Attribution of climate change: the Spectre of Liability

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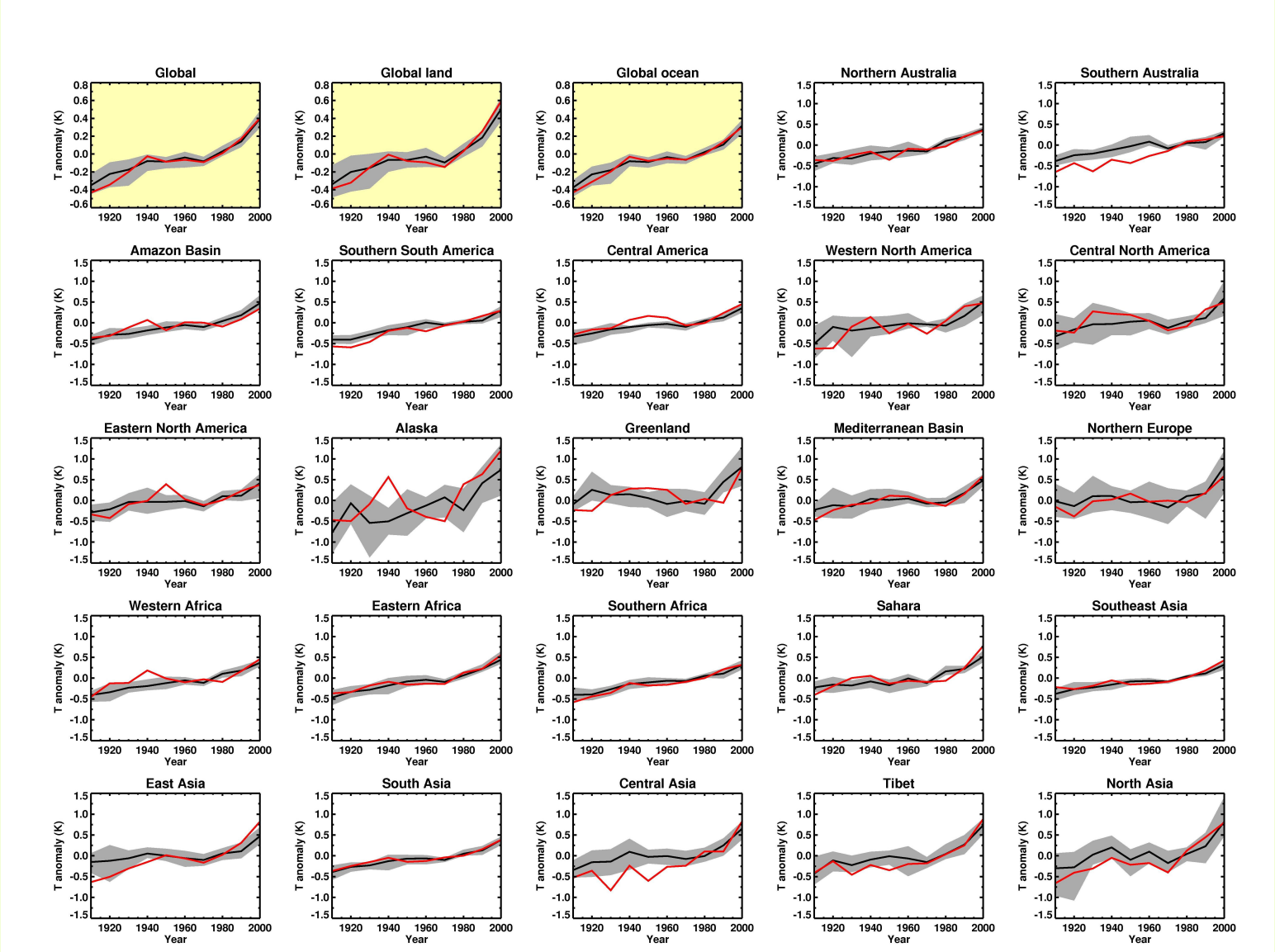
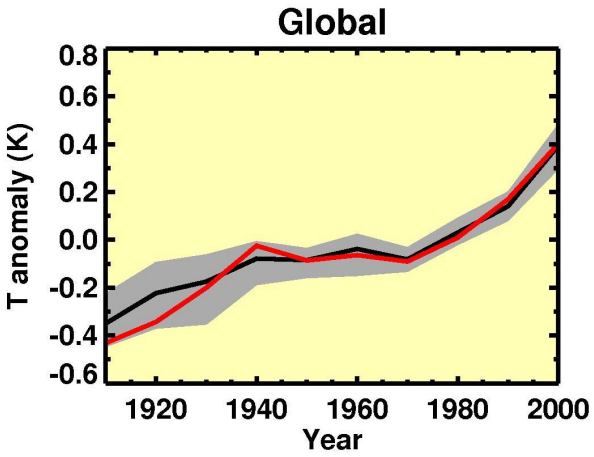
How can anyone be to blame for bad weather?

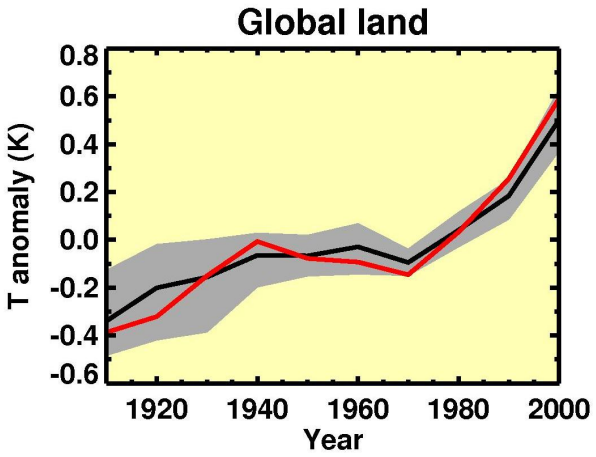
- Increasingly strong evidence for human influence on global and regional temperatures.
- Some examples of weather trends and events that *are likely* be affected by human influence:
  - 2003 Summer Heat-Wave in Europe
  - Recent warming trends in across all African regions
- Some examples of weather trends and events that *may* be affected by human influence:
  - Low-frequency changes in African rainfall
  - 2004/2005 Hurricane seasons in the Southern United States

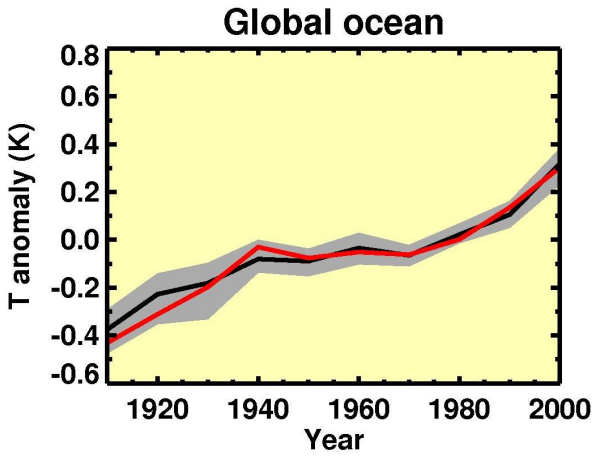
Simulated and Observed regional climate changes over the 20th century



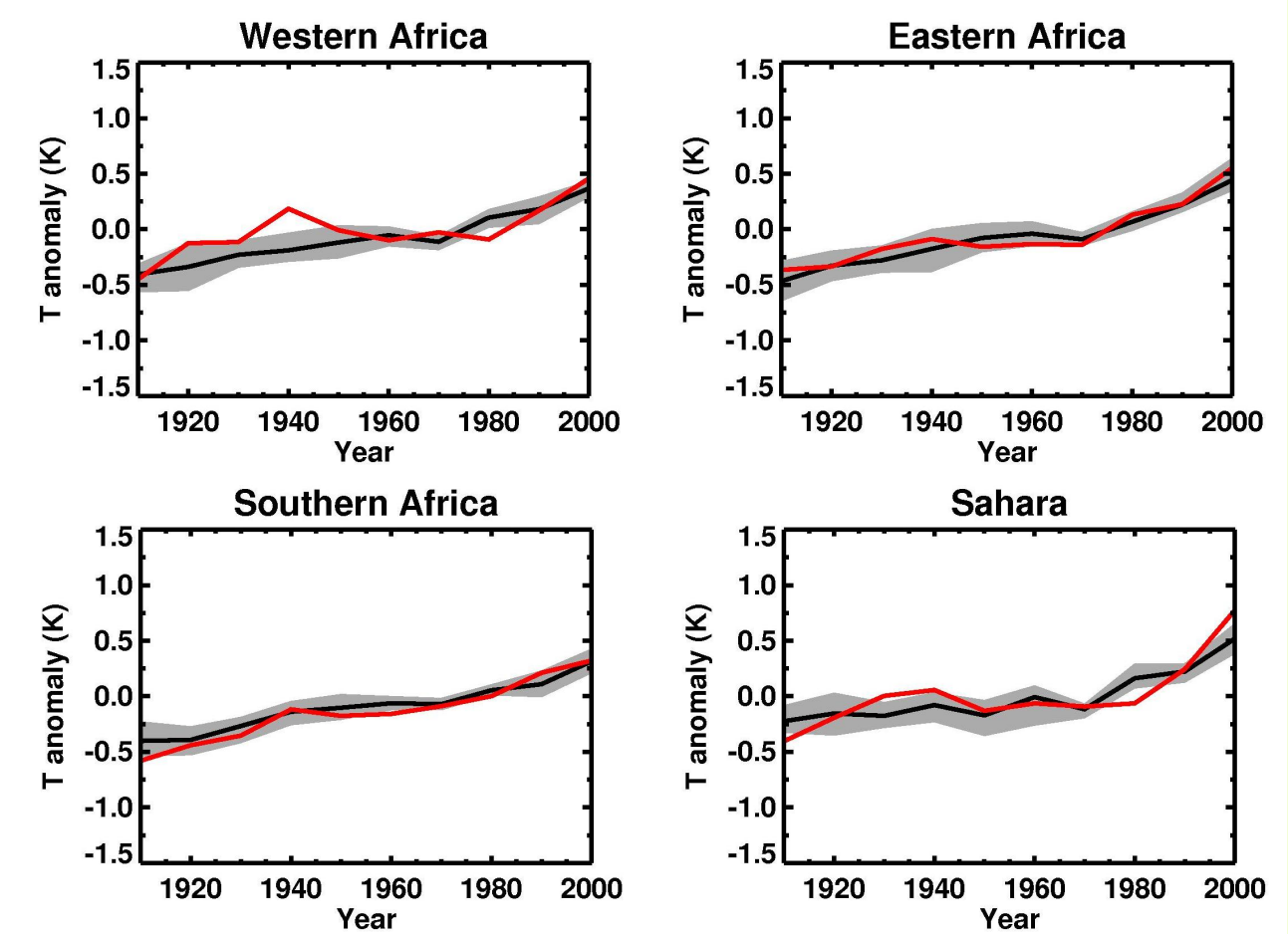
Simulated and Observed global climate changes over the 20th century







Simulated and Observed African temperature changes over the 20th century



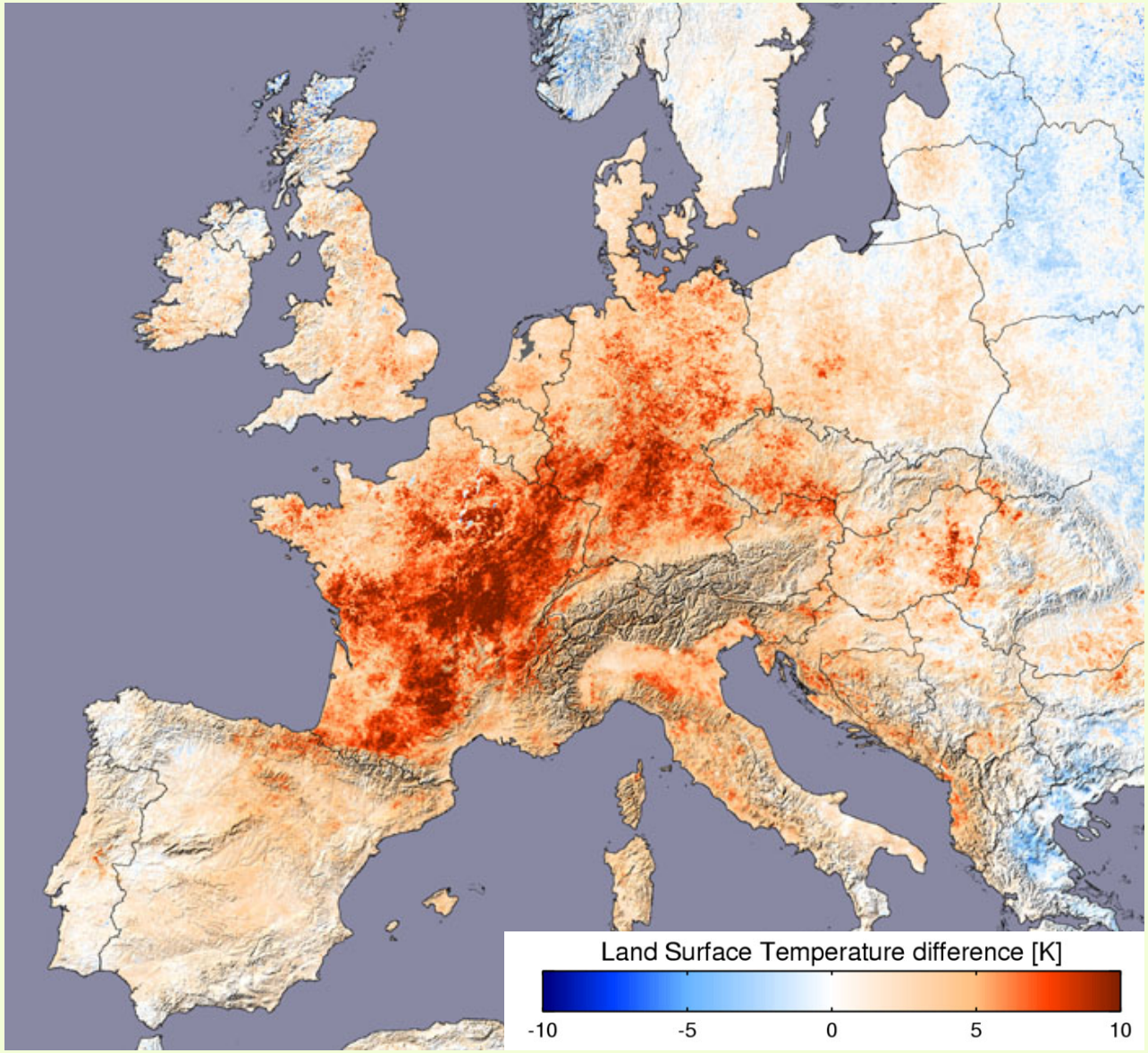
Regional temperature trends

- Most of the warming observed over the past 50 years in many regions of the world can be attributed to the influence of greenhouse gas emissions.
- But what about actual weather events?

Weather varies naturally: how can we pin down the role of climate change?

- "Climate is what you expect, weather is what you get" (Lorenz, 1982)
- and in the 21st century:
- "Climate is what you affect, weather is what gets you"
- Needed: a probabilistic, risk-based approach to attributing cause and effect.

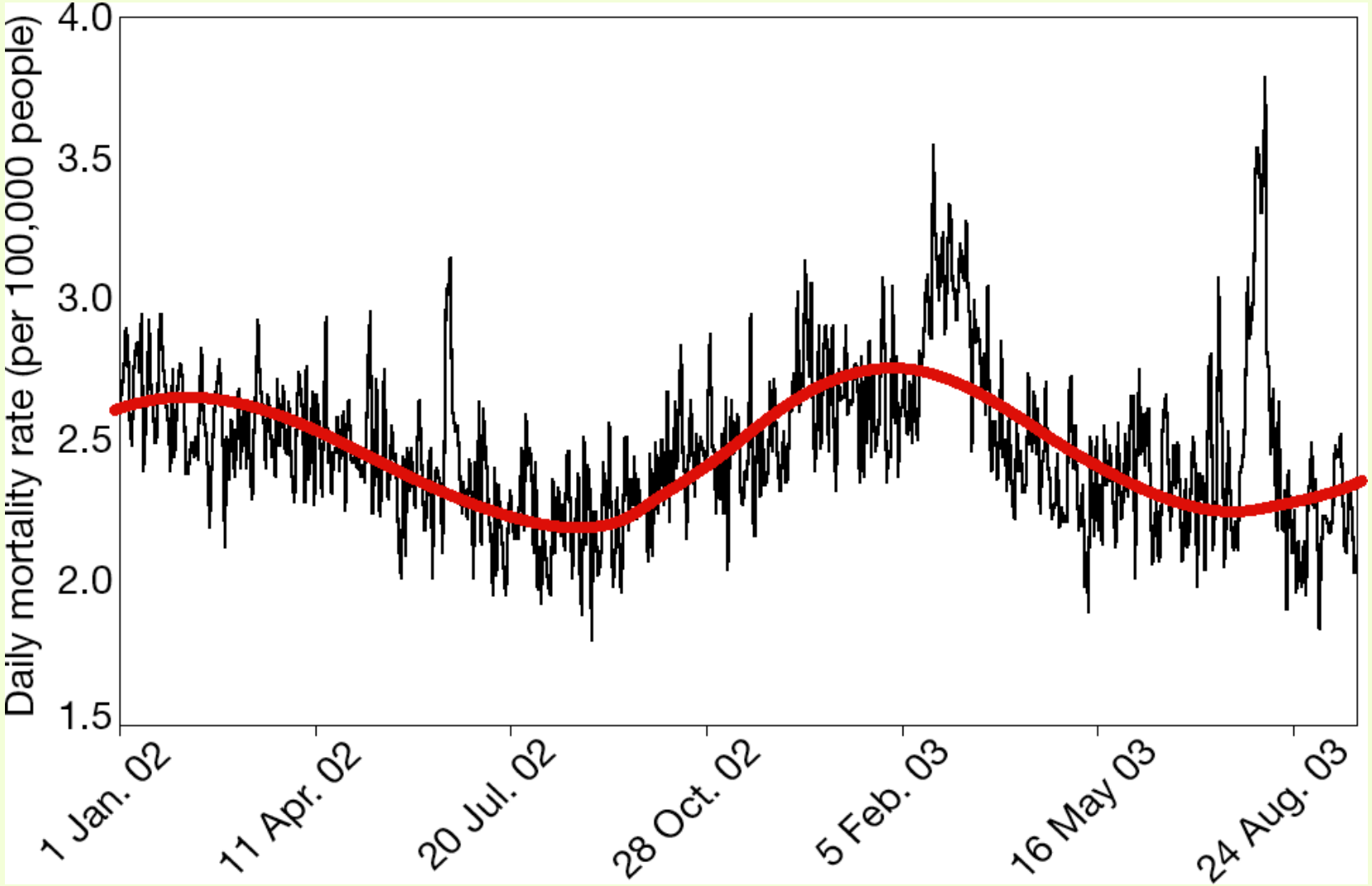
Summer 2003 temperatures relative to 2000-2004



From NASA's MODIS - Moderate Resolution Imaging Spectrometer, courtesy of Reto Stöckli, ETHZ

Heat-wave blamed for US$12.3 billion uninsured crop losses + US$1.6 billion forest fire damage

Excess mortality rates in early August 2003 indicate 22,000 - 35,000 heat-related deaths

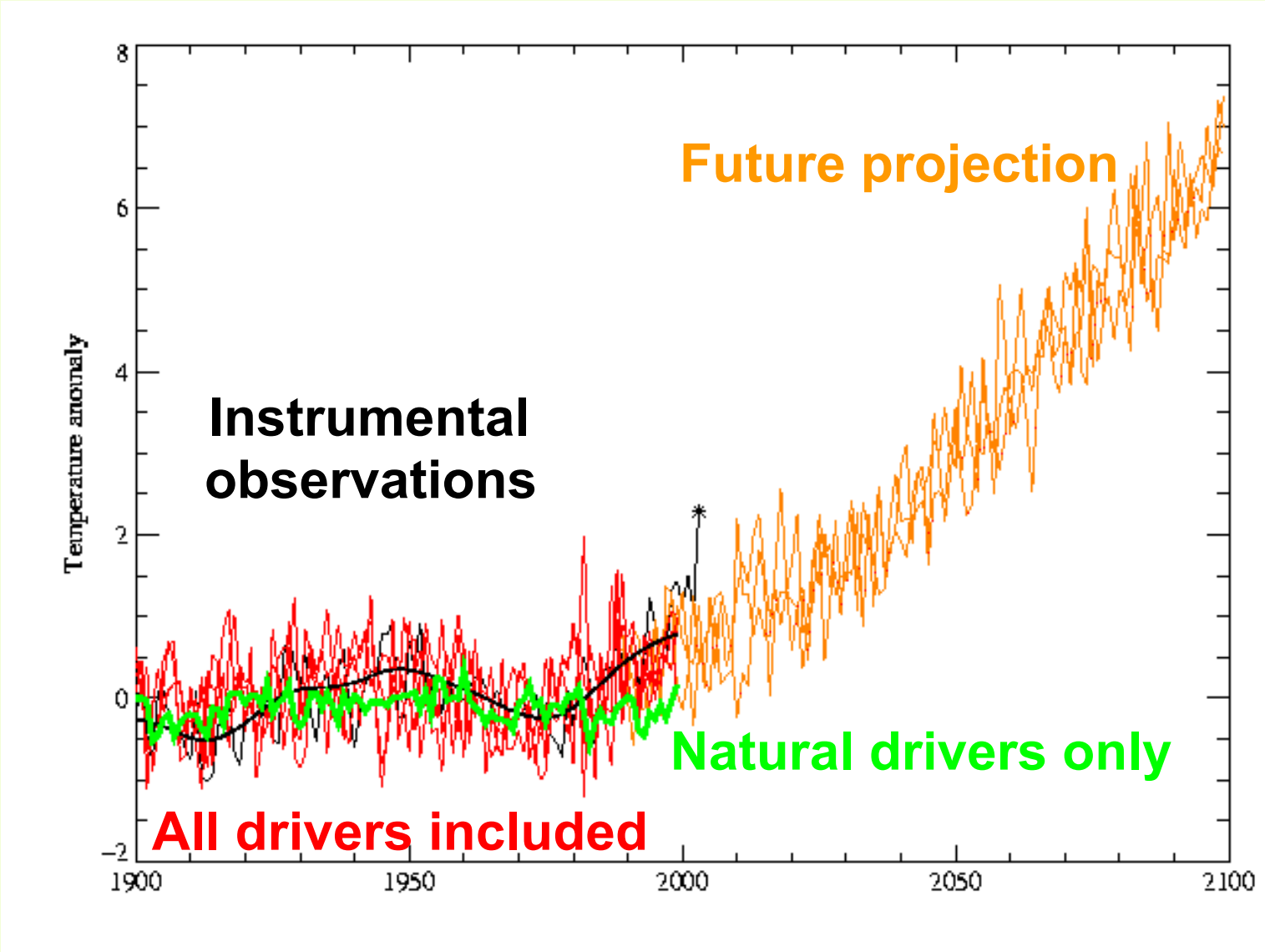


Daily mortality in Baden-Württemberg

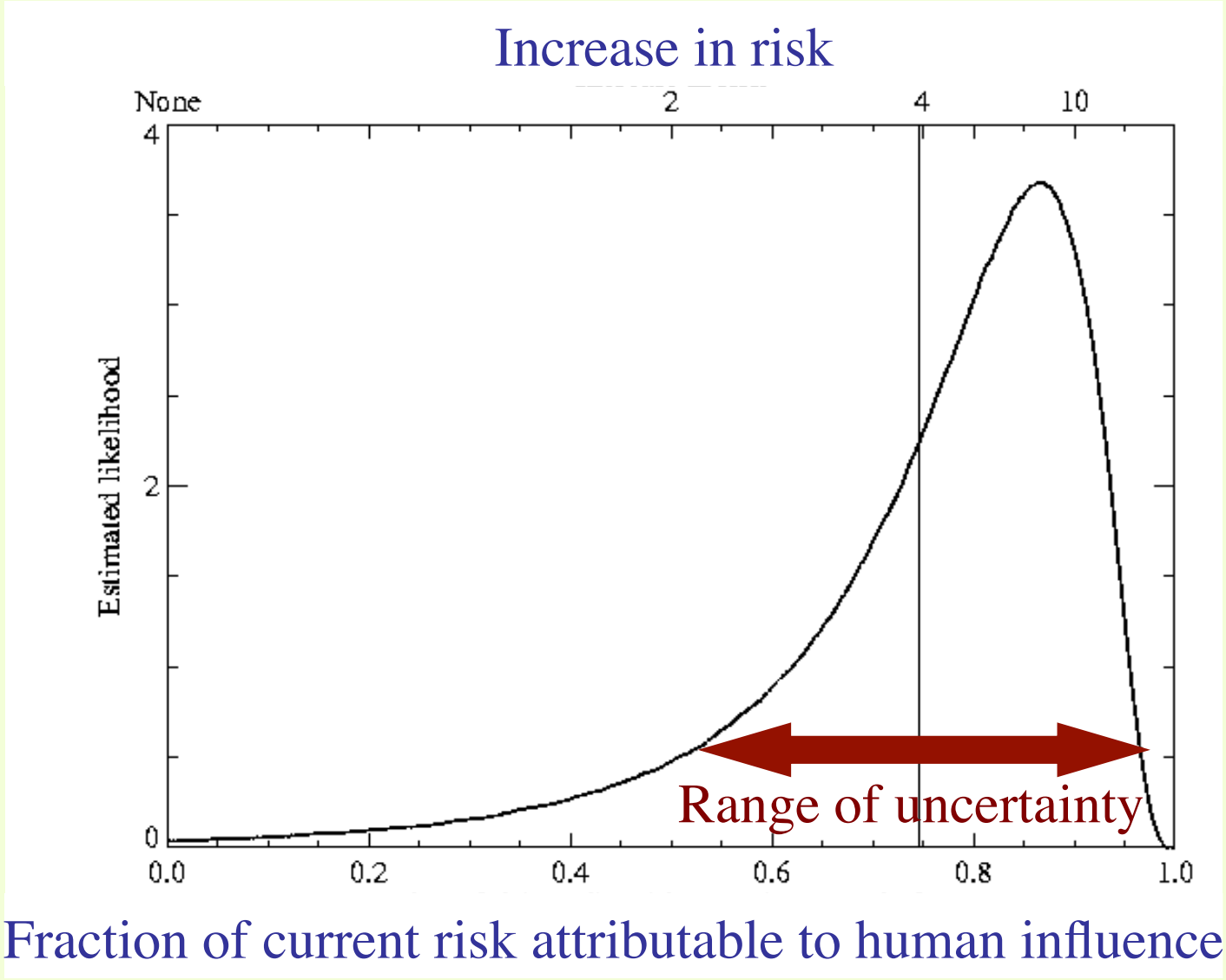
But a single heat-wave is a weather event: how can we pin down the role of climate change?

- Heat-waves (and droughts, floods etc.) occur naturally, so we will almost never be able to say that "but for" human influence on climate, this event would definitely not have occurred.
- Instead, we ask how human influence on climate has affected the *risk* of such a weather event?

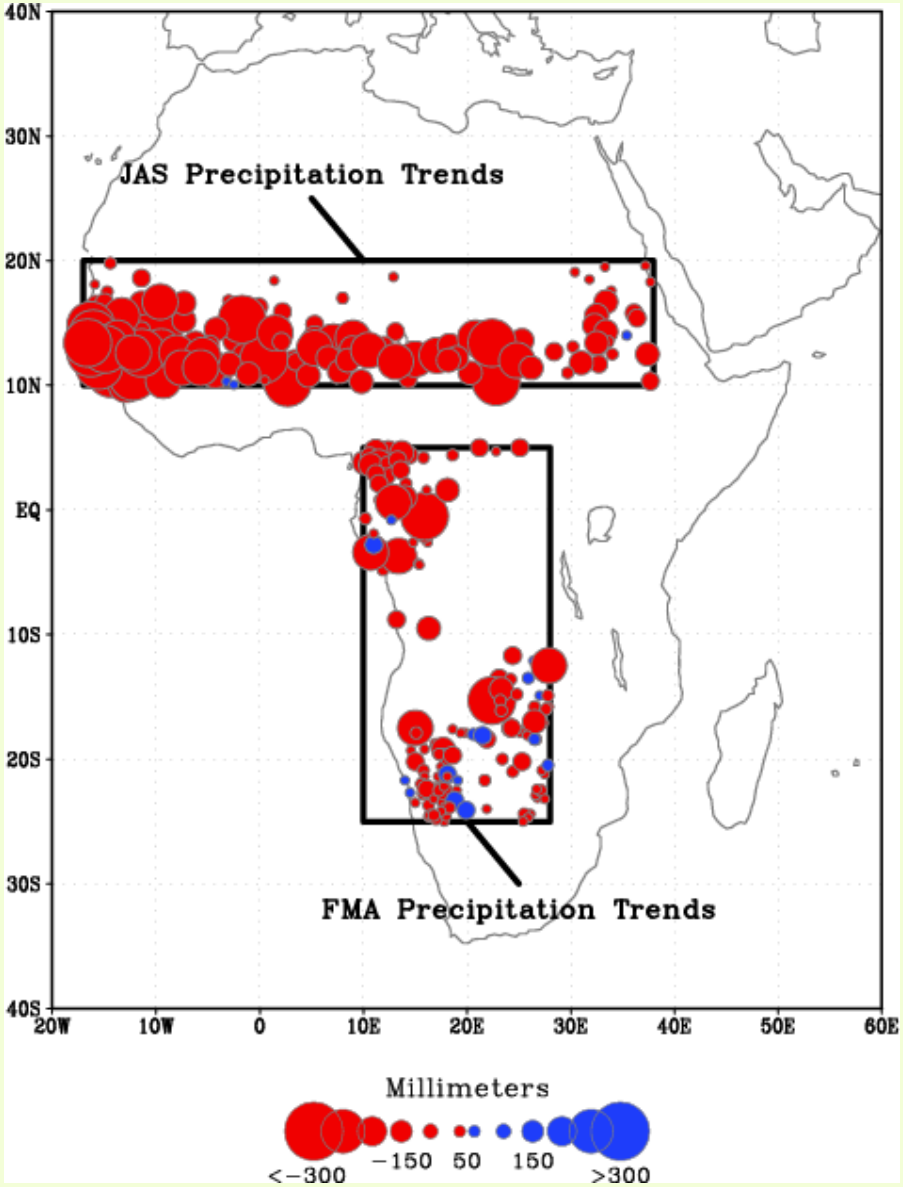
Modelling Southern European area-averaged June-July-August summer temperatures



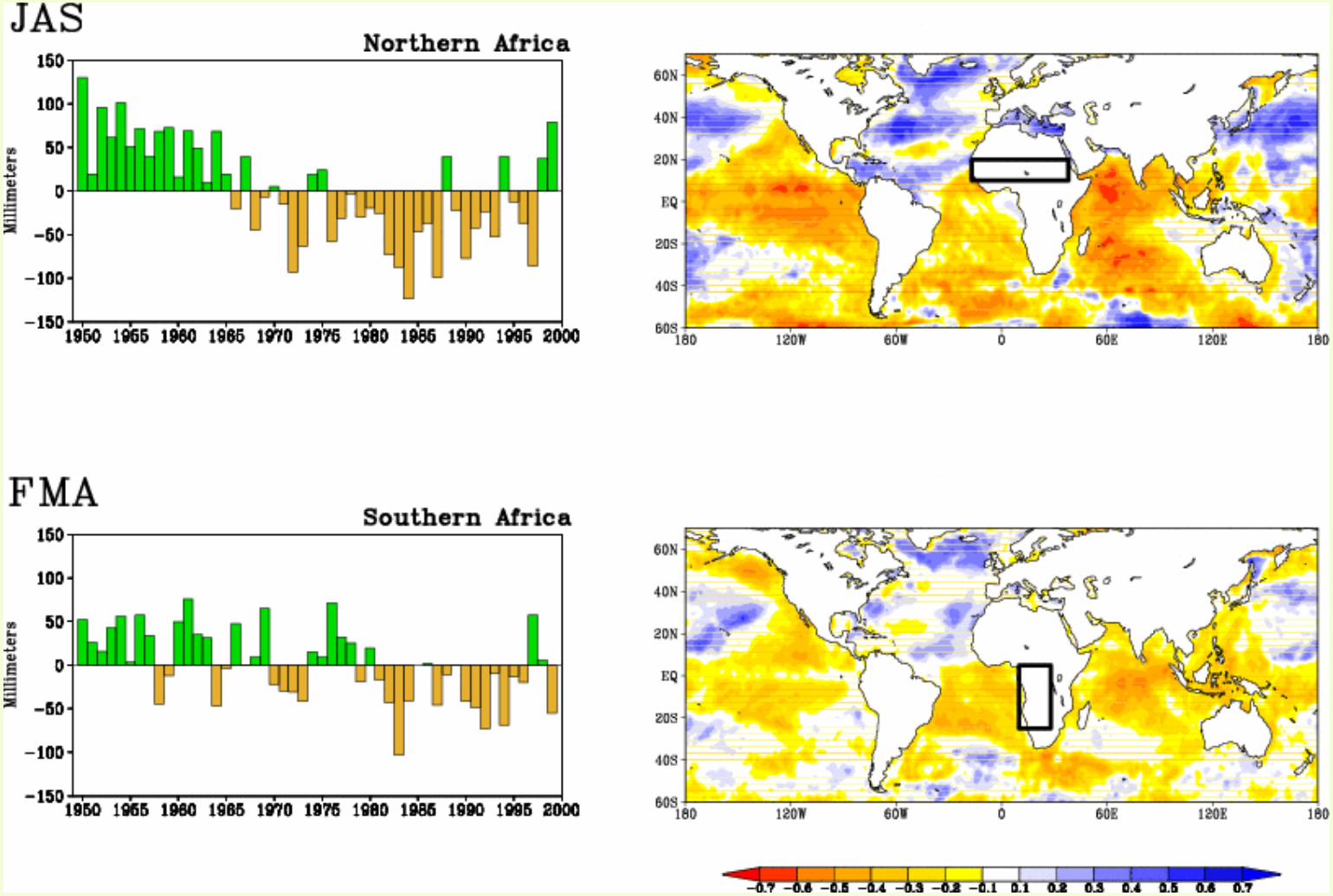
Human contribution to the risk of the 2003 heat-wave: loading the weather dice



Detection and attribution of rainfall trends in Africa: figures courtesy of Martin Hoerling, NOAA-CIRES

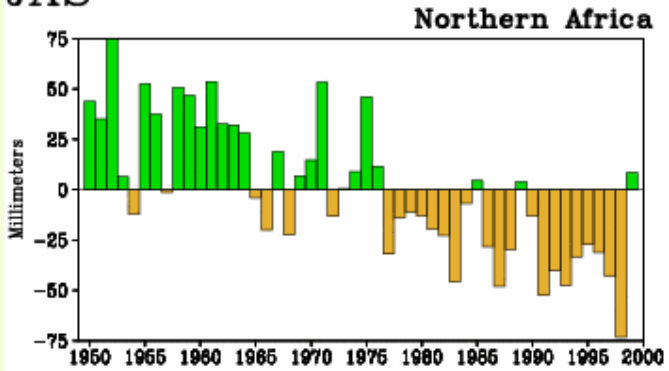


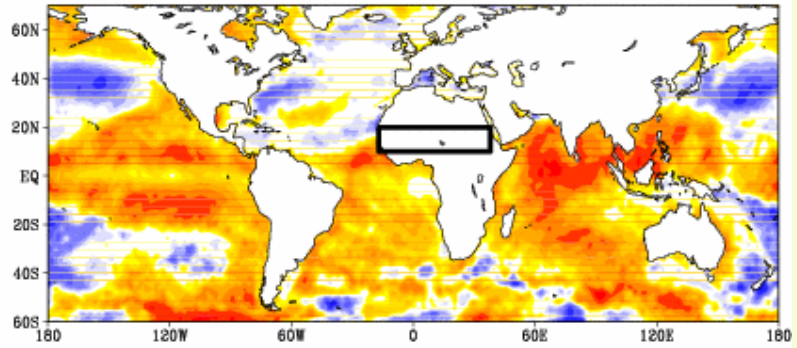
Sea surface temperature patterns associated with rainfall trends: observed



Sea surface temperature patterns associated with rainfall trends: simulated

JAS





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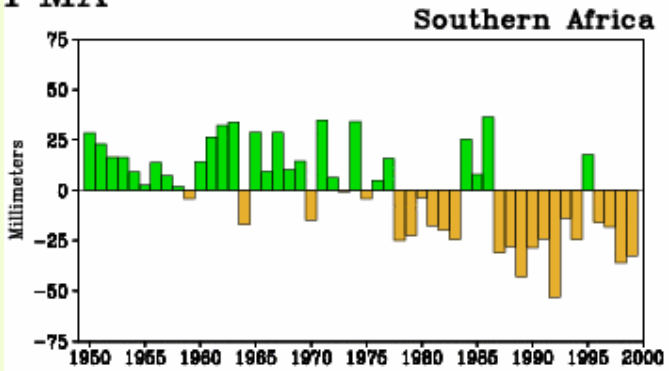
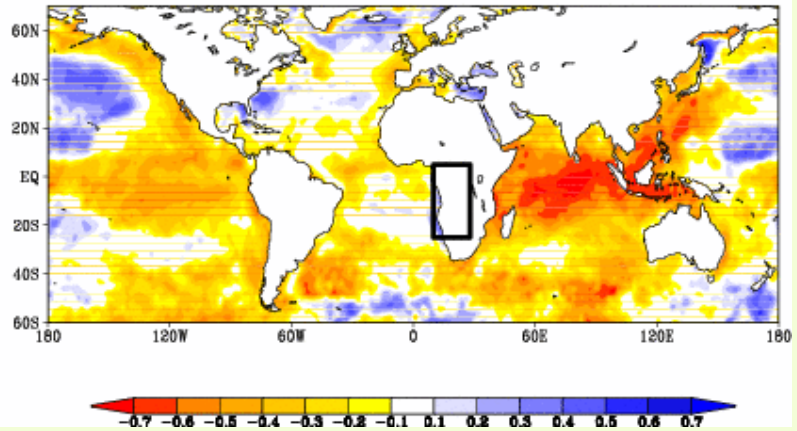
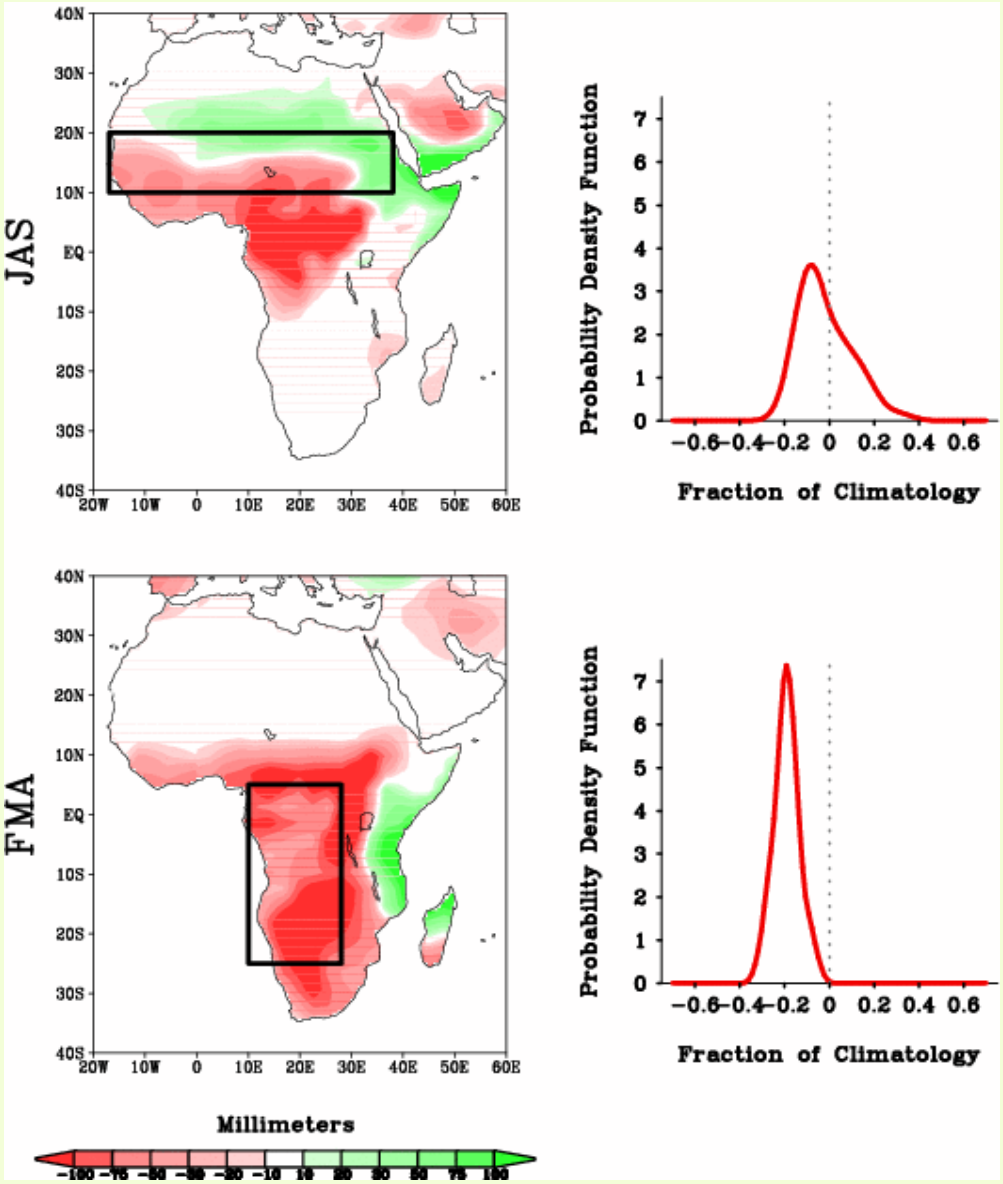
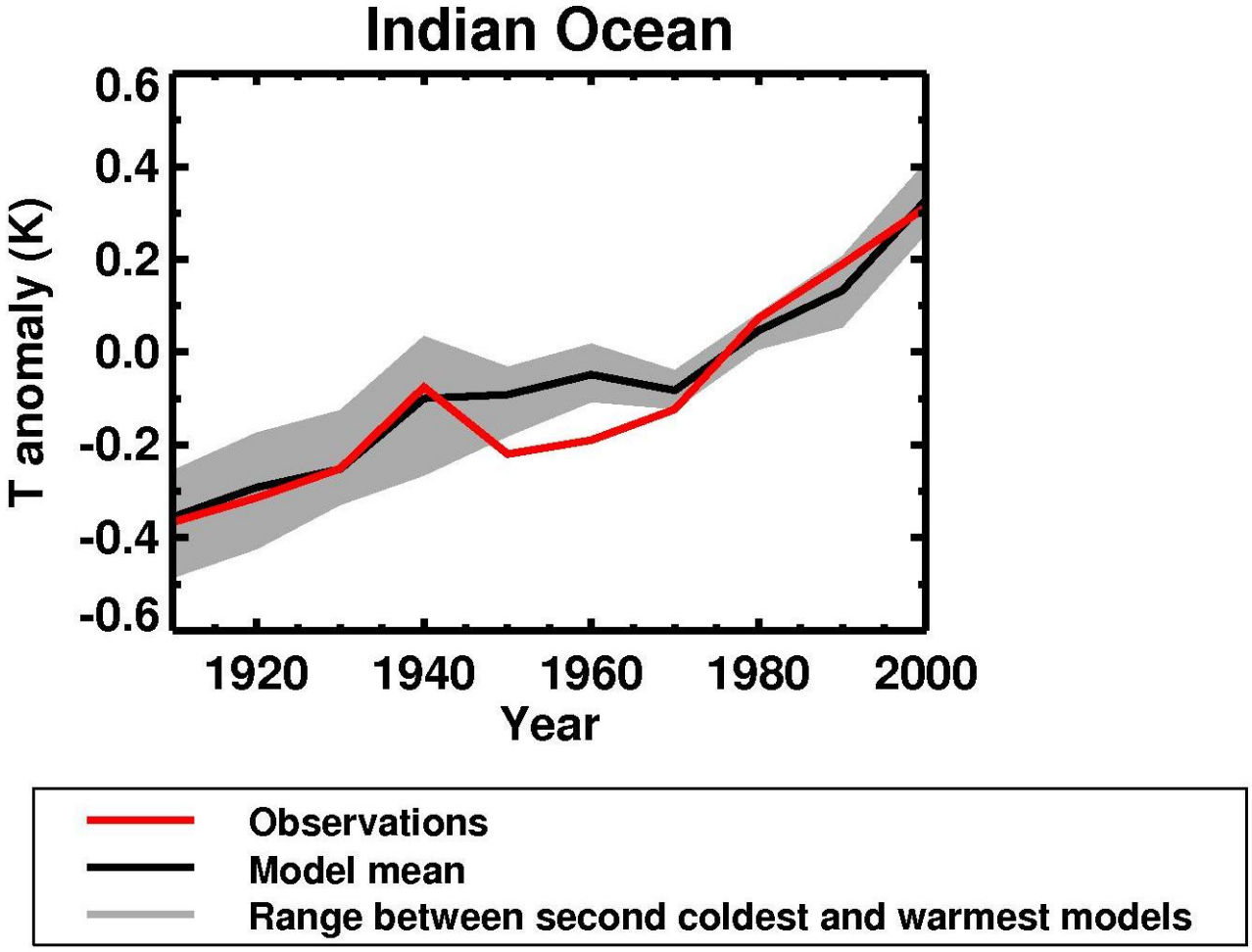




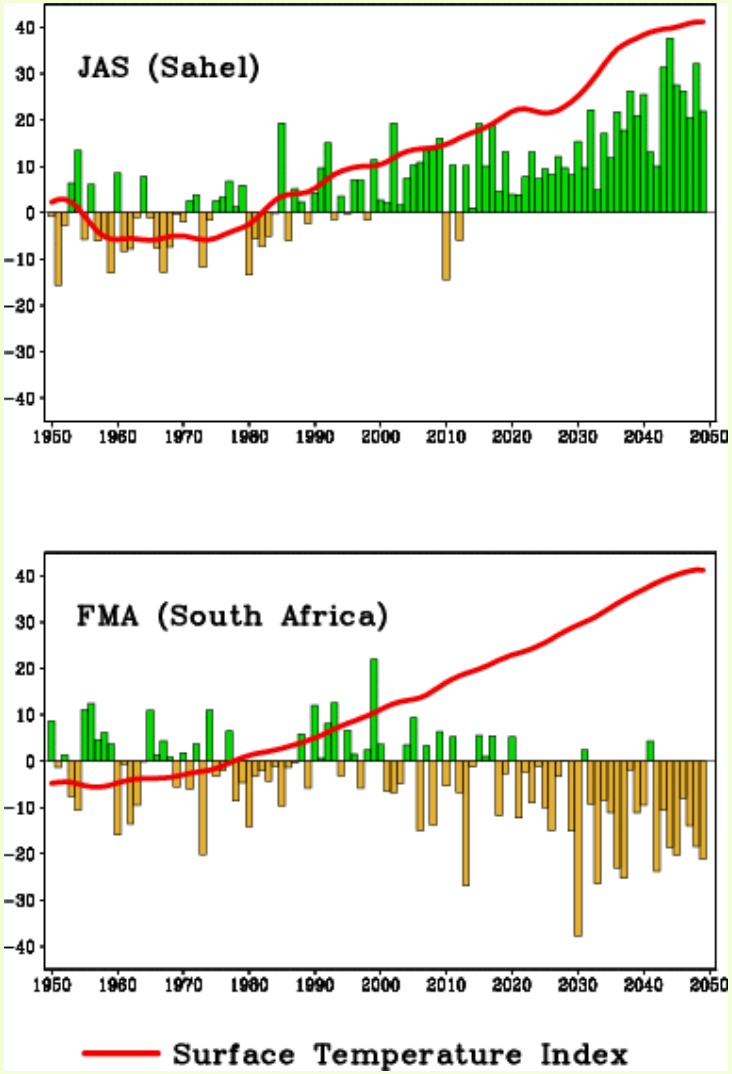
Impact of Indian Ocean warming on African Rainfall



Most of the Indian Ocean warming over the past 50 years is attributable to human activity



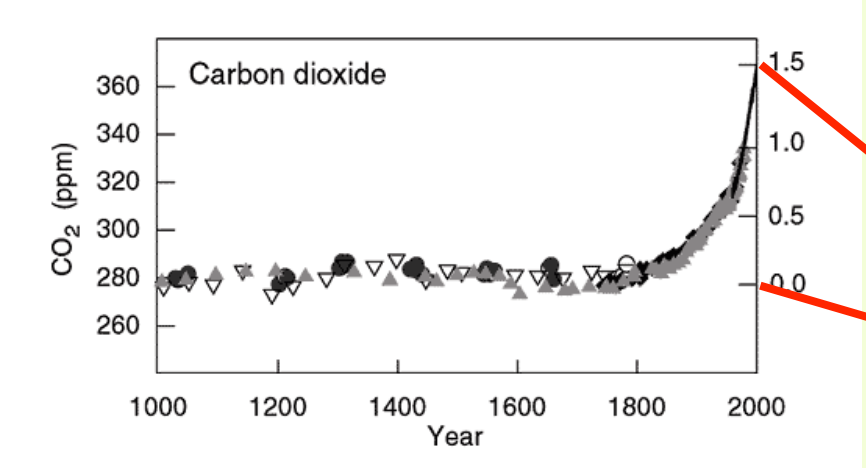
Sahel rainfall trends are projected to reverse while SA drought is projected to worsen

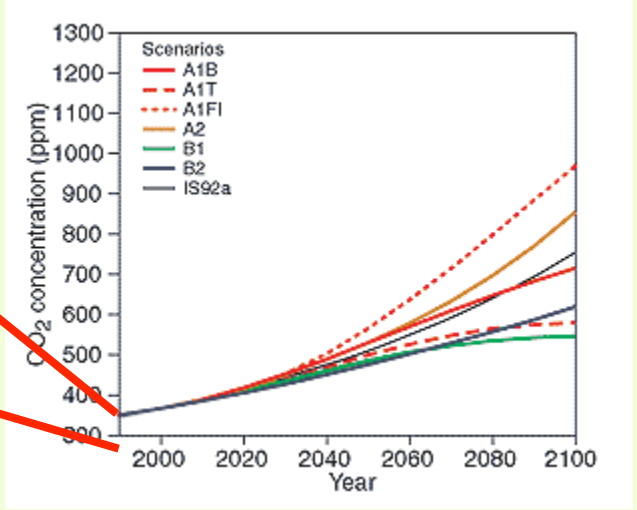


Attribution of trends in African rainfall

- Latest simulations (Hurrell and Hoerling, 2005) suggest a strong role for large-scale sea surface temperatures in both Sahel and Southern African rainfall trends.
- Sahel drought may reverse, possibly as a result of the changing balance between greenhouse warming and aerosol cooling.
- Southern African drought is more closely linked to warming temperatures in the Indian Ocean, which are attributable to human influence, and are likely to get worse.

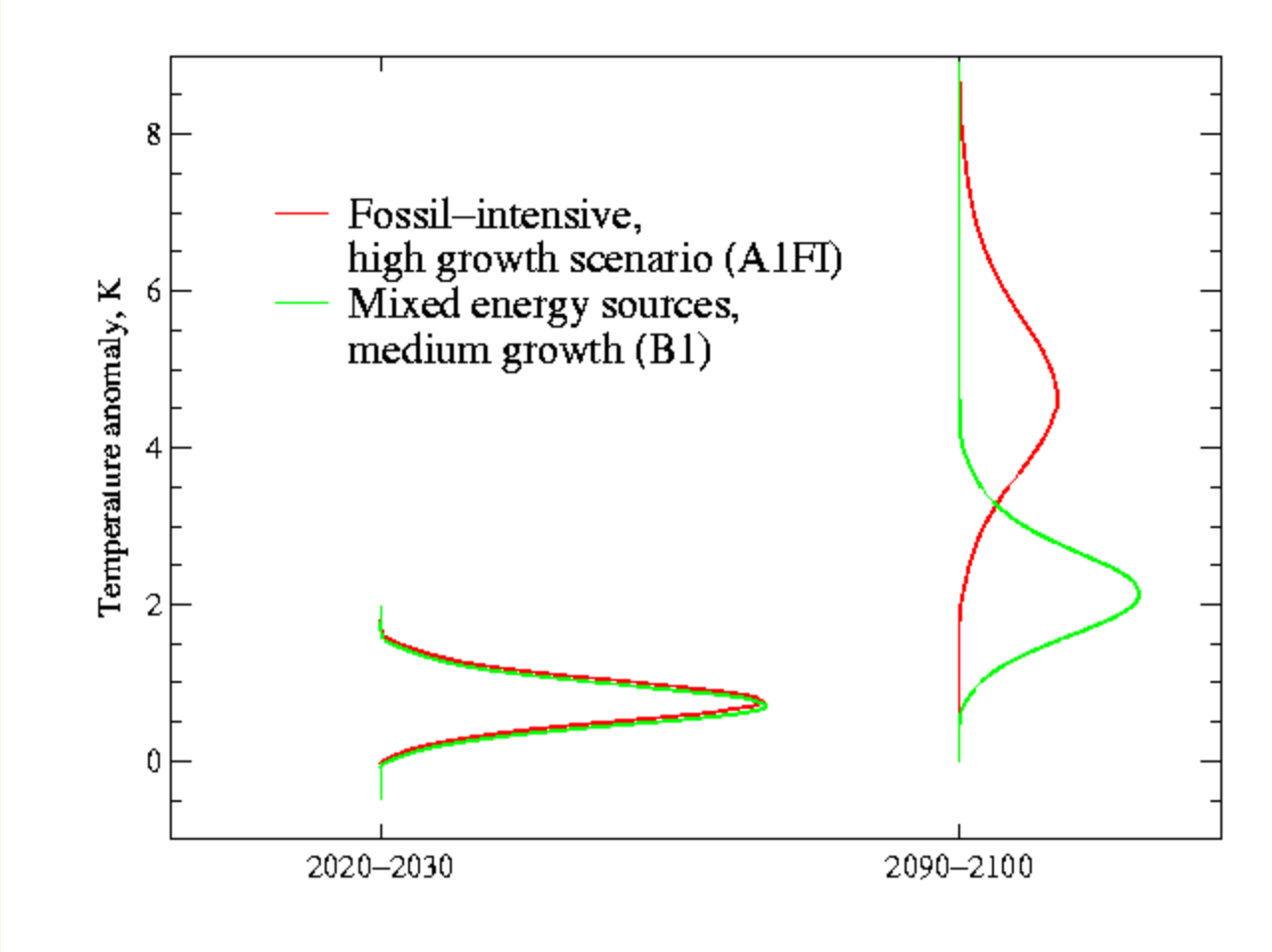
So how bad could it get? How will these risks change over the next century?



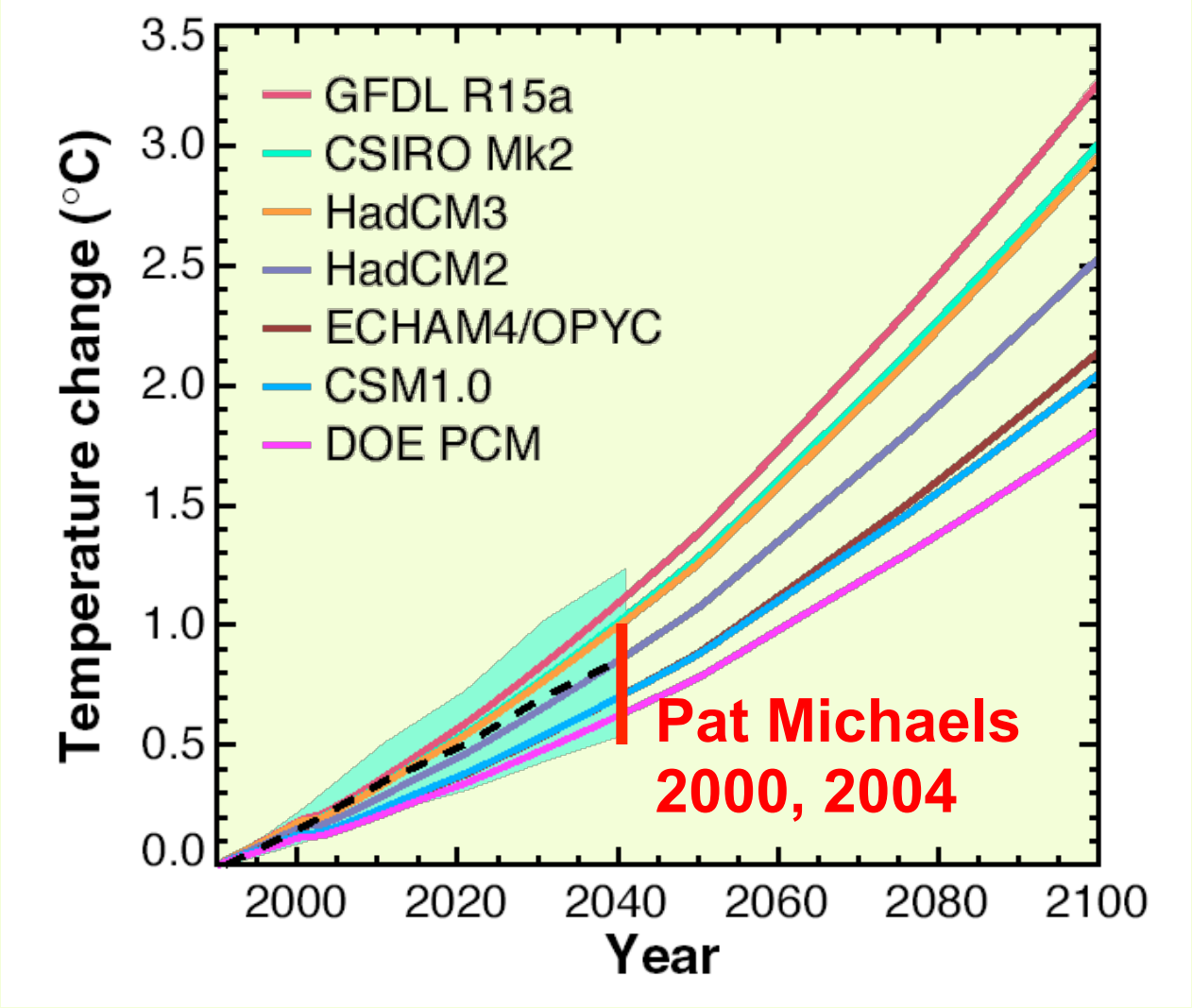


Note different scale! IPCC Third Assessment Report

Uncertainty in global warming under two scenarios of future emissions



There is a very high level of consensus in the range of responses over the next few decades



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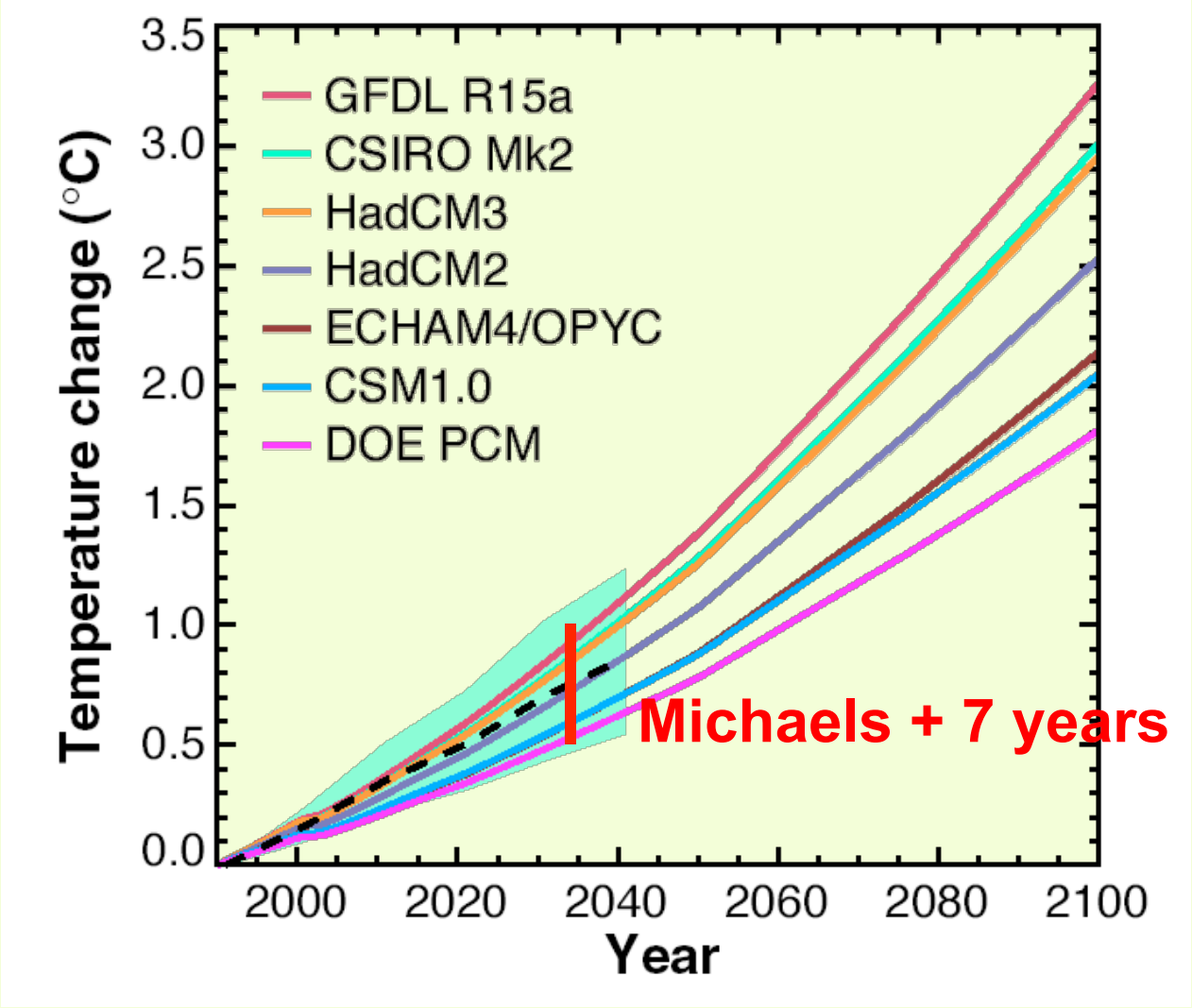
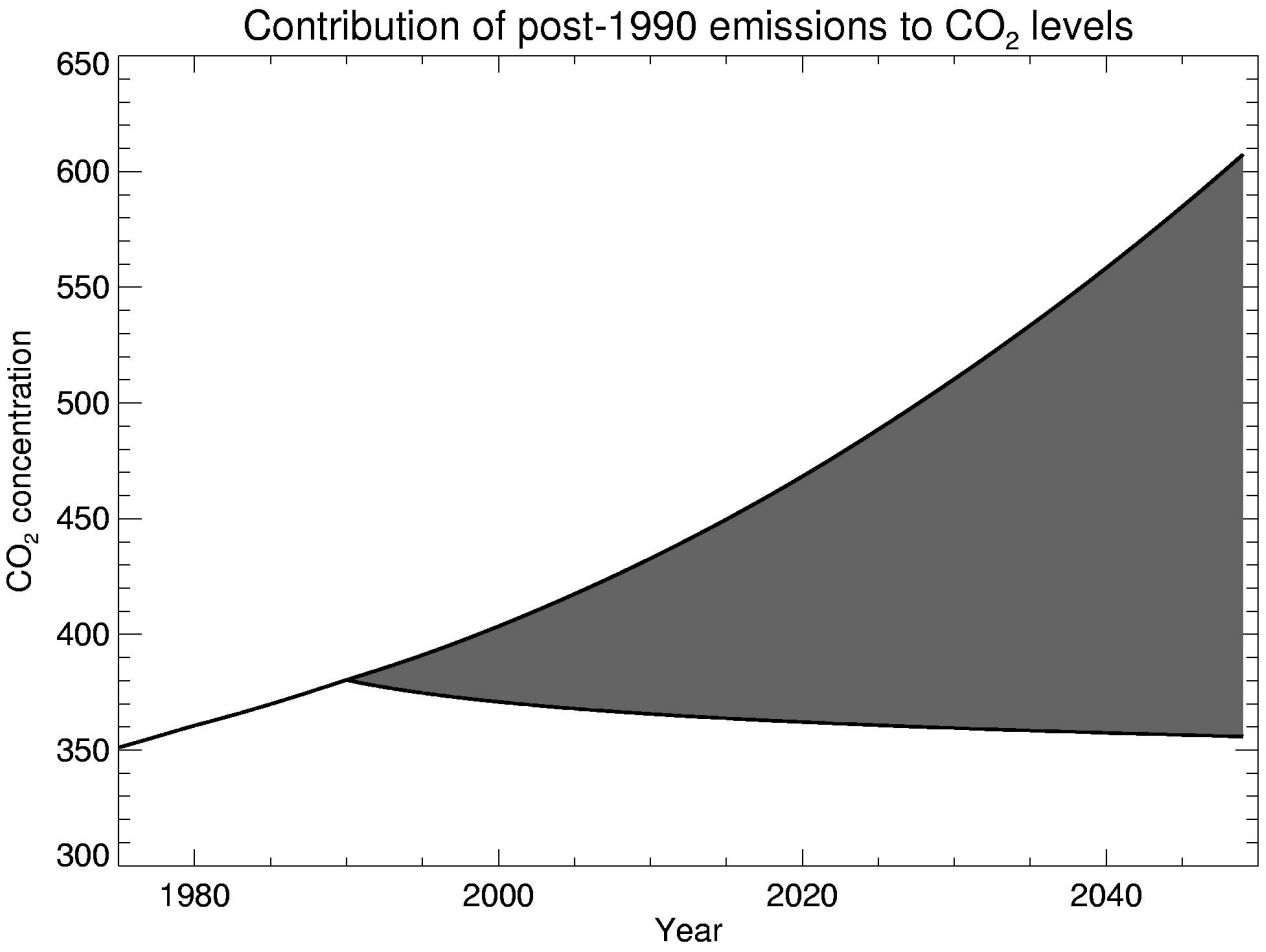


The Spectre of Liability

- Modest background warming substantially increases the risk of extreme high temperatures.
- It is likely (90% confidence) that past human influence on climate was responsible for at least half the risk of the 2003 European summer heat-wave.
- "Plaintiffs ... must show that, more probably than not, their individual injuries were caused by the risk factor in question, as opposed to any other cause. This has sometimes been translated to a requirement of a relative risk of at least two." (Grossman, 2003)

By the 2030s, >50% of anthopogenic GHG loading will be due to post-1990 emissions



Civil liability: a new paradigm for redistributing the costs of climate change?

- The contribution of past greenhouse gas emissions to some current climate risks may already exceed 50%, the threshold for civil tort actions.
- Over the coming decade, both the cost and the inevitability of climate change will become clearer, fuelling demands for compensation for:
  - Flooding and droughts
  - Heat wave damages and deaths
  - Threats to water supplies, especially from glacial sources
  - Coastal erosion and (possibly) hurricanes

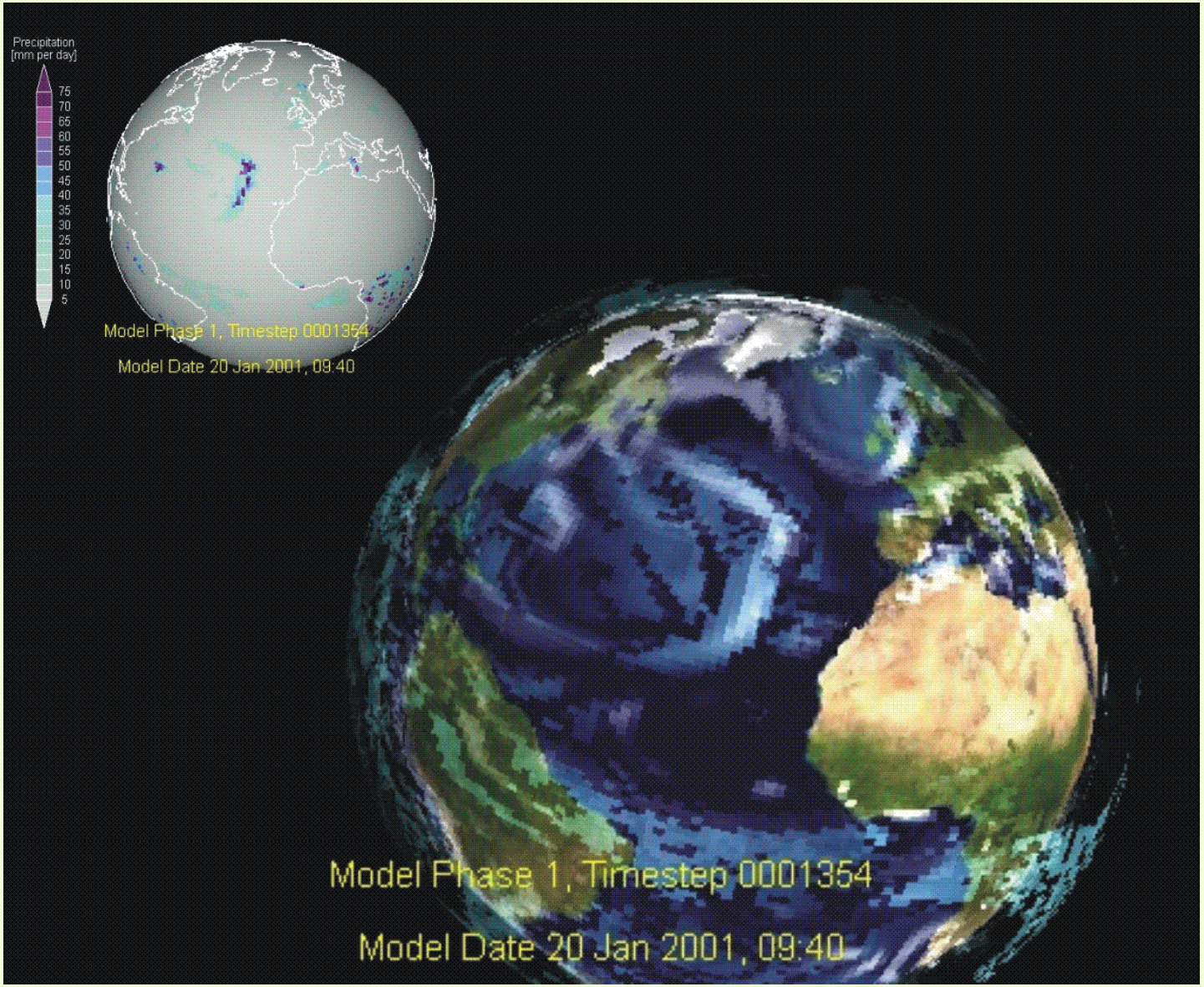
Power to the people

- Politicians tend to talk about climate change as an environmental or ethical issue: care for polar bears or future generations.
- To be addressed by regulation, on their timetable.
- This diverts attention from the injustices that are happening now: all benefit from burning fossil fuels, but some are losing out much more than others from the impacts of climate change.
- The risk, even if remote, of a successful class-action damages suit would have far more impact than any conceivable follow-up to the Kyoto Protocol.

But what could be done?

- Fossil fuels are still remarkably cheap, since we pay for the cost of extraction (and profits), not the cost of their impact.
- The current profit to be made on many sources of fossil fuel may exceed industry estimates of the cost of sequestering (burying) the carbon they generate.
- If politicians were to apply the “Polluter Pays Principle” to producers of fossil fuels, this would change rapidly: it might well make more sense to bury carbon than to risk liability.
- Countries at high risk, but which have contributed very little so far, should be lobbying hard for this.

Beware the Danae when they come bearing gifts

- The European Commission is arguing for Kyoto-style emission regulations as the way forward to control climate change.
- In their Environmental Directive of 2004, they explicitly advised that civil liability "for large-scale environmental problems to which many actors contribute" should be pre-empted if a regulatory regime is in place.
- Are these connected?

How you can help: join in our experiment simulating “The Climate that Might Have Been”