Uncertainty in IAMs

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IAMs

IAMs Draw from and Serve Other Climate Science Research

IAM

Human Systems
- Economy
- Security
- Food
- Managed Ecosystems
- Population
- Transport
- Infrastructure
- Science
- Technology
- Health

Energy

Natural Earth Systems
- Atmospheric Chemistry
- Sea Ice
- Coastal Zones
- Carbon Cycle
- Nitrogen Cycle
- Oceans
- Hydrology
- Ecosystems

Climate Modeling and Research Include:
- Carbon cycle
- Atmospheric chemistry
- Oceans
- Climate

Models and Data

Socioeconomic States, Development Paths, Multiple Stressors

IAV Modeling and Research Include:
- Energy
- Water
- Coastal zones
- Ecosystems
- Health

Models and Data
Typical IAM output
Scenarios

![Graph showing scenarios of World CO2 emissions from 2010 to 2100 with different carbon budgets. Each line represents a scenario with a specific carbon budget range.]
Model comparisons

Global Mitigation Costs (2010–2100)

relative to default technology availability

550 ppm
450 ppm

LowE1, NoCCS, NucOff, LimSW, LimBio, Conv, EERE, LimTech

12/12, 4/11, 11/11, 9/10, 13/13, 9/11, 6/11, 6/9, 0/10
Which type of uncertainty?

- Model uncertainty
- Parametric uncertainty
Economic growth
Van Sluisveld et al., Expert elicitation on future patterns of energy system change (in prep)
Diagnostics
Impacts
Decision criteria
Complexity vs uncertainty

van Zelm et al
Complexity vs uncertainty

Schoups et al
Communicating Climate Science

**Figure SPM.5** The implications of different 2030 GHG emissions levels (left panel) for the rate of CO₂ emissions reductions from 2030 to 2050 (middle panel) and low-carbon energy upscaling from 2030 to 2050 and 2100 (right panel) in mitigation scenarios reaching about 450 to about 500 ppm CO₂eq concentrations by 2100. The scenarios are grouped according to different emissions levels by 2030 (coloured in different shades of green). The left panel shows the pathways of GHG emissions (GtCO₂eq/yr) leading to these 2030 levels. The black bar shows the estimated uncertainty range of GHG emissions implied by the Cancún Pledges. The middle panel denotes the average annual CO₂ emissions reduction rates for the period 2030–2050. It compares the median and interquartile range across scenarios from recent intermodel comparisons with explicit 2030 interim.
An experiment with climate negotiations

- Elicitation of Priors of long term °C
- Providing information on a specific long term scenario (3 Treatments)

<table>
<thead>
<tr>
<th>Predicted 2100 Temperature Increase over Pre-industrial Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Format 1" /></td>
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</table>

The box covers 90% of the estimated temperatures (box edges represent the 5th and 95th percentiles) with the central line marking the mean.

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• Elicitation of Posteriors given Information
• 230 negotiations at COP21 in Paris. Replicated with MBA students

<table>
<thead>
<tr>
<th>Temperature Increase by 2100 (over pre-industrial)</th>
<th>Probability</th>
</tr>
</thead>
</table>
| less than 2°C                                     | Exceptionally Unlikely
|                                                  | Very Unlikely
|                                                  | Unlikely
|                                                  | About as Likely as Not
|                                                  | Likely
|                                                  | Very Likely
| 2-3°C                                            | 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 |
| 3-4°C                                            | 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 |
| more than 4°C                                    | 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 |
Anchoring on Beliefs

- Prior vs. Posterior for different temperature ranges:
  - <2°C
  - 2-3°C
  - 3-4°C
  - >4°C
Impact of display format