CIRCLE-2 Joint Initiative on Climate Uncertainties

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University of Exeter

Tyndall°Centre for Climate Change Research

Climate change adaptation

- Adaptation is complex and messy
- Adaptation: decision-making under uncertainty

3 paradigms of uncertain risks

'deficit view'

- Uncertainty is provisional
- Reduce uncertainty, make ever more complex models
- *Tools:* quantification, Monte Carlo, Bayesian belief networks

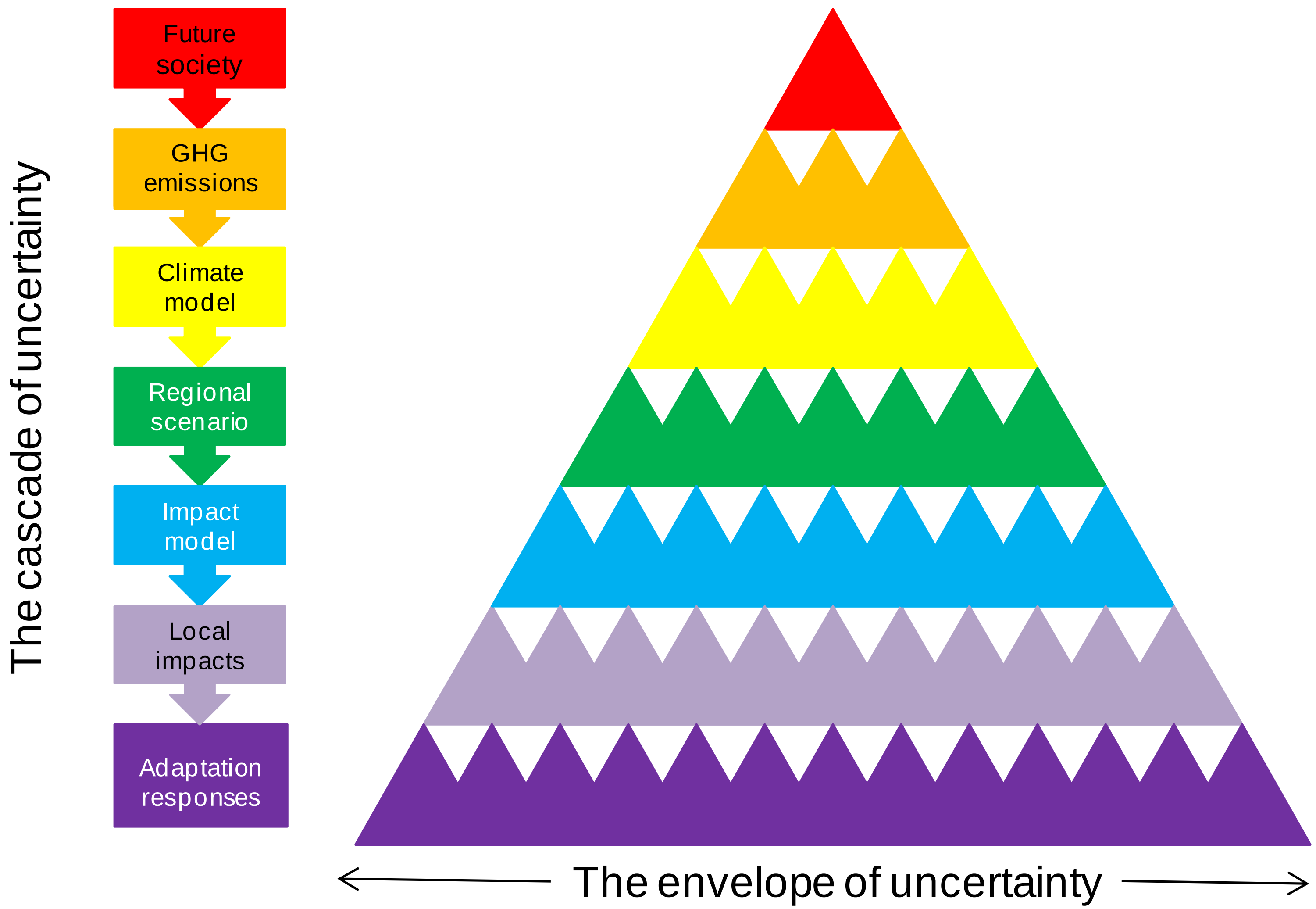
'evidence evaluation view'

- Comparative evaluations of research results
- *Tools:* Scientific consensus building; multi disciplinary expert panels
- focus on robust findings

'complex systems view / *post-normal* view'

- Uncertainty is intrinsic to complex systems
- Uncertainty can be result of production of knowledge
- Acknowledge that not all uncertainties can be quantified
- Openly deal with deeper dimensions of uncertainty
  (problem framing indeterminacy, ignorance, assumptions, value loadings, institutional dimensions)
- *Tools:* Knowledge Quality Assessment
- Deliberative negotiated management of risk

Why are there deep uncertainties?



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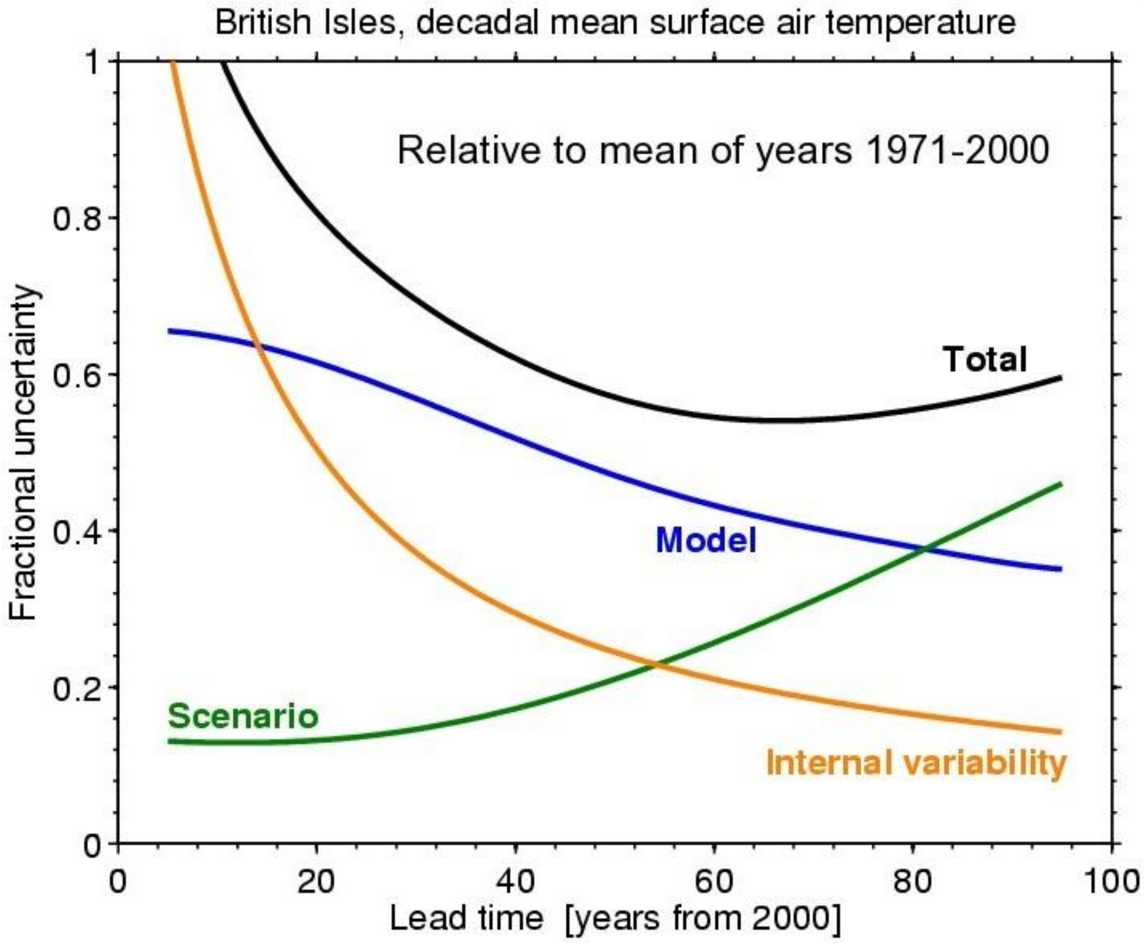
Wilby and Dessai 2010

Uncertainty as a function of prediction lead time



Hawkins & Sutton, 2009, BAMS

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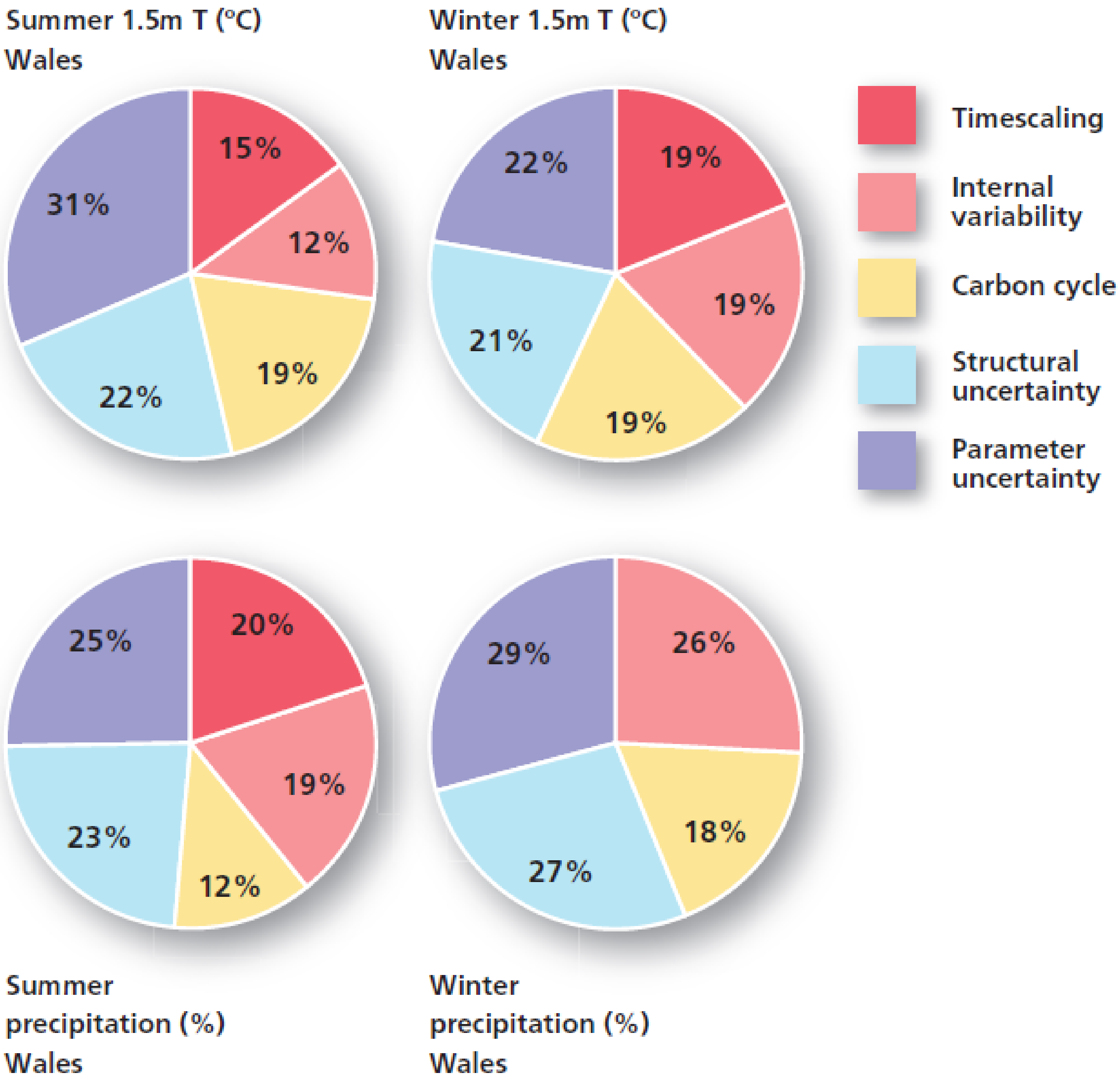
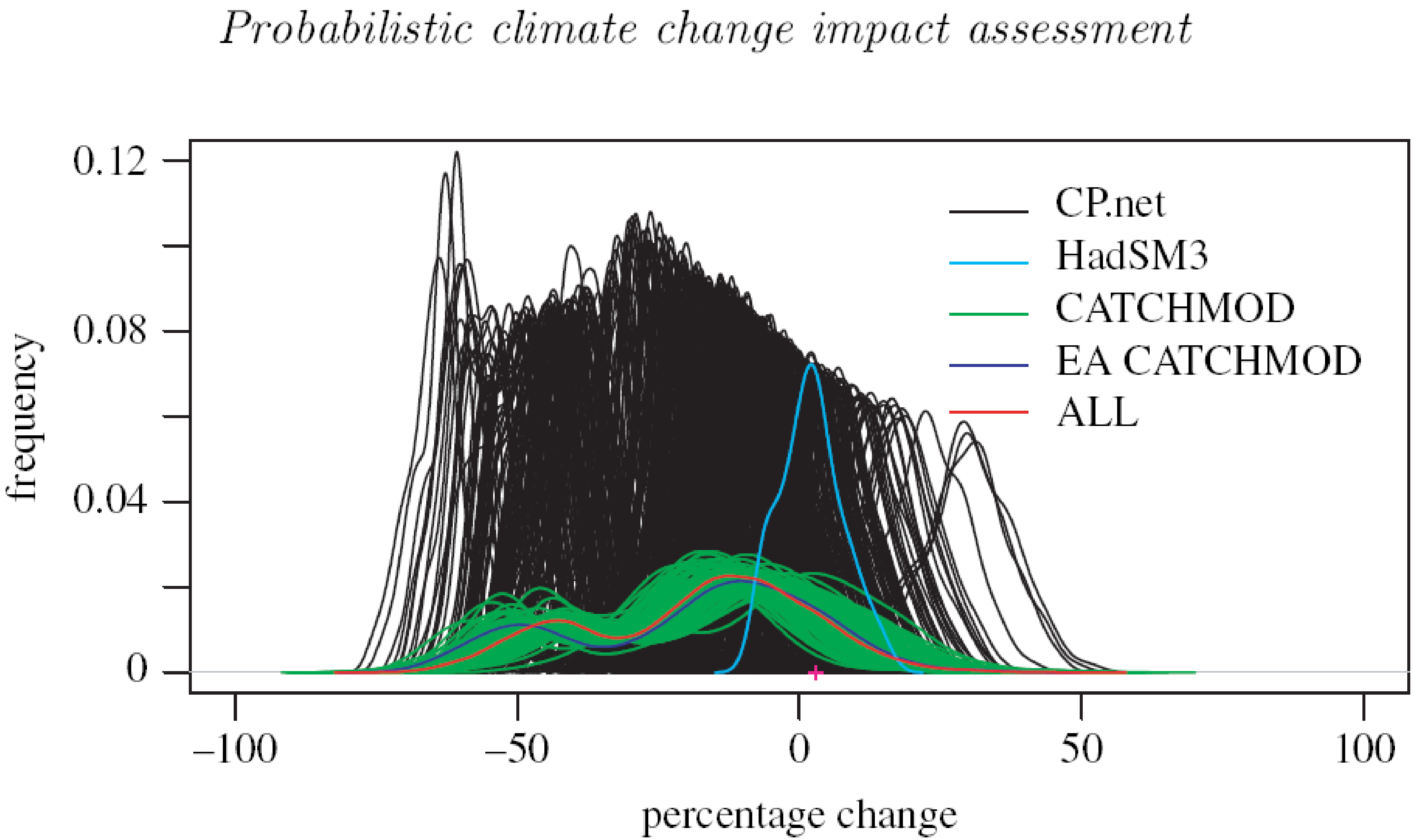


Figure A2.5: The relative contributions of different components of uncertainty to the overall spread in UKCP09 projections. These are calculated for summer and winter and for changes in temperature and percentage changes in precipitation for the Wales global climate model grid box, considering projected changes for 2070–2099 relative to 1961–1990. Spread is measured as the distance between the 10th and 90th probability levels of relevant probability distributions (this being a standard metric of spread in non-Gaussian distributions), expressing the spread obtained from each component of uncertainty relative to that obtained when all components are included.

End-to-end uncertainty quantification

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.

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Uncertainties in socio-economic drivers

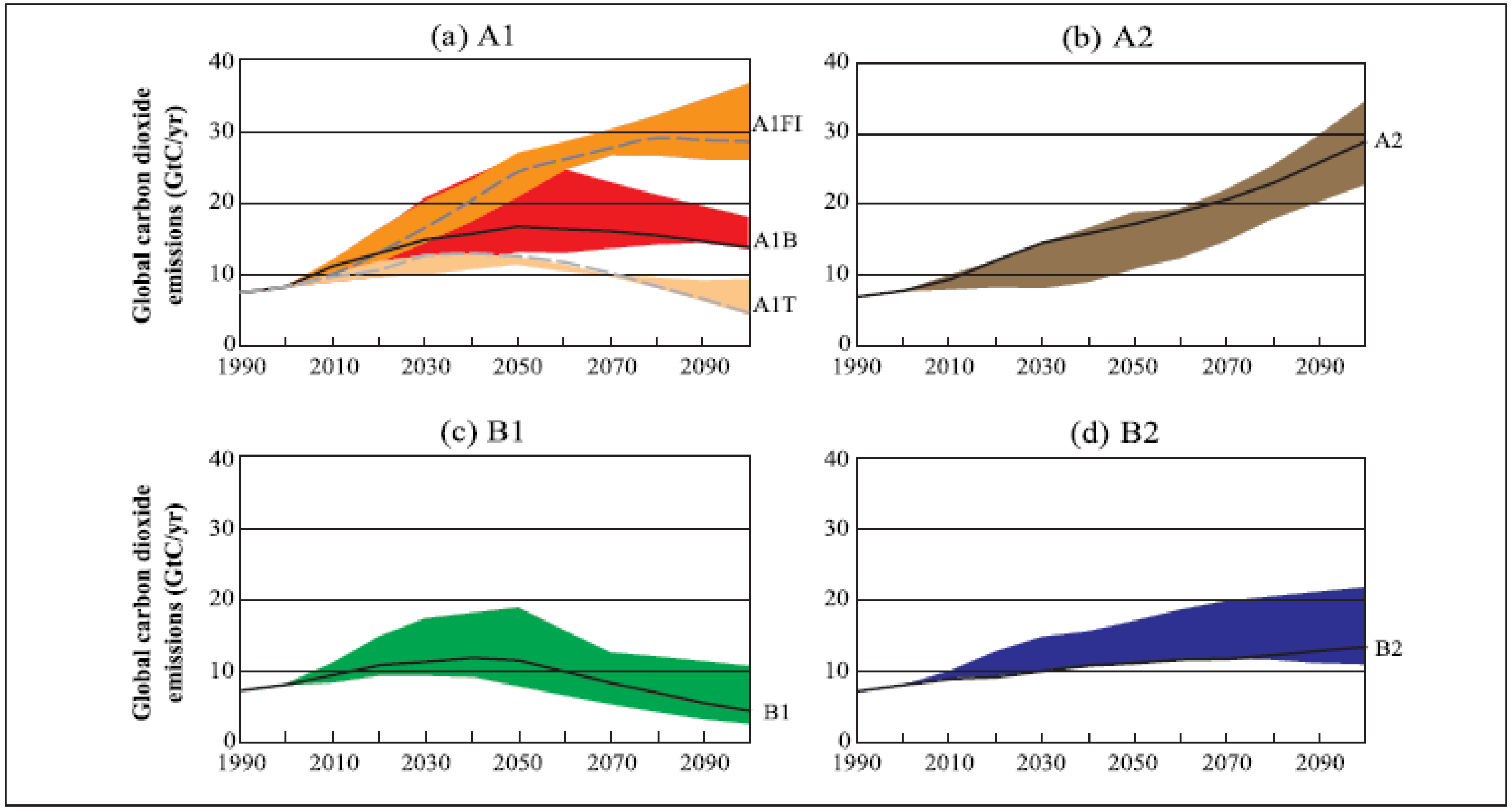

Figure 3: Total global annual CO_2 emissions from all sources (energy, industry, and land-use change) from 1990 to 2100 (in gigatonnes of carbon (GtC/yr)) for the families and six scenario groups. The 40 SRES scenarios are presented by the four families (A1, A2, B1, and B2) and six scenario groups: the fossil-intensive A1FI (comprising the high-coal and high-oil-and-gas scenarios), the predominantly non-fossil fuel A1T, the balanced A1B in Figure 3a; A2 in Figure 3b; B1 in Figure 3c, and B2 in Figure 3d. Each colored emission band shows the range of harmonized and non-harmonized scenarios within each group. For each of the six scenario groups an illustrative scenario is provided, including the four illustrative marker scenarios (A1, A2, B1, B2, solid lines) and two illustrative scenarios for A1FI and A1T (dashed lines).

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Nakicenovic et al. 2000. Emissions Scenarios. A Special Report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge.

Methods and tools

- Scenario analysis ("surprise-free")
- Expert elicitation
- Sensitivity analysis
- Monte Carlo
- Probabilistic multi model ensemble
- Bayesian methods
- NUSAP / Pedigree analysis
- Fuzzy sets / imprecise probabilities
- Stakeholder involvement
- Quality Assurance / Quality Checklists
- Extended peer review (review by stakeholders)
- Wild cards / surprise scenarios

Stockholm CIRCLE-2 workshop

- **Develop guidance** on how to deal with and communicate uncertainties (with practical examples)
- Consolidating networking
- Stimulate communication and training
- Connect to policy

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