From the Desert: an Arab - North African Perspective on Climate Change

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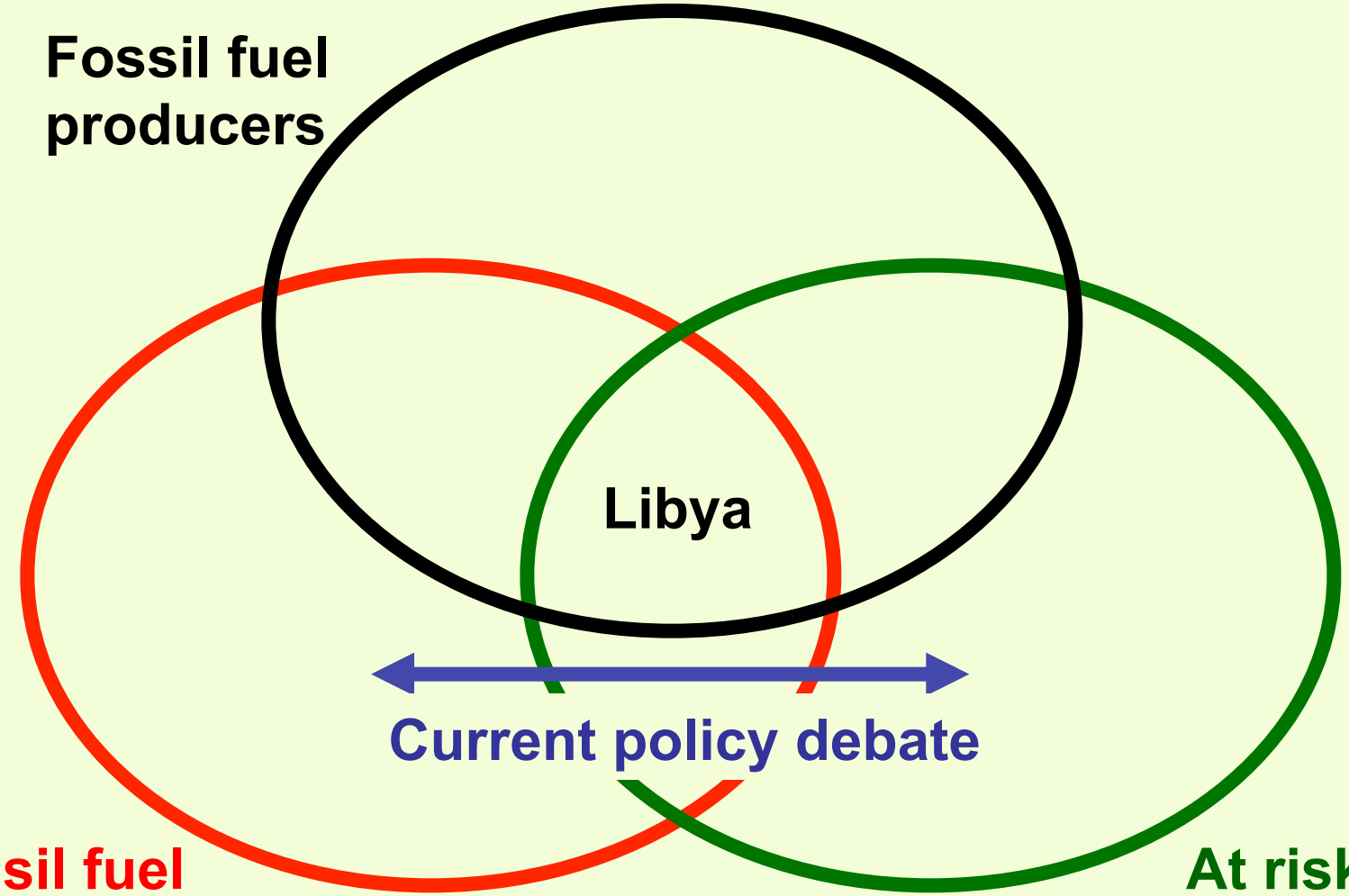
Libya at the nexus of the climate change issue



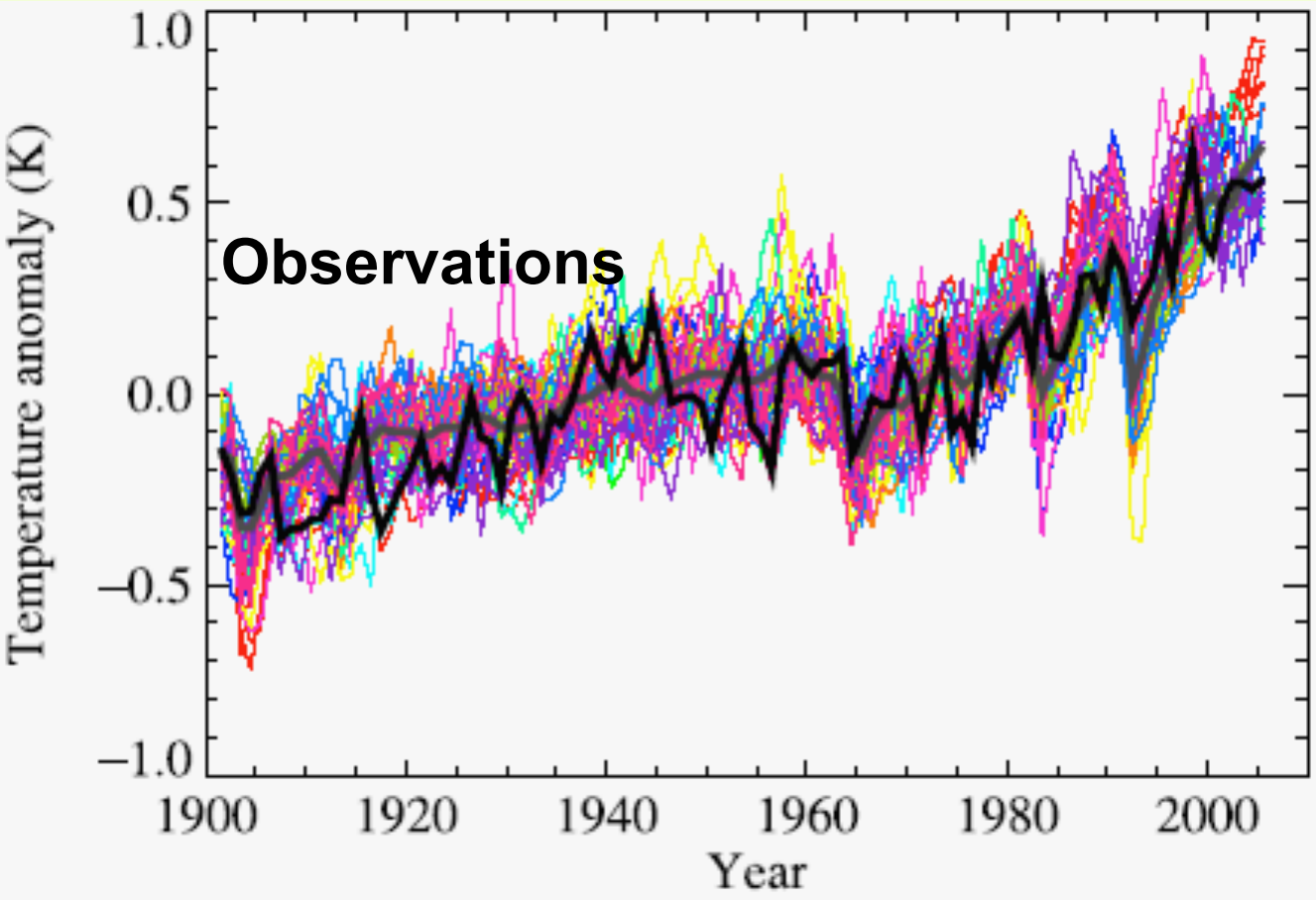
Why we need a new perspective on the climate change issue

- There are three major stakeholders in this issue:
  - Fossil fuel producers.
  - Fossil fuel consumers.
  - Everyone at risk from climate change ("the impacted").
- The mantra "climate change affects us all" is misleading: it affects some much more than others.
- Impacts are increasingly clear and will likely lead to meaningful action to reduce emissions by the 2020s.
- The current policy focus is on measures that are:
  - Economically inefficient.
  - Environmentally ineffective.
  - Directly opposed to the interests of fossil fuel producers.

Myth: Climate has always varied, so the present trend is nothing to worry about

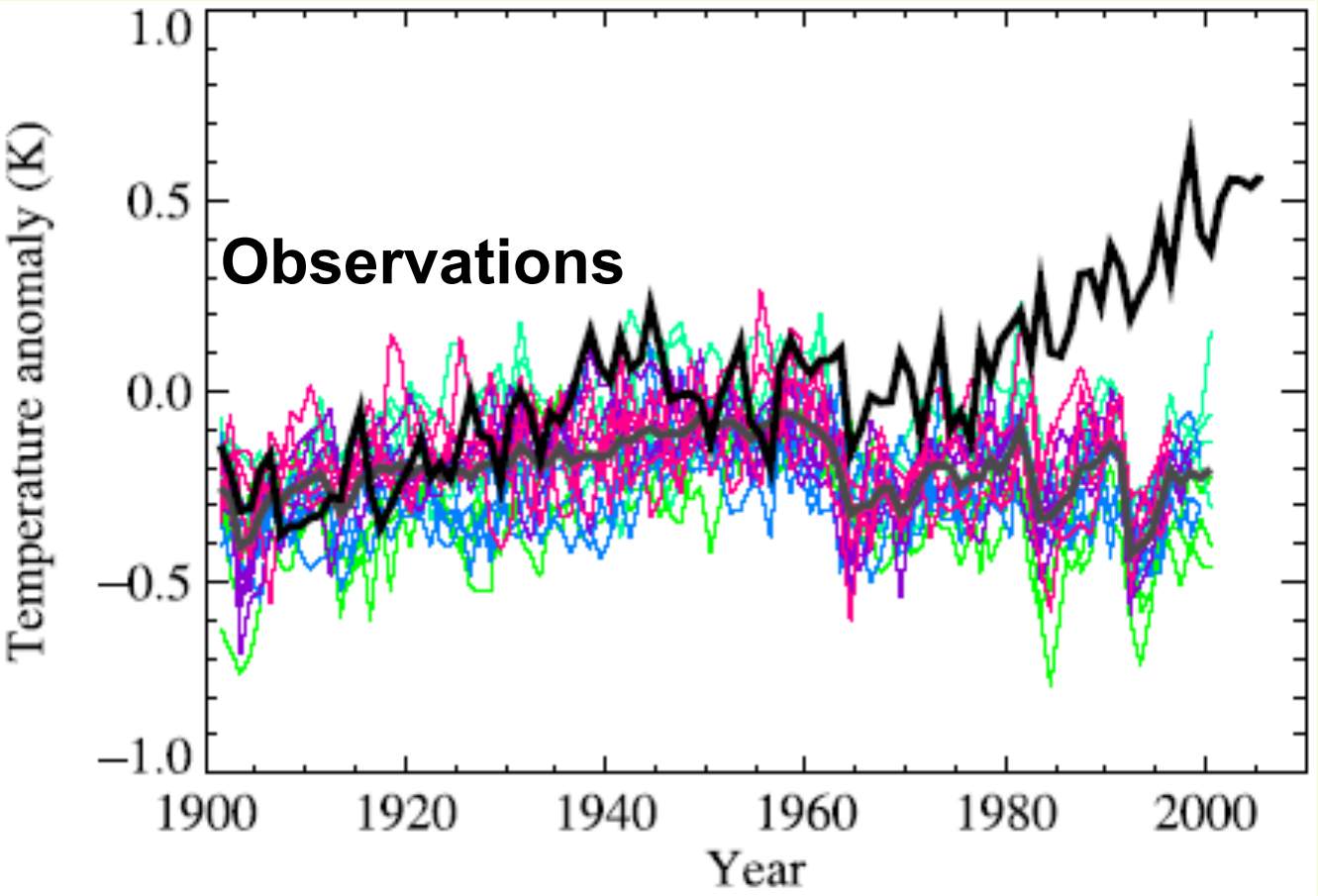
Khadijateri cave paintings

Fact: we cannot explain the past century without both human and natural influence on climate



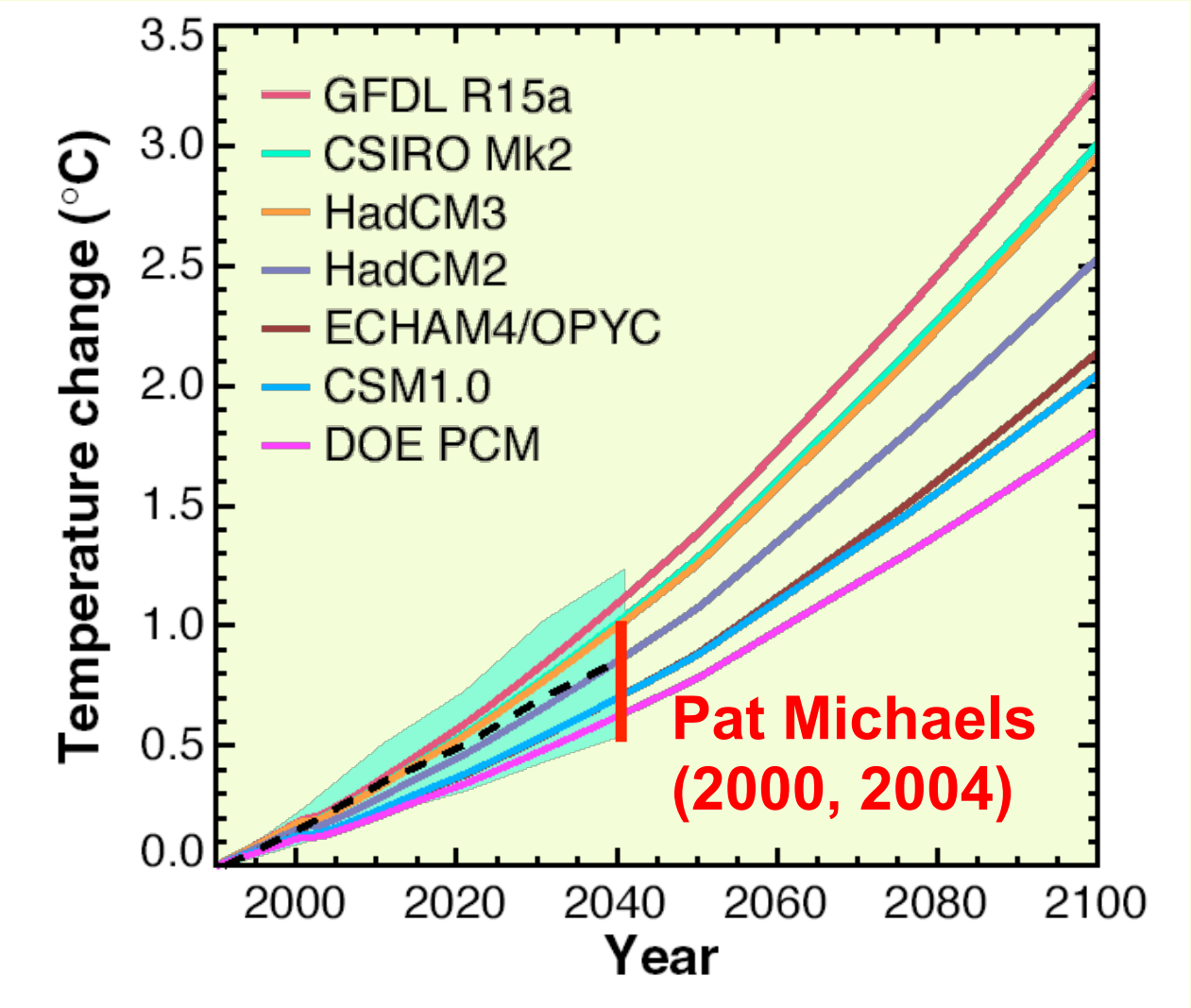
Colours: Simulations with human and natural influences

Fact: we cannot explain the past century without both human and natural influence on climate



Colours: Simulations with natural influences alone

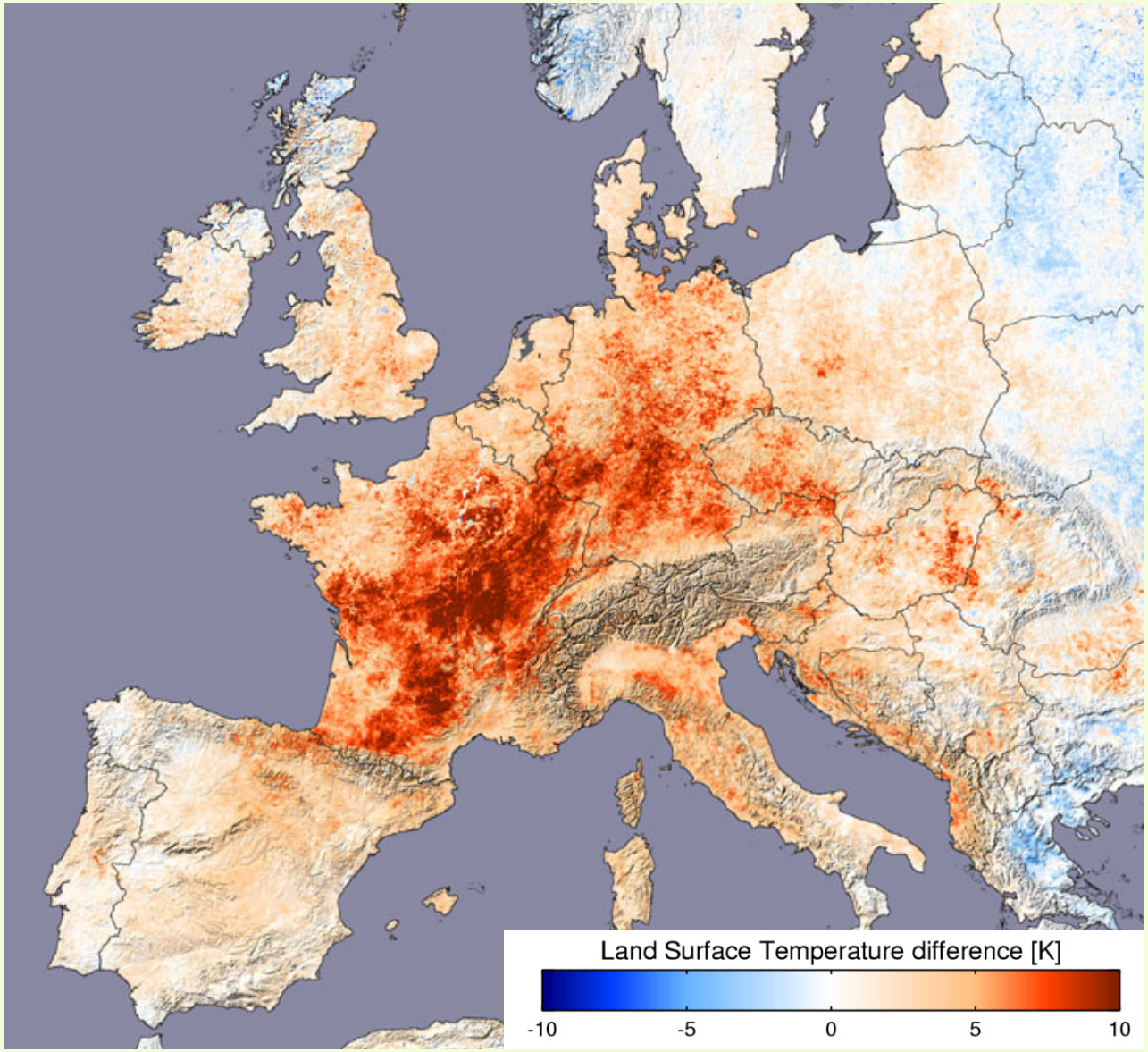
Myth: not all scientists agree that this warming will continue if GHG levels continue to rise



Climate response to the IS92a scenario of future emissions, predicted by 2001 IPCC models and by Patrick Michaels, a prominent critic of the IPCC

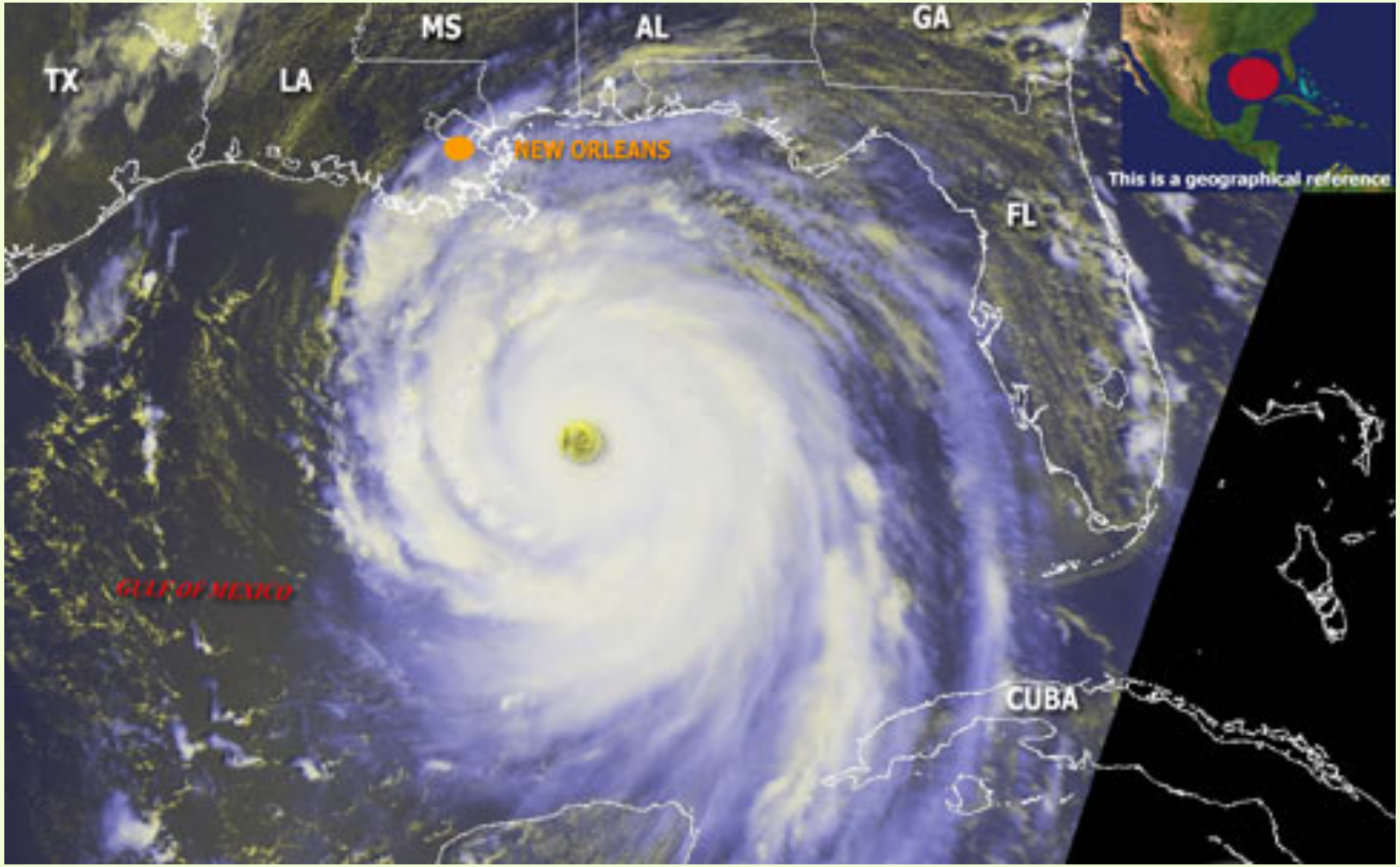
Myth: the most significant impacts of climate change are melting ice caps and sea level rise

Fact: the most significant impacts of climate change are changing risks of extreme weather

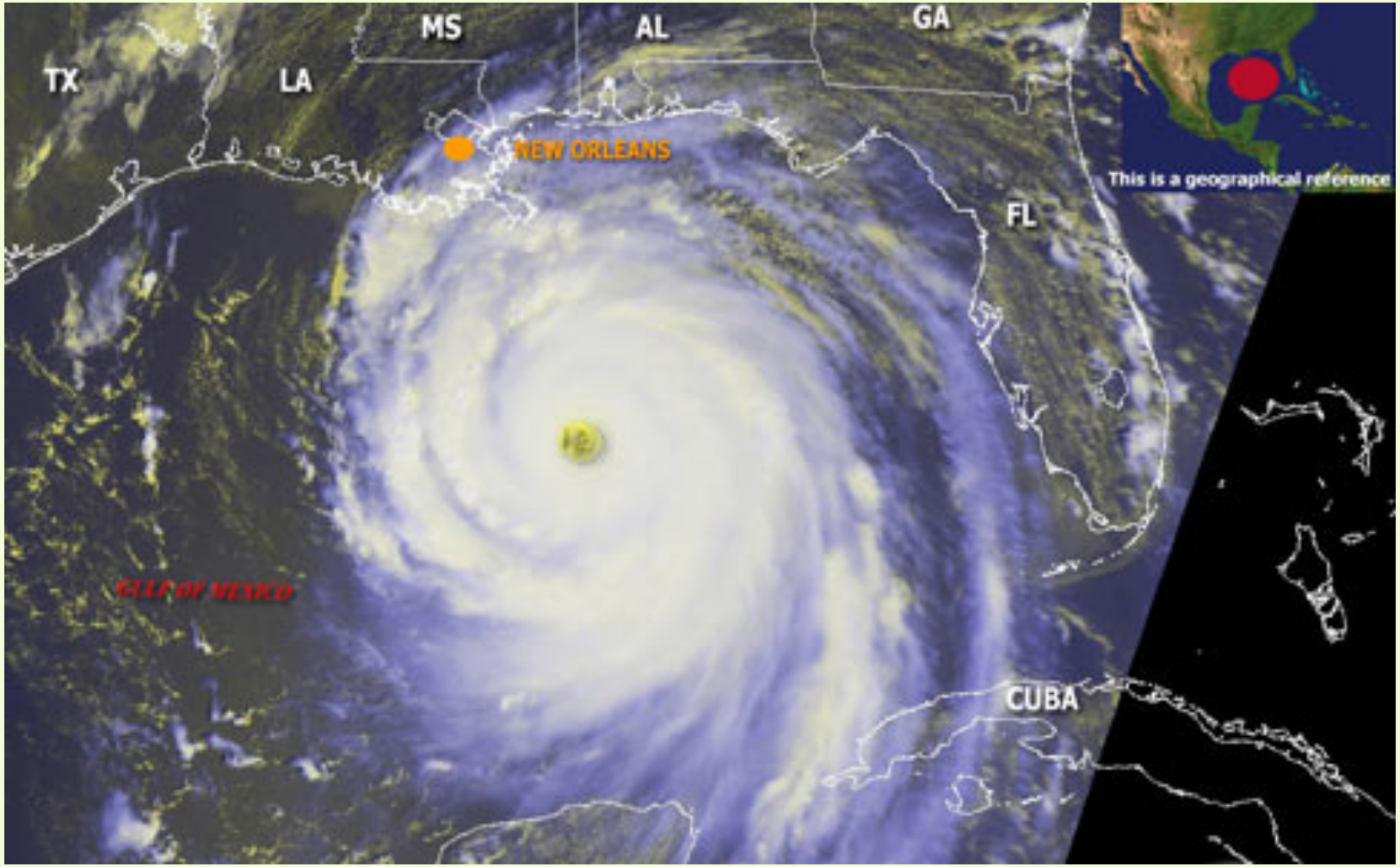


Surface temperature departures from normal in early August 2003, from NASA's Moderate Resolution Imaging Spectrometer, courtesy of Reto Stöckli, ETHZ

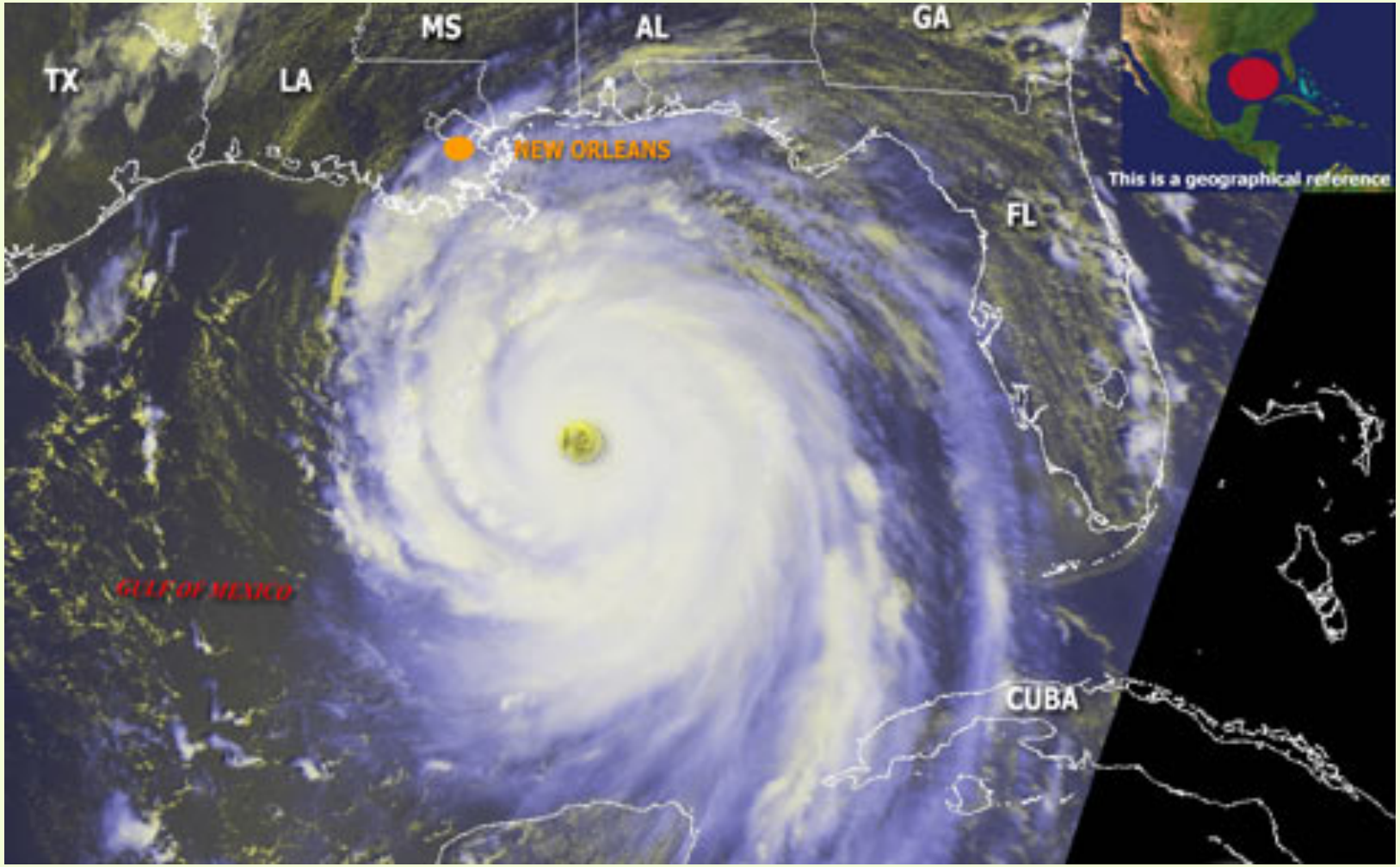
Myth: climate change was to blame for Hurricane Katerina



Myth: climate change was *not* to blame for Hurricane Katerina



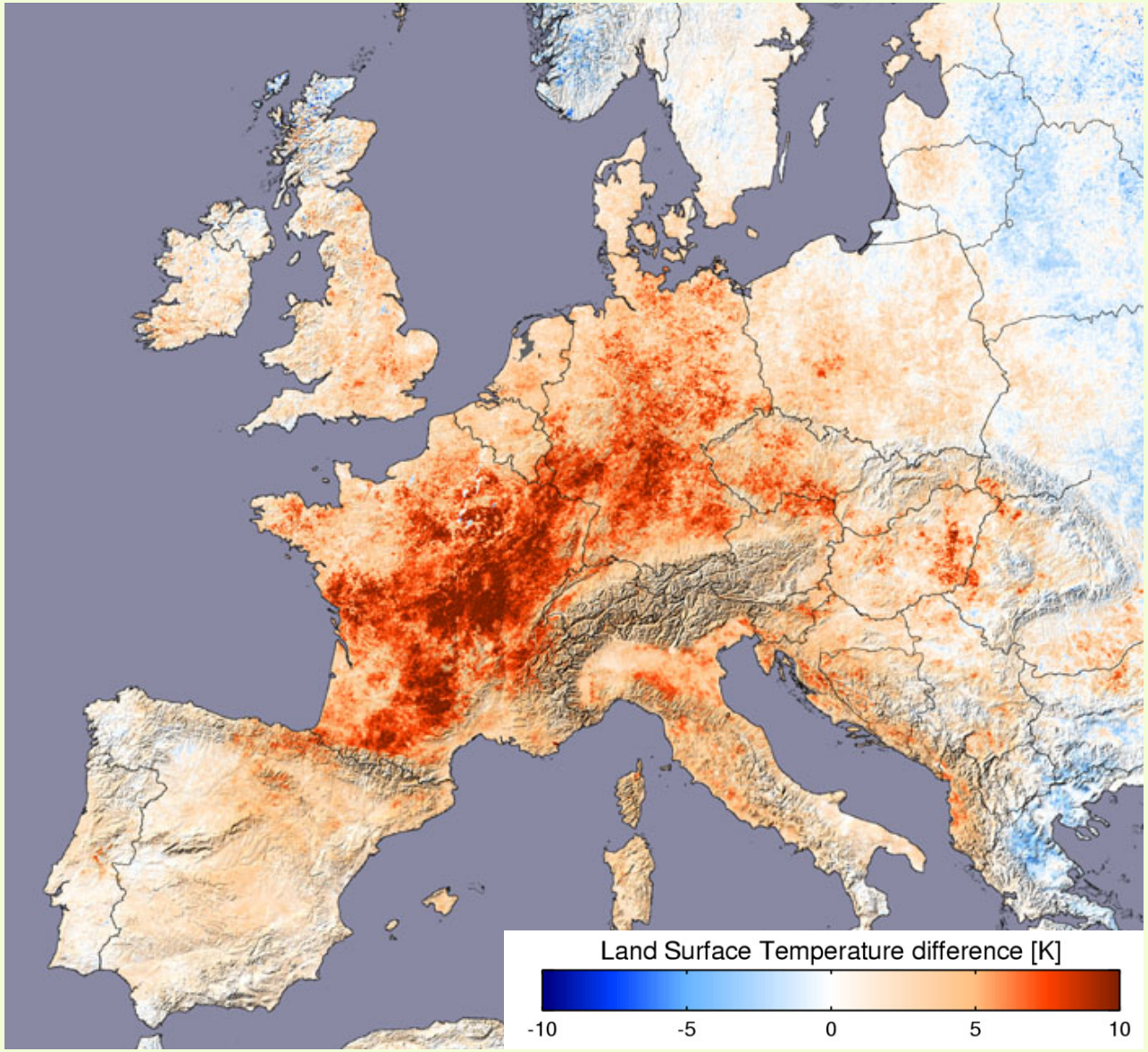
Myth: scientists have no idea whether climate change was to blame for Hurricane Katerina



Fact: we can establish a causal link between individual weather events and climate change

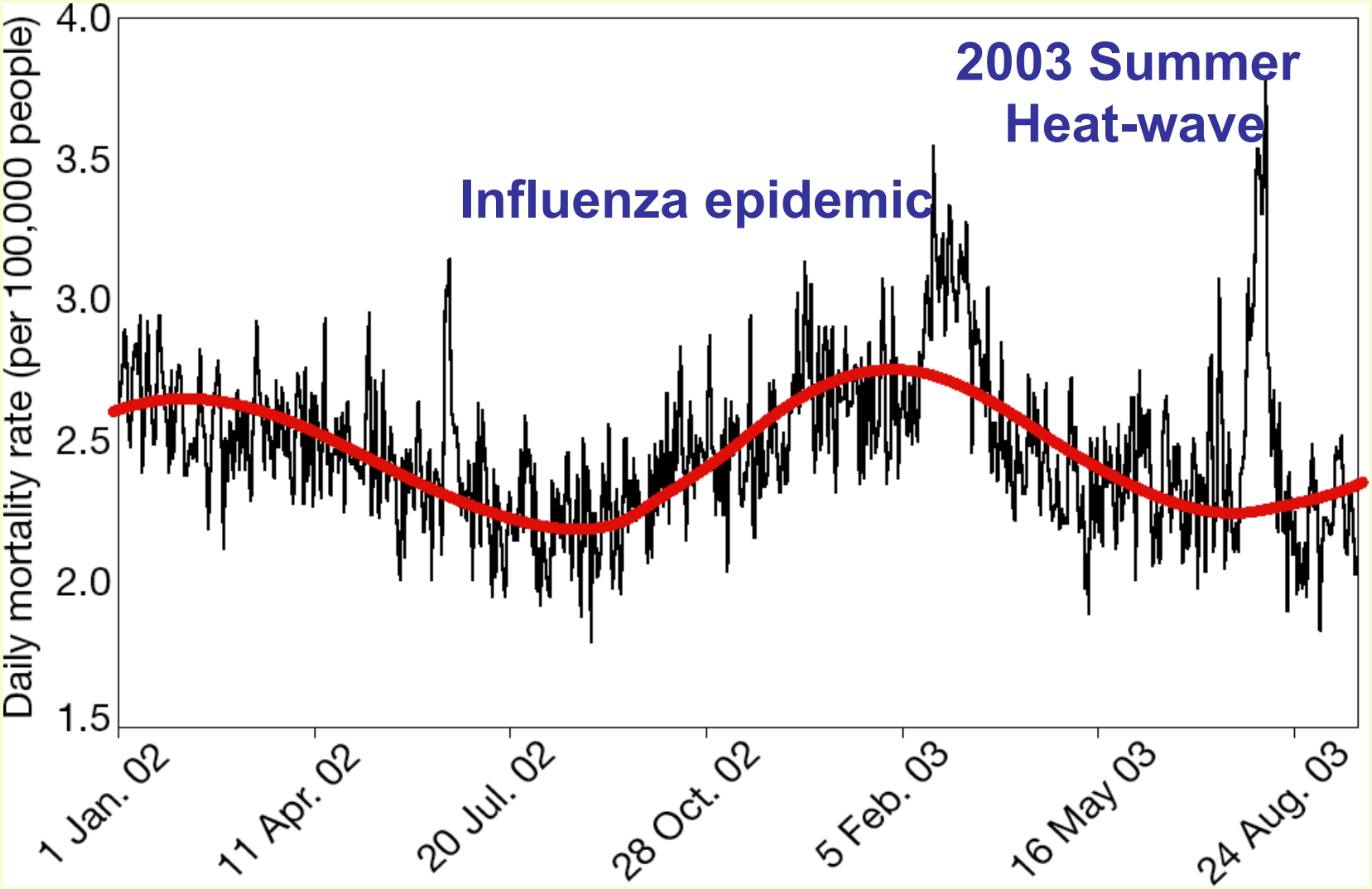
- The drivers of climate change (greenhouse gases, volcanic eruptions…) affect weather in the way that the loading on a dice helps the dice to come up six.
- Edward Lorenz's definition of climate:
  - "Climate is what you expect, weather is what you get"
- Updated for the 21st century…
  - "Climate is what you affect, weather is what gets you"
- But we cannot roll the weather dice many times to work out how the loading is changing, so we have to use computer simulation.

An example: the European heat-wave of summer 2003



Surface temperature departures from normal in early August 2003, from NASA's Moderate Resolution Imaging Spectrometer, courtesy of Reto Stöckli, ETHZ

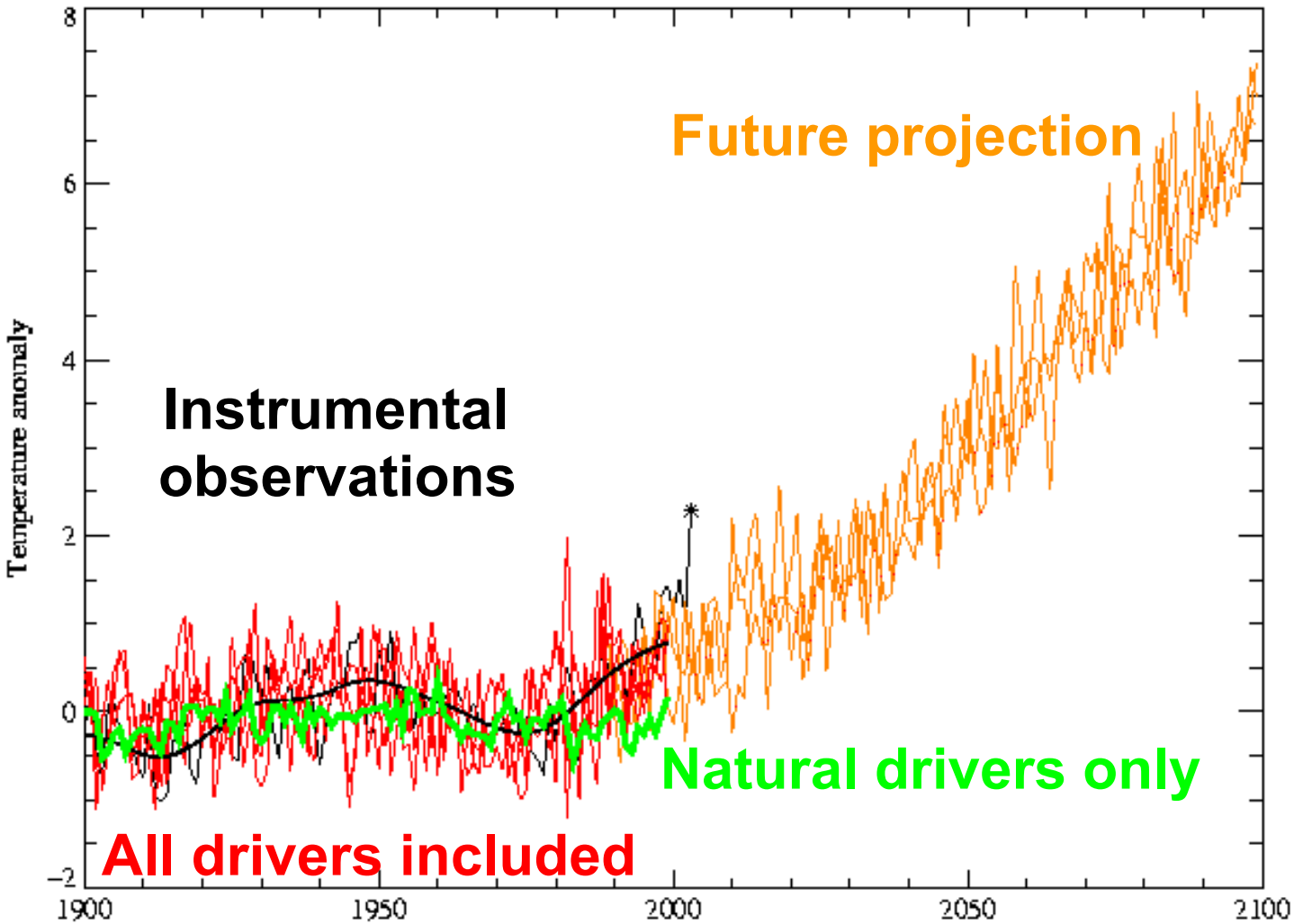
Impact of the heat-wave on mortality in Southern Germany



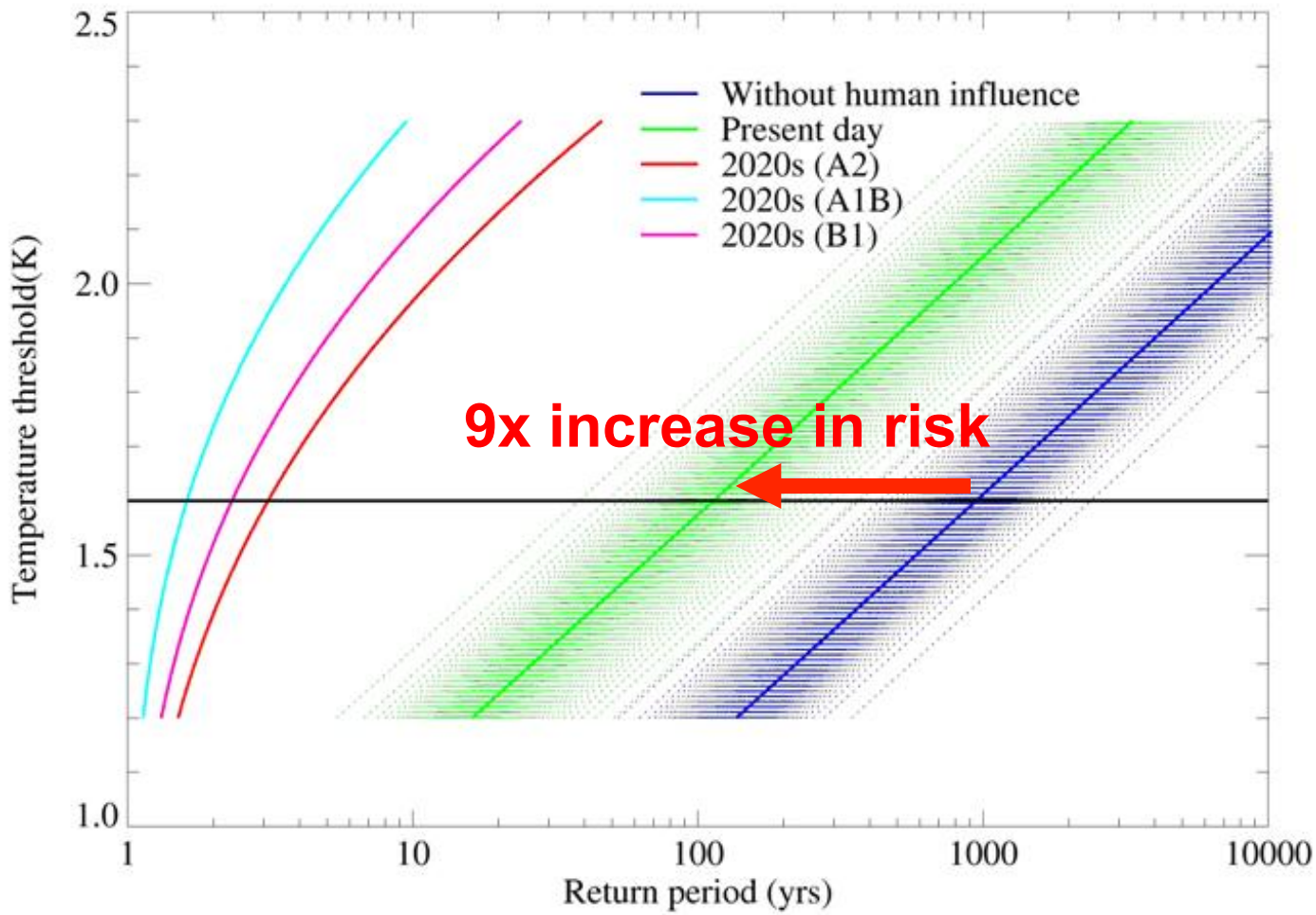
Schär & Jendritzky, 2004

Daily mortality in Baden-Württemberg, Germany

Simulating European summer temperatures with a climate model (Stott et al, 2004)



How human influence on climate has affected the risk of heat-waves in Europe



A more challenging example: flood risk in the United Kingdom

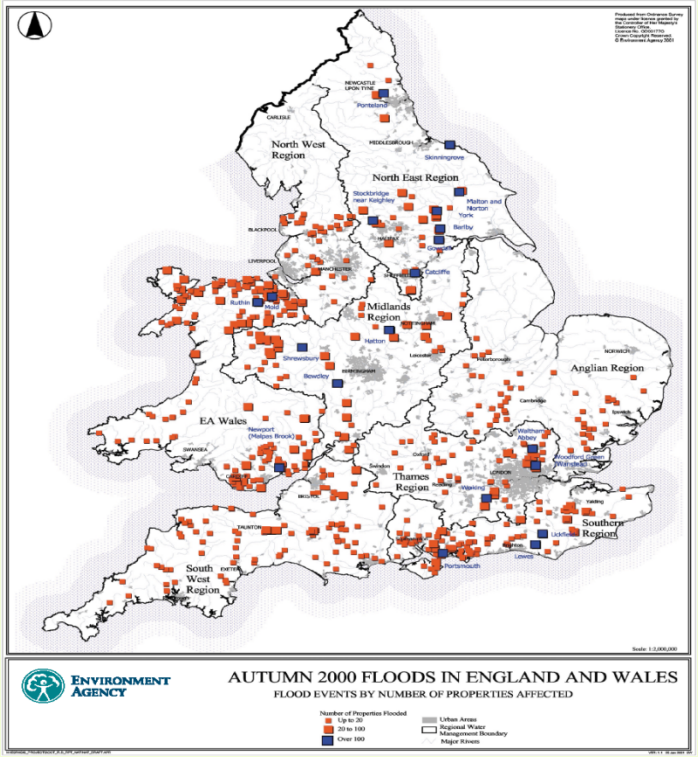
Photo: Dave Mitchell

South Oxford on January 5th, 2003

Autumn 2000 floods in the UK

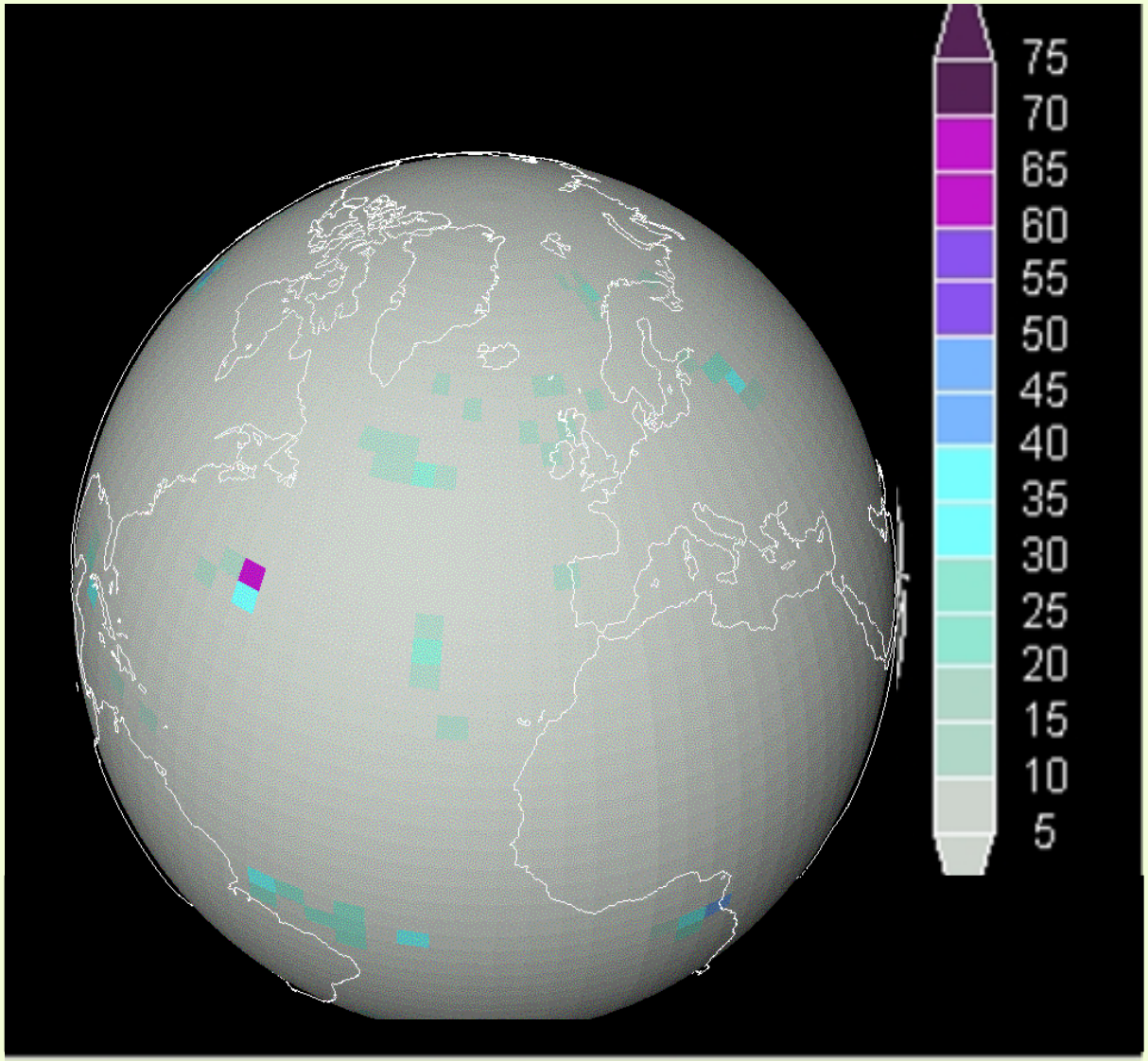
Sep-Nov 2000 was wettest Autumn in England & Wales since records began in 1766, with almost double (196%) the 1961-1990 average seasonal precipitation.

Nationwide impact:
£1.3bn of insured loss.
Over 10,000 properties flooded.

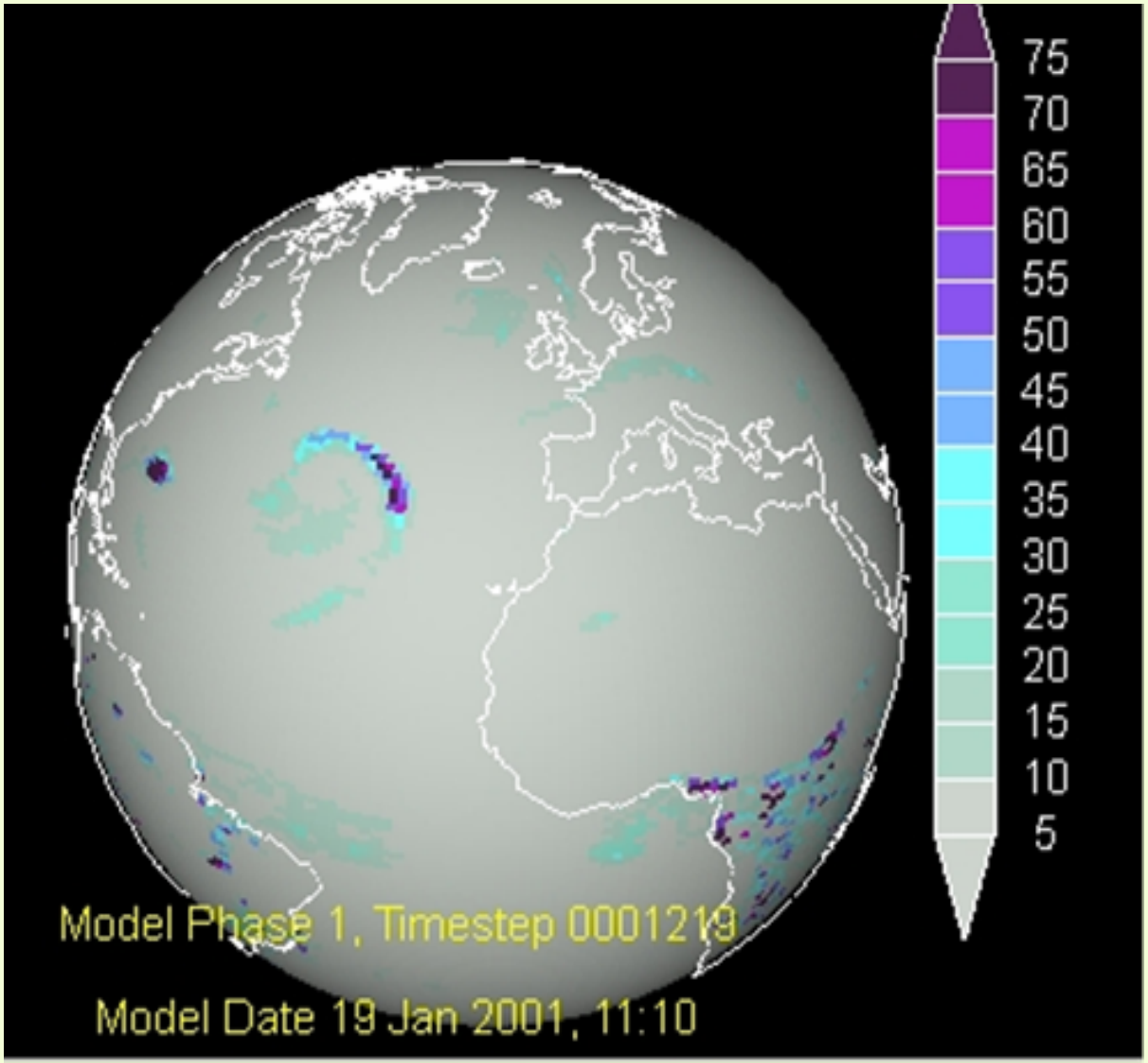


It has happened before: Shillingford historic flood levels

Standard climate models may be good enough for heat-waves, but not for precipitation



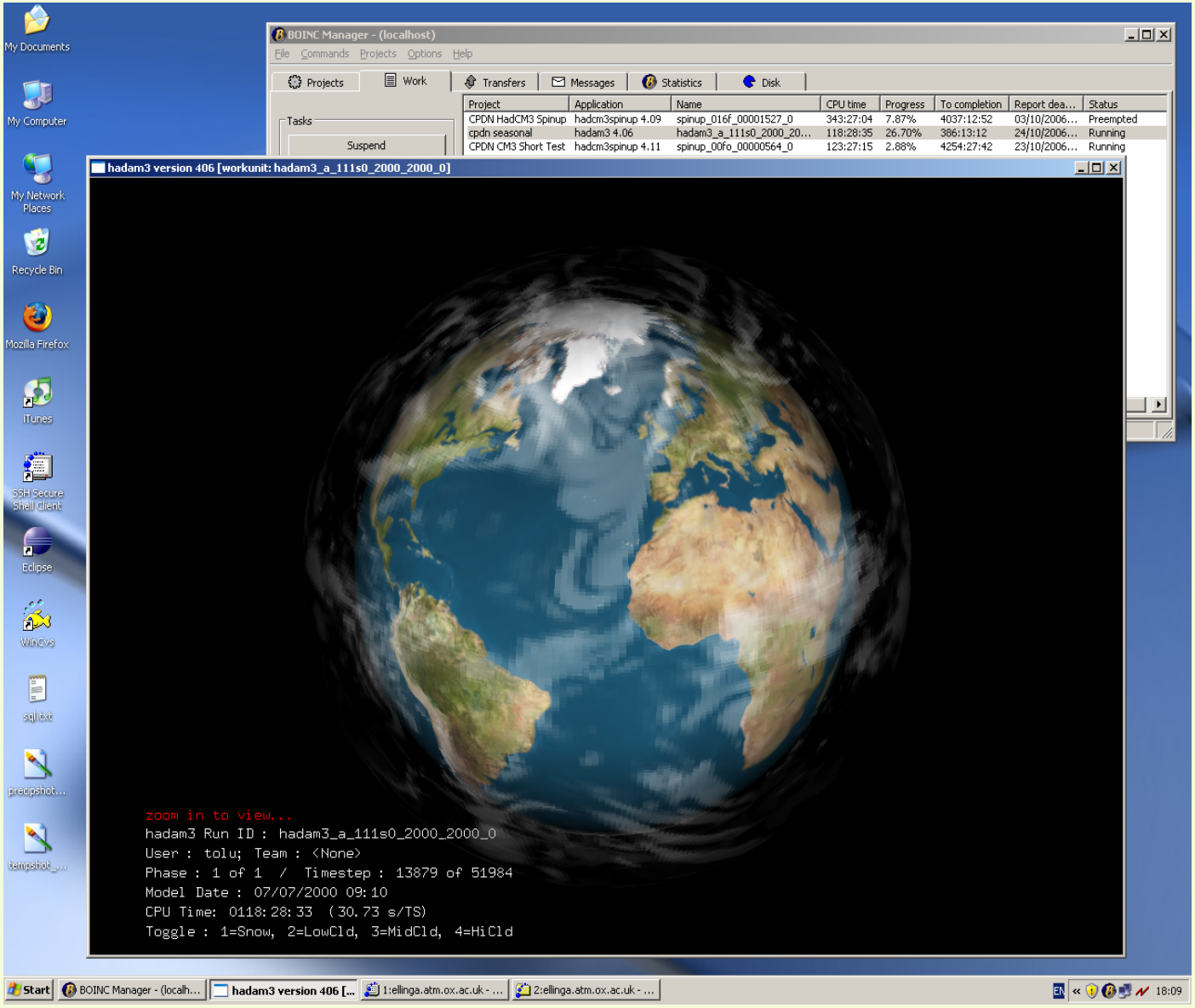
Precipitation in a higher-resolution (1.25x0.8°) version of HadAM3



The climate*prediction*.net seasonal attribution experiment (Pall et al, 2007)

- Aim: to quantify the role of increased greenhouse gases in precipitation responsible for 2000 floods.
- Challenge: a relatively unlikely event, even given y2k climate drivers and sea surface temperatures (SSTs).
- Approach: large (multi-thousand-member) ensemble simulation of April 2000 – March 2001 using forecast-resolution model (80km resolution around UK).
- Identical "non-industrial" ensemble removing the influence of increased greenhouse gases, including attributable SST change.
- Use several coupled models for SST pattern.

Simulating the climate that might have been on your desktop: http://attribution.cpdn.org



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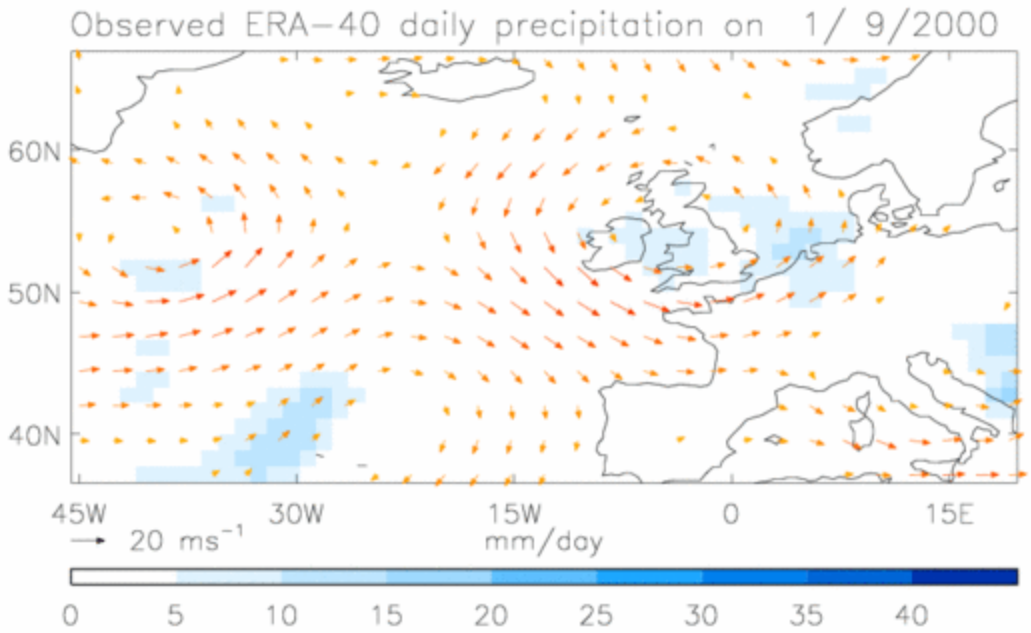
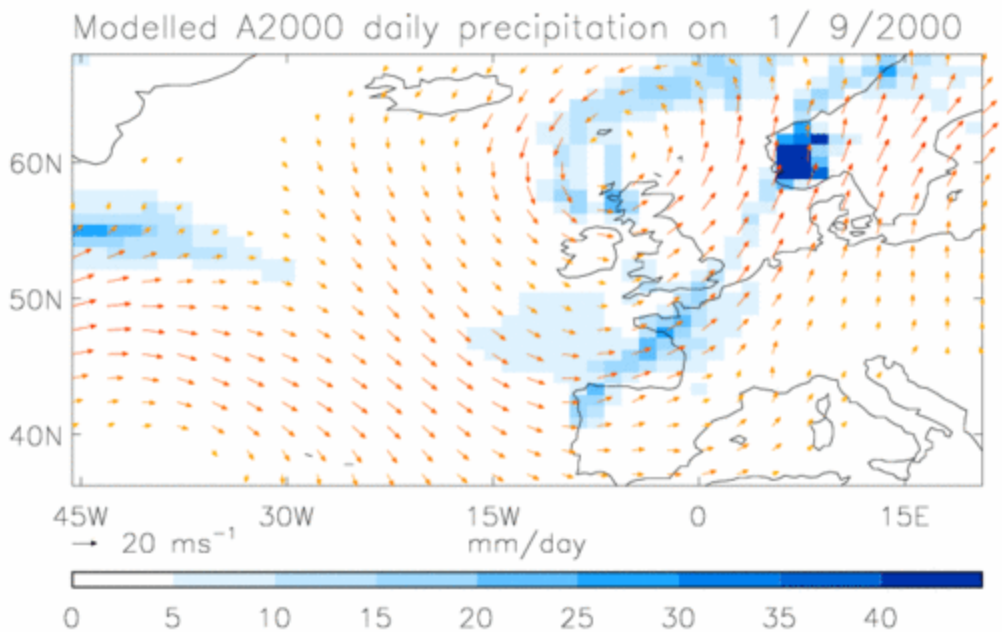
The world's largest climate modelling facility: www.climate*prediction*.net

~260,000 volunteers, 170 countries

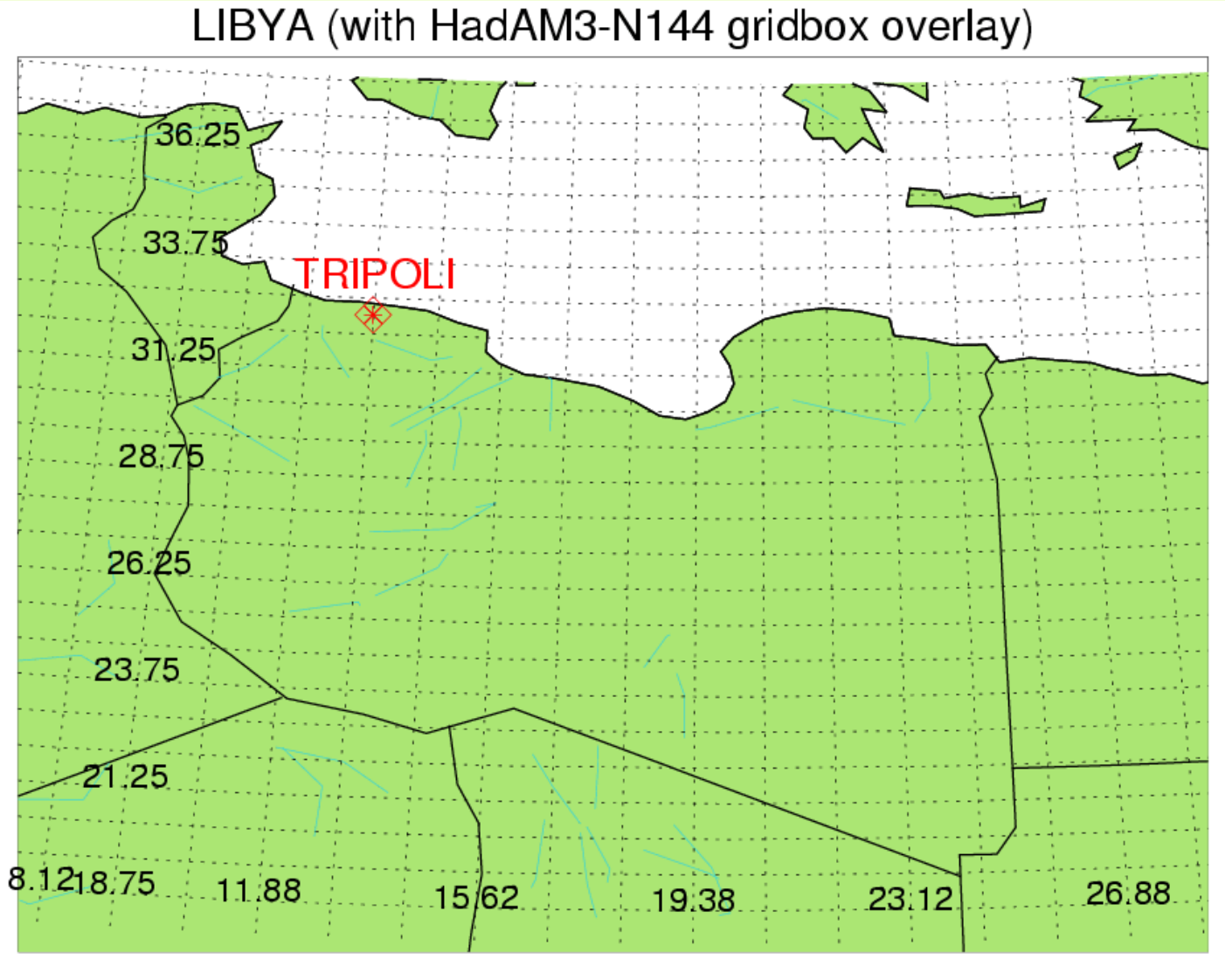




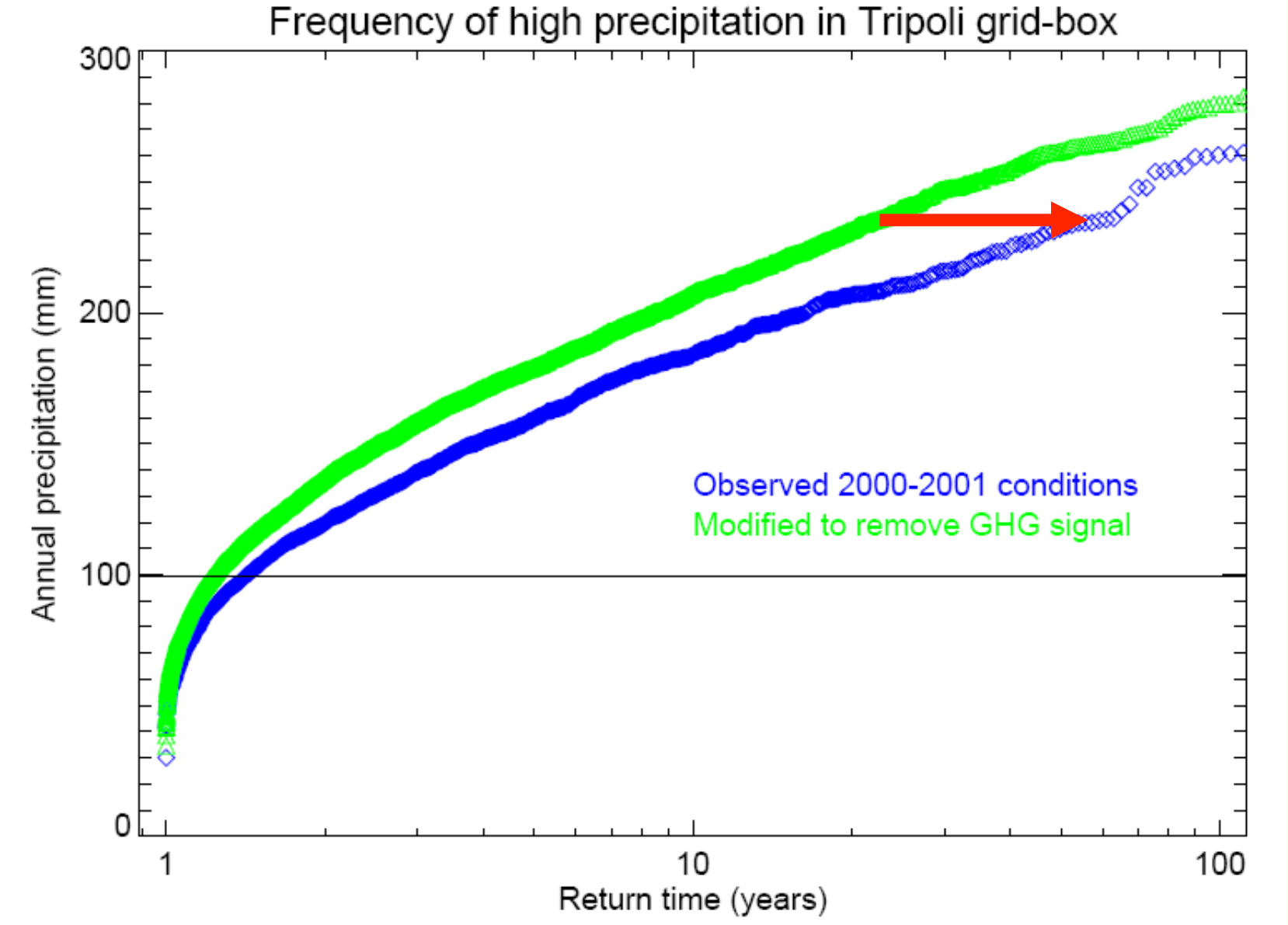
Autumn 2000 as observed (ERA-40 reanalysis)…

…and in one of the wetter members of our ensemble.

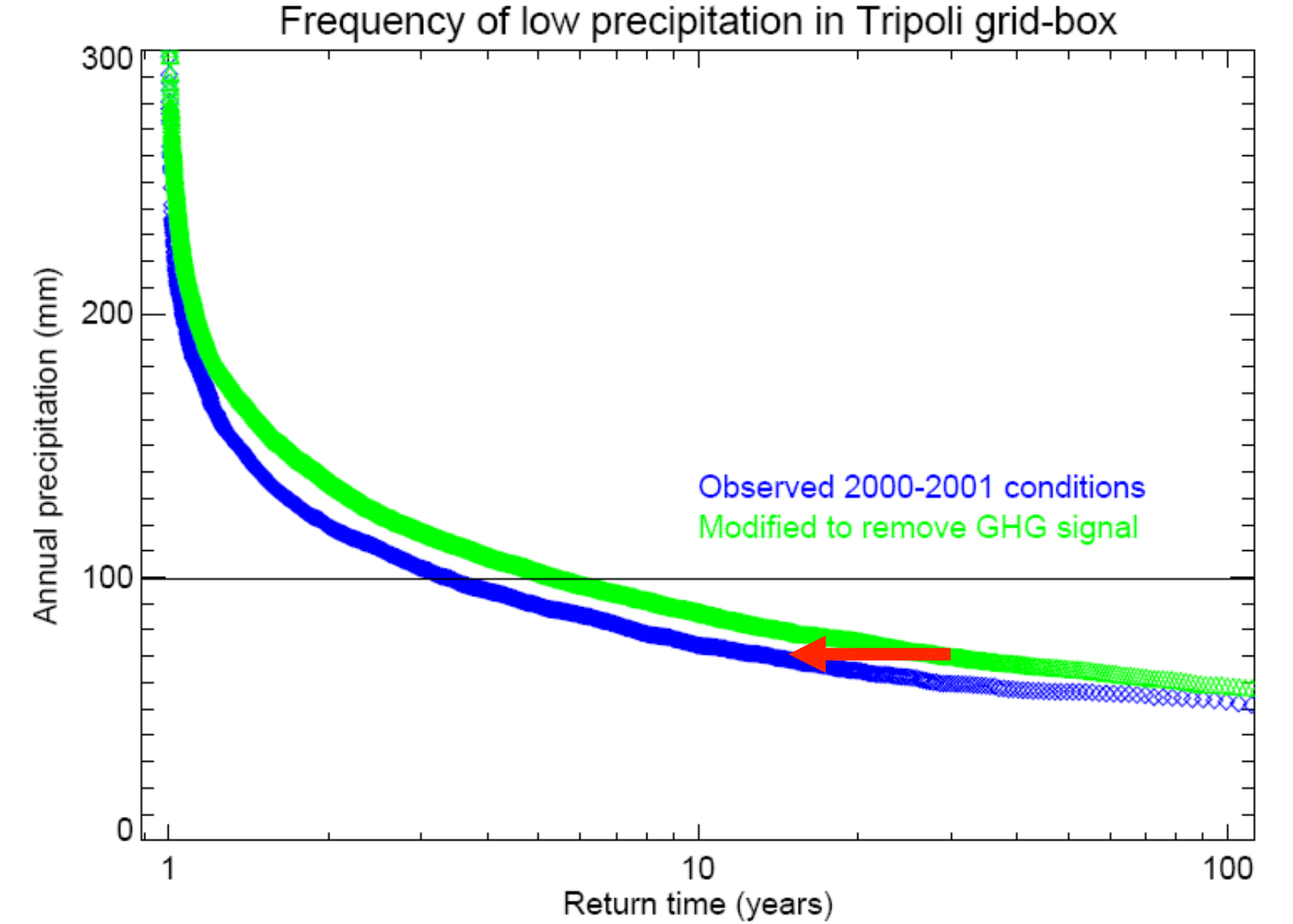
Model resolution over Libya



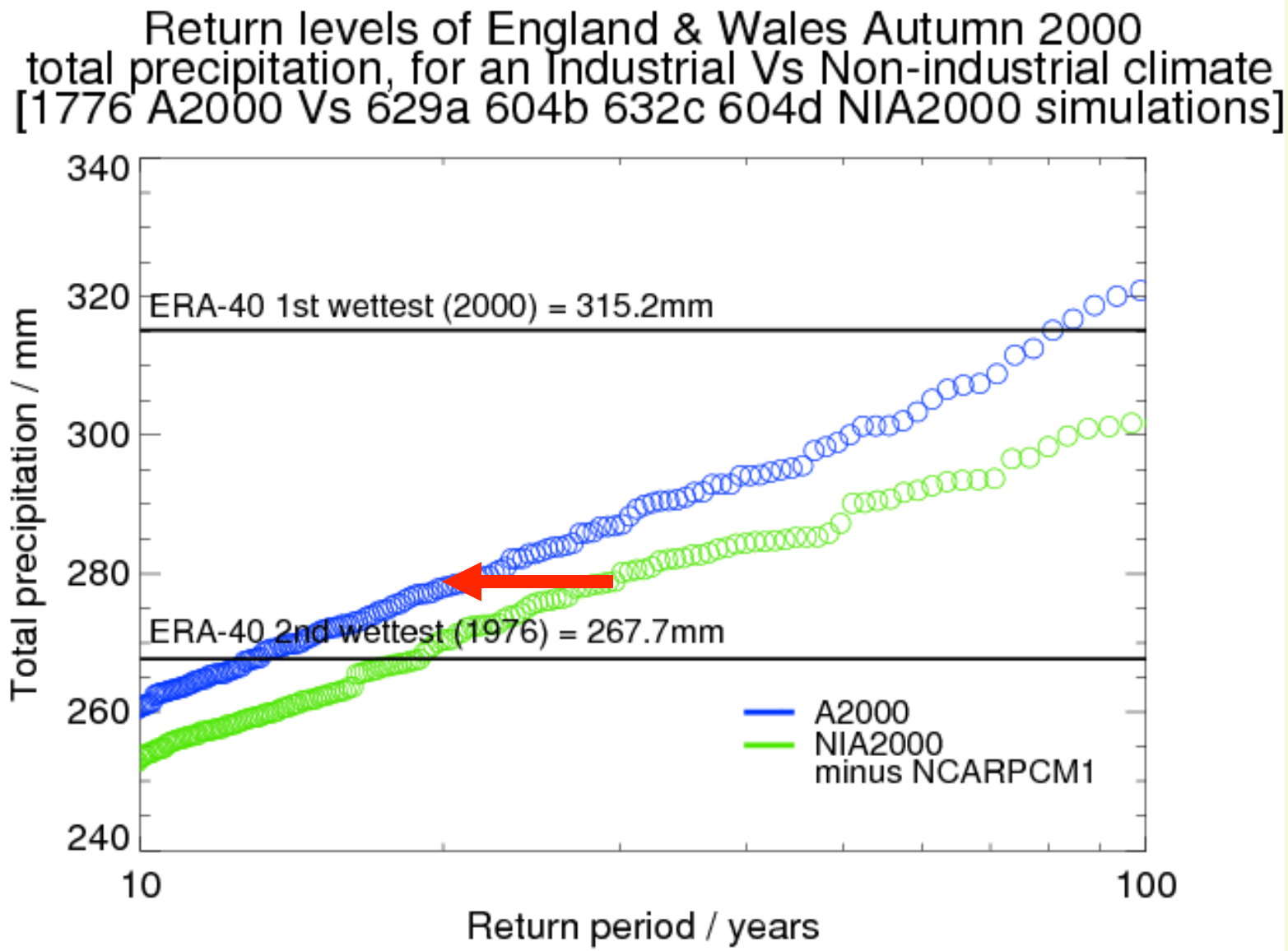
Changing flood risk in Tripoli due to greenhouse gas increase 1900-2000



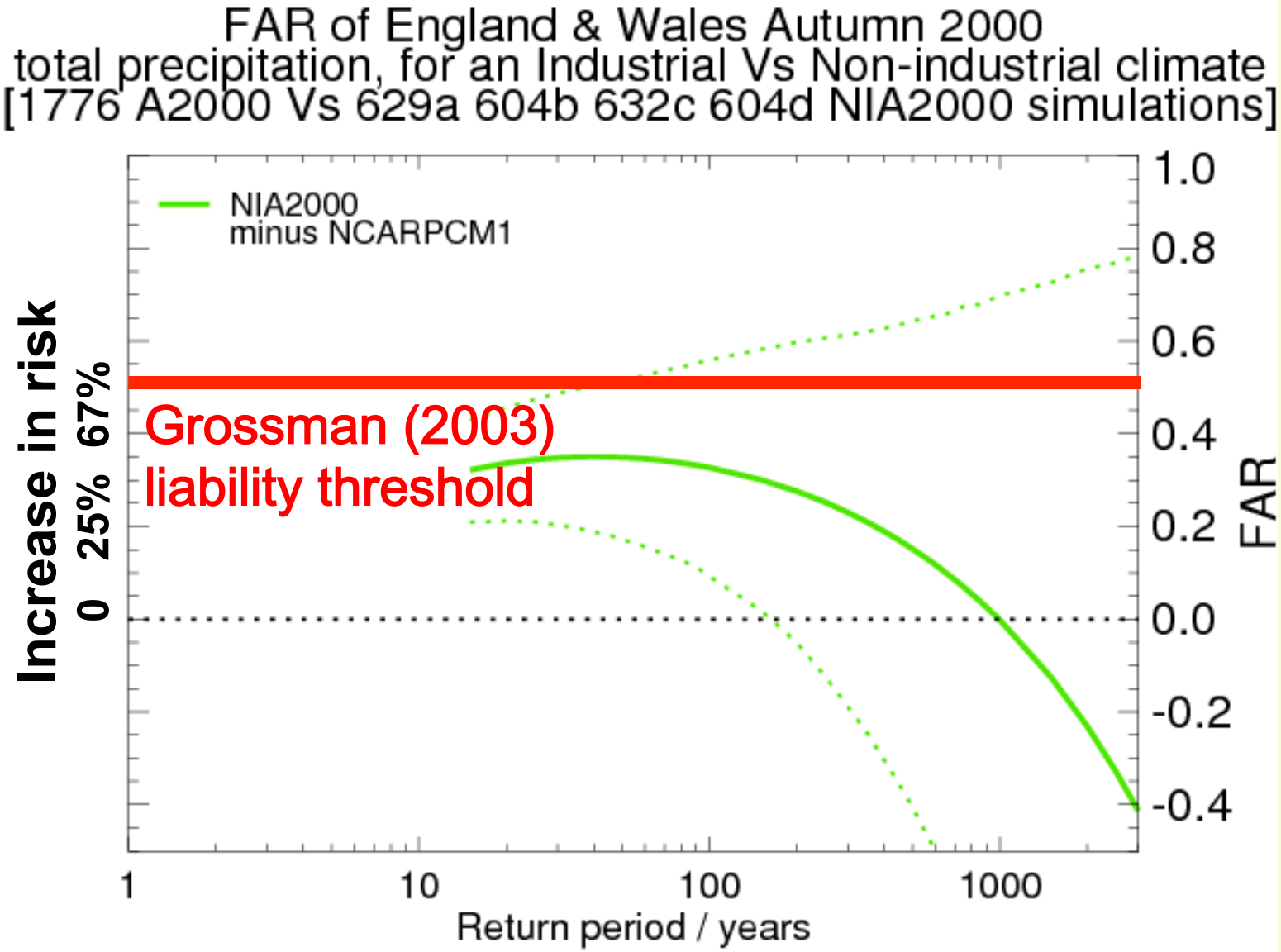
Changing drought risk in Tripoli due to greenhouse gas increase 1900-2000



Changing flood risk in the United Kingdom due to greenhouse gas increase 1900-2000



Fraction of current risk of Autumn-2000-type precipitation attributable to GHG increase



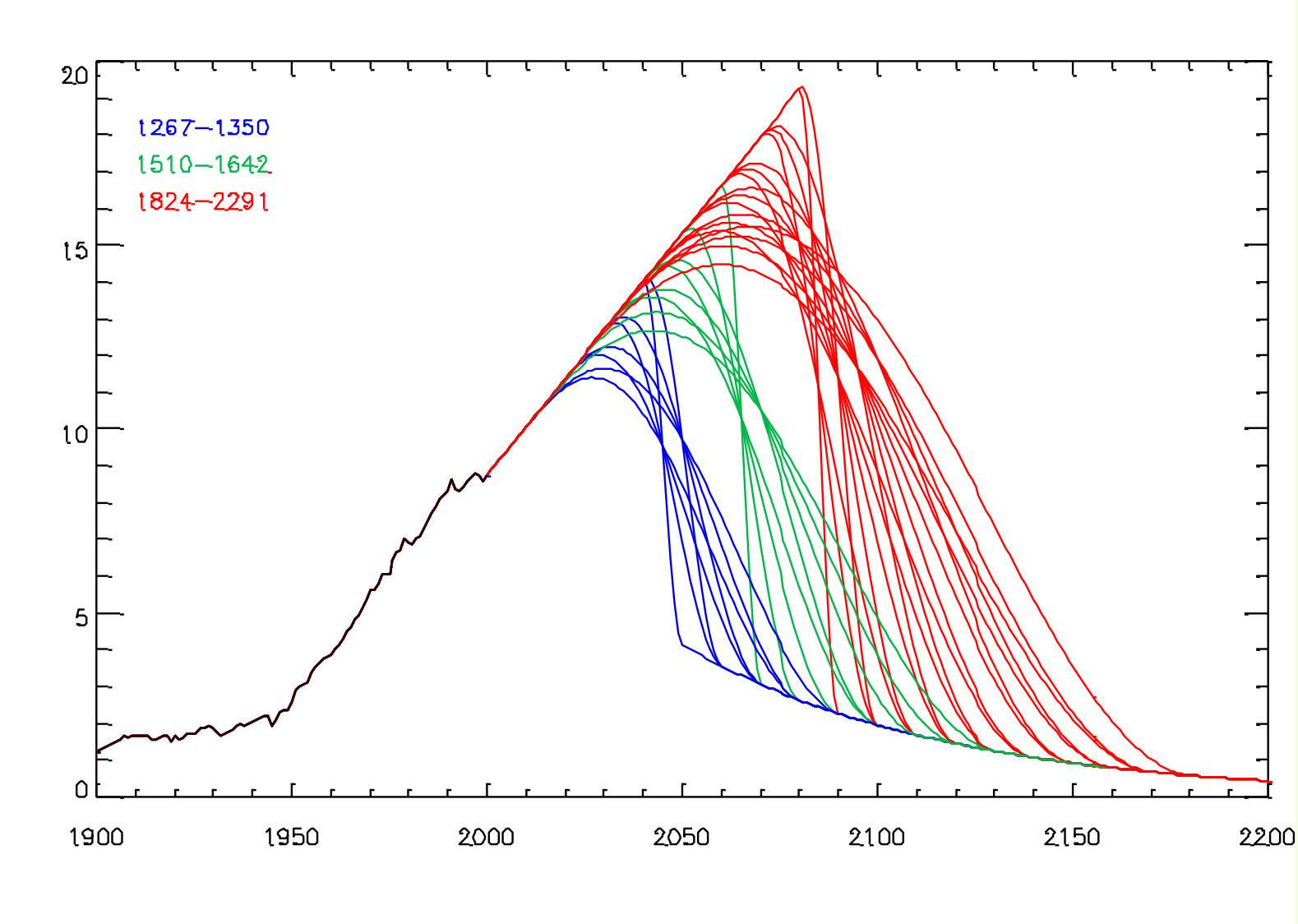
Why action to control greenhouse gas emissions may be coming sooner than you expect

- We estimate that there is a better than 9 in 10 chance that past human influence has more than doubled the risk of a heat-wave equal or greater than the summer of 2003 (Stott et al, 2004).
- Soon (not yet) we may be able to do the same for floods in Oxford, droughts in Libya and hurricanes in Louisiana.
- "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)

What is the worst possible consequence of climate change for Libya?

- A panic-stricken transition, fuelled by the prospect of liability, to stringent emission controls through cap-and-trade regimes or pollution taxes in fossil fuel consuming nations.
- If successful, this would:
  - Reduce fossil fuel consumption.
  - Drive down the price of oil.
- And the irony is, it would make very little difference to the risk of dangerous climate change.

Emission profiles consistent with a ~20%, ~50% and ~80% risk of maximum warming >2°C



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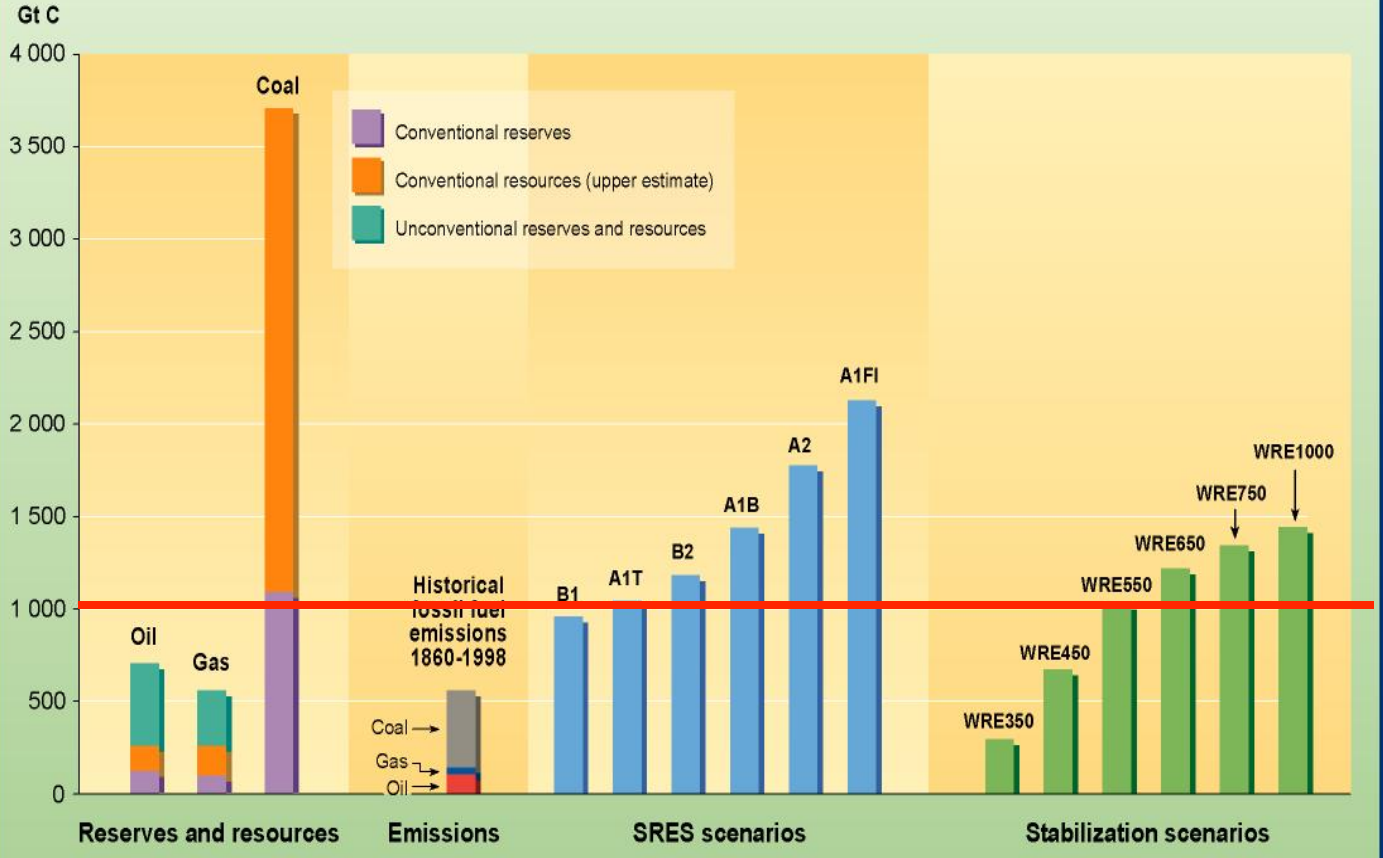
Why rationing won't work

- There is no "sustainable per capita emission rate": we don't know what is sustainable, but likely less than half *today's* per capita consumption in China.
- We can estimate maximum warming for a given *total* carbon dioxide emissions 1700-2200:
  - ~1,100-1,200 GtC → ~20% risk of max. temperature >2°C
  - ~1,300-1,500 GtC → ~50% risk of max. temperature >2°C
  - Emissions to date (fossil fuels and land use): ~500 GtC
- Extrapolating past land-use fossil mix, this implies a total fossil carbon release of: one trillion tonnes.
- And it doesn't really matter how fast you release these emissions…

Carbon in fossil fuel reserves and resources compared with historical fossil fuel carbon emissions, and with cumulative carbon emissions from a range of SRES scenario and TAR stabilization scenarios up until the year 2100

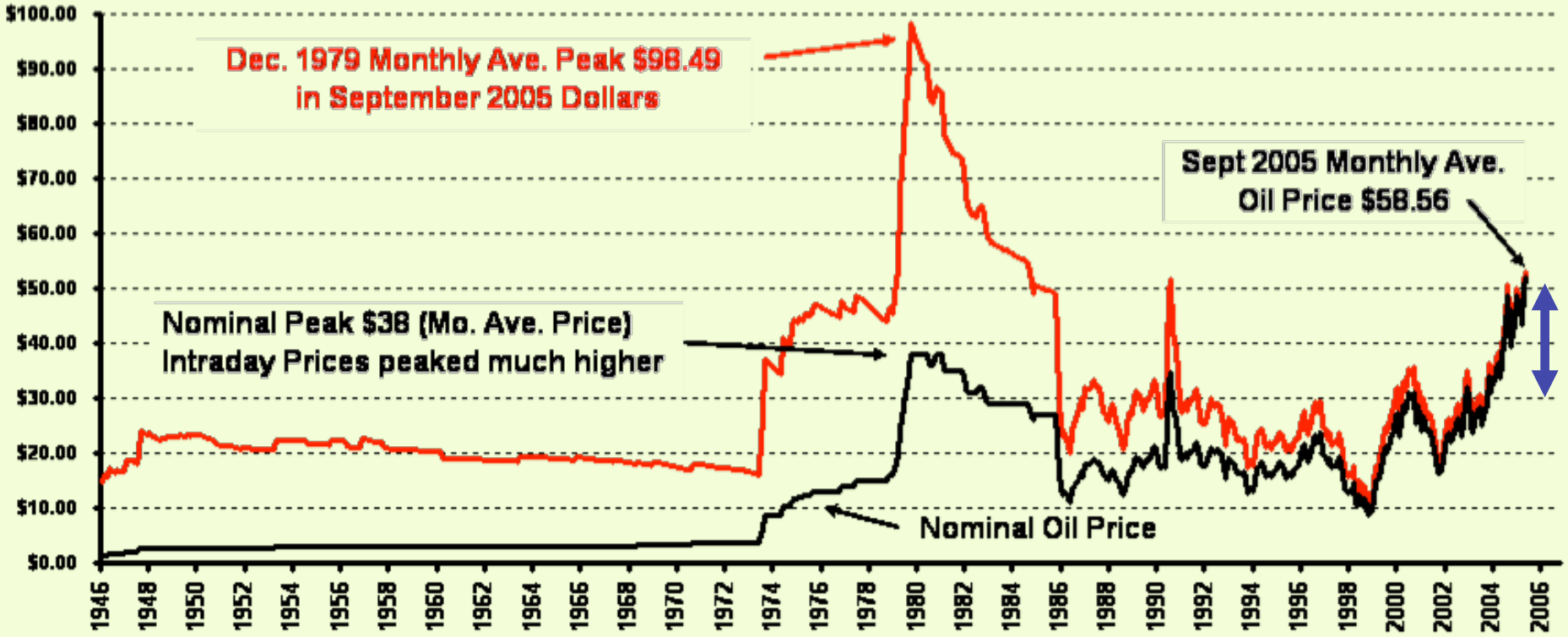


SYR - FIGURE 7-5

Fact: We will burn more fossil fuel than we can afford to dump in the atmosphere, so the only real issue is how fast we can move to sequestering (burying) the CO_2 released

Carbon capture and storage facility, In Salah gas field, Algeria

And we can afford to pay a lot more for fossil fuels than it costs to dig them up



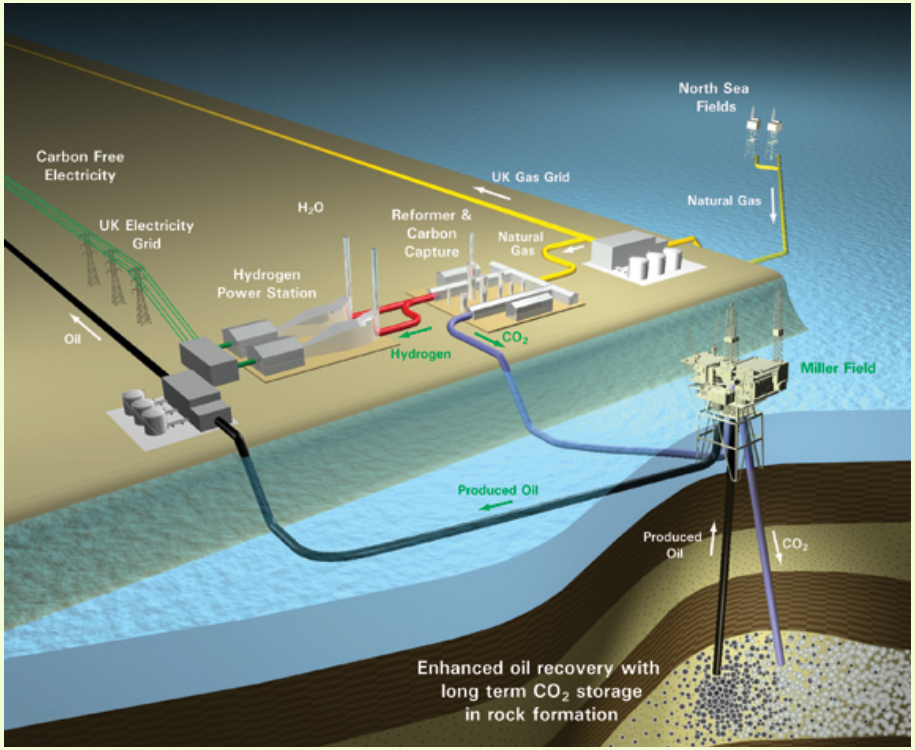
Nominal Monthly Ave. Oil Price

Inflation Adjusted Monthly Average Oil Price

Source of Data:
Illinois Basin Crude Prices- www.ioga.com/Special/crudeoil_Hist.htm
CPI-U Inflation index- www.bls.gov

Sequestration cost of $20/barrel, or $150/tonne

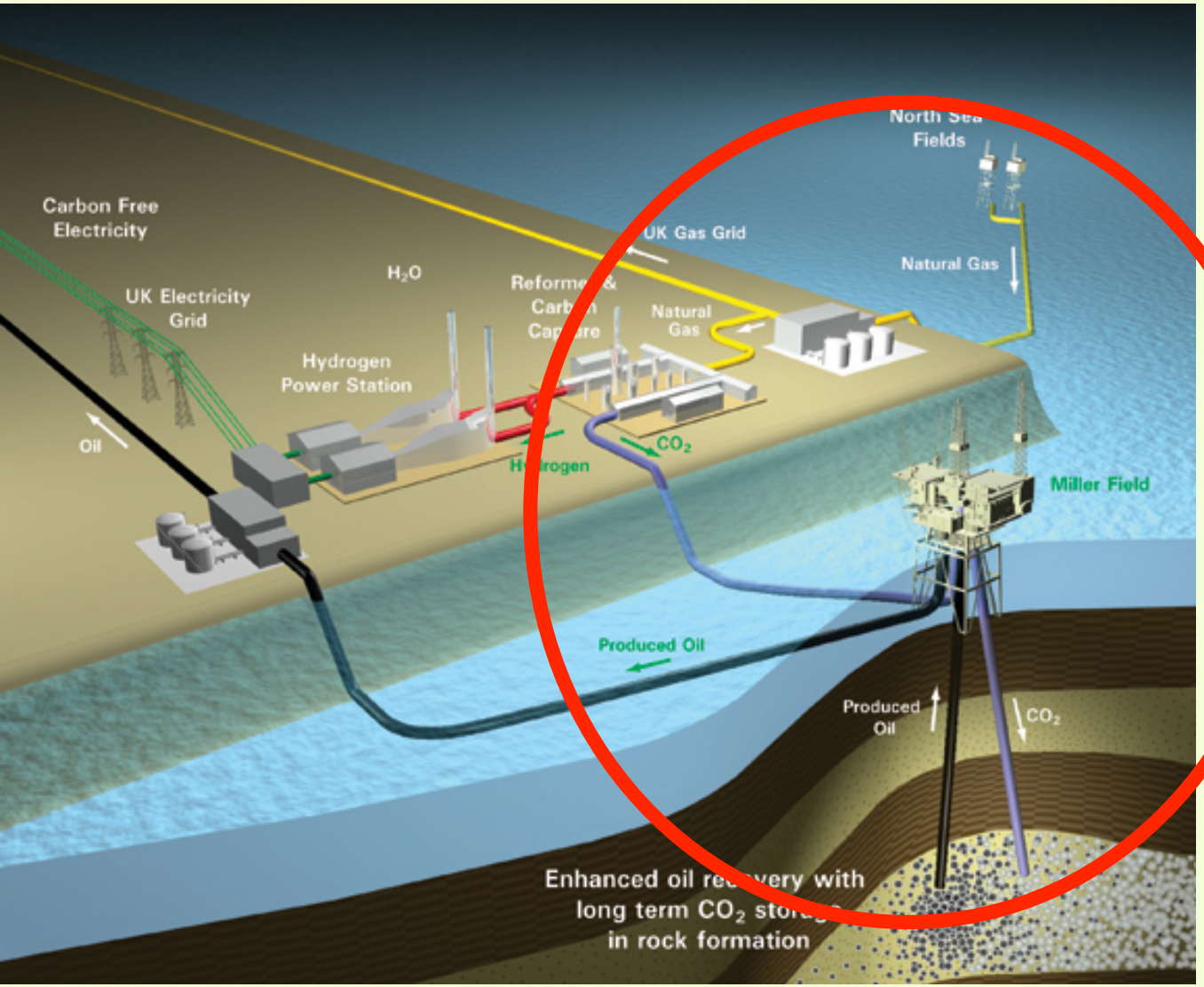
How would this work?



Schematic “climate neutral” power plant.

- **With the prices people are clearly prepared to pay for fossil fuels…**
- **…existing technologies could be used to capture the equivalent amount of carbon dioxide generated by burning those fuels and bury it back underground...**
- ***…and there would be no need to ration consumption.***

And the advantage for Libya is…

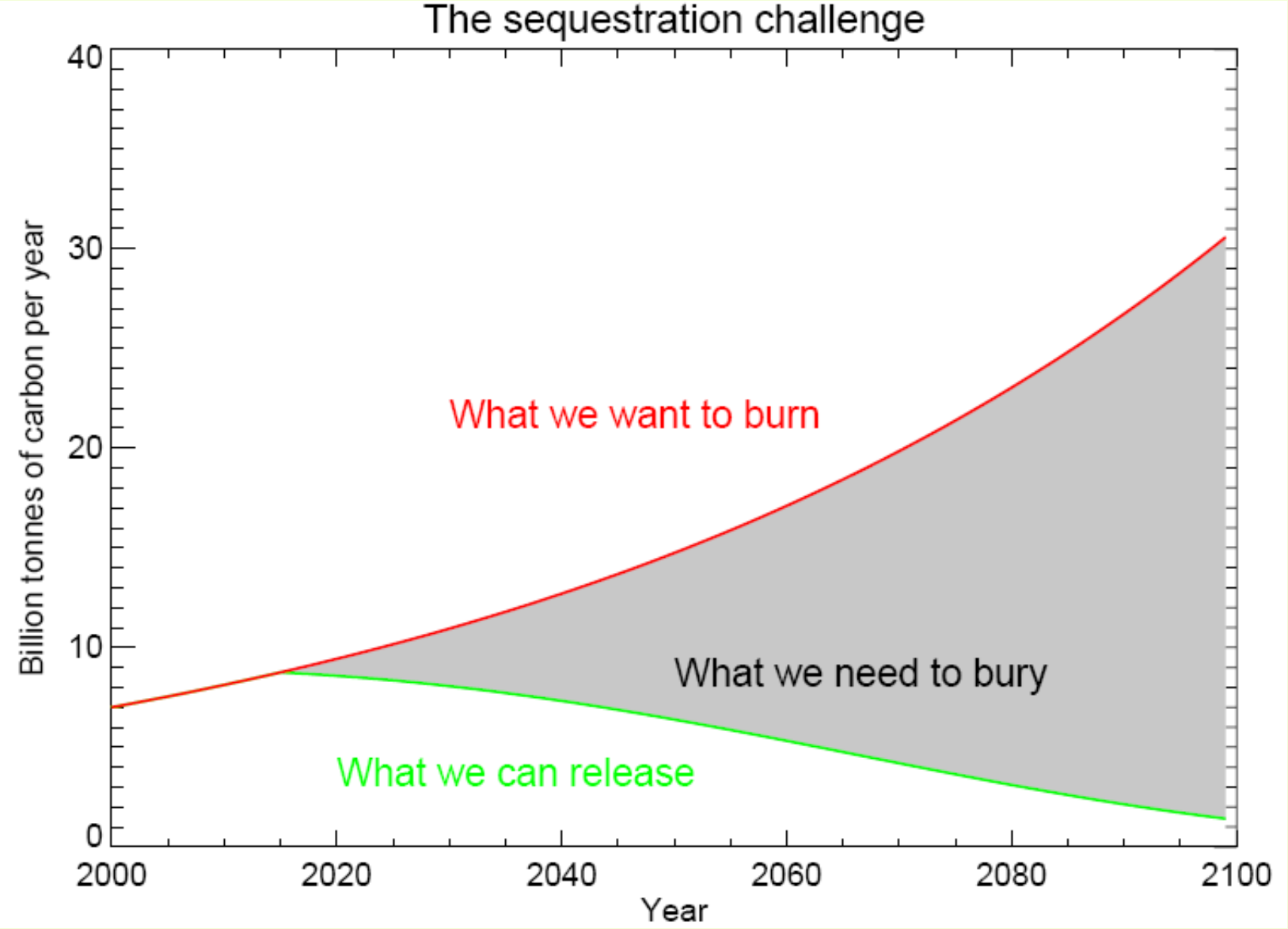


All this could be here

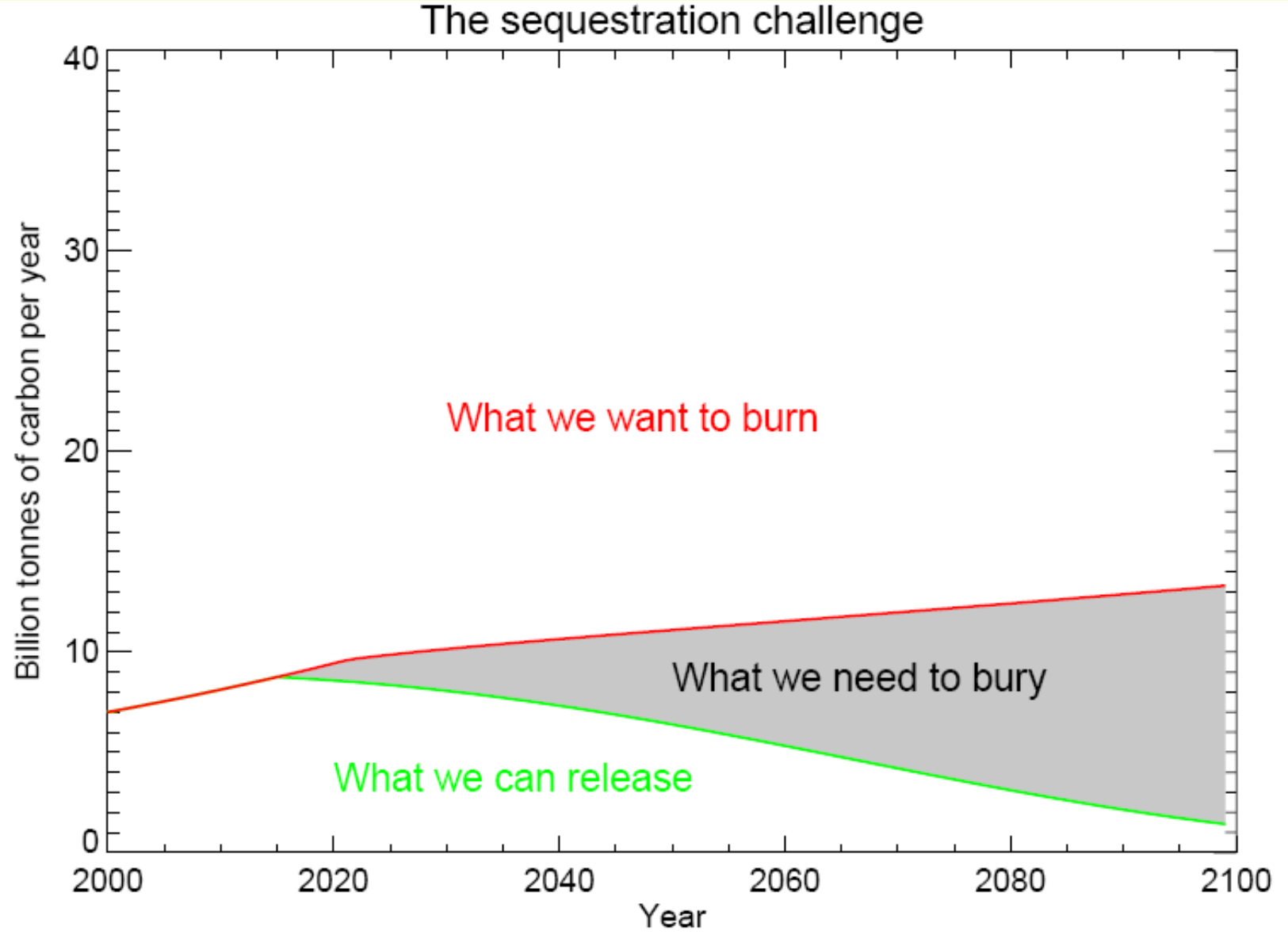
A scenario for containing the risk of dangerous climate change without limiting consumption

- Let's say we accept a ~30% risk of >2°C warming (policies can be adjusted to keep risk at this level).
- This means we can release another ~600GtC.
- So, as we release
  - 0-150GtC, build-up infrastructure
  - 150-300GtC, sequester 25%
  - 300-450GtC, sequester 50%
  - 450-600GtC, sequester 75%
  - 600GtC onwards, sequester 100%
- As for nuclear energy, renewables, energy efficiency etc., if fossil fuel prices plus sequestration costs make them economic, we'll use them.
- If not, we won't.

The sequestration challenge



Of course, reducing consumption makes the challenge easier, but is that in *your* interest?



From the Desert: the wide open space for an alternative policy approach to climate change

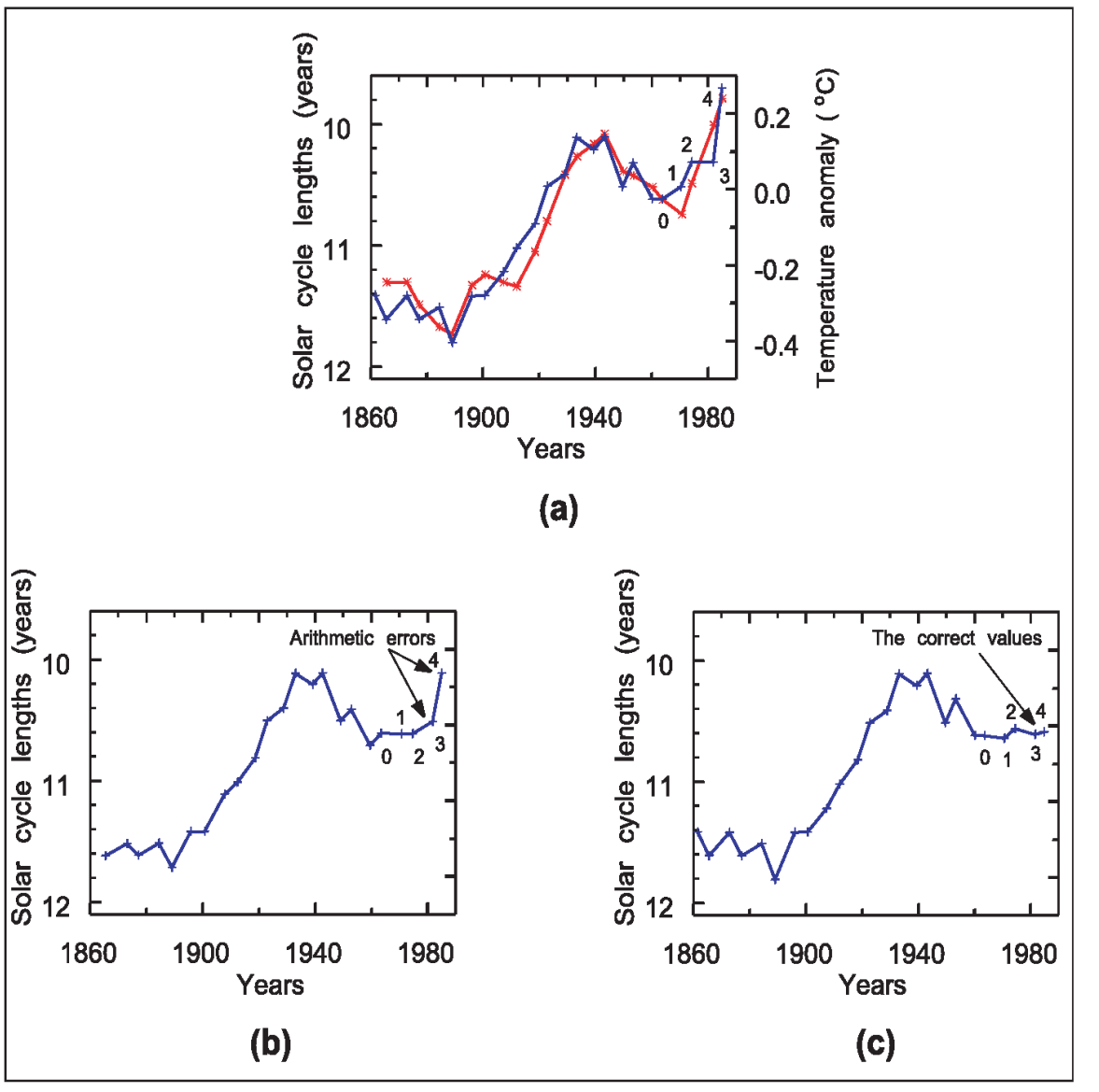
- Fossil fuel producers could radically alter the terms of the climate change debate by framing it as a waste-disposal problem, not a consumption-rationing problem.
- Any such alternative must be credible: vague statements about "energy intensity" won't wash.
- Straightforward denial won't work either, thanks to growing public awareness of this issue.
- Now is the time to start working on what your alternative will be.

How Oxford could help

- Strong interdisciplinary program on climate change.
- Independent of UK government.
- Established links with Arab nations (including Libya and the Gulf States) on water scarcity issues.
- New project enabling regional climate modeling on personal computers with UK Met Office & Microsoft.
- One of the UK's principle centres for Islamic Studies.

Oxford Centre for Islamic Studies

Myth: observed temperature changes can be explained by solar variability



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