CLIFFS, Loughborough, 26 October 2005

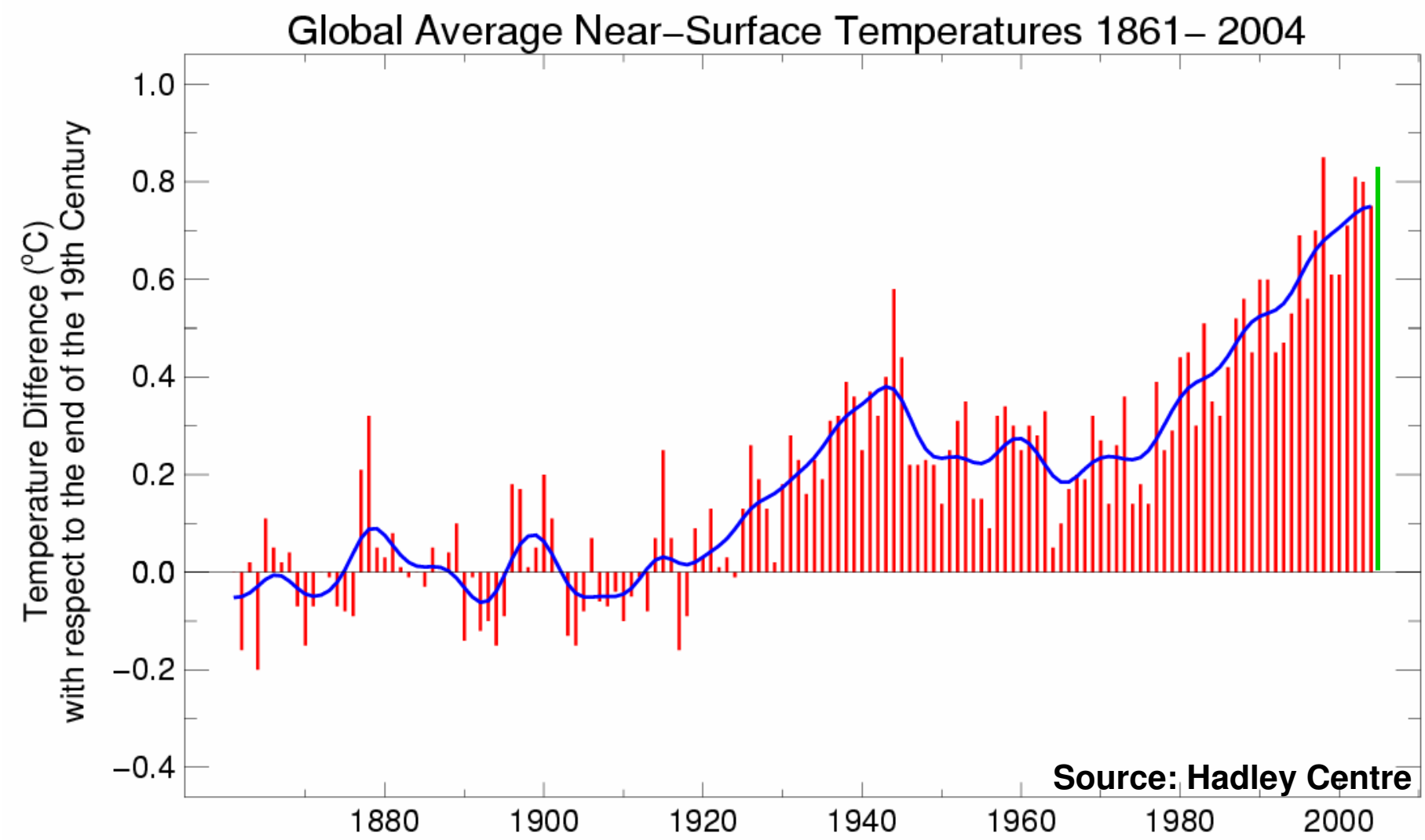
New scenarios of UK Climate Change (UKCIPnext)

Geoff Jenkins, Hadley Centre, Met Office, Exeter

Research funded by defra
Department for Environment Food and Rural Affairs

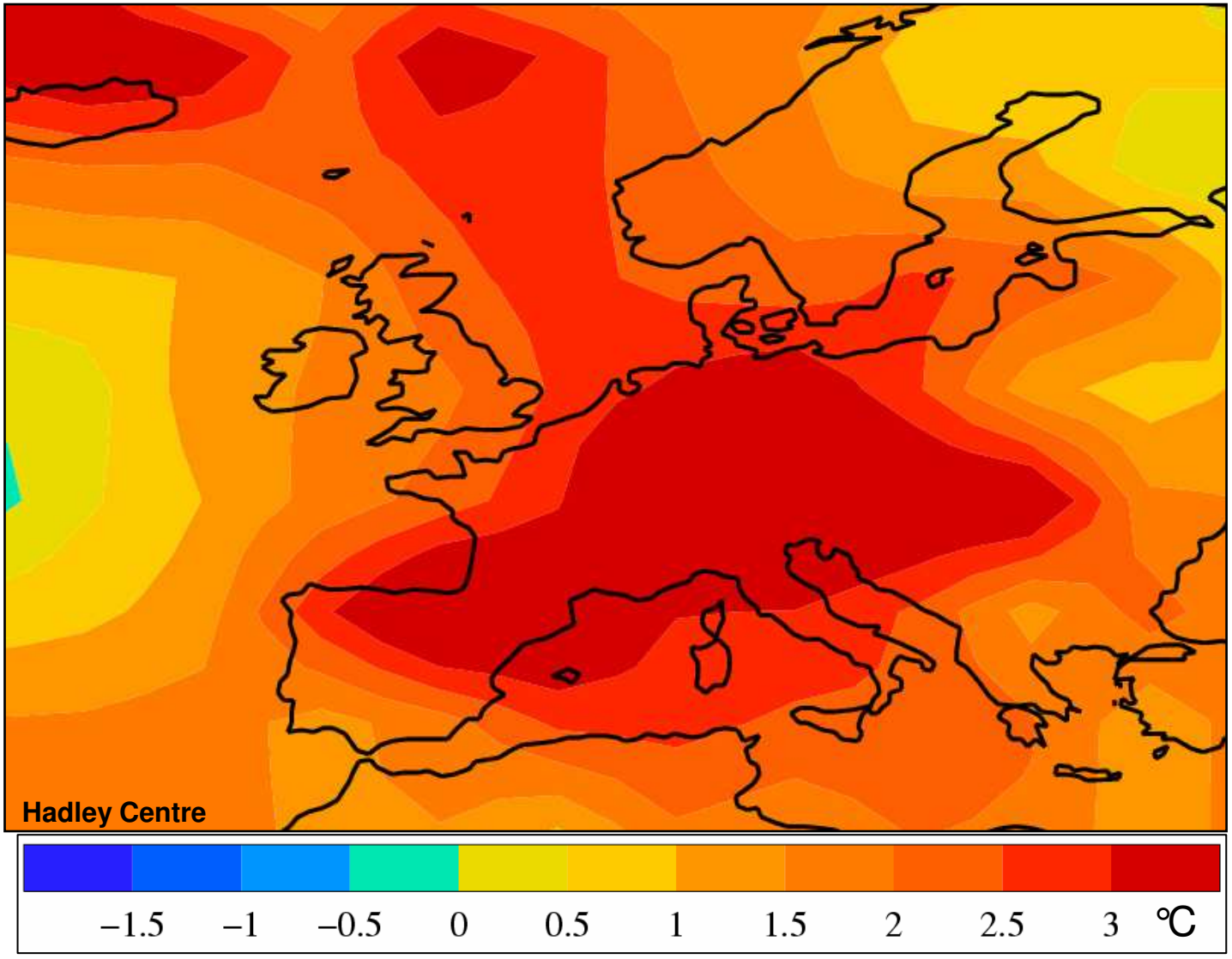
2005 heading to be second warmest on record

(to end August)



Hadley Centre for Climate Prediction and Research

Hot 2003 European summer: human activities have doubled the risk

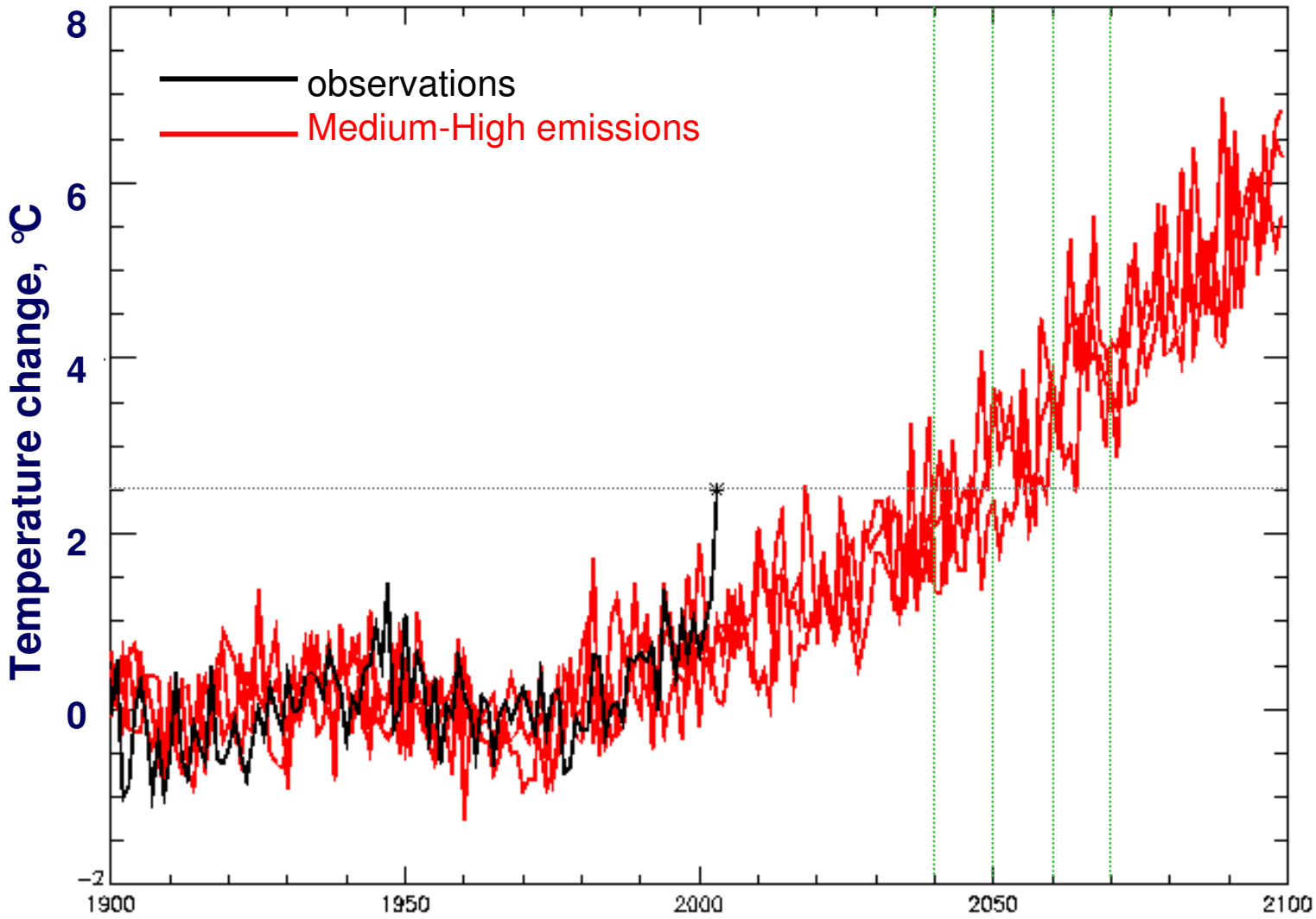


A recent paper in Nature from the Hadley Centre estimates with a high probability that half the risk of the 2003 European summer heatwave can be assigned to man's activities

Source: Peter Stott, Hadley Centre

Hadley Centre for Climate Prediction and Research

European 2003 summer temperatures could be normal by 2040s, cool by 2060s

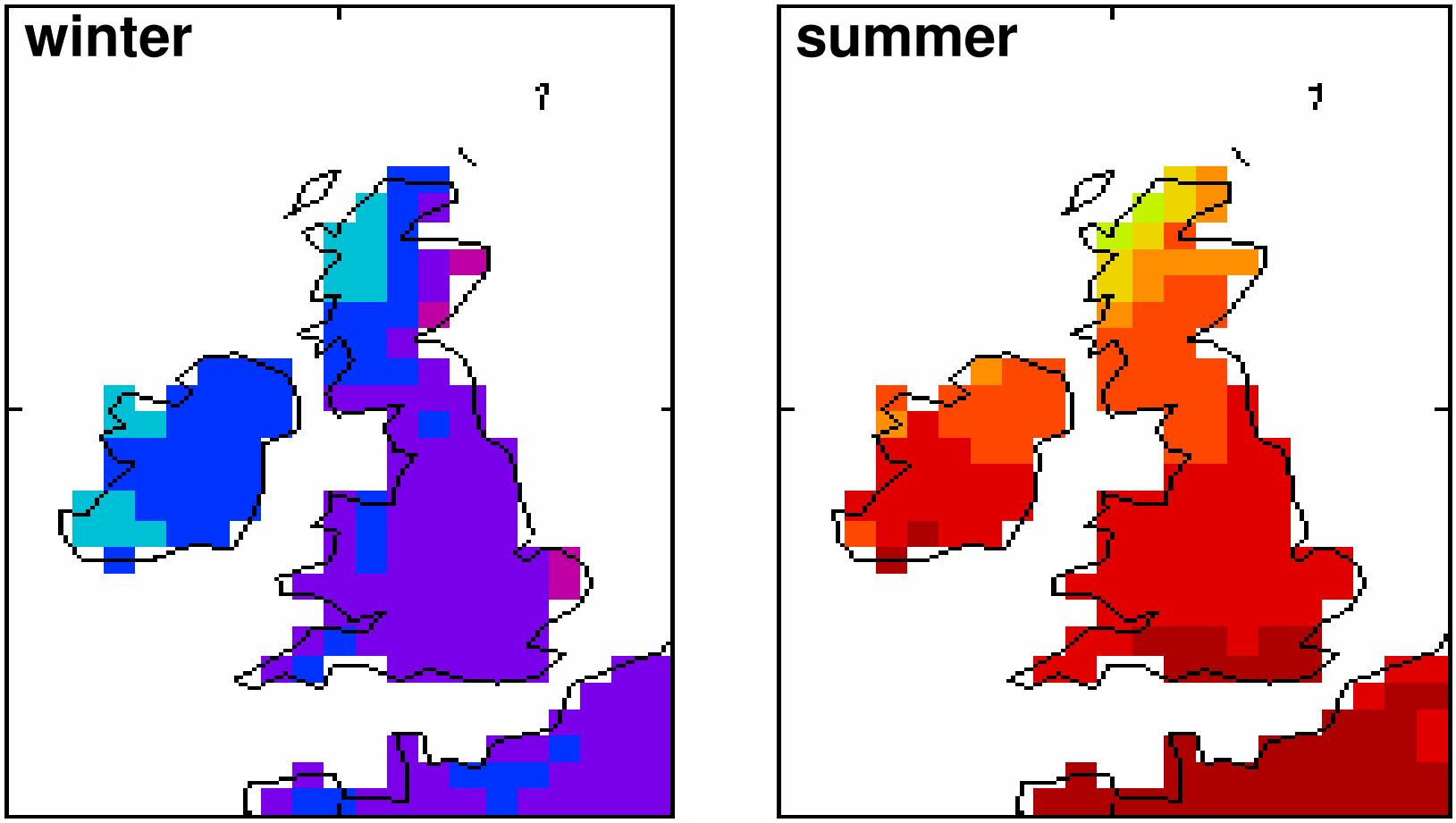


Hadley Centre for Climate Prediction and Research

Source: Peter Stott, Hadley Centre

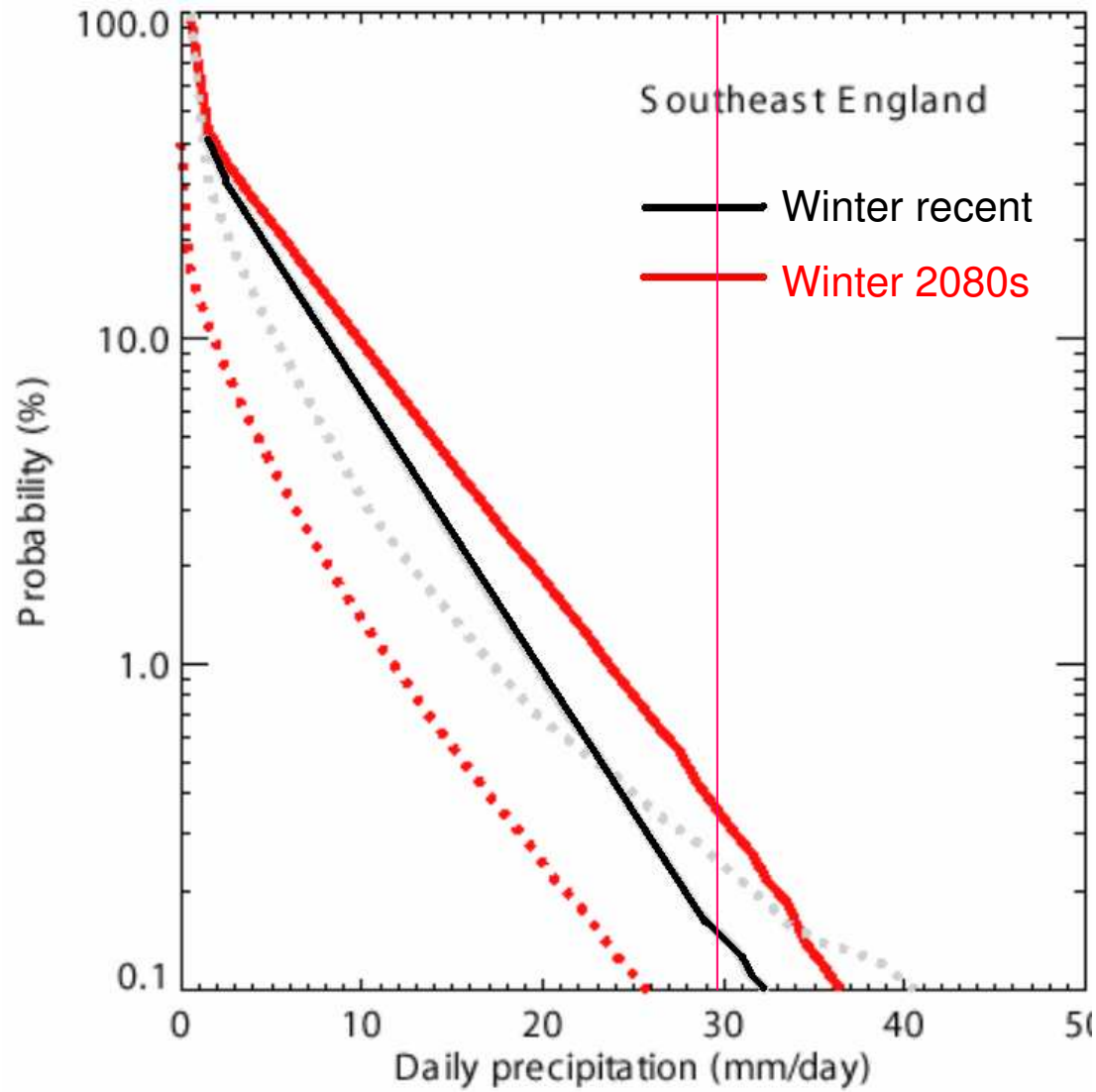
Change in UK precipitation by the 2080s

Medium – High emissions scenario



UKCIP02

Probability of winter daily rainfall exceedence



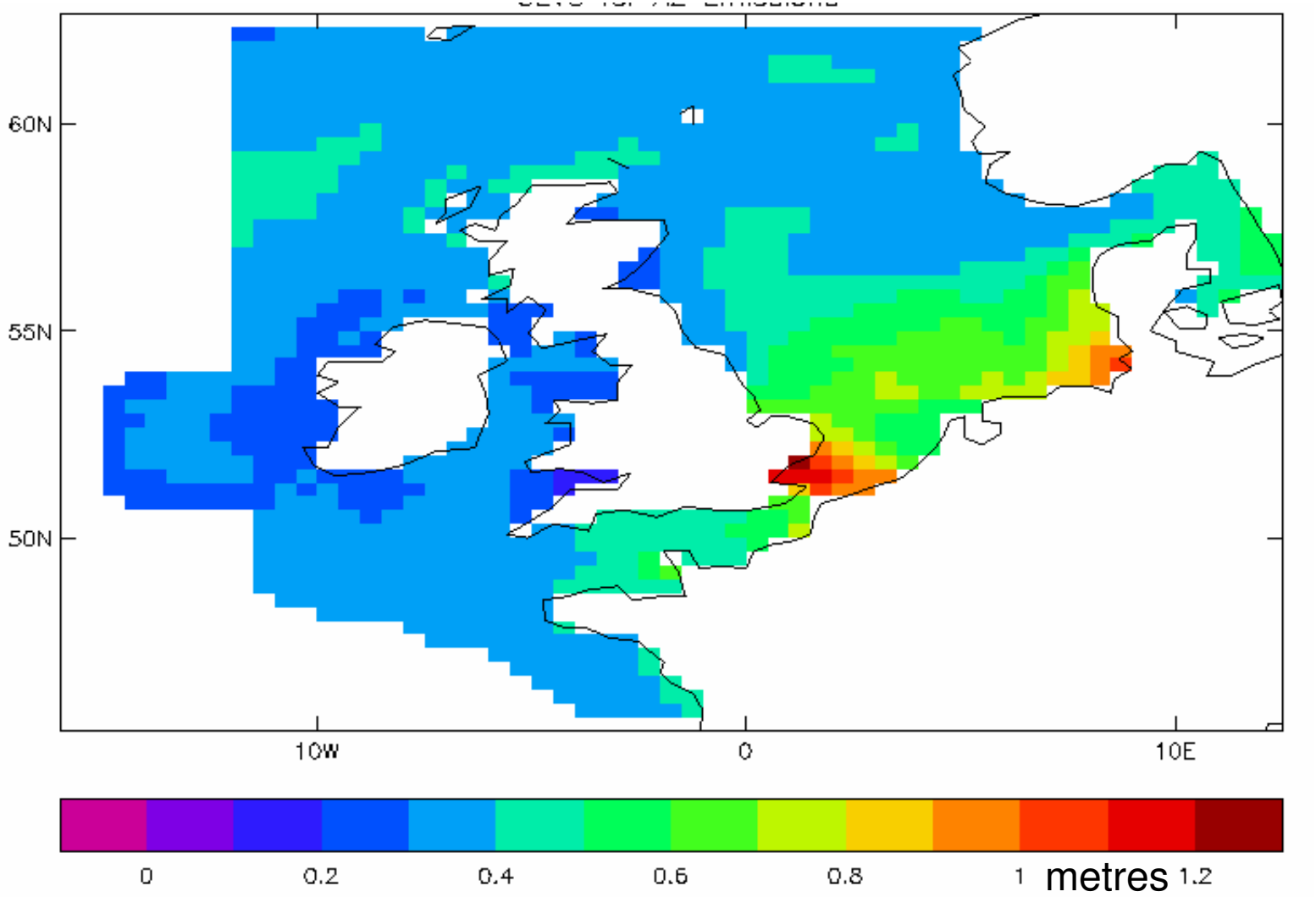
Medium-High Emissions Scenario

UKCIP02

Hadley Centre for Climate Prediction and Research

N Sea storm surges could be a metre higher

by the 2080s, Medium-High emissions; with a 30cm SLR



UKCIP02

Hadley Centre for Climate Prediction and Research

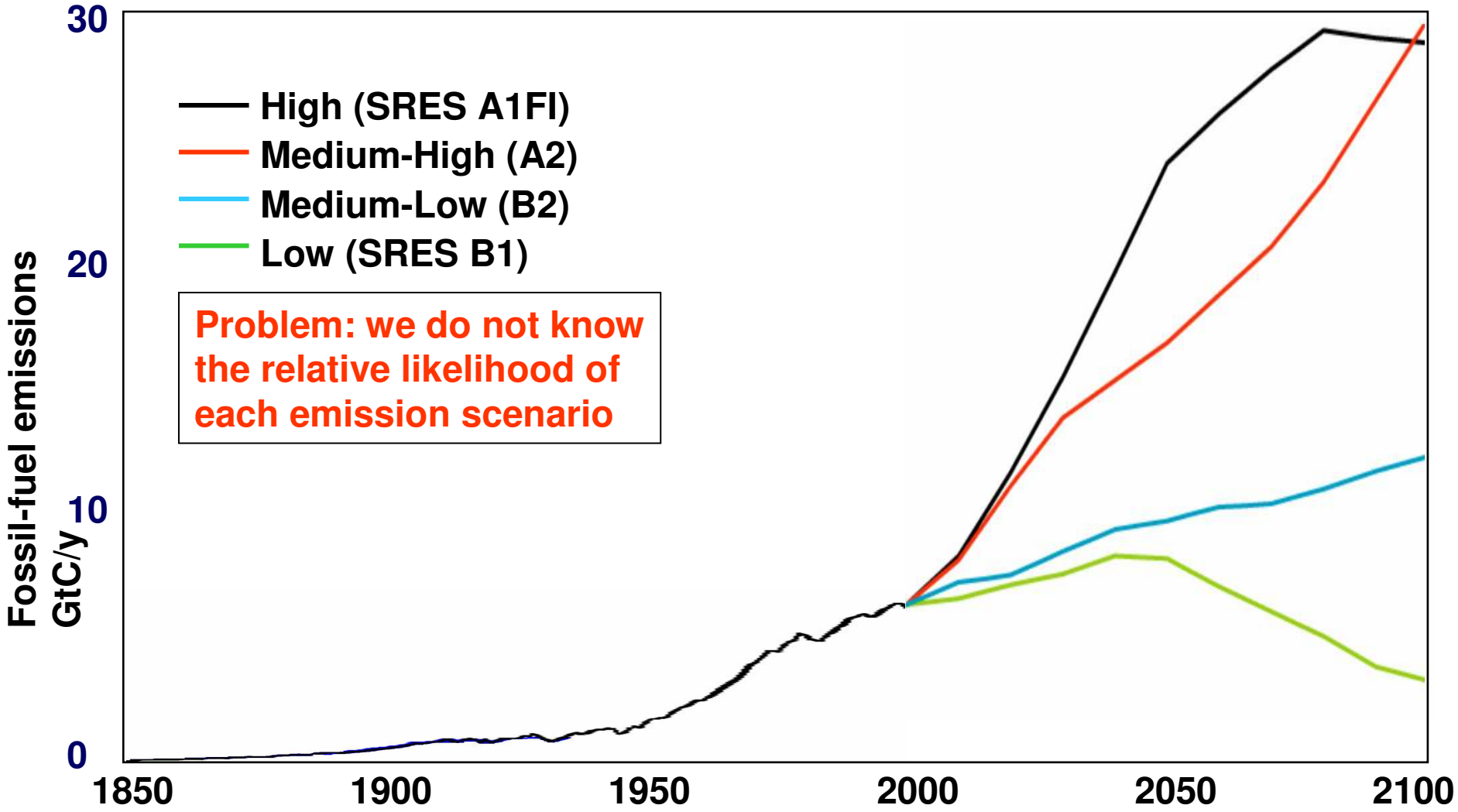
Uncertainties in predictions arise from:

- Emissions uncertainty
- Natural variability
- Modelling uncertainty

Hadley Centre Technical Note 44:
"Handling uncertainties in the UKCIP02 scenarios of climate change",
Geoff Jenkins & Jason Lowe, November 2003

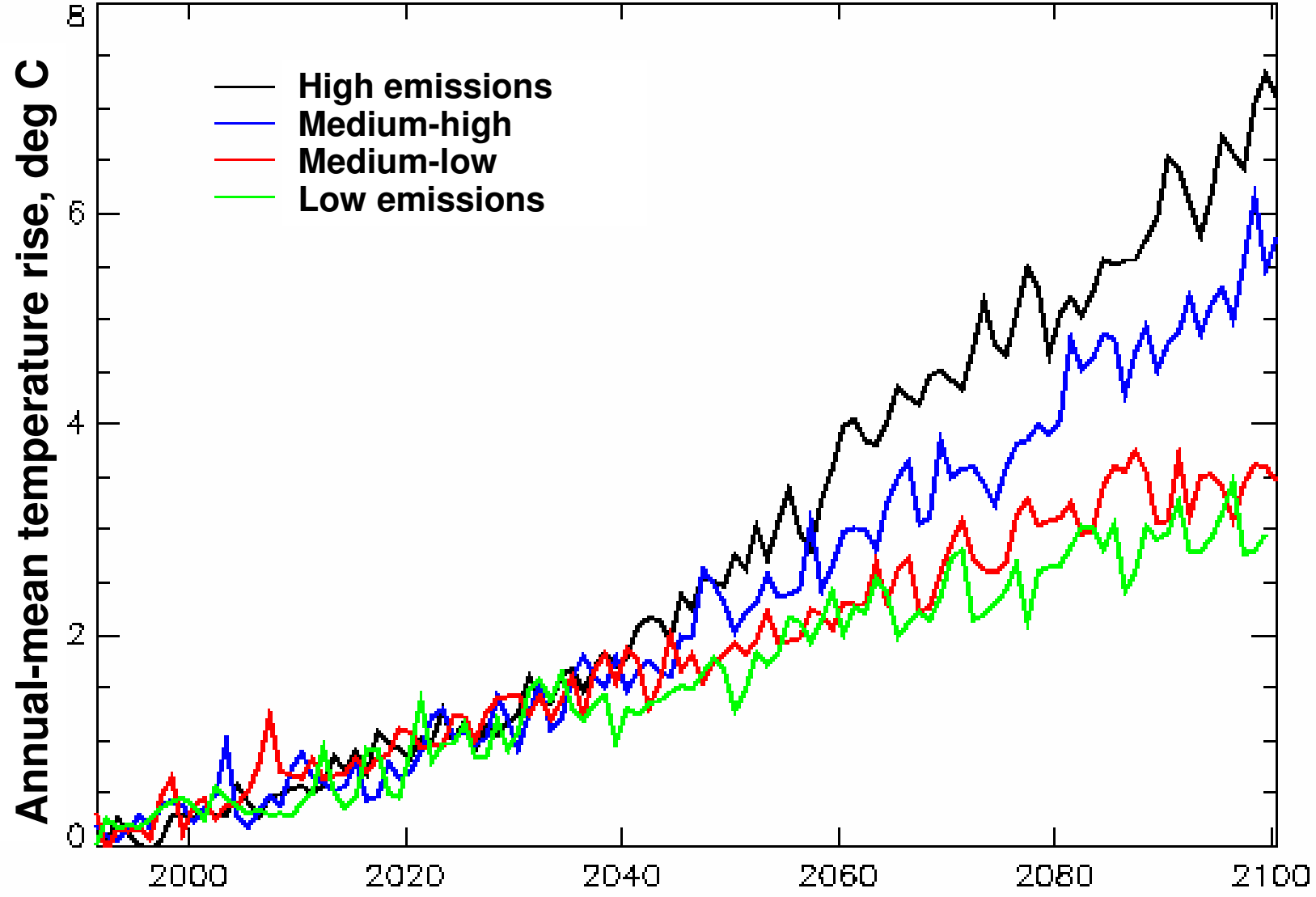
www.metoffice.gov.uk/research/hadleycentre/pubs/HCTN/HCTN_44.pdf

Emissions to 2000, and IPCC projections to 2001



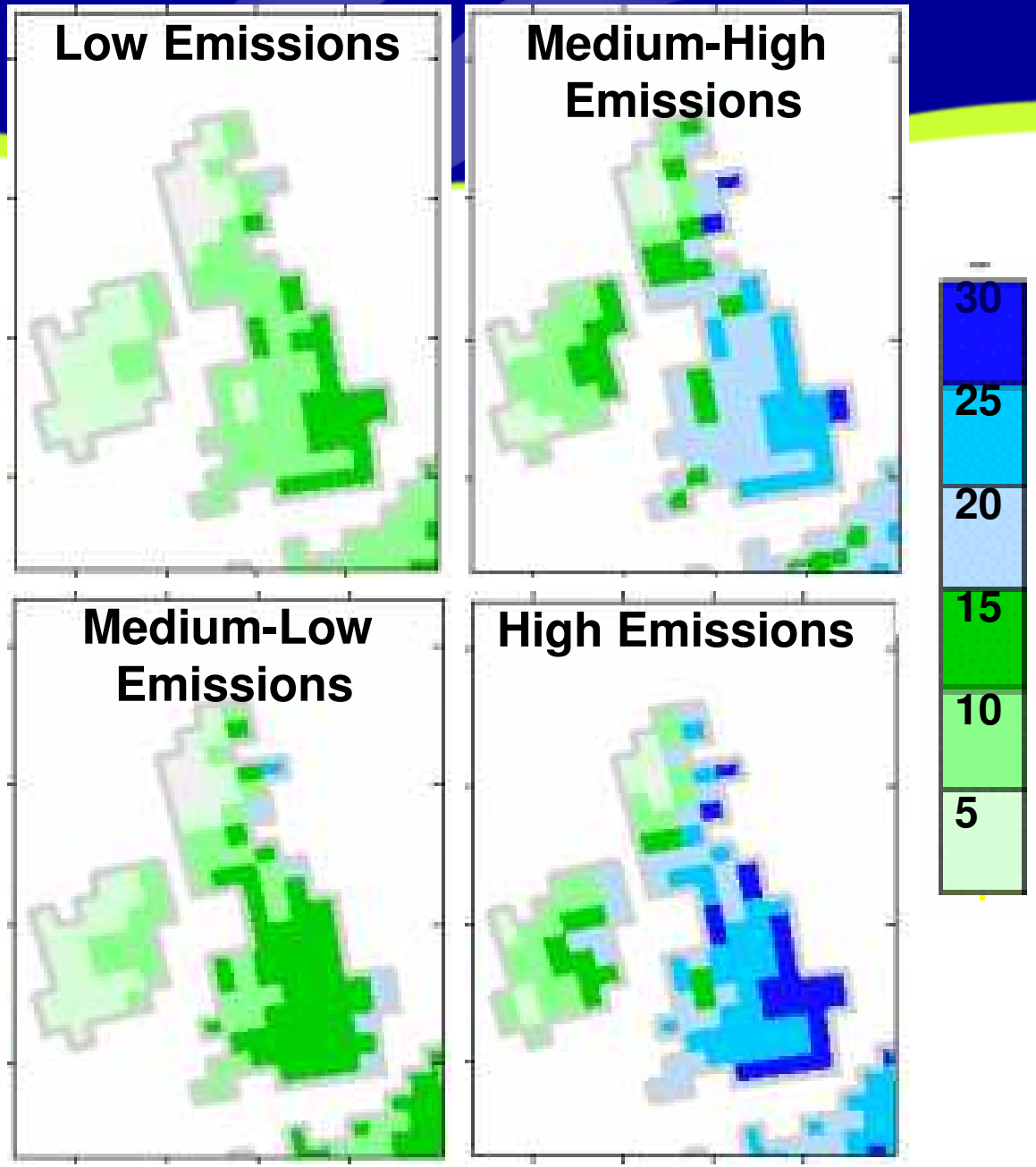
Source: CDIAC and IPCC

Land global warming over next 40 years does not depend on emissions scenario



Hadley Centre for Climate Prediction and Research

Source: Hadley Centre



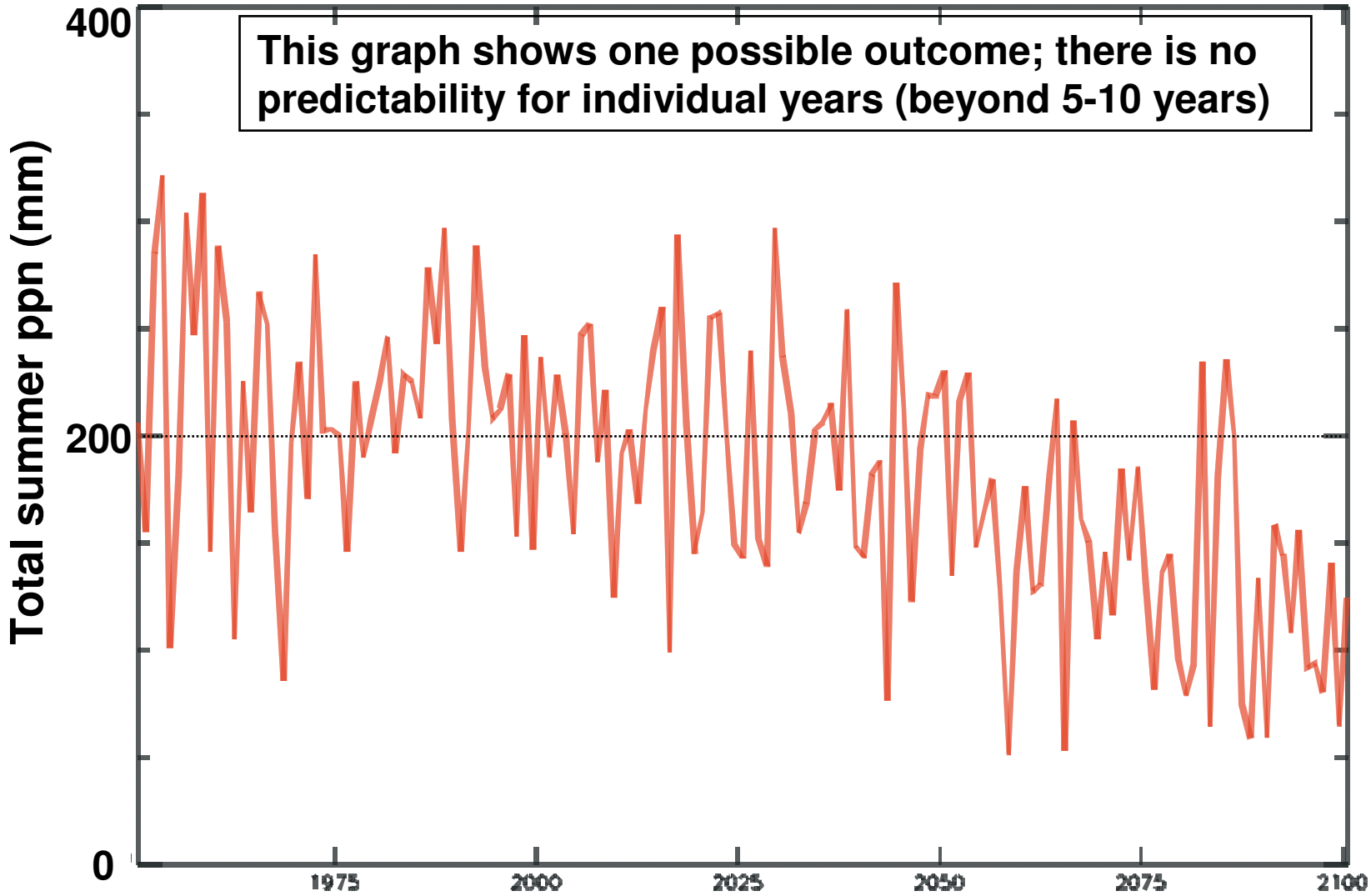
Handling emissions uncertainty in **UKCIP02**

% CHANGE IN WINTER PRECIPITATION by 2080s under four future emissions scenarios

No difference for 2020s; small for 2050s.

No indication of relative likelihood

Model-simulated England & Wales precipitation



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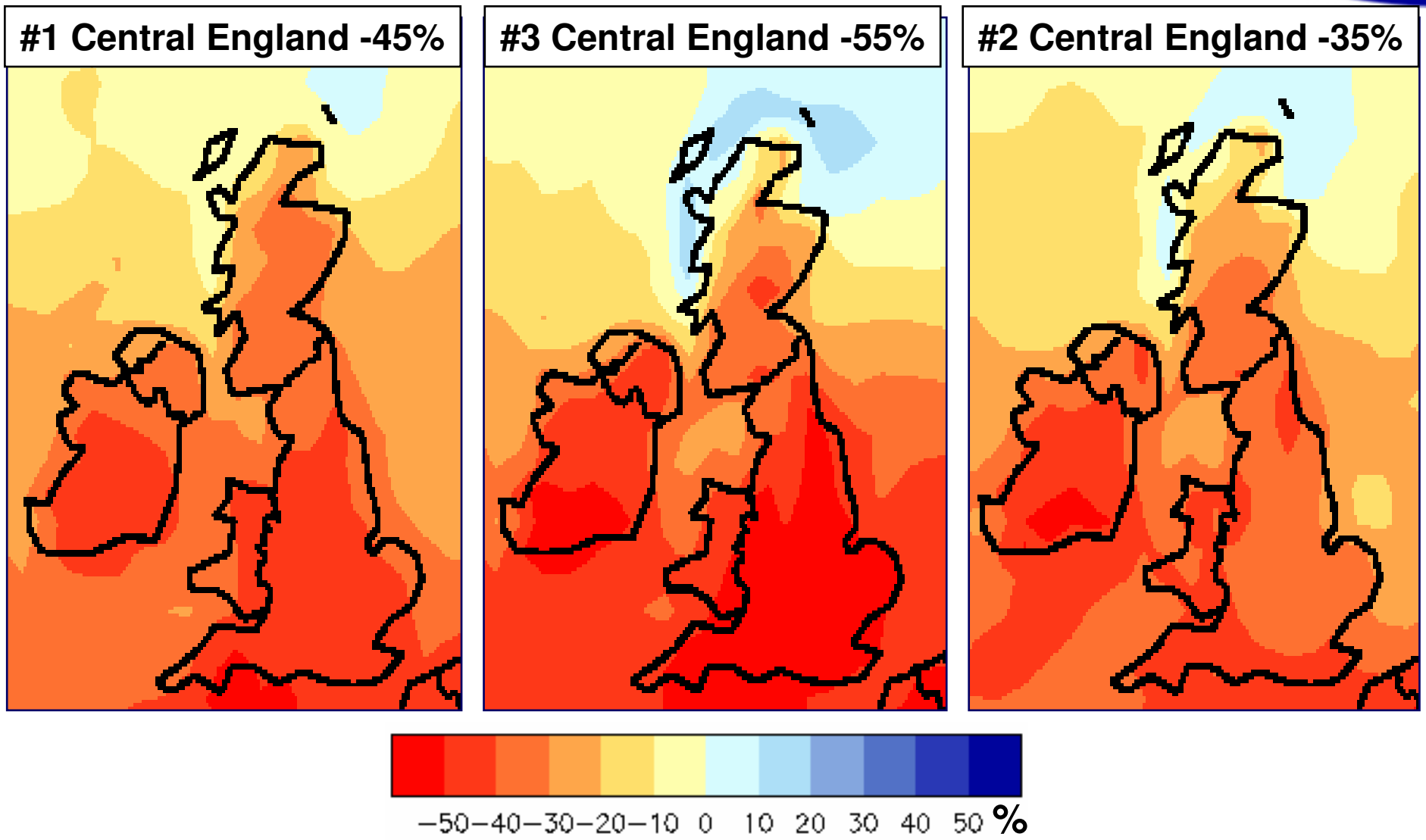
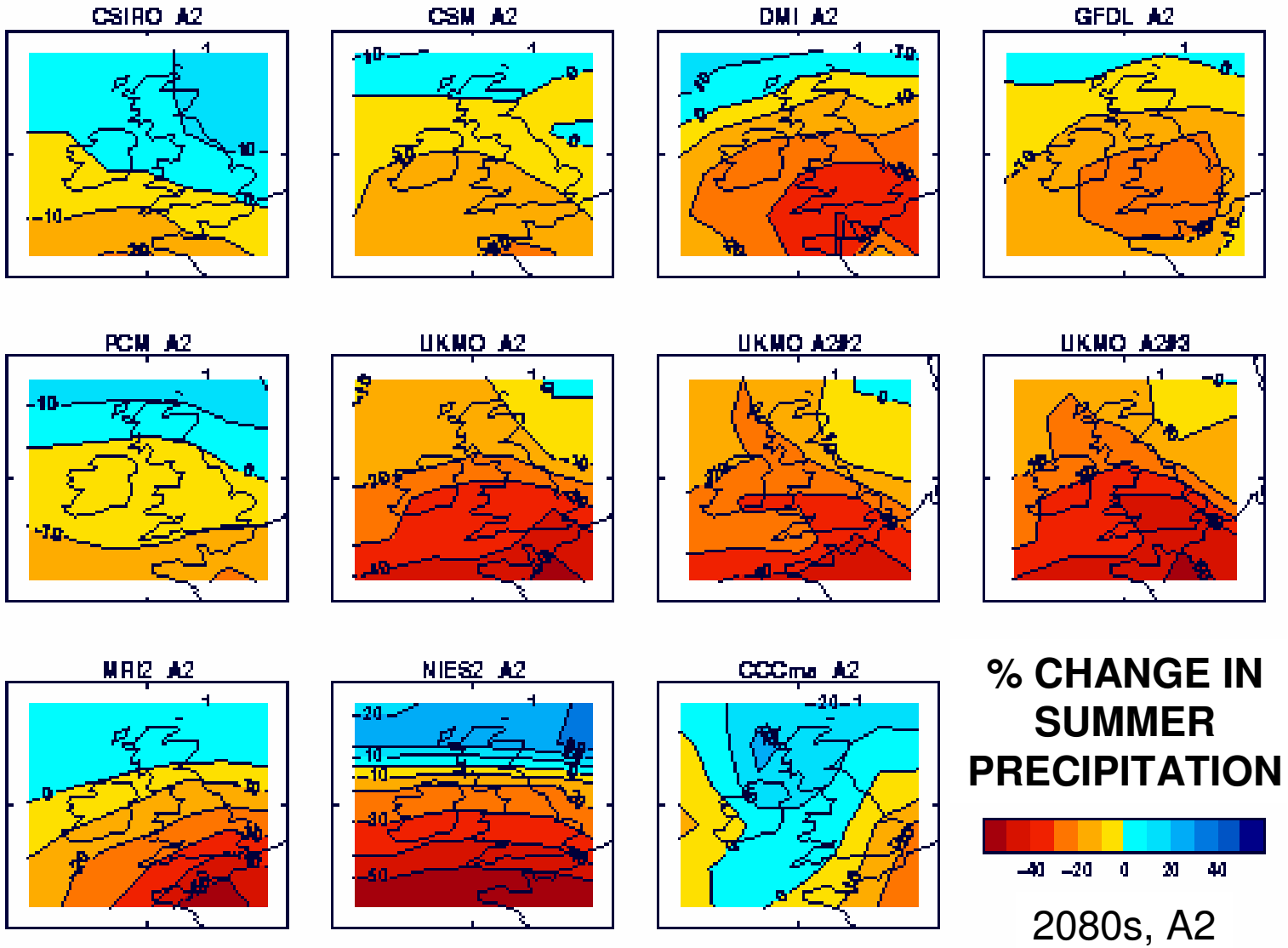
The effect of natural variability on predictions

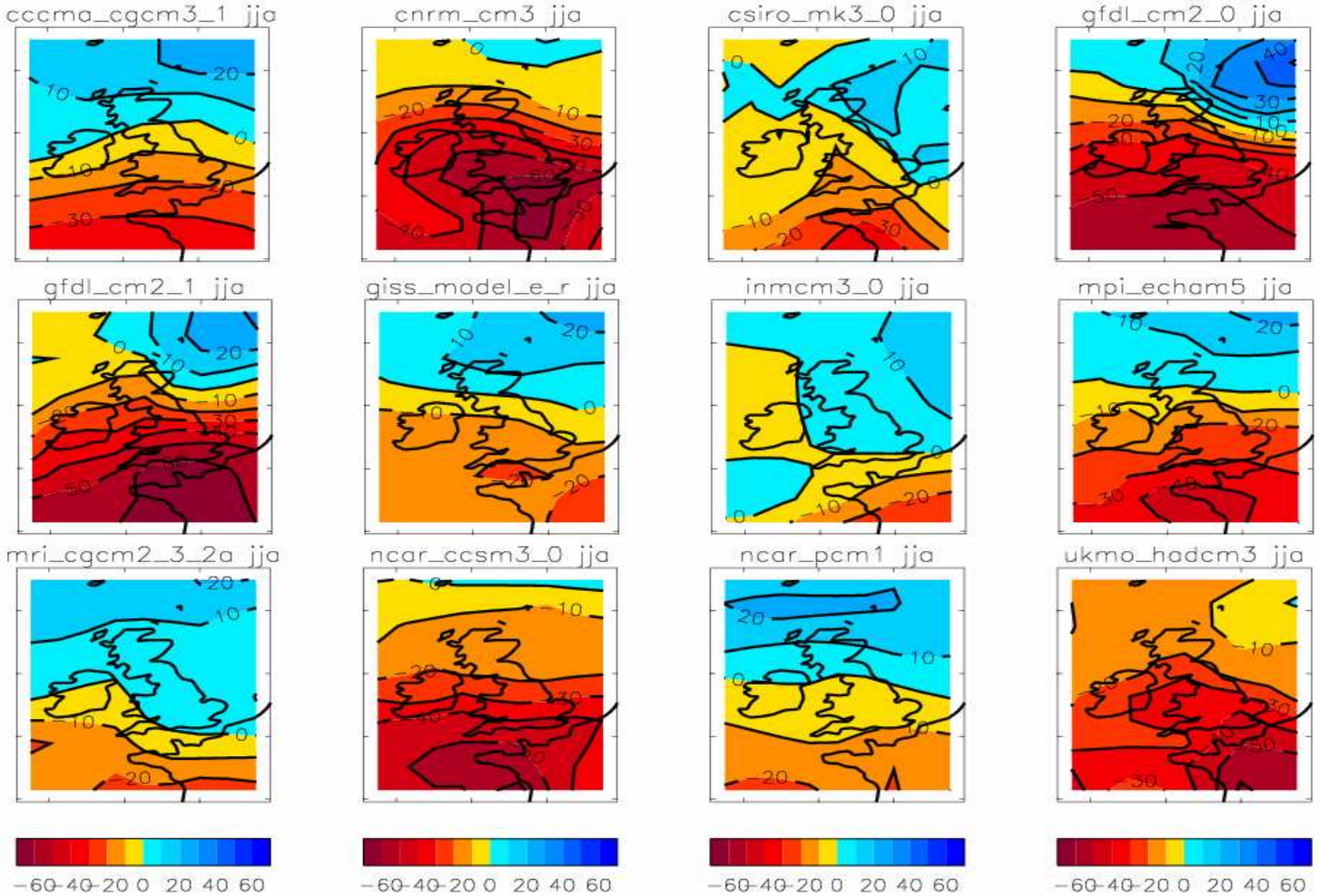
Change in summer rainfall by 2080s from 3 model runs, Medium-High Emissions



Modelling uncertainties in UKCIP02



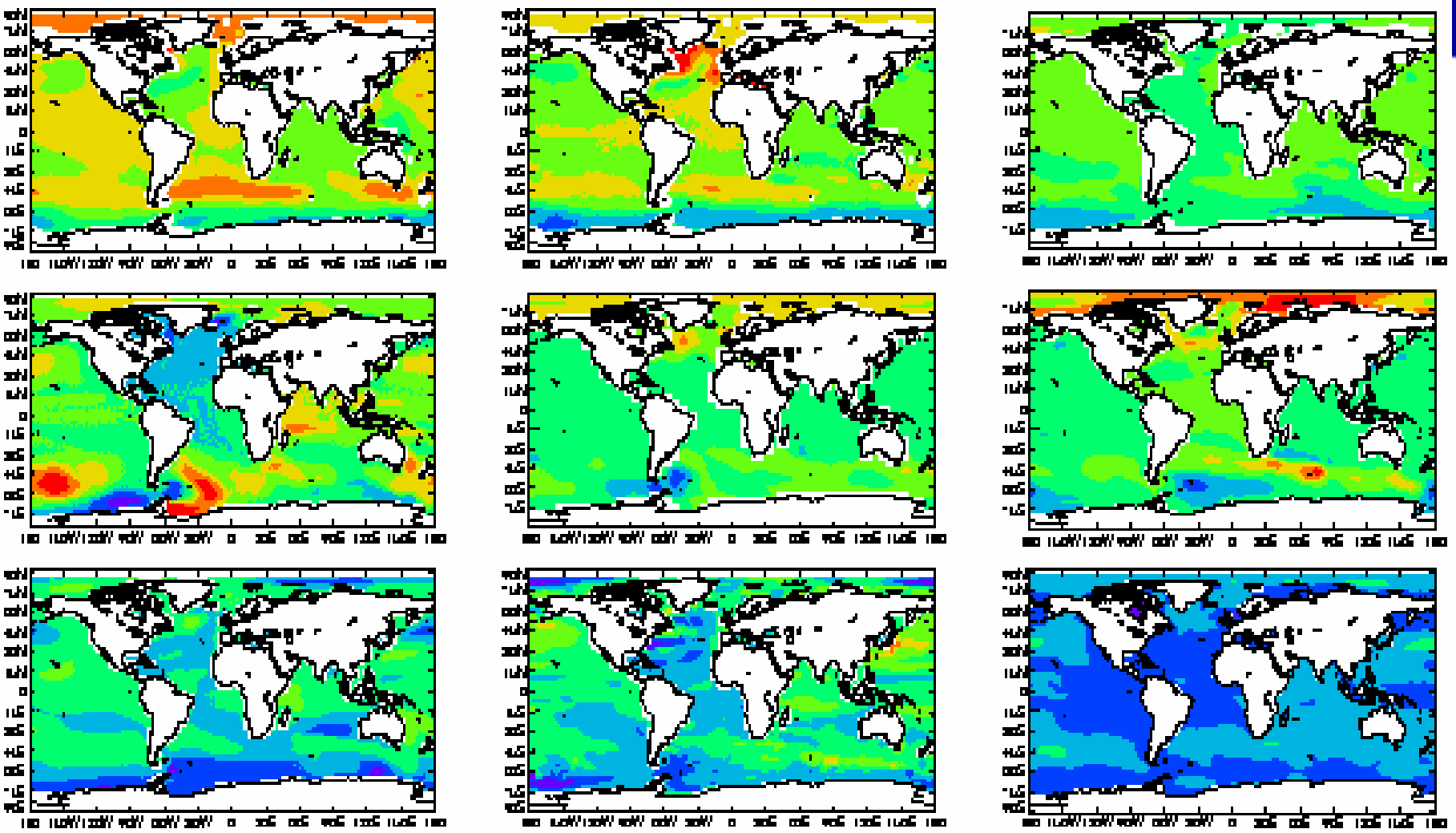
Modelling uncertainties – IPCC 4AR



Problem: we do not know the relative likelihood of each prediction

Regional sea level rise

due to thermal expansion and ocean circulation changes only



Source:
IPCC

0 0.1 0.2 0.3 0.4 0.5 0.6 m

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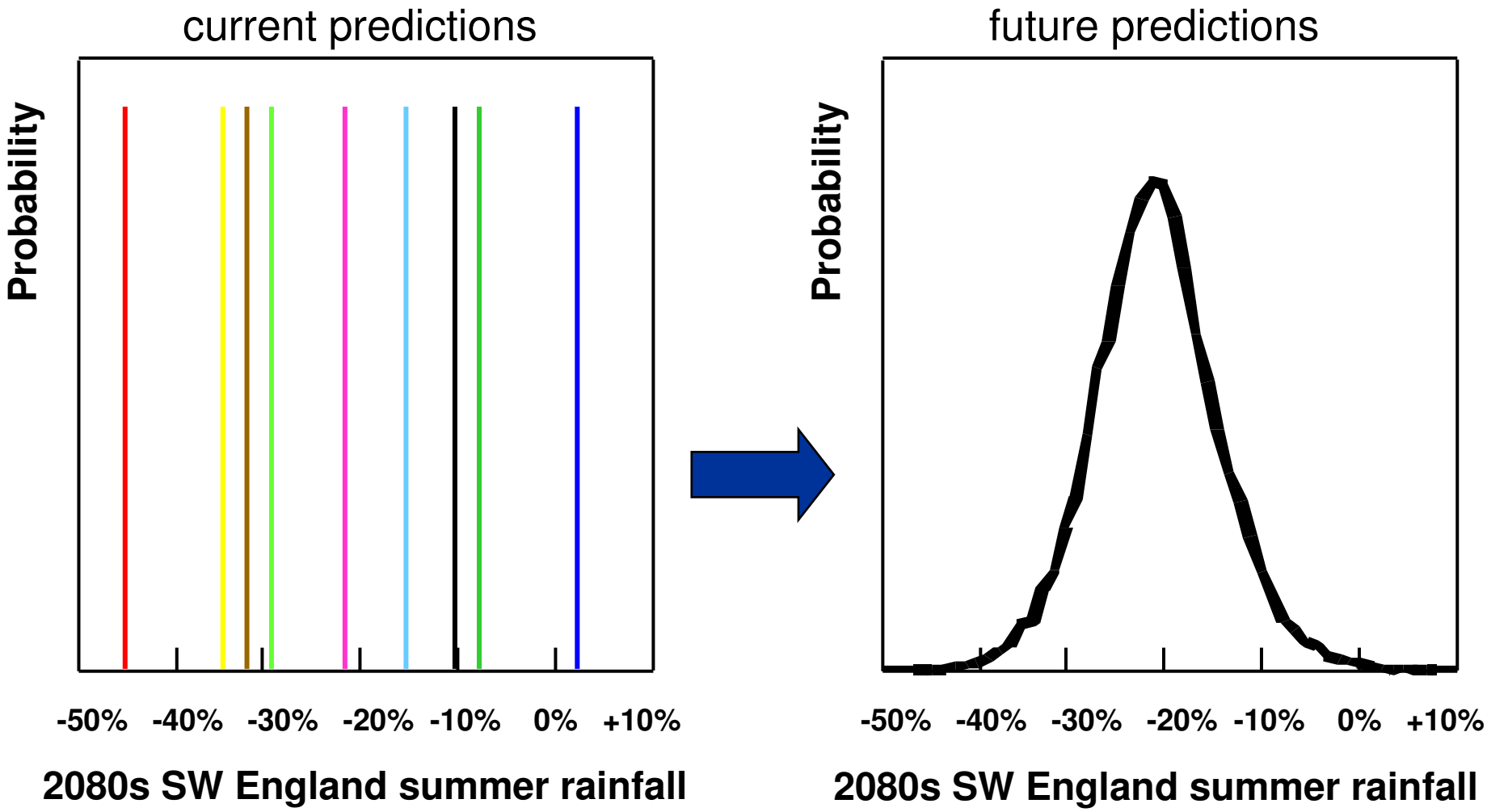
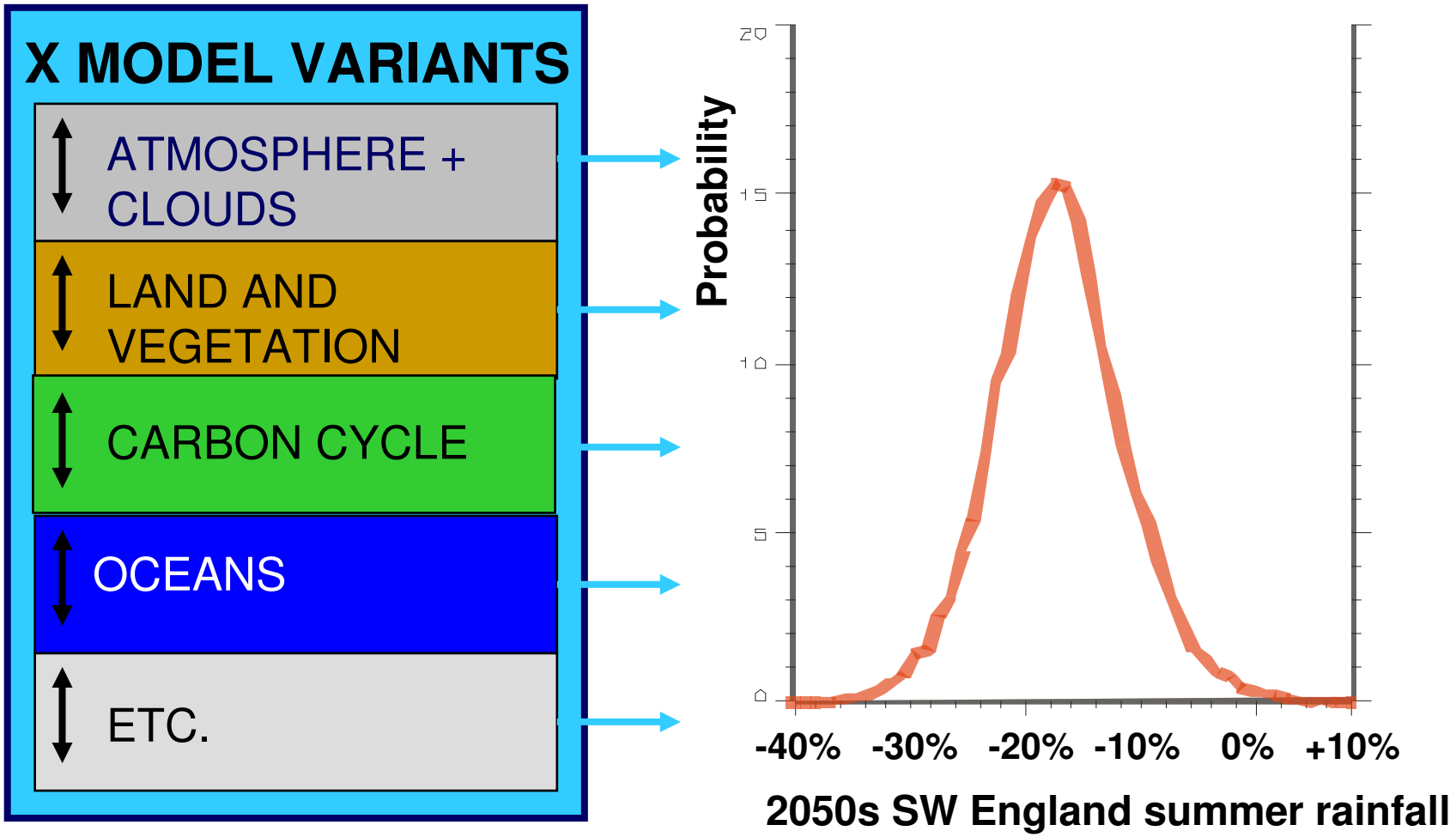
Effect of uncertainties on infrastructure planning

- Planning for highest predictions could waste money
- Planning for lowest predictions could jeopardize infrastructure adequacy, with greater costs
- Uncertainty allows planners to procrastinate or ignore the problem
- Model uncertainty is largest: deterministic predictions no longer justifiable.

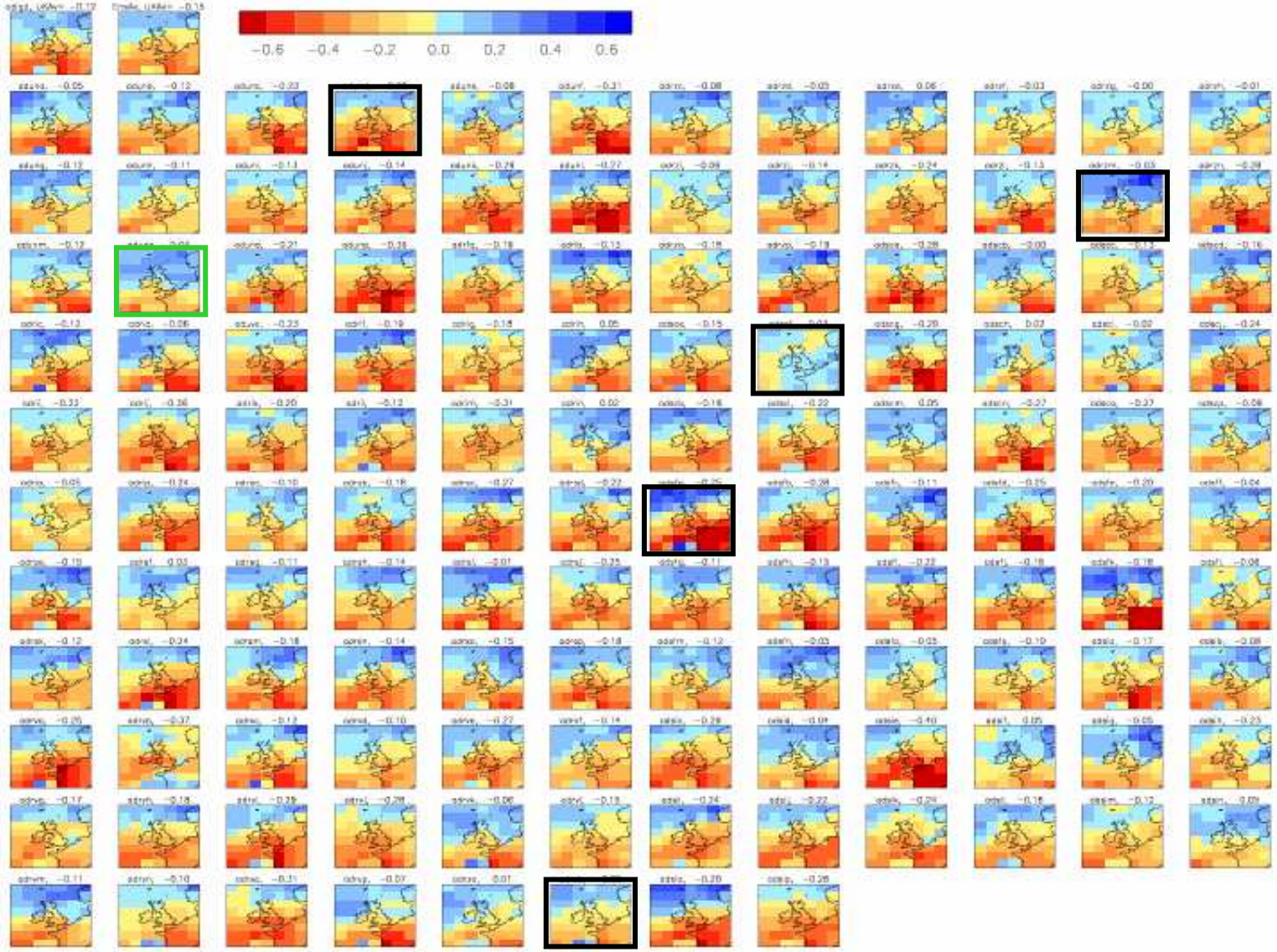
Moving from uncertainty to probability



Probabilistic climate predictions



Change in summer rainfall: 128-member ensemble



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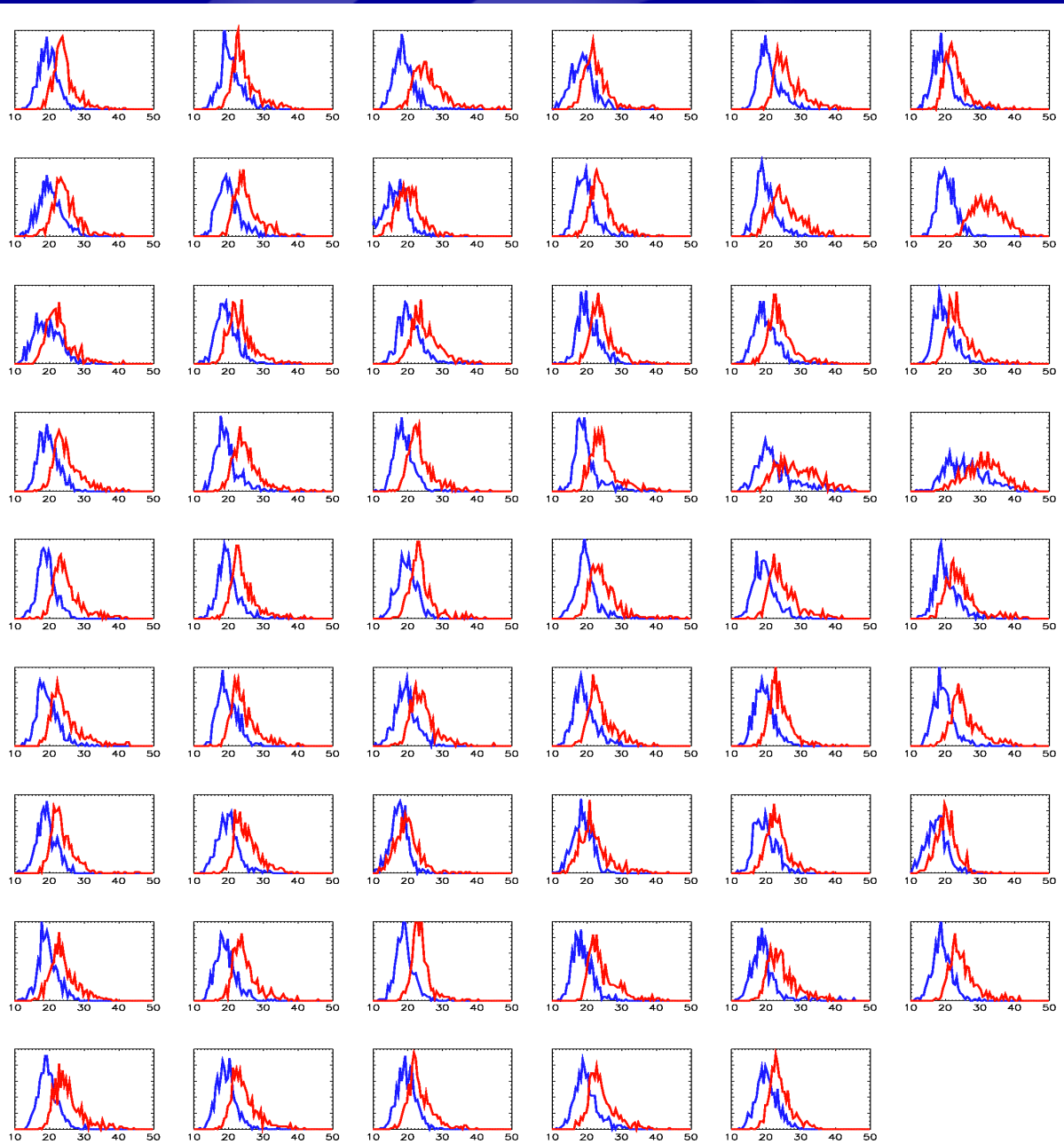
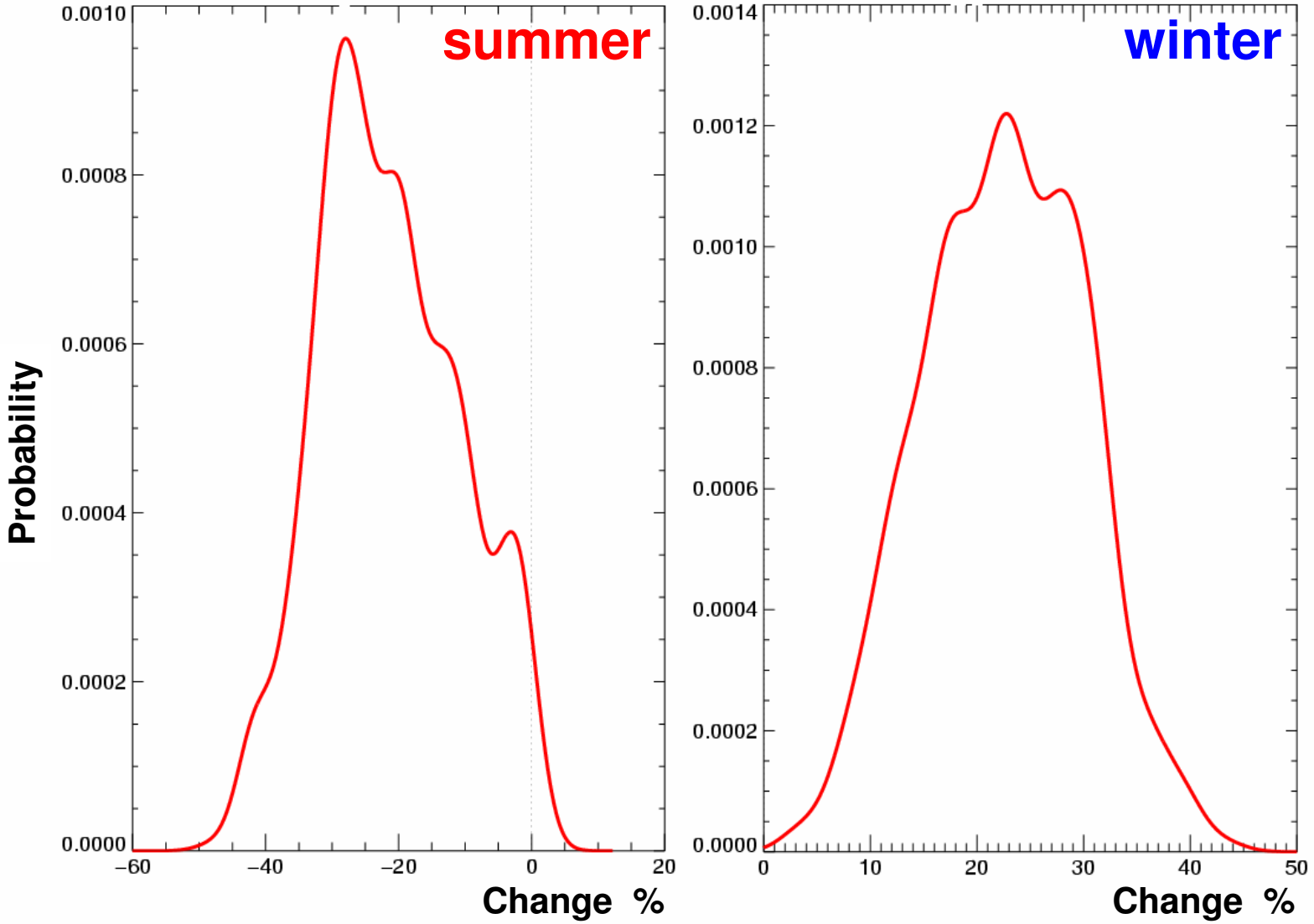


July daily maximum temperatures SE England (53 member ensemble)

current

future

Probability of change in England & Wales rainfall



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UKCIPnext scenarios: user requirements

- **UR: Single scenario, high resolution, based on several climate models, not just Hadley.**
- Single deterministic scenarios no longer justifiable; probabilistic predictions are the key.
- Probabilistic predictions available only from Hadley Centre model in near future; main problem is combining these with single predictions from other models.
- This has implications for daily data, areal averages, etc.
- Big "physics ensembles" for probabilistic predictions need huge computing capacity.
- This limits resolution to 50km; x2 resolution = x8 computing power.

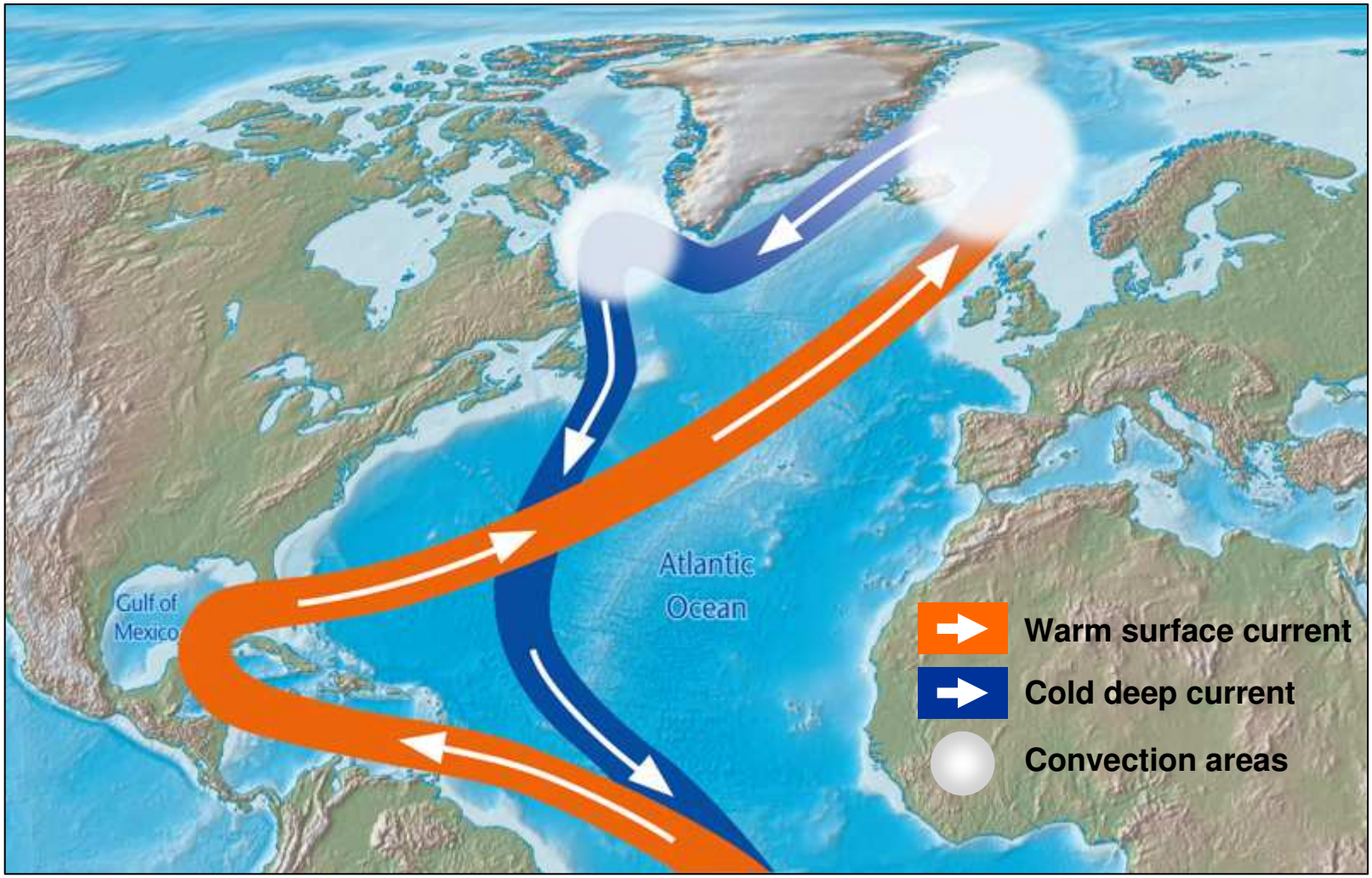
Next steps

- Probability predictions, derived from Hadley and other climate models, well underway
- Defra setting up Steering Group for scenarios.
- We want to work with high-end users to optimise the way the scenarios are used.
- Eg: relationships between degree of protection and cost, to convolve with probability curves.
- Suggestions for case studies very welcome.
- UKCIPnext launch target: Spring 2008

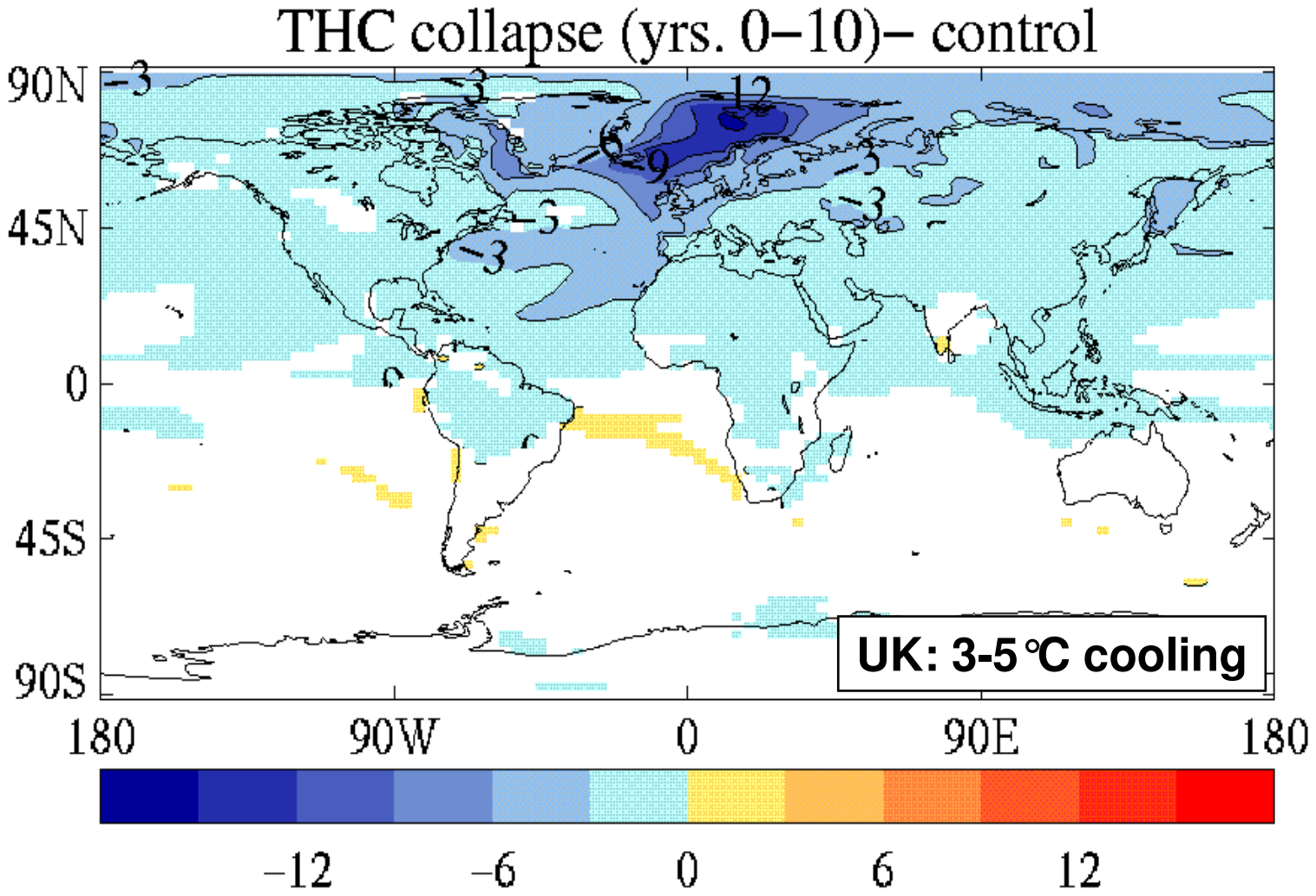
Summary: UKCIPnext

- Emissions uncertainty will be covered, in a manner tbd.
- Natural variability uncertainty will be covered.
- Model uncertainty will be covered by a combination of Hadley Centre ensembles and other centres' models
- Deterministic predictions are no longer defensible; probabilistic predictions are the key to handling uncertainty.
- Available computing power limits the resolution to 50km.
- Work with users to optimise application of scenarios.

Ocean circulation in the North Atlantic



Cooling from a Gulf Stream collapse: NOT a standard scenario



Gulf Stream collapse not predicted