Observed climate variability, change and impacts

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QIII What do we understand about the impacts of these variations or changes?

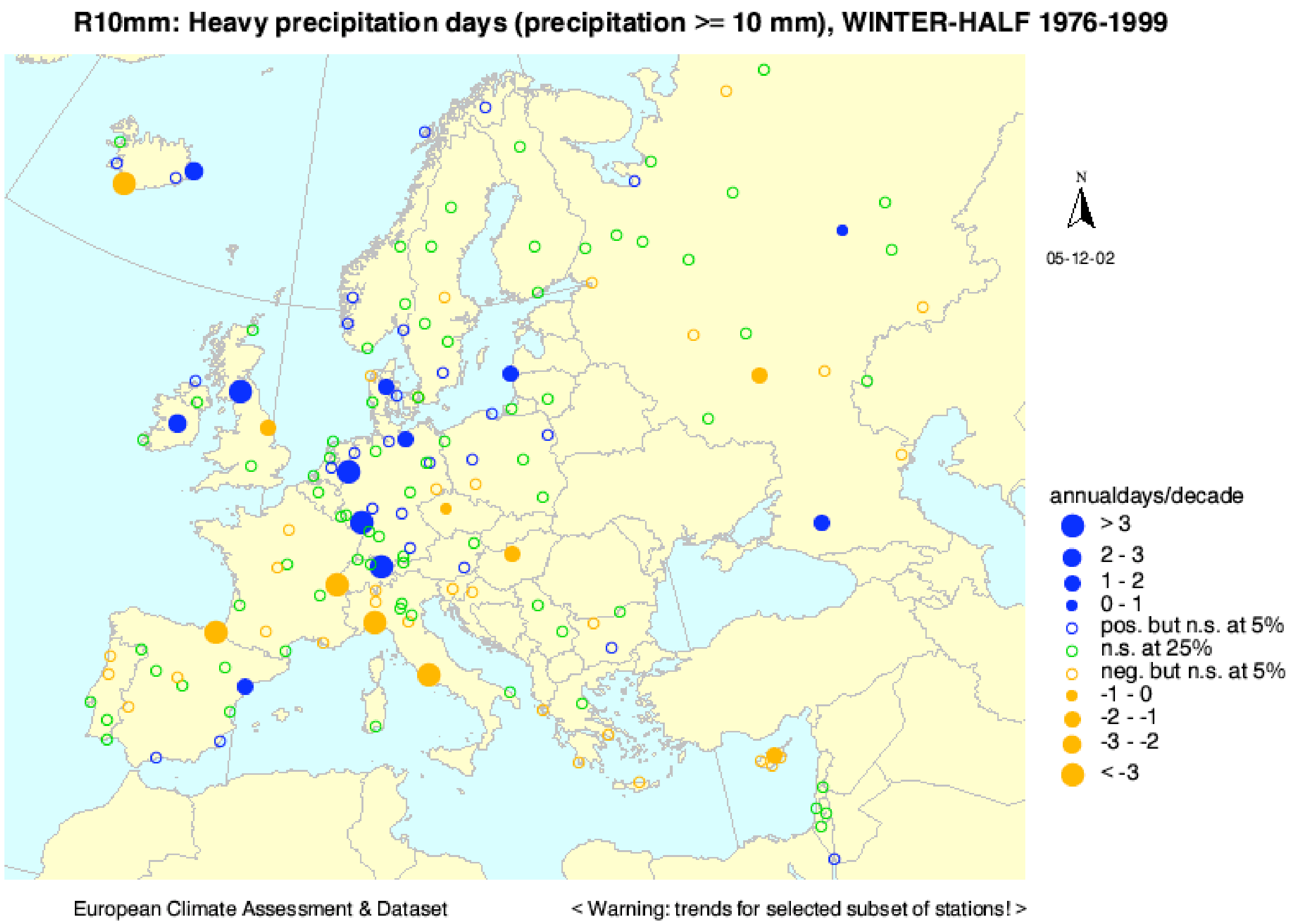
- Some post-IPCC TAR European studies on observed extremes
- Some results from IPCC WGII TAR
- Observed impacts 1: Using the complete record to explore impacts
- Observed impacts 2: Using extreme seasons to explore impacts
- Some thoughts

Here I discuss only socio-economic impacts

Some European studies on observed extremes

Changes in observed extreme winter-half rainfall

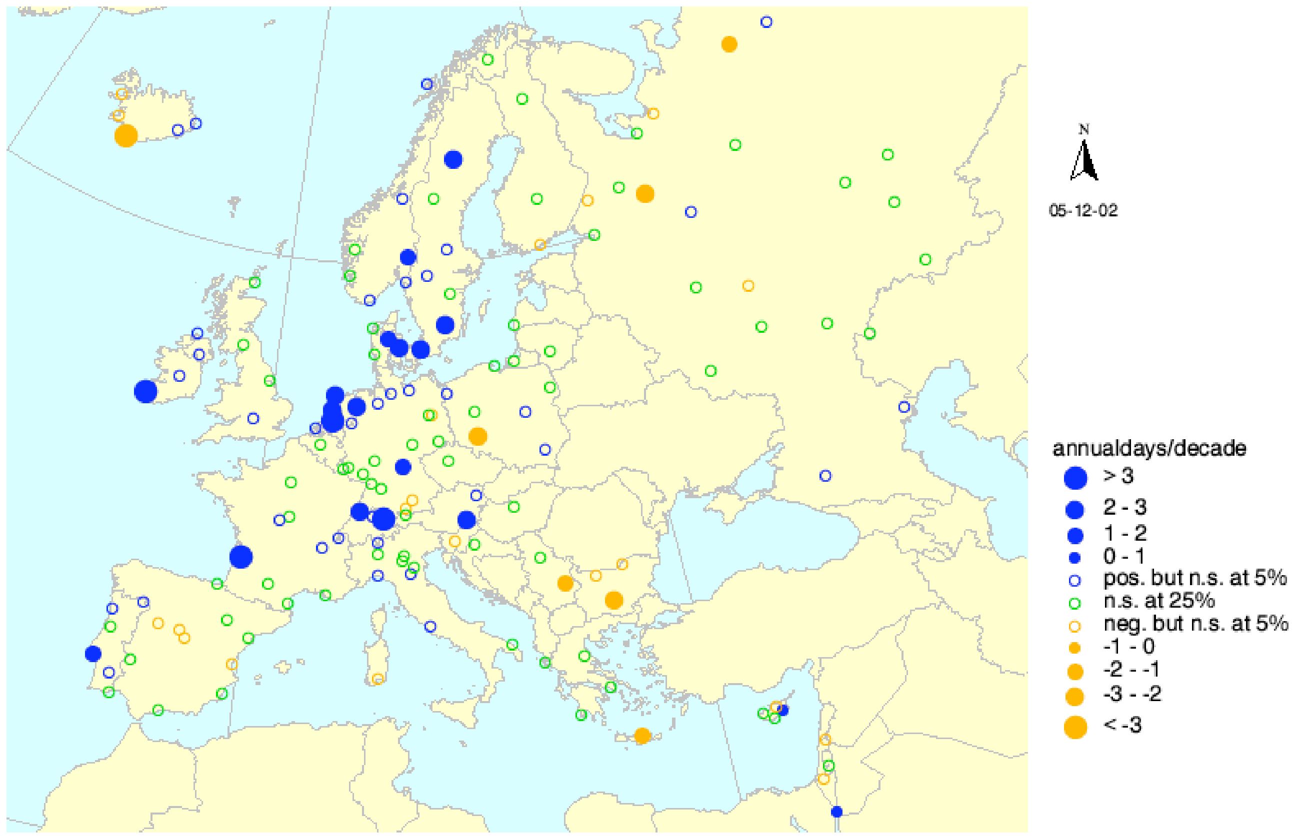
Met Office



Now updated by STARDEX project

Changes in observed extreme summer–half rainfall

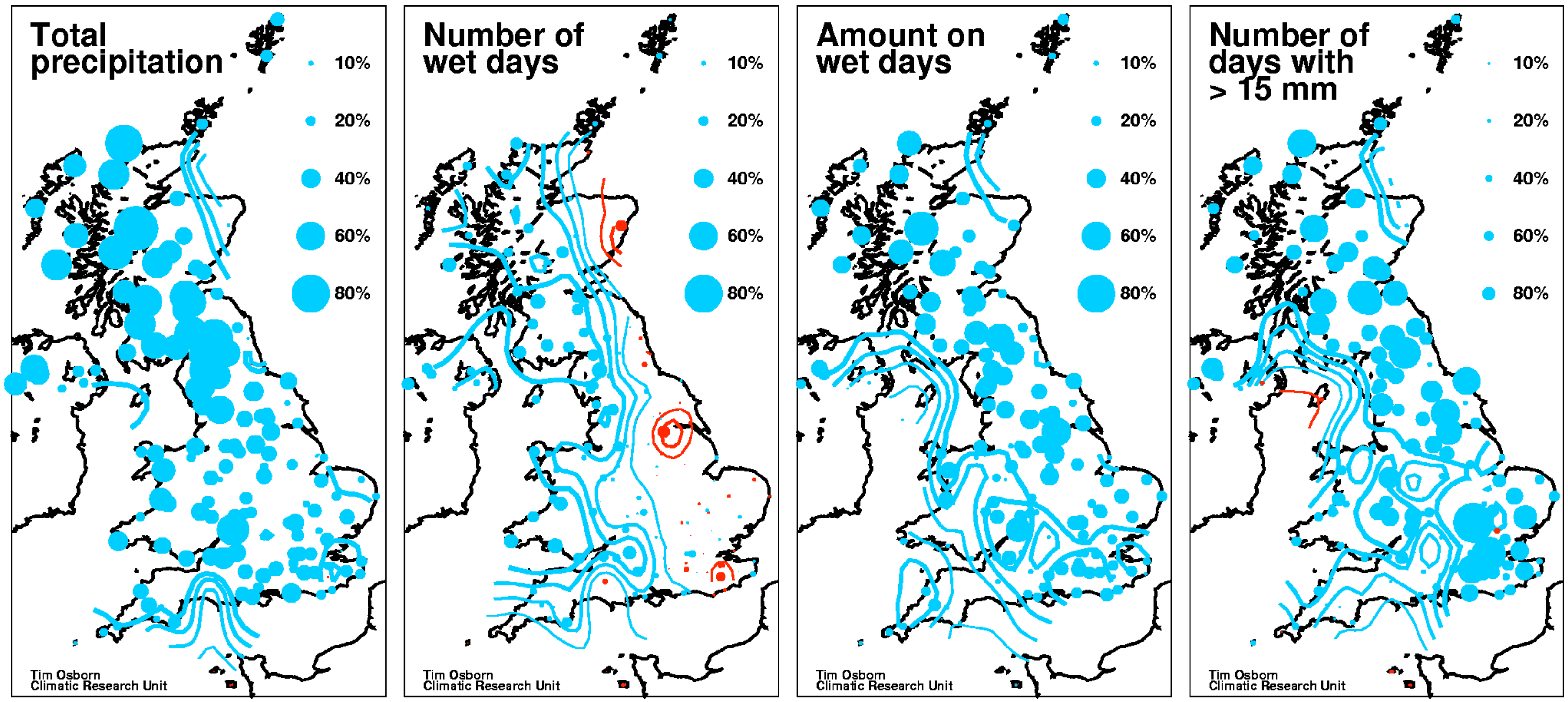
R10mm: Heavy precipitation days (precipitation >= 10 mm), SUMMER-HALF 1976-1999



European Climate Assessment & Dataset < Warning: trends for selected subset of stations! >

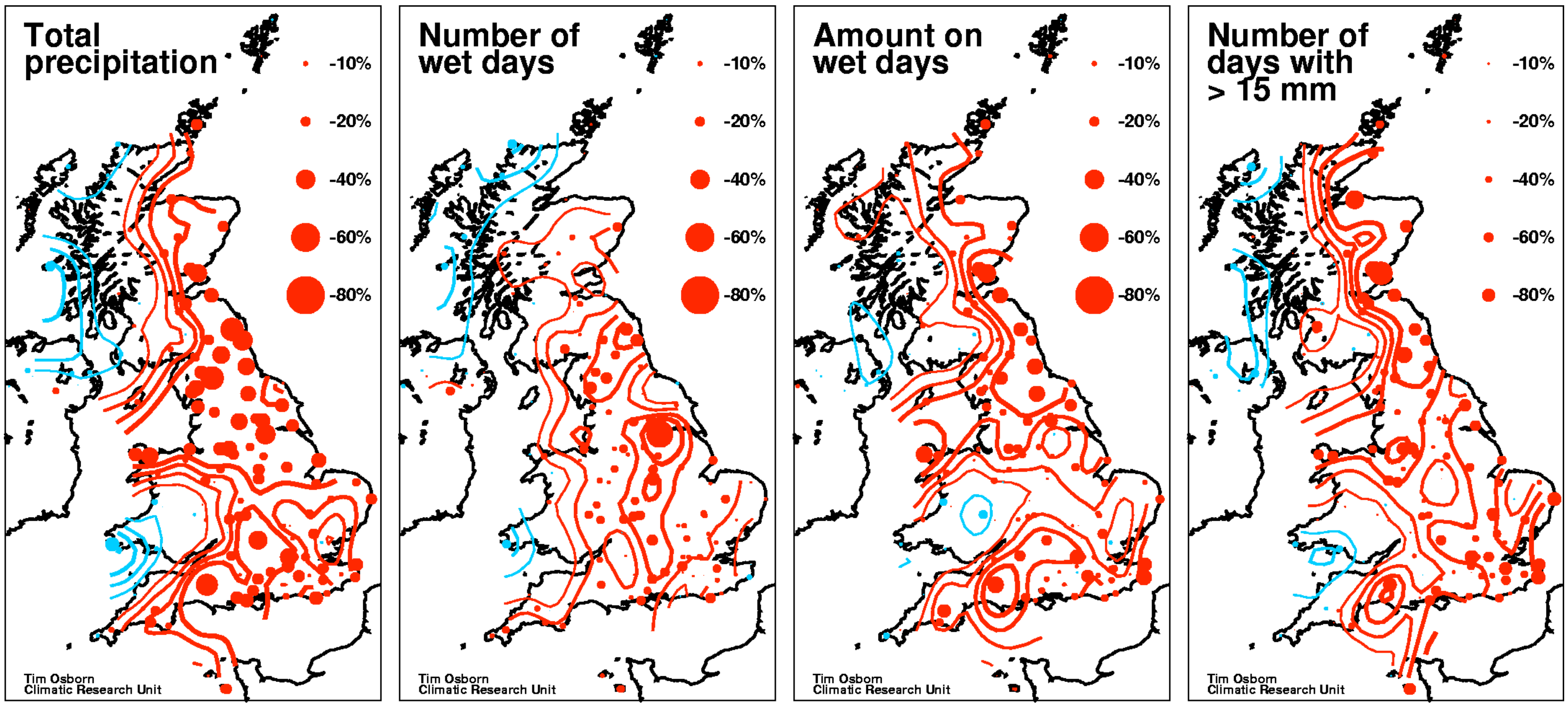
Trends in winter precipitation, 1961-95,

Osborn and Hulme, 2002



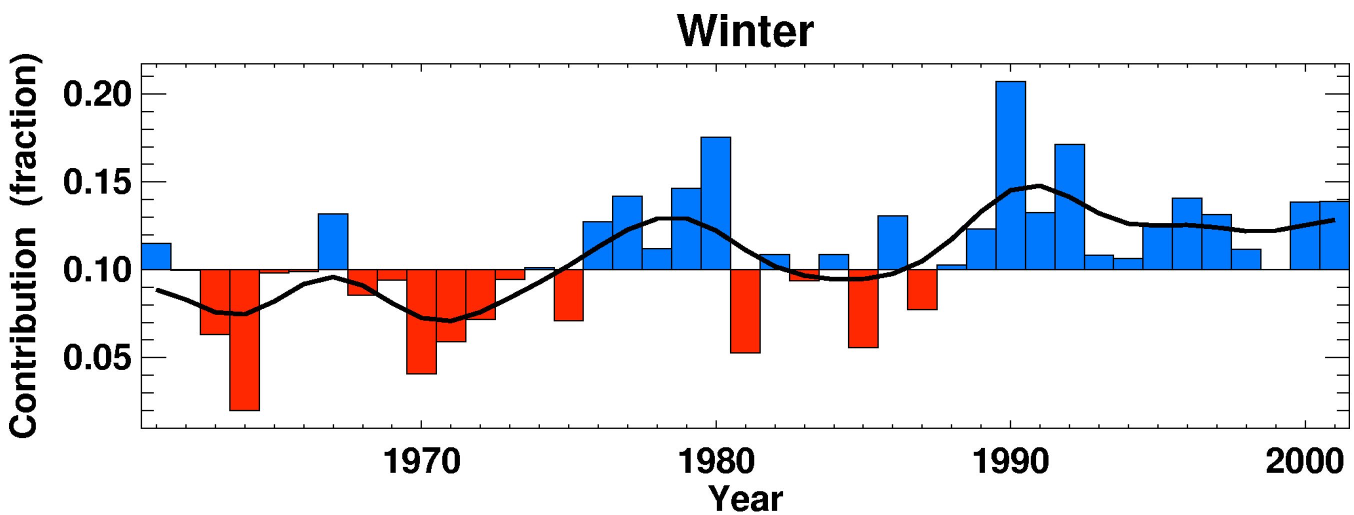
Increases are blue, decreases are red. Trends are expressed as percentage changes over the 1961 to 1995 period

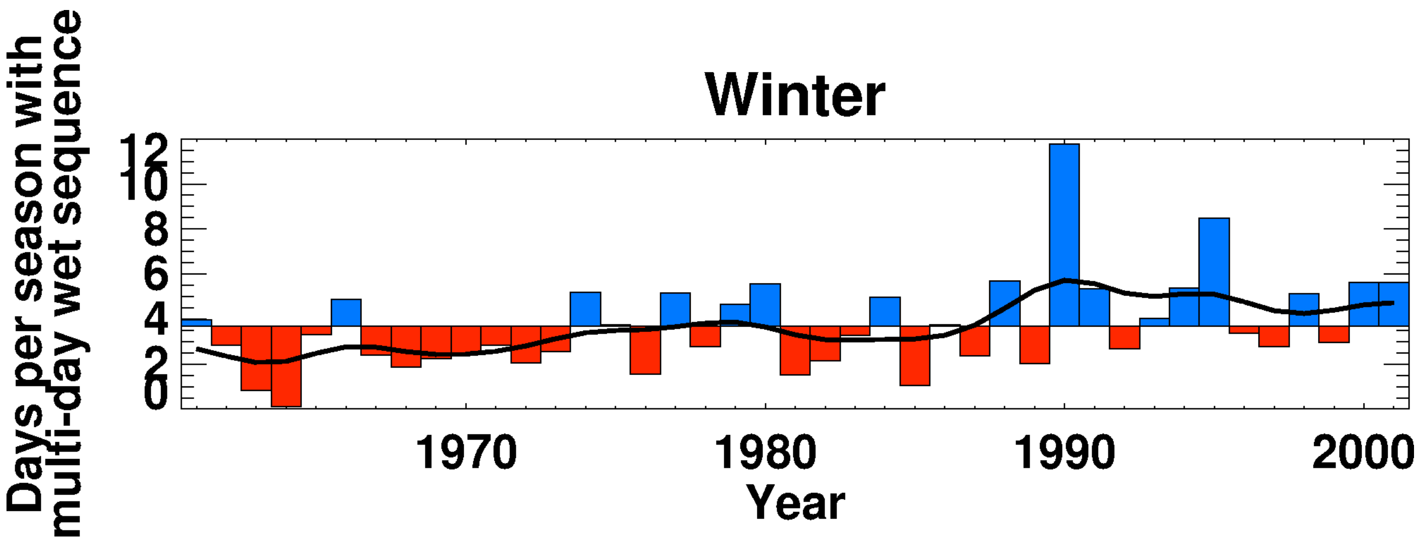
Trends in summer precipitation, 1961-95



Increases are blue, decreases are red. Trends are expressed as percentage changes over the 1961 to 1995 period

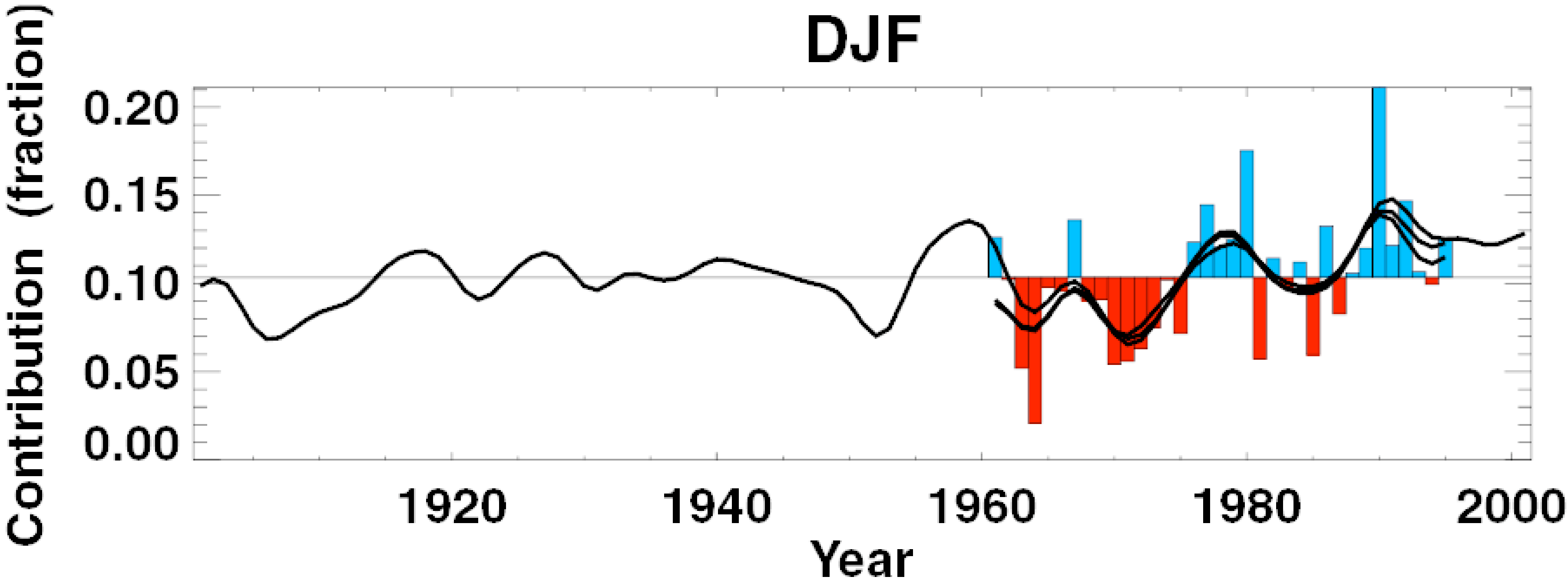
Trends in characteristics of heavy winter rainfall



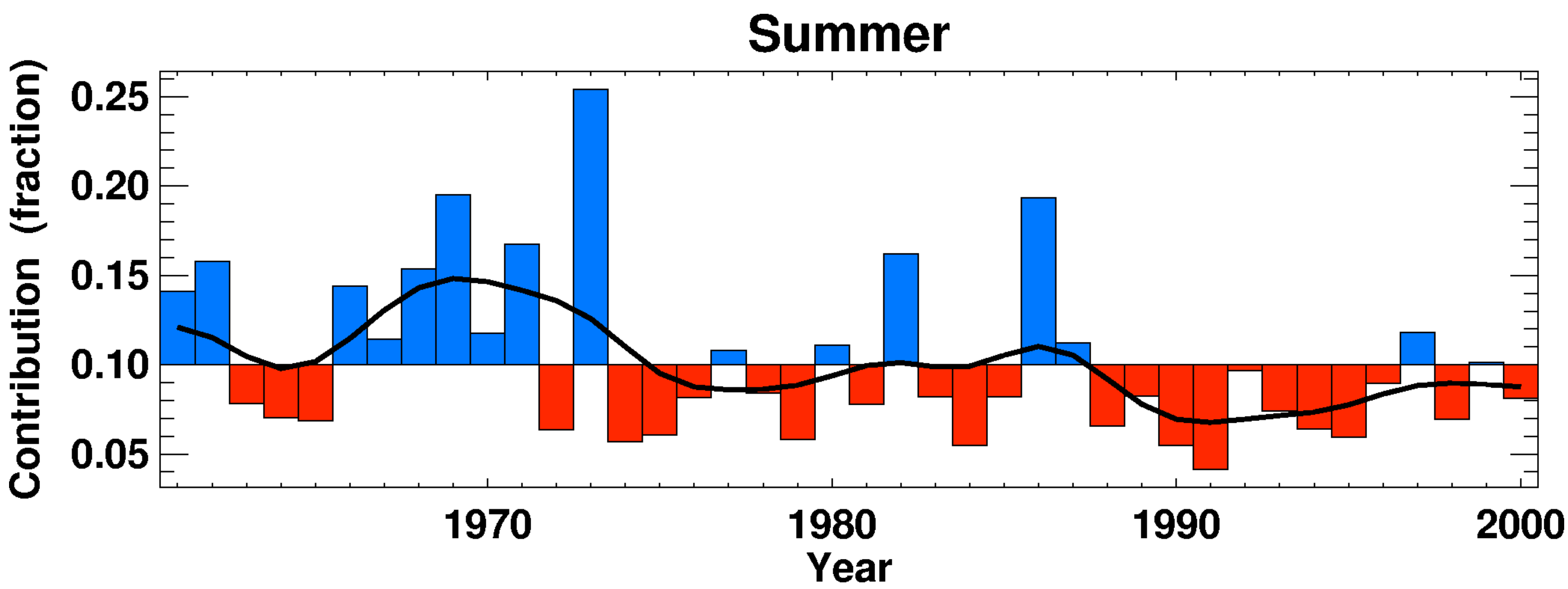


Longer trends in heavy winter precipitation

Fraction of each season's precipitation from "HEAVY" category events

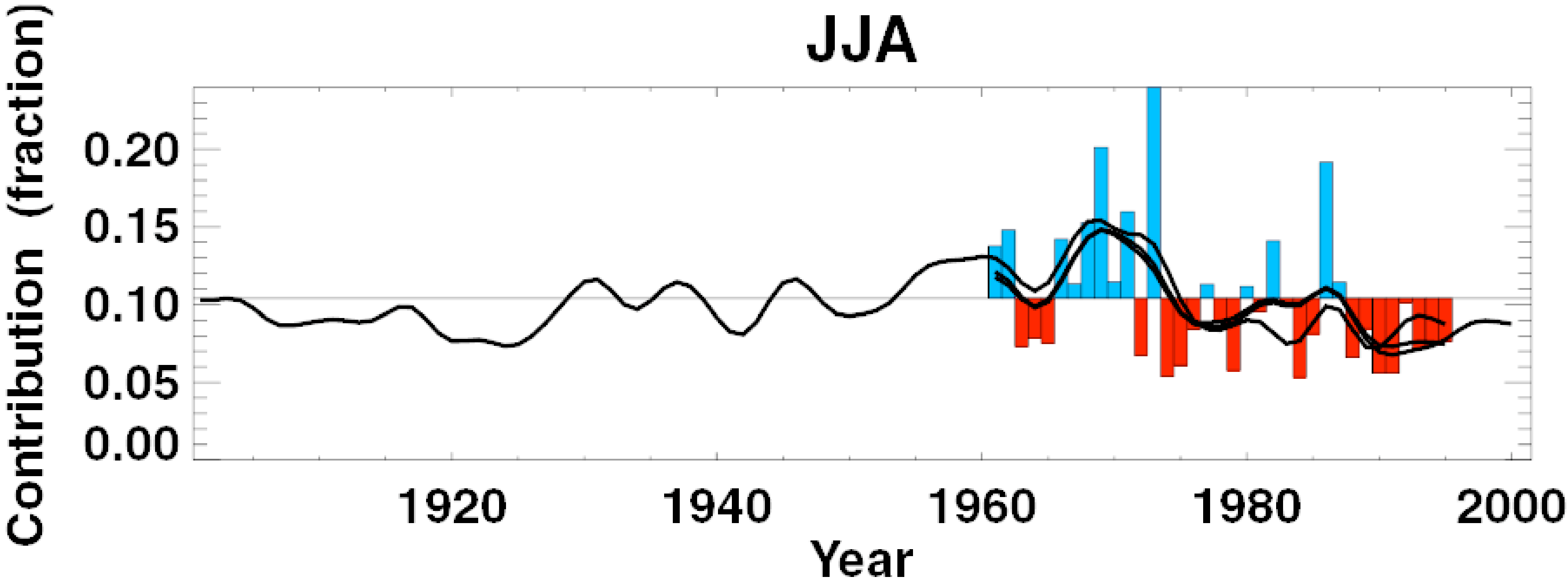


Trends in occurrence of heavy summer rainfall



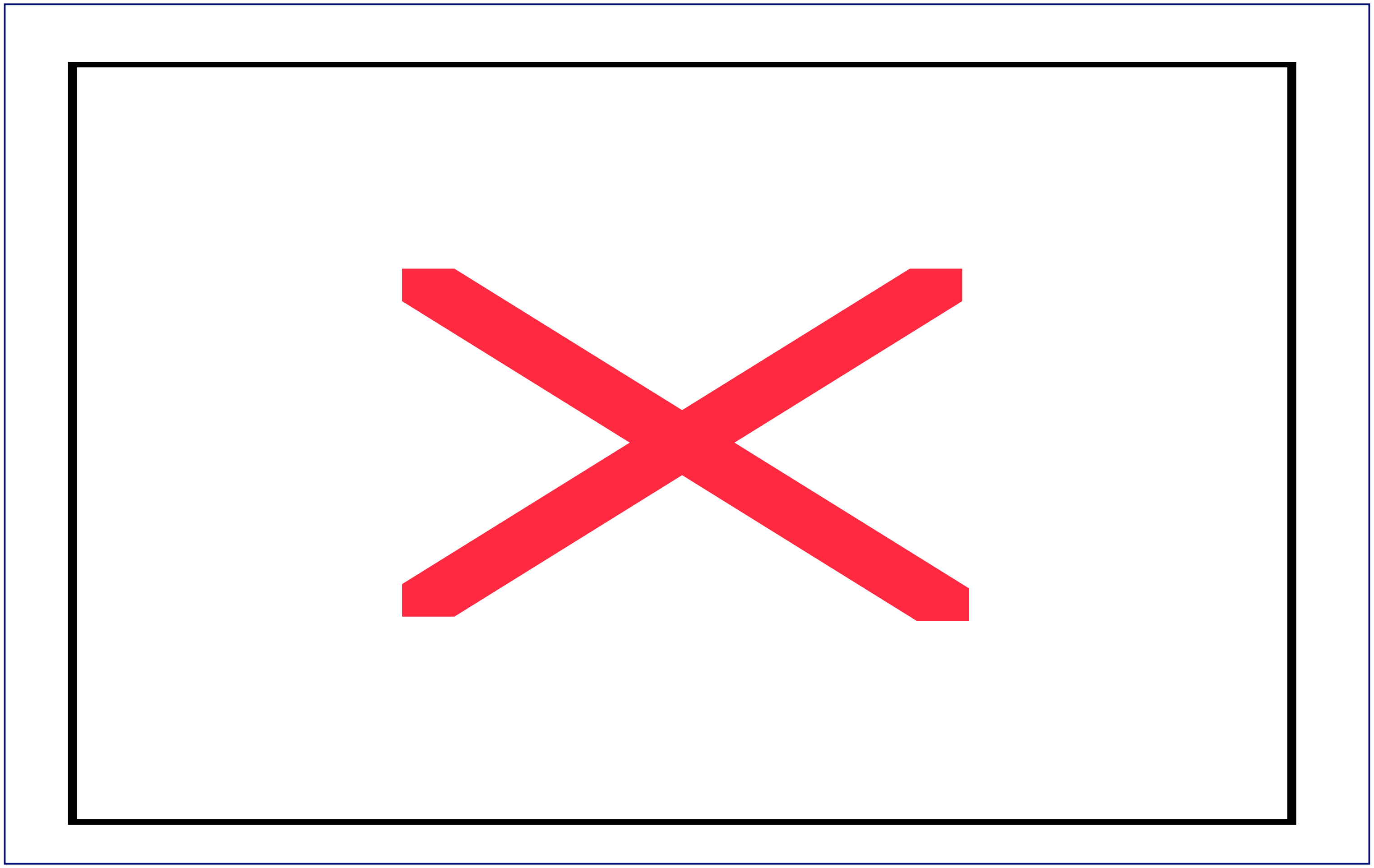
Longer trends in summer heavy rainfall

Fraction of each season's precipitation from "HEAVY" category events



Some results from the IPCC WGII TAR

Extreme event occurrence: confidence in observed and predicted changes

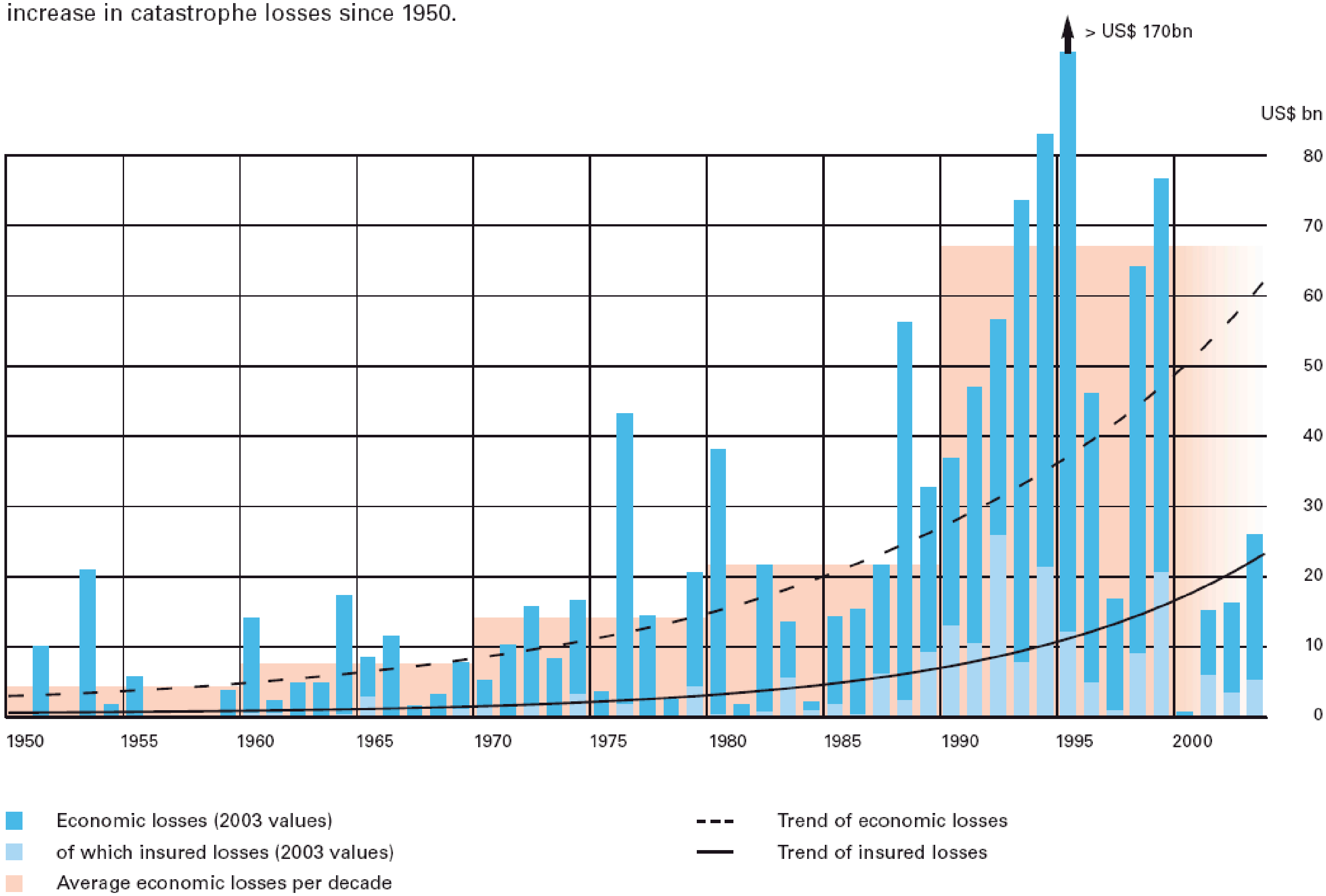


IPCC WGI TAR SPM

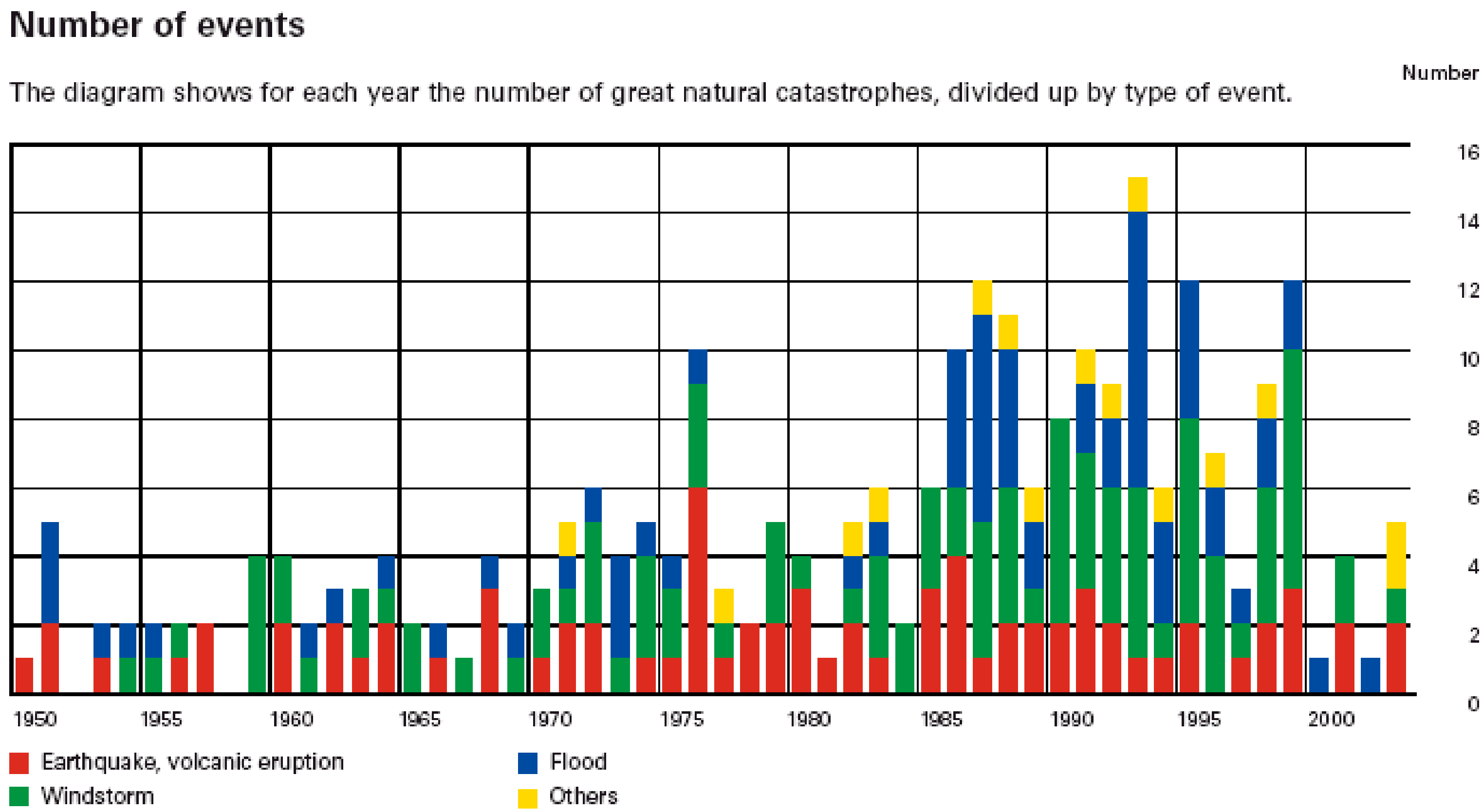
Natural Catastrophes: economic and insured losses since 1950

Economic and insured losses with trends

The chart presents the economic losses and insured losses – adjusted to present values. The trend curves verify the increase in catastrophe losses since 1950.



Number of natural catastrophes, 1950-2003
(MunichRe, 2004)



Decade comparison of natural catastrophes, 1950-2003

Decade	1950-59	1960-69	1970-79	1980-89	1990-99	Last 10 yrs
Number of events	20	27	47	63	91	60
Economic losses	42.7	76.7	140.6	217.3	670.4	514.5
Insured losses	**-**	**6.2**	**13.1**	**274**	**126.0**	**83.6**

The comparison of the last ten years with the 1960s shows a dramatic increase

Last 10:60s
2.2
6.7
13.5

Losses in US$ bn (2003 values)

Source: Munich Re, 2004

Current state of Munich Re datasets

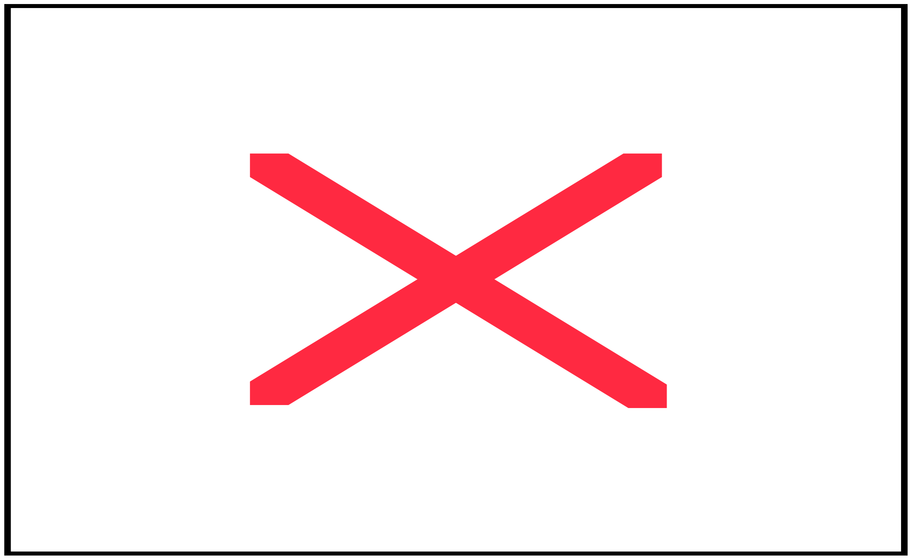
- Widely dismissed as unrelated to climate variability
- This position may be too absolute: it hasn't been rigorously investigated
- Currently being re-visited

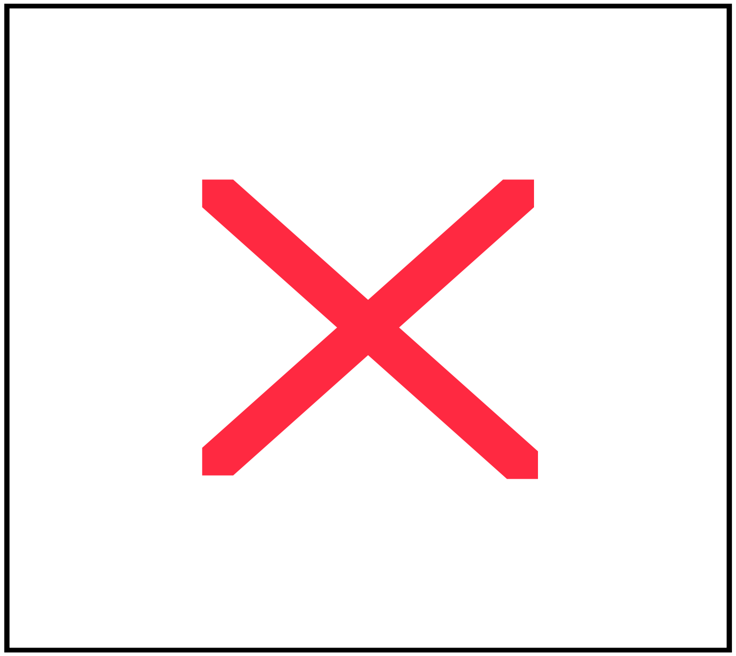
Observed impacts 1

Using the complete record to explore impacts

EU WISE study: results for the UK

Outdoor fires

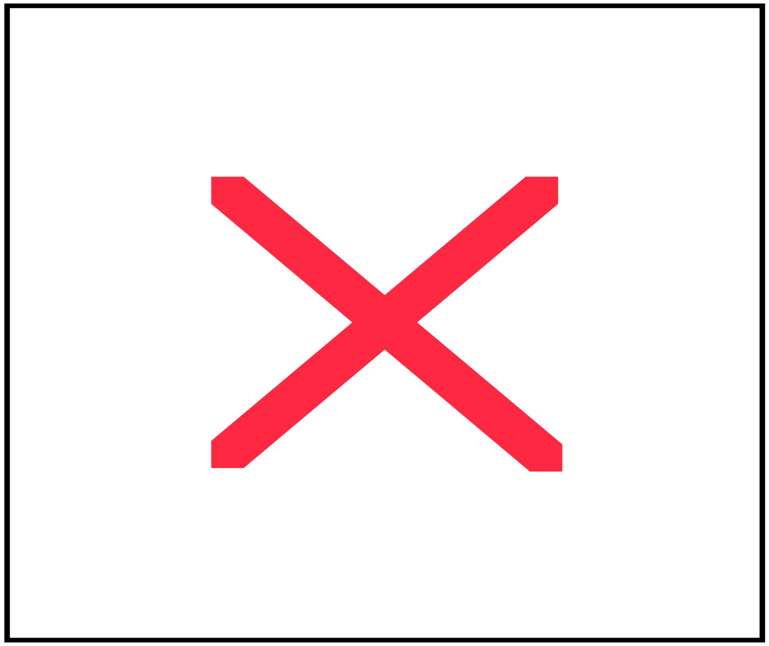




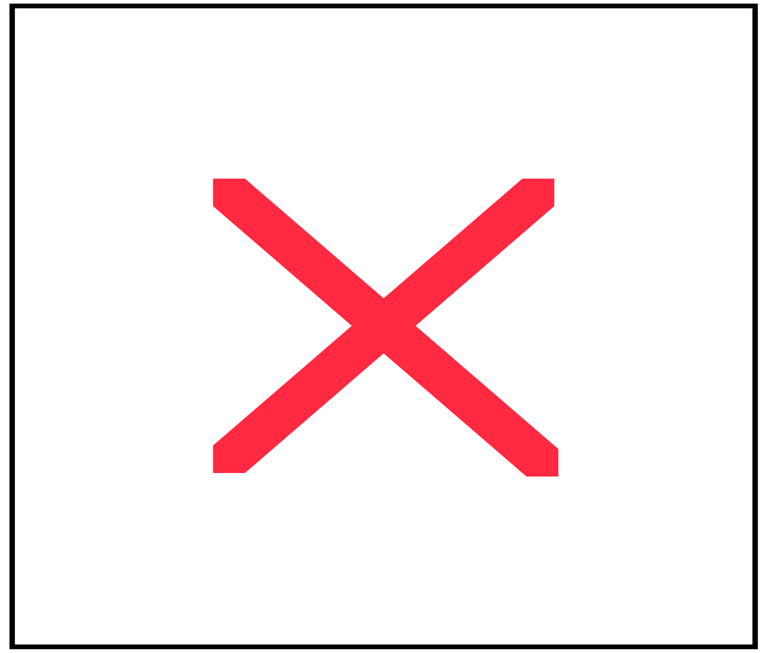
- 1degC increase in summer temperature would lead to a +55,000 (29%) increase in annual number of fires
- A decrease in summer rainfall of 10mm would lead to a +6,500 (3.5%) increase in the annual number of fires

Energy – gas consumption

Seasonal total gas sales and CET



JFMCET and JFM gas sales



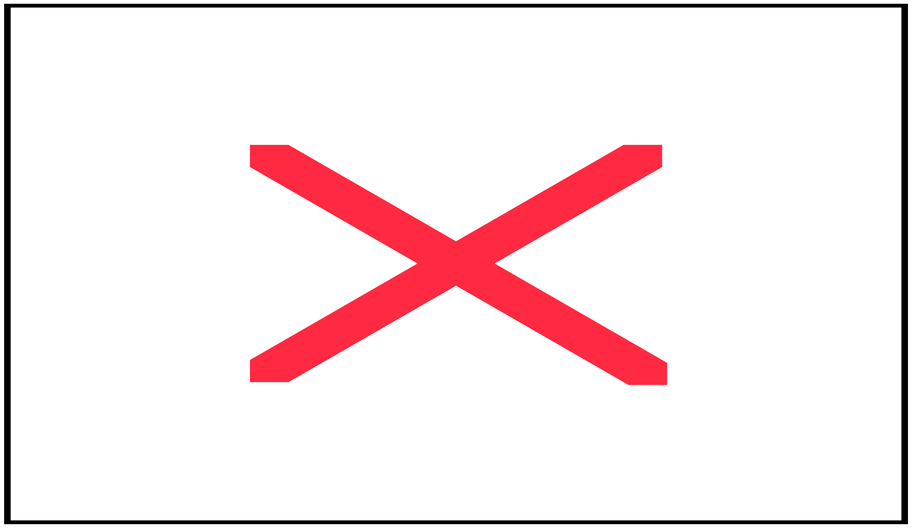
R_{all} = -0.70

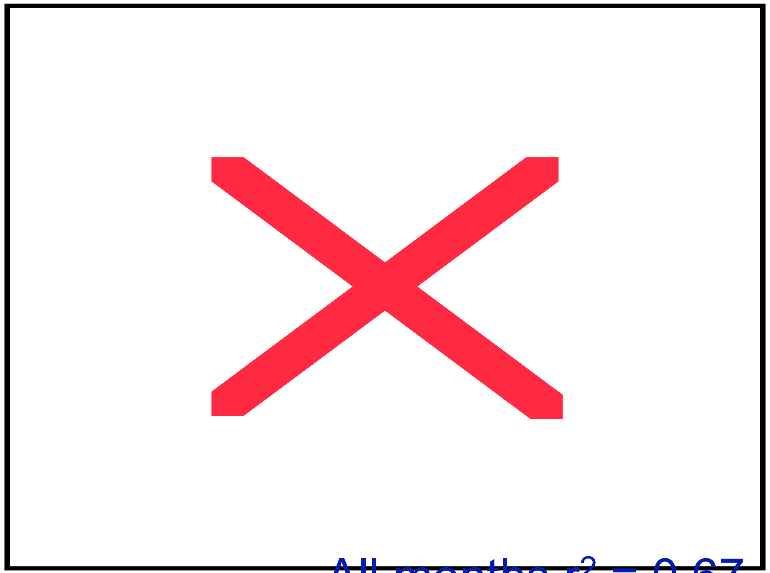
R_{JFM} = 0.84

- Temperature is the main predictor of gas demand
- A warming of 1degC should reduce domestic gas demand by 5.2% (a saving to the consumer of ~200 million EURO)
- A warming of 1degC should reduce domestic electricity demand by 2.5% (a saving of ~210 million EURO)

All cause death rate

In July, the change between a negative relationship up to ~17°C, and a direct relationship at higher temperatures, is clear. Most countries show this, but the temperature at which the change occurs varies because of acclimatization

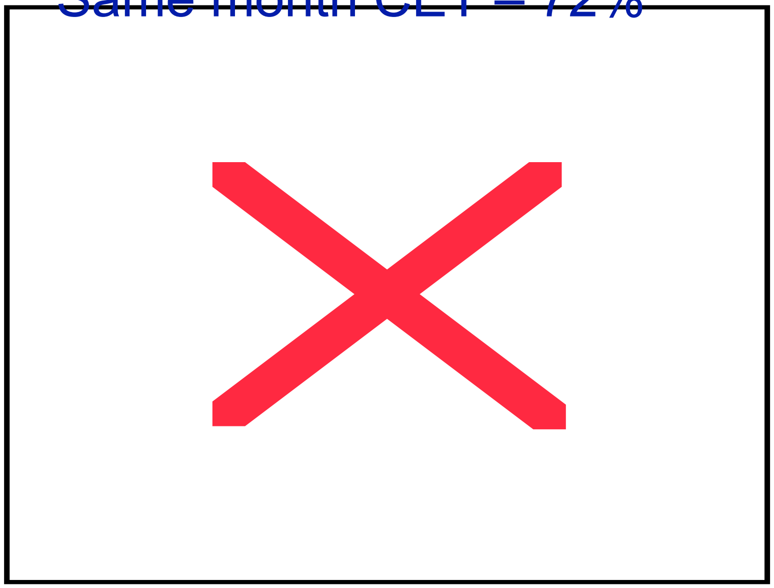




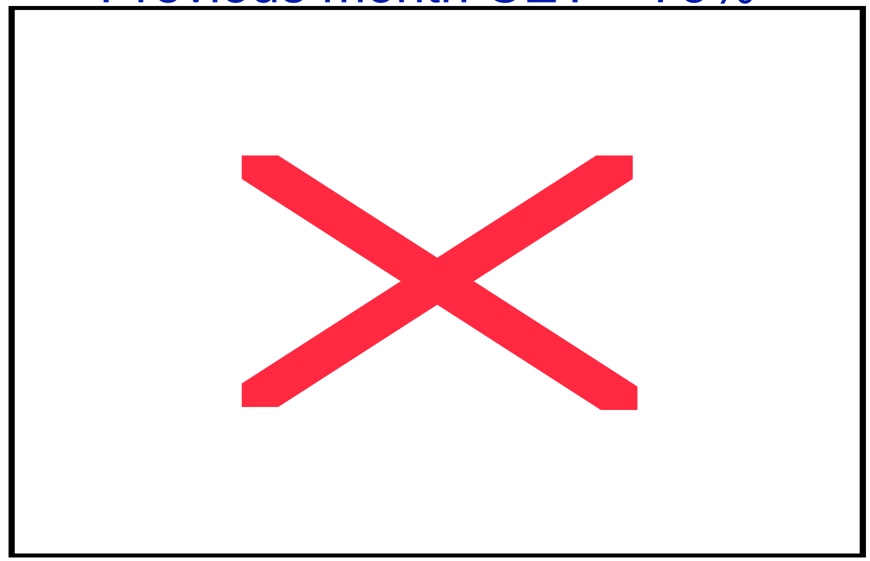
All months $r^2 = 0.67$

Food poisoning

Same month CET – 72%



Previous month CET – 75%



Increases in food poisoning notification rates due to:

- 1°C rise in temperature 4.5%
- 2°C rise in temperature 9.5%
- 3°C rise in temperature 14.8%

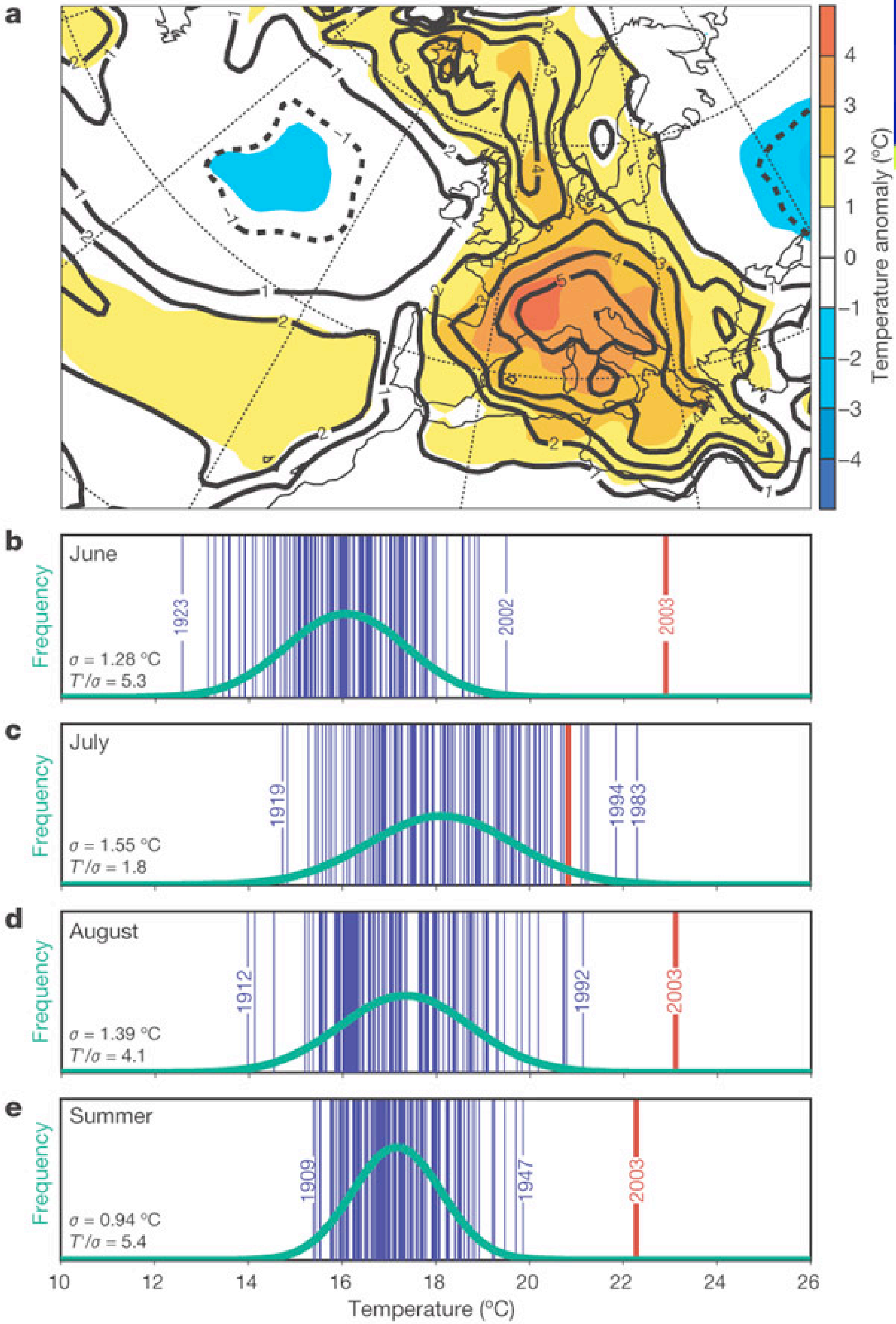
Observed impacts 2

Using extreme seasons to explore impacts:

Extreme summer of 2003

European heat wave, 2003

- Probably the hottest summer since 1500 (Stott et al, 2004)
- The heatwave is estimated to have led to the premature deaths of 15,000 people in France
- Very high night time temperatures were an important reason for the number of excess deaths.
- In Paris, temperatures did not drop below 23°C from August 7th to 14th
- The highest night time temperatures ever recorded in Paris were on 11 and 12 August: 25.5°C
- By 2040 more than half of Europe's summers are likely to exceed the record temperatures of 2003. By 2100, the summer of 2003 could even stand as unusually cool (Schar & Jendritzky, 2004).



Characteristics of the summer 2003 heatwave

Map: JJA temperature anomaly with respect to 1961–90 mean.

Graphs: Swiss monthly and seasonal summer temperatures for 1864–2003.

The values in the lower left corner of each panel are the standard deviation and the 2003 anomaly normalized by the 1864–2000 standard deviation

Victims of the hot summer of 2003 in Europe (Munich Re, 2004)

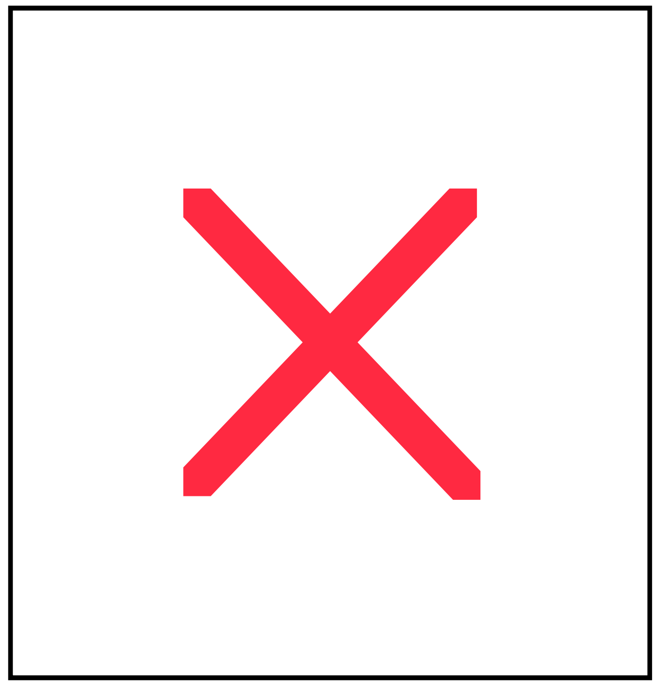
	Fatalities
France	14,800
Spain	2,000
Portugal	1,300
Italy	4,000
Germany	3,500
United Kingdom	900
Netherlands	500

Thinking about adaptation responses to extremes is important

UK water industry following the 1995 hot, dry summer

Change in leakage level:

% reduction in 1996/7 compared to 1994/5



Some thoughts

- Choice of impacts-related extremes is not simple and requires consultation
- Demonstrating a link between climate variability and impacts is straightforward:
  - whether it is extremes or the complete record
  - whether we search in socio-economic sectors, the natural environment, or primary industry
- There are confounding factors, but the signal is clear and the exercise is valuable
- The great challenge is to take the next step, to consider whether the relationships between climate variability and impacts can be extrapolated to climate change and, if so, how
- The role of adaptation, and adaptation as an impact of climate variability, is neglected and deserves greater prominence