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Enabling Delta Life

HSGR 02: Future flood risk in the Rhine basin

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KvK projectendag
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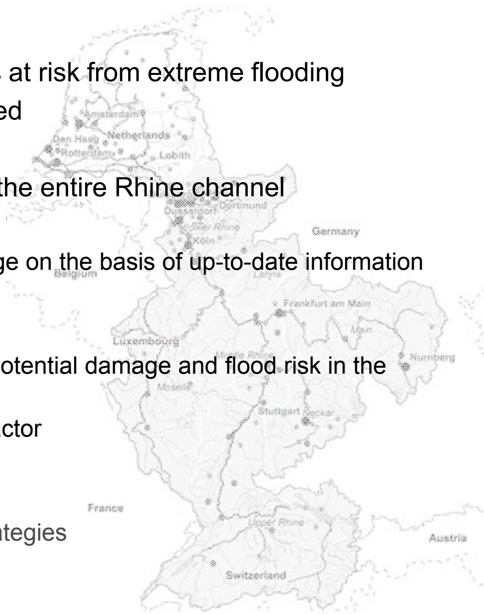
Problem and research goals

- ~10 Million people live in areas at risk from extreme flooding
- Increase in flood risk is expected

- Develop a flood risk model for the entire Rhine channel
  - Estimate potential flood damage on the basis of up-to-date information
  - Evaluate current flood risk
    - > Probability x damage
  - Estimate the development of potential damage and flood risk in the future
    - > What is the main driving factor

  - Assess various adaptation strategies



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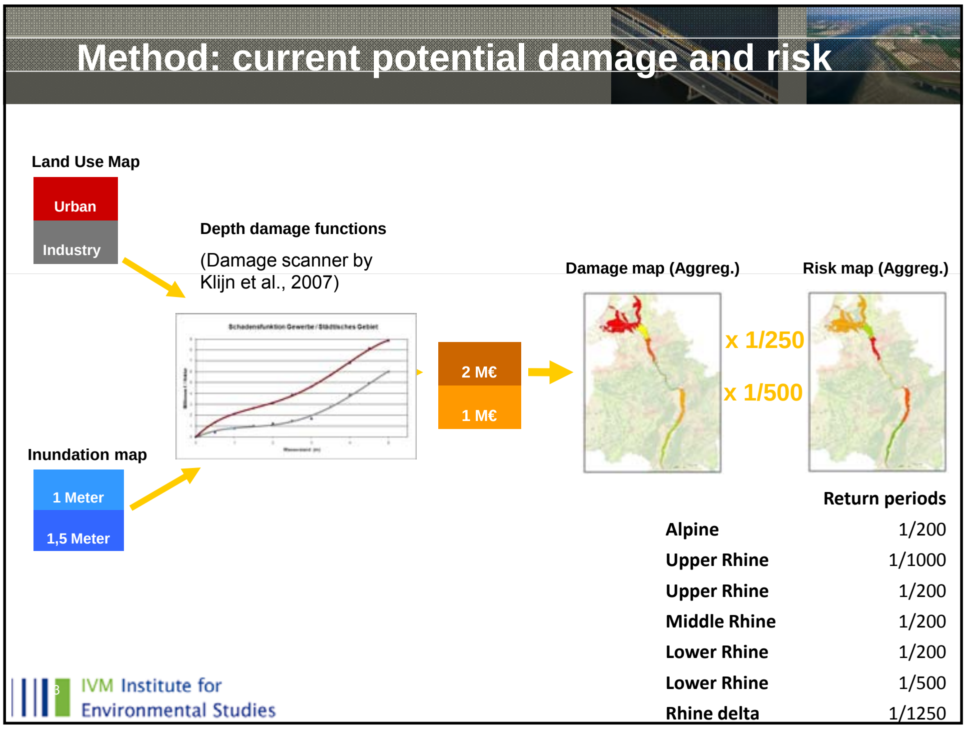
Method: current potential damage and risk
Land Use Map
Urban
Industry
Depth damage functions
(Damage scanner by Klijn et al., 2007)
Damage map (Aggreg.)
Risk map (Aggreg.)
2 M€
1 M€
x 1/250
x 1/500
Inundation map
1 Meter
1,5 Meter
Return periods
Alpine 1/200
Upper Rhine 1/1000
Upper Rhine 1/200
Middle Rhine 1/200
Lower Rhine 1/200
Lower Rhine 1/500
Rhine delta 1/1250
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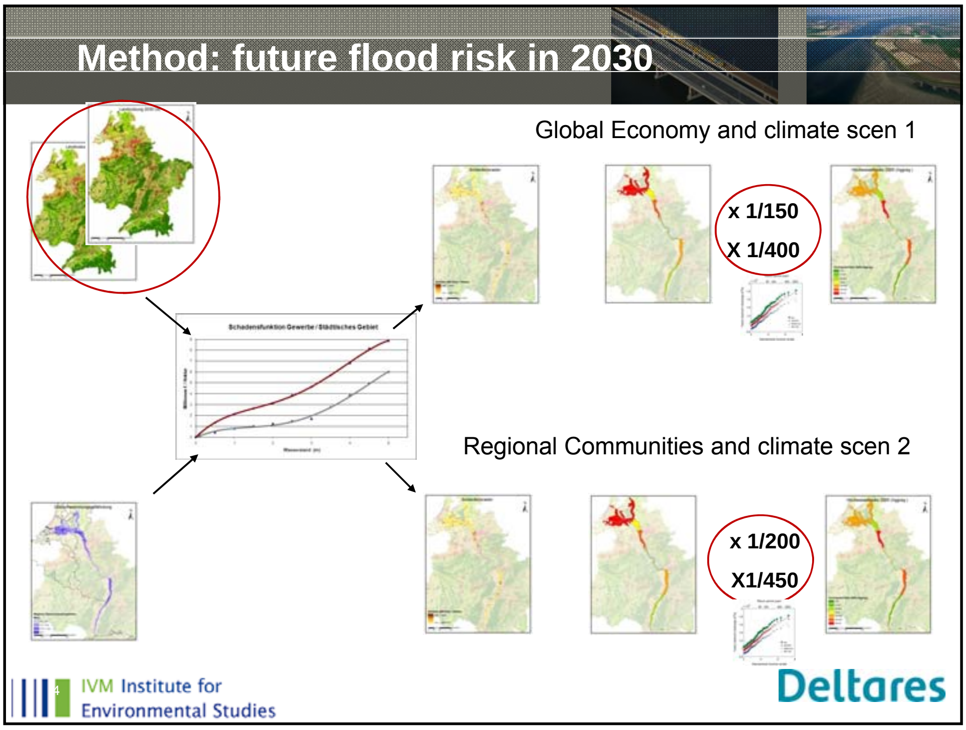
Method: future flood risk in 2030
Global Economy and climate scen 1
x 1/150
X 1/400
Regional Communities and climate scen 2
x 1/200
X1/450
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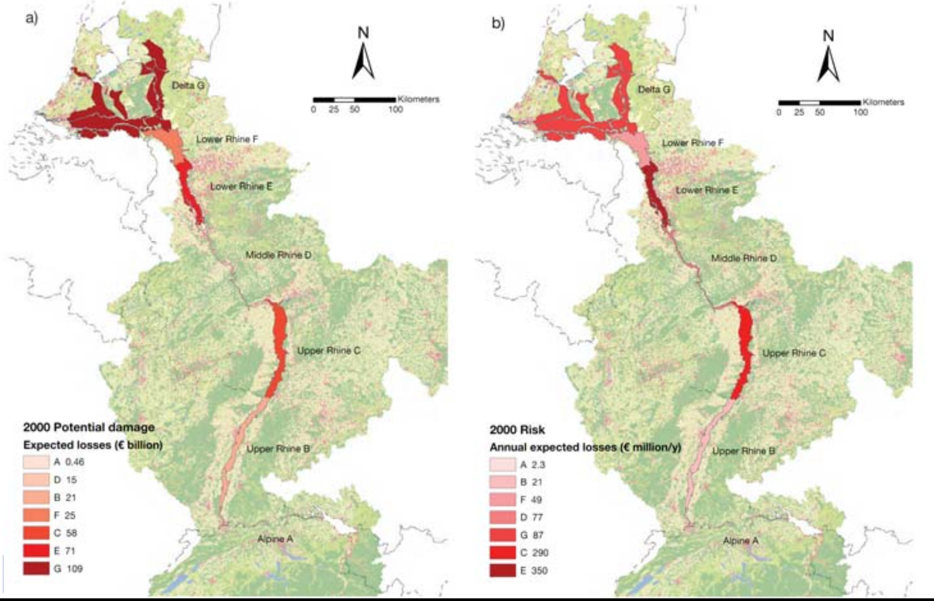
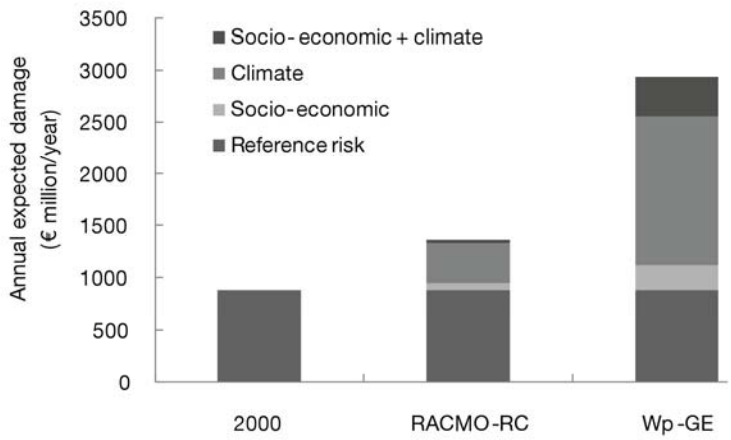
Results: aggregated



Results



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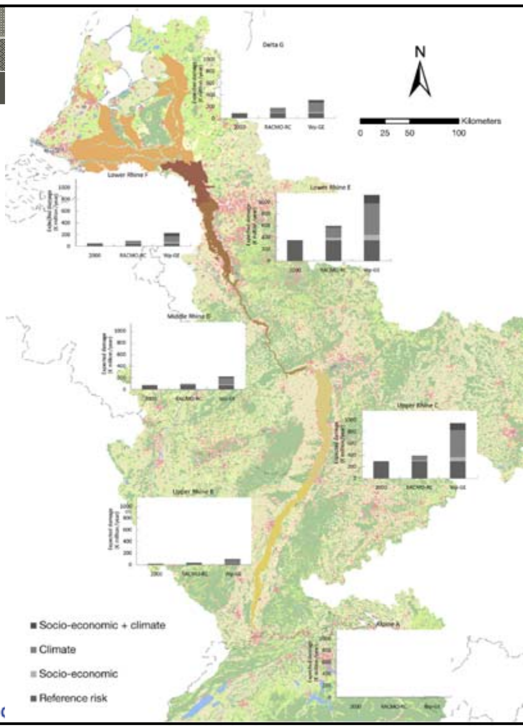
Results



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Conclusions and recommendations

- Highest potential damage NL: 109 BEuro
  Highest flood risk in Nordrhein Westfalen: 350 MEuro / yr
- 2000 – 2030: 54 – 230 % increase in basin-wide flood risk
  - ~ three quarters climate change
  - no projections for increased capital value included
- Probability of extremes is very uncertain, impact of climate change even more
  → damage reduction seems robust adaptation measure
- Method needs improvement:
  - Inundation simulation
  - Damage estimates
  - Estimates of safety levels

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Method: socio-economic scenarios

Global Economy

- Strong population and economic growth
- International economic integration
- Strong role of the individual
- Private interests

Regional Communities

- Low economic and population growth
- National / regional focus
- Strong role of governments
- Environmental regulations

"claims GE - EURURALIS"

EURURALIS

"claims RC - EURURALIS"

„Land Use Scanner"

Suitability Maps
- Flood zones
- Nature areas
- Retention areas
- Distance Maps
  - DEM

(Rietveld & Hilferink, 1999; Loonen and Koomen, 2008)

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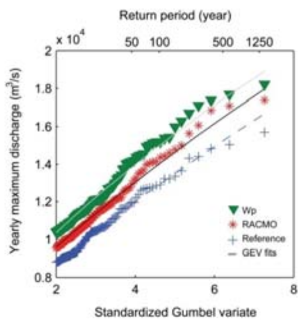
Method: climate change scenarios

- Taken from Te Linde et al., 2010
- Long time series (weather generator)
- 'Low' scenario and 'high' scenario

Assumption: no dike raise



For every section:

p Ref	*p* Scen1	*p* Scen2
0.050	0.062	0.0129
1/200	1/160	1/77

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Method: flooding probabilities

- Safety levels:
- - Dutch delta: design standard
- - Other sections: based on a report by ICPR and expert judgement (interviews)

	Return periods
Alpine	1/200
Upper Rhine	1/1000
Upper Rhine	1/200
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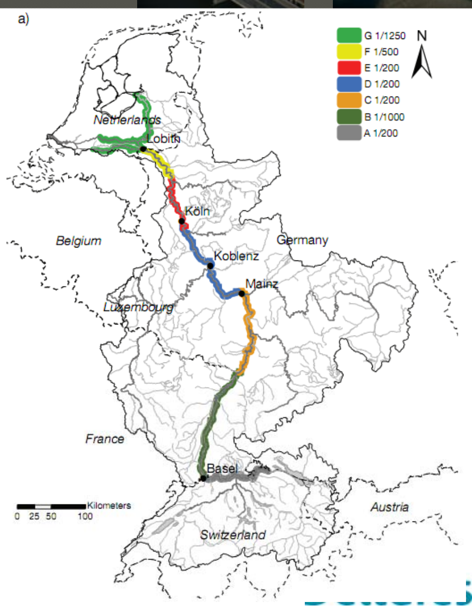

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