

ERA-NET CRUE Funding Initiative

**Simulation of Flood Risk and non-structural
Risk Management**

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Motivation

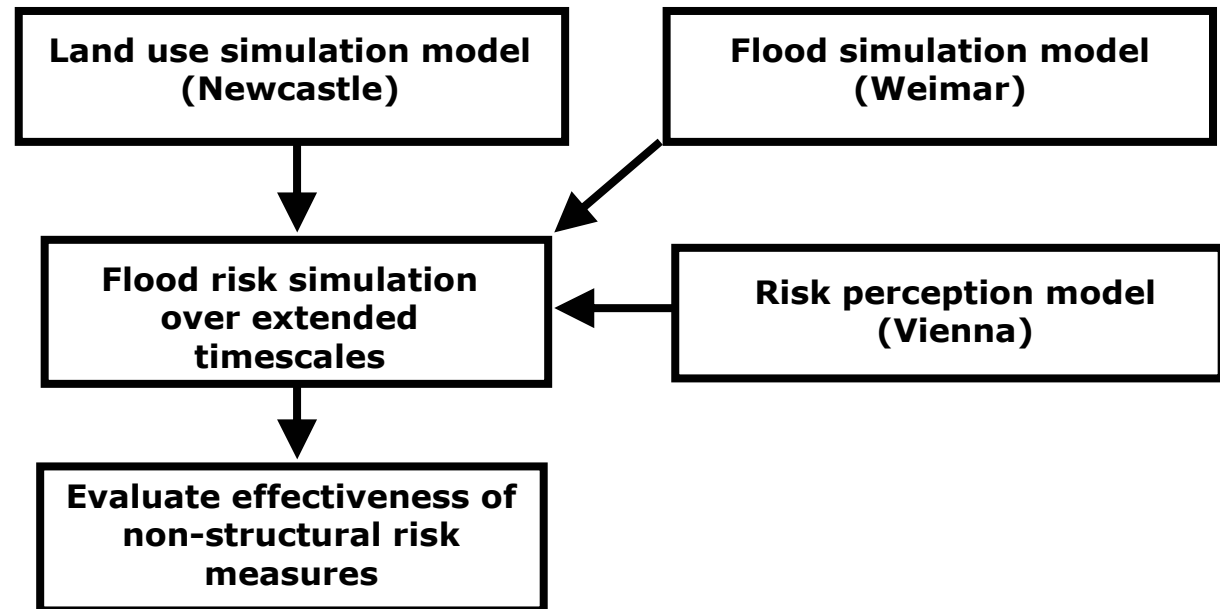
- Effectiveness of existing non-structural measures is difficult to incorporate into a risk analysis.
- Longer term 'risk signals' given through non-structural (and structural) measures such as development policy, insurance premiums etc. and actual flood events influence long-term trends of development in the floodplain.
- Interdisciplinary novel approach is proposed that draws upon inundation modelling, flood risk analysis and land use modelling which enables changes in human behaviour to be dynamically updated during simulations.



Basic concept

- multi-disciplinary as it brings together economic, flood and land use modelling
- new risk analysis methods to explore the effectiveness of non-structural flood risk measures.
- changes in risk over extended timescales due to changes in land use and vulnerability influenced by changes in regulation and market instruments

Overview of risk framework



Risk perception model – Group Vienna

Problem:

- flood (and similarly earthquakes, hurricanes, avalanches etc.) count among low probability, high loss events
- underinsurance is very common
- it has been established that premium is always regarded too high, even if in fact subsidized; widespread reason for not taking out insurance
- furthermore, flood insurance is especially prone to adverse selection
- market failure on part of both, supply and demand

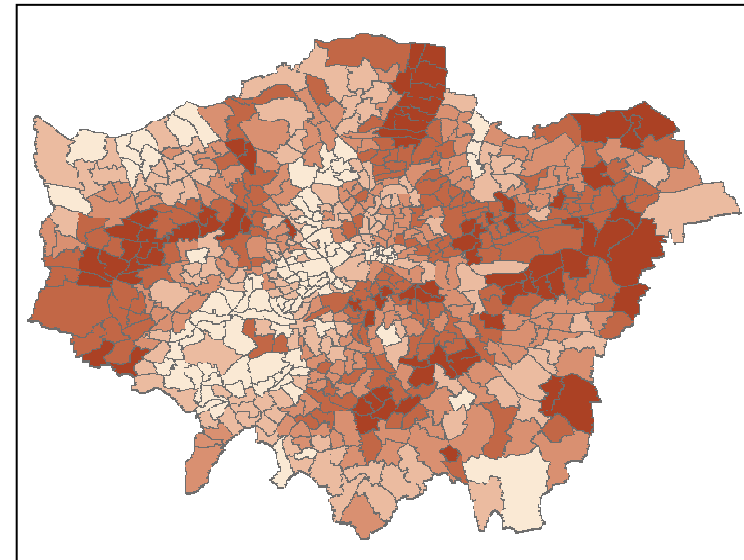
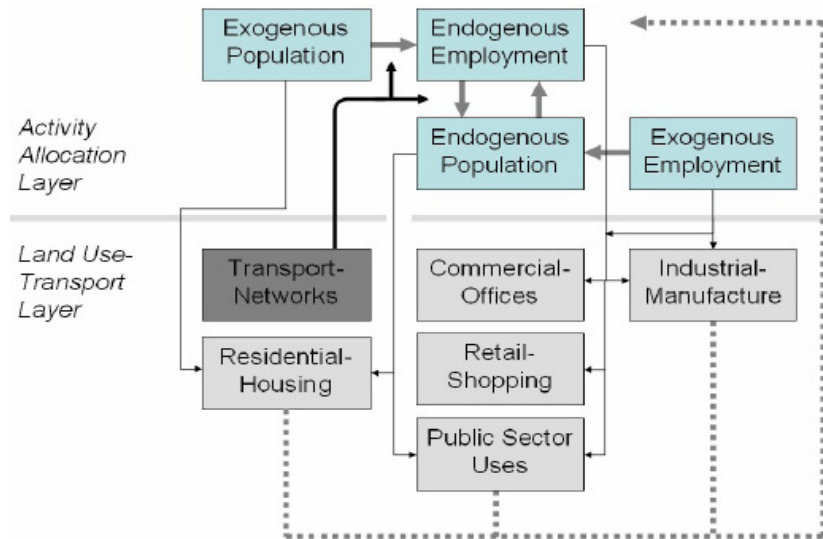
Risk perception model – Group Vienna

Approach:

- Assess insurance cover over time (several flood incidents in recent time); supply and demand side
- Assess factors of risk perception (e.g. recency, proximity)
- LPHL effects have been shown to get overcome (within limits) by risk communication measures; assess the effect of several alternatives
- Assess insurance techniques to counter adverse selection
- Assess insurance techniques to build sustainable portfolios

Current land use model:

- GIS embedded
- Simulates changes in population, property and employment etc.

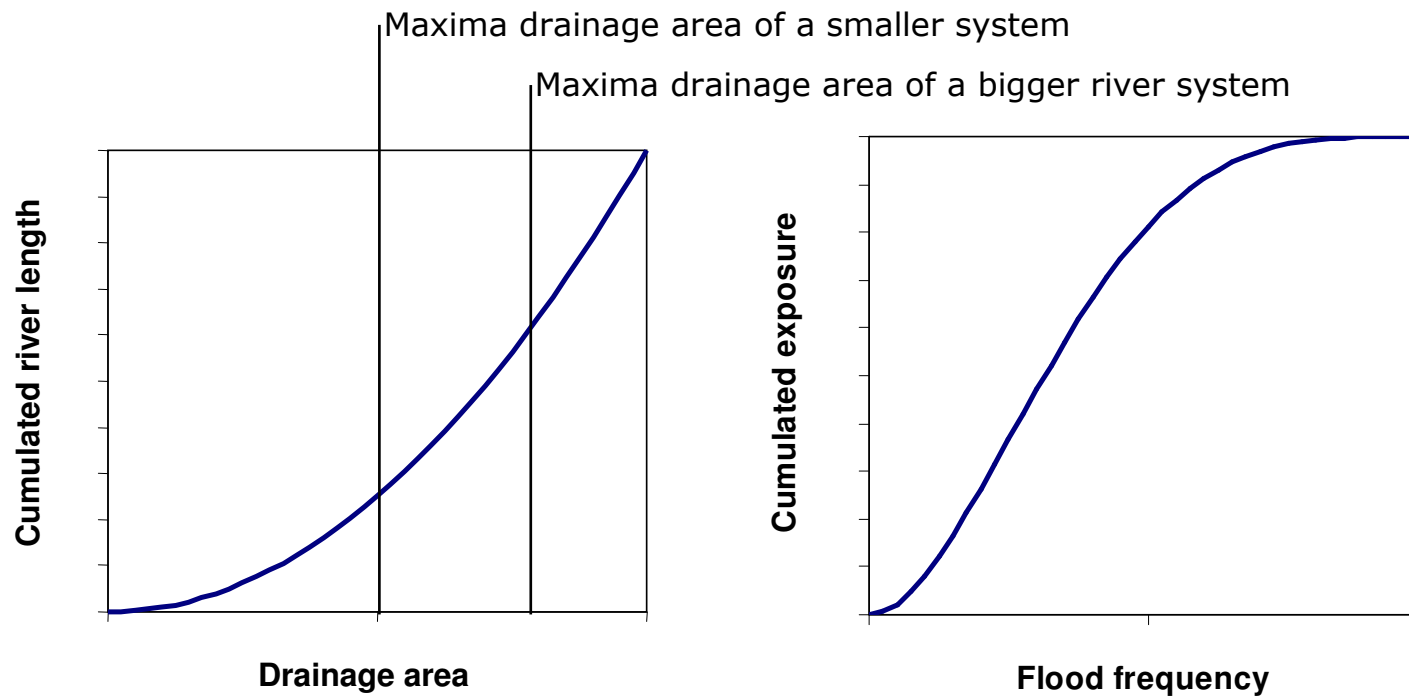


Further development requires adding flood related components:

- *attractors* (river view amenity, poor development control *etc.*)
- *repulsors* (insurance premiums, flood risk planning)

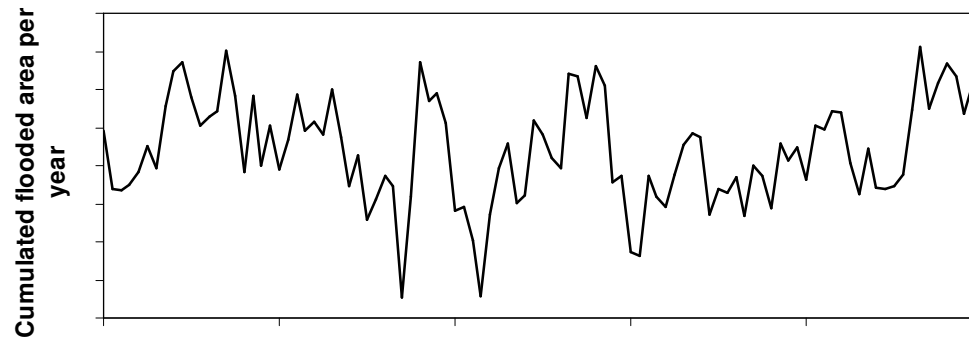
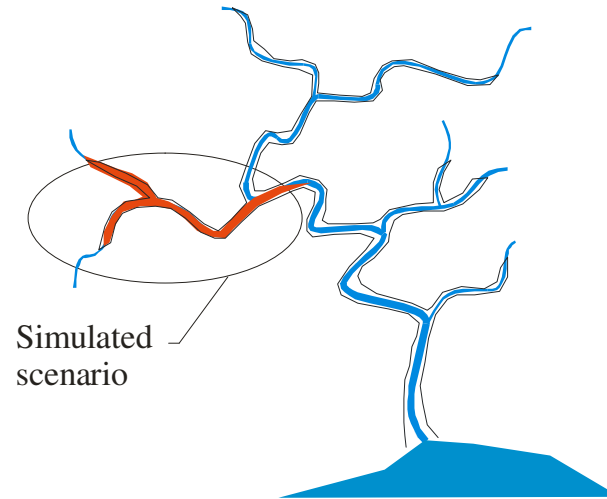
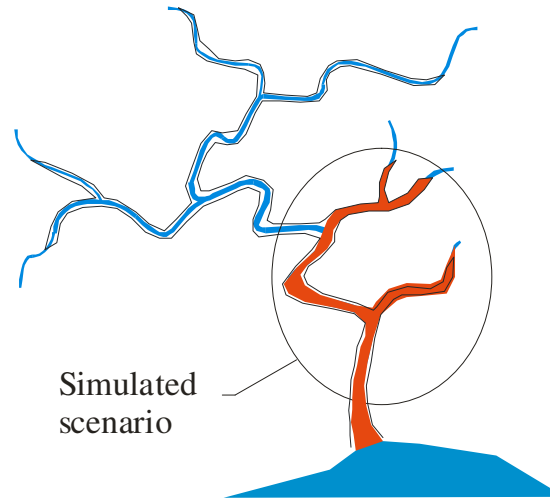
Flood simulation model – Group Weimar

Modelling of an unreal but realistic river system.

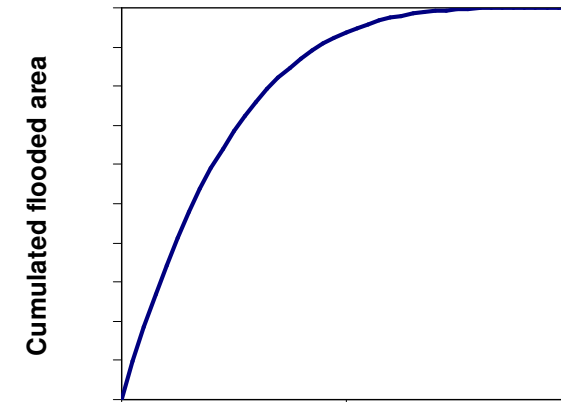


Flood simulation model – Group Weimar

Simulation of a flood history



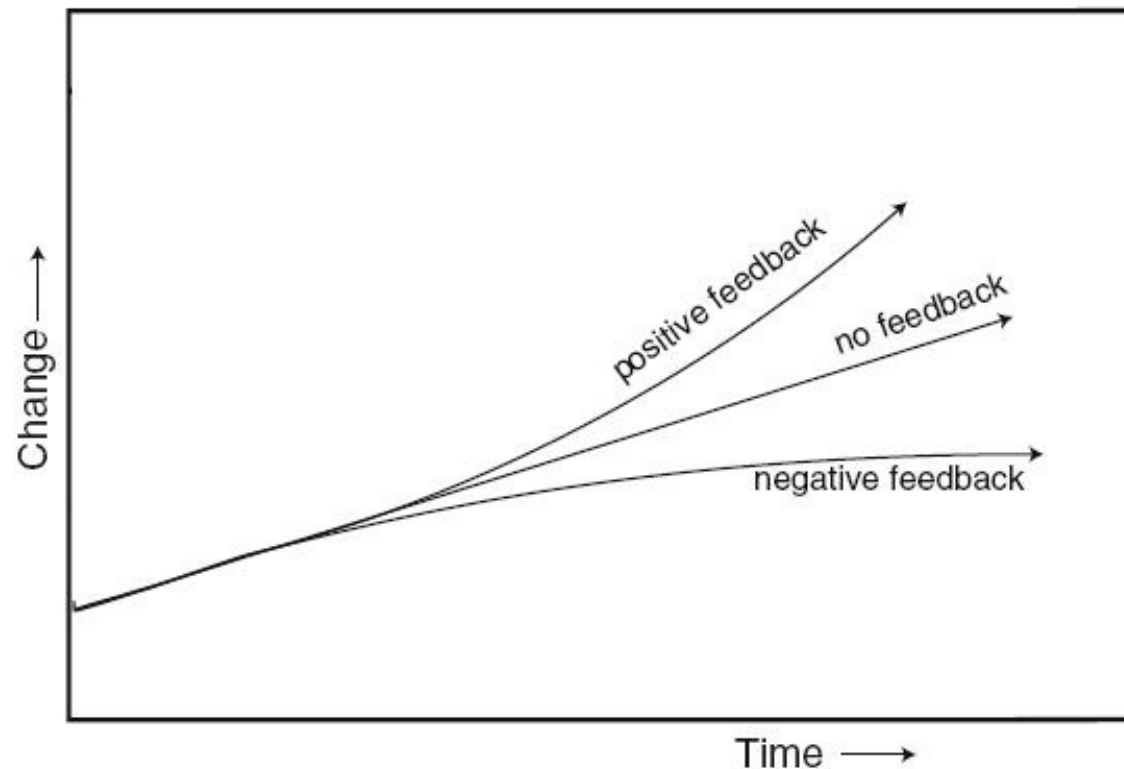
Time [year]



Flood frequency

Flood Risk Analysis

- Typically FRA is based on the assumption of uni-directional processes between drivers and impacts
- However, in reality the impacts of change may affect future land use changes as a consequence of *feedback*



- Well observed phenomenon that structural flood control mechanisms *entice* development in flood, as people perceive that they will be protected

