

How can Climate Services help to estimate losses, damages and adaptation costs



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Loss & Damage Conference, Bangkok, Thailand, 30-31 August 2013

Economics of adaptation, calculation of losses and damages...

- Help designing efficient climate policies (cf. e.g. Hanneman 2000)
- Can help to identify risk prone areas
- Serve as criteria to prioritize action (e.g. Bruin et al. 2009)
- Help choosing between adaptation/GHG mitigation actions (e.g. Tol 2005)
- Help identifying economic barriers to adaptation (e.g. Moser et al. 2010)
- Provides comparability (where it is worth to invest:
 $\text{benefit} = \text{adaptation costs} - \text{L\&D}$)



Second 500yr event (river flood 2013) within 11 yrs (Germany, Austria, Czech Republic)



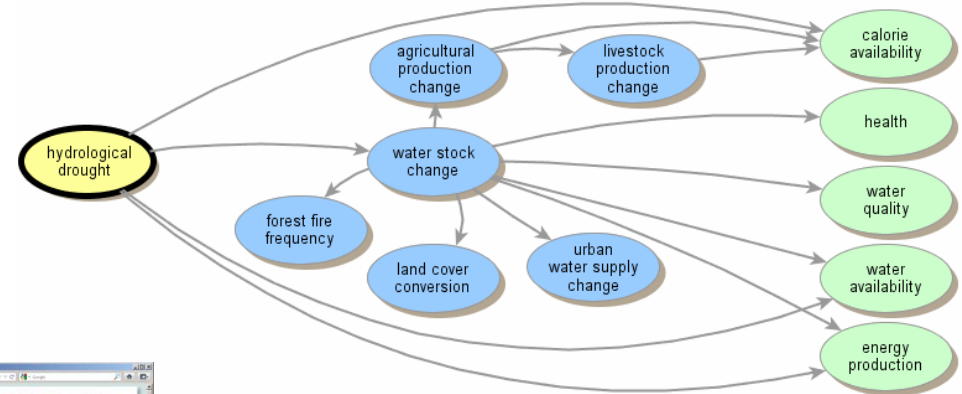
Climate Impacts: global and regional adaptation support platform

Systematic Information collection (integration)

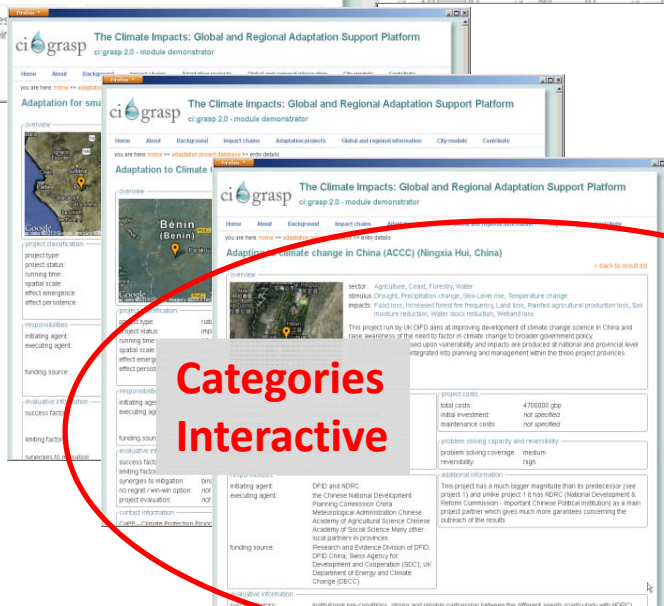
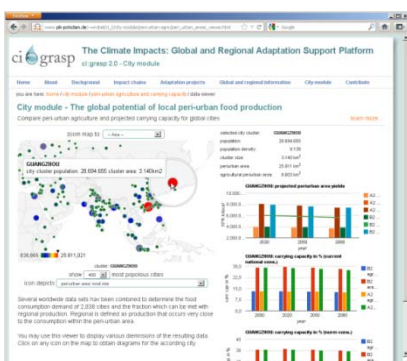
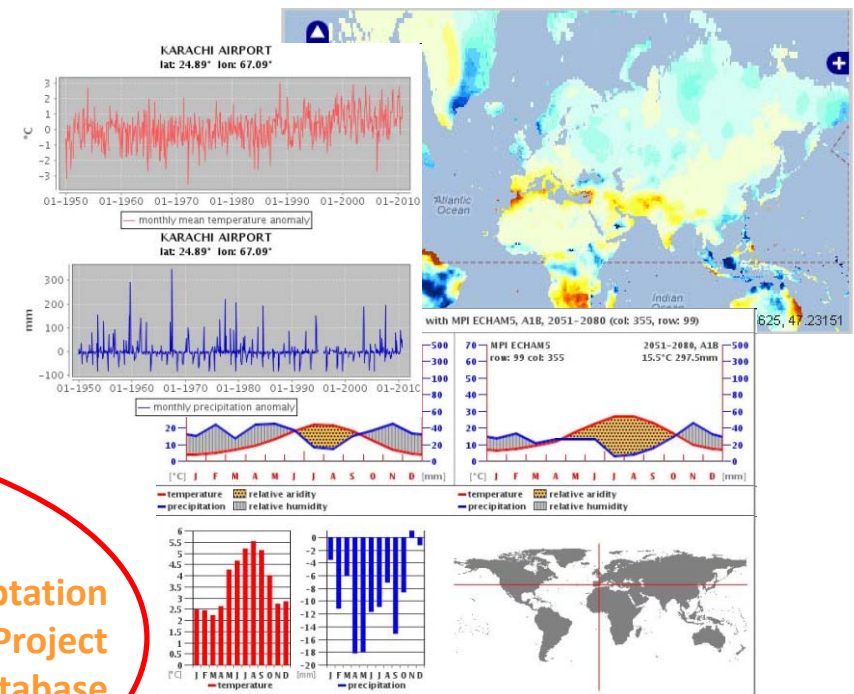
Content Structure based on Impact Chains



Cities



Global and Regional Climate Change Information



Categories Interactive

Adaptation Project Database

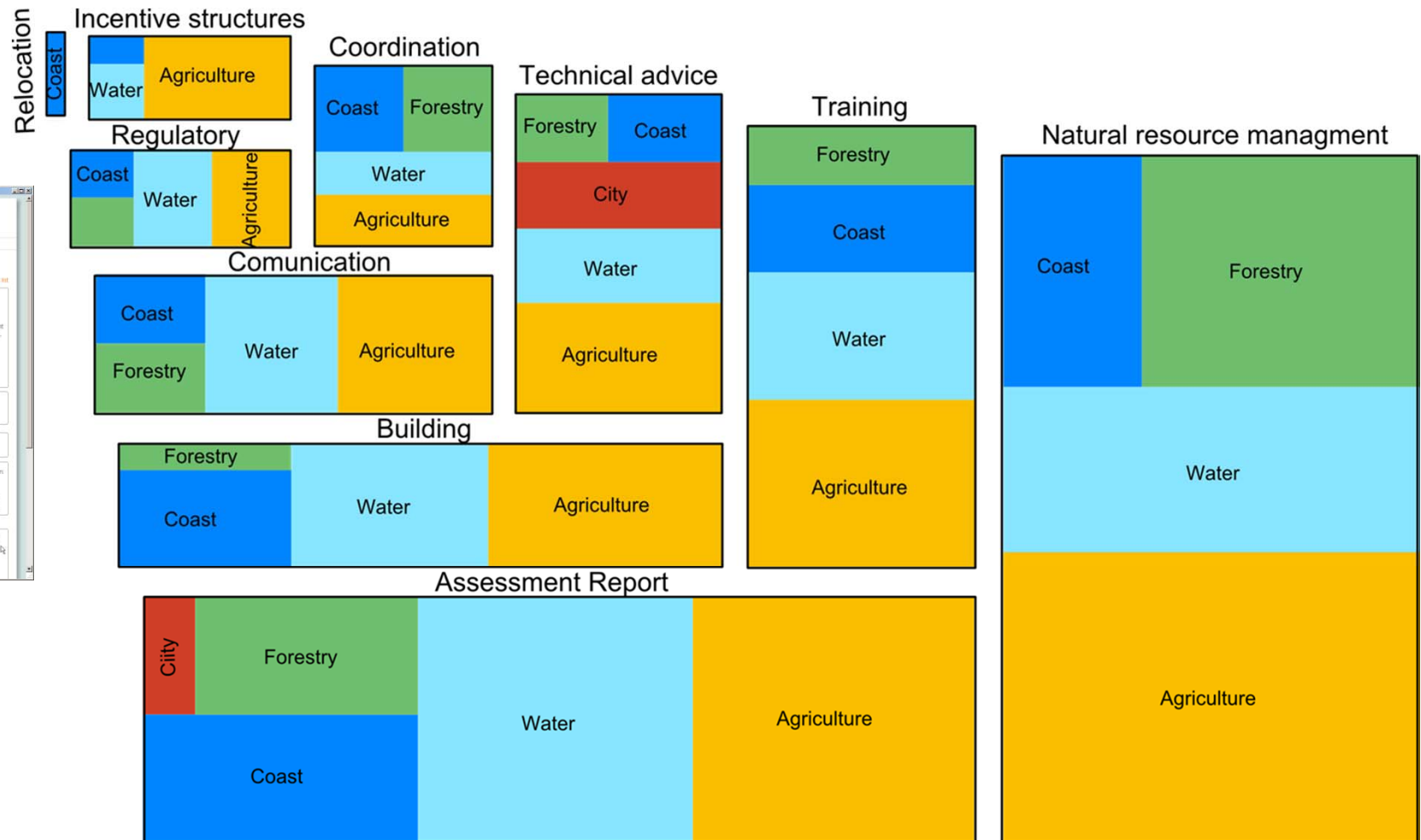
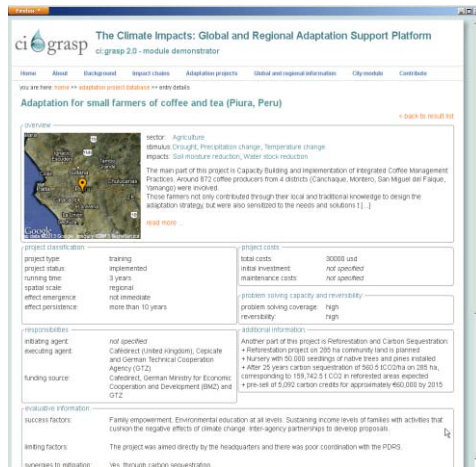
Sustainability Challenges

Source: PIK/Kropp & CCD Team 2013



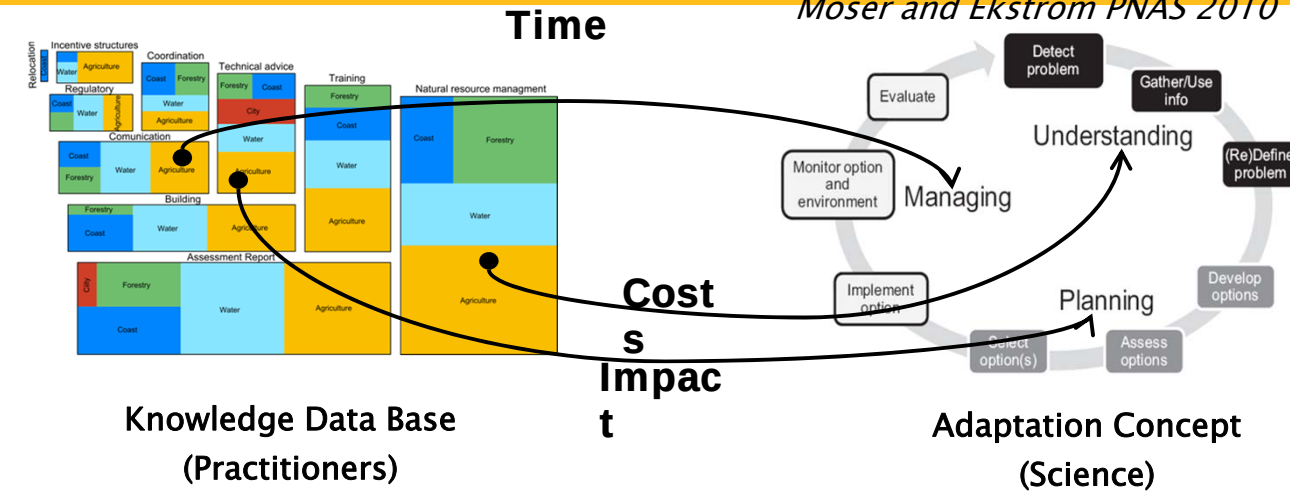
Ci:grasp: Adaptation Database

- Database freely available @ cigrasp.pik-potsdam.de/
- > 300 adaptation projects; 5 sectors; 29 countries
- Relevant for adaptation e.g., climate impact, project type, running time, costs...



Understand adaptation as a process!

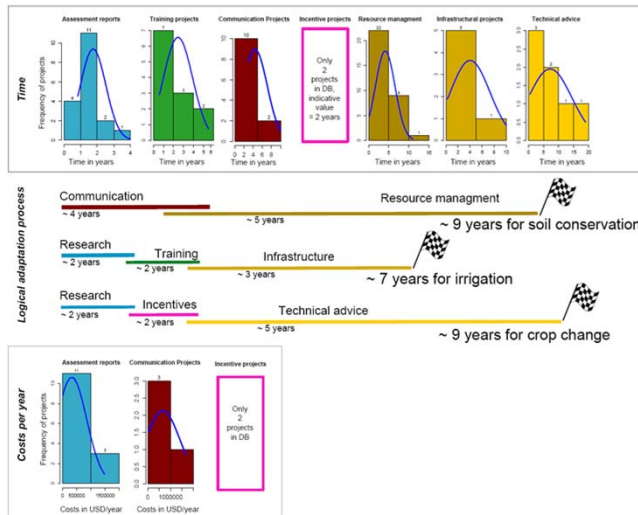
Moser and Ekstrom PNAS 2010



Logical Adaptation Pathways (LAP's)

Logical in the sense that adaptation is a rational sequence of actions.

Pathways because there is more than one solution to the same problem.



Translates to costs



India

Soil conservation

RCP _{2.6}	2.5	1.6
RCP _{4.5}	3.3	2.4
RCP _{6.0}	1.9	3.8
RCP _{8.5}	3.4	2.5

Irrigation

RCP _{2.6}	29.5	18.2
RCP _{4.5}	37.3	25.4
RCP _{6.0}	22.9	46.7
RCP _{8.5}	33.5	29.9

Current situation:

No consideration of adaptation as *a process* in the cost methodologies

Disregard of particular *phases*

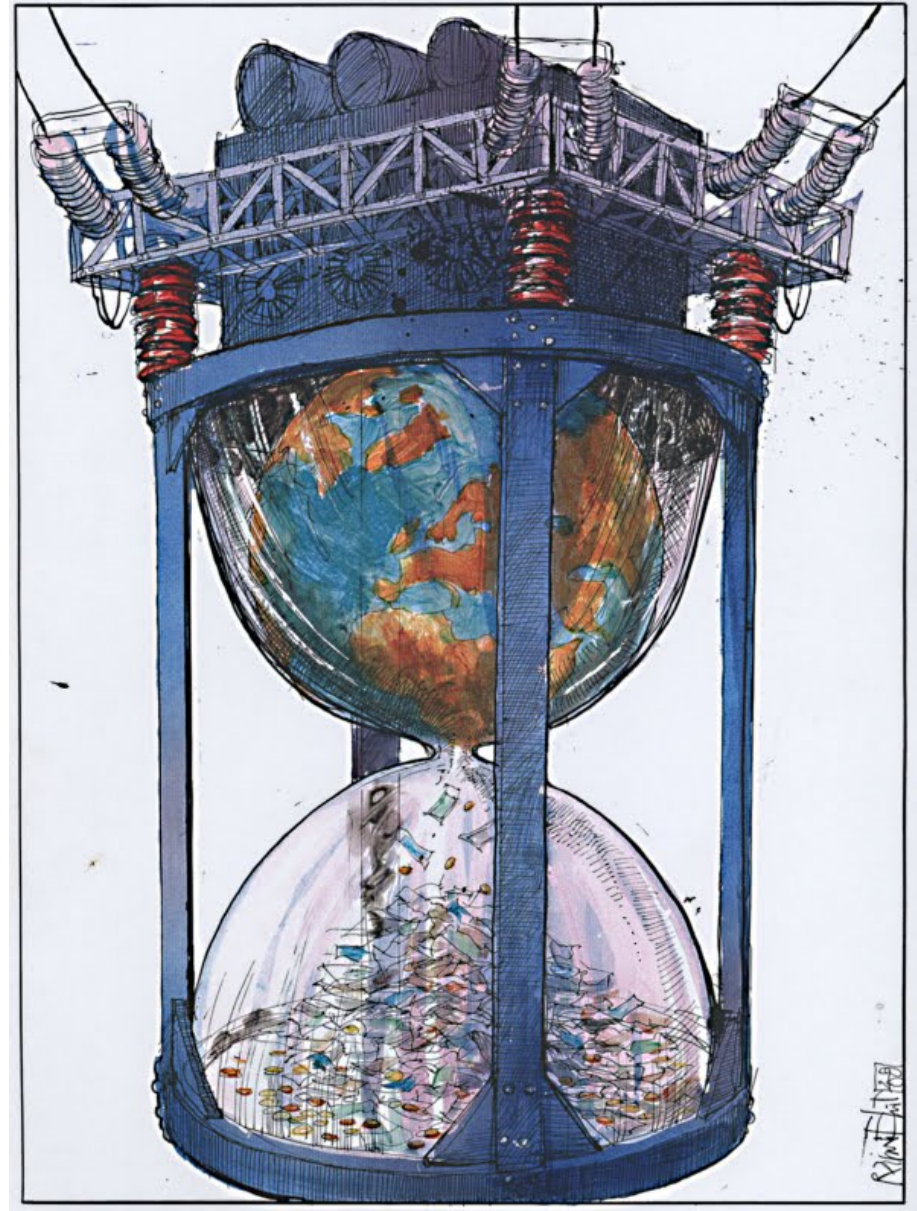
Independence of *phases*



Adaptation is conceptualized (and taking place?) in a more complex manner than investigated by economic frameworks...

Source: PIK/Costa & Kropp (2013): Assessing the costs of adaptation to climate change in developing countries. Final Report, Potsdam

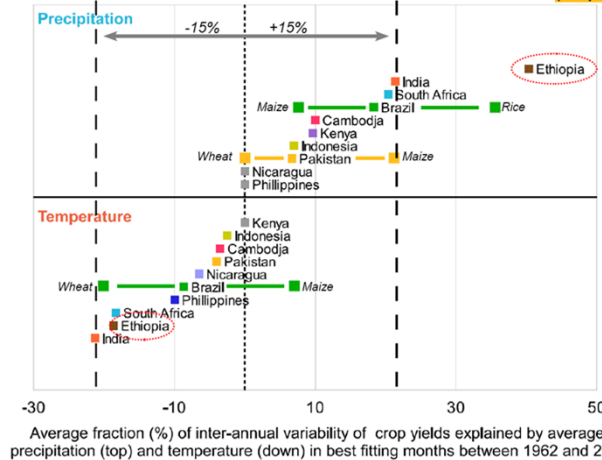
Additional
Preconditions
(examples)?



Requirements for estimating L&D of climate change

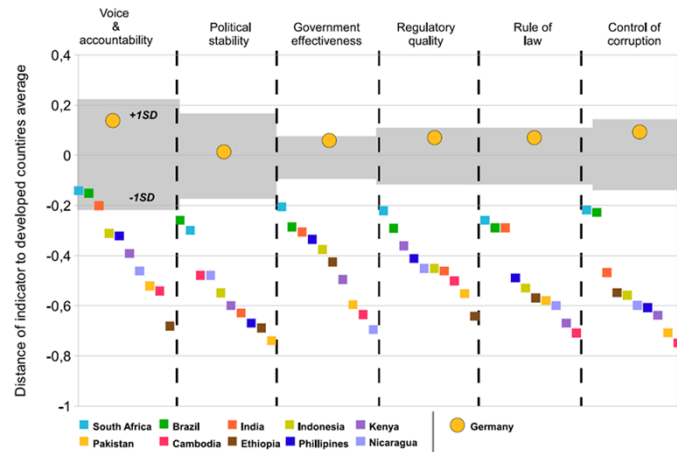
Average dependency (%) of annual yield (rice, maize & wheat) on climate variability between 1962-2000.

(AdapCosts results)



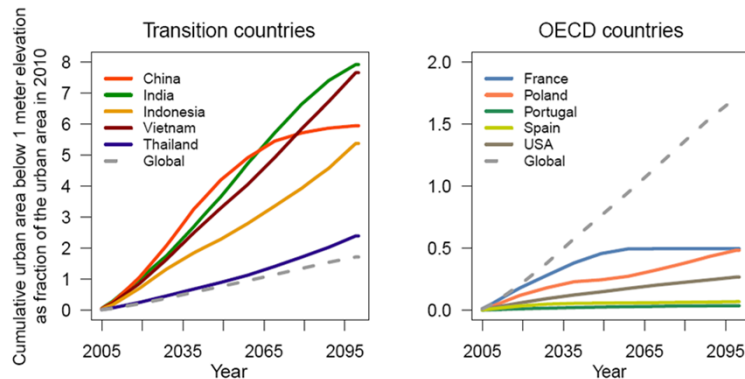
Source: **PIK/Costa & Kropp** (2013): Assessing the costs of adaptation to climate change in developing countries. Final Report, Potsdam

Understanding past climate-socio-economic relations for sectors



Ranges of institutional indicator-scores for developed countries, i.e. HDI above 0.8.

Differentiate (and account for) the inherent adaptive capacities of societal systems

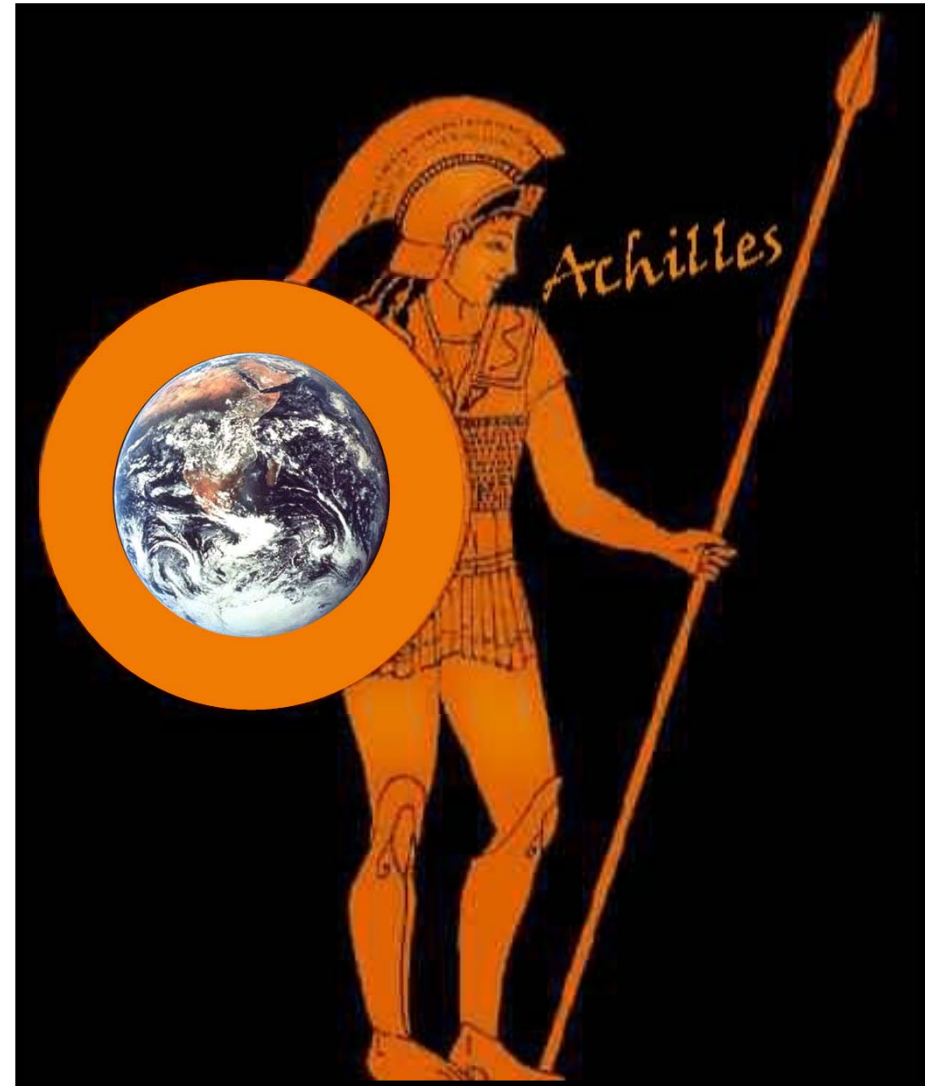


Evolution of the major factors determining loss and damages in the future

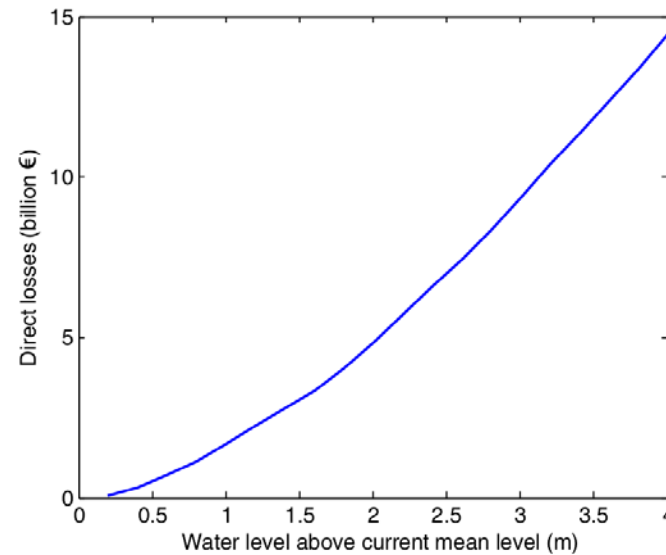
Projected urban area to be added to coastal zones below the 1m elevation mark. (AIM & RCP6.0).

The „Achilles heel“ of any (quantitative) methodological approach

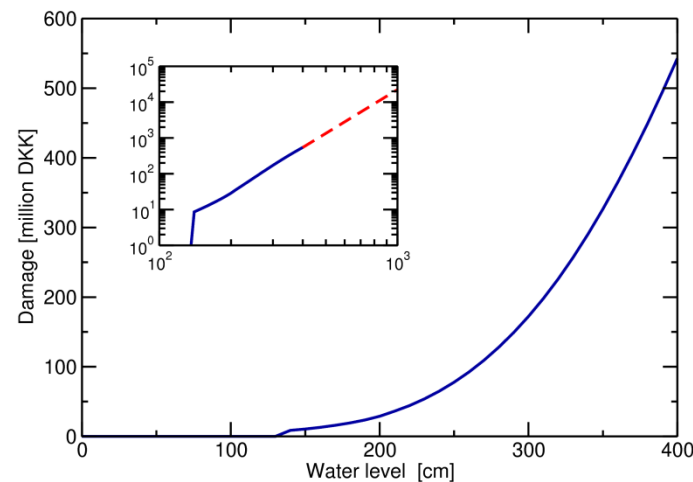
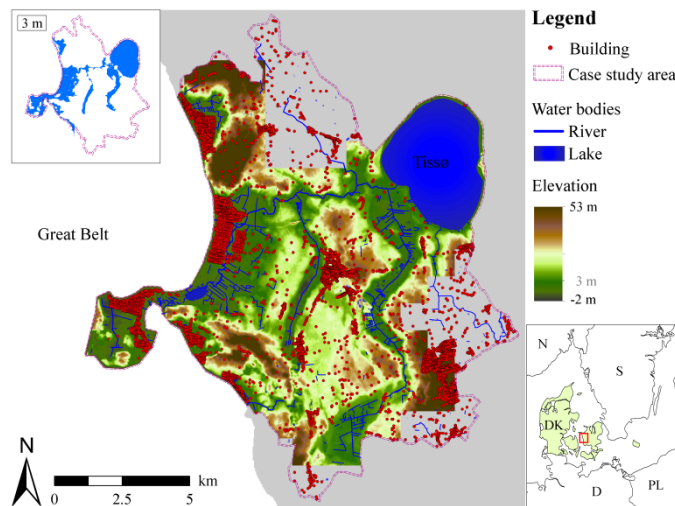
The nature of the loss and damage function!



The crux of the damage function: is it in any case different or do it exhibit specific characteristics?



Copenhagen/DK
Hallegatte,
Climatic Change,
2010

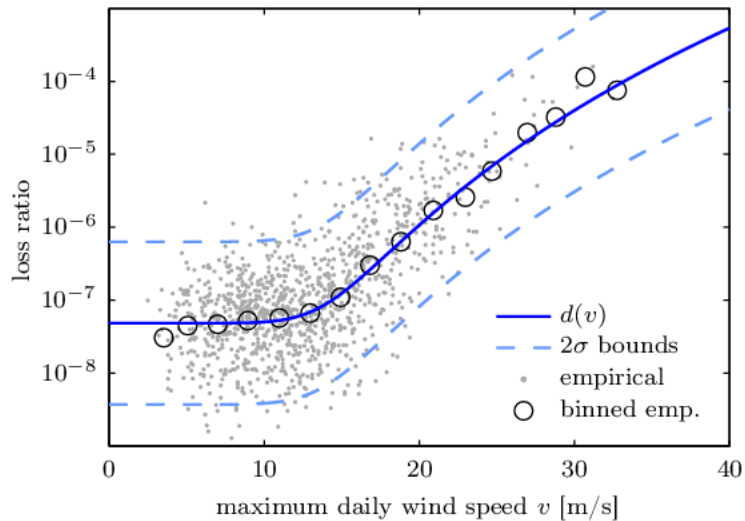


Kalundborg/DK
Boettle, NHESS,
2011

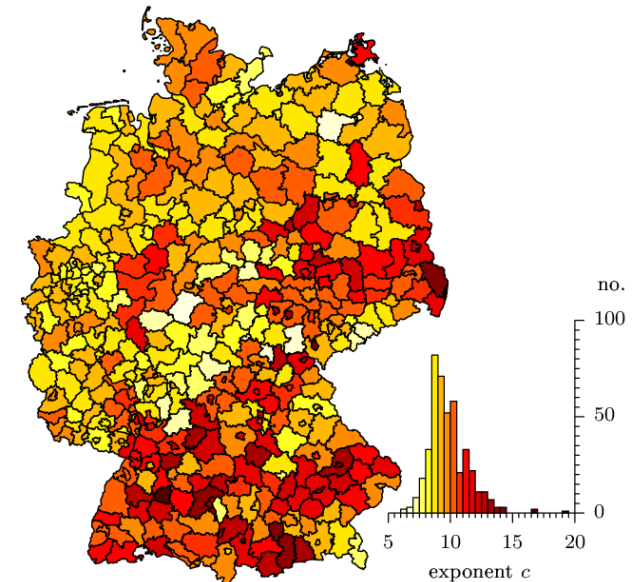
Storm Damage to Residential Buildings

Patterns of vulnerability with much better resolution

Power-law based damage function



'Damage Exponent' $c \approx 9$

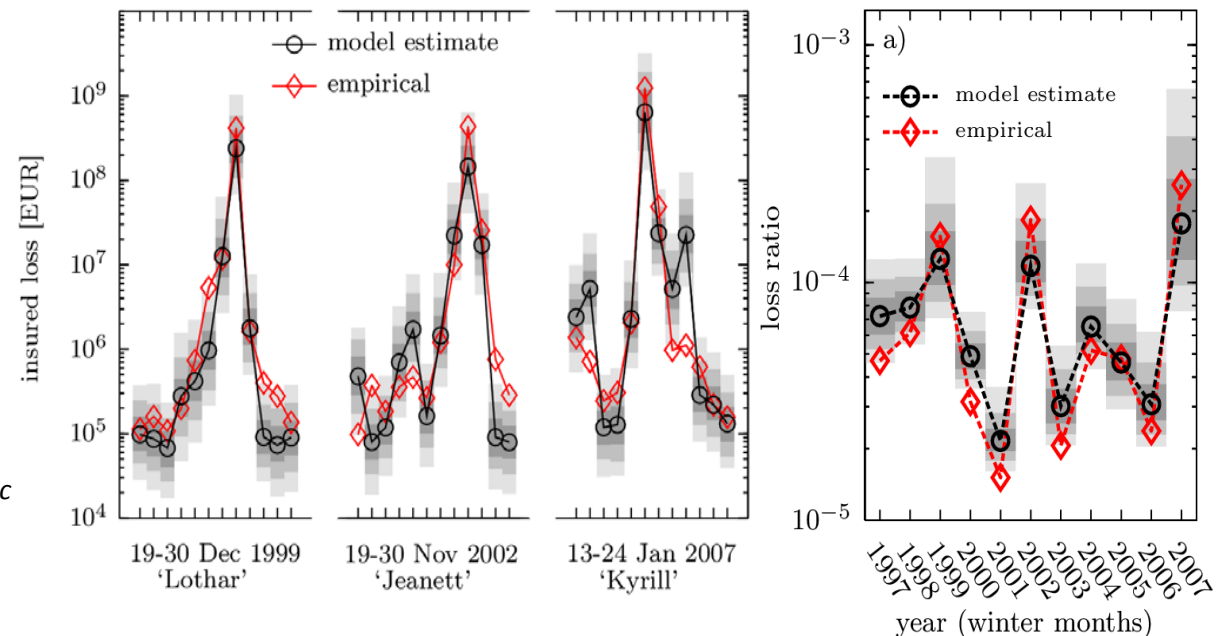


Daily and annual out-of-sample loss estimates

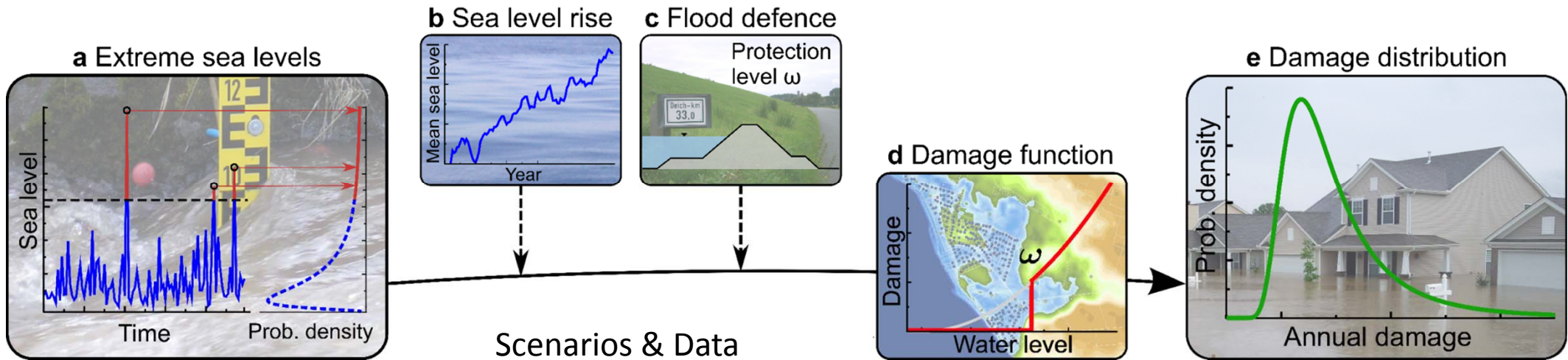
$$d(v) \approx \left(\frac{v}{b}\right)^c + a.$$

$$D_\epsilon(v) \sim \ln \mathcal{N}(\ln d(v), \sigma^2)$$

Prahl/Rybski/Kropp/Burghoff/Held (2012): Applying stochastic small-scale damage functions to German winter storms, GRL



For example: Damages in Coastal Cities



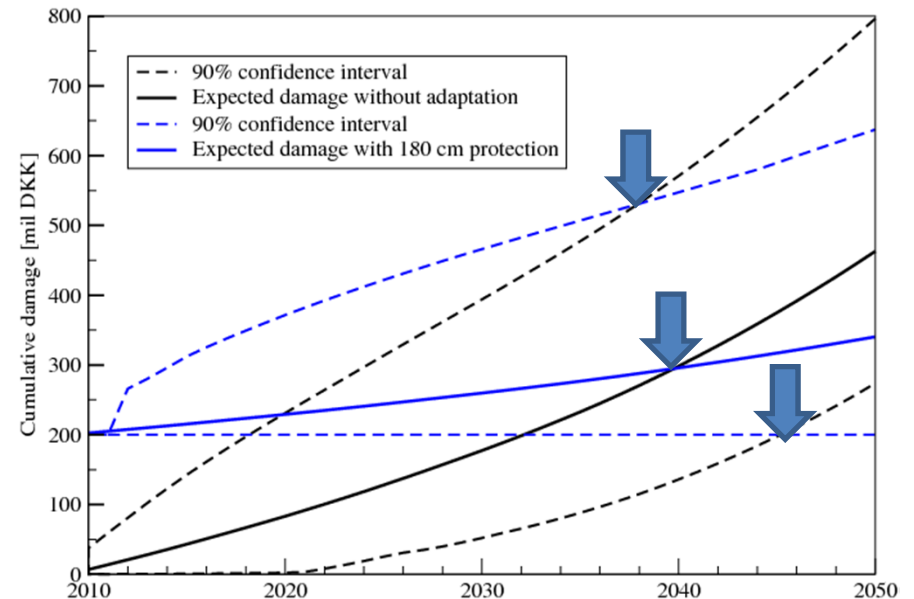
Stochastic description of
ESL:

Damage function has the form $D(x) \sim x^\gamma$

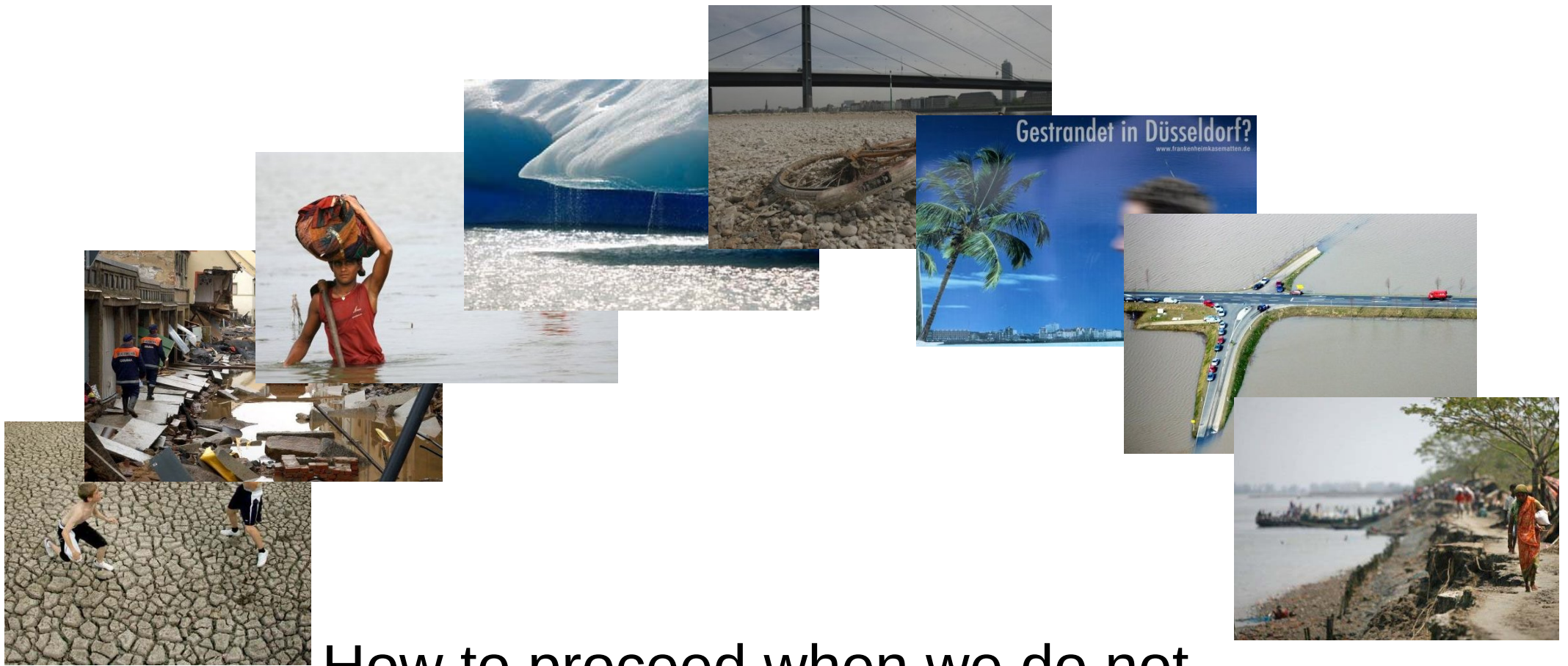
‘Damage Exponent’ $\gamma \approx 4.1$

Idea:
Cumulative damage instead
of case damage!

Relative uncertainty based
on $\text{STD}/E \rightarrow t^{1/2}$



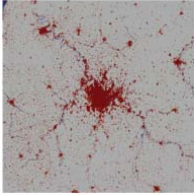
Amortisation points



How to proceed when we do not know where assets are precisely located?

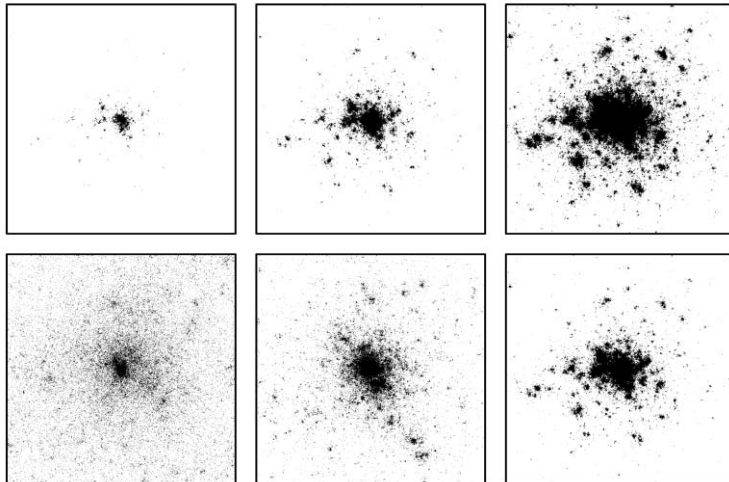
Generalization for data scarce situations?

Paris 2000



Gravitational City Model

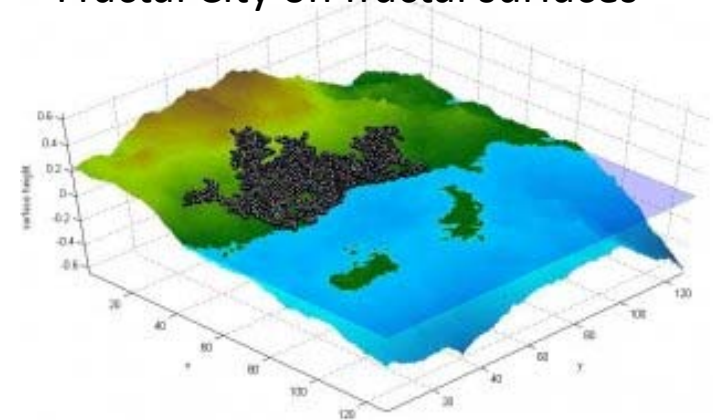
Rybski/Cantu Ros/Kropp (2013): Distance-weighted city growth Phys.Rev. E.



Parametrization



Fractal City on fractal surfaces

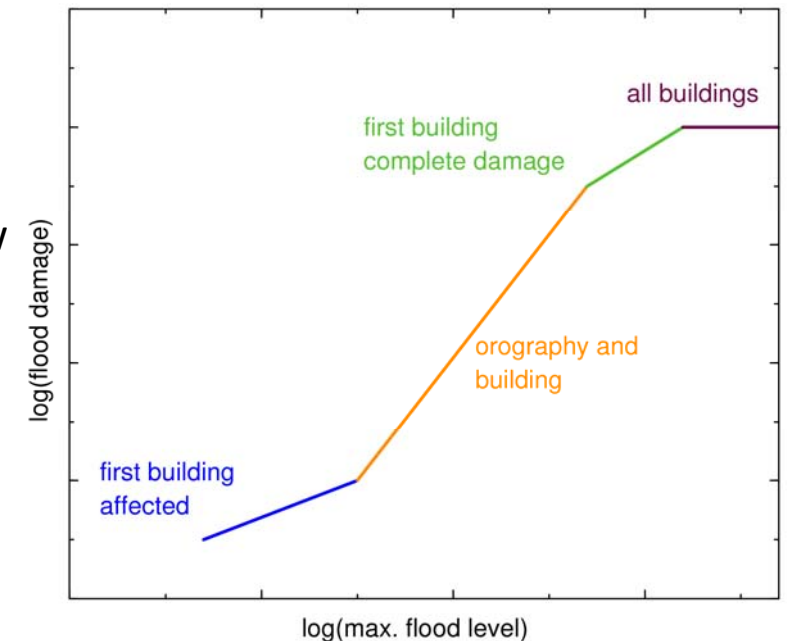


Summer Flood Grein/river Danube 4.6.2013

Preliminary results: show certain regimes for damage functions

Extension to the globe

Source: PIK/Prahl et al. In prep



Summary: How to proceed with L&D economic valuation?

- Use existing data bases as an information sources
- Integrate approaches: mismatch between approaches (L&D/ adaptation cost assessments)
- Adopt a broad definition of loss and damage in order to capture the (sometimes unknown) economic effects
- No quantification tyranny, some qualitative measures of economic loss are inevitable
- Data restrictions, attribution and accounting problems and the level of restrictions should made clear
- Recognise that certain climatic stressors are „represented“ in the damages
- Much more concerted research (comparability) is needed

Thank you for your attention!

