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“To know one’s ignorance
is the best part of knowledge”

–Lao Tzu



“Any clear way, though it lead to death, is preferable to the tangle of uncertainty”.

- Charles Horton Cooley, U.S. sociologist



“Doubt is not a pleasant condition, but certainty is an absurd one.”

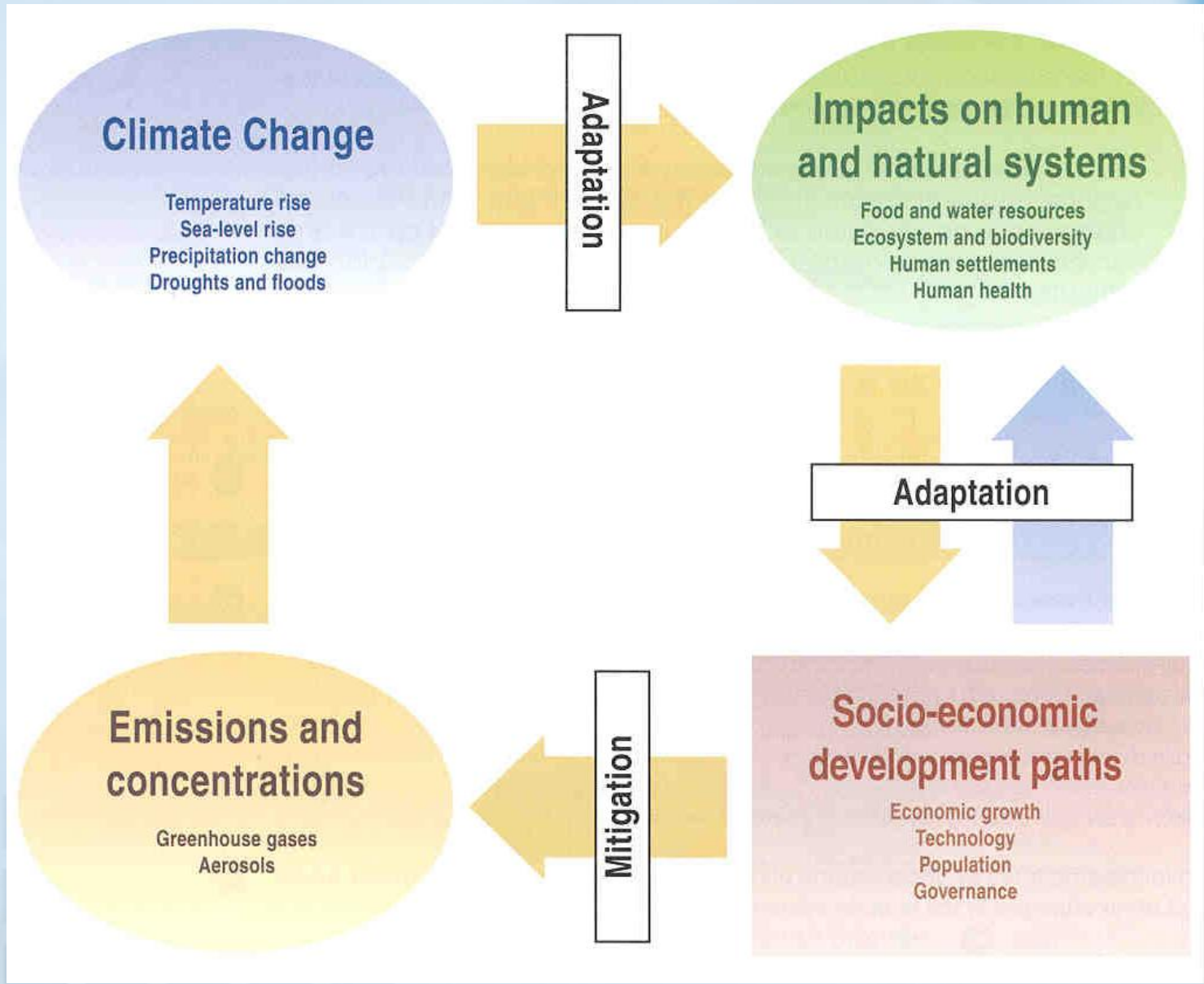
-Voltaire

Uncertainty – what is it?



A state of lack of knowledge or incomplete knowledge or more completely:

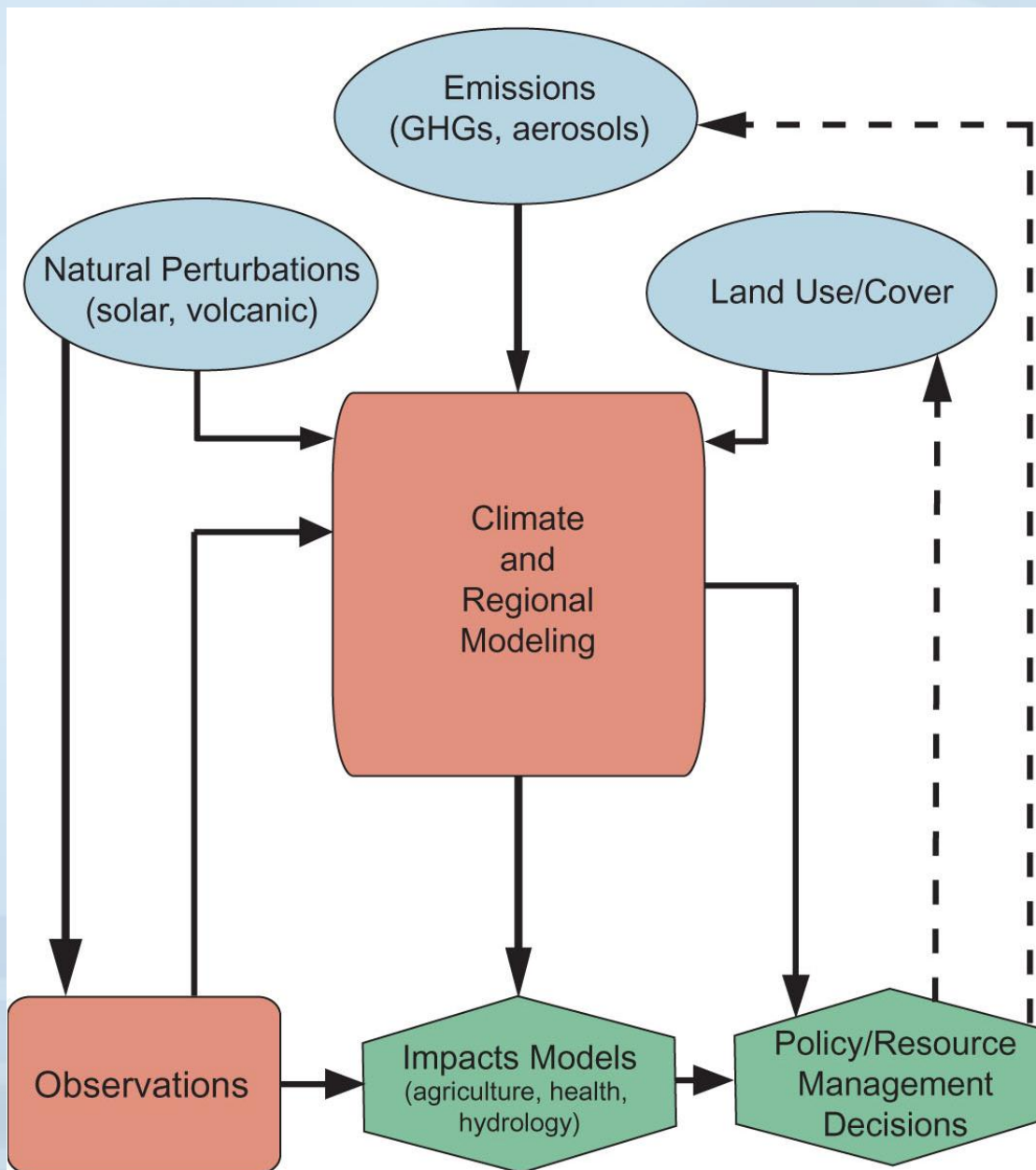
A state of incomplete knowledge (about the future), often with a random component reflecting random processes (e.g, rolling of dice). Total uncertainty is a combination of random (aleatory) uncertainty and epistemic uncertainty (the incomplete knowledge due to complexity of world). Probability is viewed as the standard measure of uncertainty.



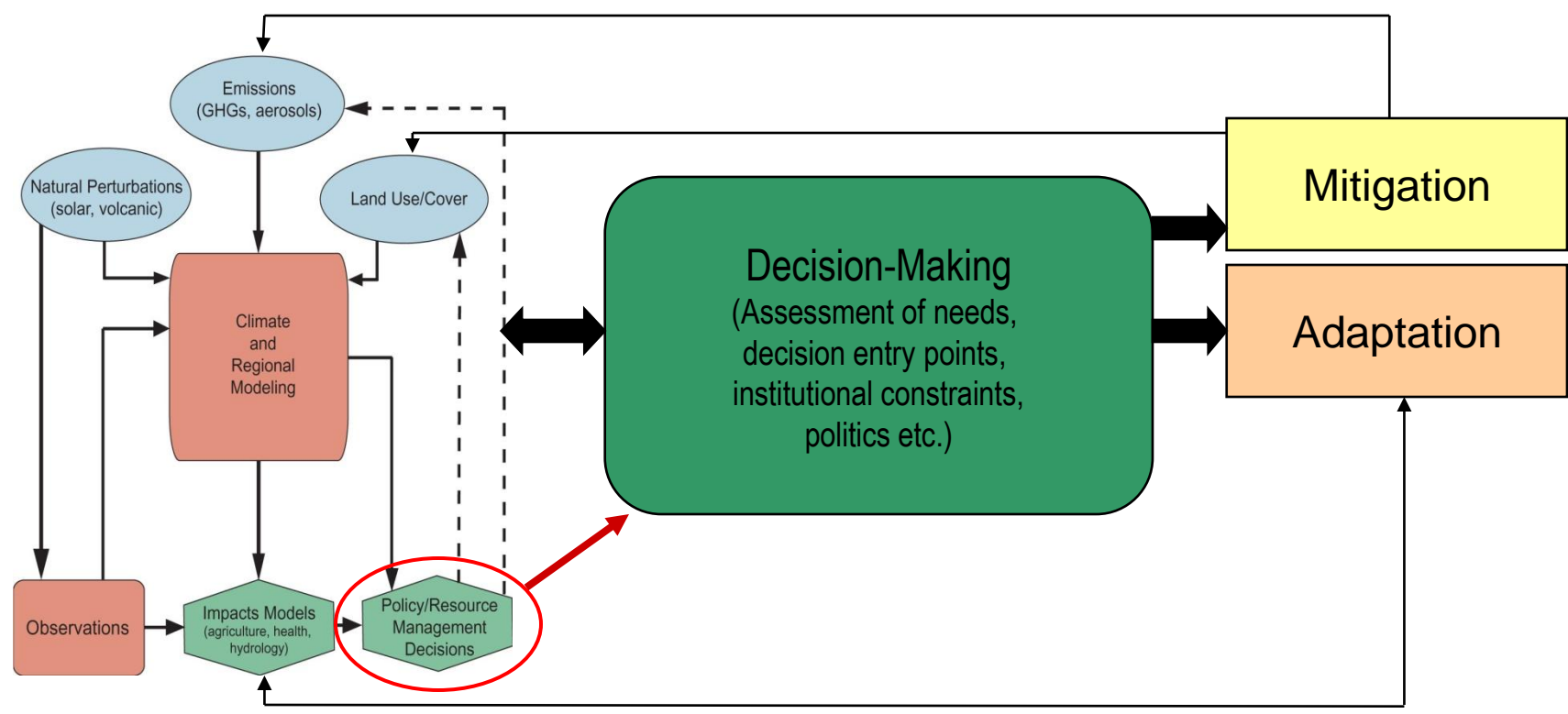
Cascade of Uncertainty for Climate Change Research



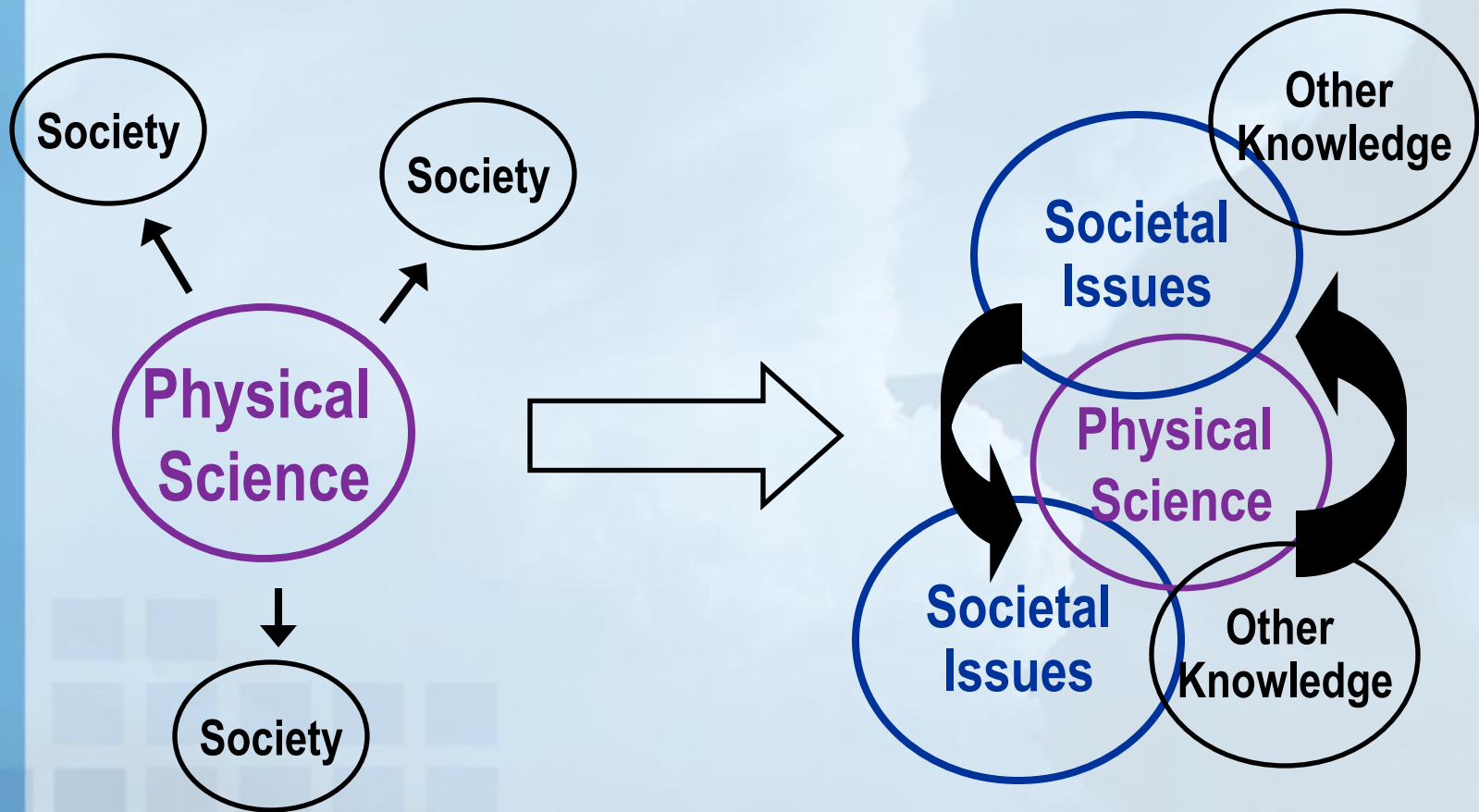
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Toward Decision-making as a Central Focus



Scientific Information in Decision Processes





San Francisco
**Water
Power
Sewer**

Symbiosis





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Developing Mitigation and Adaptation Strategies

Moving from 'Is Climate Change Happening?' to 'What do we do about it?'



Emphasis on actionable science

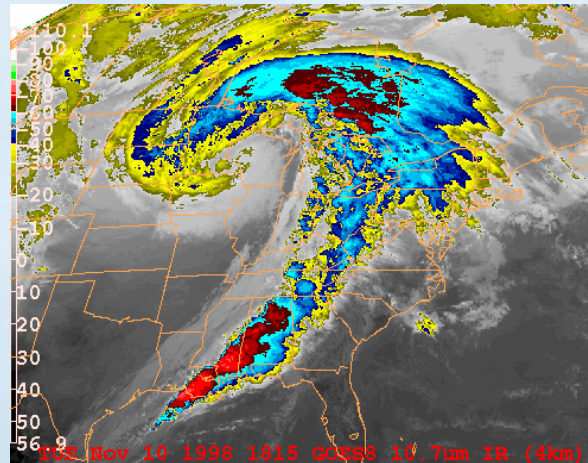
IPCC 2001 Critical Gaps in Extremes



IPCC WG 1

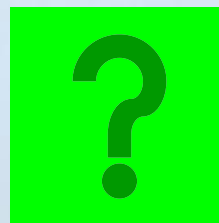
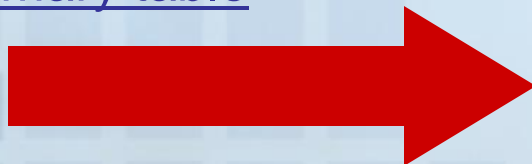
High uncertainty:
Unwilling to list probability in summary table

Frequency of mid-latitude storms in the future??



IPCC WG 2

High uncertainty, but also high impact:
Included in summary table even with high uncertainty





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Positive Signs of Integration



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**MANAGING THE RISKS OF EXTREME
EVENTS AND DISASTERS TO ADVANCE
CLIMATE CHANGE ADAPTATION**



**SPECIAL REPORT OF THE
INTERGOVERNMENTAL PANEL
ON CLIMATE CHANGE**



Extremes and Adaptation

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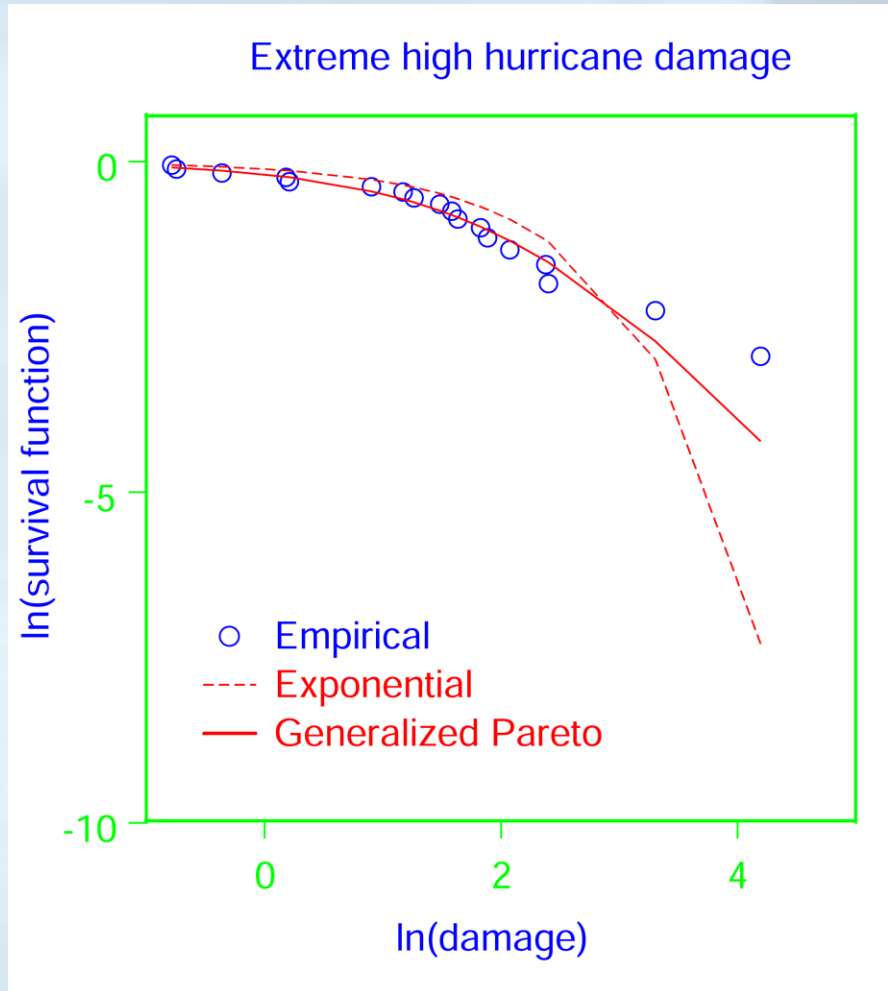
IPCC, 2011

This report considers climate change and its effects on extreme (weather and climate) events, disaster, and disaster risk management; how human response to extreme events and disasters could contribute to adaptation objectives and processes; and how adaptation to climate change could be more closely integrated with disaster risk management practice.

Anticipating Hurricane Damages



This figure shows that the upper tail of the distribution of economic damage from hurricanes may be heavier than commonly assumed (i.e., storms with high damage are not as unusual as conventional analyses would indicate).



Katz, R.W., 2002: Stochastic modeling of hurricane damage.

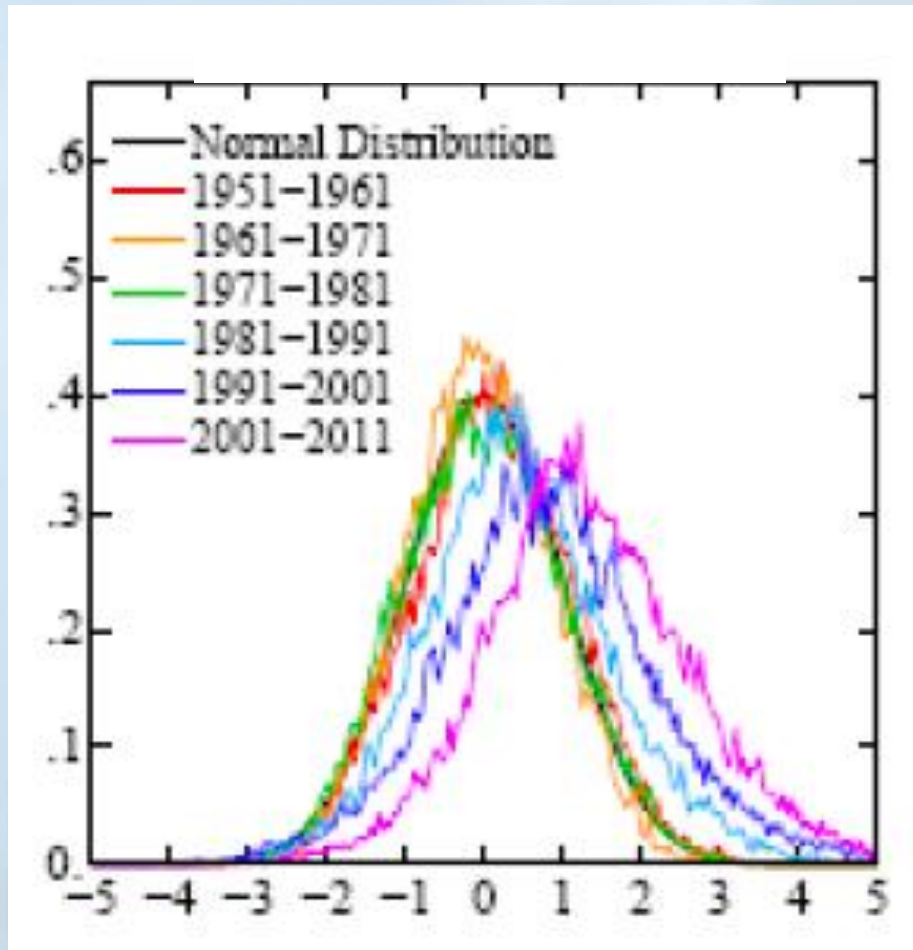
Journal of Applied Meteorology, V. 41, pp. 754-762.

Public Perception of Climate Change and the New Climate Dice

Hansen et al. 2012, *Proceedings of the National Academy of Sciences*

‘The chance (the dice) of unusually warm or cool seasons relative to climatology, have become progressively "loaded" in the past 30 years, coincident with rapid global warming.’

Summer temperature anomaly distribution for NH land



Hansen et al. 2012
PNAS

Comments on Hansen et al. 2012

- John Holdren, US Science advisor – praise
- G. Morgan, Prof. Carnegie Mellon – an important next step in statistically based arguments
- Andrew Weaver, climate scientist, U. Victoria – science is excellent and reframes the question
- Kevin Trenberth, NCAR – important paper that helps communicate the problem
- Roger Pielke, Jr. – Hansen doesn't understand social science, thinking study like his could spur action.



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What is the danger of false certainty?

Why are we doing this workshop?

- To understand the strands of uncertainty throughout the climate change problem in order to maximize effectiveness in any one area.
- It does not mean that all participants are expected to always engage in highly interdisciplinary research.
- It does mean that hopefully your research activities will be informed by and benefit from the larger uncertainty context.

The Importance of Generational Change





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S. Schneider, 1978

in

Climatic Limits to Growth

‘Tough decisions that have to be made generally are value judgments of how to weigh risks and benefits in the face of large uncertainties.’

The End



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