Should the uncertainty in climate scenarios limit adaptation?

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The underlying goal of the summit is no less than to prepare a blueprint to launch a revolution in climate prediction.

"... climate models will ... play an important, and perhaps central, role in guiding the trillion dollar decisions that the ... world will be making to cope with the consequences of changing climate. ... adaptation strategies require more accurate and reliable predictions of regional weather and climate extreme events than are [currently] possible"
A conundrum ...

if adaptation needs accurate and precise climate prediction ...

and if regional climate prediction is laughable/uncertain/imprecise ...

then do we give up on adaptation? (or wait for the revolution?)

‘Adaptation needs accurate and precise climate prediction’

“The effectiveness of pro-active adaptation to climate change often depends on the accuracy of regional climate and impact projections, which are subject to substantial uncertainty.”

[Füssel, H-M. 2007]

But how widespread is this view – among scientists, science funders, decision-makers?
Climate Scientists’ Perspectives

“It is ... essential that GCM predictions are accompanied by quantitative estimates of the associated uncertainty in order to render them usable in planning mitigation and adaptation strategies.”

[Murphy.J. et al. 2004]

“It is ... vital that more detailed regional climate change predictions are made available both in the UK and internationally so that cost-effective adaptation and appropriate mitigation action can be planned.”

[Met Office Hadley Centre 2007]

Science Funding Agency Perspective

“NERC-funded science must play a leading role in the development of risk-based predictions of the future state of the climate – on regional and local scales, spanning days to decades. Advances in climate science ... are necessary to develop the high-resolution regional predictions needed by decision makers ... for adaptation and mitigation strategies.”

[NERC Science Strategy 2007-2012]
Decision-Maker Perspectives

“[Adaptation] plans will only be effective to the extent that climate science can provide ... agencies with climate scenarios that describe a range of possible future climates that California may experience, at a scale useful for regional planning. Reducing uncertainty in projections of future climates is critical to progress ...”

[Hickox, W.H. and Nichols, M.D. 2003]

“Adaptation to climate change will require further research to predict the impacts at regional level in order to enable ... public and private sectors actors to develop cost-effective adaptation options

EU Commission ‘Winning the battle against climate change’

So What are the Limits to Climate Prediction?

Uncertainties in climate prediction arise from:

- Lack of knowledge (Epistemic uncertainty)
  - Parameter uncertainty
  - Structural uncertainty
- Randomness (Natural stochastic uncertainty)
  - Initial conditions uncertainty
- Human actions (Human reflexive uncertainty)

Cox and Stephenson, Science, 2007
Accuracy versus Precision

High accuracy
Low precision

‘Global mean temperature will increase between 1.4°C and 5.8°C by the end of the century’

Low accuracy
High precision

‘Mean maximum summer temperature will increase by 3.7°C by the end of the century in the Rotterdam area’
So is Climate Adaptation Therefore Limited?

Not if we understand the wider contexts in which adaptation has to take place...

... spatial planning, technical regulation, economic priorities, cultural preferences, risk psychology, adaptive management, risk management…..
Hazard, vulnerability, adaptation & risk

Hazard + Exposure = Vulnerability

Hazard + Adaptation = Low vulnerability Low risk

Are there Alternatives to Predict-and-Adapt?

Predict-then-adapt approach Assess-risk-of-policy framework

Structure Problem
Characterise Climate Uncertainty
Design Adaptation
Evaluate Outcome

Structure Problem
Propose Various Strategies
Assess Strategies Against a Wide Range of Qt/QI Futures
Summarise Trade-Offs Among Promising Strategies

Outcome Optimised for Robustness
Adaptation (autonomous) Adaptation (with investments)

Climate parameter (e.g., rainfall)

Drought risk Flood risk

“Acceptable risk”

Frequency

P1 P2

Acceptable risk

Adaptation (autonomous) Adaptation (with investments)
We argue that the epistemological limits to climate and ESM predictions should not be interpreted as a limit to adaptation, despite the widespread belief that it is ...

... climate adaptation strategies can be developed in the face of deep uncertainties.

Thank you