

# Justice, Risk and Climate Change: A Case Study of Deep Uncertainties in Sea-level Rise Projections



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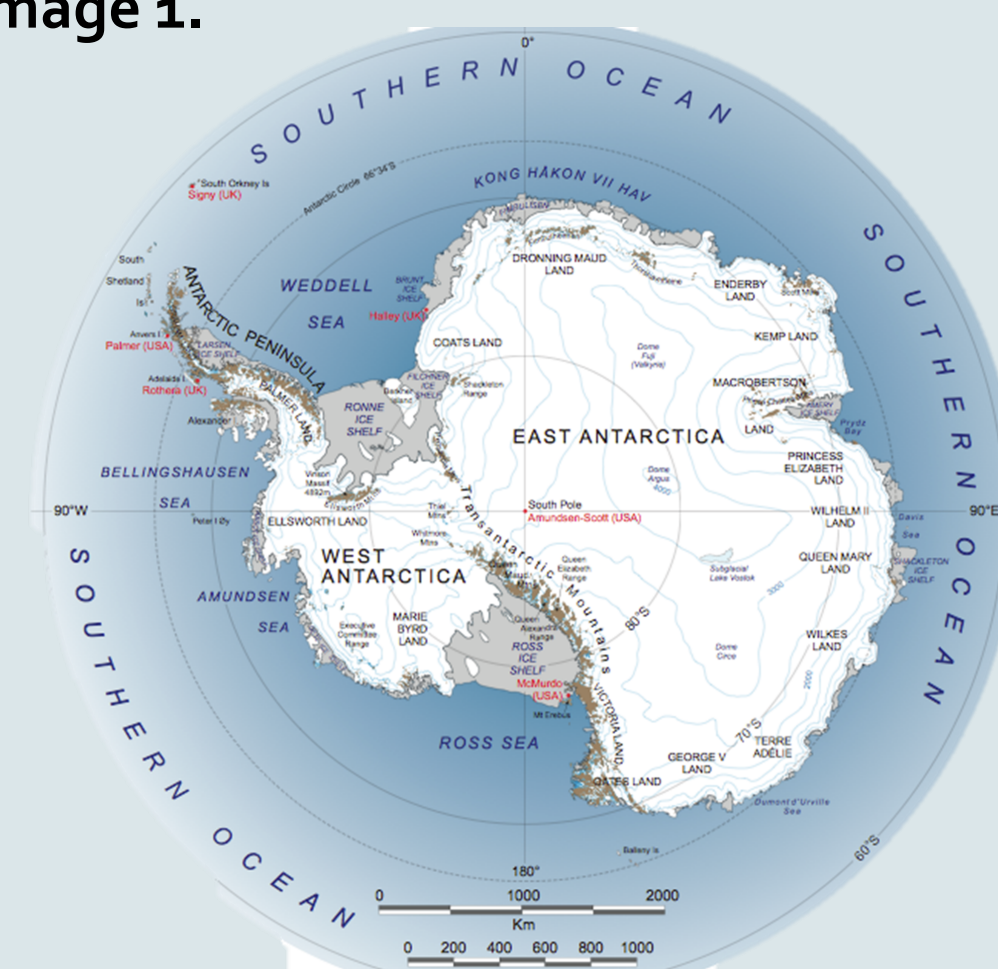
## Introduction

**Problem:** The deep uncertainty surrounding sea-level rise (SLR) projections, particularly the incorporation melt in the West Antarctic Ice Sheet (WAIS), introduces issues of political urgency as well as injustice.

## Solution:

- Reduce potential environmental and social harm, include WAIS melt contribution to SLR projections
- Use the Precautionary Principle as a tool to justify preemptive mitigation and adaptation policies for low-probability but high-risk climate events.

Image 1.



Lima NASA

Image 2.

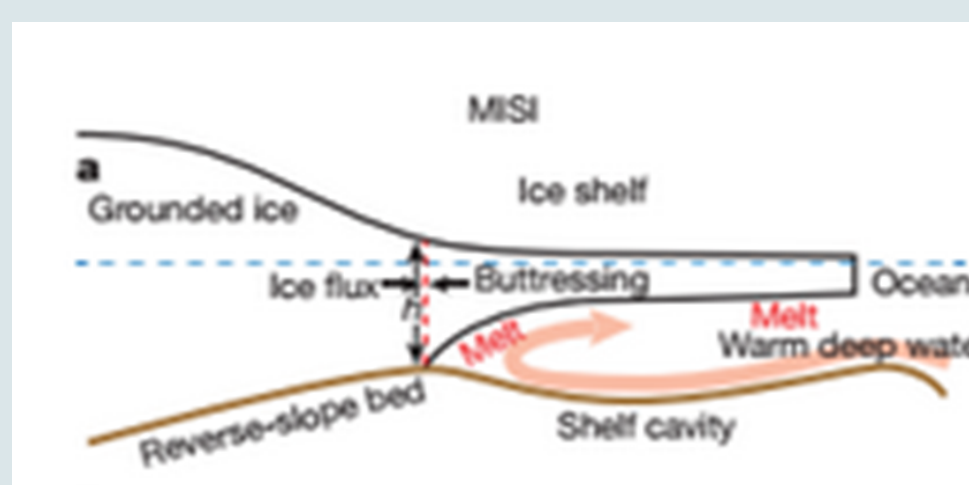
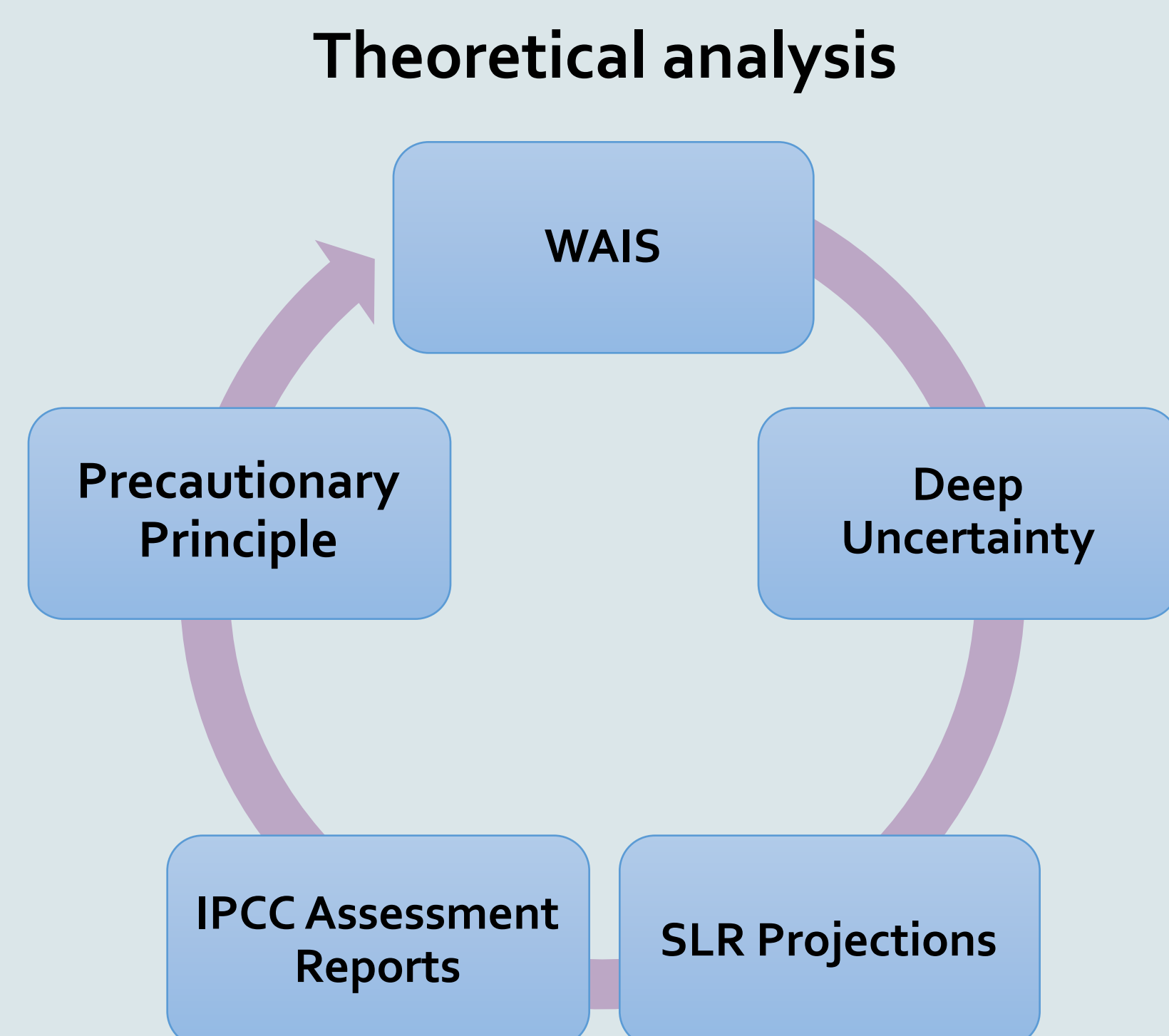


Image 1. WAIS map  
Image 2. Ice Buttressing and Grounding line Structure from DeConato and Pollard (2016)

## Motivation

SLR threatens global well-being as storm surges and floods inundate coastal areas, displacing billions.

## Methods



### Statistical analysis

- Compare CO<sub>2</sub> emissions to juxtapose atmospheric warming contributors with vulnerable nations
- Using R and RScript, depict the range of expert SLR projections, expanding Bakker et al., (under review), to update SLR projections with potential WAIS contributions from DeConato and Pollard (2016) for WAIS contribution to SLR (Fig. 4 & Fig. 5)

## The Long-Term Global Climate Risk Index (1995-2014)

### Most Vulnerable Nations

1. Honduras
2. Myanmar
3. Haiti
4. Philippines
5. Nicaragua
6. **Bangladesh**
7. Vietnam
8. Pakistan
9. Thailand
10. Guatemala

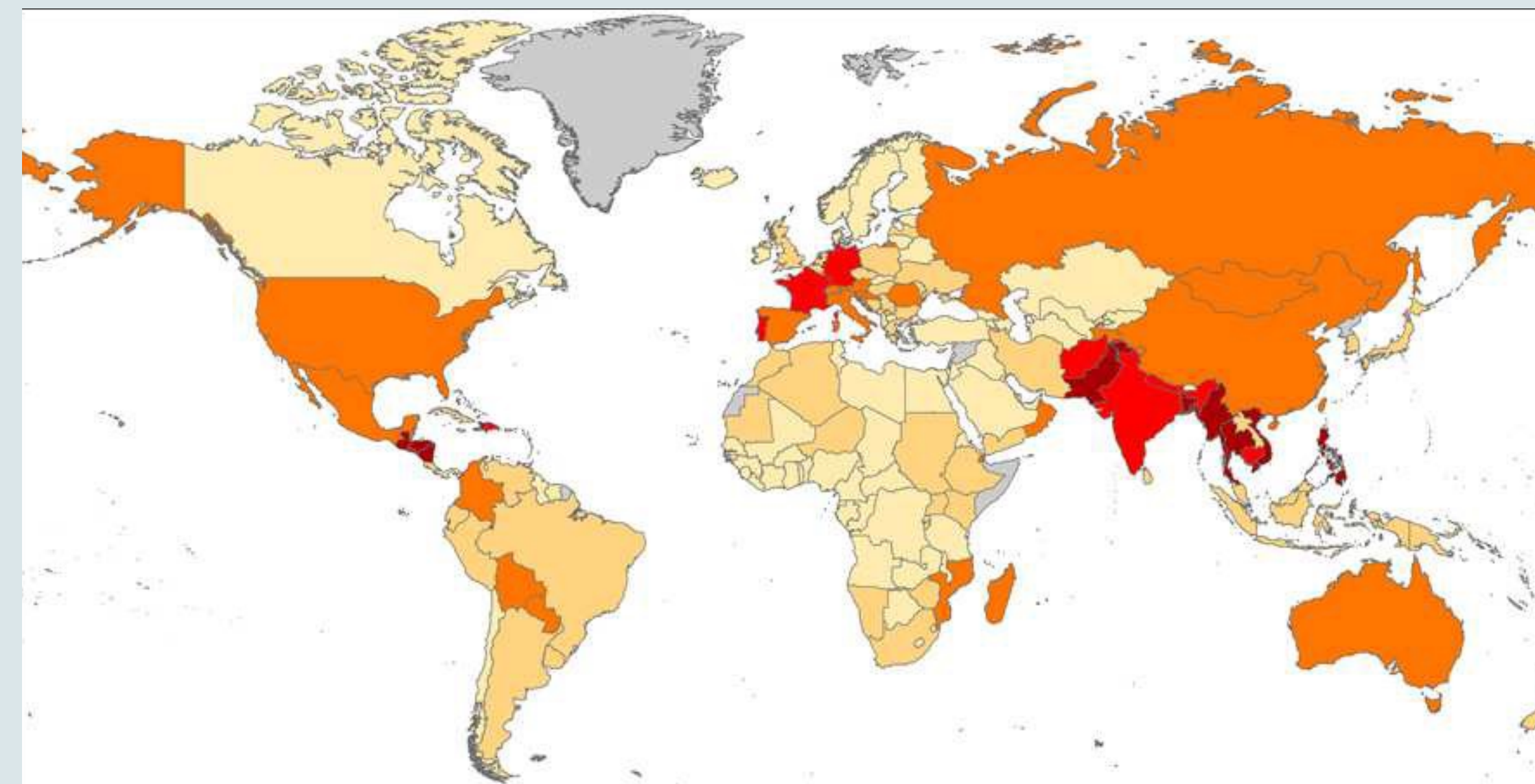


Fig. 1 Germanwatch 2016 Global Climate Risk Index (1995-2014). The nations in dark red are the most vulnerable, Bangladesh is among the most affected nations in the past twenty years (p. 5).

Climate Risk Index: Ranking 1995 - 2014  
 1 - 10, 11 - 20, 21 - 50, 51 - 100, > 100, No data

## Results

Per Capita CO<sub>2</sub> Emissions (1970-2014)

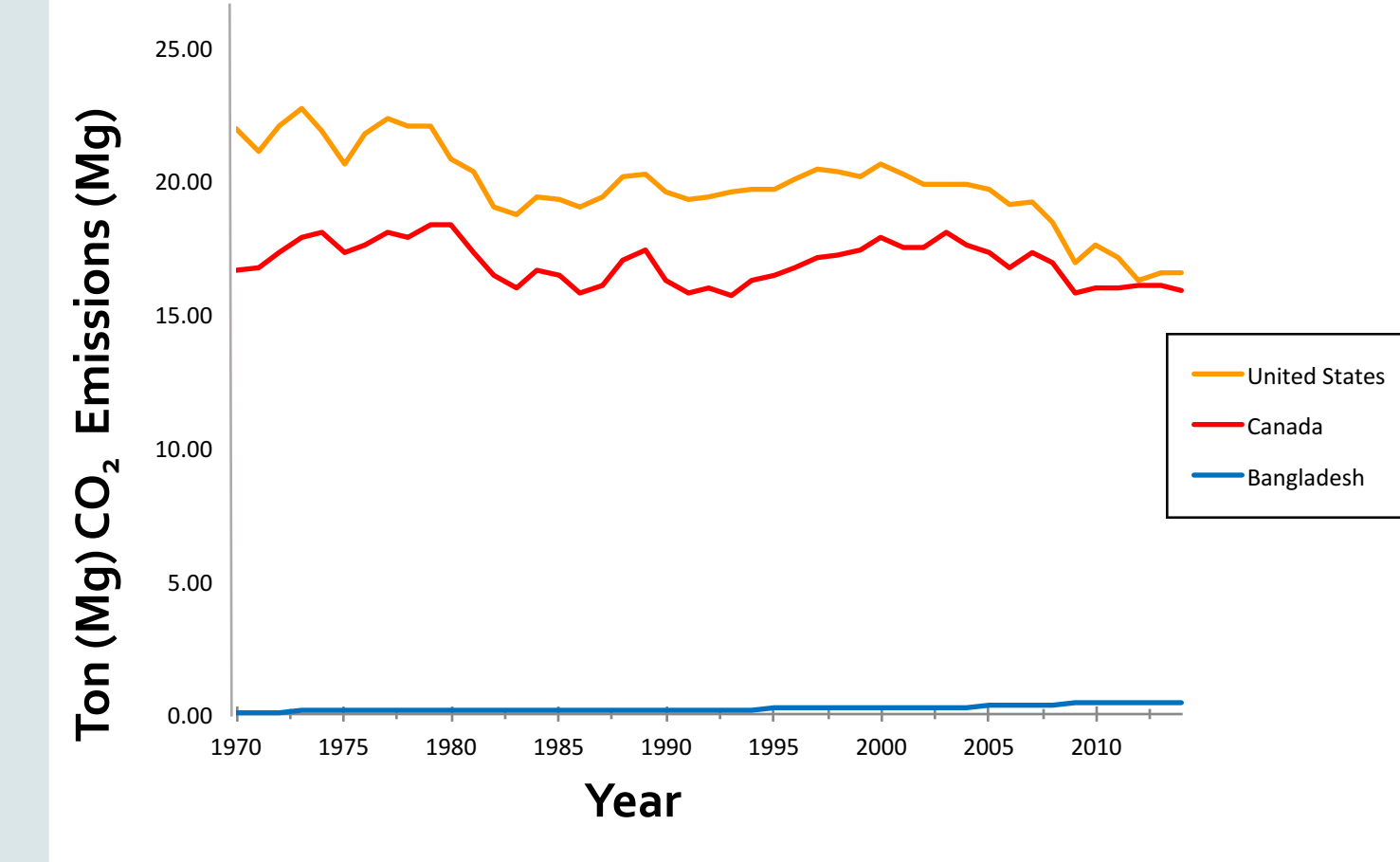
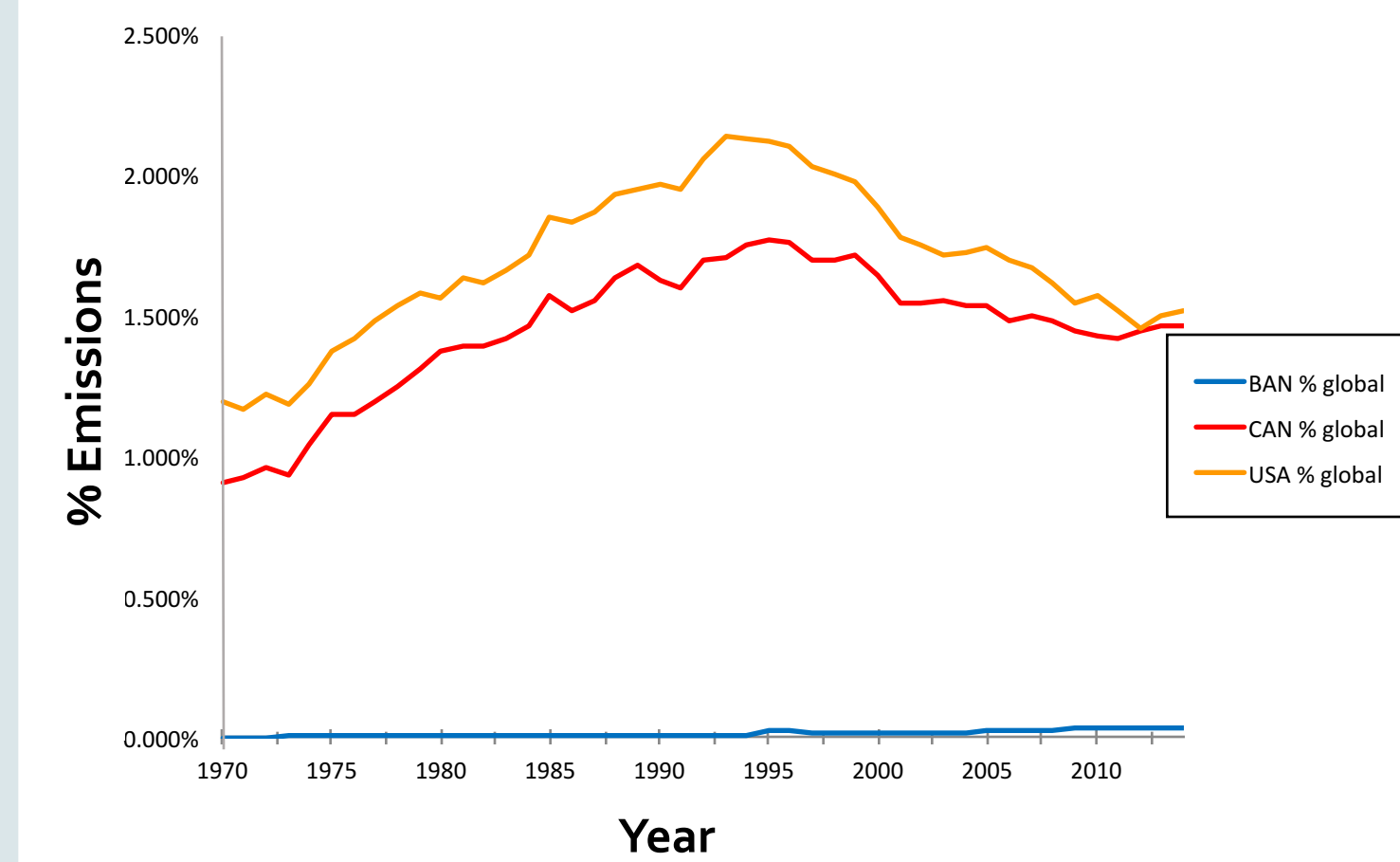


Fig. 2 Per Capita CO<sub>2</sub> Emissions (1970-2014). Historical consumption of CO<sub>2</sub> and thus contribution to GHG emissions and atmospheric temperature rise.

Fig. 3 Percent Global CO<sub>2</sub> Contribution (per capita). Demonstrates how developed nations, like the US and Canada, produce significantly larger portions of global CO<sub>2</sub> emissions.

% Global CO<sub>2</sub> Contribution Per Capita (1970-2014)



Sea-level Rise Projections

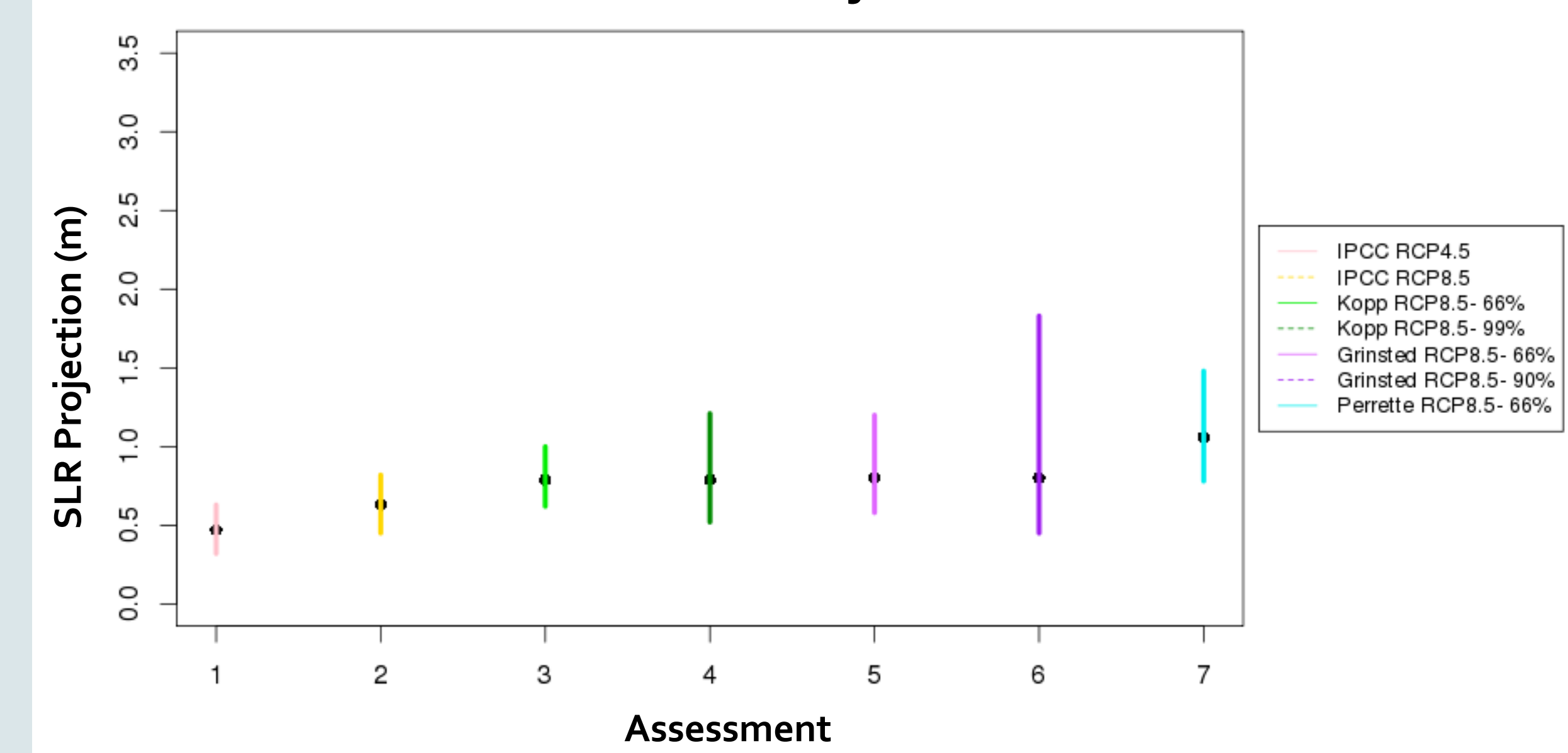


Fig. 4 Sea-Level Rise Projection. This data came from Bakker et al., (unpub.) and illustrates the range of SLR projections between experts. This includes RCP4.5 as well as RCP8.5 projections, however the focus on RCP8.5 asserts a future with comparatively high GHG emissions and thus dangerous levels of SLR. The range in projections demonstrates the deep uncertainty of SLR behavior into the future.

Sea-level Rise Projections w/ DeConato and Pollard (2016) WAIS Contribution

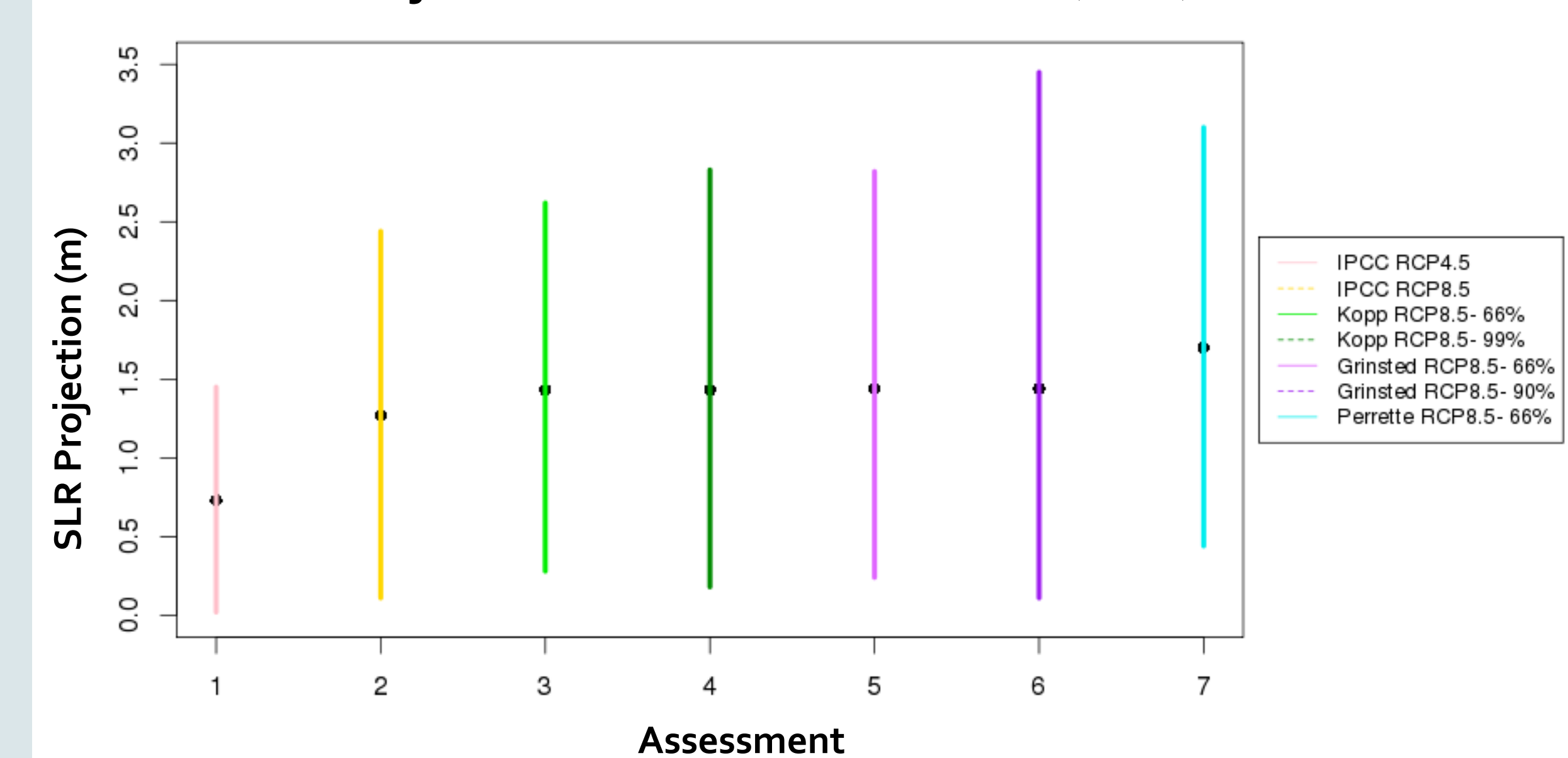


Fig. 5 Sea-level Rise Projection with DeConato and Pollard (2016) WAIS Contribution. This data combines the WAIS melt projections by DeConato and Pollard (2016) with the Fig. 4 SLR projections from Bakker et al., (unpub.). The addition of WAIS melt results in significantly higher SLR projections under RCP4.5 and RCP8.5 scenarios. Although the range in projections continue, SLR doubles across all existing estimates. This dramatic increase in SLR with WAIS melt suggests a sense of urgency to include ice melt in future projections.

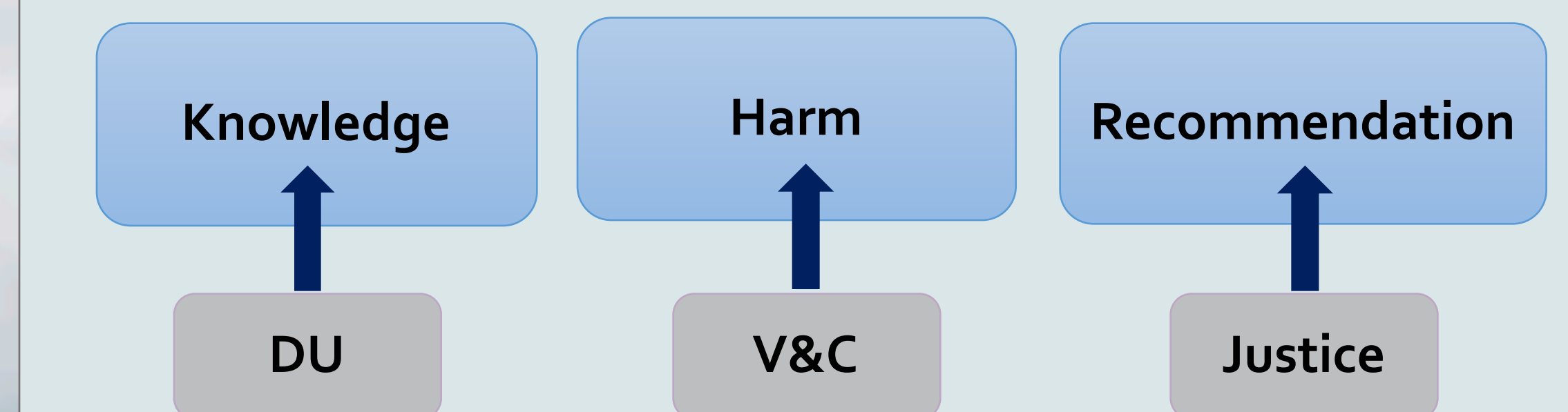
## Implications for Ethics

- By excluding WAIS, SLR projections do not accurately represent future SLR scenarios
- WAIS contribution is potentially devastating for global sea-levels

## The Precautionary Principle

Why act with precaution?

- Precautionary action is justified if the following conditions are met...



Accounting for deep uncertainty and justice in future climate change policy development.



floodlist.com

## Conclusions

1. Sea-levels will rise dramatically with WAIS (harm cond. & knowledge cond.)
2. Discrepancy between contributing countries and vulnerable countries (justice concern)
3. Taking points 1 and 2 into consideration, further motivate and justify preemptive precautionary action to mitigate and adapt to climate change

## Future Work

- Economic benefits of precautionary action
- Include WAIS analysis in future Assessment Report SLR projections

## Acknowledgements

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## References:

- Steel, Daniel. *Philosophy and the Precautionary Principle: Science, Evidence, and Environmental Policy*. 2014.
- DeConato and Pollard. "Contribution of Antarctica to past and future sea-level rise." *Nature*. 2016.
- Bakker et al., (unpub.) "Sources and implications of deep uncertainties surrounding sea-level projections."