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Enabling Delta Life

Trends in extreme weather impacts: attribution relevant to the Loss & Damage Mechanism

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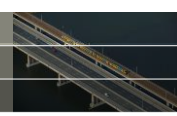
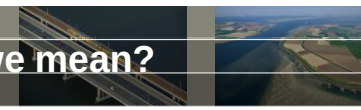
Introduction



- Uncertainty in damage and loss estimates
- Analysis of historic losses: attribution
- Projections
- Role of vulnerability

Loss and damage: what do we mean?



Loss and Damage definition (James et al. 2015 *NCC*):

- Residual damages (after adaptation)
- Actual and potential (risk)
- Current impacts and future projections
- Human induced climate change
- Uncertainties in attribution larger for extremes than impacts from slow onset processes
- Vulnerability to which types of extremes? And relation to anthropogenic climate change

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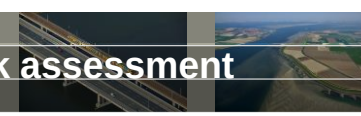
Domain of natural hazard risk assessment



- Focus on extreme (rare, high impact) events
- Loss and damage may also cover slow onset processes that lead to losses and damages

- Traditionally dominated by engineering and economic sciences
- Strong role for statistics and probability theory

- Damage: to physical assets
- Loss: defined as loss of assets, or human lives
- Economic loss: monetised loss (often emphasis on physical assets)

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Disaster loss databases

Global databases of economic losses from natural hazards are:

- Fragmented:
  - Developing countries severely underrepresented (insurance)
- Incomplete:
  - Not all hazards included - droughts typically underrepresented
- Biased:
  - More recent events better covered than events before ~1980
- Uncertain:
  - There is no common reporting convention on which losses should be included (private, public, direct or indirect)

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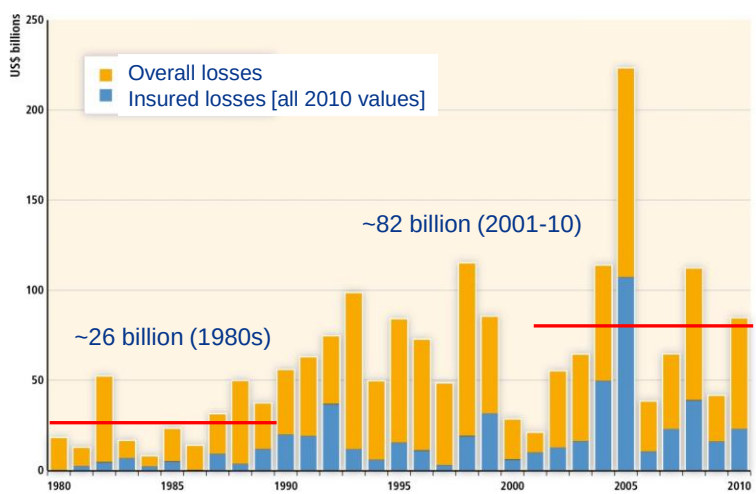
IPCC SREX: Large weather-related catastrophes



Source: Munich Re GeoRisks Research, August 2011

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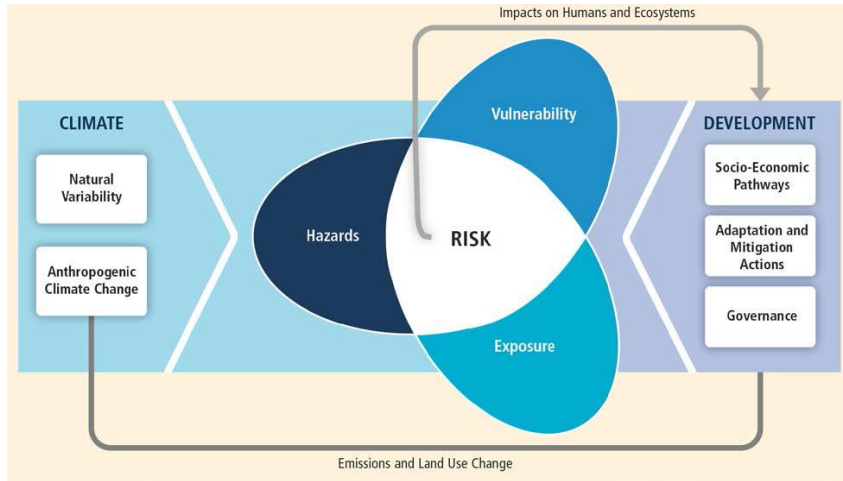
Risk = *f*(hazard, exposure, vulnerability)



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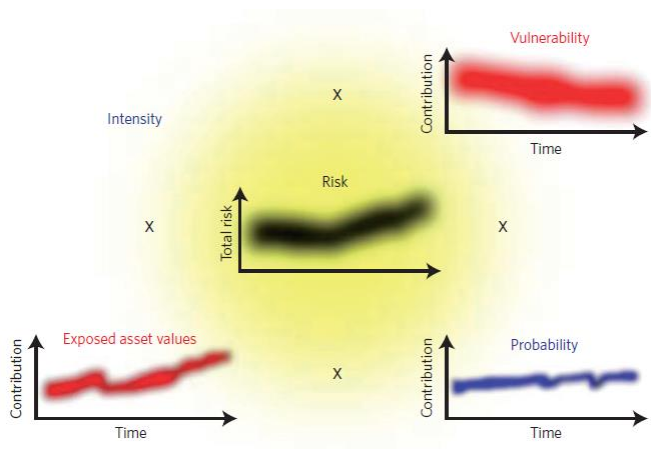
Risk: changing hazard, exposure, vulnerability



Huggel et al. 2013 *NCC*

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No upward trend after normalising for exposure

Number of studies	No loss trend	Loss increase	Loss increase due to human induced climate change
Wildfire	1	0	0
Storm	6	2	?
River floods	3	2	?
Tornado, thunderstorm, hail	2	2	?
Various weather	3	0	0
Total	15	6	?

(from Bouwer 2011 *BAMS*)

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Conclusions from IPCC

IPCC **SREX** (2012)*:*

"Increasing exposure of people and economic assets has been the major cause of long-term increases in economic losses from weather- and climate-related disasters (high confidence)."

Long-term trends in disaster losses adjusted for wealth and population increases have not been attributed to climate change (…)"

IPCC **AR5 WG2** Chapter 18 (2014):

"(E)xtreme events have caused increasing impacts and economic losses, but there is only low confidence in attribution to climate change for these"

New research:

- Evidence for reductions in vulnerability for flood (Mechler & Bouwer 2015)
- Sub-proportional behaviour of exposure for cyclones (Estrada et al. 2015; Geiger et al. EGU 2016*)*

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Projections of future risks

Wide variety of studies, very few that take a risk analysis approach

Reviews (Bouwer 2013 *RA*; IPCC AR5 WG2 Chapter 10)

Projected trend is upward, due to anthropogenic climate change

Many different hazards, including:

- Tropical cyclones
- Extra-tropical cyclones
- River/pluvial flooding
- Hailstorm

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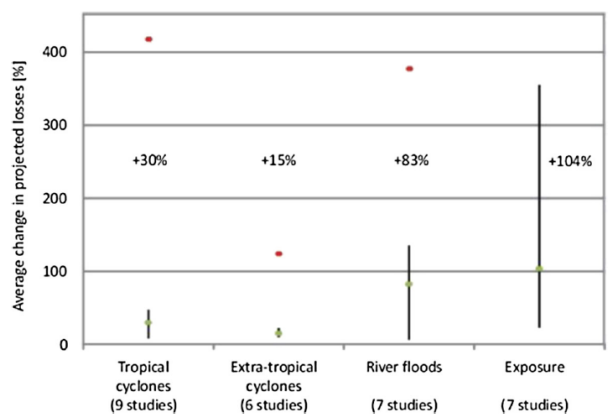
Role of projected exposure

Future events:

- Exposure is expected to be relatively large (Bouwer 2013 *RA*)



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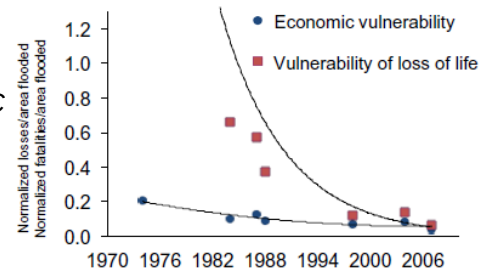
Role of historic vulnerability

Historic events (Bangladesh):

- Mechler & Bouwer 2015 *CC*



- IAHS Panta Rhei WG: comparison of impacts from historic flood events: role of drivers including hazard, exposure and vulnerability

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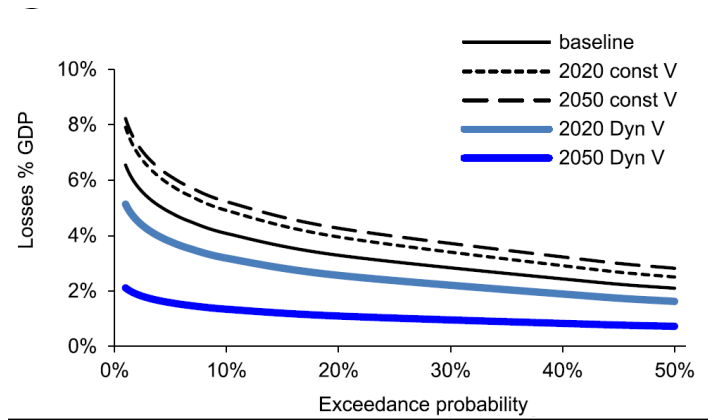
Role of projected vulnerability

- Vulnerability decline will downscale future risks (Mechler & Bouwer 2015 *CC*):



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Some conclusions

- Using impact models it is possible to asses (economic) impacts from (changes in) extreme weather events, including risk potentials
- Very little/no evidence for increasing economic losses from extreme weather due to anthropogenic climate change
- This is the case for many hazard types, including river floods, and tropical and extra-tropical cyclones
- Role of vulnerability changes still poorly understood
- Expected changes in exposure and vulnerability are very large, but still difficult to project
- Scope of Loss & Damage will need to consider the non-climatic dimension of future climate risks