

Promoting disaster preparedness and resilience by co-developing stakeholder support tools for managing the systemic risk of compounding disasters- the EU PARATUS project



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This project has received funding from European Union's Horizon Europe Research and Innovation Programme under Grant Agreement N°101073954.



UNITED NATIONS
Office for Outer Space Affairs



Centre for Disaster Resilience

- ITC is recognized worldwide for achievements in teaching, research and capacity development in the field of geo-information science and earth observation.
- ITC provides international postgraduate education, research and project services.
 - Disaster Management
 - Food security
 - Smart cities
 - Water management
 - Biodiversity, ecosystems
 - Governance
- Projects-Science-Education are Integrated
- Focus on delivering stakeholder relevant products: handbooks, WEB-based analysis tools, **open source software**, training material based on local data





#HorizonEU



**IMPLEMENTING SEVEN HORIZON EUROPE AND TWO OTHER EU PROGRAMMES¹
WITH €22.7 BILLION² FROM 2021 TO 2027 IN PARTNERSHIP WITH 7 COMMISSION SERVICES**

● DG Research and Innovation

● DG Education, Youth, Culture and Sport

● DG Agriculture and Rural Development

● DG Communications Networks, Content & Technology

● DG Migration & Home Affairs

● DG Environment

● DG Employment, Social Affairs and Inclusion

Horizon Europe



€6.2 billion



€1.8 billion



€3.1 billion



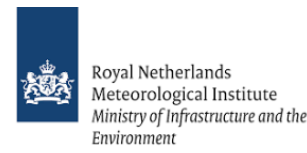
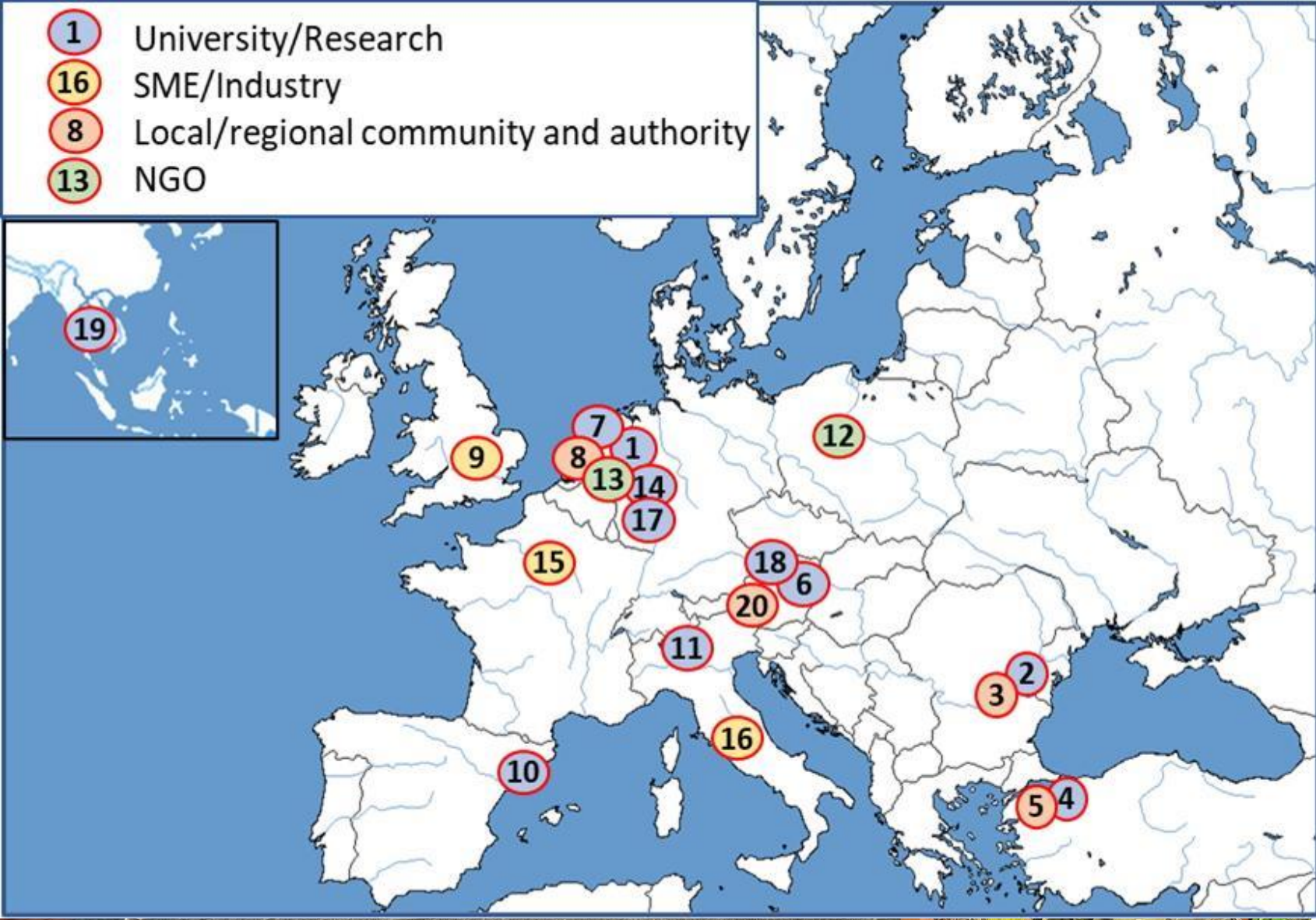
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Losses from natural, accidental and man-made disasters are reduced through enhanced disaster risk reduction based on preventive actions, better societal preparedness, and resilience and improved disaster risk management in a systemic way."

- 5 million Euro
- 1 October 2022
- 19 partners
- representatives of scientific areas that are related to disaster risk management, societal and historical aspects;
- as well as local or regional communities and authorities, from at least 3 different EU Member States or Associated countries.



- 1 University/Research
- 16 SME/Industry
- 8 Local/regional community and authority
- 13 NGO



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Looking back: learning from historical data



Flood of the [Geul](#) in the centre of [Valkenburg aan de Geul](#), Netherlands / Source: Wikipedia

to **understand**
and **analyse** the
dynamic and
interactive
conditions of risk

to **make better**
predictions for the
future

cross-border cooperation

a strong debate on the early
warning system

the awareness, risk perception
and behaviour of the population.





Looking back: learning from historical data



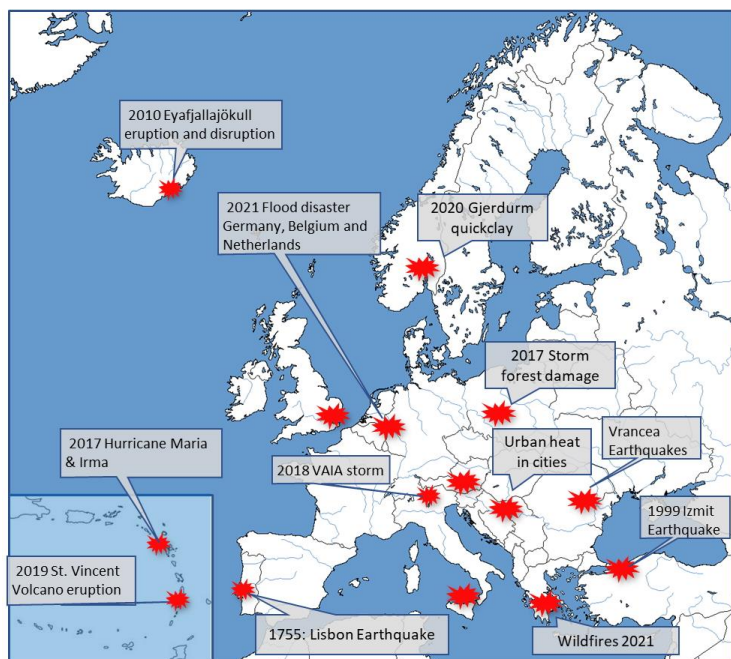
Challenge:

**Post-Disaster Need
Assessment**

Physical damage

Economic loss

Recovery cost



Estimation of Impacts and losses of future events





Looking back: learning from historical data



Proposed Solutions: "Past is the key for the future"

Forensic Analysis

Remote sensing monitoring

Disaster Databases

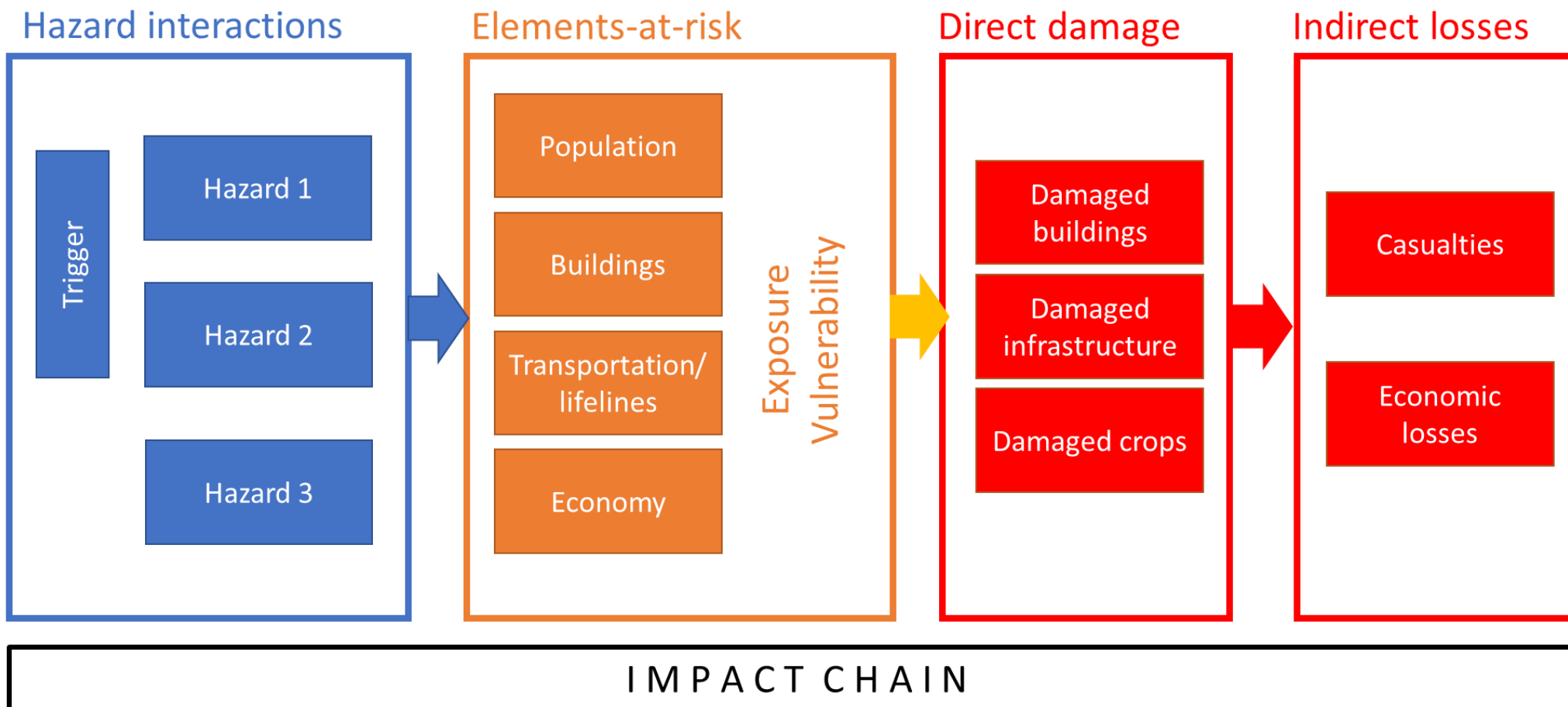
R1: a standardized participatory methodology and a toolbox for co-developing impact chains

R2: to augment historical disaster mapping with hazard interactions and sectorial impacts.

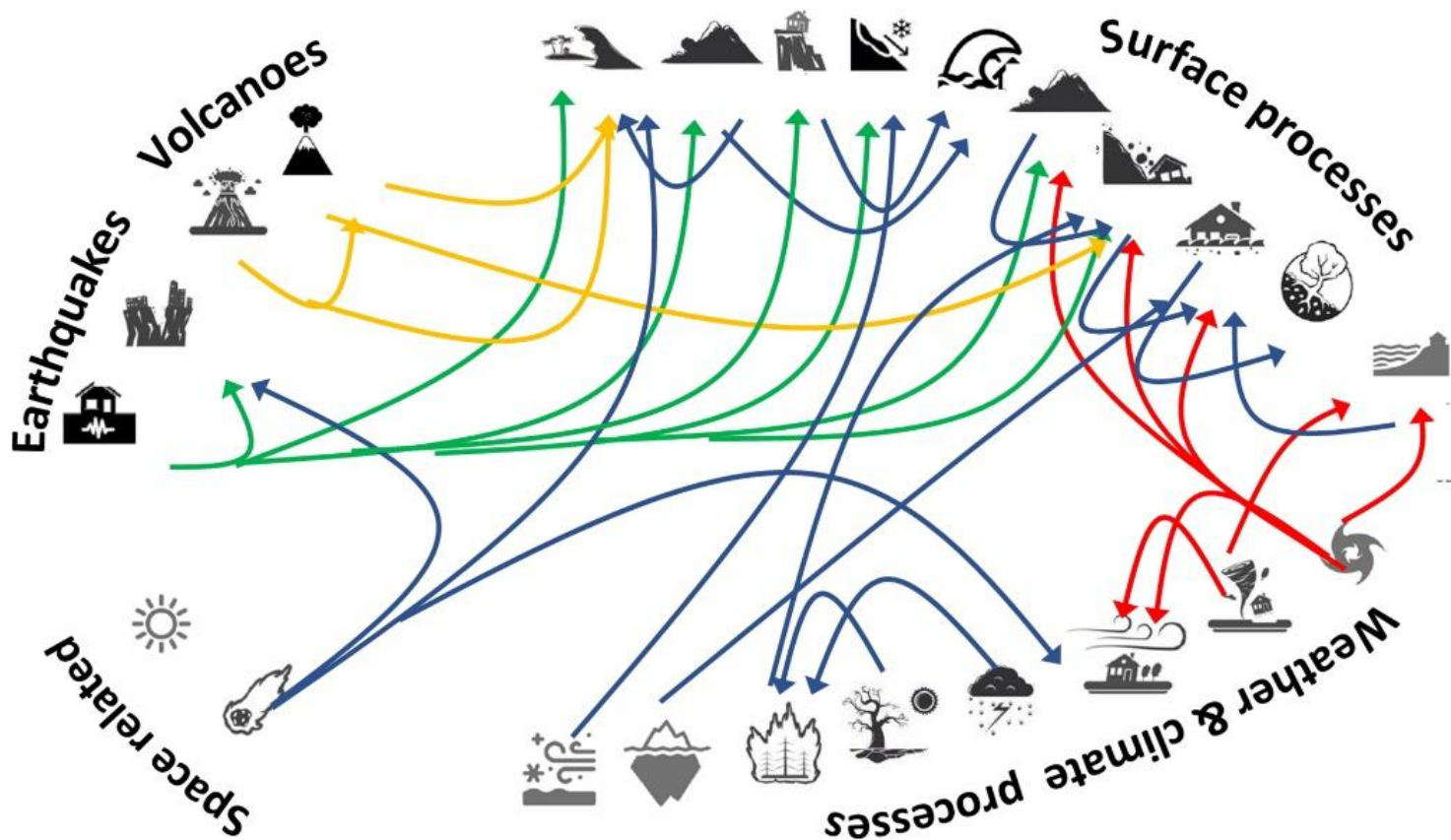
R3: to improve data on historical events and for multi-temporal exposure datasets



Impact chains



Hazard interactions



to **assess** multi-hazard and multi-sector impact chains

to **codeveloped** scenarios considering changes in climate conditions and dynamic exposure information and their interactions

A look into the past



Carrington's event



Hurricane Katrina



Eyafjallajökull Eruption



Kerala Floods

1859

2005

2010

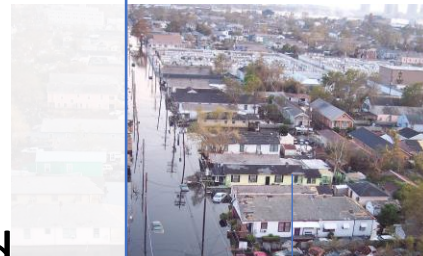
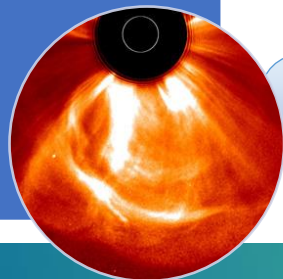
2018



A look into the past

- Most powerful geomagnetic storm recorded
- Failure of telegraphic systems in Europe and North America
- Near miss in 2012

Carrington's event



Hurricane Katrina



Eyafjallajökull Eruption



Kerala Floods

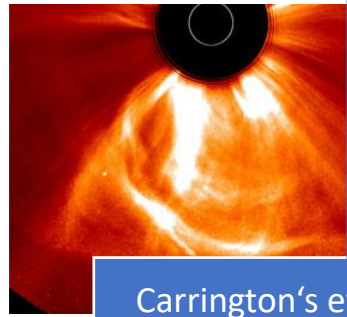


2005

2010

2018

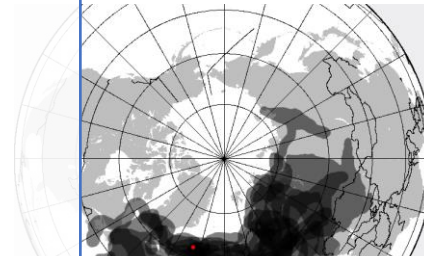
A look into the past



Carrington's event

- 1800 fatalities, \$125b damage
- 80% of New Orleans flooded
- Communication and transportation destroyed

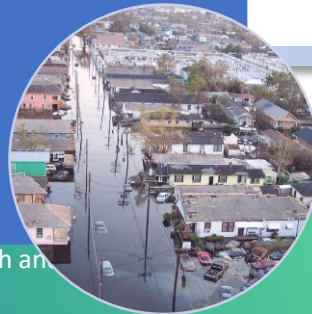
Hurricane Katrina



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A look into the past



Carrington's event



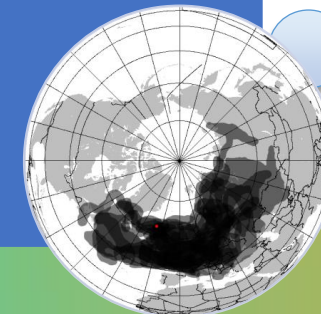
Hurricane Katrina

- VEI4 eruption
- Highest air travel disruption since WWII
- 10m passengers affected, \$1.7b damage



Kerala Floods

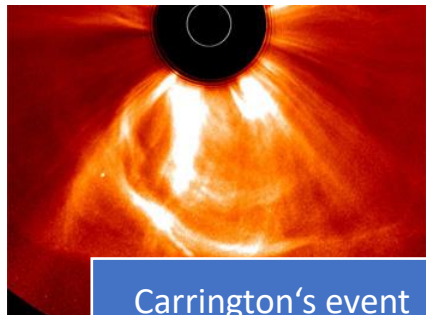
Eyafjallajökull Eruption



1859



A look into the past



Carrington's event



Hurricane Katrina



Eyafjallajökull eruption

1859

2005

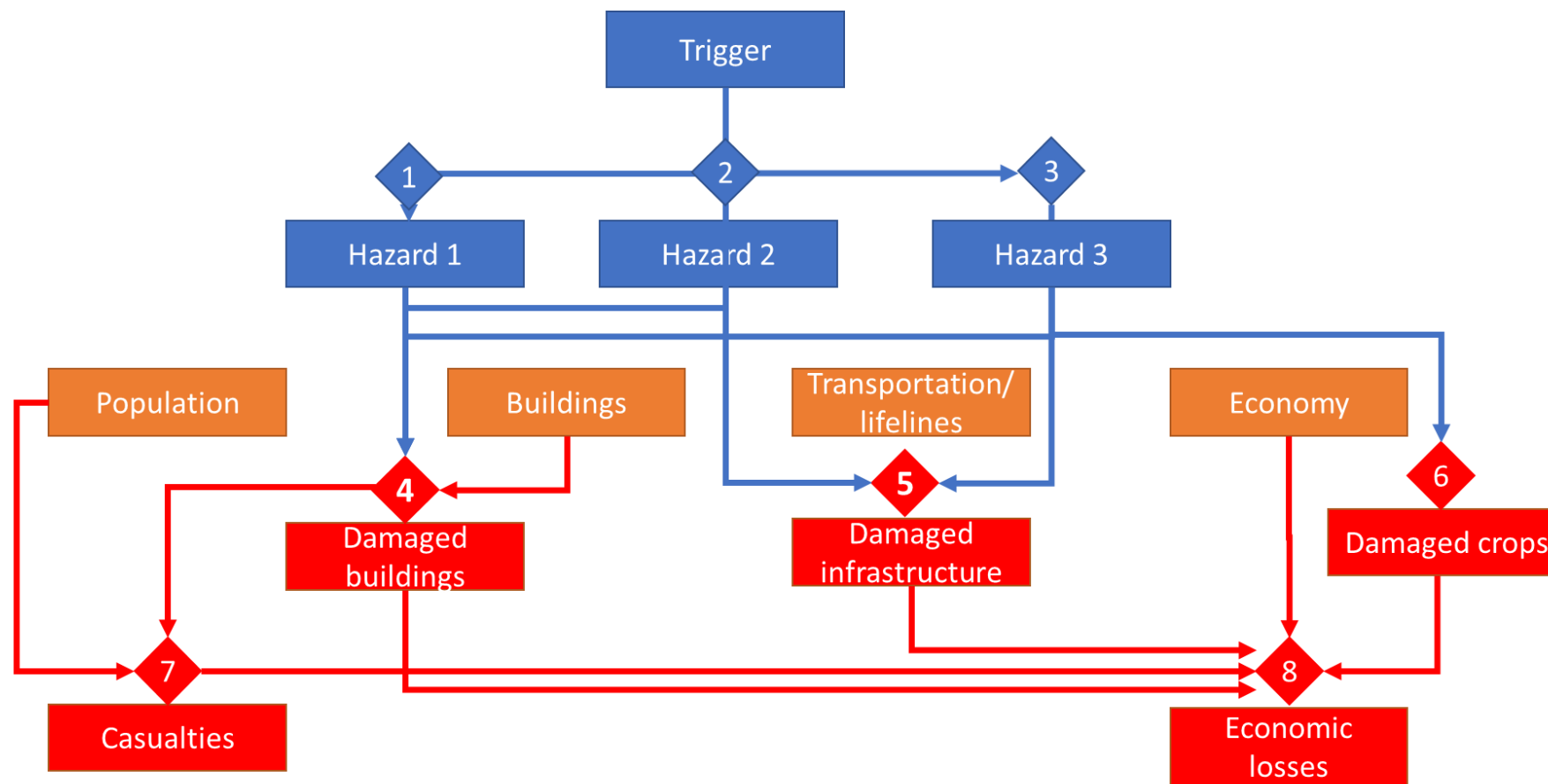
2010

- 483 deaths, >1m evacuees
- 10'000km roads destroyed
- Severe drought followed
- 2019 and 2020 events

Kerala Floods



Impact chain definition

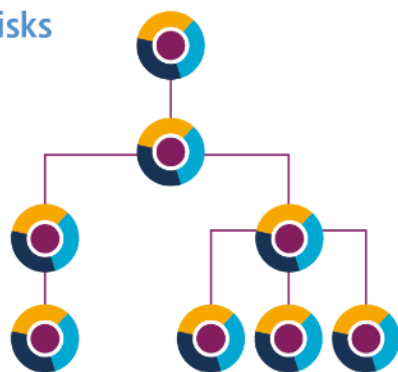


Multi-hazard impact chains

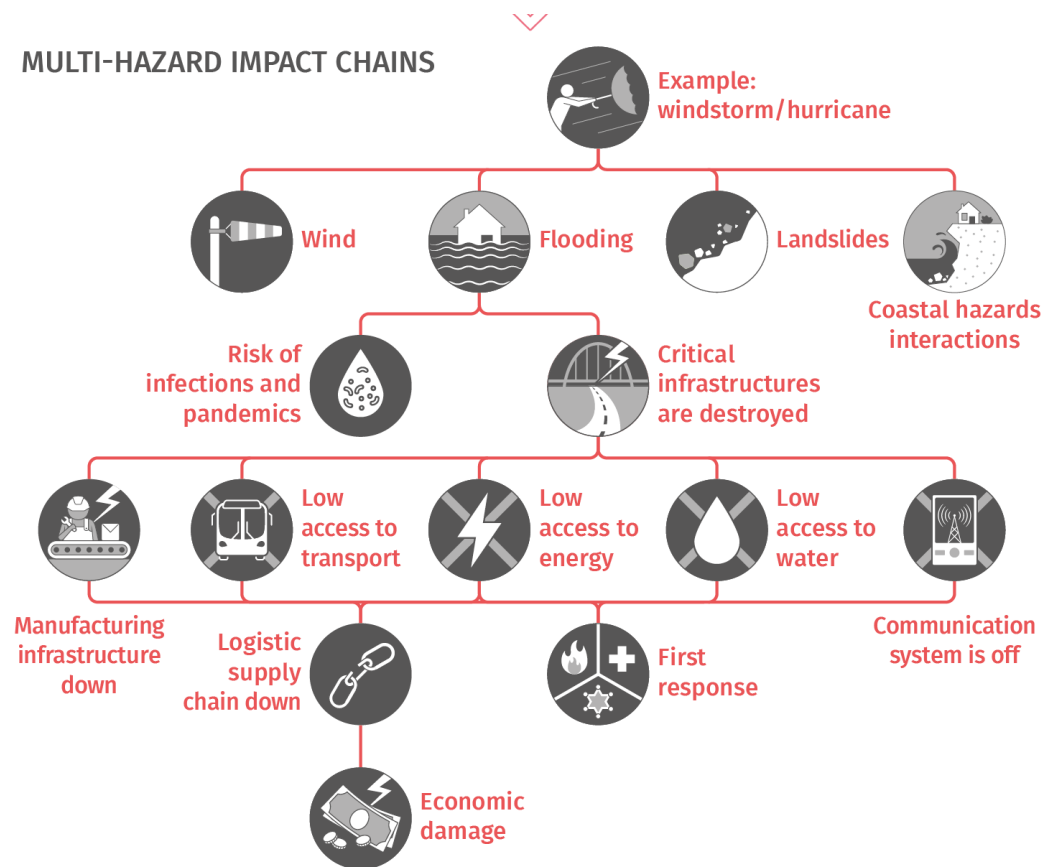
Compound risks



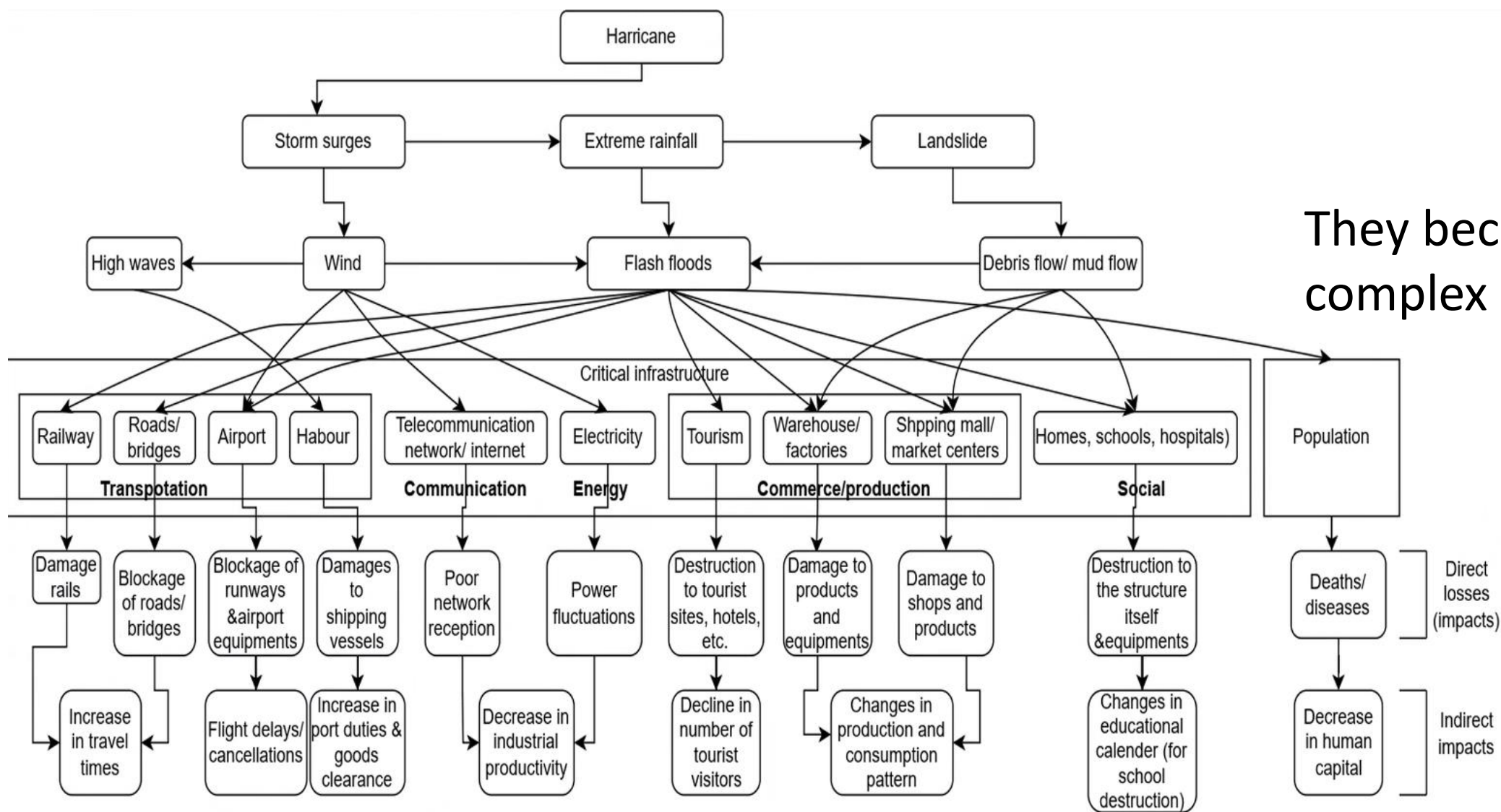
Cascading risks

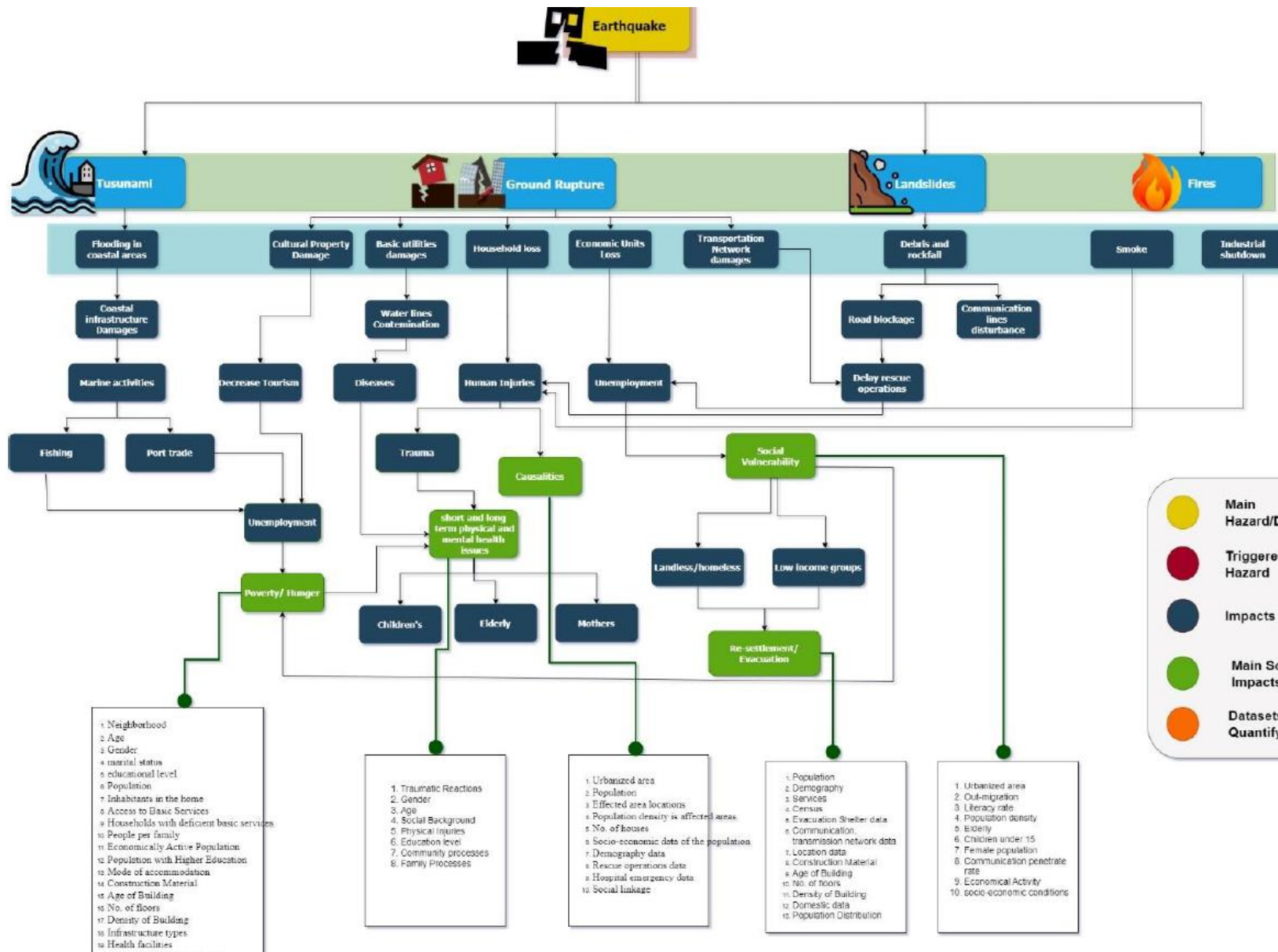


MULTI-HAZARD IMPACT CHAINS



They become really complex



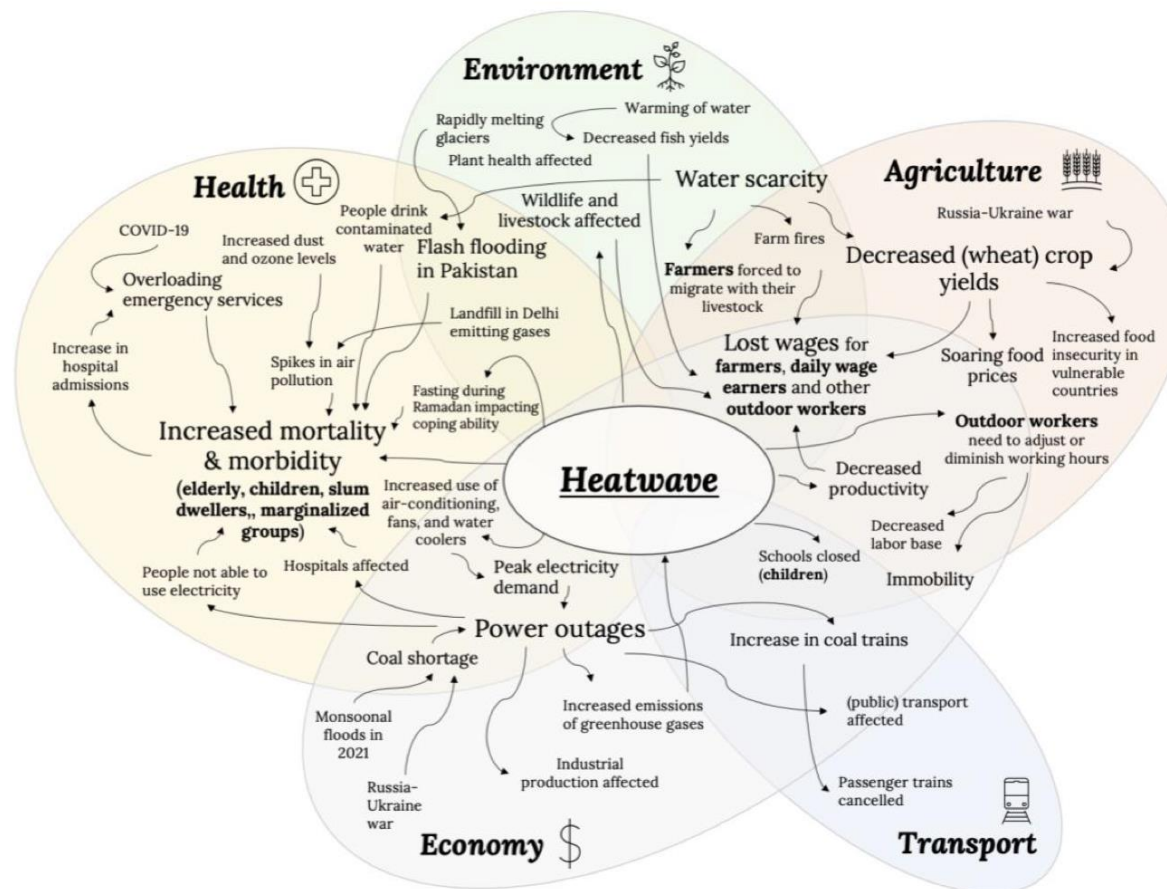


Should be broken up into components



Multi-hazard impact chains

- Event specific
- Sector specific
- How to describe?
- How to quantify?



Application case study areas: Caribbean islands

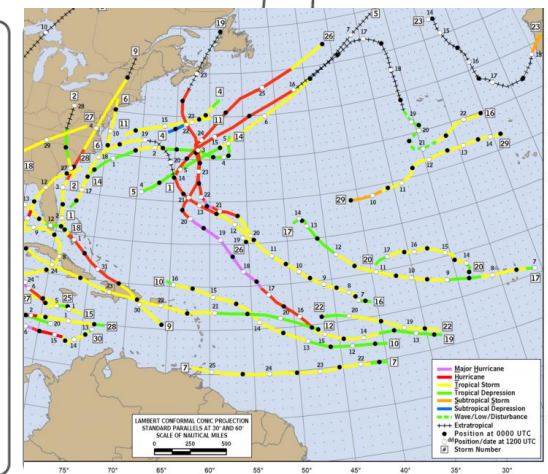
- **KNMI** as case study coordinator
- Multi-Hazard Early Warning Platform
- **Impact-based forecasting for humanitarian response planning** (Netherlands Red Cross as key stakeholder)
- **Communications** (Radiocommunications Agency Netherlands, Caribbean Desk & Local Communication organisations)
- **Hazards:** tropical storms (extreme wind, rainfall, windfall, storm surge, flash floods, debris flows and landslides), earthquakes, tsunamis, volcanic eruptions (and associated hazards, such as ash cloud dispersal), pyroclastic flows, lava flows and lahars



CARRIBEAN

Multi-hazards: tropical storms, volcanoes, space weather, earthquakes

Impact in sectors: humanitarian, preparedness, telecommunication, tourism, cross-border transport



Application case study area: Alps

- UNIVIE as case study coordinator
- the interruption of cross-border transportation
- Hazards: extreme wind, floods, rockfall, mudflow, landslides and snow avalanches.
- Stakeholder: Hazard forensic and co-development of scenarios is done by ASFiNAG, & Italian counterpart and with several other partners (UNIVIE, EURAC, GLOMOS).
- Regional economic impact will be projected for various scenarios related to the interruption of cross-border transportation due to compounding events.
- Also, another focus will be on local communities, focusing on a wider range of natural hazards, including drought, wind storms, and flash floods. Several stakeholders will be involved, such as GBA (Geological Survey), and WLV (torrent and avalanche control).

ALPS

Multi-hazards: floods, landslides, droughts, avalanches

Impact in sectors: cross border transportation, economic sectors, land use planning



Application case study area: Romania

- UB as case study coordinator
- Emergency Situations Department (DSU)
- **Emergency response planning will focus on** various compounding event scenarios for the city of Bucharest
- RO-ALERT system
- Consequences of a major earthquake on the intervention times in Bucharest will be mapped over the systemic vulnerability image of the city. Ground displacement InSAR-data will be used as input for ground instability
- improve the understanding on how the entire system will react in such conditions, highlighting complex vulnerability hotspots
- impact chains will be evaluated for the road infrastructure.



ROMANIA

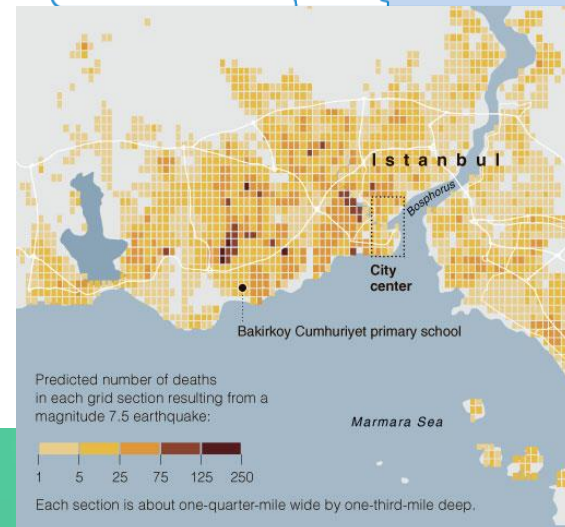
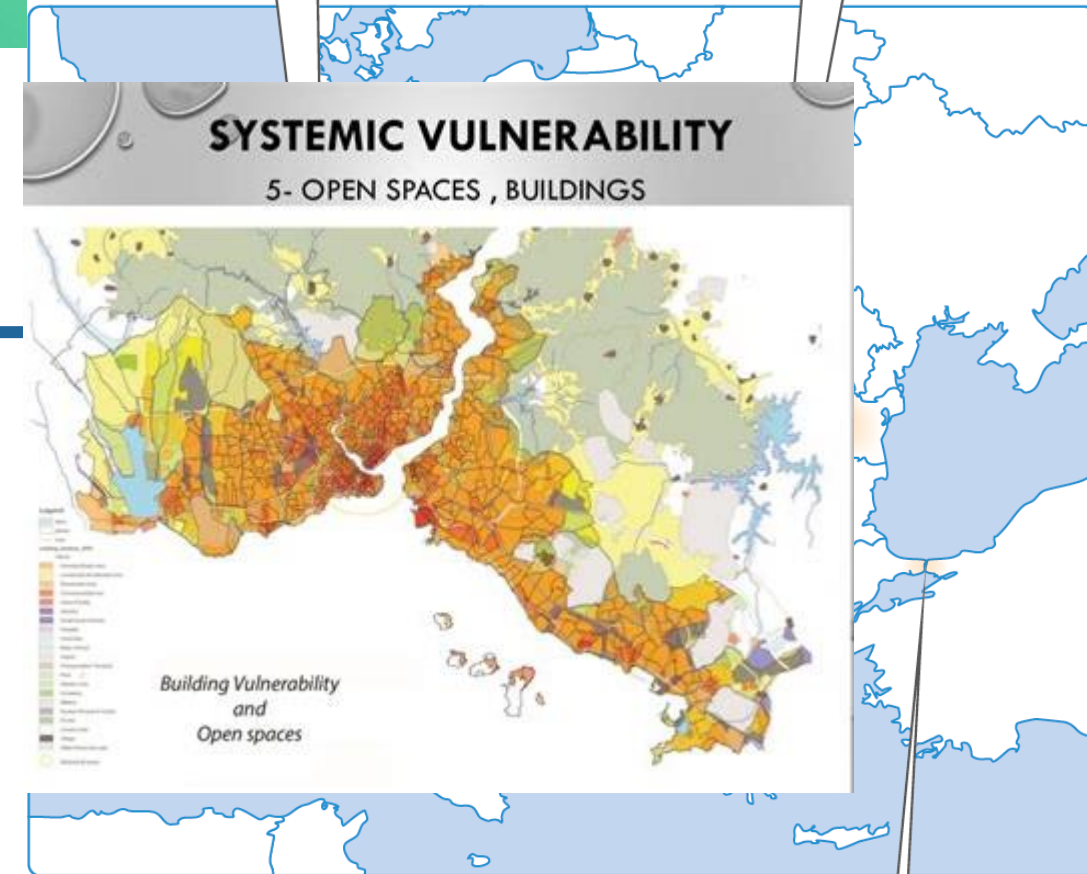
Multi-hazards: earthquakes, floods, landslides, droughts, pandemic

Impact in sectors: response planning, insurance, public financial management, health



Application case study areas: Istanbul Metropolitan

- Case study coordinator: Istanbul Technical University (ITU)
- Key stakeholder: Istanbul Metropolitan Municipality (IMM)
- Hazards: earthquake and cascades: tsunamic, landslides, liquefaction. hydrometeorological hazards (extreme temperatures, fires, and flooding)
- **urban expansion speed**, composition and integration of new migrants (native, foreign and refugees from countries like Syria and Afghanistan)
- disadvantaged groups become more vulnerable
- **focus on urban dynamics** (demography, social, economy, built-up environment, etc.) to reveal systemic vulnerabilities

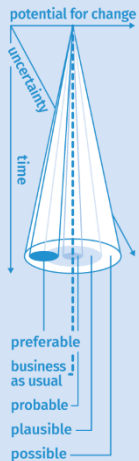


ISTANBUL

Multi-hazards: earthquakes, Covid-19, heatwaves, fires

Impact in sectors: megacity, housing, disadvantaged groups, cultural heritage, economic sectors





Today's future

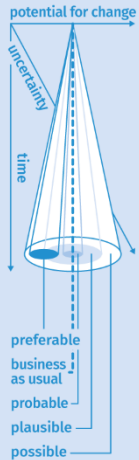
Challenge

Development of a **multi-hazard impact chain estimation** service based on **past observations and current conditions**
&
its application for **modelling the impact under future scenarios**, with a special focus on adequately **expressing uncertainties**
&
translating **regional climate scenarios into locally usable ones** that indicate changes in the frequency of extreme events and using them in multi-hazard models.

Proposed Solutions: tools and guidelines

- to quantify and communicate uncertainties
- for the co-development of scenarios of climate change, land-use change, and population changes for different sectors

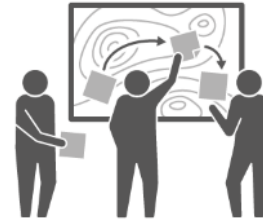




Adapting to changes



Social simulation game, Forum Theatre and Virtual / Augmented Reality experiences - all offered by the Climate Centre and CRS.



co-develop context-specific decision-making tools suitable for stakeholders in different sectors and risk governance settings

Challenge:

Climate information is often abstract and does not

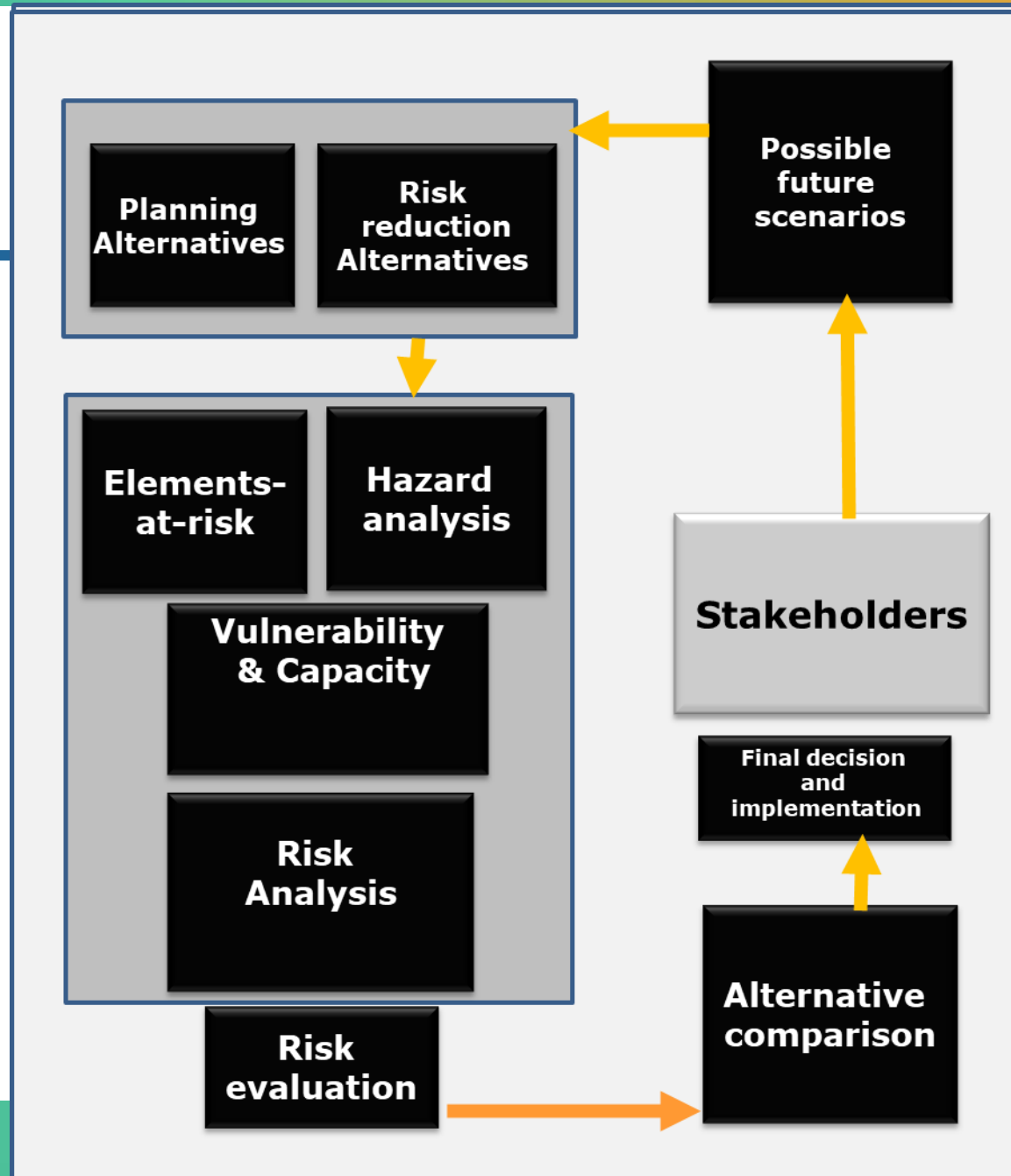
- respond to key stakeholders' perspectives
- connect to the complexity of the decision making processes.

Many decision support tools

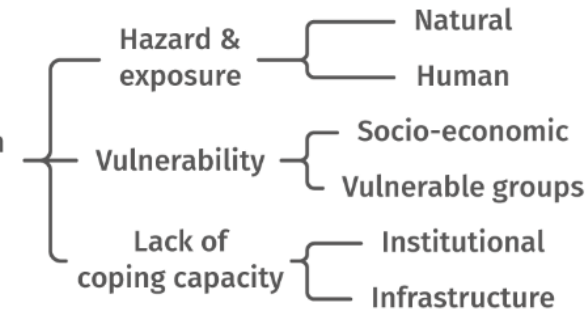
- focus on a short-term timeframe
- exclude consideration of long-term scenarios.

Co-develop a service to analyse **dynamic exposure, vulnerability and systemic risk**, that can be applied in all phases of the disaster risk management cycle.

- Current situation
- Compare risk reduction alternatives
- Compare future trends
- Compare best change-proof alternatives



The user-centred risk assessment service



Challenge: no publicly available tools for analysing multi-hazard risk and their use in complex impact chains.

Proposed Solutions: an open and online, user-centred methodology and tool for systemic risk assessment, co-designed with stakeholders and addressing physical, socio-economic, and environmental aspects.



Hosting the tool

- CMINE (Crisis Management and Innovation Network): For first and second responders
- 510 Global: for humanitarian sector



510



Improving
humanitarian action
with data & digital

-
- Prof. Cees van Westen

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<https://www.linkedin.com/company/paratus-eu/>

