



Reconciling different flood risk concepts for adaptive flood risk management planning

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KfC research programme: theme 1 (2010-2014)



Adaptation of *flood risk management policy* to climate change at national and regional levels: *innovative measures and instruments*

by a consortium of:

- Deltares
- Delft University of Technology (DUT)
- Wageningen University en Research Centre (WUR)
- Institute for Environmental Studies, Free University, Amsterdam
- HKV [lijn in water](#)
- Flood Hazard Research Centre (FHRC MU)
- GFZ German Research Center for Geosciences

Character: scientifically sound, but practice-oriented (co-financed by stakeholders; relationship with Netherlands' Delta Programme, (regional) water boards and provinces, and (local) communities)



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Flood risk management planning: challenges

Context:

- Increasing flood risk because of 1) climate change and 2) socio-economic development (demography)
- Planning for the long-term: fundamentally uncertain (scenarios)

Character:

- Risk-based: uncertainties about probabilities of extreme flood stages
- From reacting on disasters to anticipating change: Netherlands' Delta Programme

Key issues:

- Which structural and non-structural measures to combine into strategic alternatives?
- How to decide which strategic alternative to choose?



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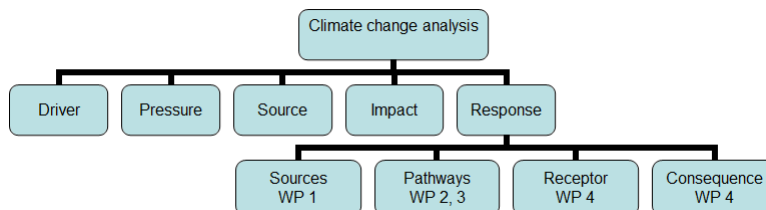
Background (common ground)

DPSIR (Driver, Pressure, State, Impact, Response)

- o.a. IPCC

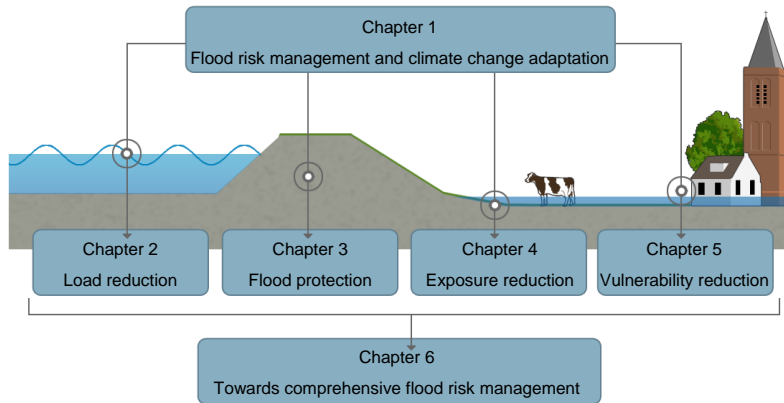
SPRC (Source, Pathway, Receptor, Consequence)

- o.a. FLOODsite



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Possible responses cf. (interim) report



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Flood risk key shared concept: unambiguous?



Flood risk

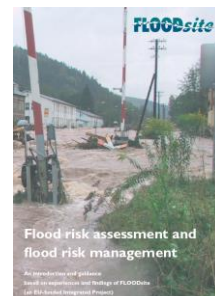
Thus consider :

- > effectiveness (in risk reduction)
- > cost-effectiveness/ efficiency

measures for all three components in view of

Sustainability

- Climate-change proof
- Other criteria, a.o.:
 - > Robustness
 - > Spatial quality



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Flood risk concepts in different 'frames'



1 Quantitative risk analysis (engineers)

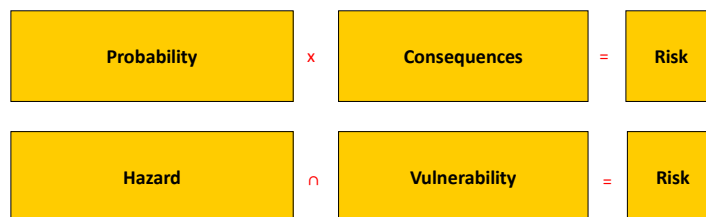


2 Risk mapping (planners)



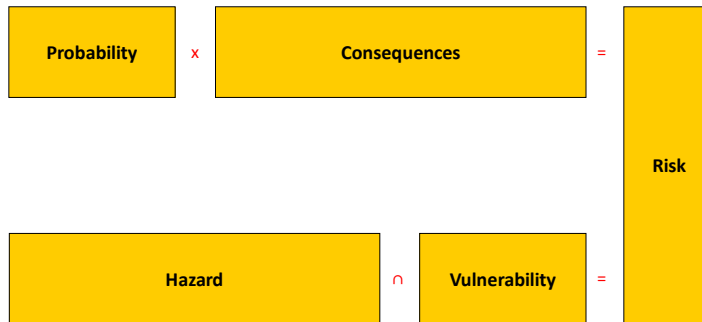
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Figure versus map



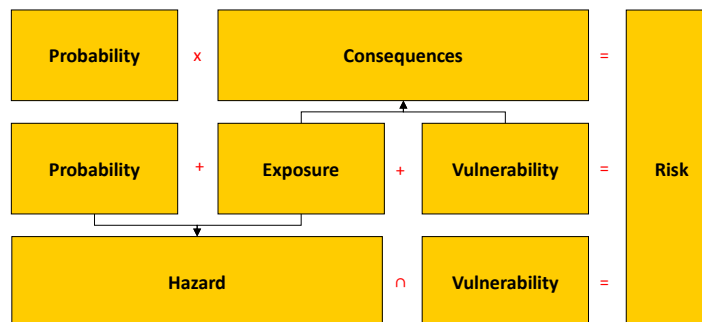
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Only partial overlap



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Location of exposure characteristics explains



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Different frames, different approaches



Consequence is a given → flood is to blame → tendency towards flood protection

Hazard is a given → people and their development are to blame → tendency towards spatial planning and emergency management

We see this in:

- different approaches between Netherlands and e.g. UK, Germany, France
- different approaches and poor mutual understanding between Delta Programme 'Flood Security' and Delta Programme 'Urban Development and Re-development'



26 september 2014

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DP 'Flood Security': focus on protection



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Main challenge: new protection standards for 2050

Underlying principles :

1. Basic 'safety level' for everybody in protected area
2. Where consequences large (many fatalities/ much economic damage) better protection (if $B/C > 1$)
3. 'Vital' infrastructure extra protected

Operationalisation:

1. Via Local Individual (drowning) Risk ($< 10^{-5}/\text{yr}$) to **a protection standard for the flood defence**
2. Via Benefit-Cost Analysis (incl. fatalities) to **a protection standard for the flood defence**
3. Via the involved stakeholders, occasionally to **a protection standard for the flood defence**



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DP 'Development': focus on spatial planning and building codes



Otherwise?



Elsewhere?



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Main challenge: a policy framework for new development and re-development



Underlying principles

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Operationalisation:

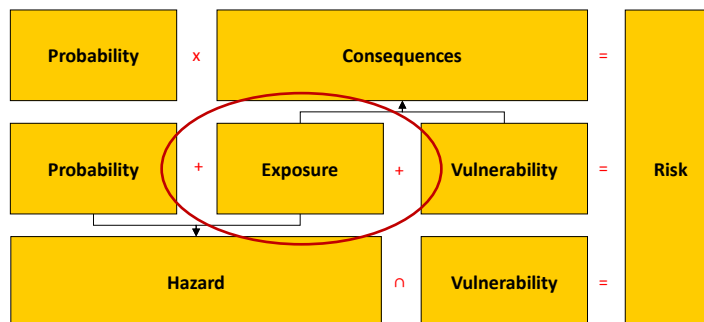
1. Hazard zoning
2. Policy framework?
3. Building regulations?



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Influencing 'exposure' is the neglected element



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Measures that influence exposure (KfC)



Making Room for Rivers (also lowers flood water level)

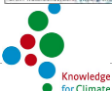
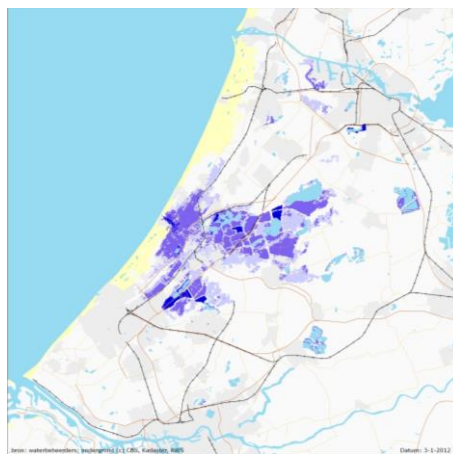
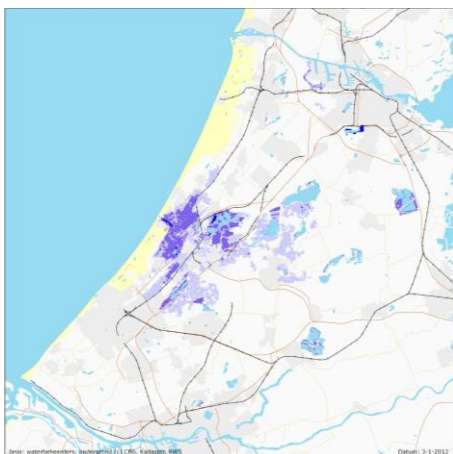
Compartmentalisation (reduces flooded area, slows down inflow (fatalities), protects vulnerable sites)

'Unbreachable' embankments (slows down inflow (easier evacuation/ time to flee), reduces total inflow volume: less area flooded)



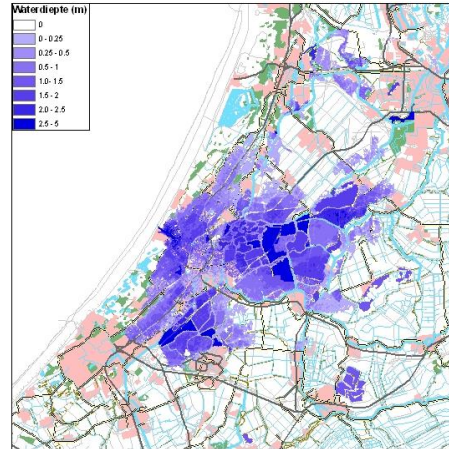
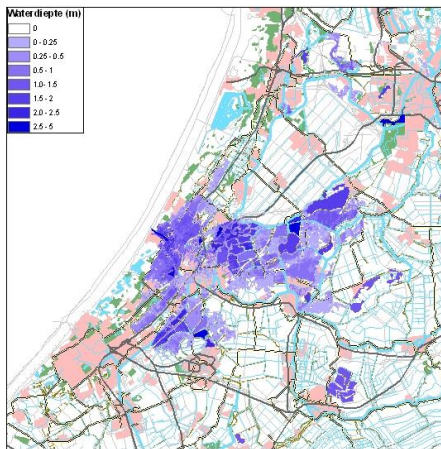
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Compartmentalisation becomes more attractive with higher sea level (+ 85 cm)



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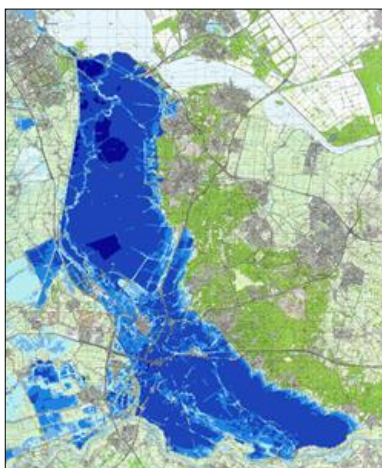
Compartmentalisation becomes more attractive with higher sea level (+ 1,3 m)



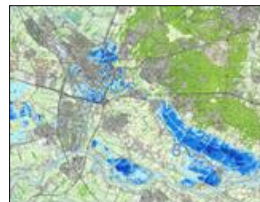
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Reducing exposure by unbreachable embankments: less consequences



Breach of conventional embankment versus overtopping of 'unbreachable embankment'



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Conclusions



- Flood risk is not an unambiguous concept
- Its definition influences framing:
 - of what constitutes the risk,
 - of what can/should be done to reduce it
- It is possible to reconcile the different concepts
- This aids the dialogue between engineers and planners
- That helps to draft a *comprehensive* adaptation strategy for the future
- Our KfC-consortium tried to give equilibrated attention to measures that reduce flooding probabilities, influence exposure characteristics and/or reduce society's vulnerability



Paper to be published in Mitigation and Adaptation Strategies for Global Change (MITI)

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Thanks for your attention



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