Improving climate prediction for water resource planning

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Walker Institute for Climate System Research

UK Groundwater Forum, London, May 13th 2008

Predictions or scenarios?

Predictions:

- forecasts of what will happen in the future

Risk-based approaches to dealing with uncertainty

Scenarios:

- stories describing possible futures

Scenario planning: vulnerability-based approaches

Key issues

Estimating impacts and coping with uncertainty

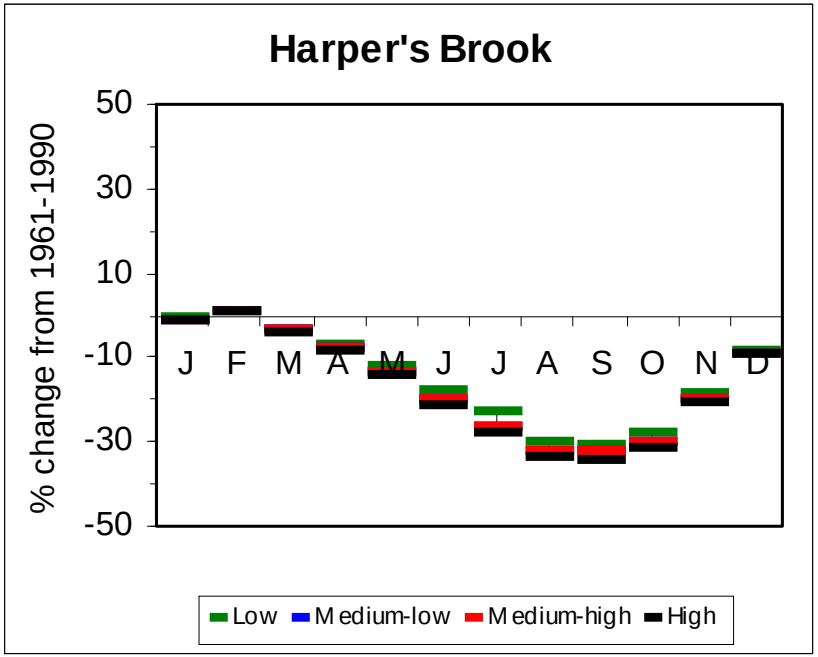
Credible scenarios for changes in climate

Scenarios over the adaptation time scale

Probabilistic scenarios?

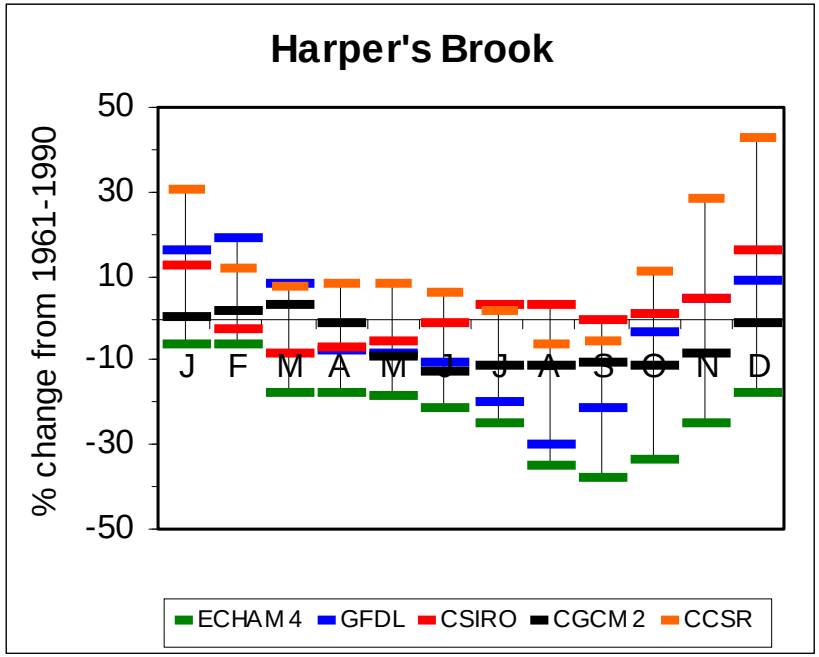
Robust tools

Credible scenarios



UKCIP02

Change in mean climate



Multiple scenarios

Credible scenarios

Change in extreme events?

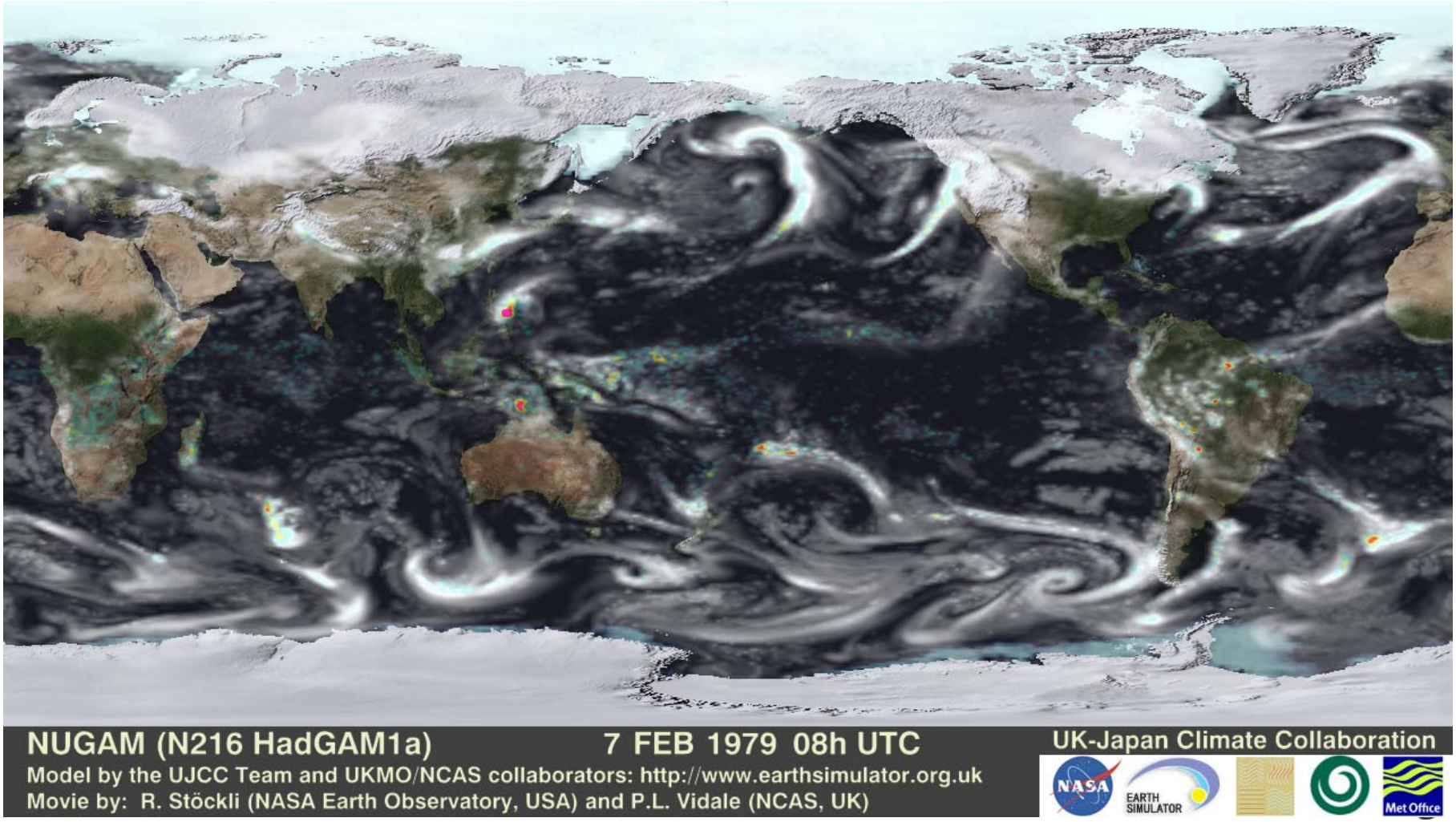
- *rainfall intensity > high flow events*
- *dry spells > drought events*
- *anomalous seasons?*

Change in year-to-year variability?

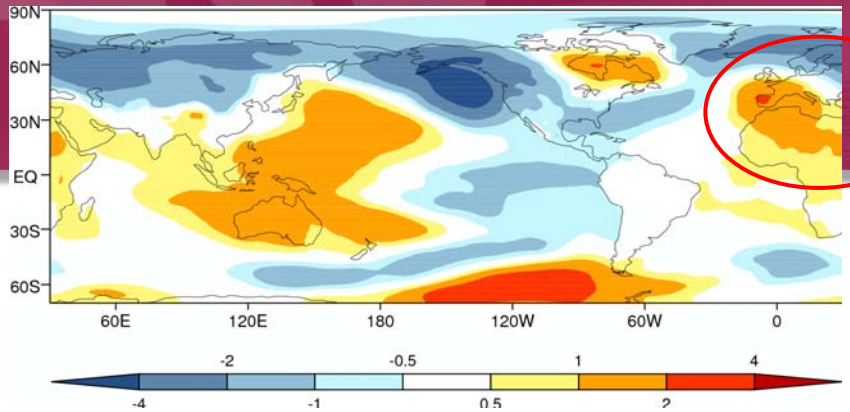
- *changing probability of successive "dry winters"?*

Credible scenarios

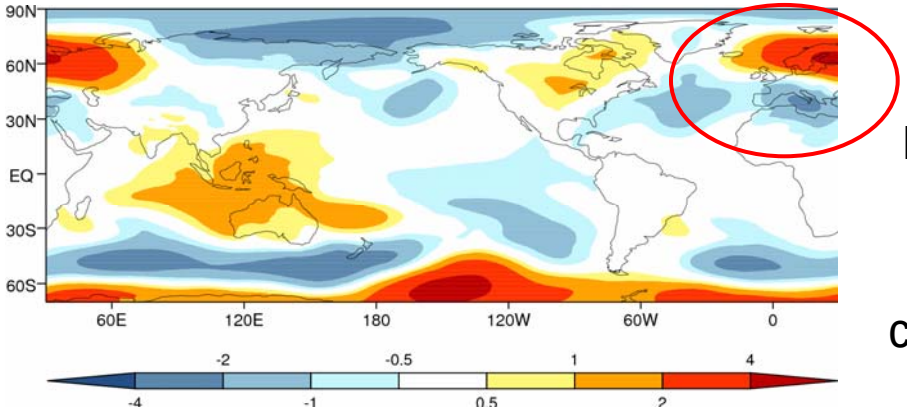
High resolution climate models



El Nino

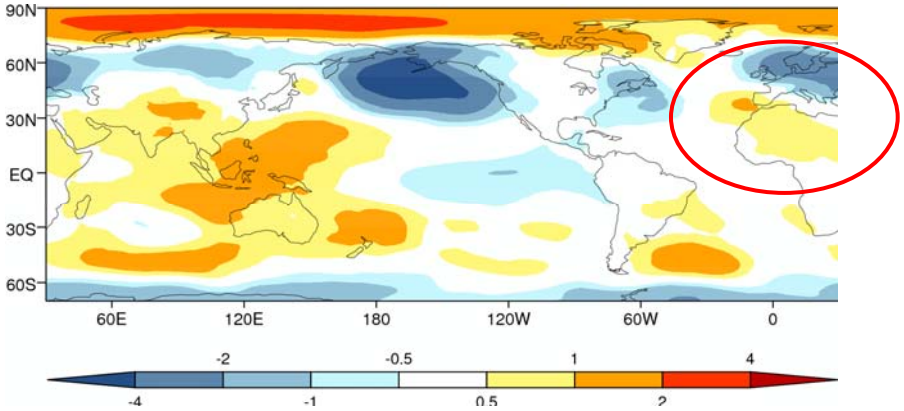


Observations:
ERA-40



HadGEM1.2

El Nino DJF mslp composites from ERA40, HadGEM1.2 and HiGEM1.2. Units hPa.

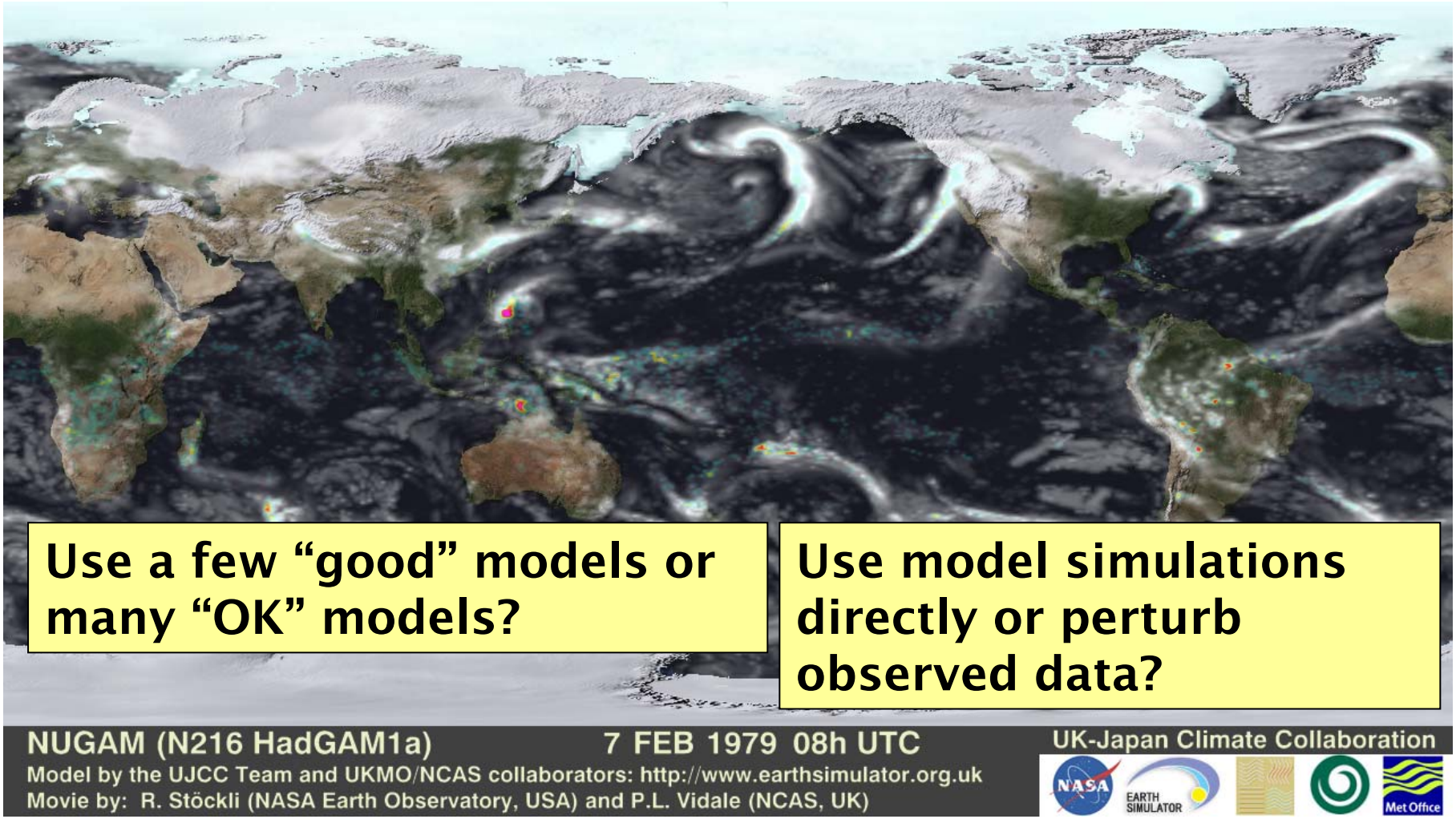


HiGEM1.2

Len Shaffrey, NCAS-Climate

Credible scenarios

High resolution climate models



Use a few "good" models or many "OK" models?

Use model simulations directly or perturb observed data?

Scenarios over the adaptation time scale

What is likely to happen by 2030?

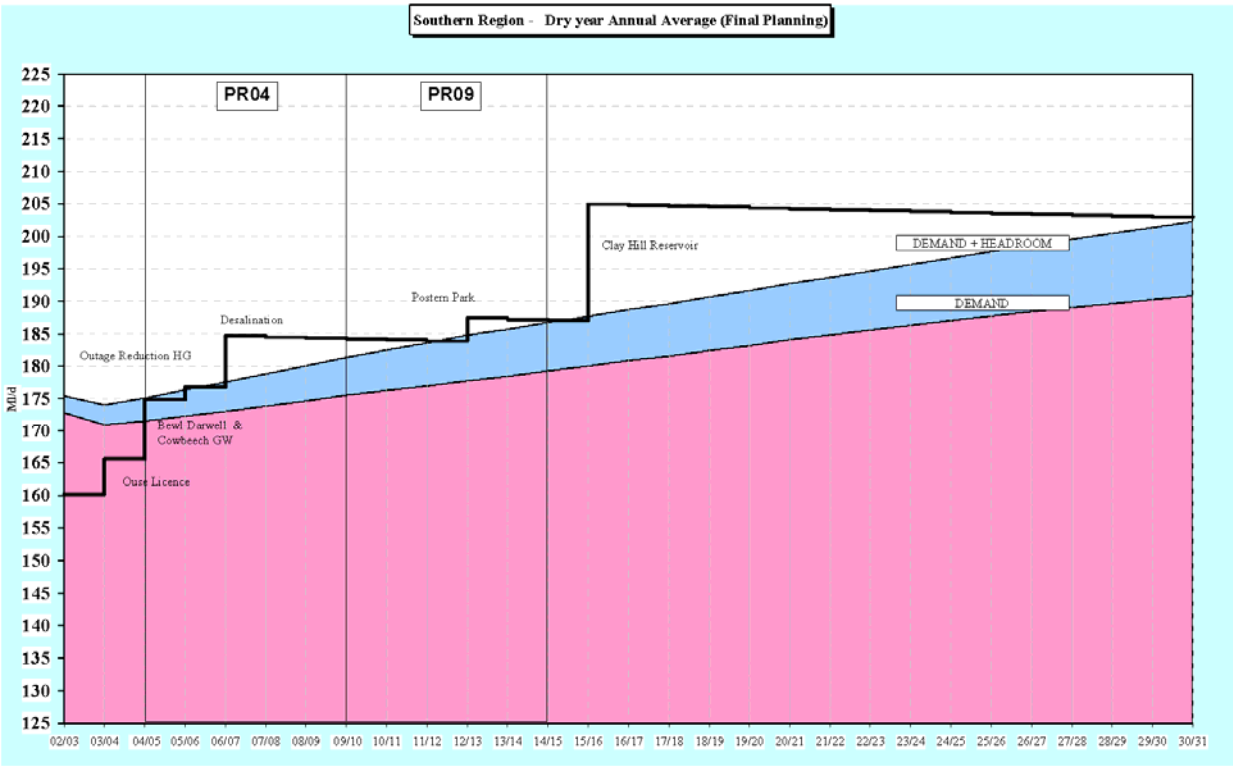
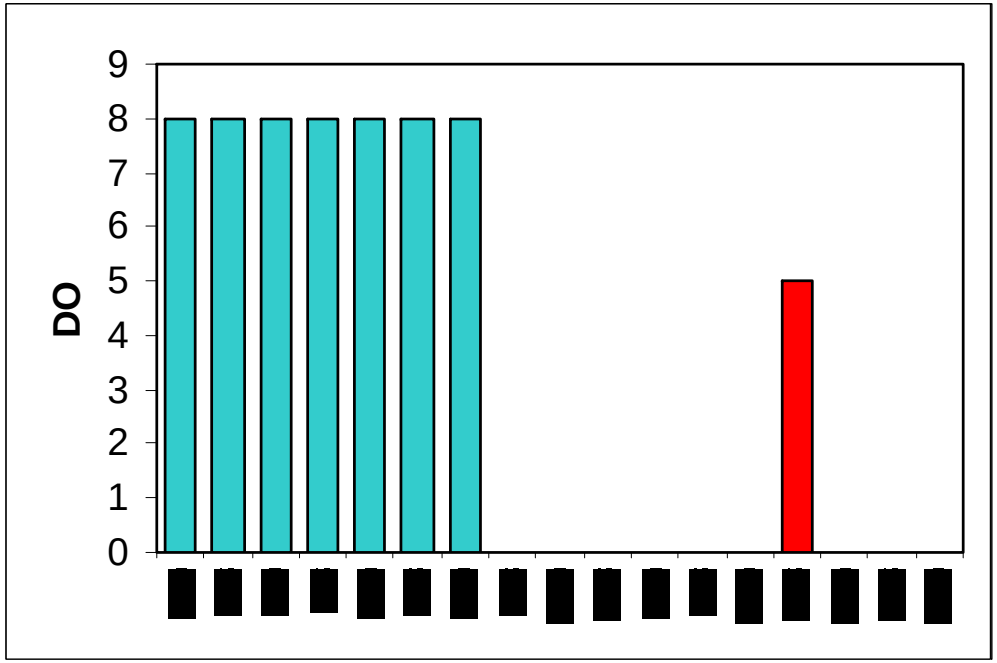


Figure 3 **Supply Demand Balance Southern Region (Dry Year Annual Average, Final Planning)**

…and how will change evolve over time?

Scenarios over the adaptation time scale



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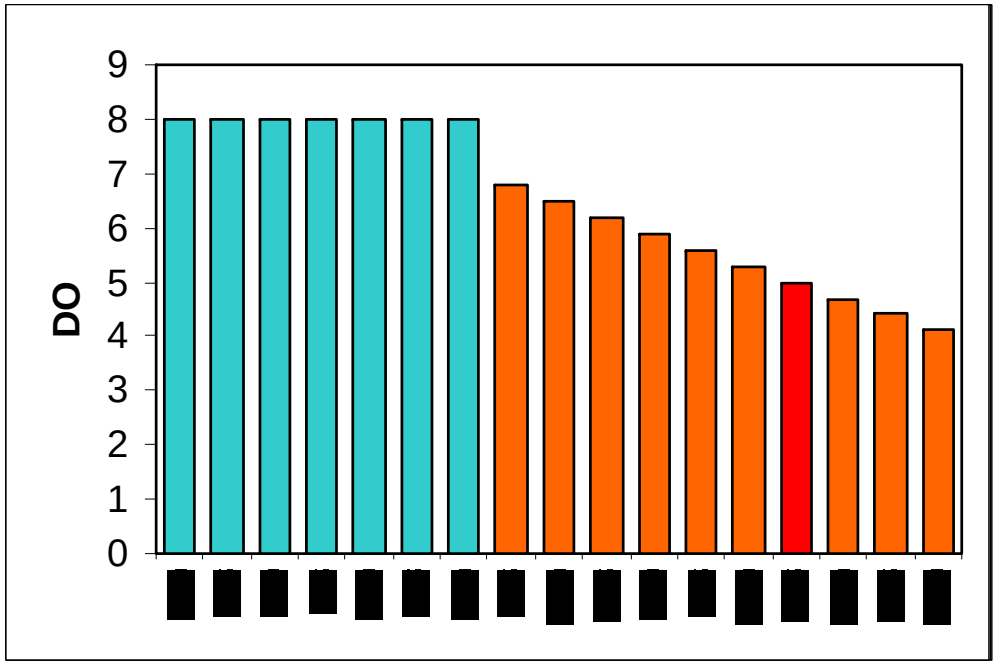
Scenarios over the adaptation time scale



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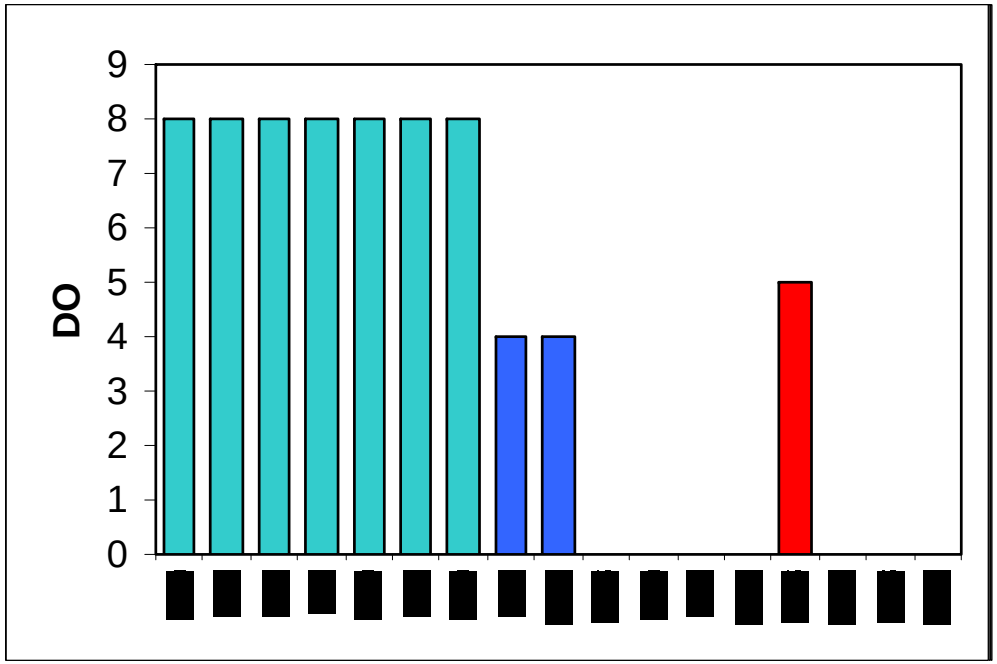
Scenarios over the adaptation time scale



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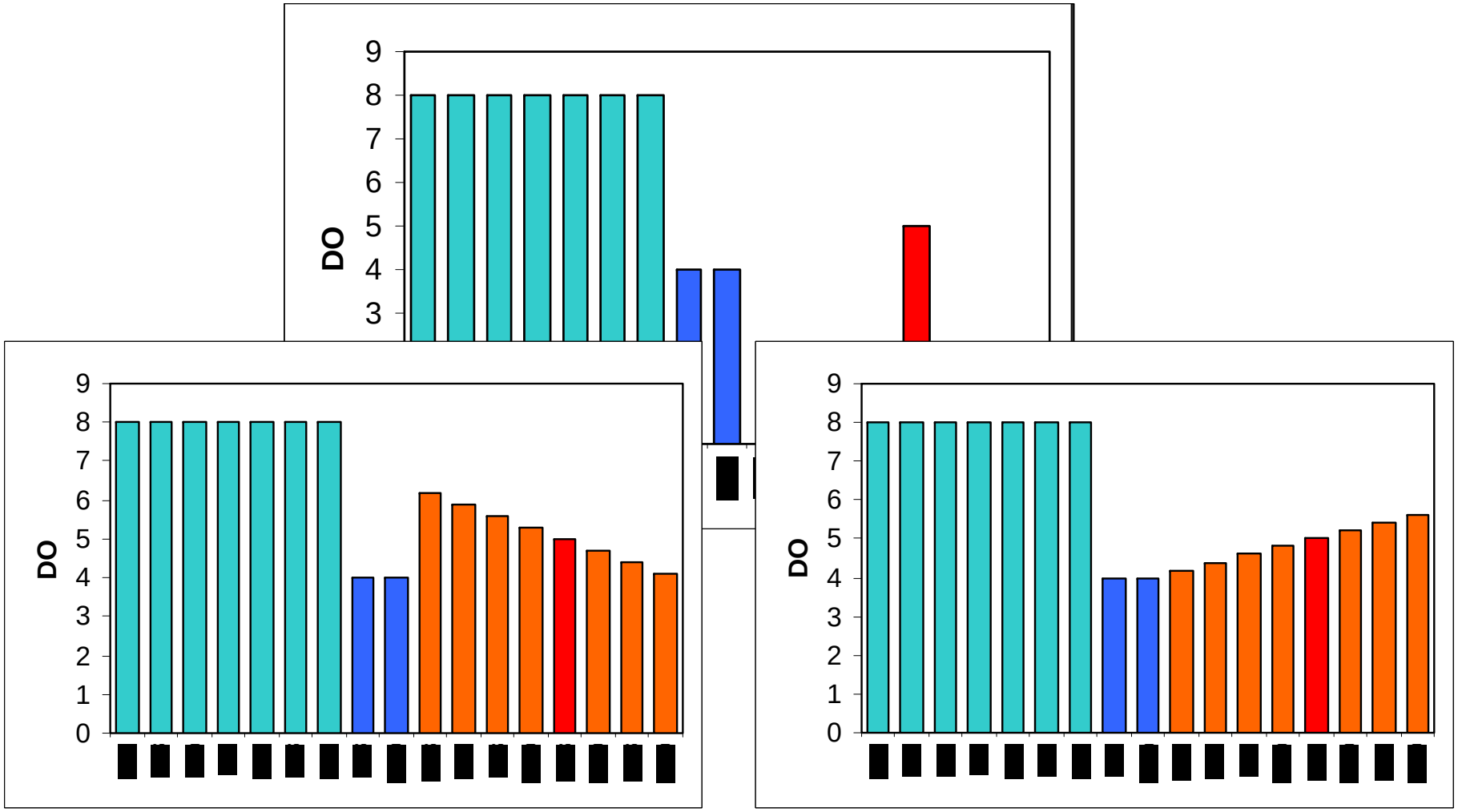
Scenarios over the adaptation time scale



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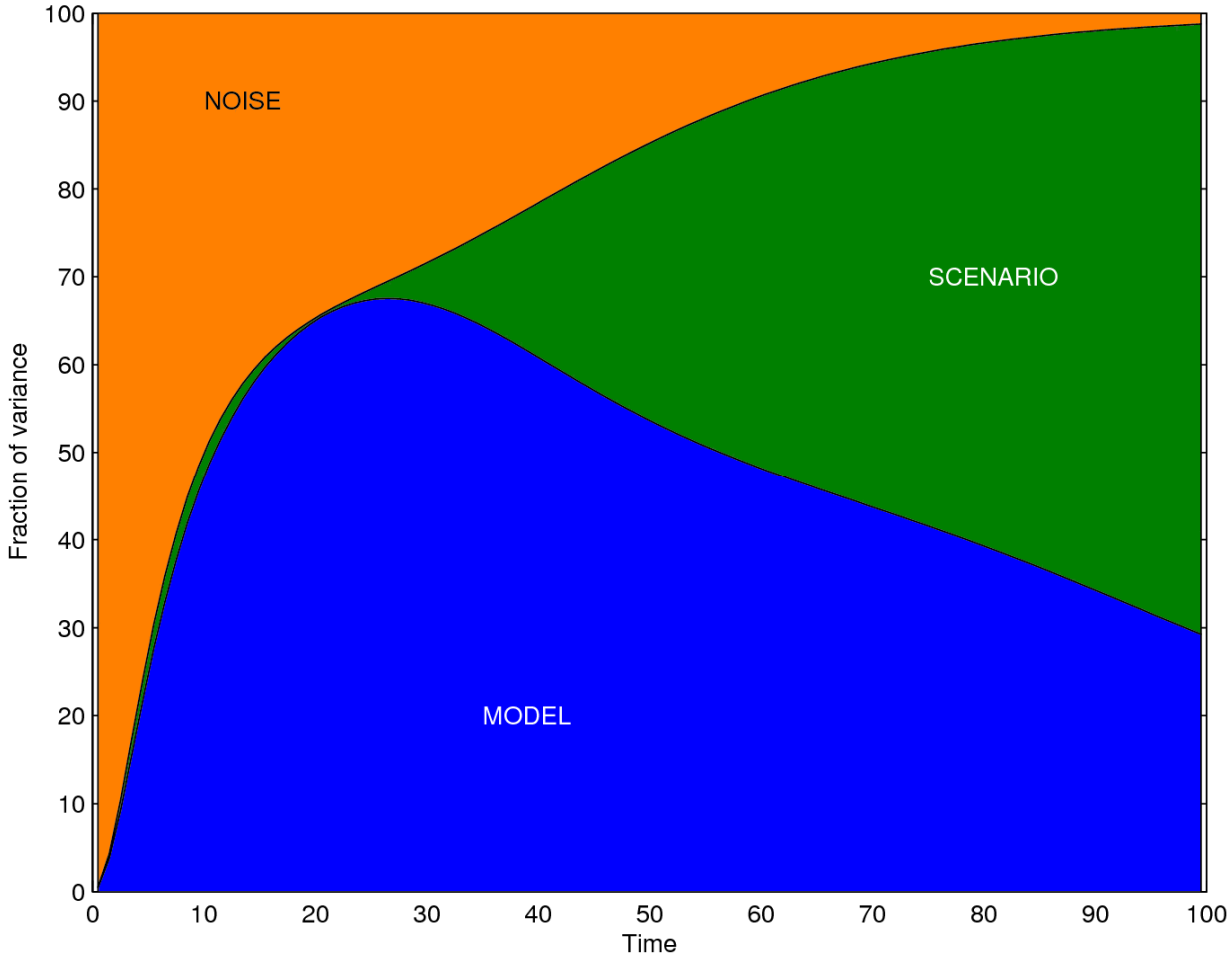
Scenarios over the adaptation time scale

We need to find some way of reconciling climate change projections with recent experience

….combination of natural variability plus a climate change signal

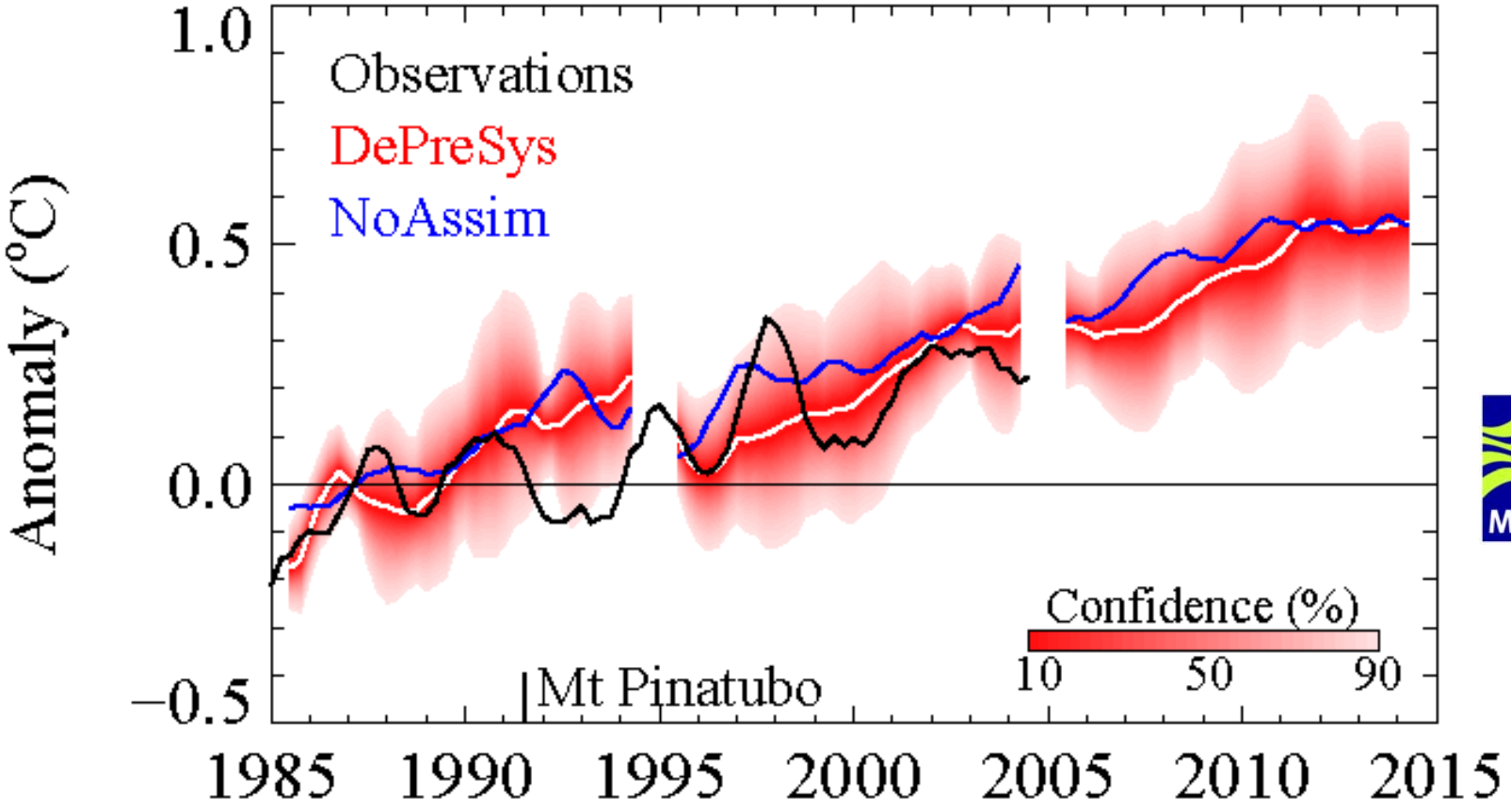
Scenarios over the adaptation time scale

Rowan Sutton



years

Will decadal forecasting work?



Smith et al. (2007) *Science*

Probabilistic approaches

What are they?

- approaches which seek to characterise the likelihood of different outcomes

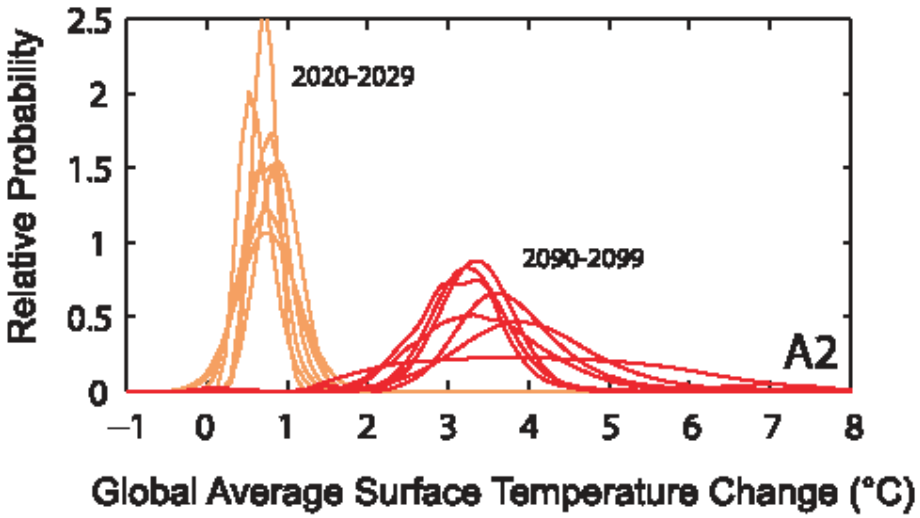
(i) to inform a risk-based approach

(ii) to characterise “feasibility” of scenarios/stories

Probabilistic scenarios

Future weather will be a function of:

- *future emissions*
- *climate sensitivity*
- *climate system response*
- *natural variability*



IPCC (2007)

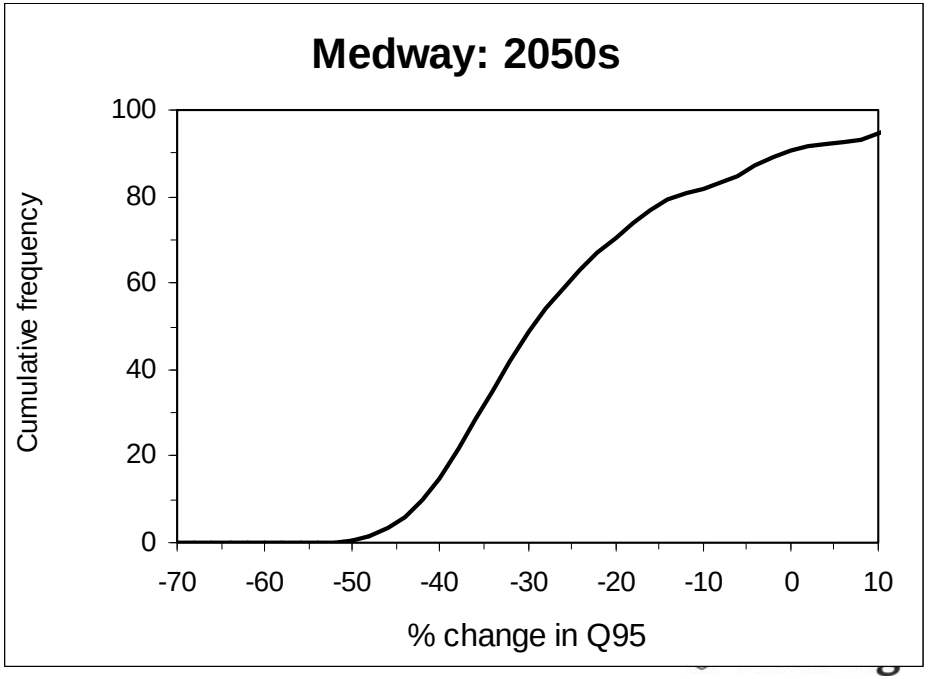
Probabilistic scenarios

We will not be able to infer probability distributions of changes in hydrogeological characteristics from probability distributions of changes in weather variables

Run multiple scenarios to construct frequency distributions of outputs

Weighting?

Non-linearity



Robust tools

Hydrological models which can simulate changes in flows, recharge and quality under changing conditions

Hydrological models which can be applied with multiple scenarios (thousands?)

Clear guidelines on how to estimate impacts at the **strategic** and **planning** scales

Conclusions

Do we need scenarios or predictions?

Climate science can now give us more credible “scenarios”

Do we have the capacity to use these to make credible projections of change in hydrogeological characteristics?

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Thank you

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