

# Coupled Ethical-Epistemic Issues in Assessing and Managing Risks From Sea Level Rise

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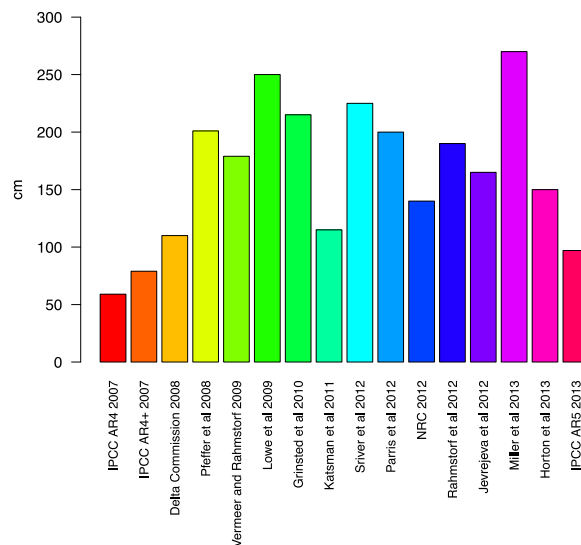
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## Upper Bounds of Some Recent GMSLR Projections for year 2100



## Why are SLR assessments not converging? (Why should they?)

- Different assumptions and choices. Why?
- Choices made within science are influenced by "value judgments"
- A "value judgment" is simply an evaluation based on "values".
- Examples of standard values in science:
  - *coherence, simplicity, explanatory power, fruitfulness, conservative burden of proof, etc.*

## Epistemic vs Non-epistemic values

- *Epistemic values*
  - goal of knowledge
  - (From Greek *episteme* = knowledge or learning)
- *Non-epistemic values*
  - other goals
  - (often social or ethical)
- Social and ethical values affect science *externally*:
  - type of experiments that are allowed on human or animal test subjects, prioritization of funding of research, etc.
- But they also affect science *internally*:
  - Prioritizing epistemic values only is also a social value judgment!

## Example: High priority on epistemic values can have policy implications

A high priority on epistemic values suggest only saying well-established and uncontroversial facts.

IPCC AR4:

“this report does not assess the likelihood, nor provide a best estimate or an upper bound for sea level rise”

IPCC AR5:

Projected ranges are “*likely*” with “*medium confidence*”.

IPCC SLR Chapter authors (in *Science* commentary):

“there is roughly a one-third probability that sea-level rise by 2100 may lie outside the ‘likely’ range” (Church et al. 2013, p 1445).

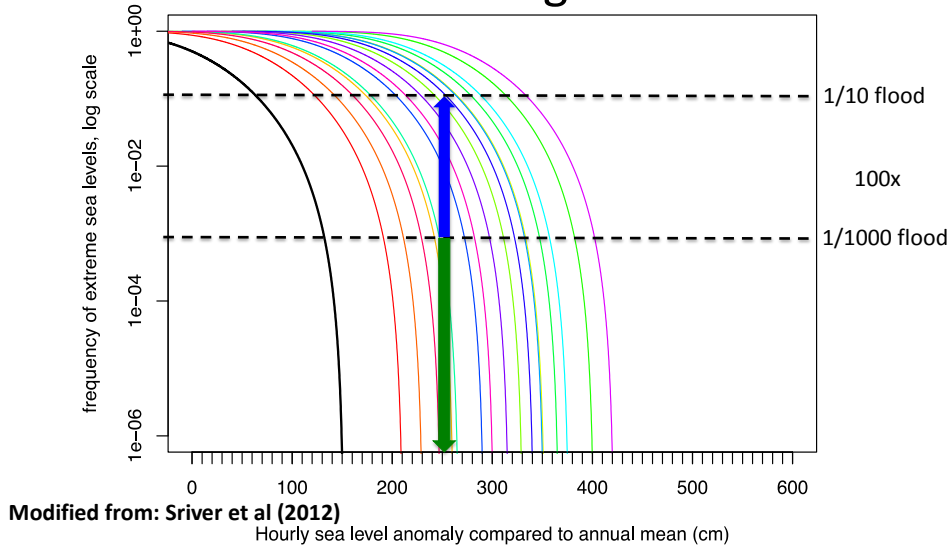
## Value judgment: “how to communicate uncertainty”

The choice of using the “likely” range in the IPCC is based on a social and epistemic value-judgments

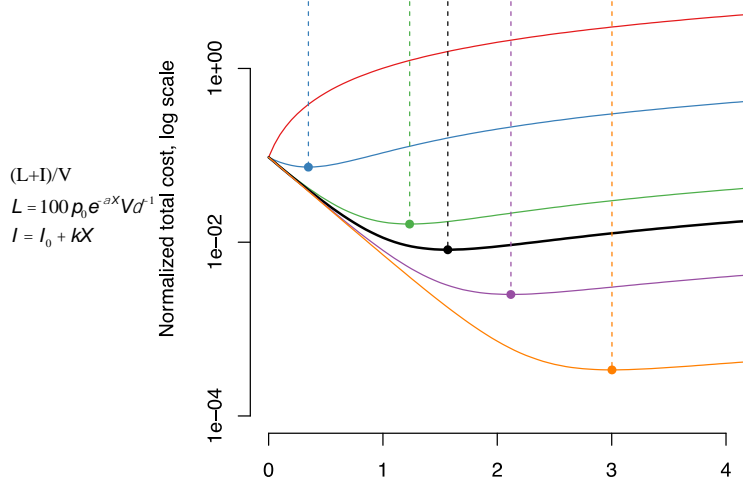
Other choices are possible. They could perhaps have said the following of the global mean sea level rise by 2100...

- “it is *very likely* to be less than 2 meters (medium confidence)” (compare. Parris et al 2012, NOAA)
- “it is *virtually certain* to be less than 10 meters (high confidence)”
- “it will be definitively be less than 80 meters (high confidence)”

## How (epistemic) value judgments in SLR projections can affect risk of flooding



## How (social) value judgments in decision analysis can affect optimal dike height



Using Van Danzig (1956) model & data Dike heightening [m]

## Both epistemic and social values are important for planning for SLR

- Different applications have different requirements, hence different values should be used.
  - This is obvious for cost of flooding, but not always obvious for scientific SLR projections.
1. Value judgments (epistemic AND social) affect SLR projections.
  2. Value judgments ought to be appropriate for application.
  3. Hence, a particular SLR projection may not be appropriate for a particular application

### Recommendations for SLR planners 1: **Use vulnerability/robust-based decision making approaches**

#### **"Predict-then-Act"**

- Best available prediction drives decision making
- Maximise expected utility
- "What is most likely to happen?"

#### **"Seek Robust Solutions"**

- Identify vulnerabilities across full range of futures and identify policies that perform reasonably well across this range
- Minimize regret
- "How does my system work and when might my policies fail?"

Weaver, Lempert, Brown, Hall, Revell and Sarewitz *WIREs Clim Change* 4, 2013.

## Recommendations for SLR planners 2: **Integrate SLR scientists in decision-making processes**

- But they need to understand that epistemic values are not the only values that are important in a practical context!
- They need to be able to balance epistemic values against other relevant social values in the project.

## Recommendations for SLR scientists (writing papers and reports)

1. Make value judgments explicit in papers/reports
2. Aim to sample full uncertainty range
3. Understand that different applications have different needs
4. Try to leave value judgments open to the end-user (or anticipate these and choose for them, if this is not possible).

## Conclusions

1. The concepts of epistemic and social value judgments is useful.
  - Help us understand underlying reasons for differences between different projections
  - Provides a theoretical tool to improve SLR planning and science
2. Value judgments (epistemic AND social) in SLR projections can affect risk of flooding
3. Recommendations for SLR planners:
  - Use vulnerability/robust-based decision making approaches
  - Integrate SLR scientists in decision-making processes
4. Recommendations for SLR scientists:
  - Understand that different applications have different needs (different values)
  - Make value judgments explicit in papers/reports
  - Aim to sample full uncertainty range

## Future research

- How does value judgments influence planning for SLR?
- How does value judgments influence SLR science?
- Can we develop integrated decision-methods to better manage value conflicts?
- How can theoretical insights be mainstreamed?

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# Thank you!

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## What does this mean?

- In theory, it might be possible to provide statements on all levels of confidence, but this is often not practical due to constraints (money, time, space, cognition, communication etc).
- This means that scientific assessments have to take non-epistemic values into account
- Especially social consequences of being wrong (Rudner's argument for the necessity of non-epistemic values)

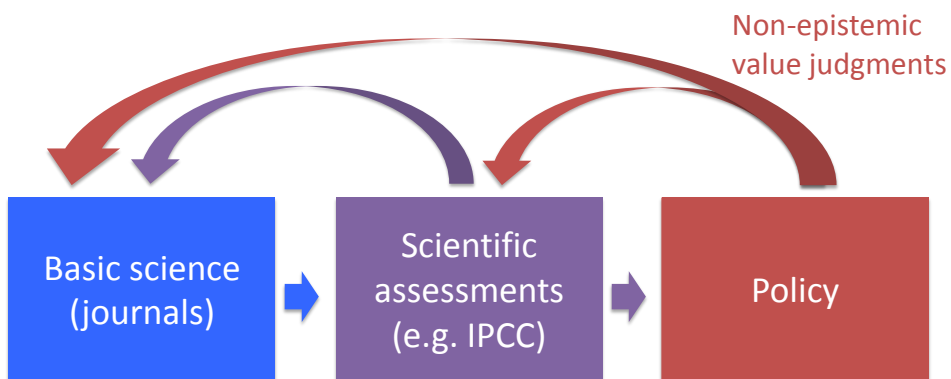


## Value judgment: “how to value different methods and models”

To choose what methods and models to take into account is a value judgment

“Many semi-empirical model projections of global mean sea level rise are higher than process-based model projections (up to about twice as large), but there is no consensus in the scientific community about their reliability and there is thus low confidence in their projections.” (IPCC 2013, WG1 SPM)

The same argument holds for value judgments in basic science  
(recursively)



## Basic science (journals)

How is uncertainty communicated?

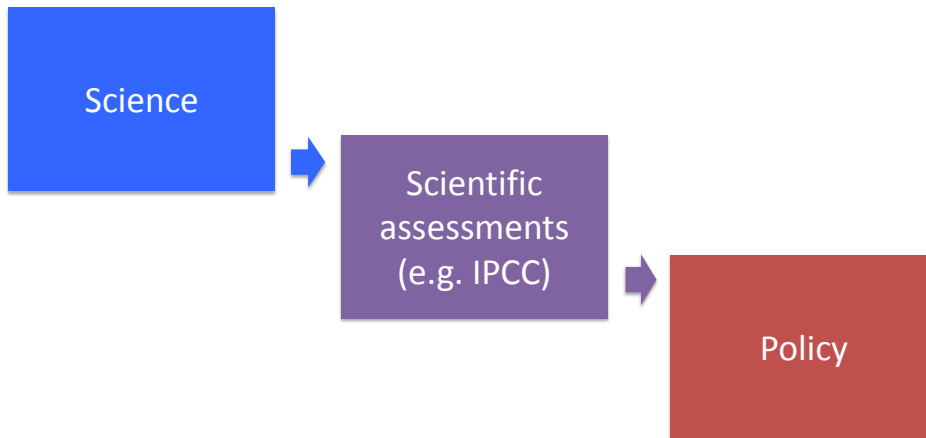
What methods and models are used?

What is not being said?

## Recommendations

- Remember that science is not insulated from the rest of the world
  - Actions have consequences
  - “What are the risks of being wrong?”
- Explore the “shadowy tails of the dangerous end of the probability distribution”
  - Such information can have very high value for some decision-makers
  - Make sensitivity analyses
- Work with end-users to make expert assessments
  - So they don’t need to rely on IPCC only

## Traditional "Predict then act" model of relation between science & policy



## Alternative: vulnerability-and-response-option ("robust solutions")

