Dealing with uncertain climate information in adaptation to climate change

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WCRP Workshop on Regional Climate: Facilitating the production of climate information and its use in impact and adaptation work

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Why are we here?

- The workshop will focus on the research priorities for facilitating the production and use of regional to local climate change information in adaptation and risk management

What is adaptation to climate change?

- IPCC definition: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation
- Other important concepts: vulnerability, sensitivity, adaptive capacity and resilience

Adaptation highlights from IPCC AR4

- Adaptation to climate change is already taking place, but on a limited basis
- Adaptation measures are seldom undertaken in response to climate change alone
- Many adaptations can be implemented at low cost, but comprehensive estimates of adaptation costs and benefits are currently lacking
- Adaptive capacity is uneven across and within societies
- There are substantial limits and barriers to adaptation

Adaptation concepts

- Adaptation is a process
- Adaptation is made up of actions throughout society, by individuals, groups and governments
- Adaptation can be motivated by many factors, including the protection of economic well-being or improvement of safety
- It can be manifested in myriad ways: through market exchanges, through extension of social networks, or through actions of individuals and organisations to meet their own individual or collective goals

Adger, W. N., et al. (2005), Successful adaptation to climate change across scales, *Glob. Environ. Change-Human Policy Dimens.*, *15*(2), 77-86.

Adaptation concepts

- Adaptation is happening across scales, from the international to the national to the local
- These levels of actions take place within hierarchical structures such that the levels interact with each other.
- Individual adaptation actions are therefore not autonomous but constrained by institutional processes such as regulatory structures, property rights and social norms associated with rules in use

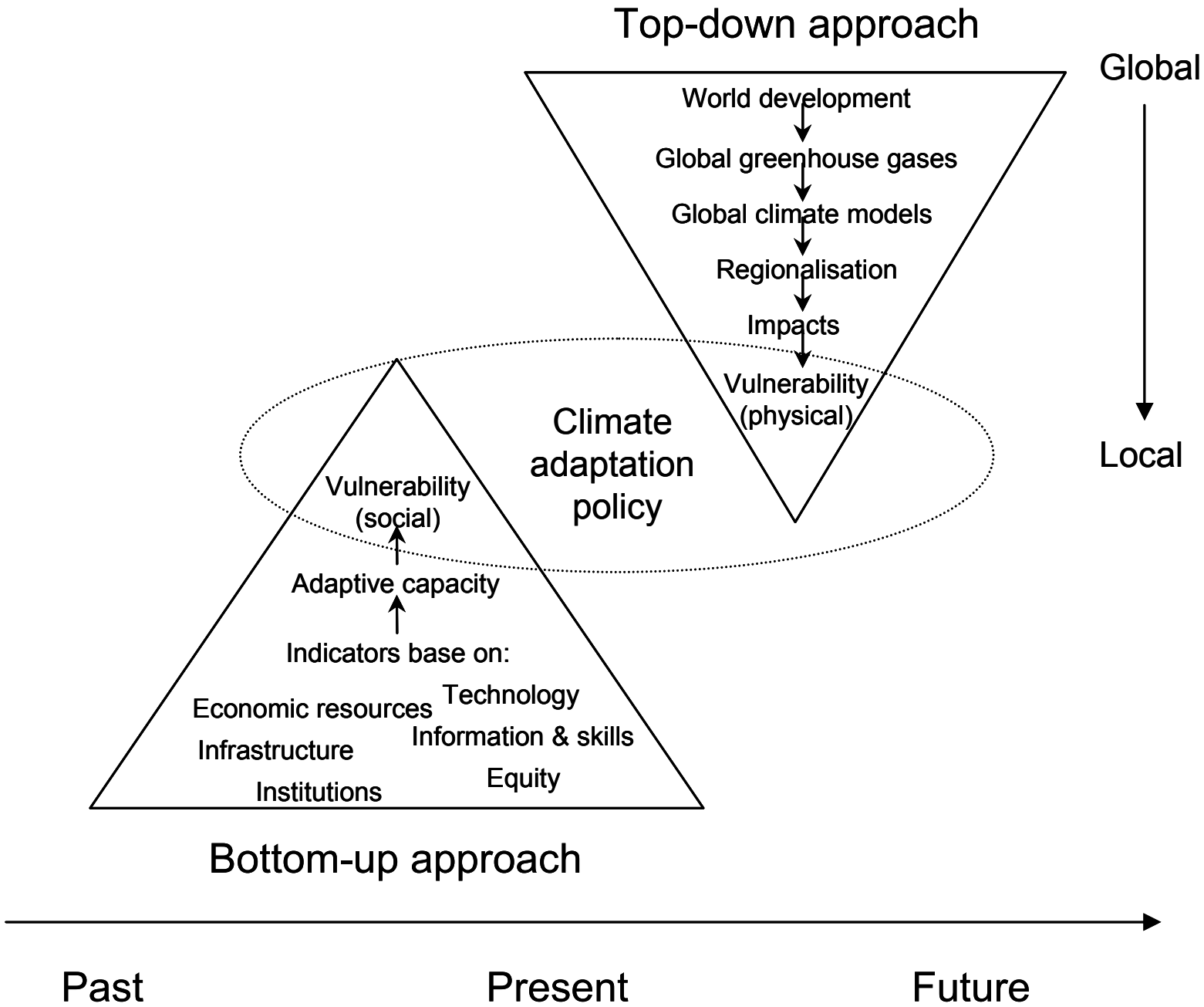
Adger, W. N., et al. (2005), Successful adaptation to climate change across scales, *Glob. Environ. Change-Human Policy Dimens.*, *15*(2), 77-86.

Adaptation concepts

- Adaptation can involve both **building adaptive capacity** thereby increasing the ability of individuals, groups, or organisations to adapt to changes, and **implementing adaptation decisions**, i.e., transforming that capacity into action.
- Actions associated with building adaptive capacity: communicating climate change information, building awareness of potential impacts, maintaining well-being, protecting property or land, maintaining economic growth, or exploiting new opportunities.
- Adaptation decisions happen without a particular context so it is difficult to separate climate change adaptation decisions from actions triggered by other events

Adger, W. N., et al. (2005), Successful adaptation to climate change across scales, *Glob. Environ. Change-Human Policy Dimens.*, *15*(2), 77-86.

Informing adaptation policy



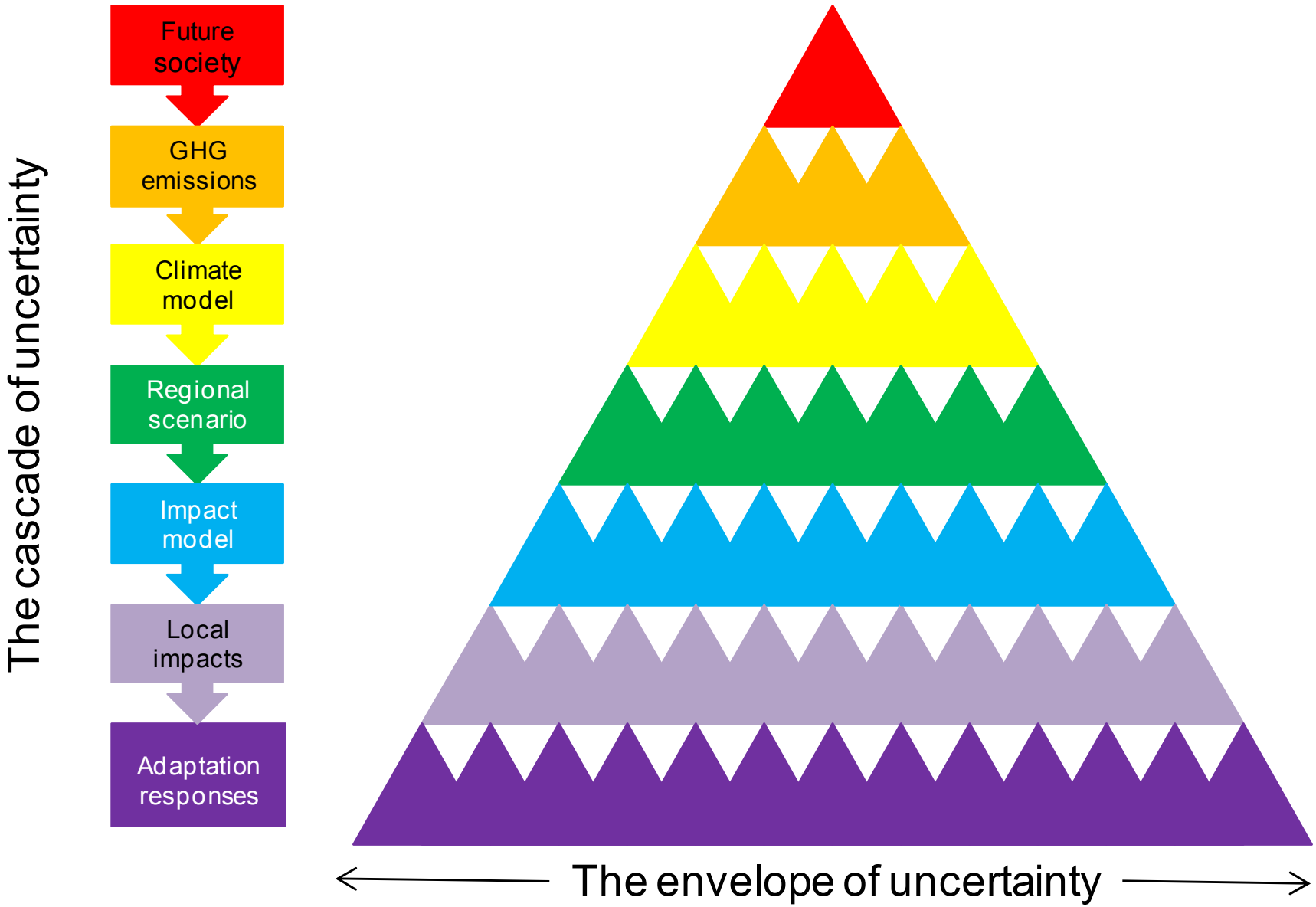
From: Dessai, S., and M. Hulme (2004), Does climate adaptation policy need probabilities?, *Climate Policy*, 4(2), 107-128.

Adaptation timescales: the now

1	**Rainwater harvesting through various techniques including traditional methods.**
2	Develop and implement disaster preparedness and recovery programs, including forecasting, early warning systems and rapid response strategies to cope with extreme weather events.
3	Develop and implement an awareness raising programme on adaptation to the potential impacts of climate change on vulnerable sectors.
4	Promotion of modern and more efficient irrigation technologies to increase use efficiency.
5	Design and implement watershed management and terrace-rehabilitation programs.
6	Improve crop management programs by changing sowing date, crop density, tillage practices, fertilizer levels, growing season for crop, and enhancing crop specific characteristics (harvest index, photosynthetic efficiency). Make use of accumulated experience by farmers, by collecting and documenting local knowledge.
7	Reuse of treated waste water and grey water from mosques for irrigation to compensate water shortage.
8	Develop and implement Integrated Coastal Zone Management programmes
9	Expand green belts zones for coastal areas in both mainland and islands ecosystems by planting and re-planting mangroves and palms, and establishing/maintaining nurseries that provide cultivars and other materials.
10	Design and implement sustainable land management strategies to combat desertification and land degradation
11	Conduct studies and research on drought resistant and heat- and salinity- tolerant crops.
12	Design and implement pilot projects for seawater desalination using renewable energy, especially for Yemeni islands and coastal areas where drinking water is not available or vulnerable to sea water intrusion.

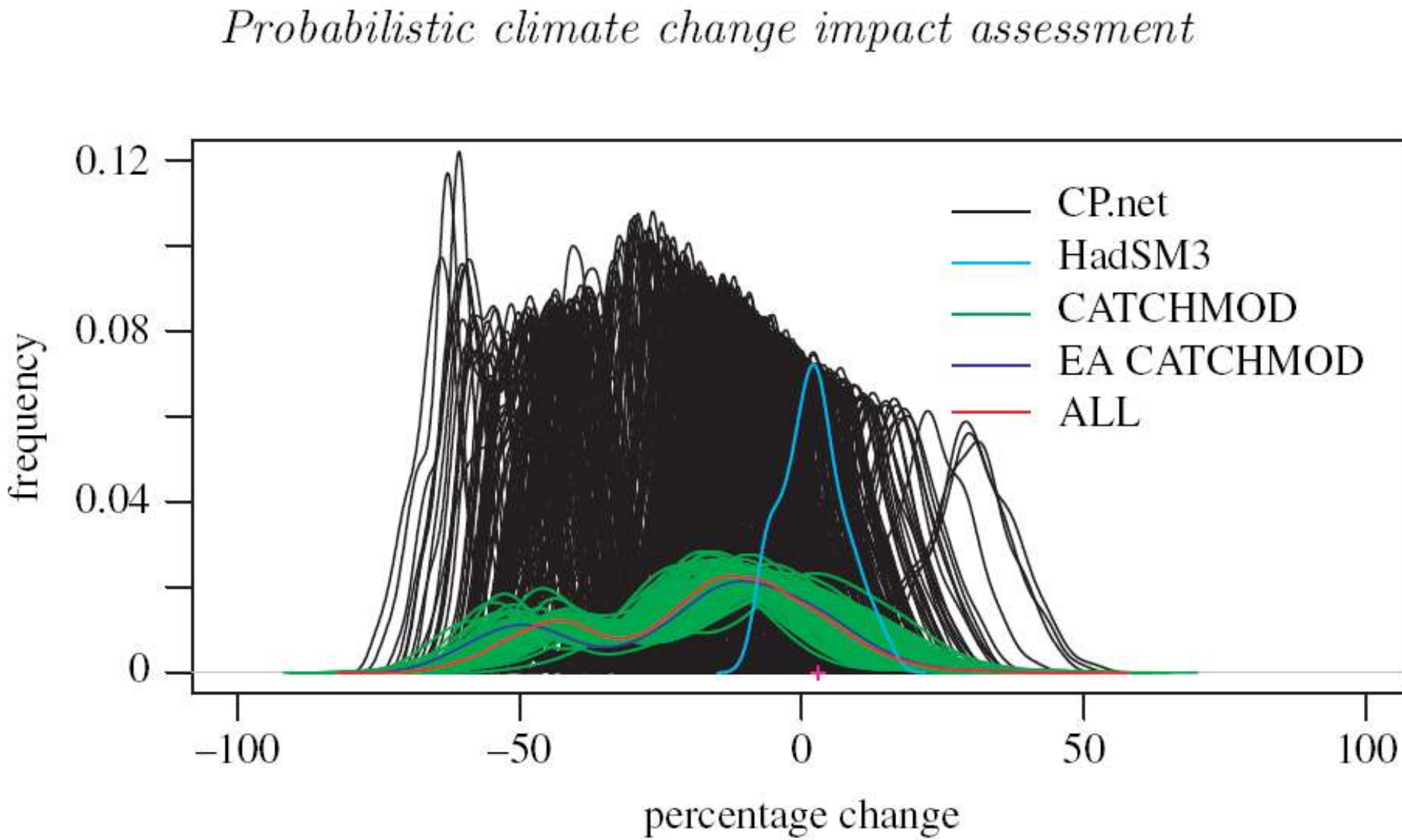
Yemen NAPA proposals: how many of these need climate model projections?

Adaptation timescales: the future



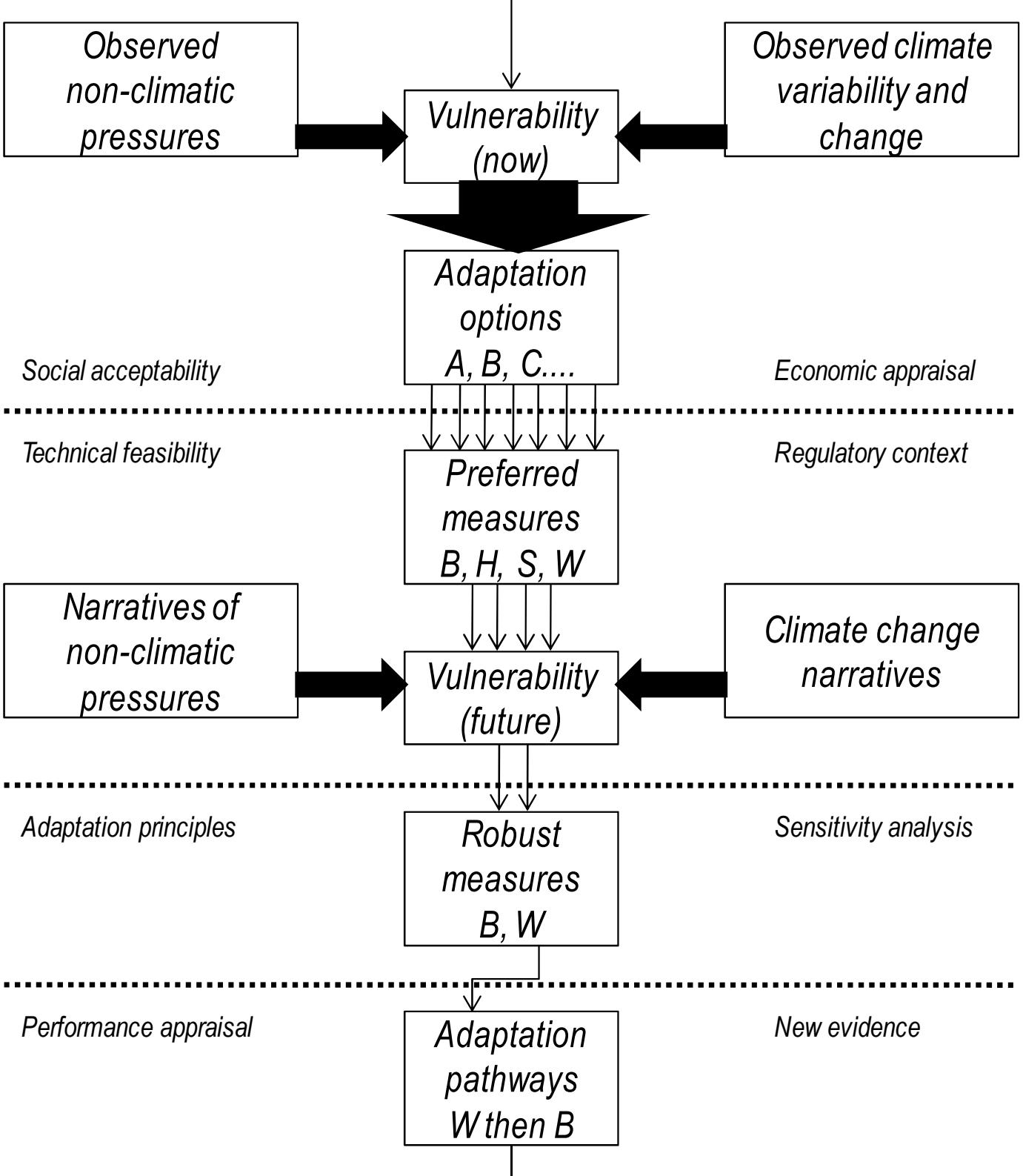
Adaptation timescales: the future

Changes in mean river runoff (2xCO2-1xCO2) at the Thames



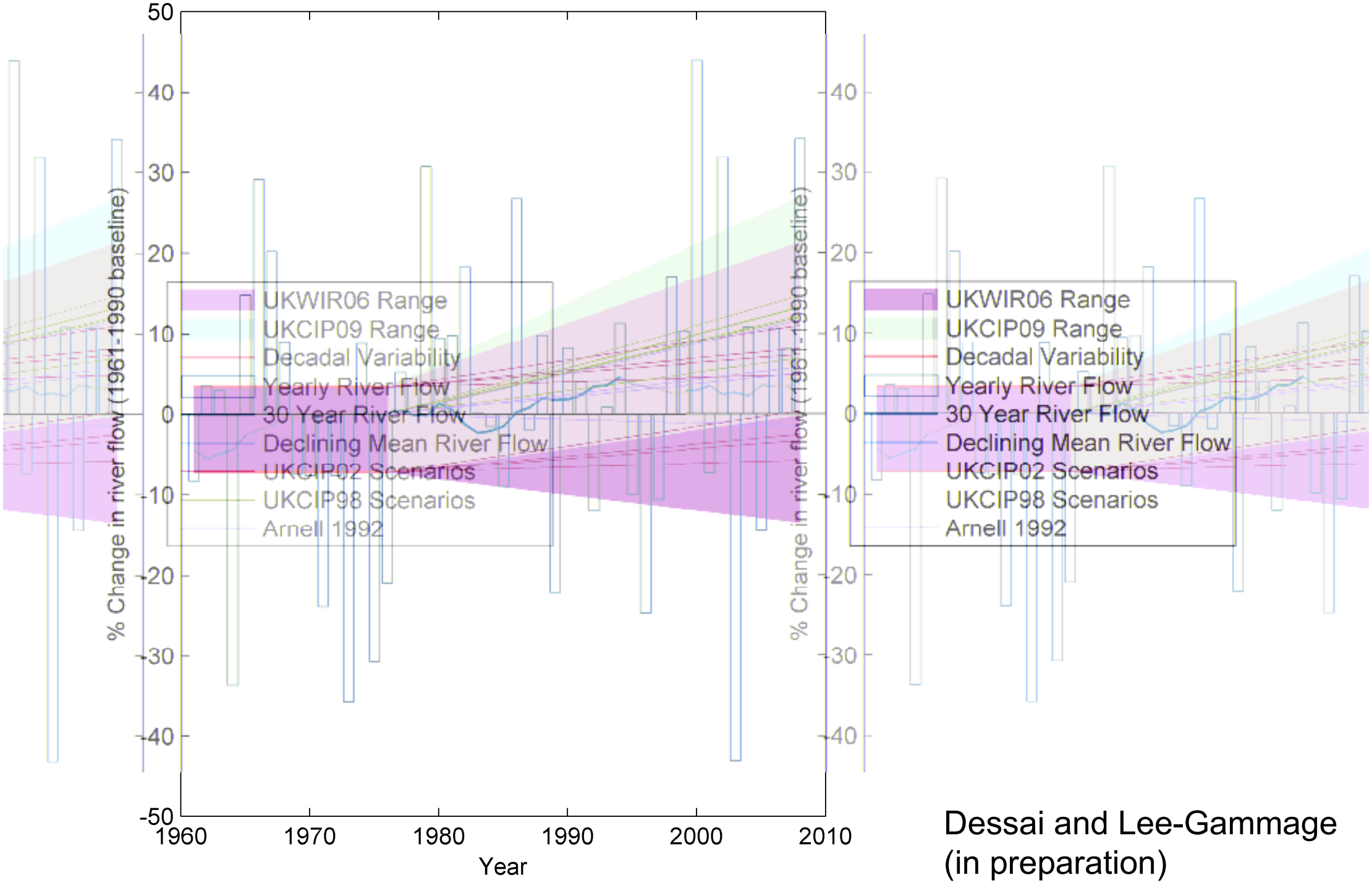
New, M., et al. (2007), Challenges in using probabilistic climate change information for impact assessments: an example from the water sector, *Philos T R Soc A*, 365(1857), 2117-2131.

Conceptual framework for a scenario-neutral approach to adaptation planning



Wilby, R. and S. Dessai (2010) Robust adaptation to climate change. *Weather* (in press)

Comparison of Predicted and Observed Streamflow
DJF
Greta @ Rutherford Br



Dessai and Lee-Gammage
(in preparation)

Production and use of climate change information

- Negotiating future climates for public policy: a critical assessment of the development of climate scenarios for the UK (Hulme and Dessai 2008, *Environ Sci Policy*)
- Lemos and Rood (forthcoming in WIRES Climate Change) argue that uncertainty critically affects the way climate projections move from useful to usable

Use of climate change information

- Usefulness is defined by scientists' perception of information users' needs (desirability)
- Usability by users' definition of what information can be readily applied to their decision process (fit for purpose)
- "Usable science refers to the degree that the science produced through the integrated assessment process results in knowledge that meets constituent needs. Thus, the knowledge produced should directly reflect expressed constituent needs, should be understandable to users, should be available at the times and places it is needed, and should be accessible through the media available to the user community." (Lemos and Morehouse)

From supply to demand driven climate science – climate services?

- Moving science from useful to usable may depend on:
  - a) technical factors (e.g. formatting, timing, skill, etc);
  - b) cognitive factors that influence the way users perceive the science-generated information (e.g. communication, trust, credibility, accessibility, experience, etc)
  - c) institutional factors that facilitate or impede the adoption of new knowledge (Lemos and Rood)
- From knowledge-driven science, to applied science and decision support tools
- Emergence of knowledge brokers/translators, boundary organisations (UCKIP, NOAA RISA) and objects

Research priorities

- Sensitivity of systems and services to weather and climate
- Understanding adaptation contexts and capacities
- Knowledge for climate adaptation
- Living with uncertainty
- Public and expert understanding of risk and uncertainty (including communication)
- Decision support tools
- Interdisciplinary research between climate scientists and social scientists with decision-makers