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Flood risk and global change:
Increasing losses, increasing uncertainty and implications for risk management

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Flood risk and global change: Increasing losses, increasing uncertainty and implications for risk management

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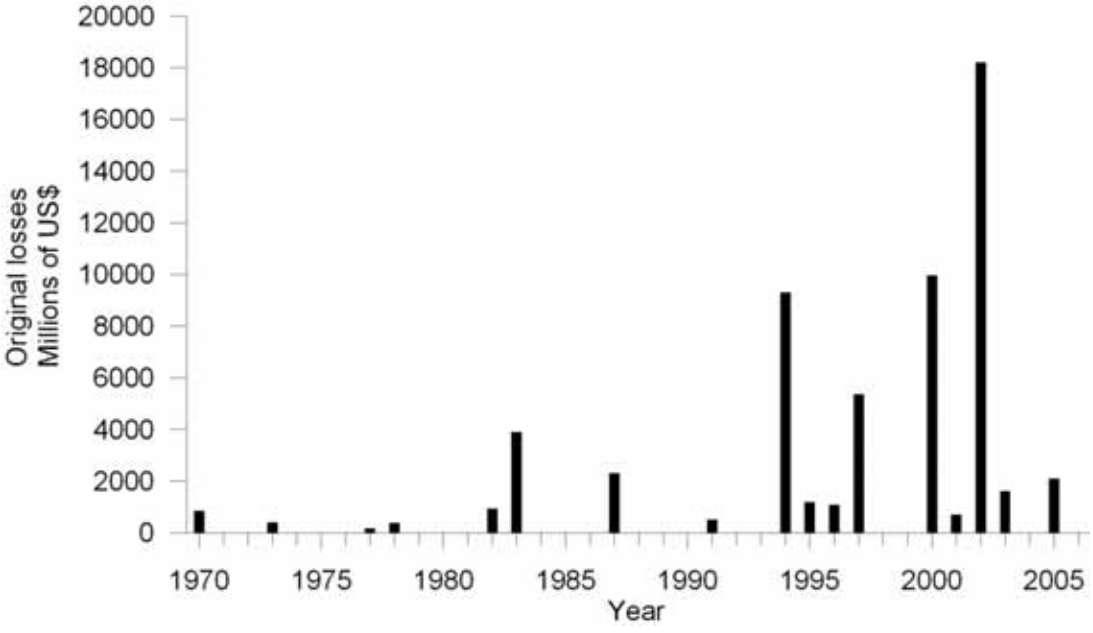
Increasing flood losses: effect of climate change?

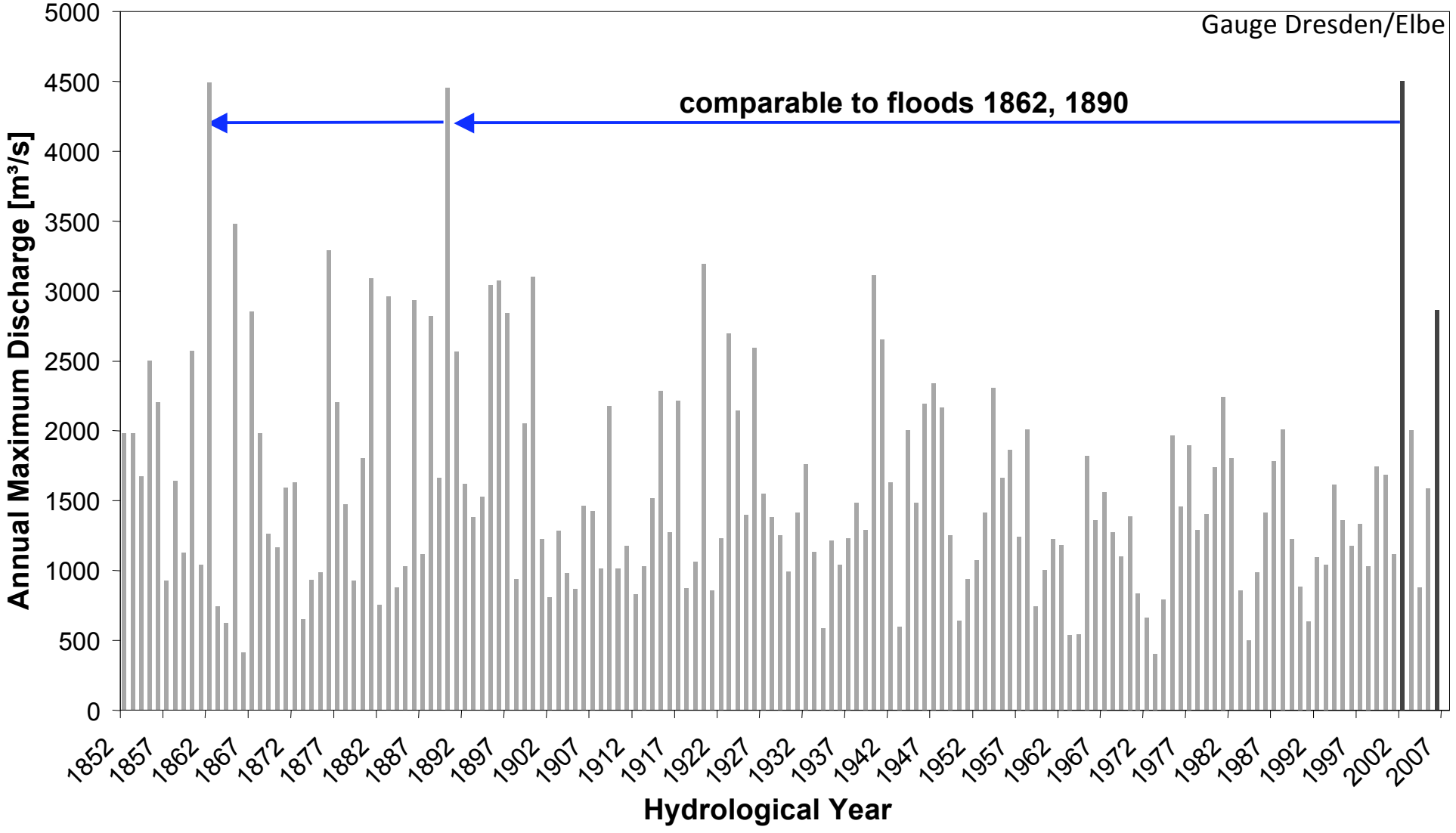


Annual flood losses in Europe from major flood disasters
(Barredo, 2009, NHESS)

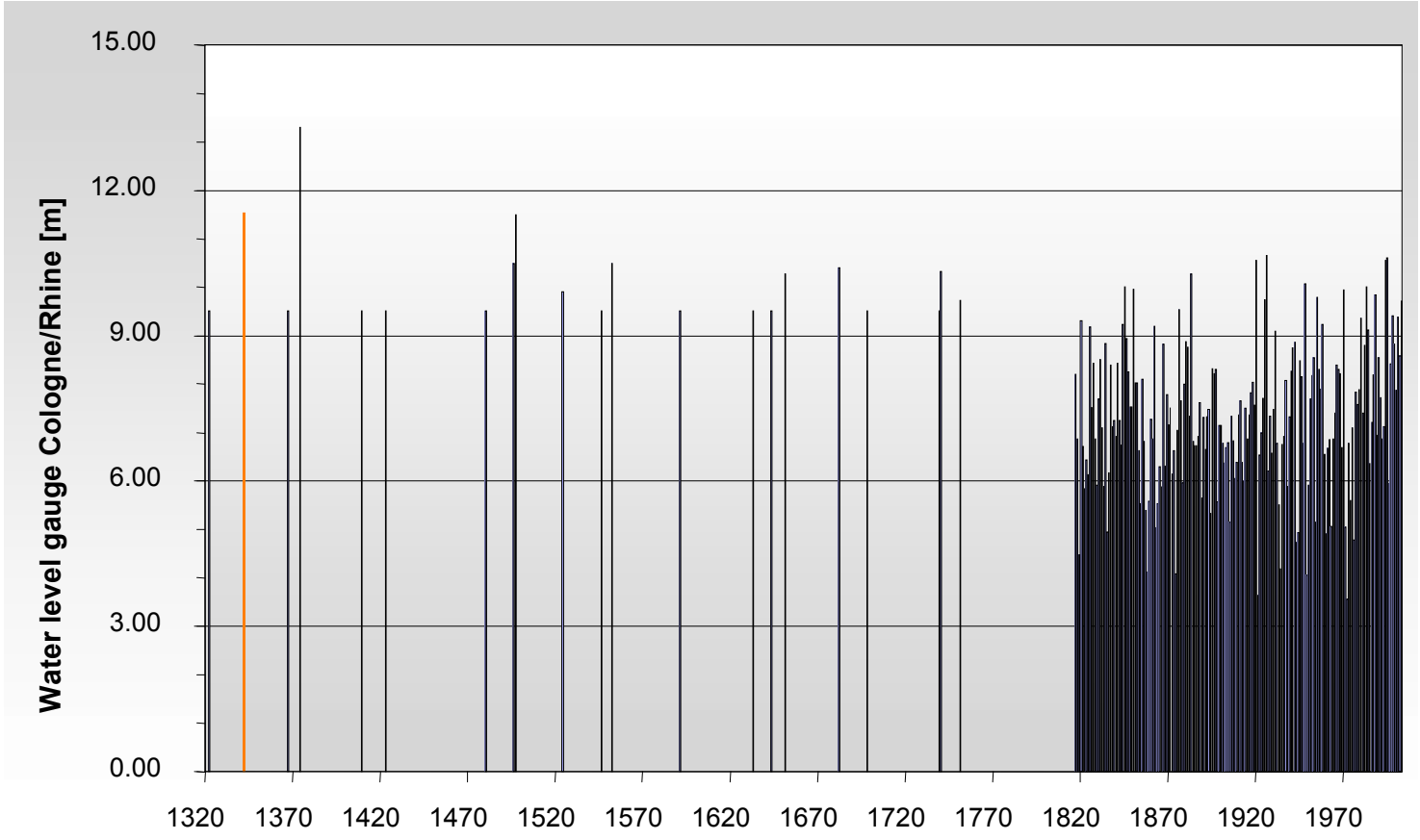
Contents:

- Changes in flood risk
- Consequences for risk management

2002 Elbe flood in historical context



Floods Cologne/Rhine



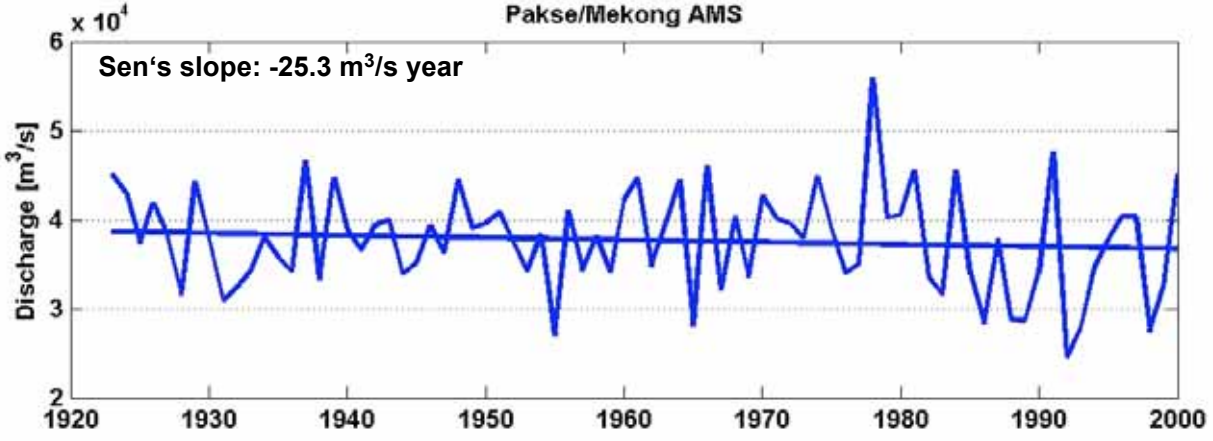
1342: Deluge of Middle Ages

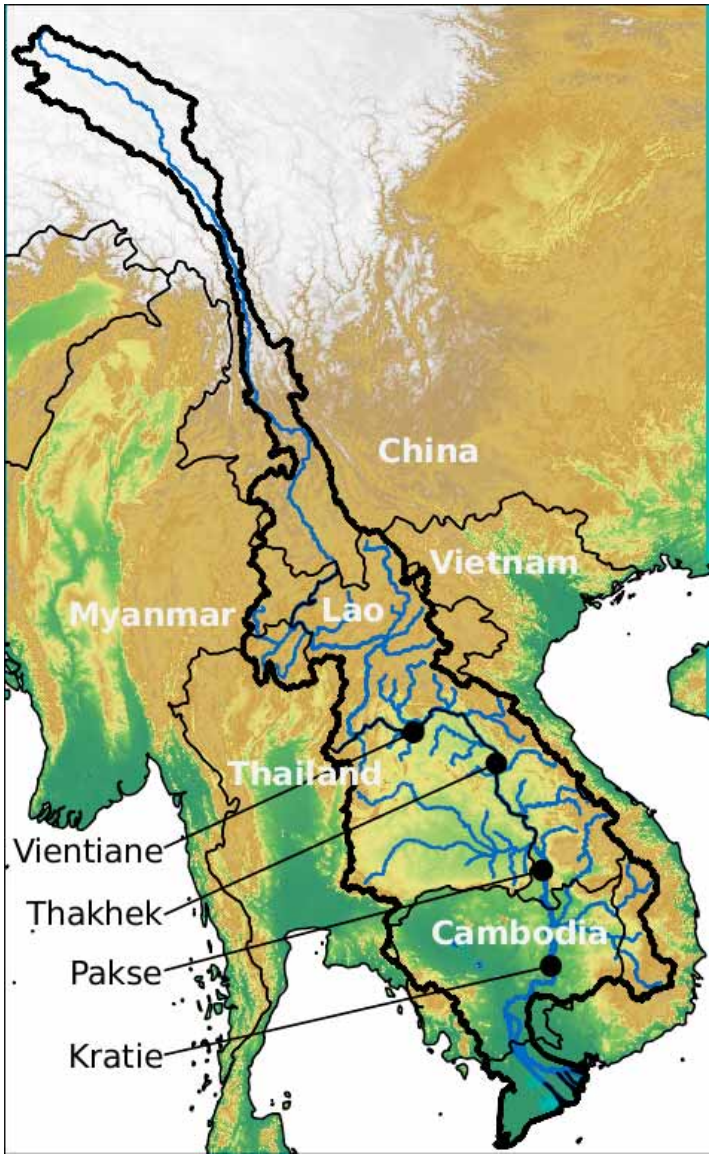
- Destruction in almost all river basins in Germany
- 6000 fatalities in Danube basin
- Erosion gullies of 14 m depth
- Destruction of complete harvest; trigger of multi-year famine

Detecting and attributing flood trends: The Mekong example

(Delgado, Apel & Merz, 2010, HESS)

- **Detection**: demonstrating that observed change is significantly different (in statistical sense) than what can be explained by natural variability
- **Attribution**: establishing the most likely causes for detected change





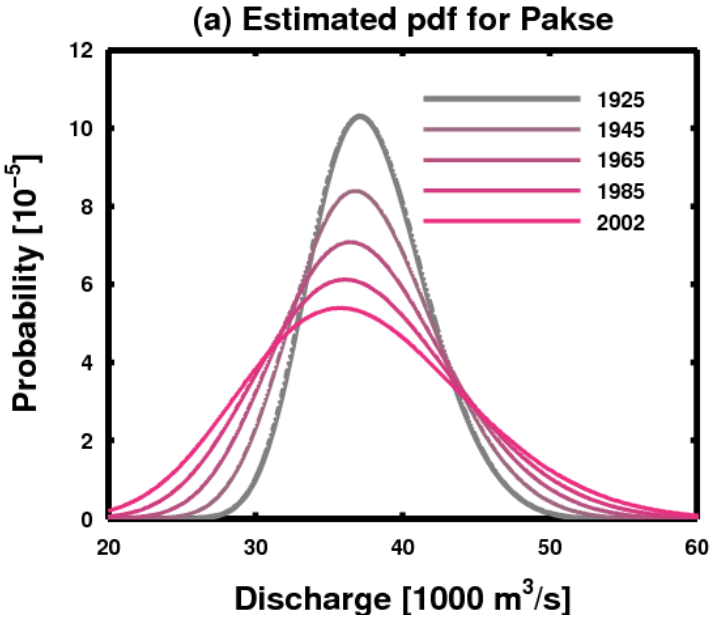
Detecting and attributing flood trends: The Mekong example

(Delgado, Apel & Merz, 2010, HESS)

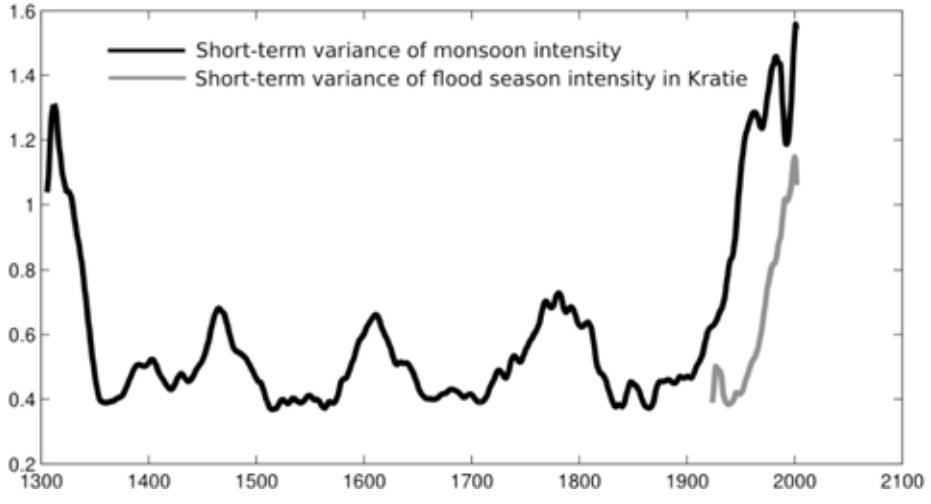
Non-stationary GEV:

- separate trends in parameters of distribution function
- decrease in location parameter, increase in scale parameter

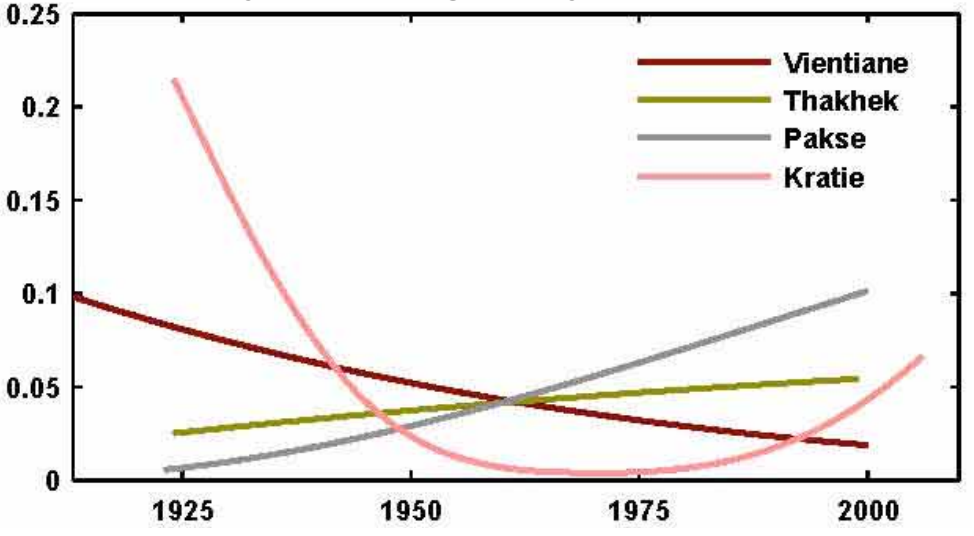
$$f_{GEV}(HQ) = g(HQ, \mu(t), \sigma(t), \xi)$$



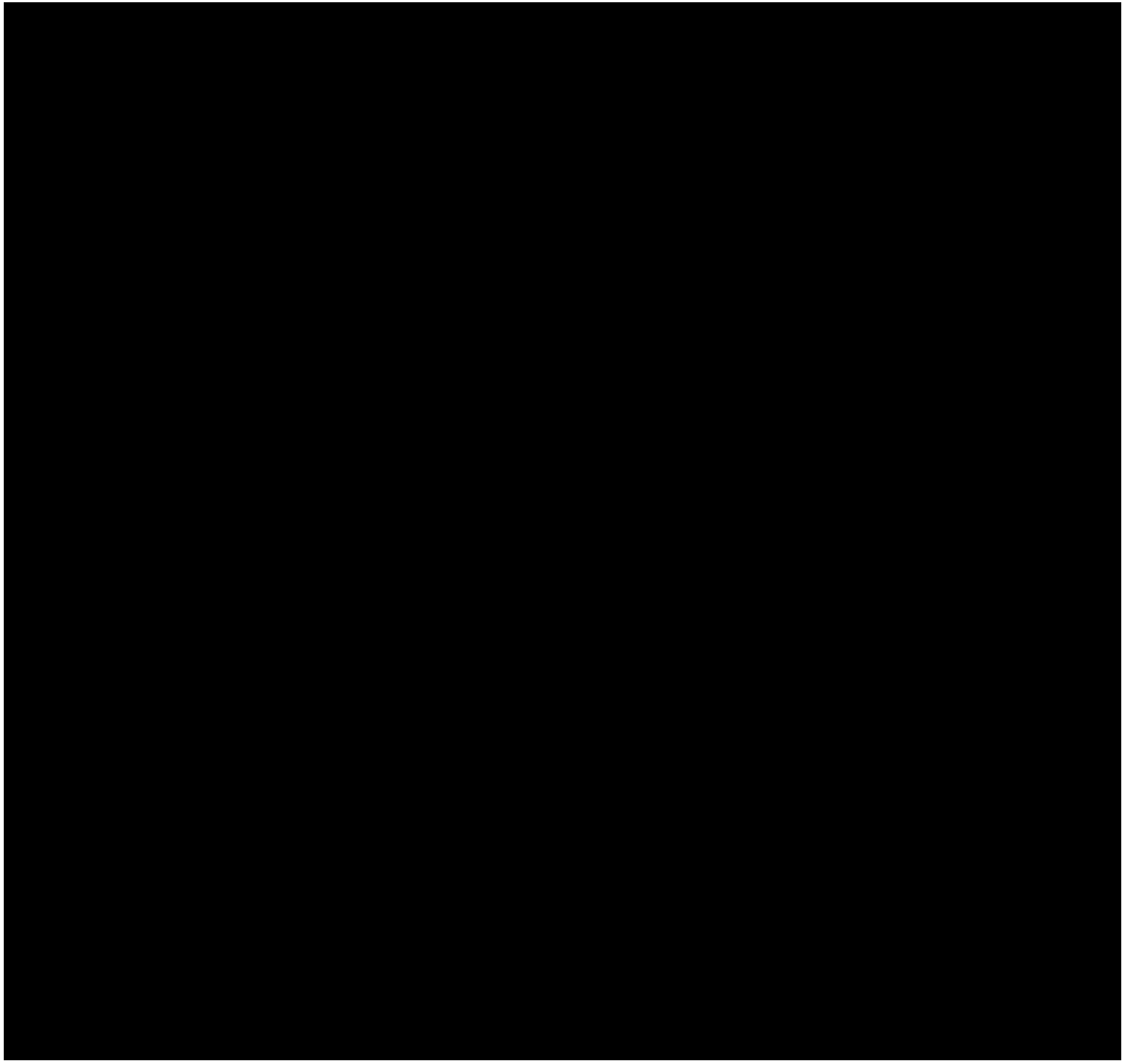
Monsoon intensity vs. flood intensity



Probability for discharge > 20-year flood

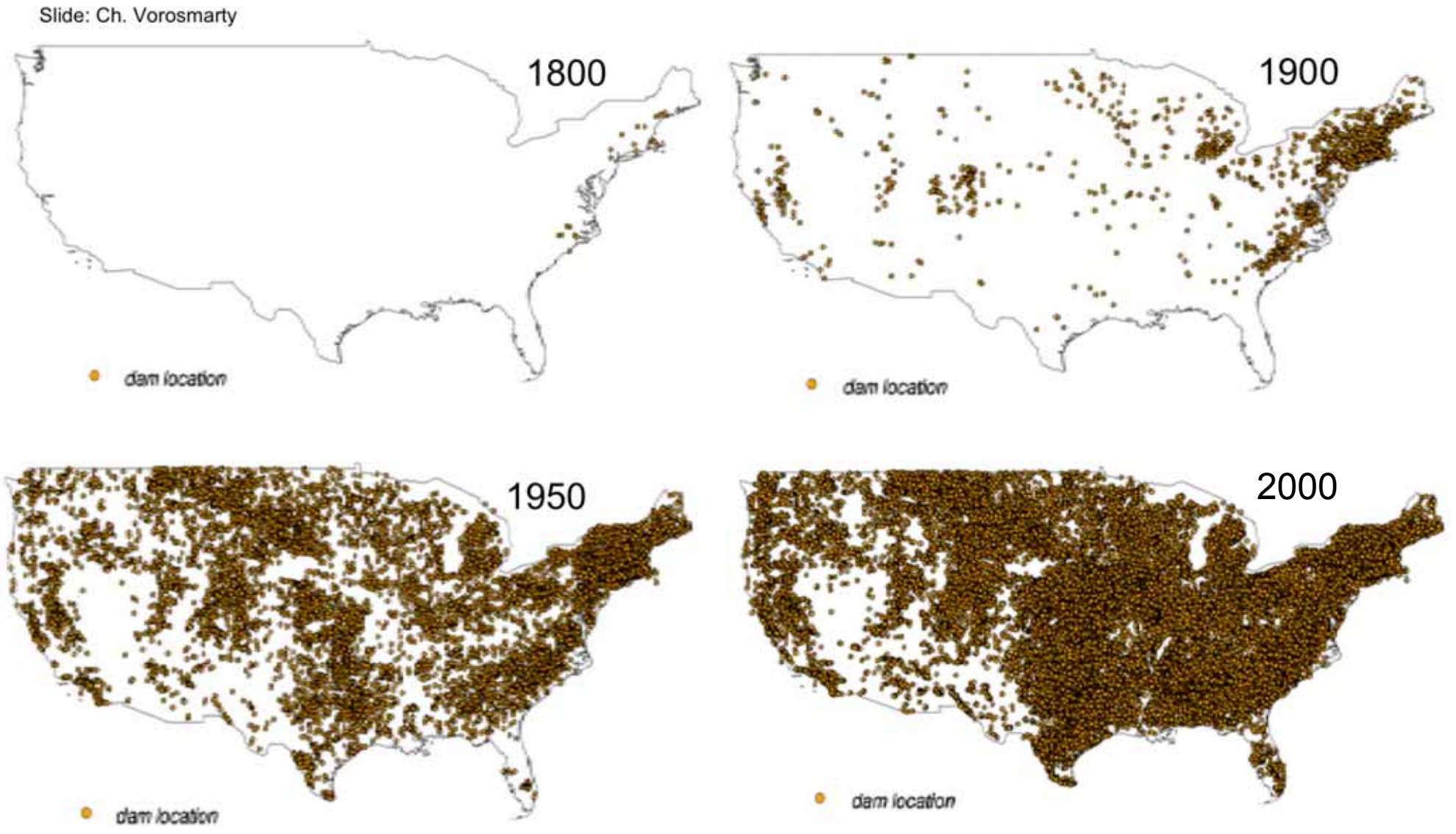


Drivers of change in hazard & risk

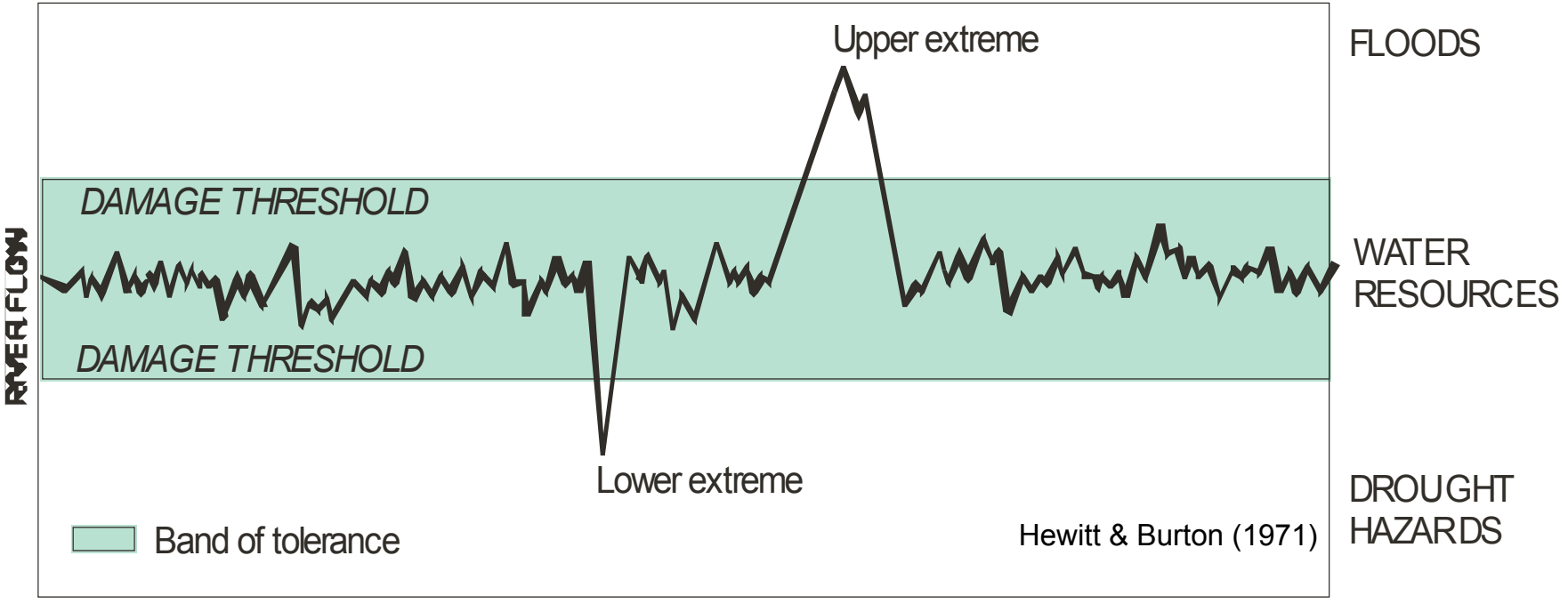


Merz, Hall, Disse & Schumann, 2010, NHESS

Example: Dams in USA



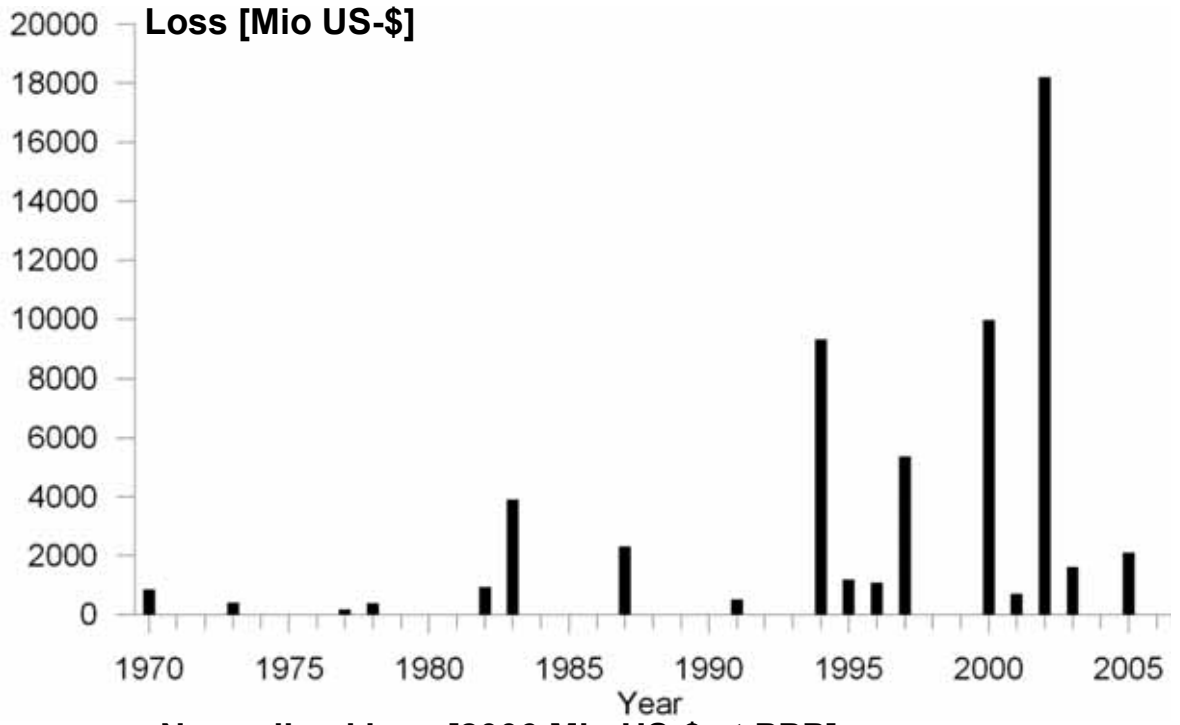
Flood risk: Hazard & vulnerability

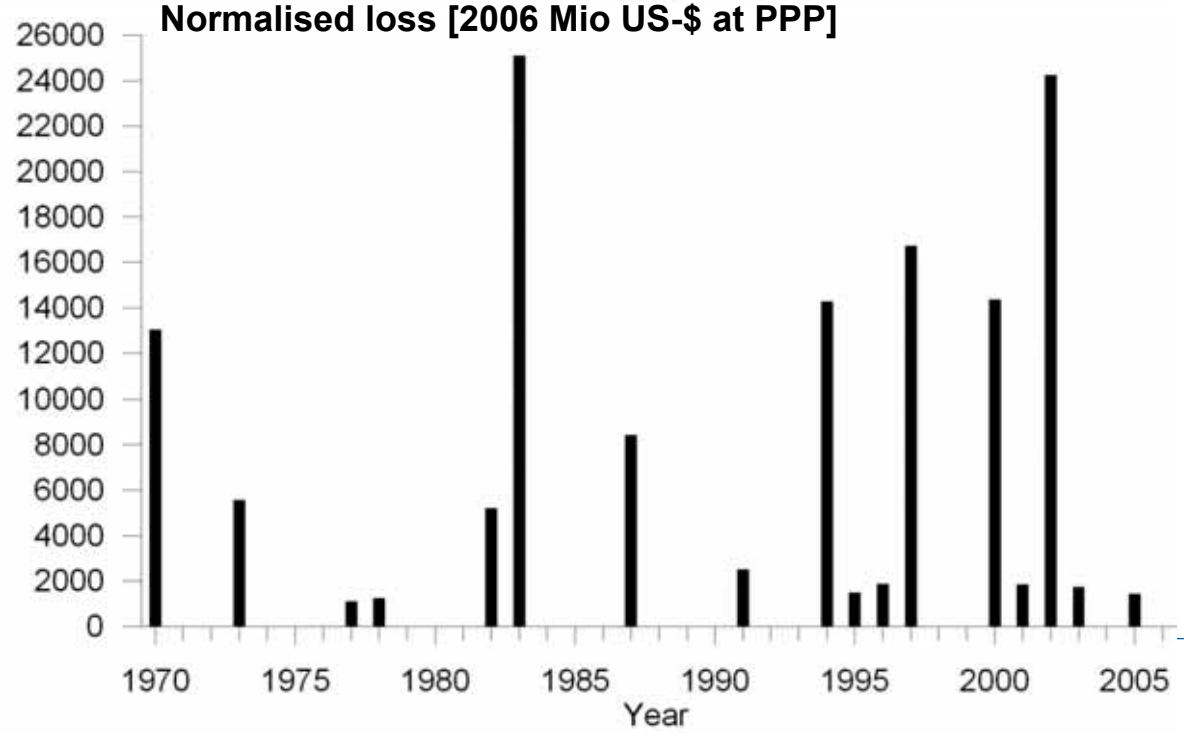


Increasing damage and socio-economic factors

- Loss from large river floods in 31 European countries, 1970-2006
- Normalisation by population, economic growth

(Barredo 2009)





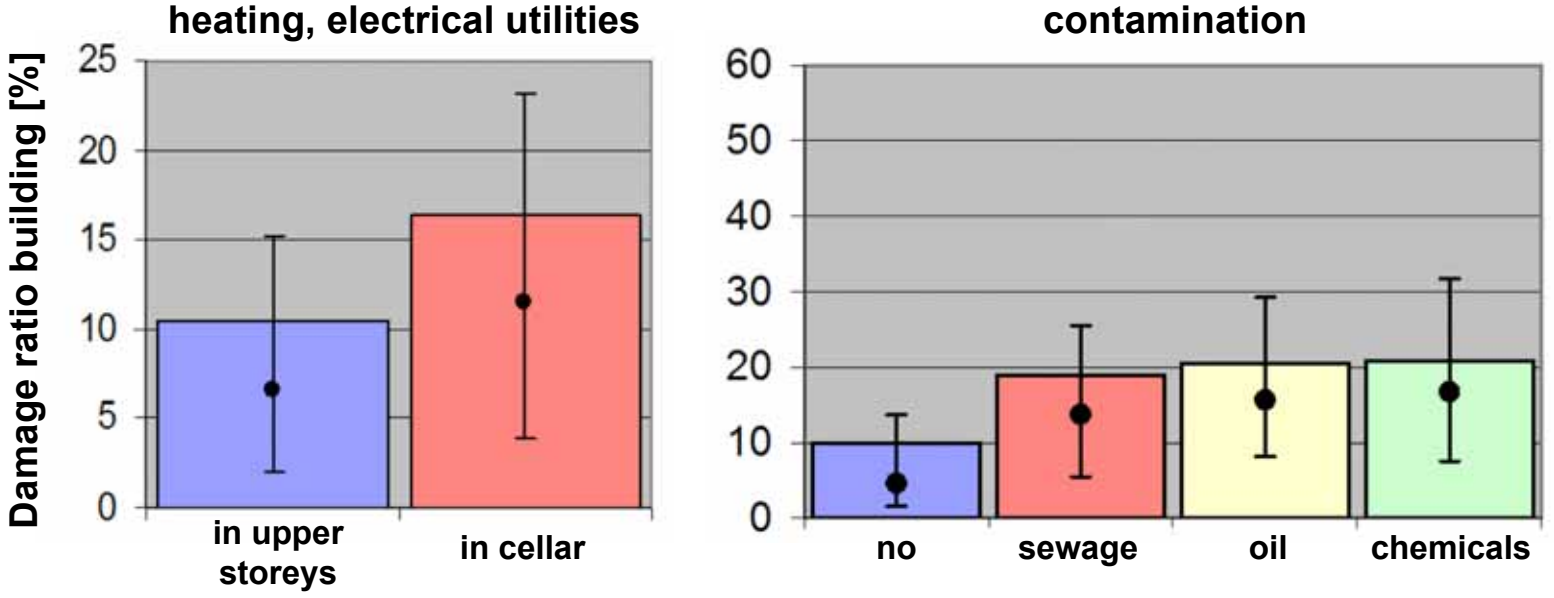
Risk management in view of change, complexity and uncertainty

Guiding principles:

- Consideration of uncertainty, unpredictability
- Adaptive management: monitoring, updating
- Robust / flexible solutions
- Dual-use solutions / diversity of solutions
- Capacity to cope with surprise

Private precaution as robust measure:

Data: 2000 flooded households in Germany (floods 2002, 2005, 2006)



Conclusions

- Flood risk is changing; considerable contribution by changes in vulnerability
- Detection, attribution of changes difficult: climate variability vs. climate change, …
- Climate change and other ‘unpredictable’ dynamic processes increase uncertainty
- New approaches for risk management required