“Climate scenarios and projections: the known, unknown, and unknowable – applied to California”

INITIAL REFLECTIONS

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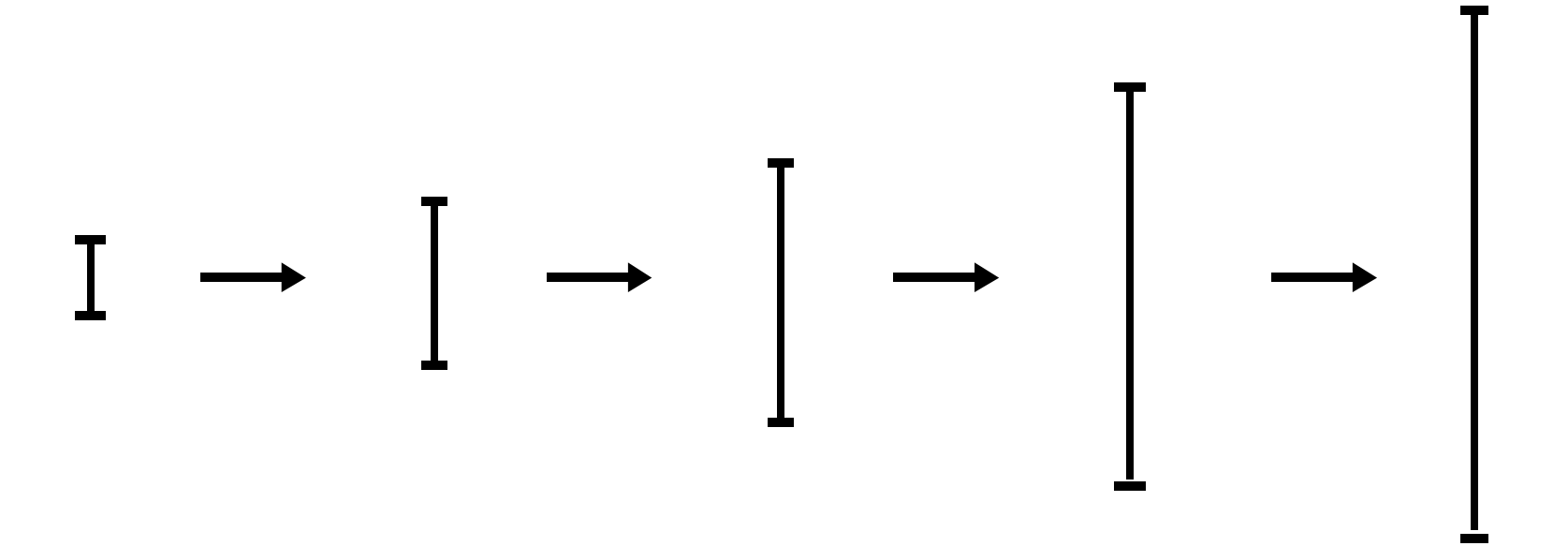
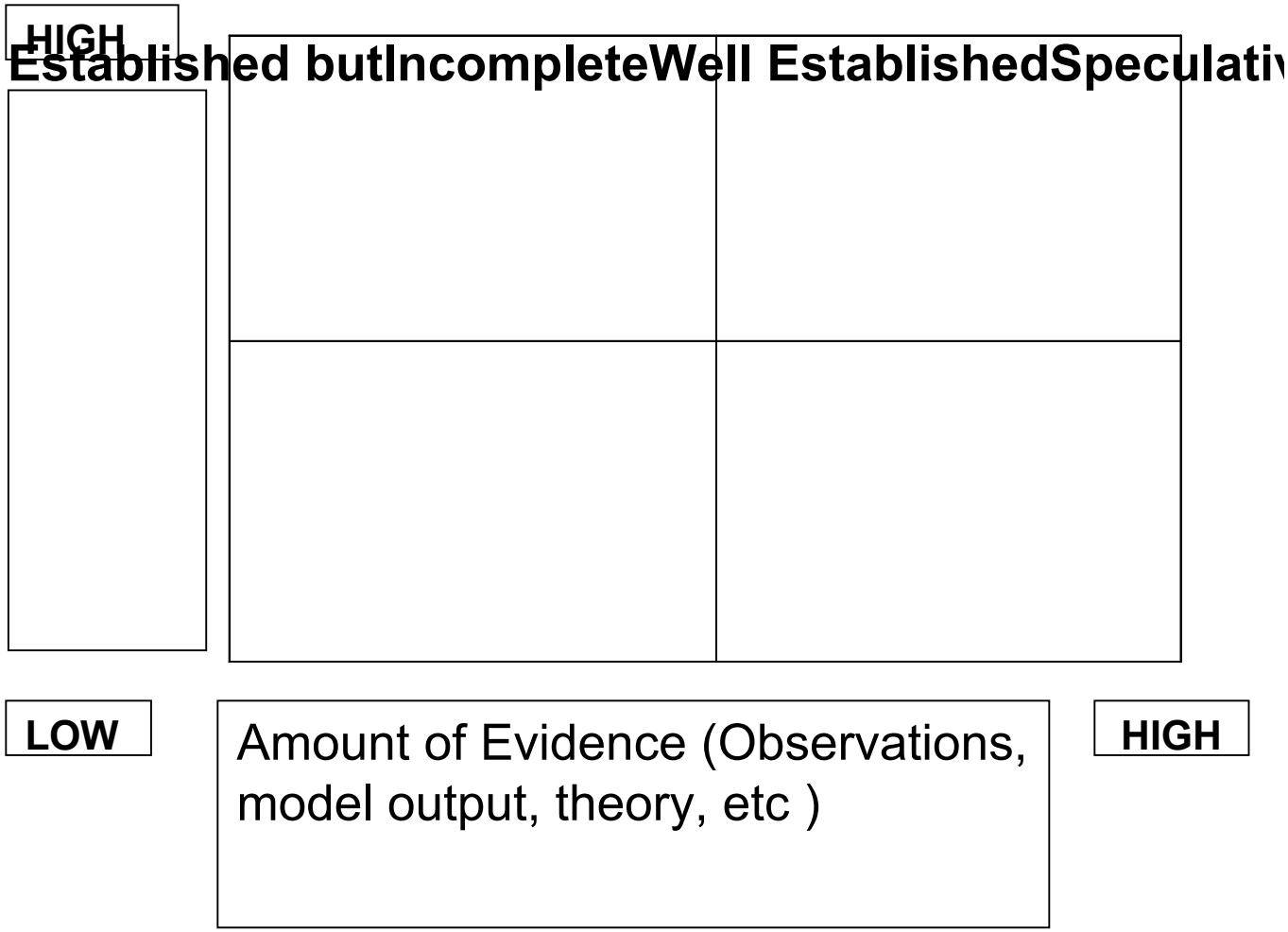
1. What can be known about climate futures and their impacts?

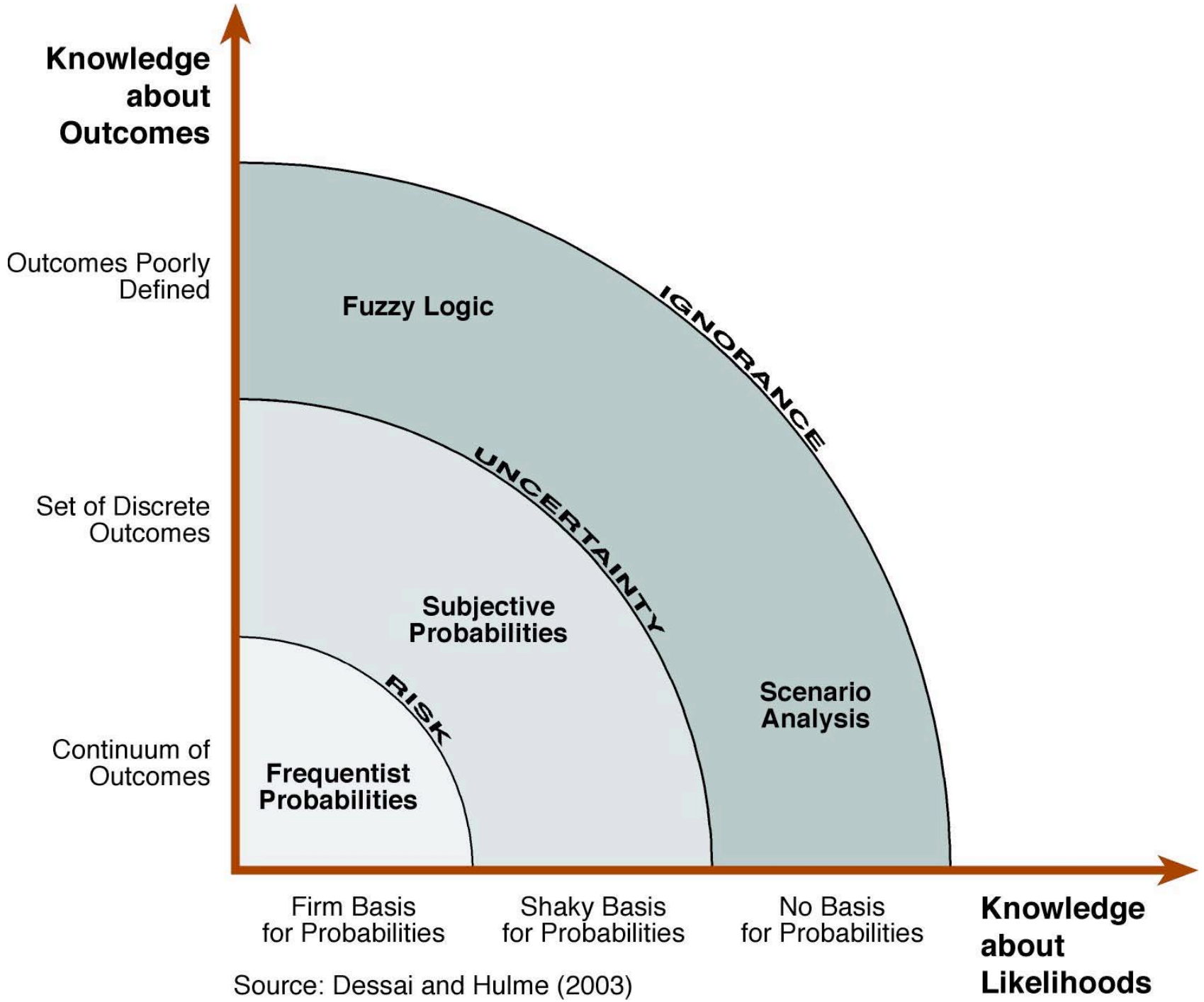


“Known, Unknown, and Unknowable”

- These are not absolute categories, but relative ones—”known” or “unknown” with what degree of confidence?
- What does it mean for something to be “unknowable?”
  - Ignorance?
  - Imaginable surprise?
  - While the carrying capacity of Earth is “unknowable,” we can say something useful about things that will affect it
- Time frame within which something is unknowable is useful in decision contexts

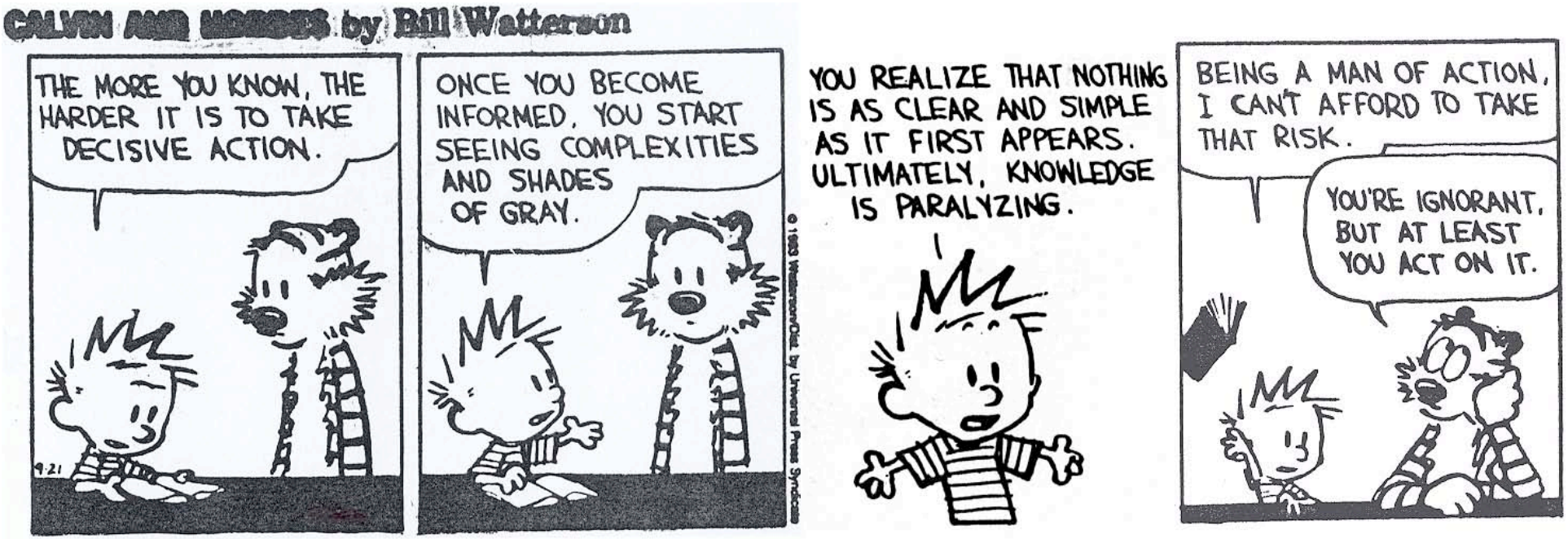
Qualitative Uncertainty Terms





Source: Dessai and Hulme (2003)

2. User perspectives: how much certainty is needed?



Organizers' Assumptions

- The use of probabilities to represent uncertainties in climate change projections will help users make more informed decisions
- It is better for experts to make these subjective judgments than non-experts
- Subjective evaluation and communication of uncertainty must employ a systematic approach to be done responsibly
- There are practical limitations for emissions, climate, and impacts projections that must be respected

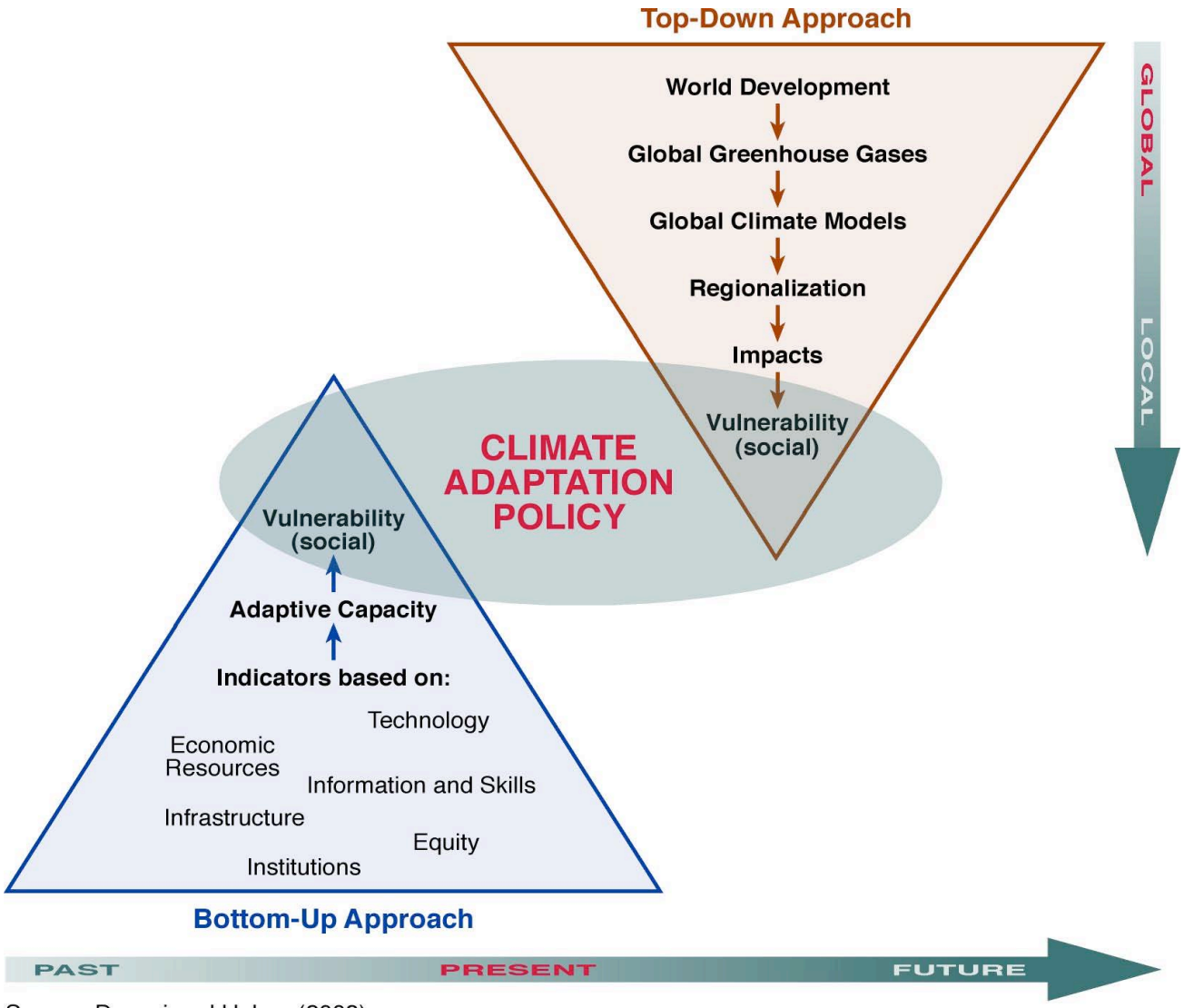
3. What can be achieved? Examples of evolving research…

- Uncertainty assessment in emissions scenarios? Estimating distributions for inputs? Energy systems future? Probability distributions for future emissions?
- Uncertainty assessment in climate science? Likelihood estimates for climate sensitivity? Statistical methods for analysis of GCM, RCM, and other data?
- Probability-based projections of impacts?

In thinking about what's doable, recall sources of uncertainty…

- Model structure: functional form, omitted variables, parameterizations, …
- Scaling/aggregation issues
- Measurement error: bias or random errors
- Miscellaneous sources: ambiguously defined concepts/terms, human behavior

4. Complementary Approach: Vulnerability assessment



Source: Dessai and Hulme (2003)

5. Broader issue of guidelines for assessments and syntheses

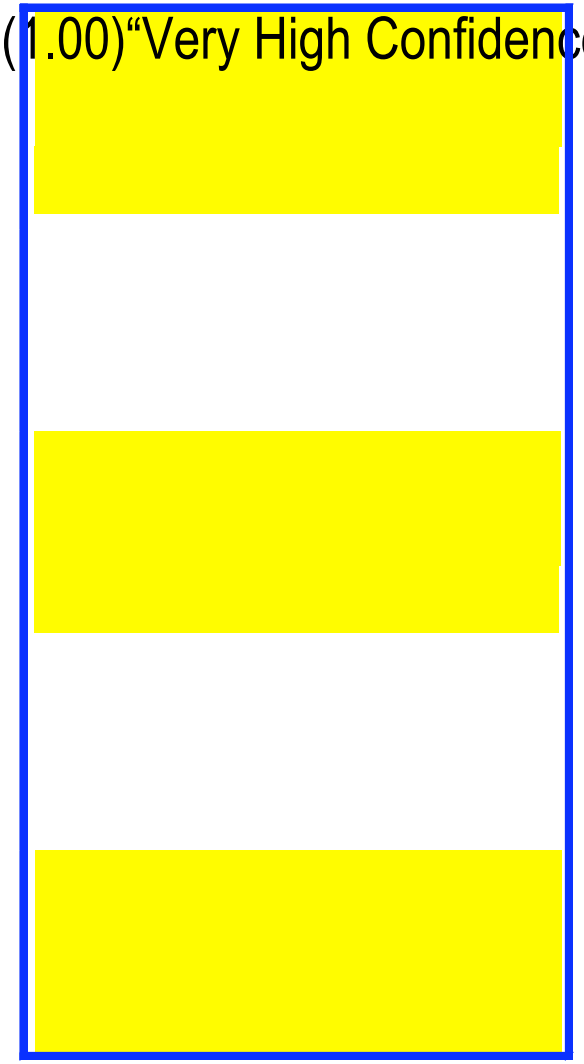
- IPCC TAR uncertainty guidance: What worked, what didn't?
- US National Assessment: Results and lessons?
- RIVM Guidance for Uncertainty Assessment and Communication (NUSAP)
- CCSP Synthesis and Assessment Products—scenario-based reports and need for general guidelines

Minimum Goals for Evaluation and Communication in Assessments (IPCC TAR)

- ✓Specify the problem/issue clearly and iteratively
- ✓Identify all significant assumptions
- ✓Choose appropriate level of precision given state of knowledge
- ✓Characterize distributions systematically
- ✓Use terminology consistently to describe state of science
- ✓Provide a “traceable account”

Consistent terminology: How well do we know …?

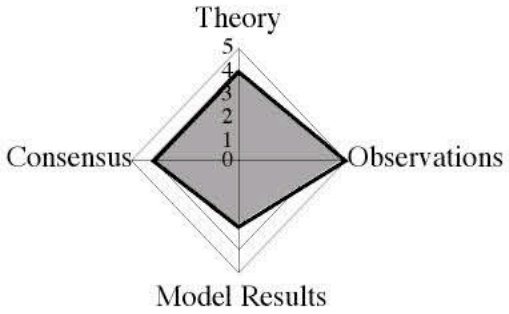
(1.00)“Very High Confidence”(0.95)(0.95)“High Confidence”(



Graphics from WG II TAR (Settlements)

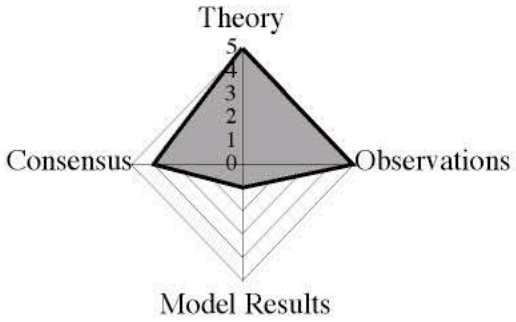
Flooding, Landslides

Confidence = High



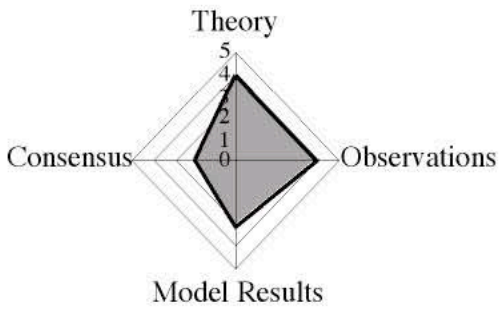
Tropical Cyclones

Confidence = Medium



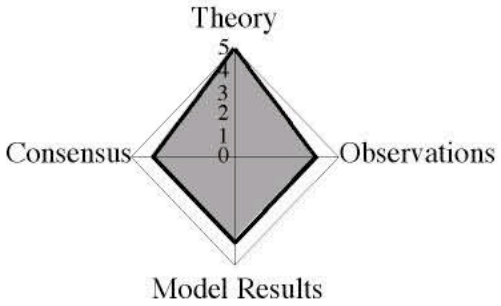
Water Quality

Confidence = Medium



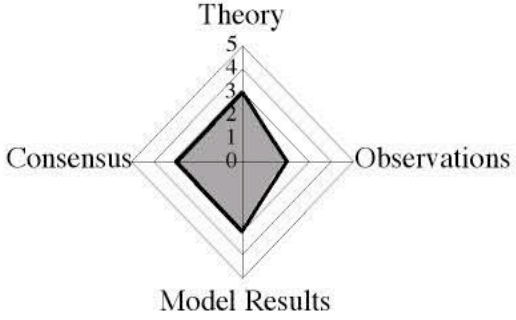
Sea Level, Coastal Infrastructure

Confidence = High



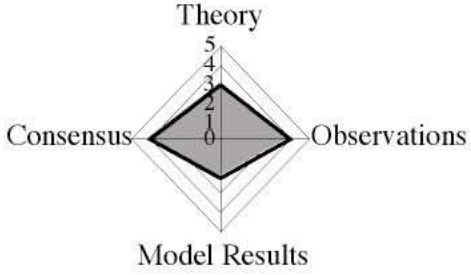
Sea Level, Resources

Confidence = Low



Heat/Cold Waves, Resources

Confidence = Medium



Damage/Abatement Cost Categories from NAS 1992

- Impacts/Damage Categories:
  - low sensitivity
  - sensitive, but adaptation at some cost
  - sensitive, adaptation problematic
- Abatement Cost Categories
  - net benefit (cost <=$0)
  - low cost (cost $1 -$9 per ton CO_2 equivalent)
  - moderate cost (cost $10 -$99 per ton CO_2 equivalent)
  - high cost (cost >= $100 per ton of CO_2 equivalent)

To recap, five different themes are addressed in the workshop

1. Develop better understanding of user perspectives for climate information
2. Clarify approaches to estimate the likelihood of climate change for different users
3. Discuss state of the art methods for uncertainty evaluation in different areas of climate research
4. Touch on vulnerability/adaptation assessment, a complementary approach to using estimates of future climate change from top-down scenario exercises
5. Reflect on how to improve evaluation and communication of uncertainty in large-scale assessment processes as inputs to IPCC, CCSP, etc.

Outcomes

- Workshop report
- Article for general audience
- Proposals for future research?
- Others to emerge during the workshop?

To close, some inspiration!

- “Probabilities direct the conduct of the wise man.” Cicero, 106-43 BC
- “The only certainty is uncertainty”. Pliny the Elder, AD 23-79
- “If a man will begin with certainties he shall end in doubts; but if he will be content to begin with doubts he shall end in certainties.” Francis Bacon, AD 1561-1626

Source: Richard Katz, 2001