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Cost-benefit analysis of local level climate change induced hazards

The TOLERATE study as example

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VATT

Presentation structure

- **Context and background**
- **Study outline**
- **Direct damage; regional economic effects**
- **Concluding observations**

Context and background

- **Spin-off from the FINADAPT project (2005/2006):**

  → more attention needed for extremes in economic assessment of CC

- **In the framework of Environmental Cluster and ISTO programmes several studies started:**

  → On flooding, storms, building codes, forestry, etc.

- **TOLERATE study focused on (downstream) river floods in urban areas (Pori, Salo)**

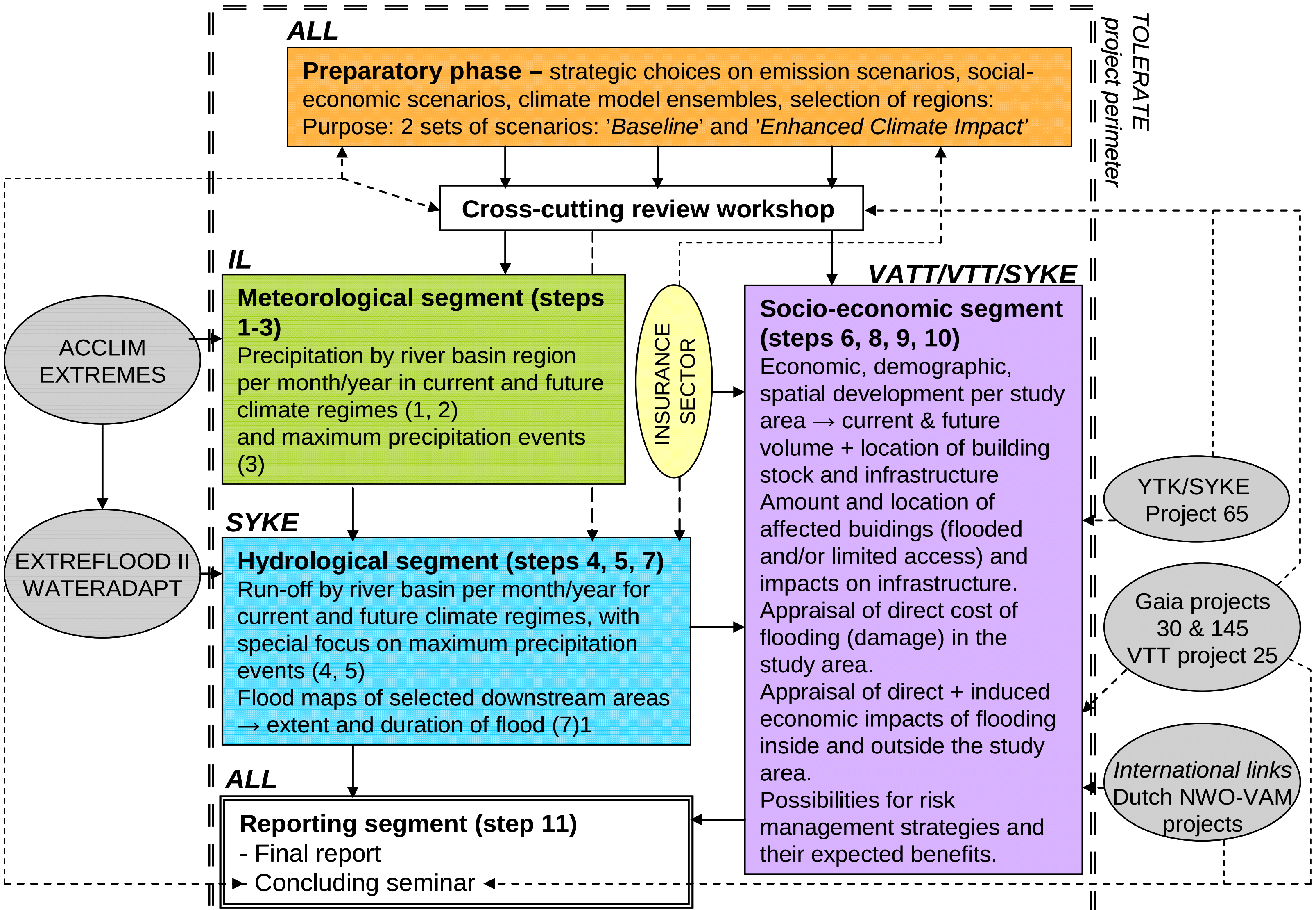
  → Attempt to create integrated assessment chain – from changes in future weather conditions via hydrology to GIS based flood maps / damage tables and economic impacts and finally to counter measure evaluation

Categorising natural hazards for economic assessment purposes

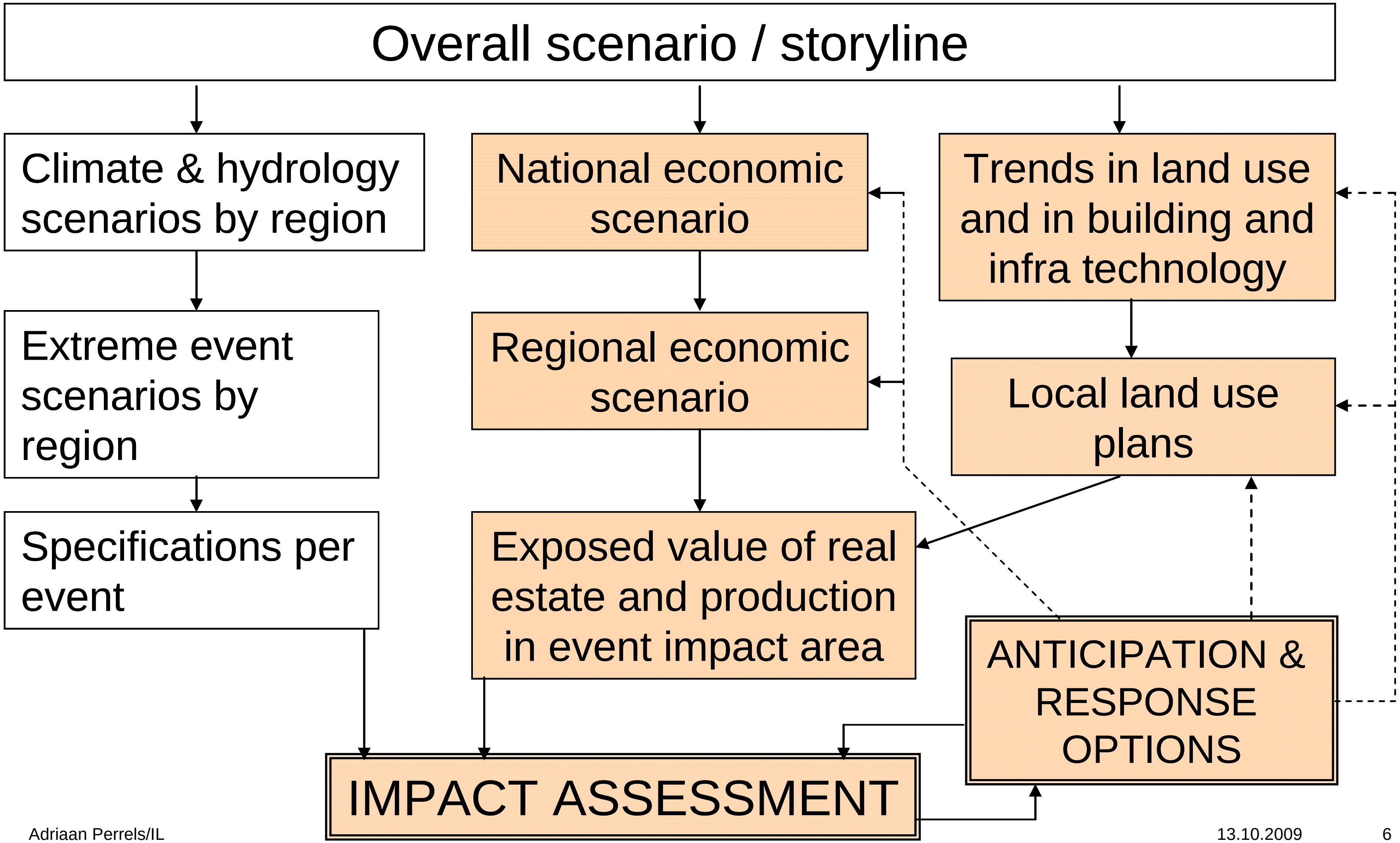
Temporal profile of the unfolding of the change	Duration of the state resulting from the change*	
	Permanent	**Transient**
Mode I: **Slow and fundamental**	- shifts in tree stands - shifts in sea levels	-
Mode II: **Slow underlying trends culminating in quick changes**	- collapsing fish stocks (1) - drought (3) -	- collapsing fish stocks (2) - drought (4)
Mode III: **Sudden and dramatic**	- large volcanic eruptions	- gales - floods TOLERATE - earth quakes

*) ‘temporal’ implies a time scale varying between a week and a few years;
‘permanent’ concerns states that are expected to last at least for decades
(1) e.g. due to lasting changes in average water temperatures
(2) e.g. due to invasive species
(3) Mediterranean EU (4) Other EU

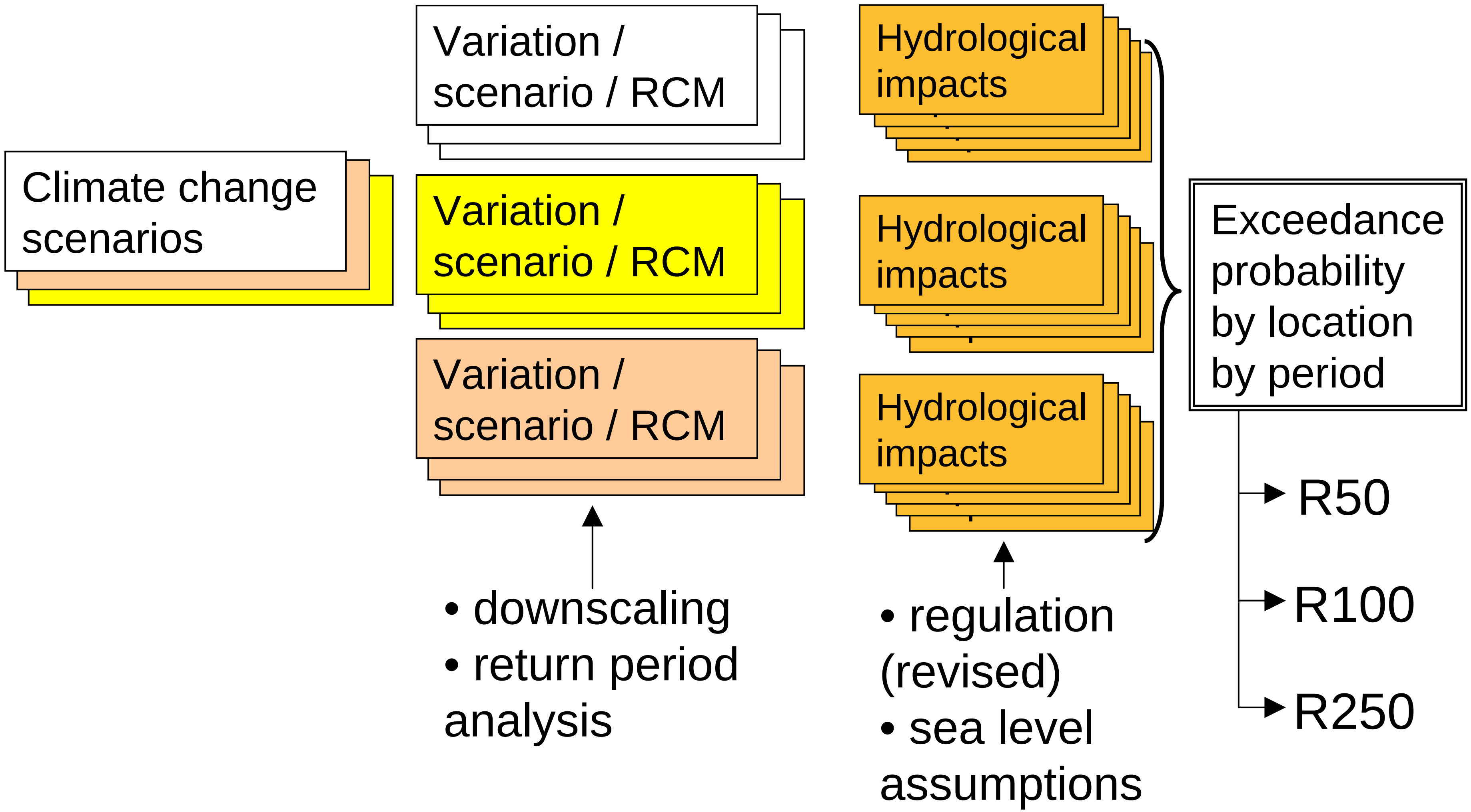
TOLERATE study structure



Scenario and data flow structure – economic focus



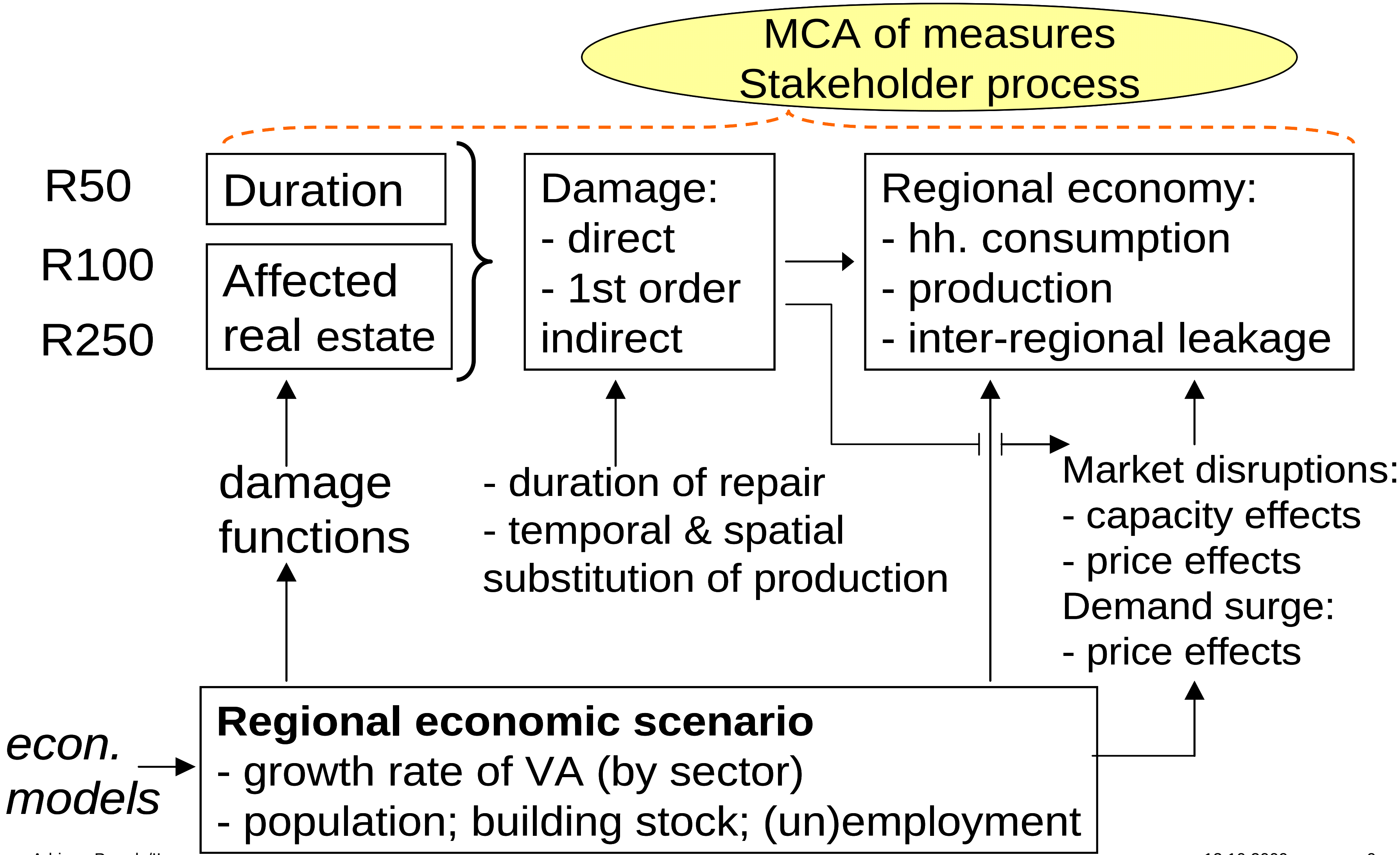
Linking natural and social-economic systems 1



Linking natural and social-economic systems 1

- Hydrological simulations showed that the flood risks for Salo were expected to diminish due to tendency towards more continued / recurrent snowmelt during winter and early spring
  - The river is not regulated and in recent climate conditions highest flooding risks used to be in the second part of Spring (cumulated snow & ice melts away)
  - All in all economic implications of CC induced changes in flood risks for Salo were likely to be small and possibly even favourable, therefore no economic assessment was carried out
- For Pori climate change appeared to result in higher risks of flooding, with a shift in critical time from Spring to Winter → detailed assessment of damage risks, regional economic effects, and evaluation of counter measures

Linking natural and social-economic systems 2



Direct damage cost for R50 and R250 – Pori

(mln. Euro)

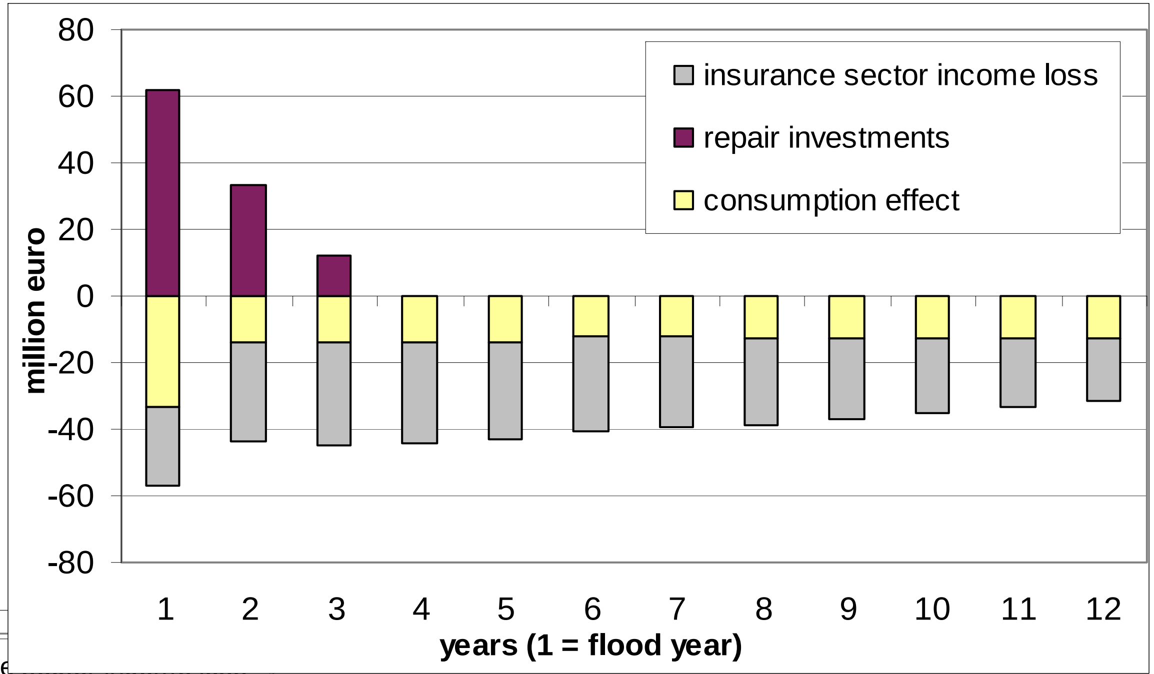
	Direct Cost – material damage (buildings, interior, equipment) and cleaning cost (in million euro)			
	Current climate		Future Climate	
	R=50	R=250	R=50	R=250
Homes	81	169	91	194
Apartments	13	53	16	67
Shops & offices	5	30	7	38
Other buildings	7	41	9	50
Auxiliary buildings	1	2	1	2
TOTAL direct cost	**107**	**294**	**123**	**350**
of which buildings	*98*	*270*	*113*	*323*

Source: TOLERATE/Perrels et.al (2009)

Cost assessment summary

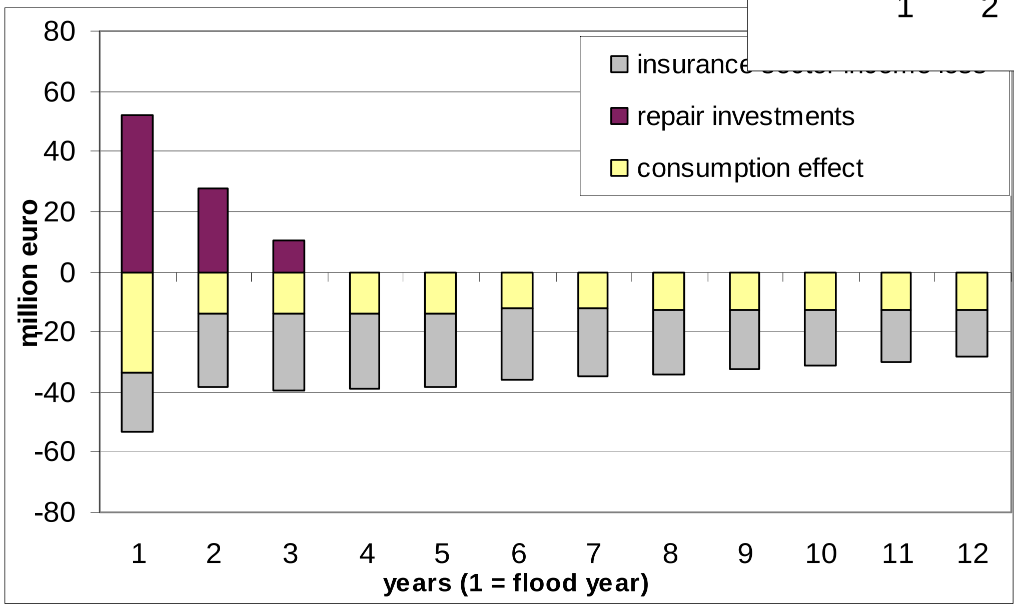
- Expected value of direct damage for R50 and R250 both approx. 60 ~ 70 mln.€ for the period 2005-2050 with 2005 building stock and no economic growth
- Economic growth share +50% - the figure depends strongly on the estimated growth rate and the time span
- Climate change share +15% ~ +20% - depending on how to weigh in different return times
- Building stock share -10% ~ +10% - depending on how spatial plans and building spatial planning technology are developing, this factor seems harder to quantify;

Regional economic impacts



Future climate

Current climate



Regional economic impacts

cumulated effect (12 year) in mln. euro		CC	FC	difference to default	
default	stepwise displacement	346	380		
	high displacement	366	404		
	low displacement	228	239		
less insurance less substitution	stepwise displacement	368	402	6 %	6 %
	high displacement	389	427	6 %	6 %
	low displacement	253	265	11 %	11 %
slow repair (no cap.corr.)	stepwise displacement	326	357	-6 %	-6 %
	high displacement	361	398	-1 %	-1 %
	low displacement	222	233	-3 %	-3 %
higher I/O multiplier	stepwise displacement	377	411	9 %	8 %
	high displacement	398	436	9 %	8 %
	low displacement	259	271	14 %	13 %

CC = current climate; FC = future climate

Conclusions

- For recurrent applications more standardisation and data coordination is necessary
- Flood risks for Pori are already significant now, and climate change worsens it
- Increase of intense downpours (cloudbursts) are a risk for many cities in Finland (so river flood assessment gives only a small part of the picture)
- Economic analysis of extreme events is still in fairly early stages of development
- In a societal decision context also non-fully informed and non-optimising risk strategies should be considered

Conclusions cont_d

- Interaction between resilience and vulnerability deserves more study
- Effective reduction of uncertainties of impact assessments should be assessed over the entire causal chain
- Uncertainty reduction efforts welcome across the board, but more stress should be placed on:
    - economy, technical development, land use, (geographical) scaling
    - Linkages (and feedbacks) between realms:

      climate – hydrology – ecology – economy – culture

See also:

http://www.vatt.fi/en/research/projects/tolerate/news/

http://www.vatt.fi/en/publications/latestPublications/publication/Publication_1345_id/785

Thank you

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