From Climate Scenarios to Economics: Identifying Key Uncertainties and Risks in the Case of Urban Flooding

Kirsten Halsnæs and Per S. Kaspersen
Ed Hawkins and Rowan Sutton The potential to narrow uncertainty in projections of regional precipitation change
Climate Dynamics, 2011
Key Questions

- How important is climate model uncertainty in relation to decision making on risks from urban flooding
- How can economic assumptions be integrated in the uncertainty analysis
- Approach:
  - Urban flooding risks are considered for alternative High End climate change scenarios including 2 degrees, 4 degrees, and 6 degrees
  - Risks are defined as probability of climate events * consequences
  - Sensitivity analysis for climate scenarios and economic assumptions to decompose cascade of uncertainties
Fractional probability of economic assumptions
Alternative Climate Variable Distributions

![Graph showing probability distributions of climate variables](Image)

- Fat tail
- Damage Cost

Probability (%) vs. Climate variable
How will the Pdf change over time?

Figure 5a on North Europe from *Collins et al, Nature Climate Change (2012)*
Annual Frequency of Flooding Events

- No CC
- RCP 4.5
- RCP 8.5
- 6 degree
Figure 1: Location of key irreplaceable assets within city centre of Odense and flooded area during high-intensity rainfall event with a maximum intensity of 40mm/hr
Damage Cost Categories
Flooding Damage Curves

Fig. 5. Estimated total damage costs due to high-intensity precipitation events in Odense, Denmark, using the damage curve (DC) and event-driven (ED) approach.
Discounting

![Graph showing the levelized costs of flood damage over a 100 yr period under a 6°C scenario and discount rates of 1 and 3% under the damage curve (DC) and event-driven (ED) approach.](image)

Fig. 8. Levelized costs of flood damage over a 100 yr period under a 6°C scenario and discount rates of 1 and 3% under the damage curve (DC) and event-driven (ED) approach.
Net Present Value of All Combinations

Event intensity (mm/hr) vs. Millions/year for different degrees of change:
- 0 Degree: No Change
- 2 Degree
- 4 Degree
- 6 Degree

The graph shows the net present value for various event intensities (mm/hr) across different degrees of change.
Fractional probability of economic assumptions
Uncertainty and Risk Preferences
Conclusions

– Economic assumptions are a large share of uncertainties in relation to urban flooding from extreme precipitation
– Climate scenario uncertainty becomes less important over time when economic assumptions are taken into consideration
– Some economic assumptions like risk aversion have a very high fraction of uncertainties in relation to decision making. Same magnitude as model uncertainty
– Integrated climate and economic analysis raise new uncertainty issues
Key drivers and economic consequences of high-end climate scenarios: uncertainties and risks

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