

Quantifying indirect disaster losses: why and how?

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European Topic Centre on Climate Change impacts,
vulnerability and adaptation (ETC-CCA)



Euro-Mediterranean Centre on Climate Change

research & innovation - policy & cooperation

- Centre of competence for multidisciplinary research on climate change.
- *COPERNICUS Marine Environment Service, Mediterranean Monitoring and Forecasting Centre; COPERNICUS Seasonal forecast;*
- *Focal point of the Intergovernmental panel on Climate Change (IPCC).*
- **European Topic Centre on Climate Change impacts, vulnerability and adaptation.**
 - Disaster risk management – EEA CLIM039 indicator



Disaster losses: direct vs indirect

- **Stock** (productive assets) and **flows** (output)
- Emphasis on the primary **trigger** (primary/secondary effects) and perhaps **method**. More useful to focus on **loss distribution** and **resilience** (loss amplification/attenuation)?
- **Economic assessment** driven by purpose (whose losses?) as opposite to damage accounting (including SFDRR).
- [in an economy in equilibrium state] **assets value = net present value of its expected future production;**

i.e. $v(\text{Stock}) = v(\Sigma \text{Flow})$

hence $DL = v(\text{Stock})$ **OR** $DL = v(\Sigma \text{Flow})$

but $DL \neq v(\text{Stock}) + v(\Sigma \text{Flow})$



Disaster losses: direct vs indirect (cont.)

- **Consumption losses** (Hellegatte and Przymuski, 2010) equal to output losses and opportunity costs (output used for reconstruction instead of consumption).
- **Attention**, post-disaster economy not necessarily (more probably than not) in equilibrium state.

Too theoretical and useless for the scope of SFDRR?

- Sendai Framework: **Understand risk and strengthen resilience**
 - Does the proposed statistical accounting ('focus on direct losses, indirect losses too complex') principle serve this goal?



G20/OECD Methodological Framework on Disaster Risk Assessment and Risk Financing

When analysing impacts of disasters pays due attention to *expected sequence or chain of events, possible amplifiers, interdependencies and spillovers, expected duration of events, distribution of impacts*

Good practices for mitigating and financing catastrophic risks,
OECD Recommendation, 16 December 2010

Risk assessment should not be limited to the direct and immediate potential effects of a catastrophe (destroyed and damaged assets and affected victims) but also integrate secondary and indirect social and economic effects through geographical interdependencies and over time



Is it important in Europe?

Consolidation of economic and fiscal policies in Europe (*European Semester*)

DG ENV 2014 Study on economic and social benefits of environmental protection and resource efficiency related to the European Semester

Climate extremes: Defining a pilot approach on estimating the direct and indirect impacts on economic activity (Triple E Consulting for DG Clima)

- Short-term indirect impacts can represent up to **49%** of the direct damages.
- Data beyond direct economic losses **appears scattered or non-existing**



Examples

[1] Past event revisited, **Piedmont 2000** flood in Italy

[2] **Model comparison** on example of simulated levee breach
(informed by 1951 Polesine flood)

[3] Future, **climate change amplified flood risk** in Italy



Piedmont 2000 Flood

Carrera et al, *Environmental Modelling & Software* 63 (2015) 109-122

Several scenarios of productivity falloff and inter-sectorial recovery.

The flood damage estimated by SDC used to 'shock' the regional economy by weakening the primary factors' productivity (capital, land and labour) that are exogenous parameters of the CGE model.

Structural loss between 3.3 and 8.8 billion Euro (in 2000 values) depending on water depth assumptions. The indirect impacts between 0.64 and 1.95 billion Euro (19-22%), depending on the controlled flexibility of substitution and mobility (rigid-flexible) and the length of productivity falloff.



Model comparison

Koks et al, *Nat. Hazards Earth Syst. Sci* (2015) under review

Two hybrid multiregional IO models (ARIO and MRIA) and regionally calibrated version of a global CGE/ICES model (IEES) applied for two flood hazards (reconstructed and simulated) in the Po-river basin area. Three different recovery paths (concave, convex and linear).

Small differences in output loss across the models within the affected region; large differences between models for spillover effects.

		ARIO	MRIA	IEES - <i>Rigid</i>	IEES - <i>Flex</i>
Veneto	<i>Concave</i>	156.4	93.9	101.8	129.6
	<i>Convex</i>	430.7	634.0	344.7	438.6
	<i>Linear</i>	434.0	605.2	379.3	482.6
Emilia- Romagna	<i>Concave</i>	306.3	334.3	203.6	261.1
	<i>Convex</i>	863.7	1108.6	688.9	883.7
	<i>Linear</i>	870.7	1053.2	758.1	972.4

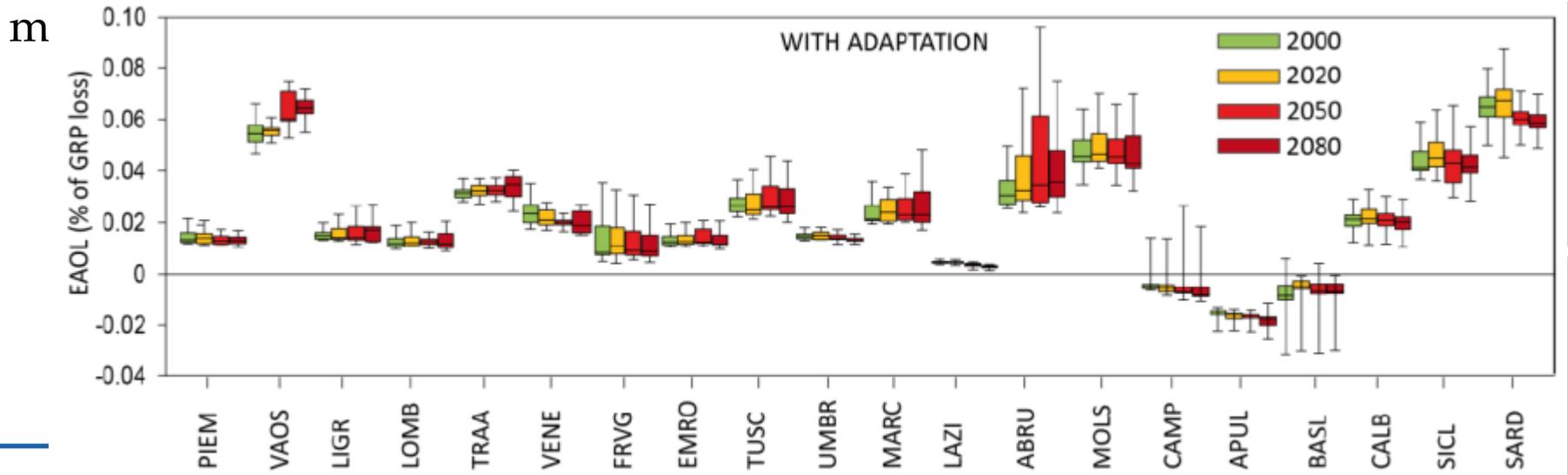


Flood risk assessment in Italy

Carrera et al, *Climatic change* (2015) (under review)

Flood hazard estimation (Rojas et al, 2013), forced with ensemble of 12 climate projections under the SRES A1B, combined with a regionally calibrated CGE model (R-CGE) to estimate EAOL per region in Italy.

Annual output losses to increase **fourfold** without adaptation. With adaptation, the losses more modest and more equally distributed. The largest share of output losses will be shouldered by Lombardy, Veneto, Trentino Alto Adige, Tuscany and Piedmont. With adaptation output losses are more

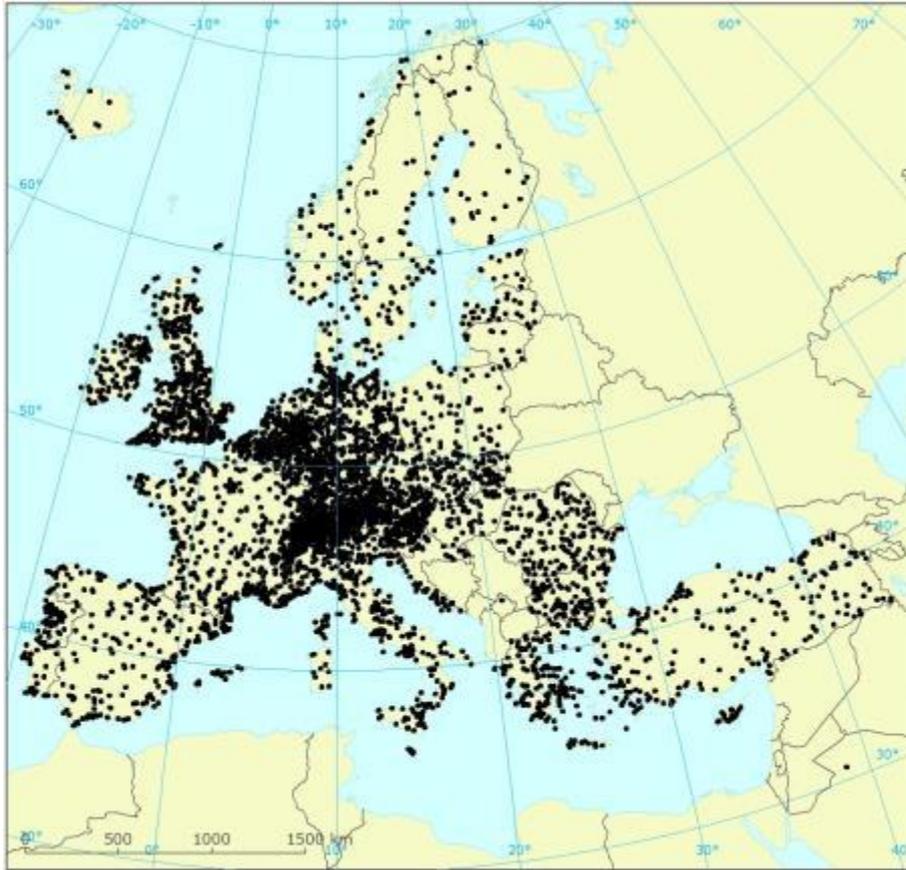


Outlook

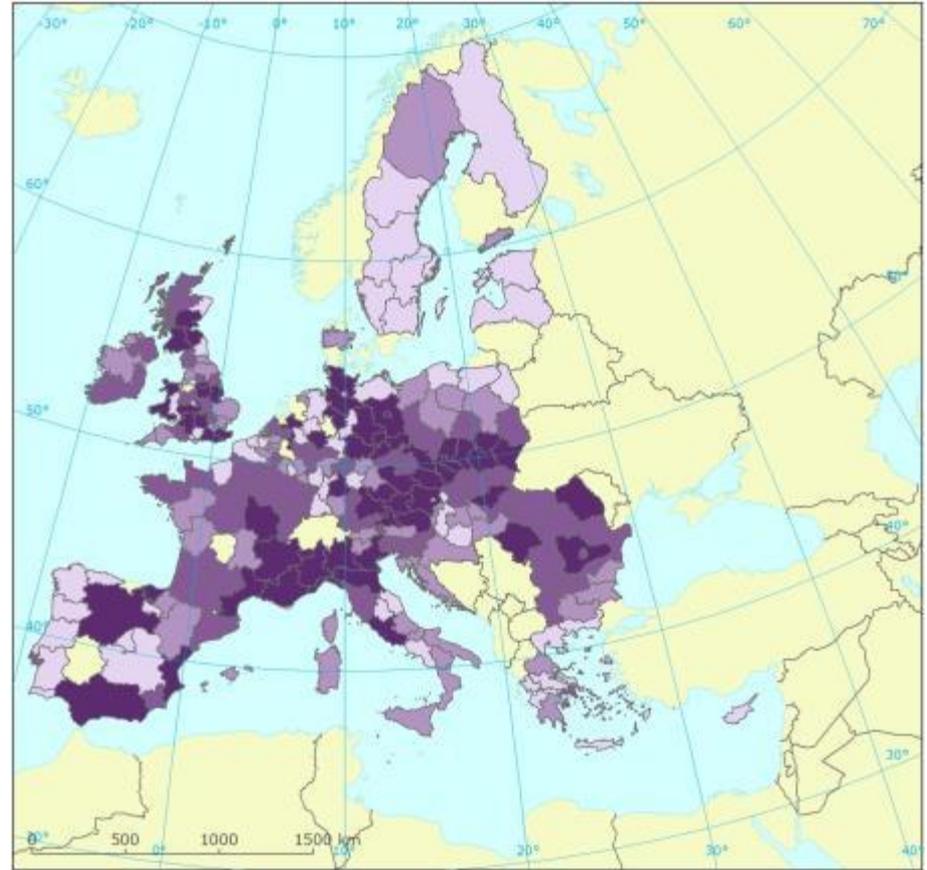
- In an increasingly interdependent **world** and, in **Europe**, inter-reliant regions, a better understanding of **distributional** and **spillover** effects of disaster risk **is critically important** for resilience enhancement,
- Increasing availability of macro-economic modelling tools at national and regional level makes assessment of full economic effects of single disaster events or comprehensive disaster risk **doable with very modest resources**,
- Various **policy contexts** benefit: Cohesion Policy; European Solidarity Fund (EUSF); multi-hazard risk assessment (CPM); economic and fiscal consolidation; Floods Directive, EC Adaptation Strategy etc.,
- Climate KIC (Pathfinder) project Cost Adapt (CMCC): Assessment of economic impacts of hazard risk and climate change on regional (NUTS2) level as a DRR and climate *adaptation service* [July – December 2015].



Excuse: EEA/ETC-CCA work on disaster losses



All MR events with additional information about location of damage...



... and distribution of flood losses across Europe



Thank you for your attention!

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