

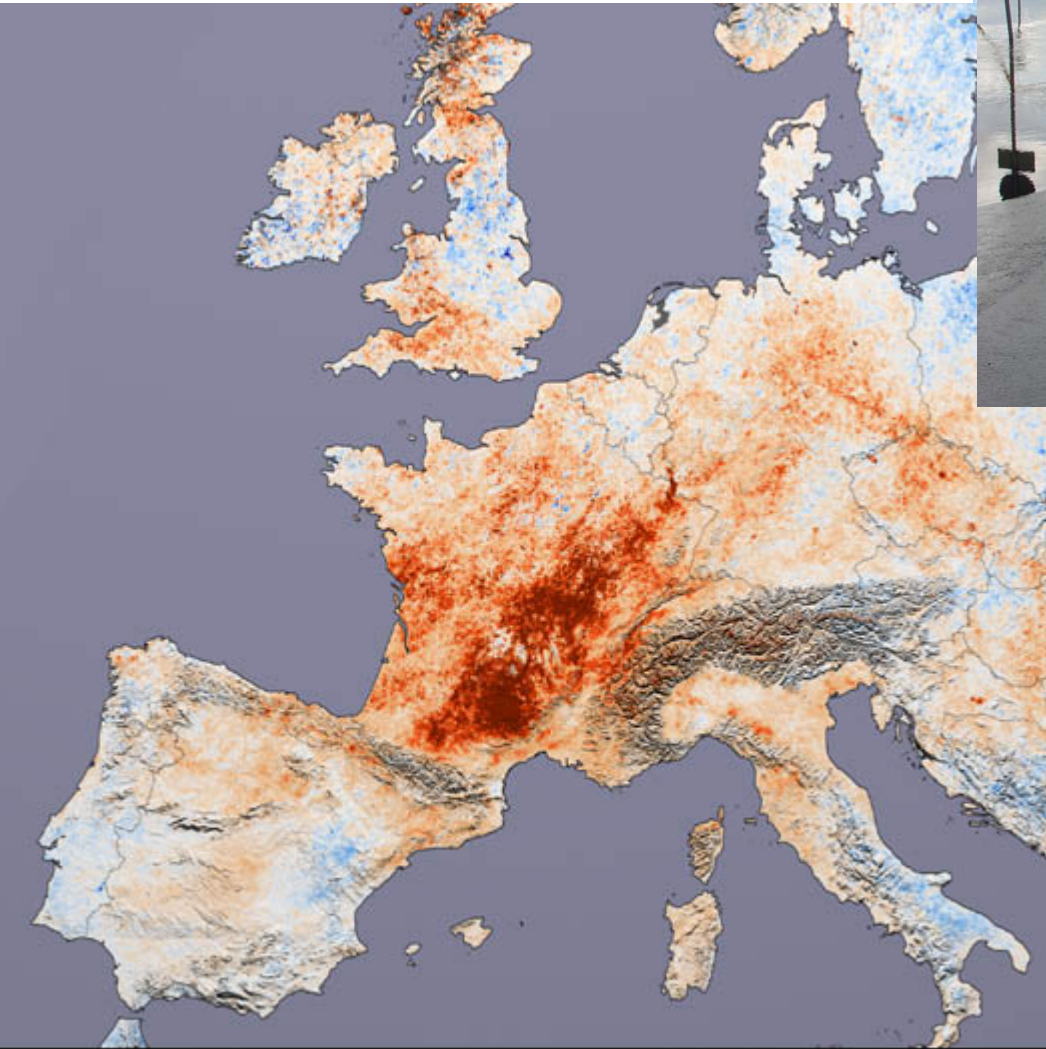
Recent weather extremes – Any signs of Climate Change?

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Floods in central- and southern Finland, July and August 2004



Temperature Anomaly (°C)

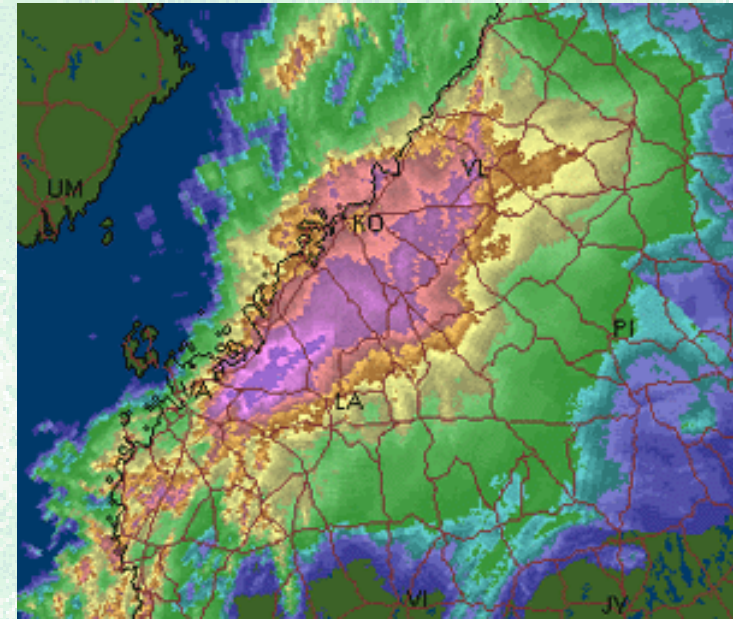


Heatwave in central and southern Europe, Summer 2003



Were summer floods of 2004 in Oravainen, Finland, caused by anthropogenic greenhouse gas emissions?

It is not possible in a causal sense to attribute an individual episode of extreme weather to changes in atmospheric composition, because the atmosphere is a chaotic dynamic system.



Weather radar image of 12-hour precipitation from 3.8. 3 p.m. to 4.8. 03 a.m. in 2004. Oravainen is located in the heaviest (violet) area of precipitation. The 24-hour total precipitation was 151 mm.



~~Was extreme weather event in xxxx on yyyy caused by anthropogenic greenhouse gas emissions?~~

This is an ill-posed question, but there are other policy-relevant questions that we can already answer.

For example:

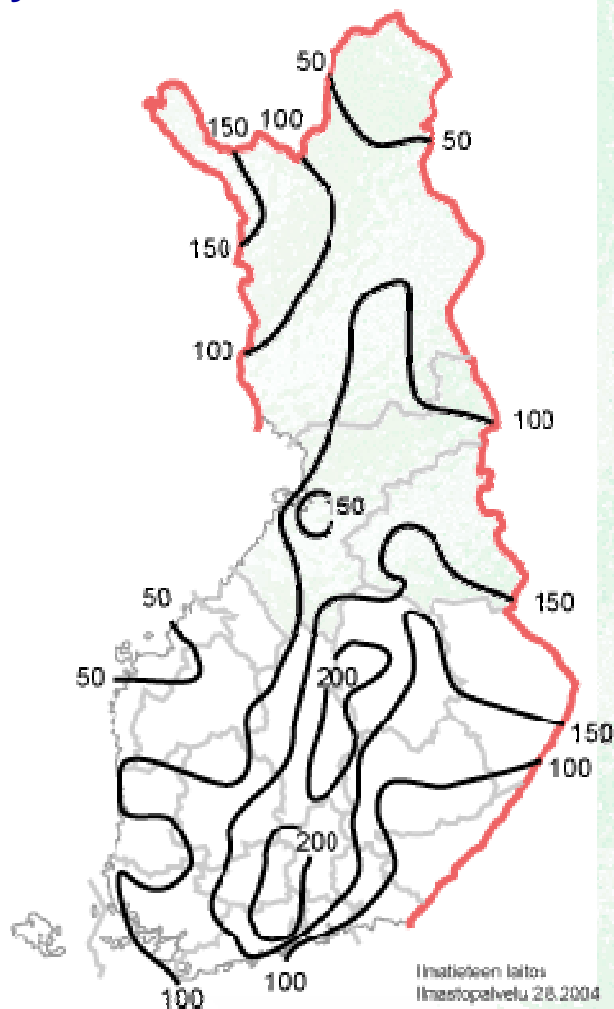
- Are heavy rains expected to increase due to climate change in Finland?**
- Are heat waves coming more frequent in Europe?**
- Are modern societies sensitive to climatic extremes?**



Heavy rainfall during the end of July, 2004

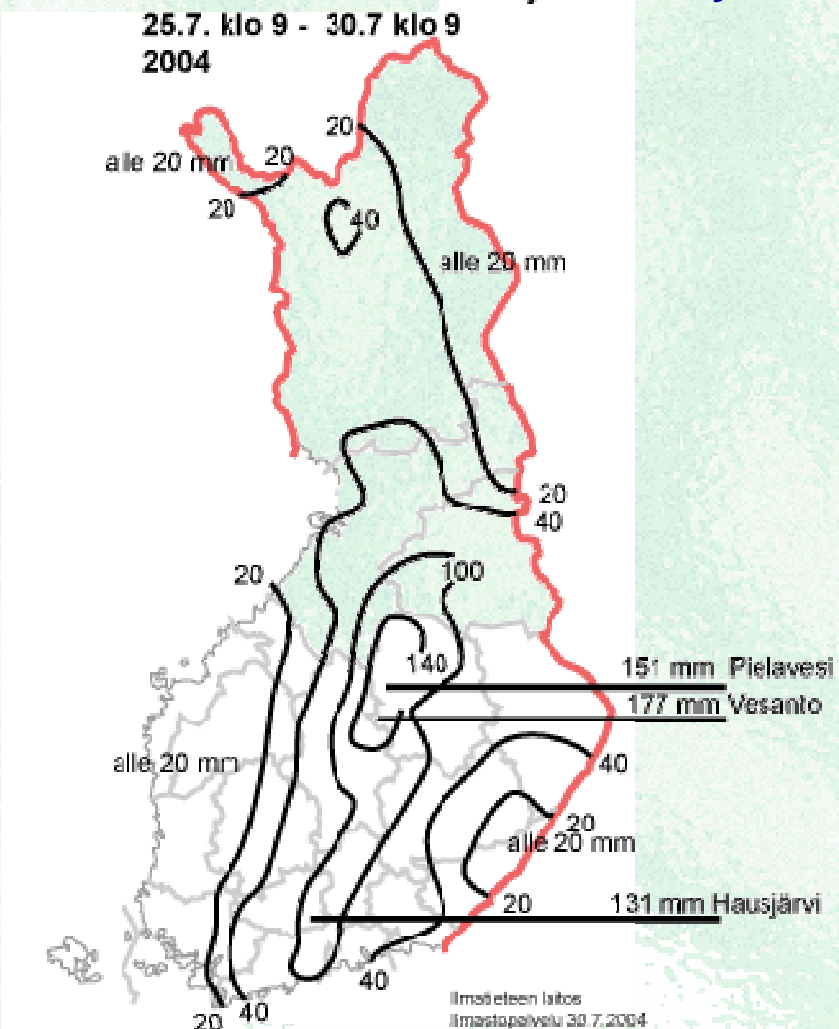
Total of July

Heinäkuun 2004 sademäärä mm



Ilmatieteen laitos
Ilmestopalvelu 28.7.2004

Sademäärä millimetreinä ajalla 25.7. klo 9 - 30.7 klo 9 2004 5-day sum



Ilmatieteen laitos
Ilmestopalvelu 30.7.2004



Examples of impacts

(heavy rainfall in July/August 2004)

Flooding, erosion, soil wetness, leaching, ...

- **damage to buildings and structures**
- **damage to roads (costs 2 million Euros)**
- **transport interruptions**
- **poor water quality**
- **increased fish mortality**
- **agricultural losses**

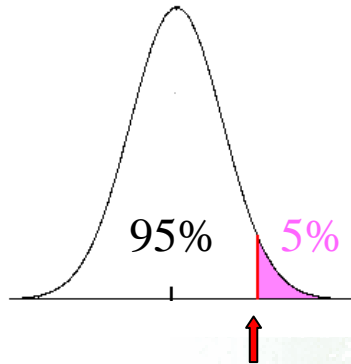


Yard of FMI observer on 3.8.2004.

Photo: Stig Backman.

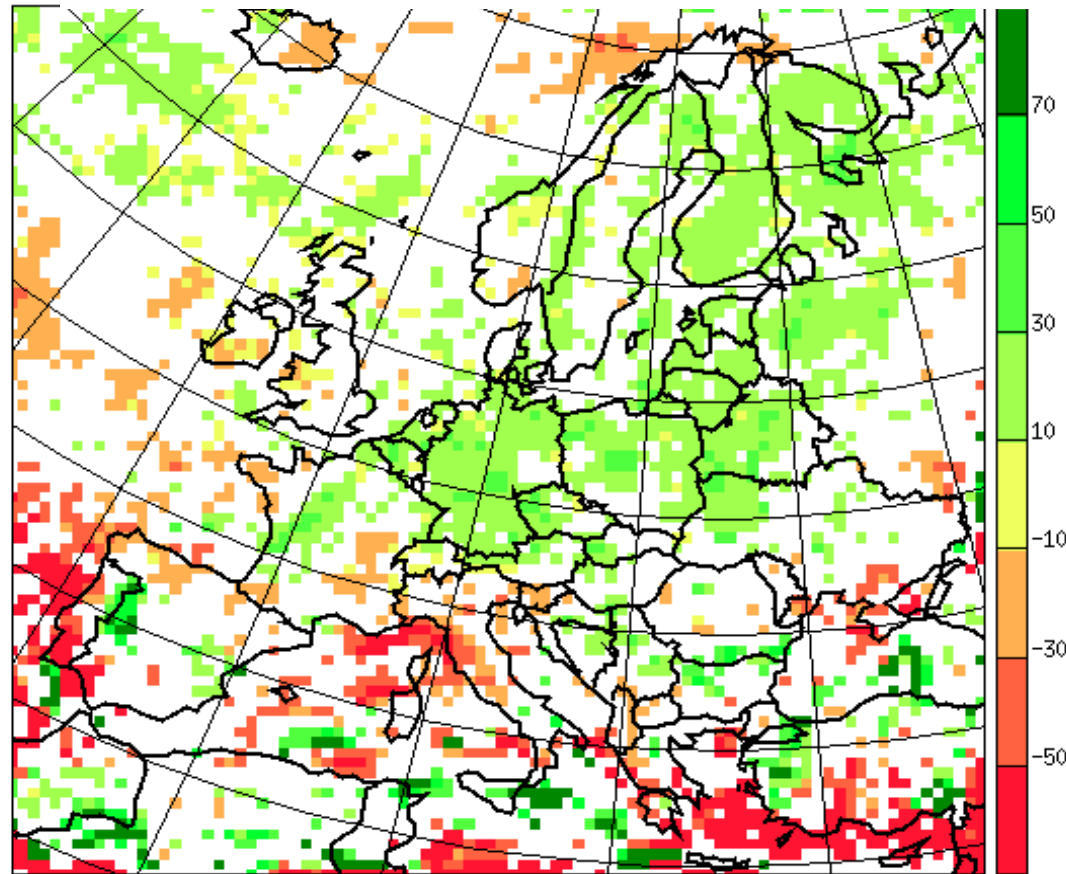


Increase of heavy precipitation



Change in heavy daily precipitation in percent (%)

SUMMER 1961-90 =>2071-2100



increase



decrease

Rosby Centre RCM (SRES A2 scenario)



Finland - Severe drought of 2002/2003

Economic losses (million €)

Water supply	8
Hydropower	50
Agriculture	15
Forestry	2
Buildings	25
Inland waterway traffic	0,5
Recreation	1
Total	102



Silander & Järvinen (2005)



What will happen to dry periods?

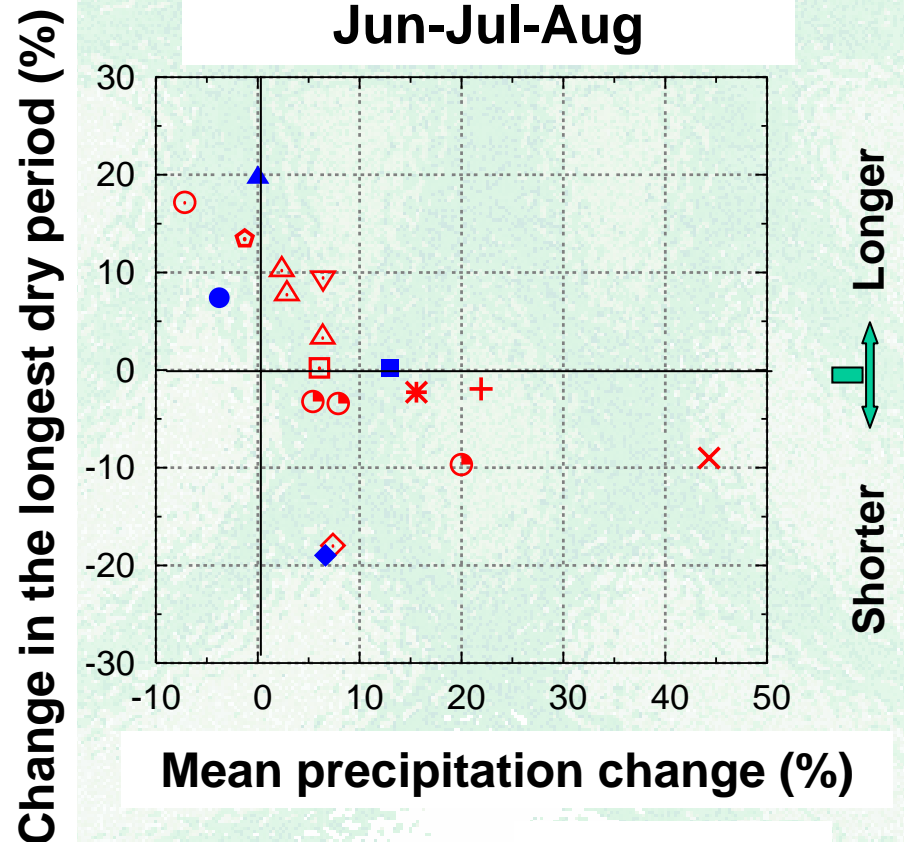
Finland 1961-90 =>2071-2100

Winter: decrease

Summer: no change or increase

Precipitation change in Finland (and Europe):

When it rains, it rains more.



Several models: SRES **A2** ja **B2** scenarios

Source: Kirsti Jylhä, FMI



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Changing Finnish society – Sensitivity to weather extremes?

Two possible examples:

- Increasing volume and safety demands of transport
- Increase of (paved) built area

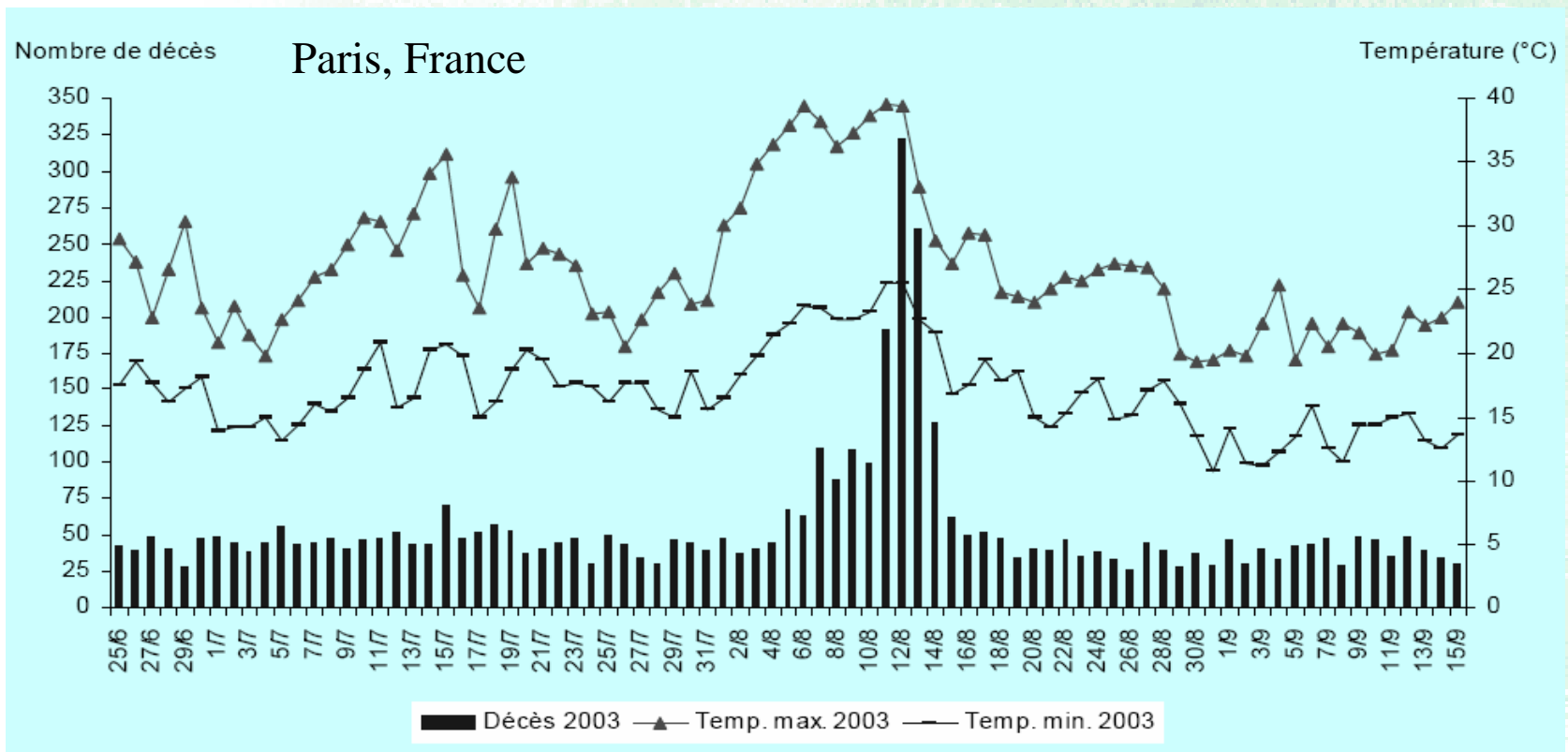


Increasing sensitivities to weather extremes in some sectors of society.

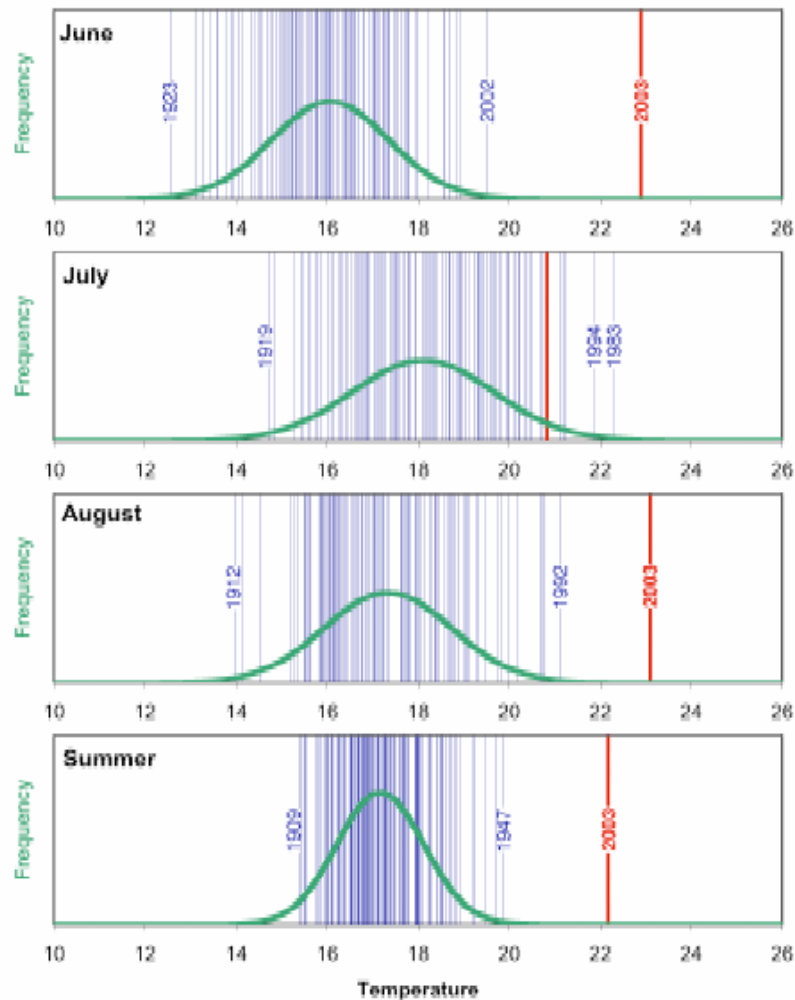


The western European summer drought of 2003 is considered one of the severest on record

- Heat related casualties in France, Italy, the Netherlands, Portugal, the United Kingdom, and Spain reached nearly 20 000
- Many countries are having their worst harvest since World War II
- Problems with power plant cooling



Summer Temperatures 1864-2003



Schär, ETH Zürich

- June, August, and JJA have the characteristics of outliers
- There is no other event (other months, cold and warm events) of this kind in the whole data series

Schär *et al.* (2004)



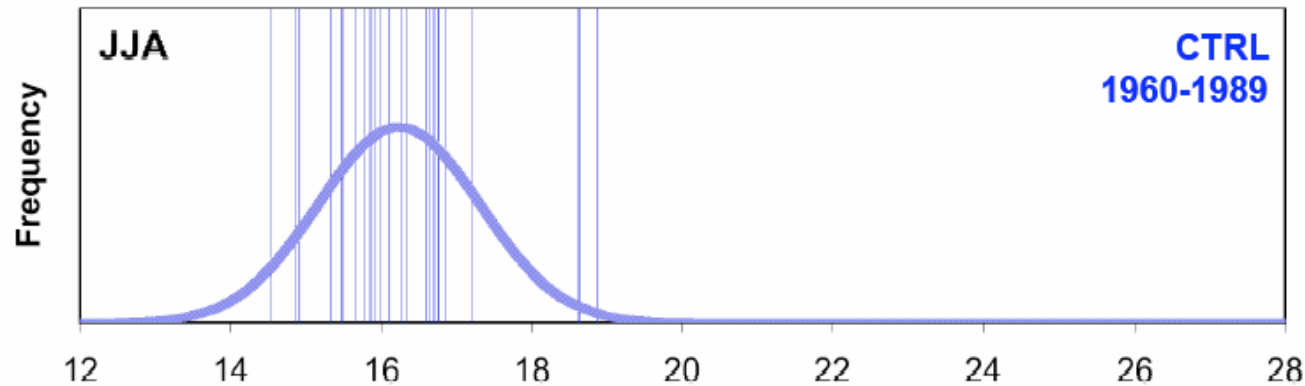
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Summer Temperatures

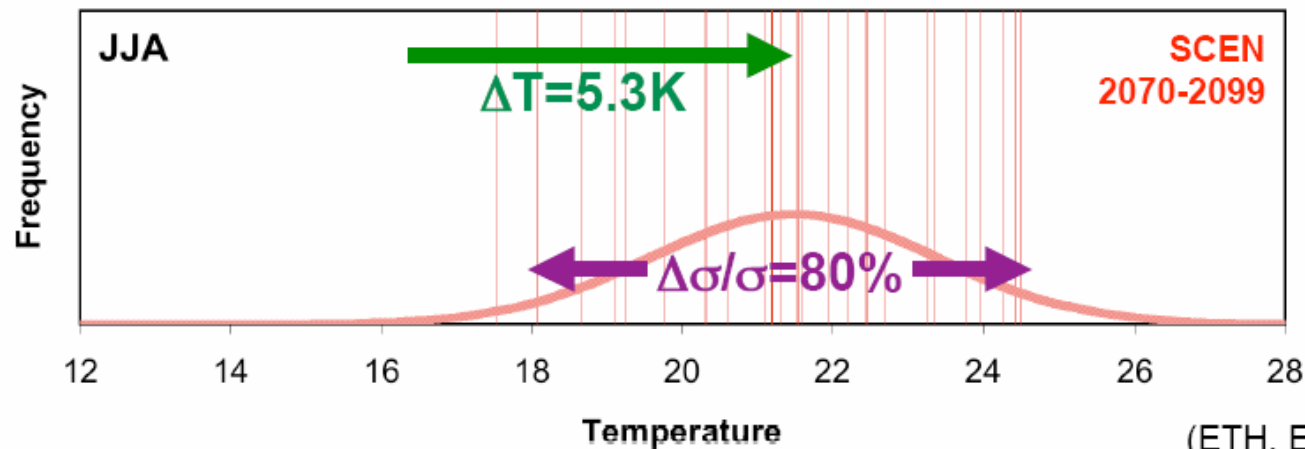
Domain Mean (F, parts of D and CH)

Gridpoint near
Zurich



Simulated:
 $T = 15.8 \text{ }^\circ\text{C}$
 $\sigma = 0.97 \text{ }^\circ\text{C}$

Observed:
 $T = 17.2 \text{ }^\circ\text{C}$
 $\sigma = 0.94 \text{ }^\circ\text{C}$



Dramatic
increase
in
variability

(ETH, EU-Project PRUDENCE)



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Schär *et al.* (2004)

PRUDENCE

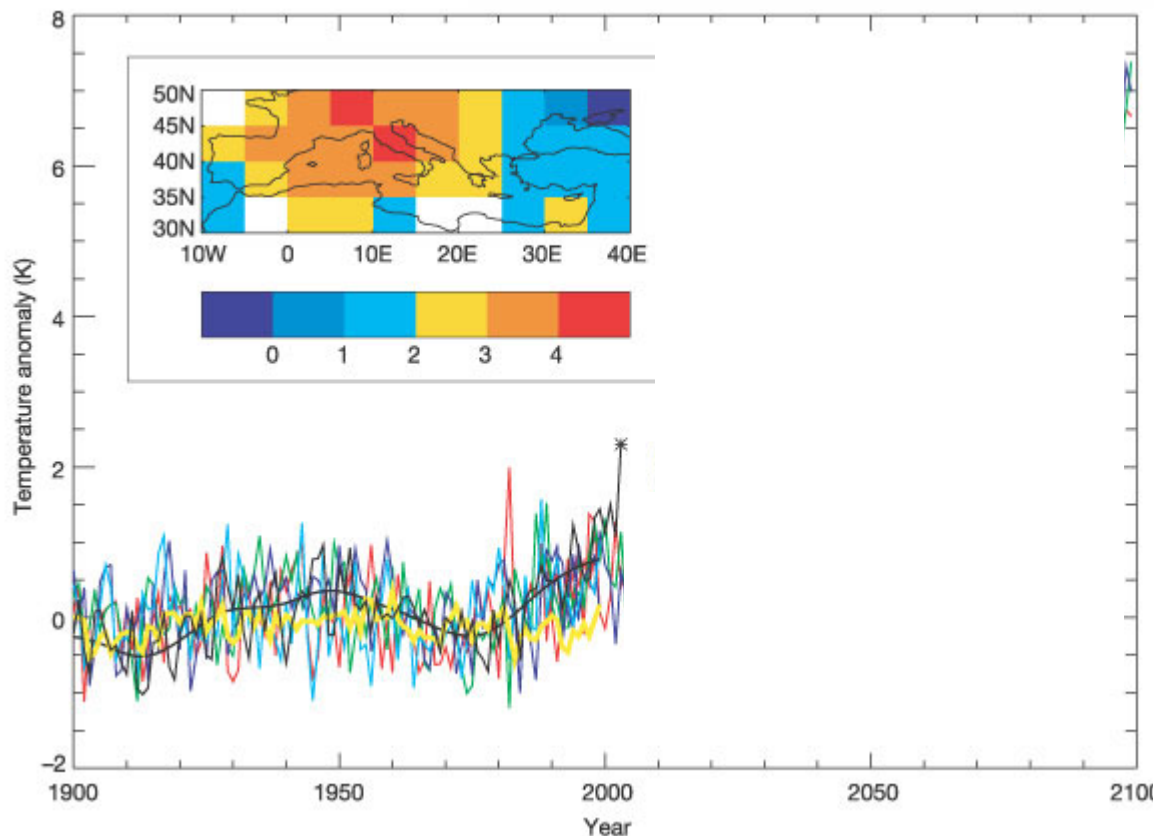
.....
**Human contribution to the European
 heatwave of 2003**

Peter A. Stott¹, D. A. Stone^{2,3} & M. R. Allen²

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**"...very likely
 (confidence
 level >90%) that
 human influence
 has at least
 doubled the risk
 of heatwave
 exceeding this
 threshold
 magnitude."**

**Human contribution to the European
heatwave of 2003**

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**"The European heatwave of 2003...
a rare meteorological event
or
a first glimpse of climate change to come?"**

Probably both."

Schär & Jendritzky, Nature 2004



Summary

Even modern societies, like Finland, are sensitive to weather and climatic extremes.

Projected changes in climate and society call for action to cut losses. Tools:

- **Weather and climatic information**
- **Community planning, engineering (adaption)**
- **Greenhouse gas emission reduction**

