UR UNDERSTANDING RISK

Macroeconomic models for flood risk analysis:
impacts and climate adaptation benefits

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Assessing economic impacts and climate adaptation benefits for policy making

Relevant for:

- DRM and CCA policies

- Policy design

- Understanding response and recovery mechanisms

- Identify vulnerabilities and resilience

- Identify where/if potential gains can occur

- Which are the wide economic impacts of flood risk in a specific country and their distribution?

- Can we experience gains in non-affected areas?

- Are impacts buffered by resilient economies?

- What would be the benefits of DRM and CCA policies and actions – under a changing climate?

Type of losses

ASSET LOSSES

PHYSICAL STOCK

OUTPUT LOSSES

FLOWS

CGE model

- A Computable General Equilibrium model is a model that uses actual economic data to estimate how the economies react to **changes**.

- It is a **system of equations** which describe the **behavior of the economic agents** (representative household and firm), the structure of the markets and the institutions, and the links between them.

- Neoclassical spirit:

  - **Consumers maximize utility** subject to an individual budget constrain.

  - **Firms maximize profit** choosing the amount of inputs and outputs. Primary factors are owned by the household and are fixed in supply.

  - **Equilibrium in the market system** is achieved when the demands of buyers match the supplies of sellers at prevailing prices in every market simultaneously.

Case studies

Northern Italy 2000 flood event
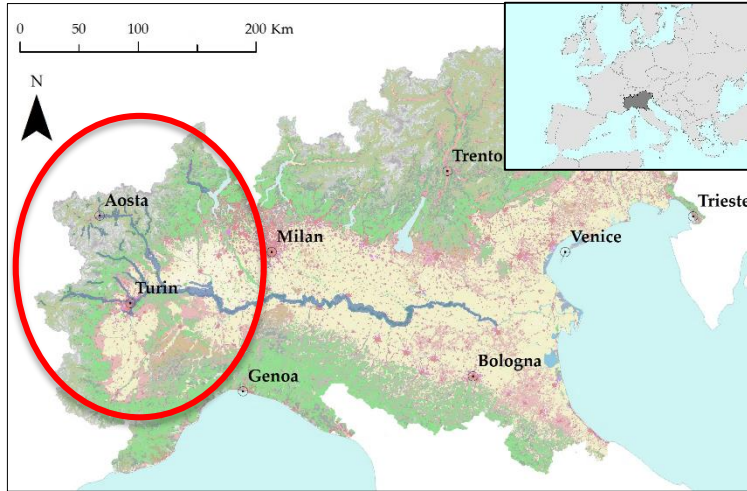
- 37 casualties

- 40,000 people were evacuated and 3,000 lost their houses

Asset losses estimations:

- **2.5 billion Euro** (Information System on Hydrogeological Disasters IRPI)

- **5.2 billion Euro** (Guzzetti and Tonelli, 2004)

- **8.6 billion Euro** (EM-DAT)
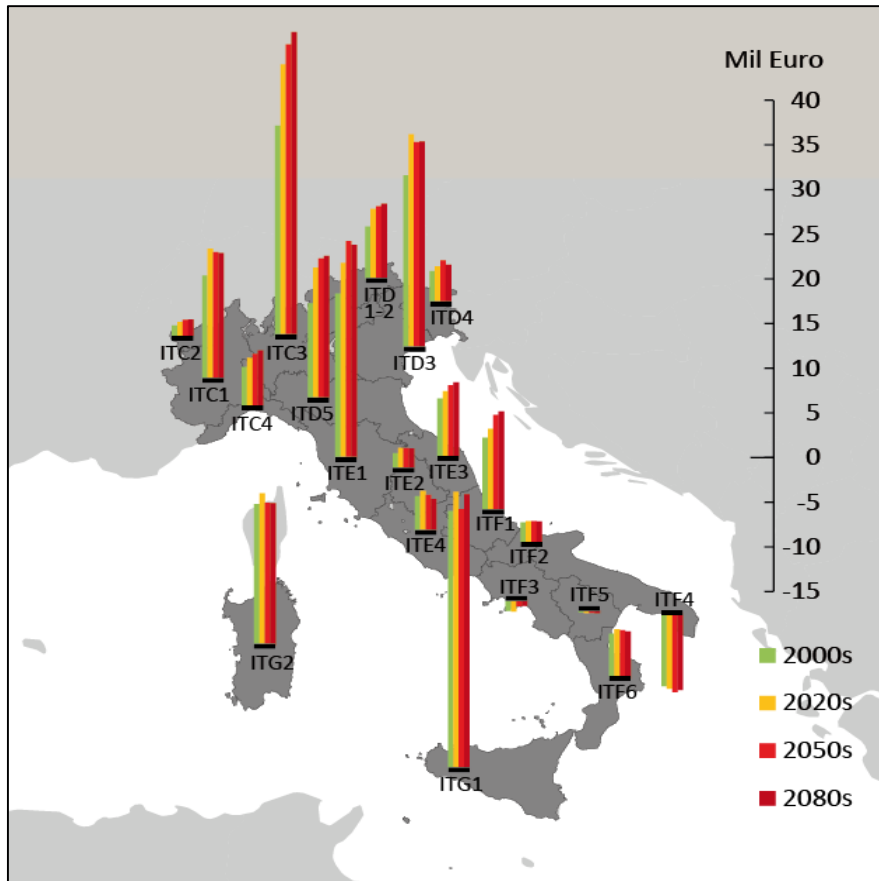
Ex-post assessment- outcomes

The integration of markets change the distribution of losses across the same country, but the national potential impact does not change significantly
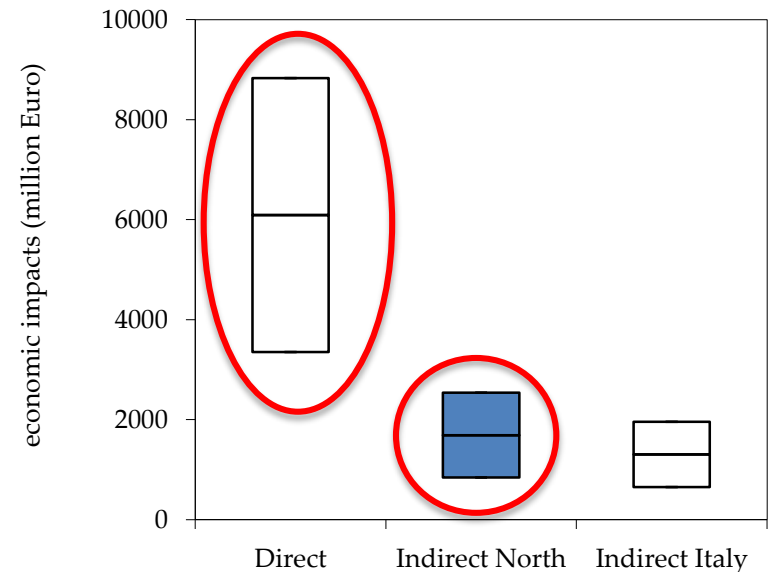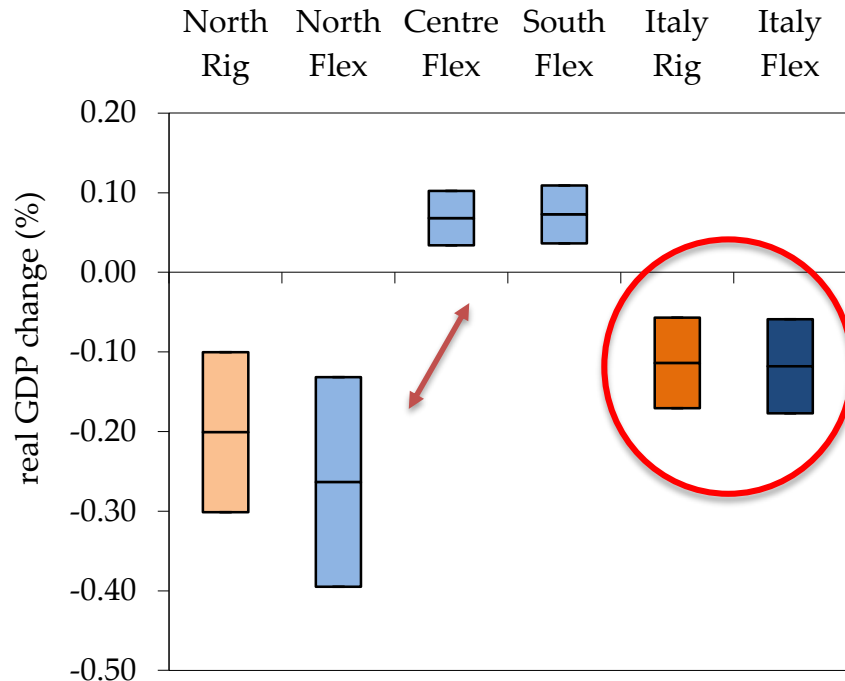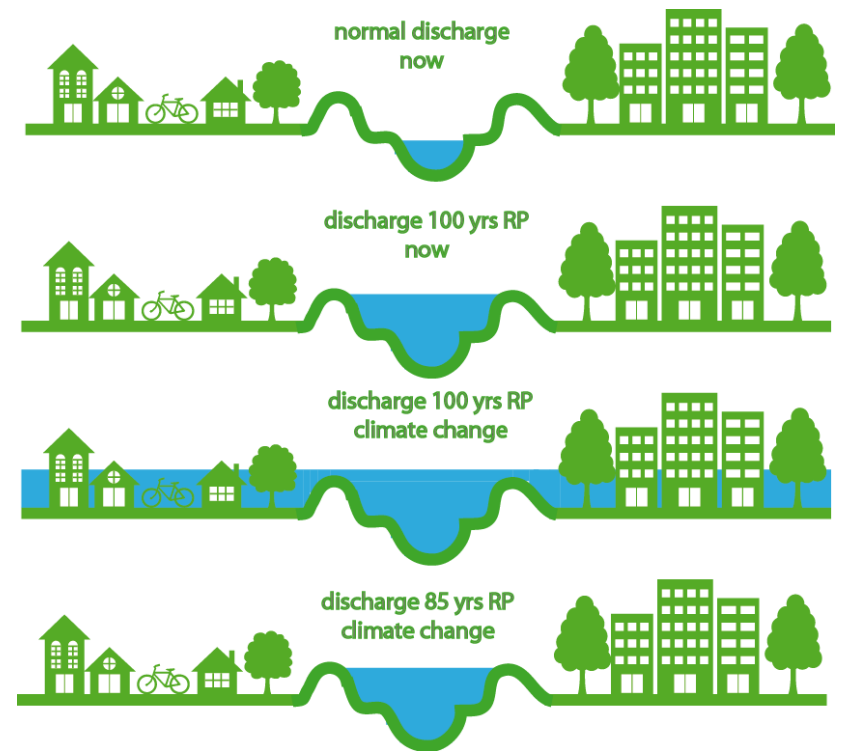

Range of sub-national and national GDP variations (in percentage of real GDP) for different type of models: rigid = rig, flexible = flex, depending on the different duration of the impact.

Range of asset and output losses using the flexible model (Euro 2000 value).

Economic risk assessment of flood risk in Italy under climate change


Mil Euro

2000s
2020s
2050s
2080s

Adaptation option: maintaining flood protection standard

normal discharge now

discharge 100 yrs RP now

discharge 100 yrs RP climate change

discharge 85 yrs RP climate change

Ex-ante assessment (Italy) - outcomes

- **In Italy expected annual losses** might reach around **600 million Euro/year without adaptation** (from around 200 mil Euro/year) by the end of the XXI century. Large economies of Northern Italy will burden the highest share of losses.

- **Adaptation** of flood protection standards to changing river discharge conditions can **reduce annual losses up to 70%**

- Different **distribution of losses** with CCA policies (more homogenously distributed)

Distribution of losses across the country %
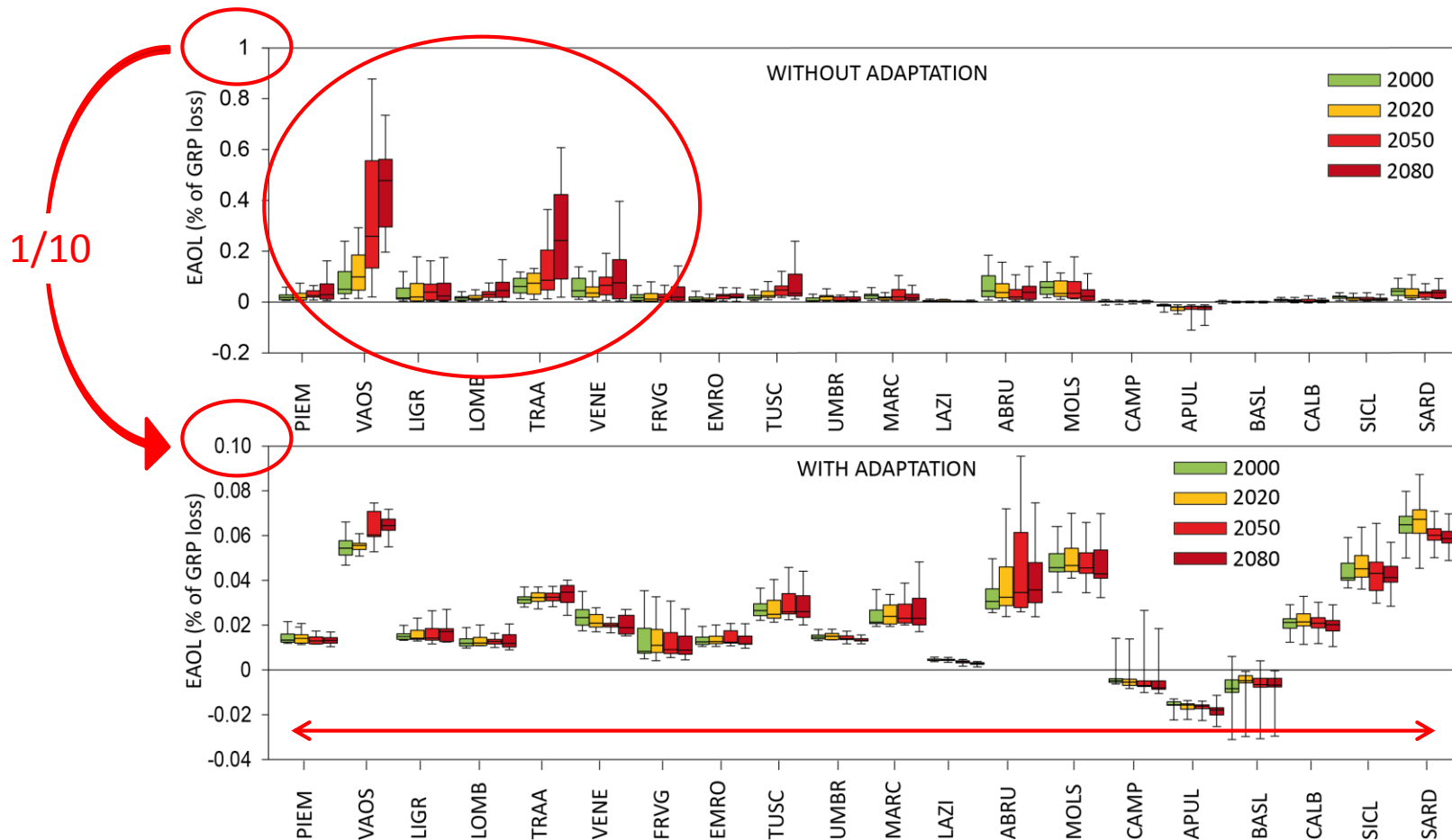
EAOL (in percentage of GRP) by region for the 2000s, 2020s, 2050s, 2080s periods under climate change, without and with adaptation. Five-numbers summaries of 12-member ensemble of regional climate simulations.

Take home messages

- The models presented, and their results, shall not be treated as **crystal balls** to predict precise economic flood losses;
- Their usefulness owes **less** to their **predictive accuracy**, and **more** to their ability to **shed light on the mechanisms** through which impacts are transmitted across economies and societies;
- They are **laboratories,** within which to analyze the dynamics of the interactions from which impacts and risk arise.
- Limitations: more **observation needed** for model calibration.

- Within these boundaries, their **policy relevance** is key to CCA and DRM interventions.
- Differential **distribution of impacts** across a country or region – e.g. impacted and non-impacted areas.
- Useful for economic analysis of DRM interventions, e.g. triple dividend of resilient.

Thank you

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