Adaptation to extremes in Europe

-Insights from the ADAM project-

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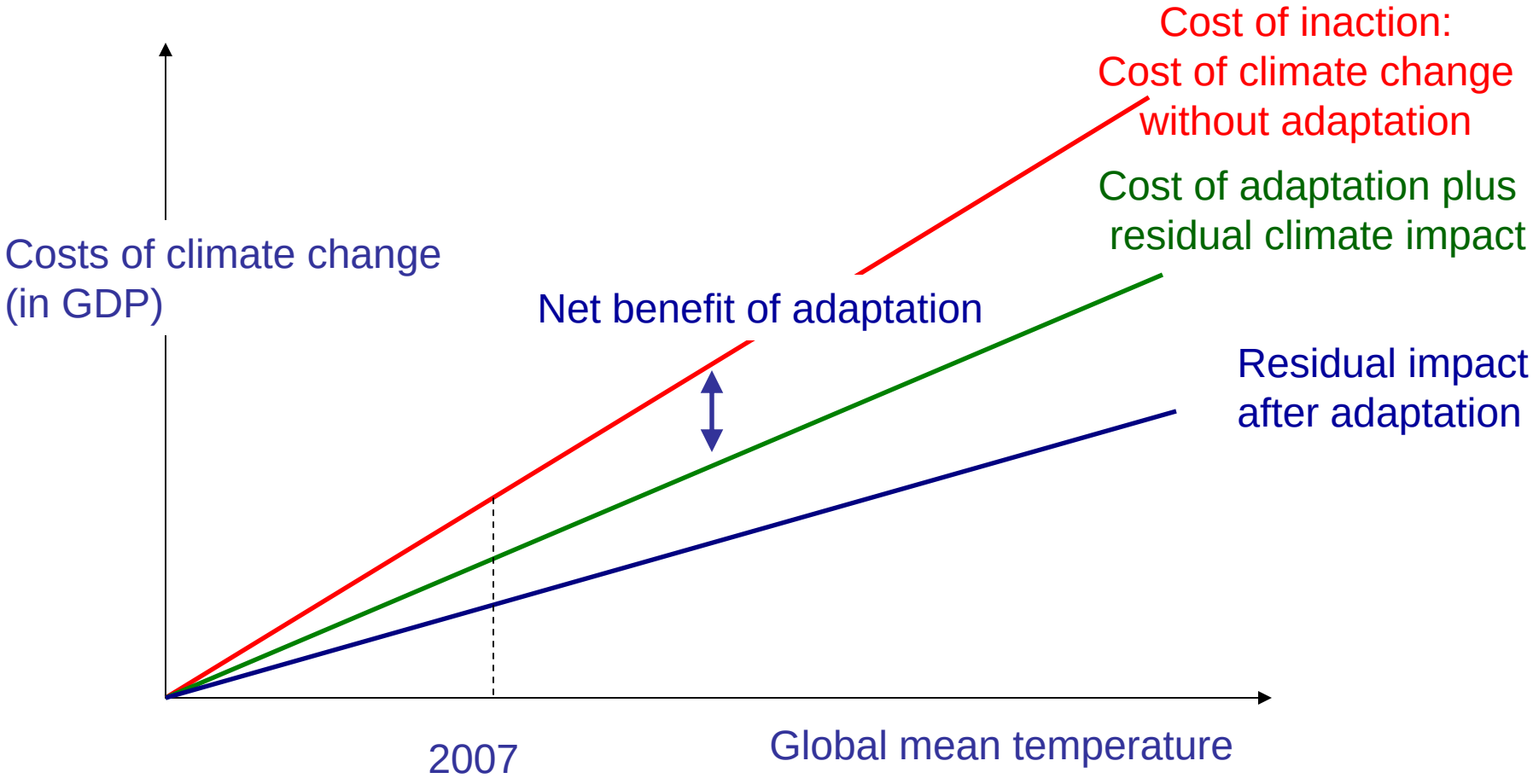
Bali COP 13 side event
EU strategies for adapting to climate change
Research Needs for Adaptation Policies

Co-organized by DG Research and DG Environment
Monday 10 December 2007, 13:00-15:00
EU Pavilion

Costs and benefits of adaptation



Slightly adapted from Stern, 2007

2 decisions of importance

- Mitigation decision: avoiding dangerous climate change Stern, 2007:
  - Cost of inaction of 5-20% losses/a can be avoided
  - with mitigation cost of 1% GDP/a
- Adaptation decision: Adapt efficiently to ongoing and unavoidable climate change
  - Where and who?
  - How much?
  - When?

Main ADAM objectives

1.Compare +2°C with +4.5°C:

Identify associated **costs and effectiveness** of existing and evolving EU (and world) mitigation and adaptation policies for **2°C vs.** assessment of the **damages avoided** compared to a scenario with **unmitigated climate change** of +4.5°C

2. Options for "filling the gap":

Develop and appraise a portfolio of longer term strategic policy options for addressing identified shortfalls for mitigation and adaptation policies and targets

Knowledge on costs of inaction

- Global damage functions with little linkage to extreme event impacts “on the ground”
- Backward-looking
- Physical and monetary impacts, rather than economic
- Climate variability not fully captured

Knowledge on costs of adaptation

- Limited and fragmented in terms of sectoral and regional coverage
  - There seem to be some low-hanging fruits, but
  - “barriers, limits and costs are not fully understood”
- Adaptation not done in isolation for coping with climate change
- Adaptation costs usually expressed in monetary terms, while benefits more mixed
- Model-based, less bottom-up analysis focussing on existing adaptation

Extreme events

	Public	Private
Planned	Adaptation to Natural Disasters	
Autonomous		

Extreme events and Europe

- In Europe, wide ranging impacts of changes in current climate already documented, such as
  - More frequent riverine and coastal flooding,
  - Increased severity of droughts,
  - Health risks, e.g. 2003 with 70,000 premature deaths,
  - Increased risk of inland flash floods
  - Natural disaster losses per year doubled over the 1990s compared to 1980s

- Increase as of today largely driven by socio-economic factors, but mounting evidence of a significant climate-change signal in natural disaster events

Focus of ADAM work on extremes

- Types
  - Floods,
  - Heat-wave,
  - Drought and frost to agriculture,
  - Forest fire,
  - Windstorms to forests.

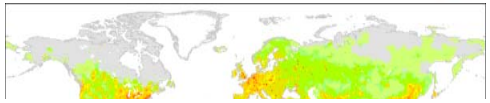
- Key vulnerable areas according to Adaptation Green paper:
  - "**Southern Europe and the entire Mediterranean Basin** exposed to a combined effect of **high temperature** increases and reduced precipitation in areas already stressed by **water scarcity**. "
  - "Densely populated **floodplains,** exhibiting an increased risk of storms, intense rainfall and flash floods leading to severe and widespread damages to built-up areas and infrastructure. "

- Sectors:
  - Aggregate
  - Public sector (Infrastructure and public finance)
  - Economic sectors

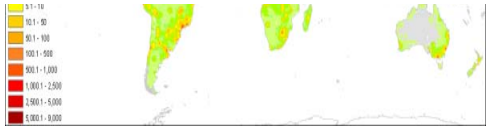
Some results

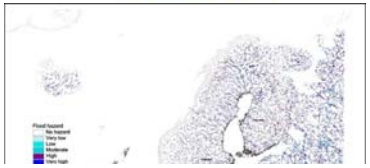
- What are spatially explicit monetary losses now and in future (2025, 2100)?
- Where are geographical hotspots?
- Fiscal and economic costs: Identify extreme events (and associated risks) that may be beyond the economic adaptive capacity of identified regions and sectors in Europe

Identify and assess drivers of risk and change: risk triangle



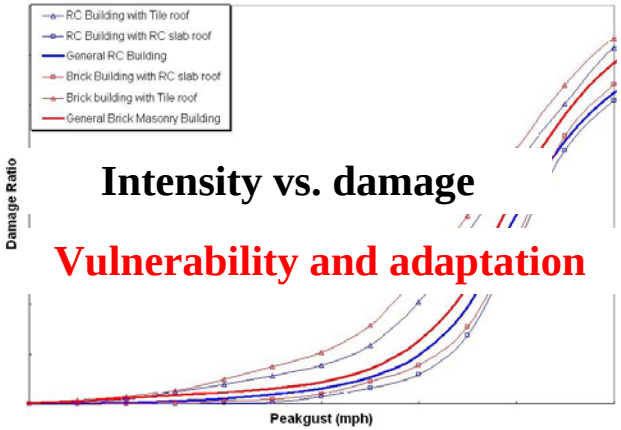
Exposure: population and capital stock exposed





Intensity and frequency

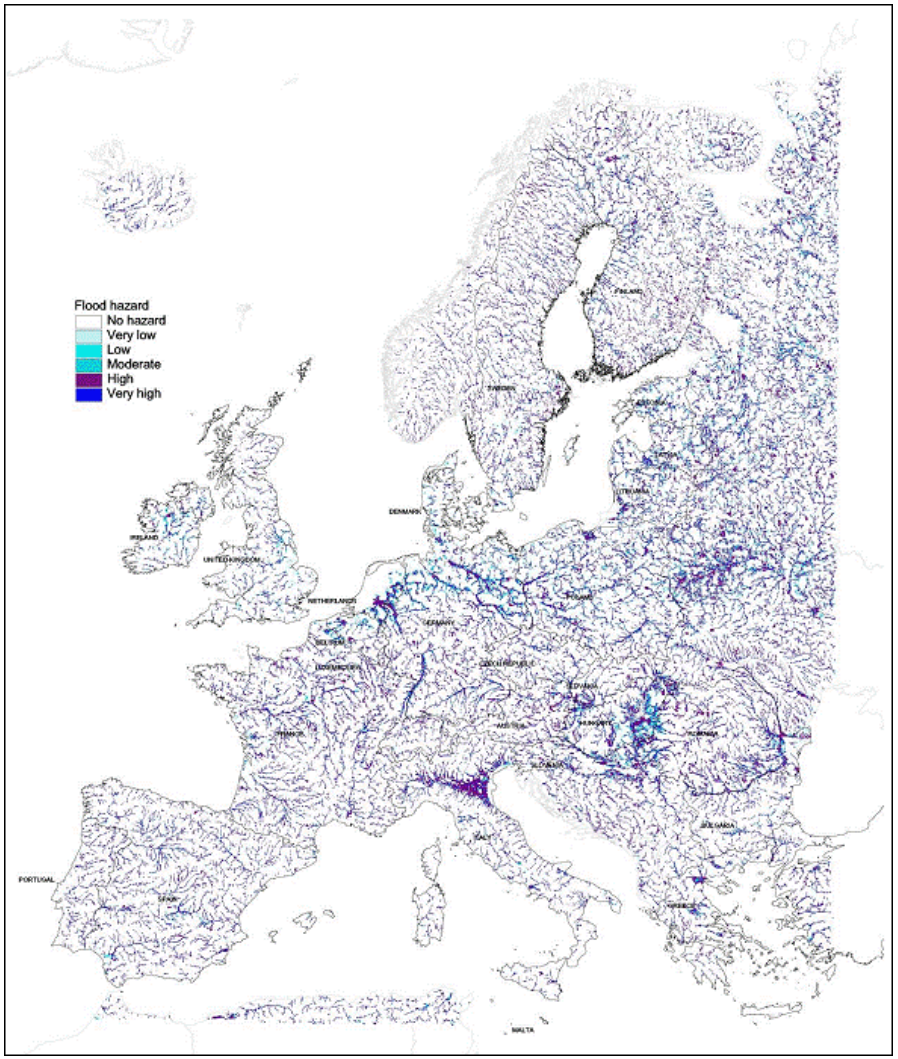
Climate change



Intensity vs. damage

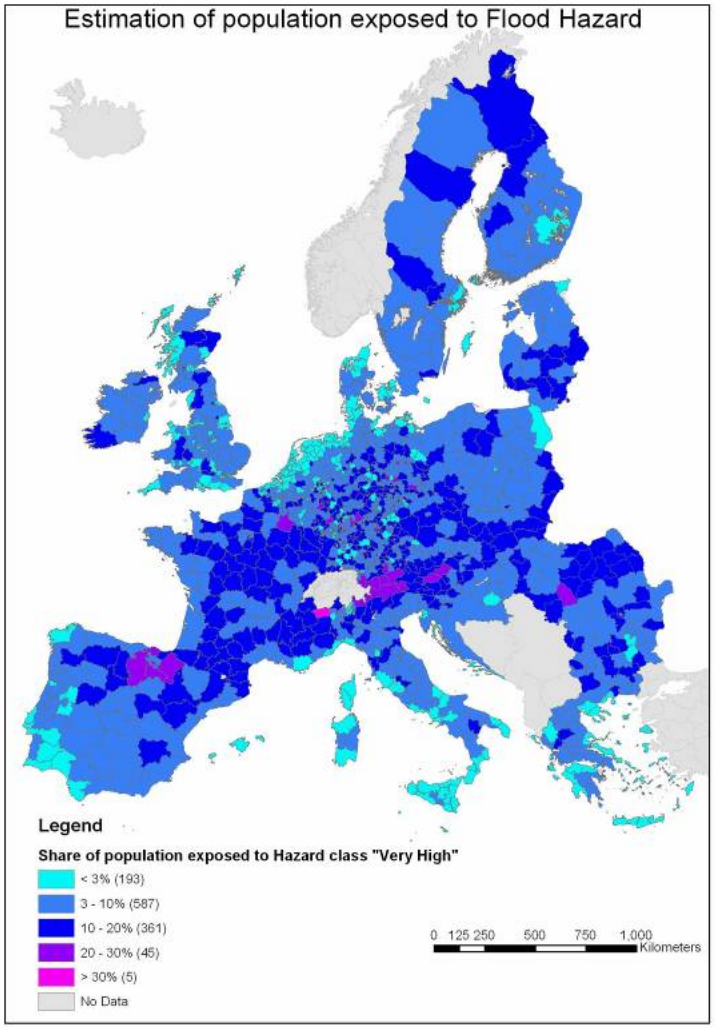
Vulnerability and adaptation

Floods: from hazard …



European Flood Hazard Map

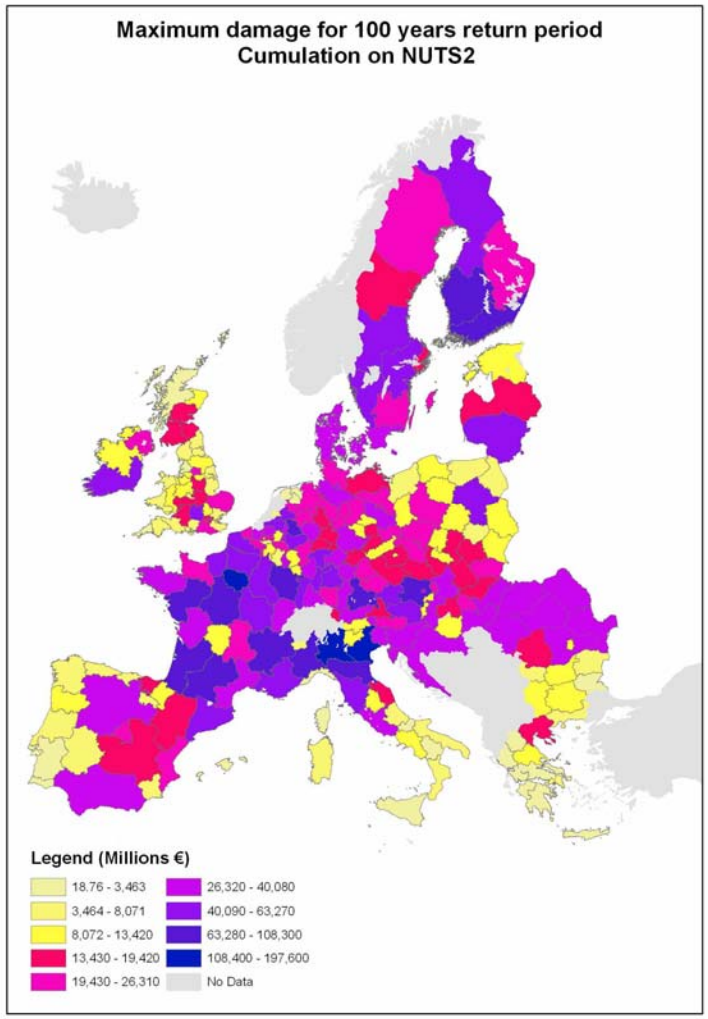
via exposure and vulnerability…



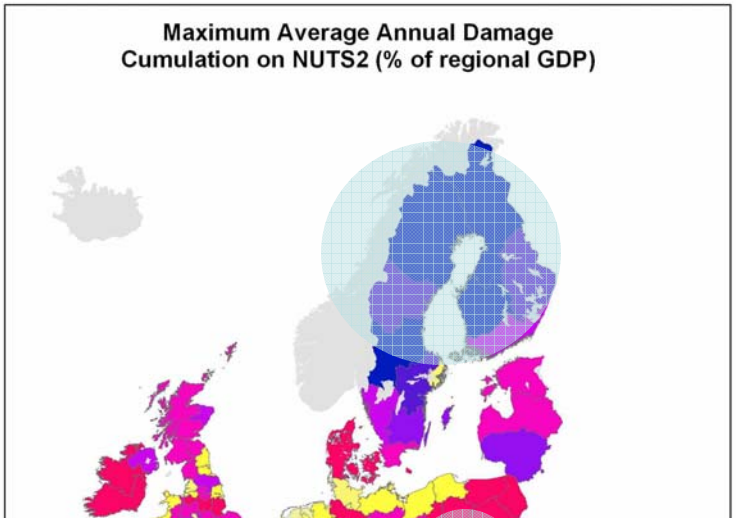
Population exposed to floods

to risk: asset losses in monetary terms

Damages for 100 year flood events



Risk in relative terms



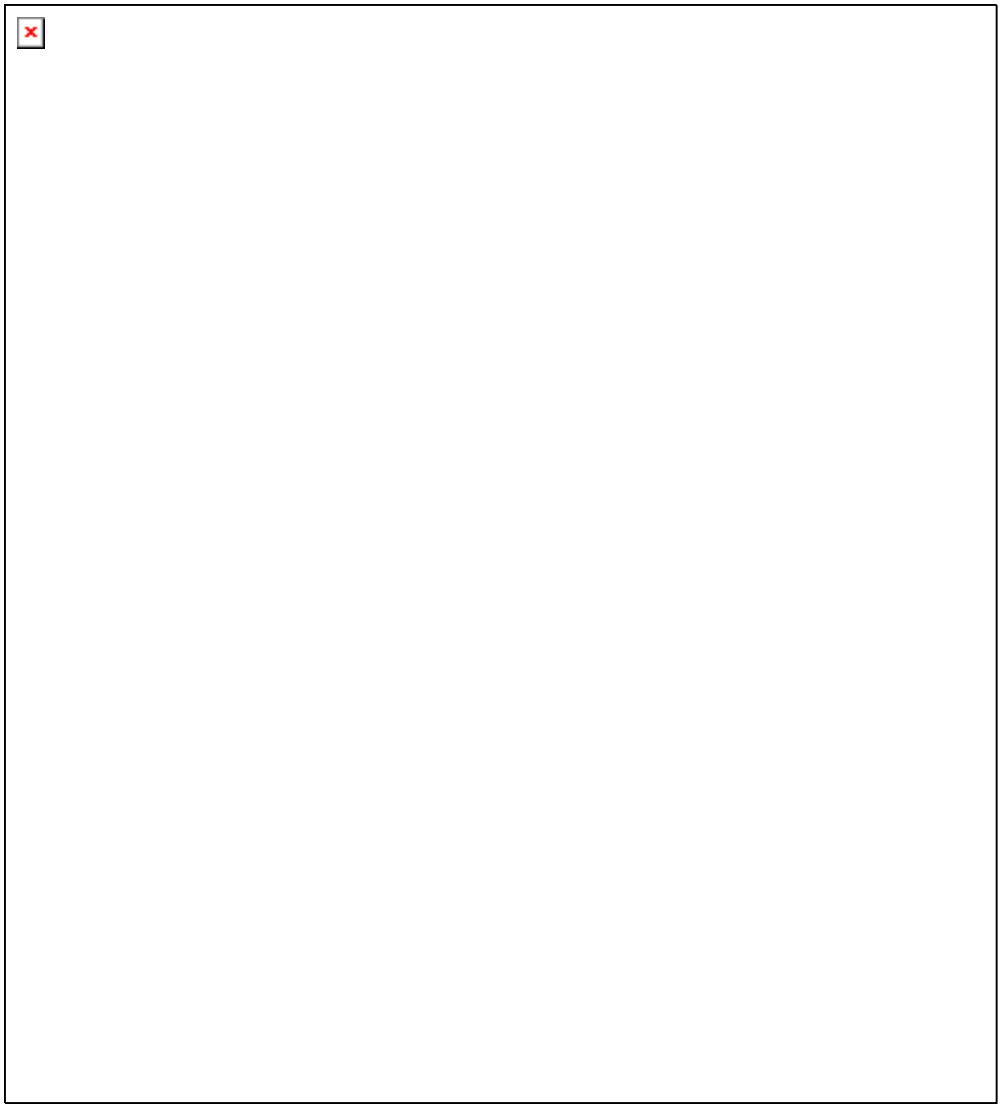
Hotspots?

In 50 European NUTS-3 regions (i.e. provinces) the share of population potentially exposed to high flood risk is above 20%;

Almost all of the 12 newcomers to the EU with potential average annual damage due to floods higher than 1% of GDP

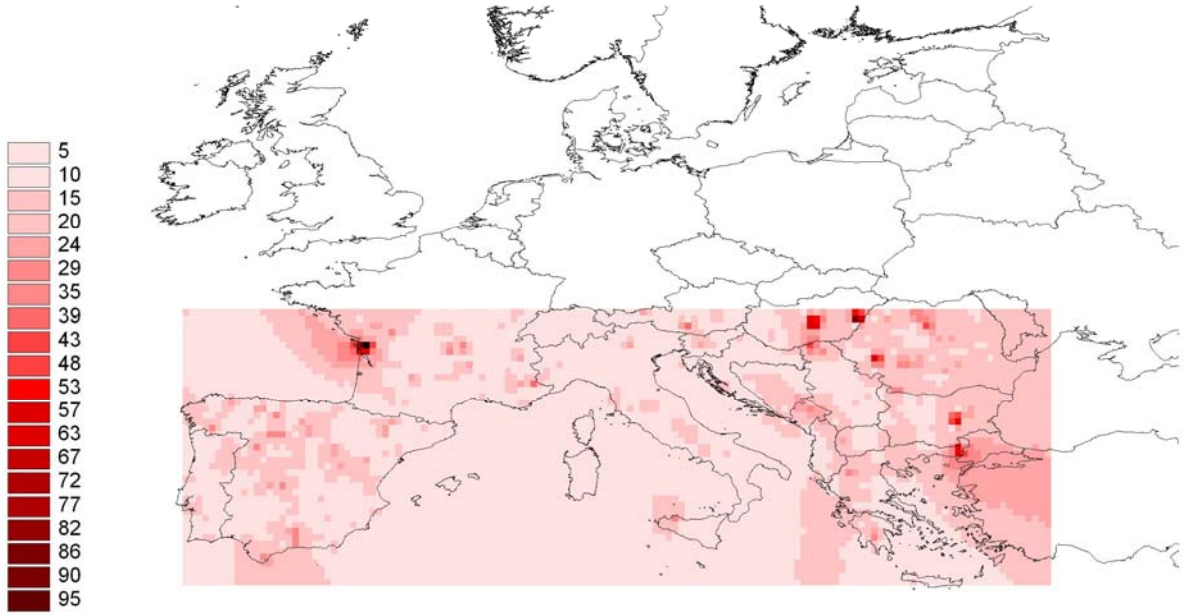
ıage
ınal GDP

Heat stress



Number of expected events with Temp. max>31°C during flowering period for the return periods of **10 and 20 years**, respectively

Agricultural risks due to heat and water stress

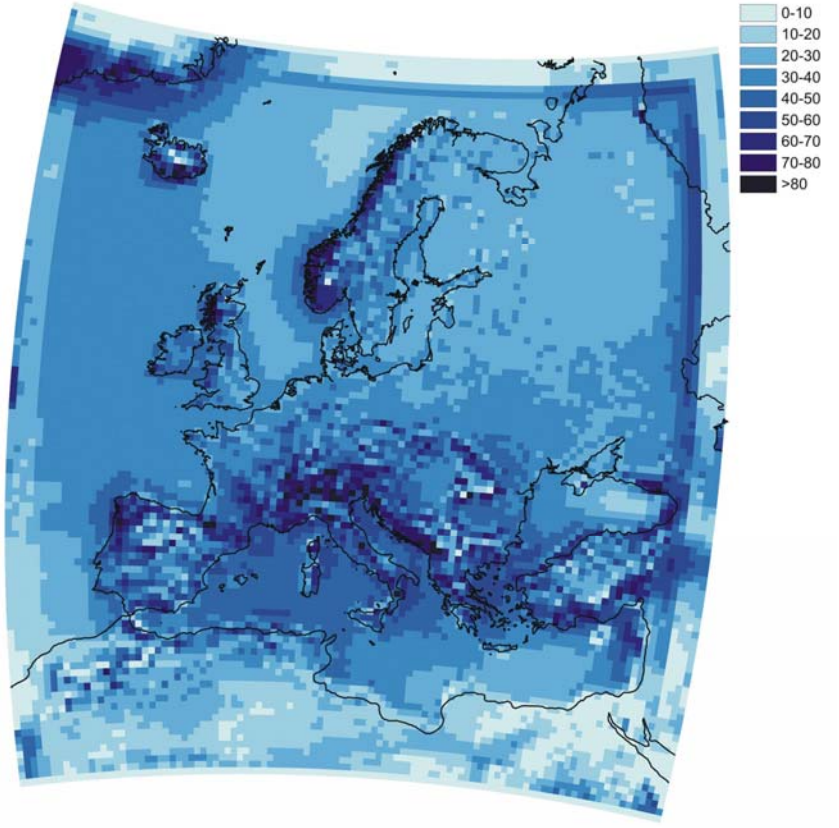


Euro/hectare

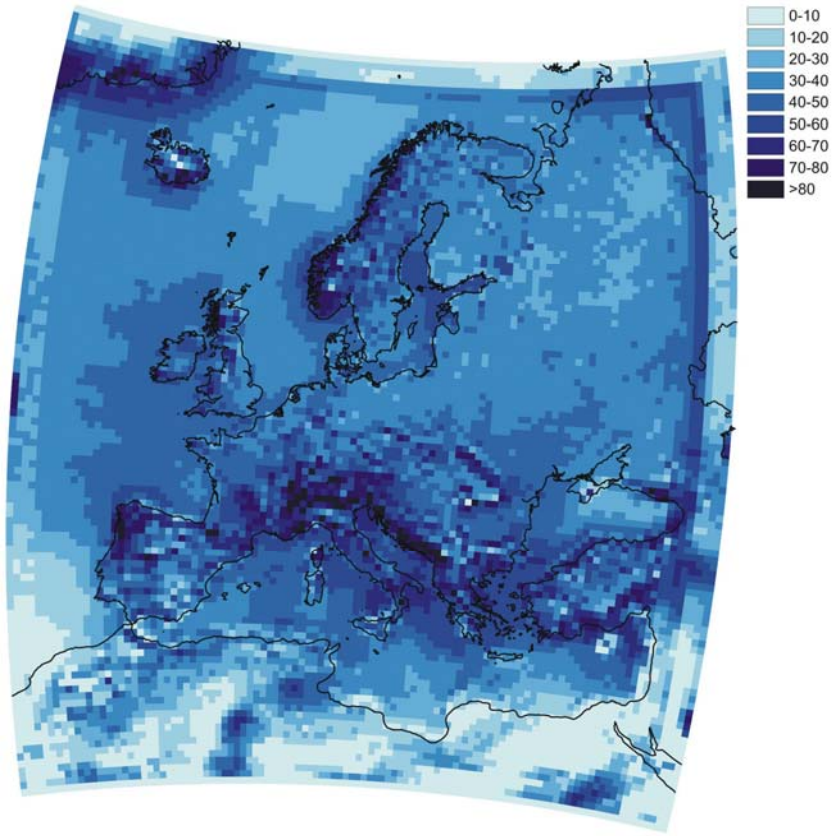
Potential economic damage (Euro/hectare) due to both heat and water stress, calculated for durum wheat for a return period of **20 years**

Future risk: heavy precipitation

Percentage share of heavy precipitation in total **annual** precipitation



Period 1961-1990



Projection for the 2090s (SRES A2 scenario)

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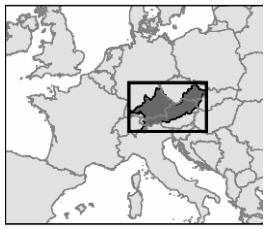
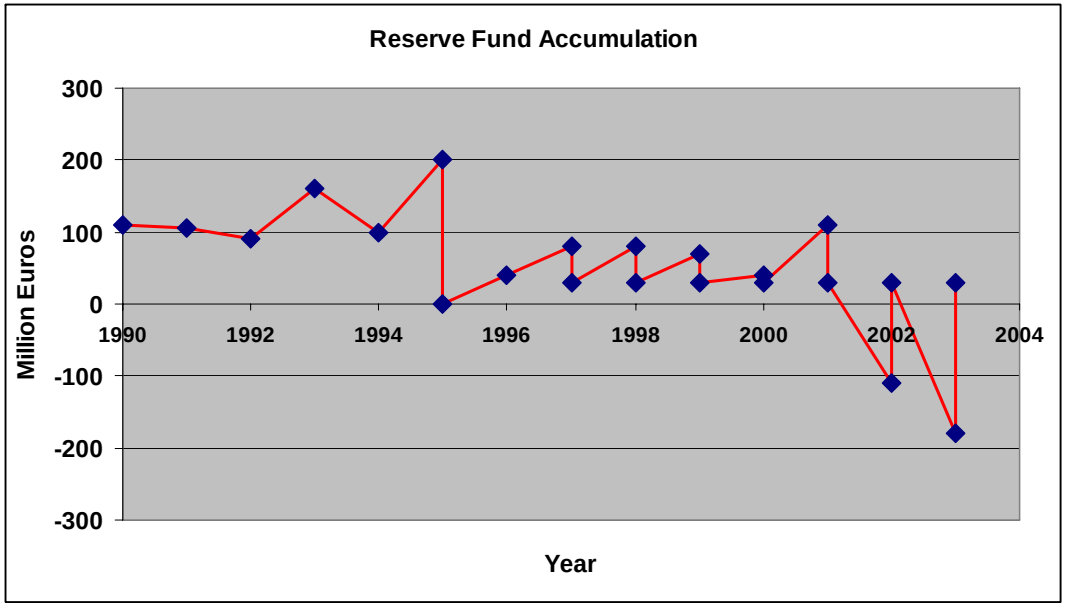
Case Study Austria



The Upper Danube catchment area

Financial vulnerability



Some EU countries/regions exhibit vulnerability

Year	Country	Nature of Disaster	First damage date	Total direct damage mill €	Category	Cost of eligible emergency operations	Eligible cost/total damage (%)	Aid/eligible cost (%)	Aid rate (% of total damage)	Amount of aid granted (mill €)
2002	Austria	Flooding	6.8.2002	2900	Major	1200	41	11.2	4.6	134
2002	Czech R.	Flooding	5.8.2002	2300	Major	1186	52	10.9	5.5	129
2002	France	Flooding	8.9.2002	835	Regional	225	27	9.3	2.5	21
2002	Germany	Flooding	10.8.2002	9100	Major	1699	19	26.1	4.8	444
2002	**Total**									**728**
2003	Spain	Oil spil	19.11.02	436	Regional	416	95	2.1	1.97	8.626
2003	Italy	Earthqu.	31.10.02	1558	Regional	248	16	12.4	1.97	30.826
2003	Italy	Volc.ea.	26.10.02	849	Regional	204	24	8.2	1.97	16.798
2003	Italy	Flooding	24.11.02	1900	Regional					
2003	Greece	Winter	1.12.02	-	Regional					
2003	Portugal	Fires	20.703	1228	Major	104	8	46.7	3.95	48.538
2003	France	Fires	2.7.03	531	Regional					
2003	Spain	Firees	1.8.03	53.2	Neighb.	29.2	55	4.6	2.5	1.331
2003	Malta	Flooding	15.9.03	30	Major	11	37	8.7	3.2	0.961
2003	Italy	Flooding	29.8.03	525	Regional	136				
2003	**Total**									**107.080**
2004	FR	Flooding	1.12.3	3.066	Regional	131.60	16.8	14.91	2.5	19.625
2004	ES	Flooding	27.3.04	3066	Regional					
2004	SI	Earthqu.	12.7.04	139	Regional					
2004	SK	Flooding	30.7.04	147	Regional					
2004	ES	Fires	17.7.04	3066	Regional					
2004	ES	Fires	12.8.04	3066	Regional					
2004	ES	Fires	24.7.04	3066	Regional					
2004	ES	Fires	27.7.04	3066	Regional					
2004	ES	Fires	26.8.04	3066	Regional					
2004	ES	Fires	28.8.04	3066	Regional					
2004	ES	Fires	30.6.04	3066	Regional					
2004	**Total**									**19.625**
2005	Bulgar.	Flooding	May 05	222.2	Major	144.4	65	6.7	4.4	9.7
2005	Bulgar.	Flooding	Aug. 05	237.4	Major	190.4	80	5.6	4.5	10.6
2005	Romania	Flooding	Ap./May	489.5	Major	160.8	32	11.6	3.8	18.7
2005	Romania	Flooding	Jul./Aug	1049.6	Major	247(')	23	21	5.0	52.4
2005	Austria	Flooding	August	591.9	Regional	196.2	33	7.5	2.5	14.7
2005	Slovakia	Storm	January	202	Major					5.6
2005	IT	Flooding		223 o.e.	Regional					
2005	Estonia	Storm	January	47	Major					1.3
2005	Latvia	Storm	January	192	Major					9.5
2005	Sweden	Storm	January	2297	Major					81.7
2005	Lithuania	Storm	January	15	Neighb.					0.4
2005	EL	Flooding		112	Regional					
2005	**Total**									**203.6**
	Total	**2002-2006**								**1058.3**

EU solidarity fund: set up in 2002 after severe flooding in Central Europe as an assistance mechanism for reconstruction and relief support for EU member countries and respective regions

Since then, more than 15 countries have asked and received assistance involving large and small EU members alike

IPCC, 2007 suggests drought and flood hazards will increase over Europe due to Climate Change

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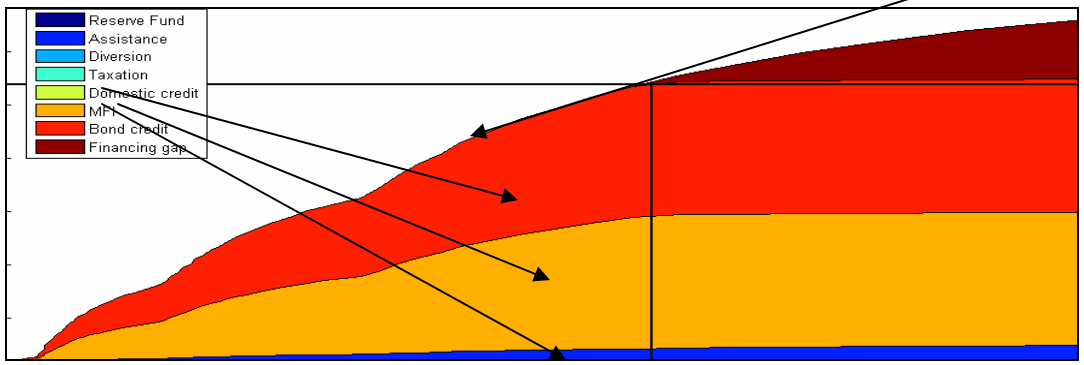
Financial vulnerability

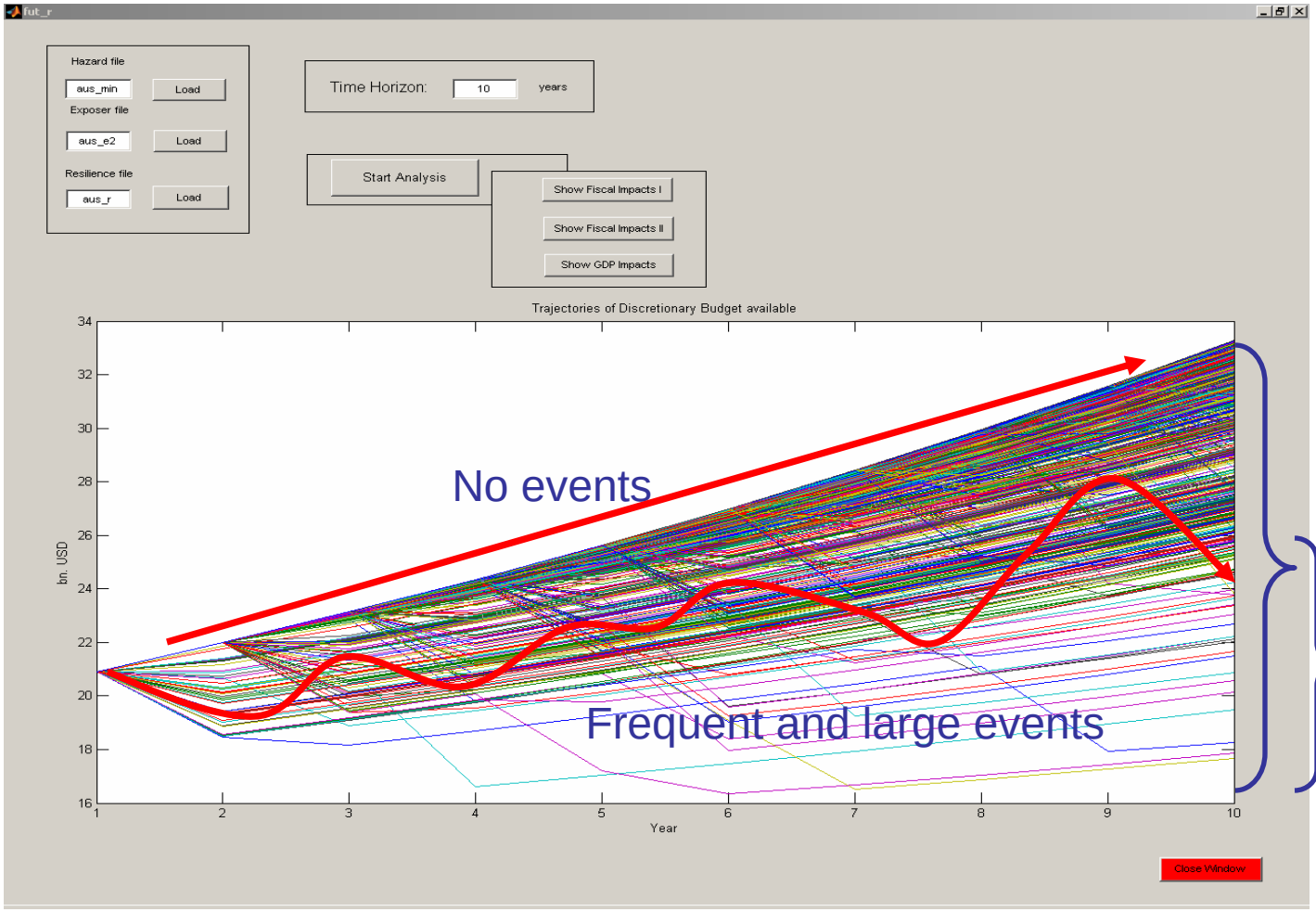
Sources for financing losses

Monetary risk function: losses vs. probability



Assessing public sector financial vulnerability to natural hazards

Fiscal Risks

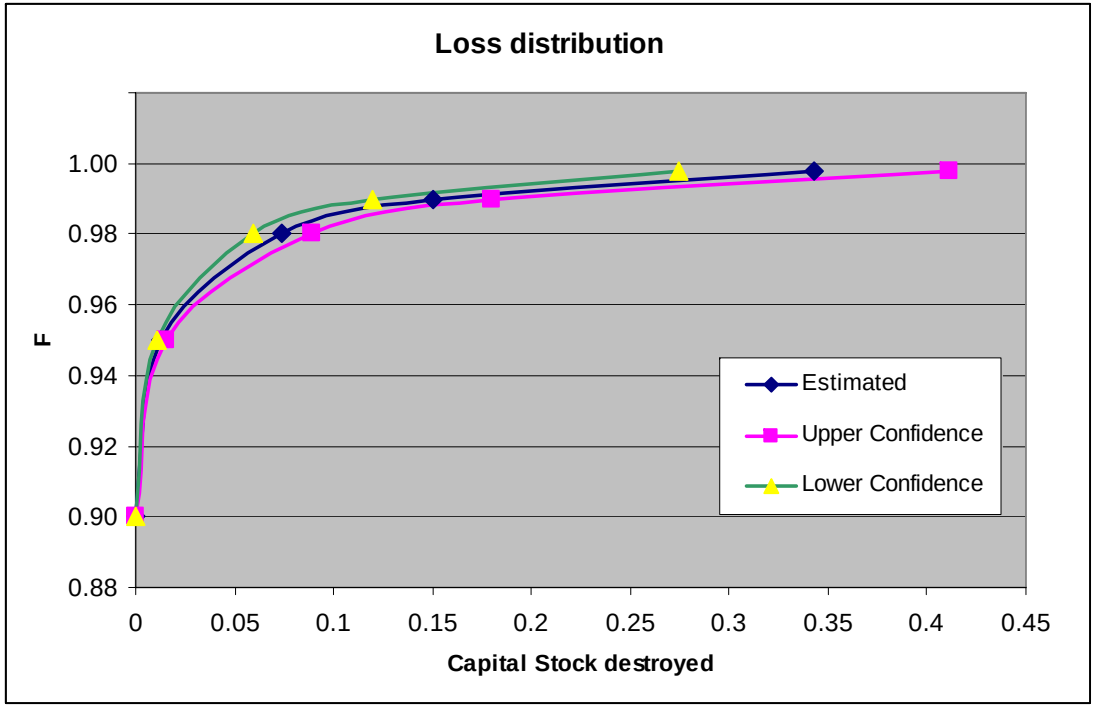


Fiscal Risk

80th percentile in future?

Trajectories of governments' variable (discretionary) budget for a time horizon of 10 years

Dealing with Uncertainties



Uncertainty is dealt with,
e.g through confidence intervals
based on JRC flood data

Adaptation

- Adaptation costs: in terms of opportunity costs via models (growth, equilibrium)
- Physical and financial adaptation
- Focus on promising options
- Beyond Cost Benefit: precautionary approach etc.
- Via expert opinion plus stakeholder process

Key ADAM outputs related to extreme events

- Open-source, probabilistic, focus on risk as outcome
- Monetary risk maps and hotspots
- Economic risks and adaptation for the public and economic sectors in hotspot countries in Europe
- Macroeconomic assessment of impacts and adaptation in EU for sets of countries
- Catalogue of “promising” adaptation options: costs and benefits
- Promotion of adaptation to extreme events via EU external assistance

Potential end users

- Public sector
  - Union: agriculture and forestry policies, solidarity fund and cohesion instruments
  - National: disaster management, fiscal and infrastructure planning
  - Regional: spatial planning
  - Local: adaptation planning
- Private sector
  - Agriculture: coping with heatwaves and drought
  - Energy: flood and storm impact on energy infrastructure
  - Insurance industry: risk
  - Households: risk incentives and perception

Comments? Questions?