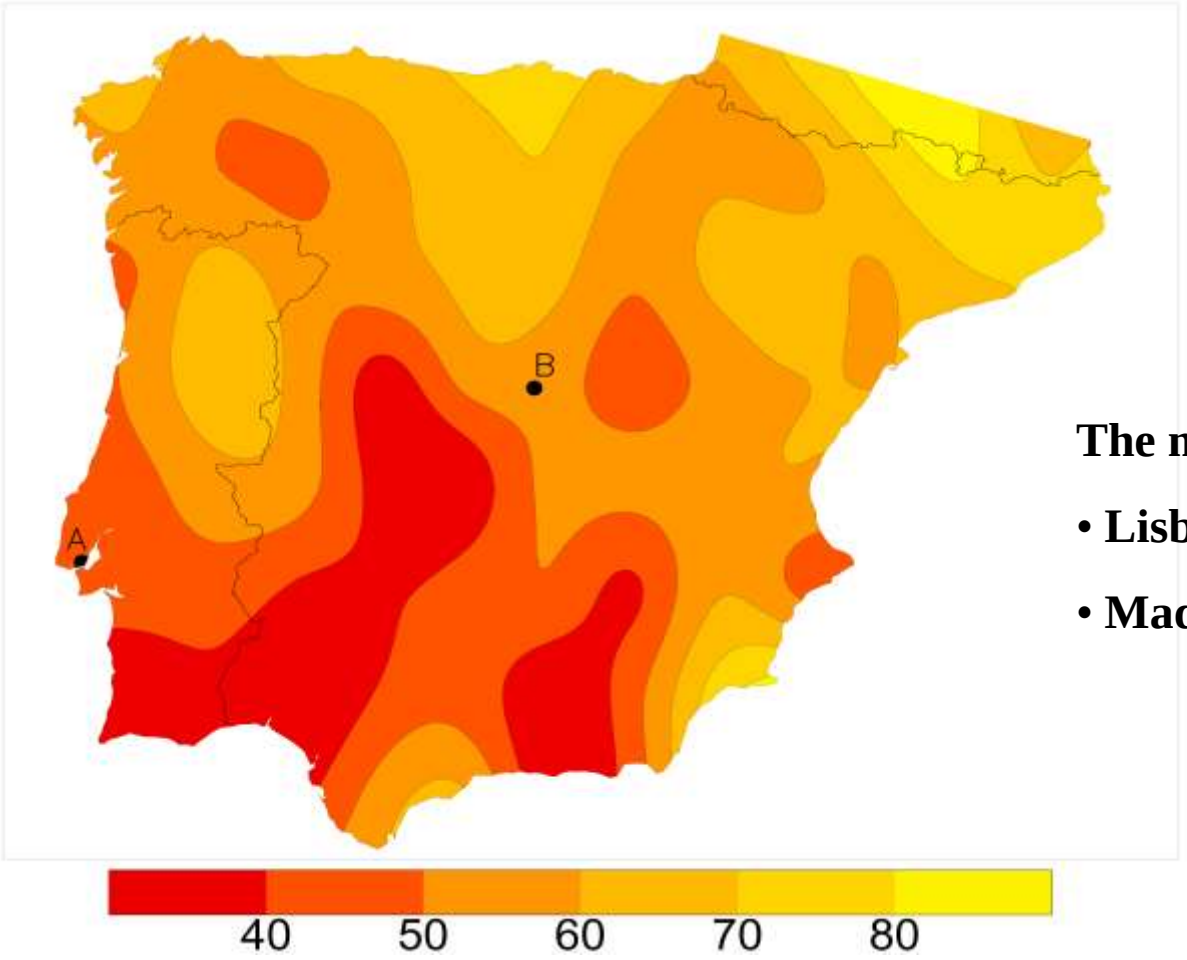
Grey bars represent the distribution for the 1500-2002 period with a Gaussian fit in solid line.

**Multiproxy temp [Luterb. (2004)] 1500-2002**

**Temperature [GISS NASA] 2003-2010**

**Barriopedro et al. (2011, SCIENCE)**

# The strongest drought in IBERIA in 2004-2005



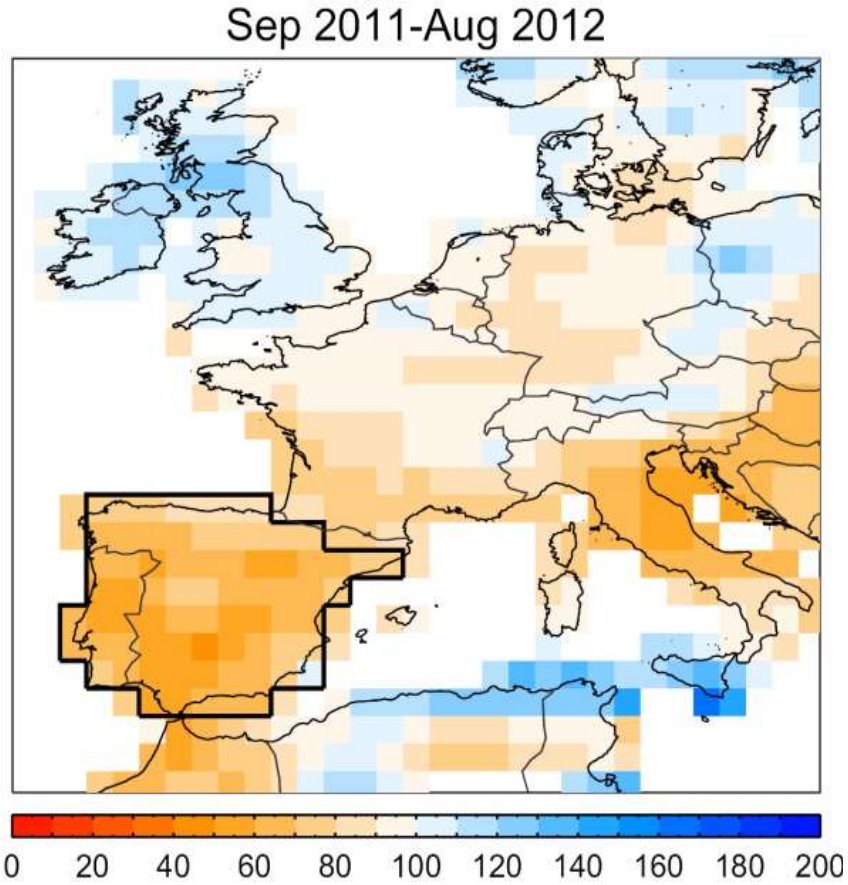

Garcia-Herrera et al. (2007)

**The most intense drought:**

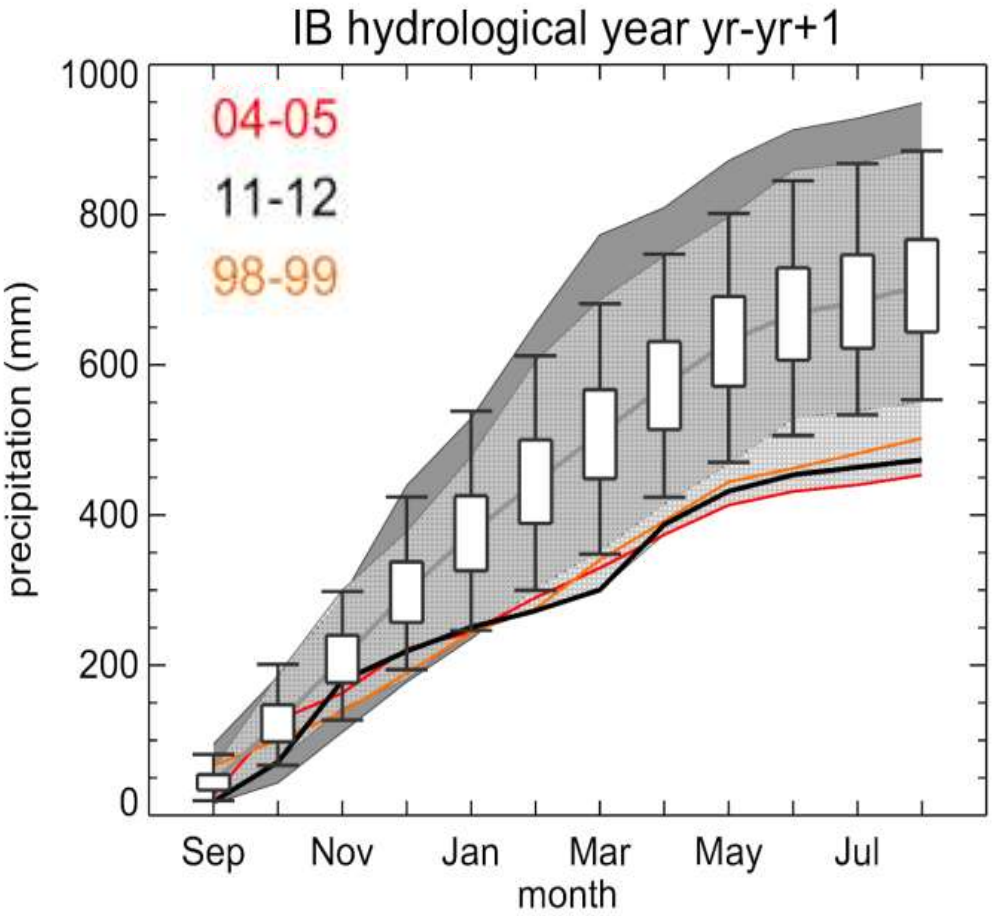
- **Lisbon (since 1865)**
- **Madrid (since 1859)**

Accumulated precipitation in Iberia between Oct. 2004 and Sept 2005

(% relative to the period 1961-1990)



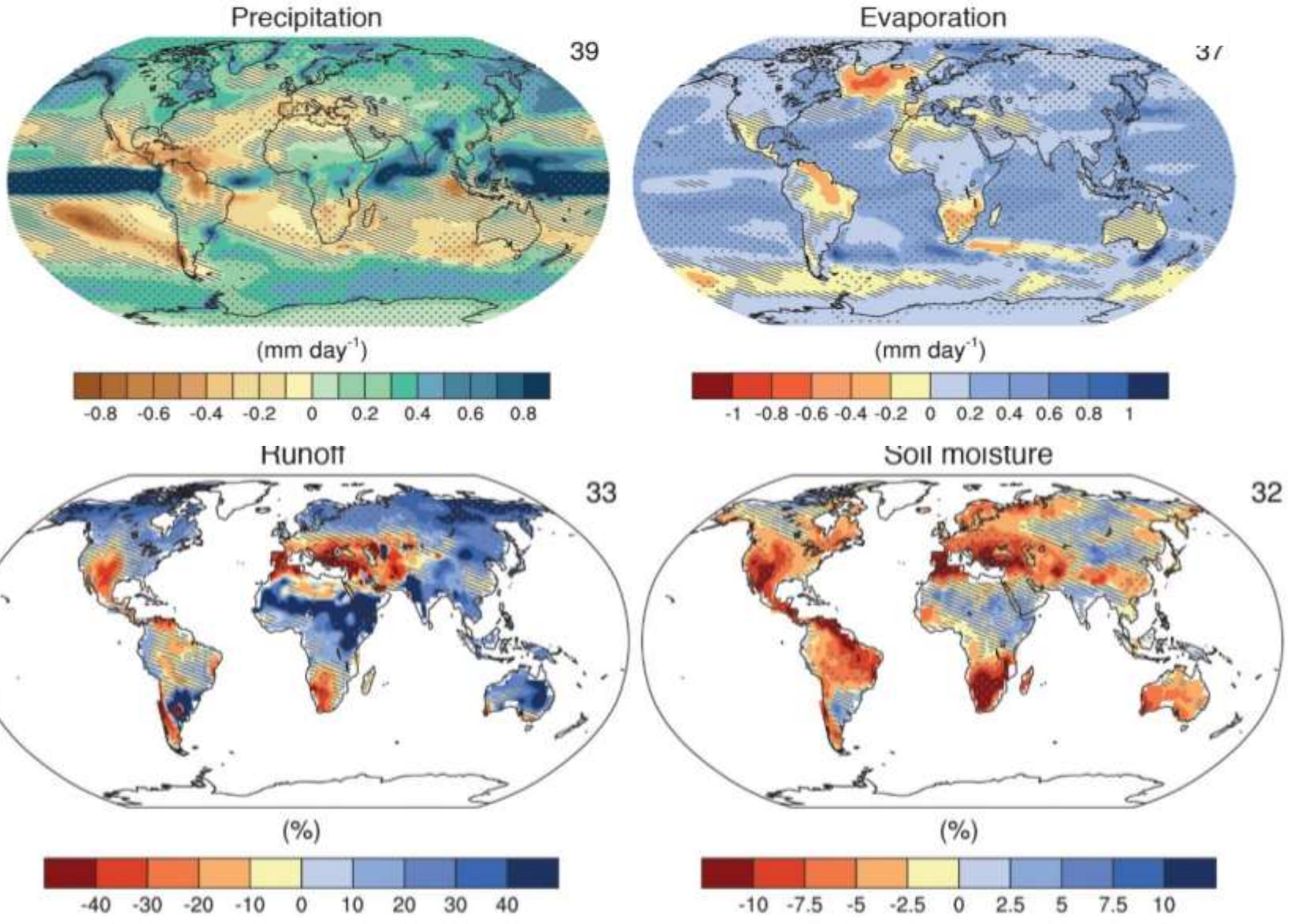

# Another major drought in **IBERIA in 2011-2012**




**Trigo et al. (2013)**

# IPCC 2014

The Mediterranean will maintain its **hotspot** status in the coming decades



# Summary

1. The Western (Eastern) Europe **heatwave** of summer of 2003 (2010) correspond to a new paradigm of extreme heatwaves that will occur more frequently in coming decades**.**

2. **Winter/Spring drought conditions** have exacerbated the strength of both summer heatwaves**.**

3. The **Mediterranean basin is getting drier** and **drought frequency has already increased** in the last 40 years **partially due to GHG**.

4. A large number of Regional Climate Models predict **more intense heatwaves** and **drought episodes** for the Mediterranean.