Working with probabilistic climate change scenarios: the challenges for the users and the developers

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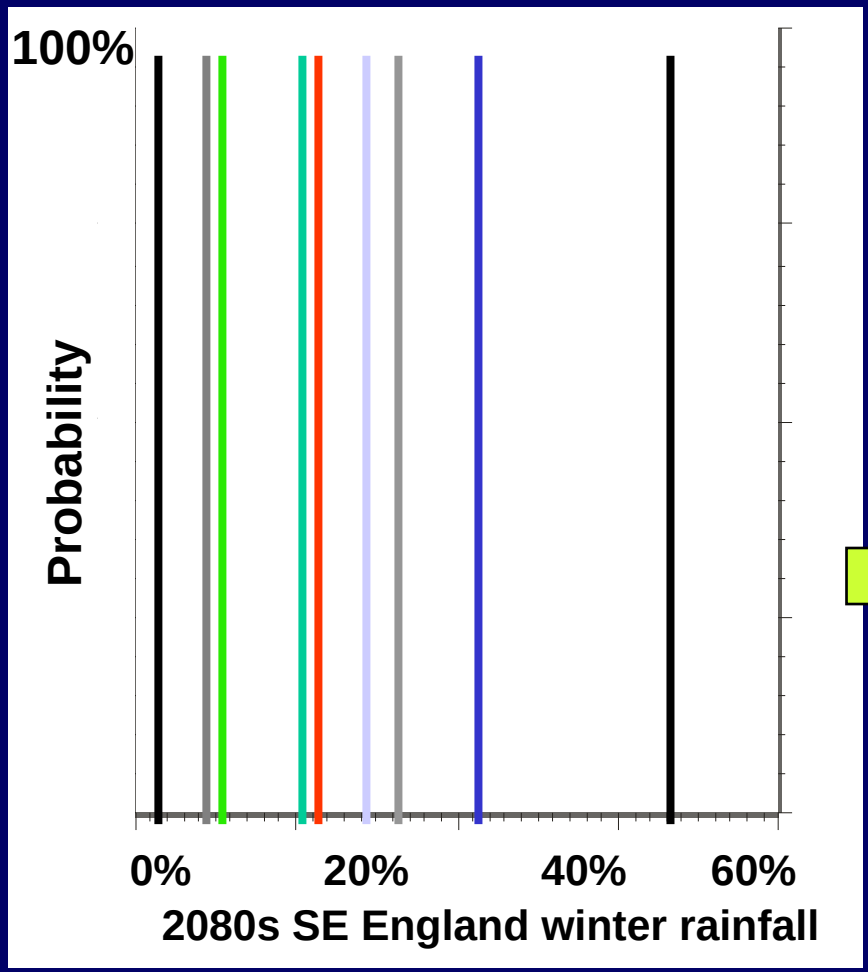
The cascade or explosion of uncertainty

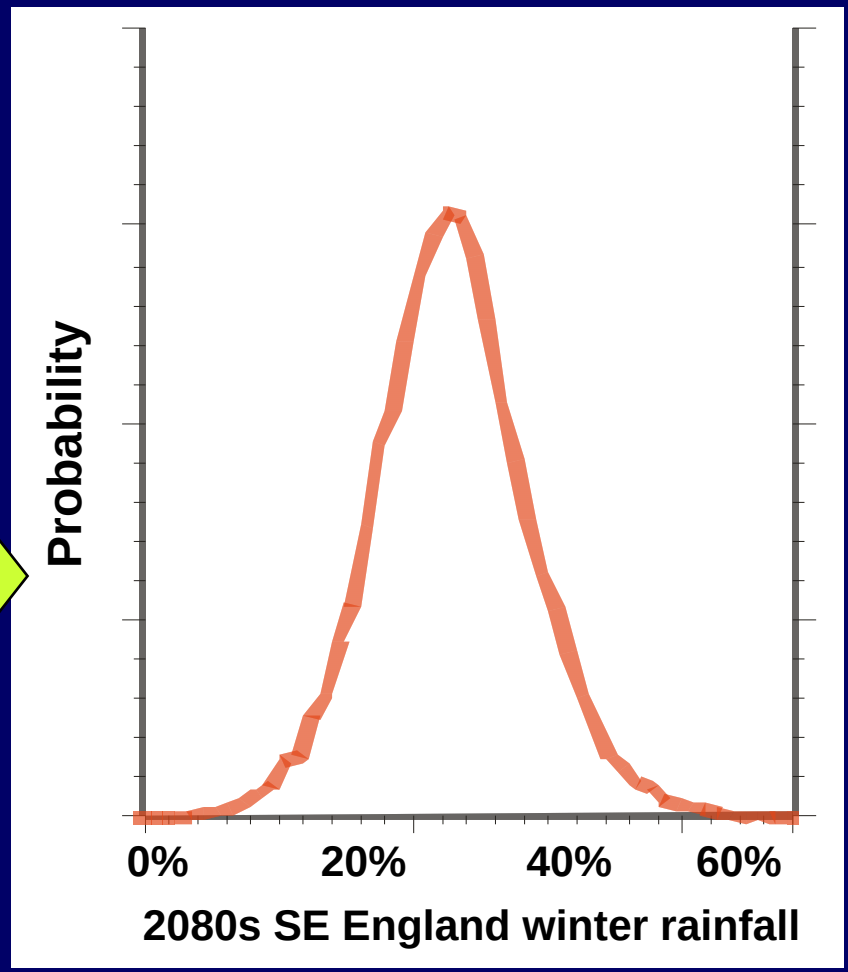
- uncertainties in emissions:
  - multiple emissions scenarios
  - pattern scaling
- different model responses:
  - inter-model ensembles
- internal model variability
  - intra-model ensembles
  - (different start/parameter values)
- downscaling method
  - inter & intra-model ensembles
  - (dynamical/statistical)

From storylines to probabilities…..

current position (UKCIP02)



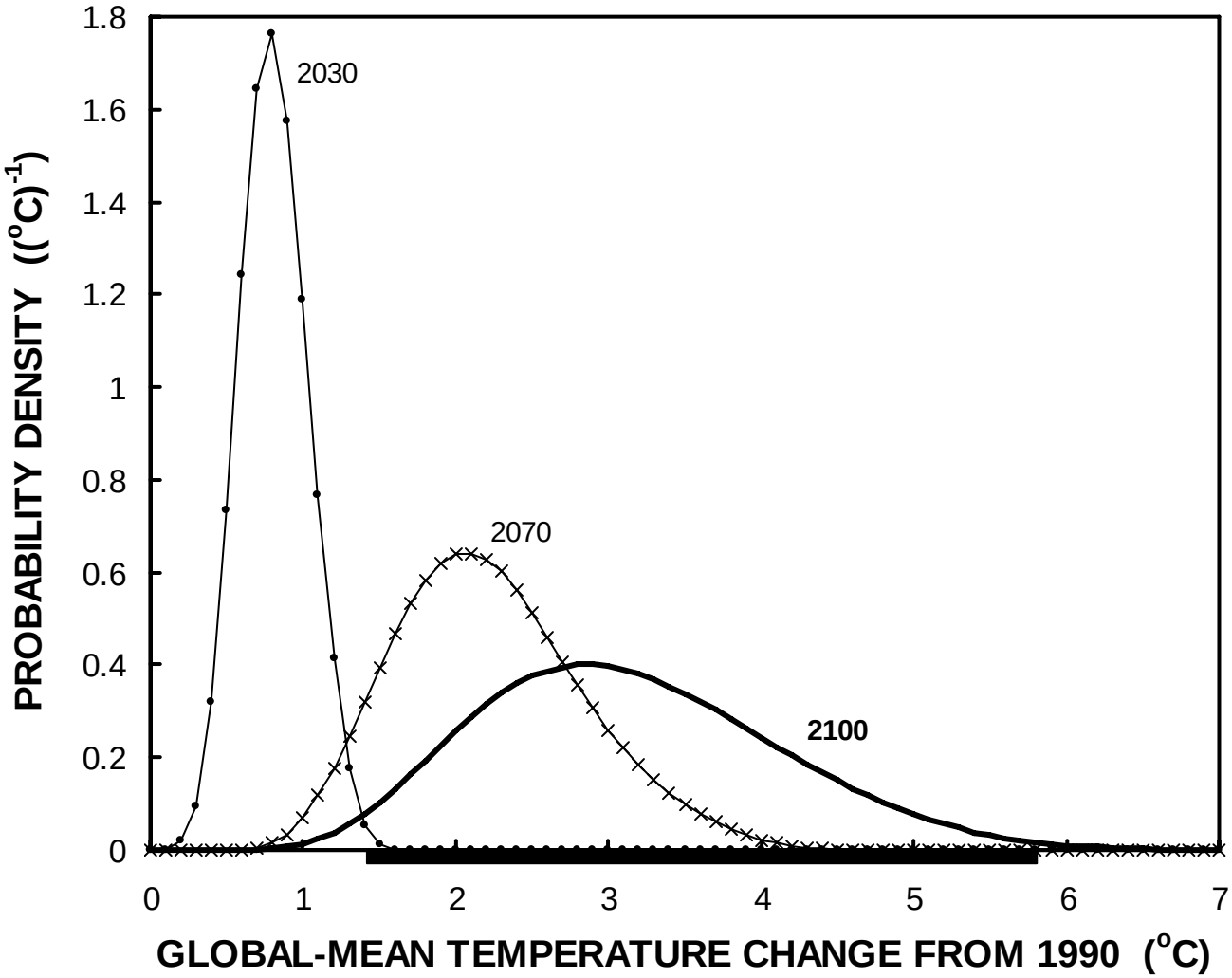
required position (UKCIPnext)



Met Office Hadley Centre

Wigley and Raper, 2001, Science, 293, 451-454

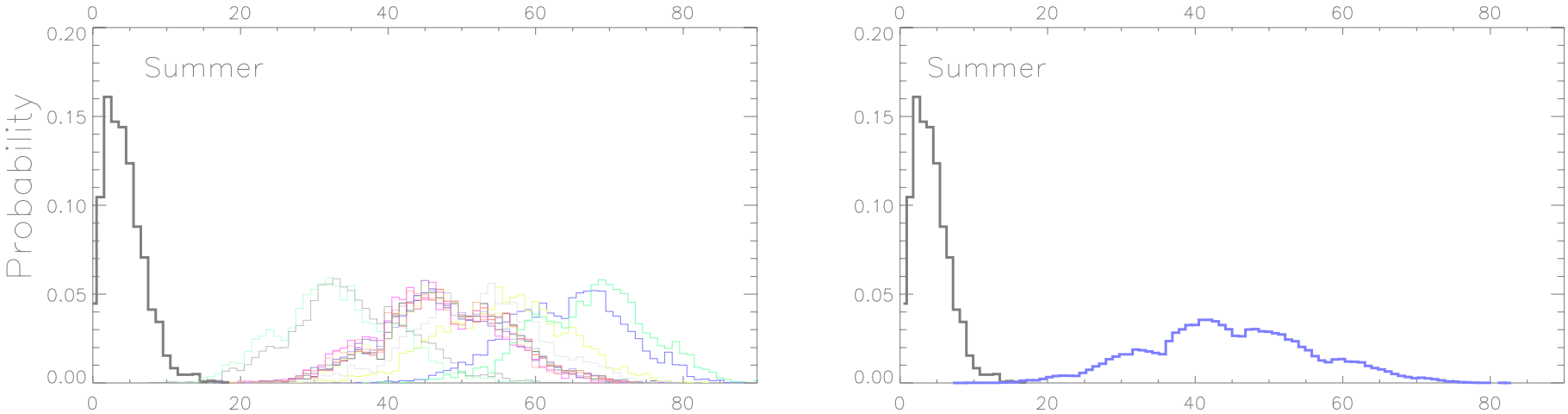
Estimation of uncertainties in greenhouse gas emissions, climate sensitivity, carbon cycle and ocean heat uptake using a ‘simple’ model



Influence of inter-model uncertainties on downscaled scenarios of extreme weather events

– an example from the UEA CRANIUM work

– BETWIXT weather generator + PRUDENCE RCMs



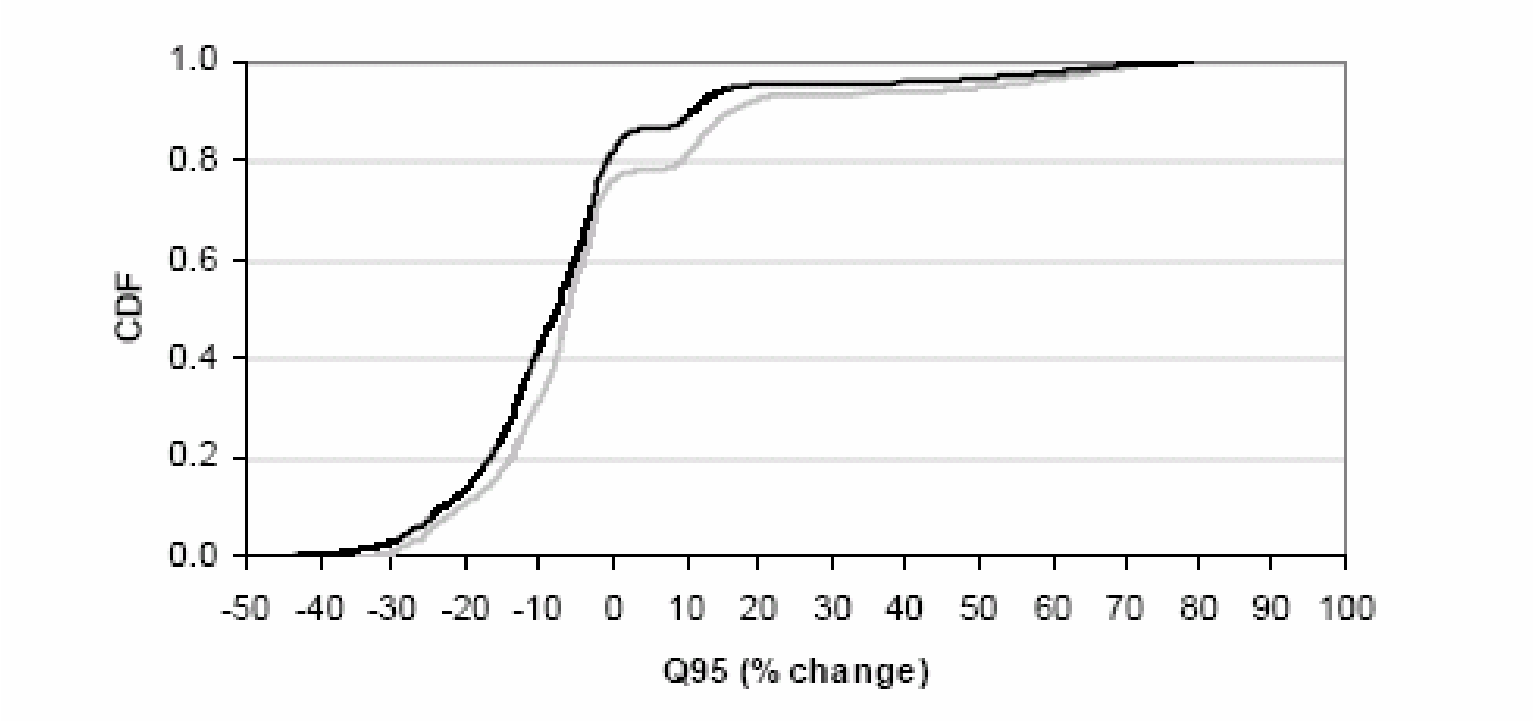
Number of ‘hot days’ at Elmdon in the 2080s – A2 scenario

Black line: 1961-1990 reference period

Thin coloured lines: results based on 13 RCM runs

Blue line in right-hand panel: ensemble average

A framework for assessing uncertainties in climate change impacts: low flow scenarios for the River Thames, UK. Wilby & Harris '05



CDF of change in extreme low flows for the 2080s
Incorporating uncertainties due to emissions, downscaling method, hydrological model parameters and structure

1. What uncertainties should be represented in climate scenarios for impacts assessments?

- what uncertainties can we reasonably expect to be represented in climate scenarios for impacts assessments?

- and what underlying assumptions will still have to be made?

- what guidance can we provide to help users take account of uncertainty?

- how explicit do we need to be about the nature of the various uncertainties and how they are (or are not represented)?

- will emissions scenario uncertainty have to be handled separately?

2. Are PDFs the most appropriate way of representing the uncertainties? What are the alternatives (e.g., probability bounds, two- or three-dimensional response surfaces)? What if users want maps?

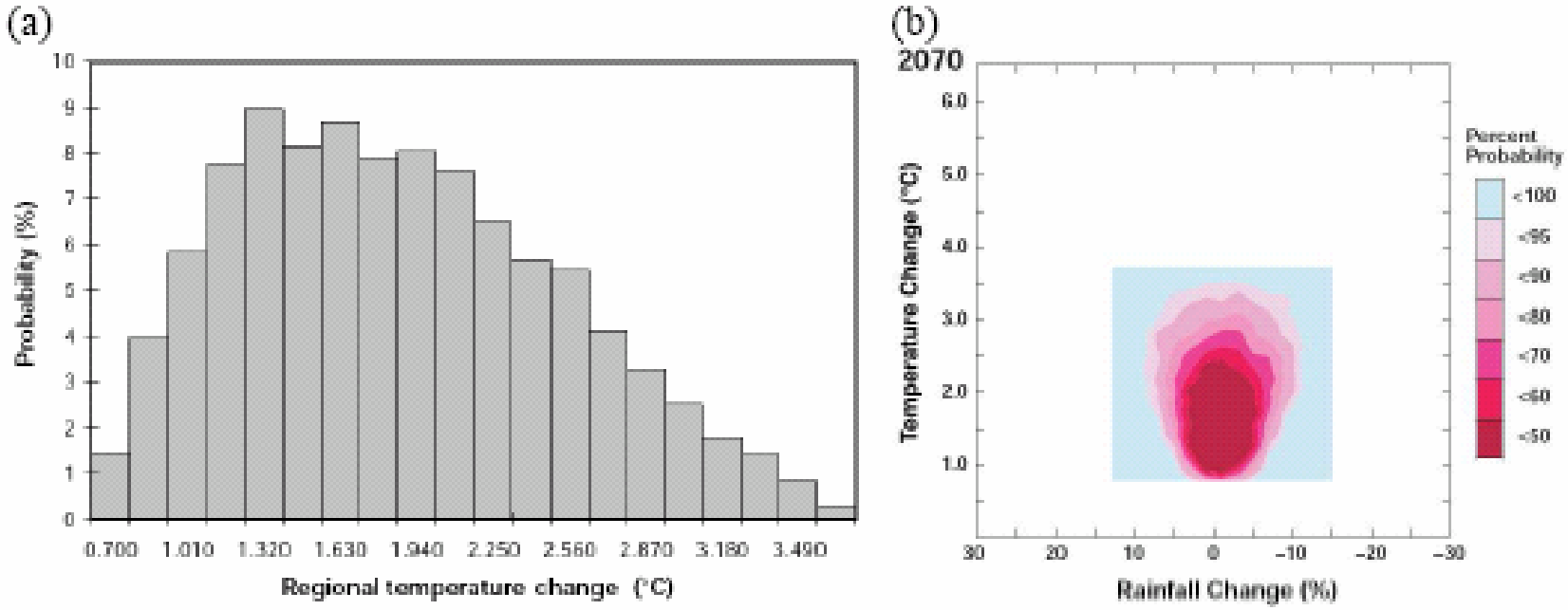


Figure 2: Probability distributions of projected climate change for inland Australia by 2070 relative to 1961-1990 based on information from global and regional climate models: (a) temperature change; (b) cumulative probability plot of temperature change and rainfall change (source: Jones 2000).

3. Are industry approaches to climate variability sufficiently advanced to cope with new probabilistic information on climate change? Are there any examples of industry using (or preparing to use) probabilistic information on climate change?

4. How might industry make use of new probabilistic information:

- what are the advantages and disadvantages, compared with non-probabilistic scenarios?

- how important is synthetic time-series data?

- can climate change impacts be described in probabilistic terms?

- how does this information fit with current decision-making processes (and attitudes to risk) and what changes to these processes will be needed?

- how will users access the information? How can it be presented most usefully to different audiences – eg., for impacts users, for decision-makers, for less technical users?

- what communications/visualisation challenges and opportunities will all this bring?