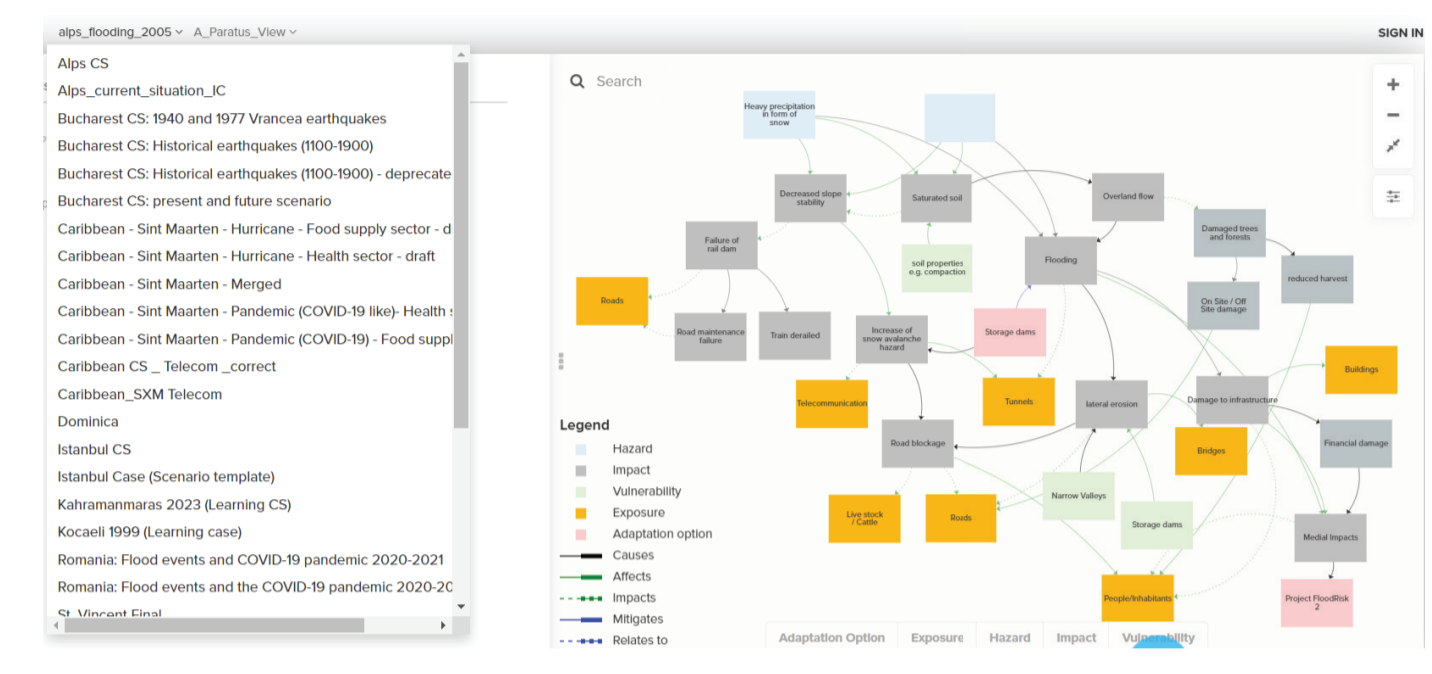




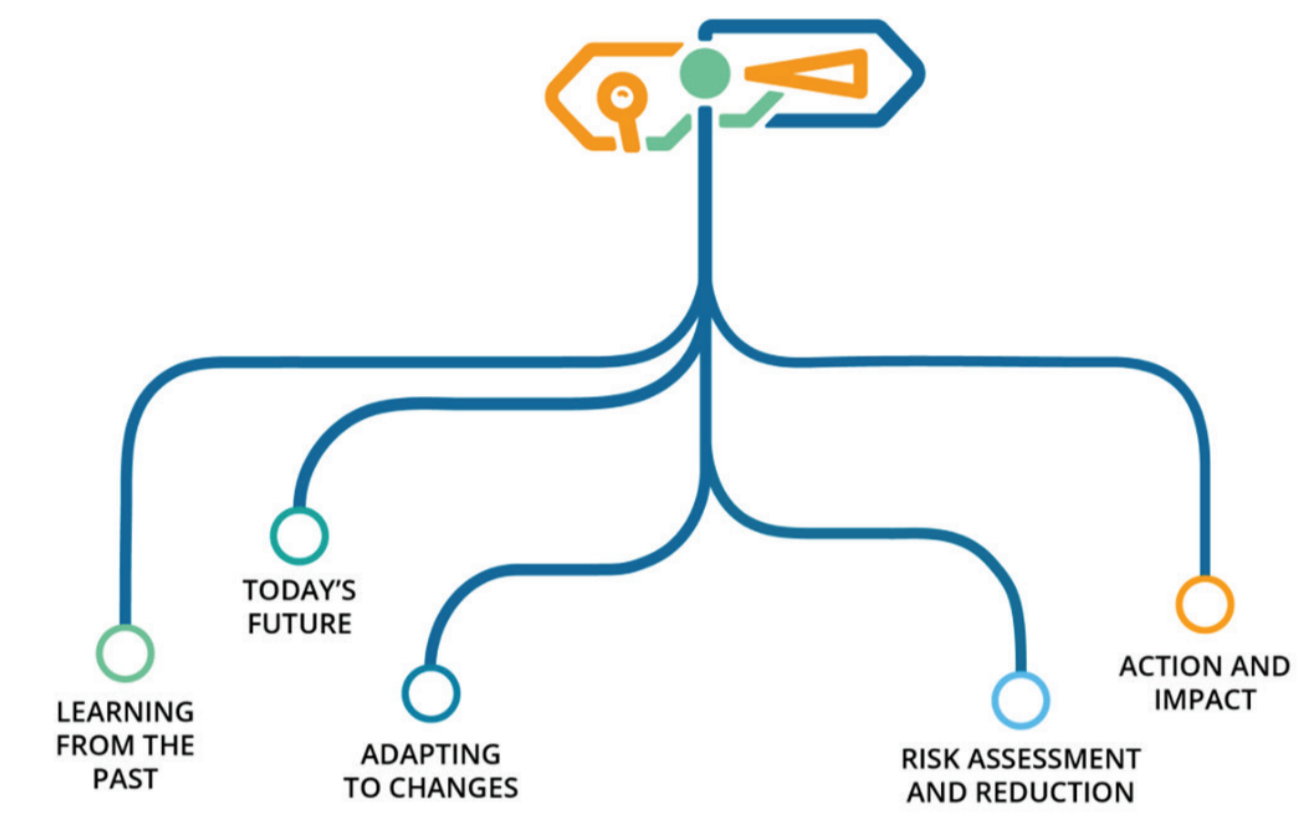
# A web-based multi-hazard risk simulation service based on impact chains

Cees Van Westen, Bastian van den Bout, Rabina Twayana, Massimiliano Pittore, Ashok Dahal, Manzul Hazarika, and Yu Han

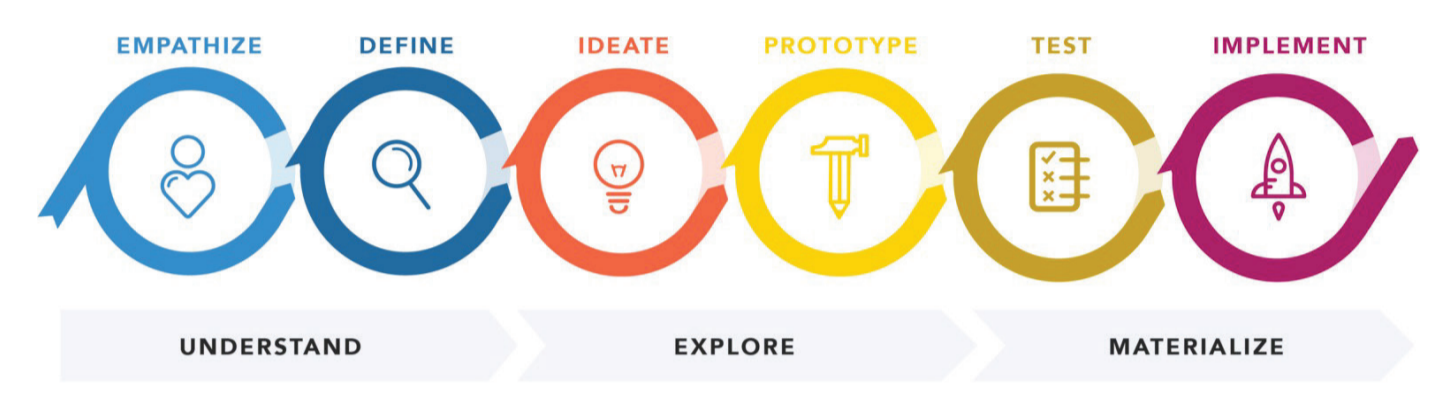
**Impact Chains.** The concept of impact chains has proven to be a useful concept for conceptually representing the risk related to hazard interactions and cascading impacts of multi-hazard extreme events. The impact) have been organized within a software tool, called KUMU



In the context of the EU PARATUS project, a web-based simulation service is being developed for first and second responders and other stakeholders to evaluate the impact and risk related to multi-hazard events building upon a representation of scenario risk through impact chains. The simulation service includes a series of tools to gather, integrate, and develop new hazard and risk information.

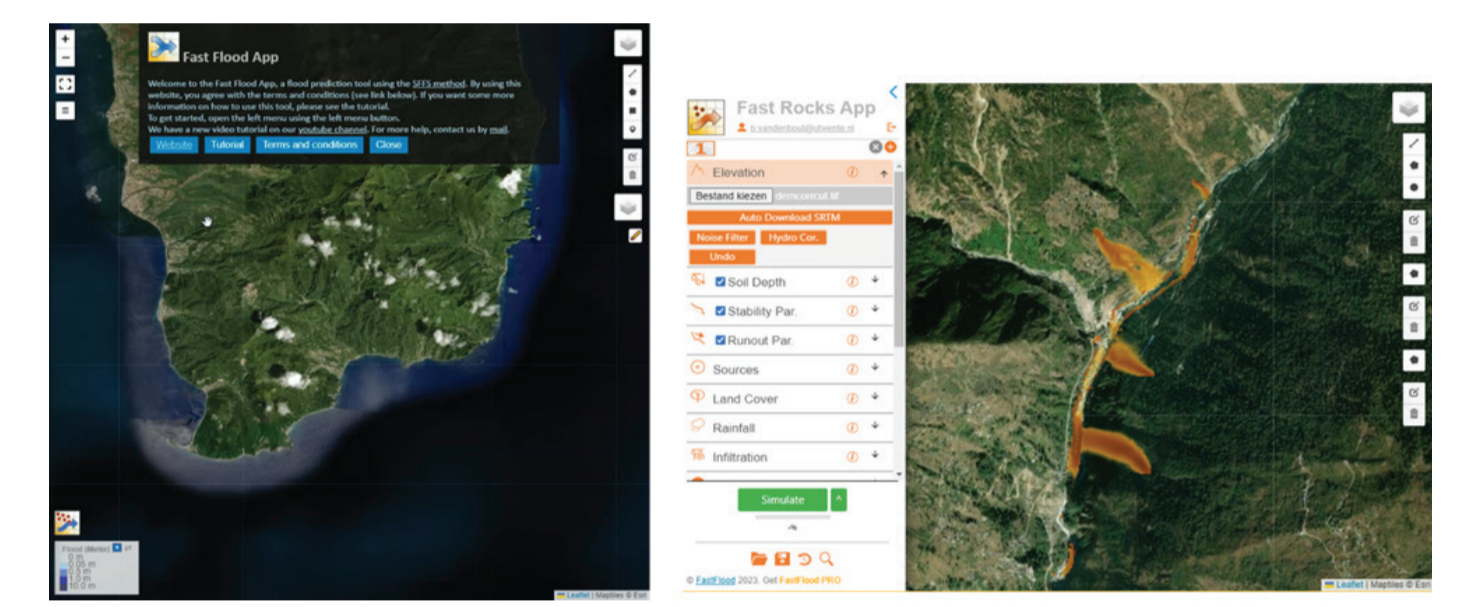


**Human-Centered Design (HCD)** is a design and management framework that develops solutions to problems by involving the human perspective in all steps of the problem-solving process. Utilized in multiple fields, including social sciences and technology, HCD has been noted for its ability to consider human dignity, access, and ability roles when developing solutions.

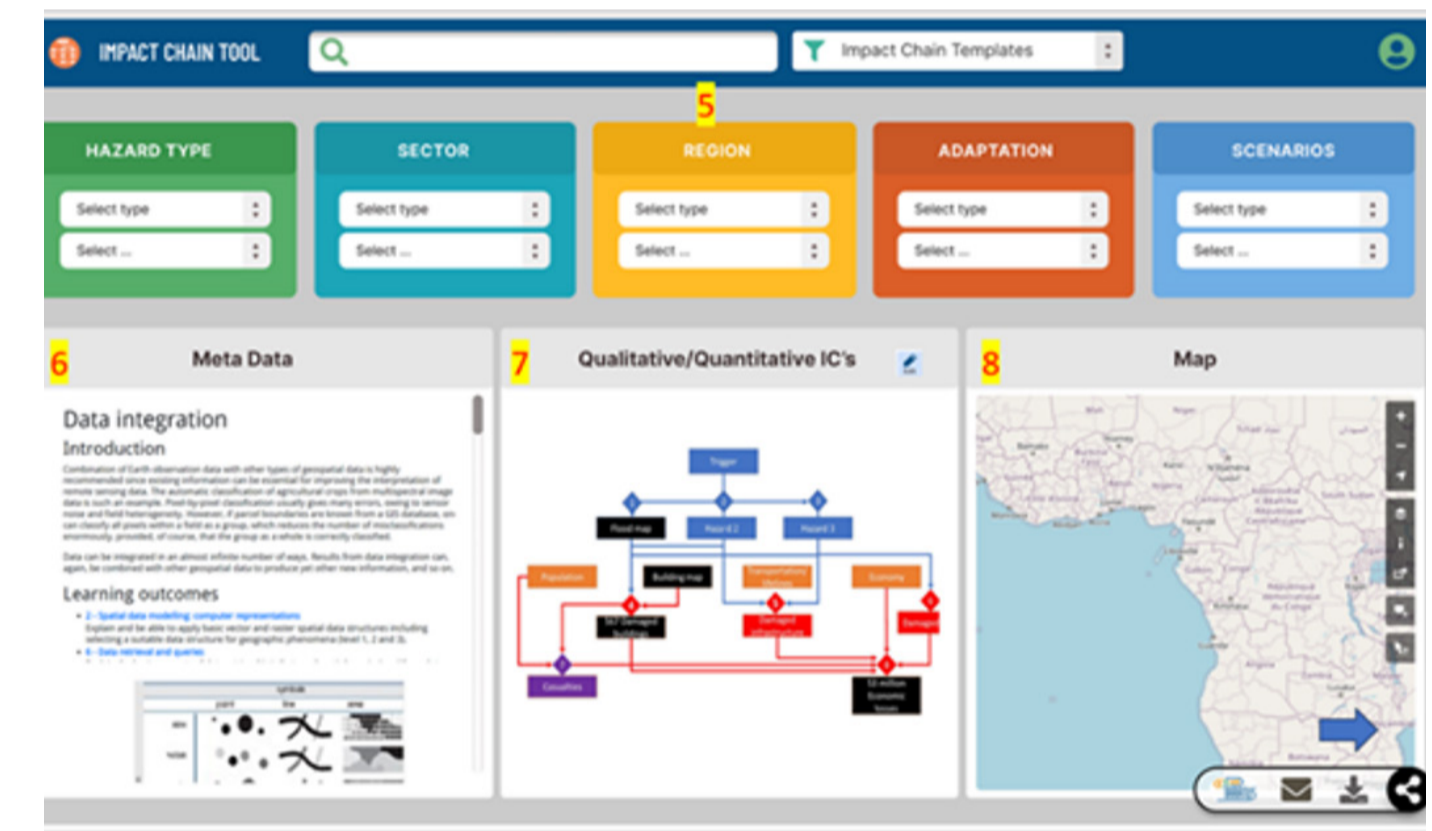


**Hazard Modelling tools.** Two tools are available for fast hazard modelling using an open online application. FastFlood.org applies physically based principles of steady-state flow to evade full dynamic aspects of flood simulations of peak flow height, velocity, and flood arrival time.

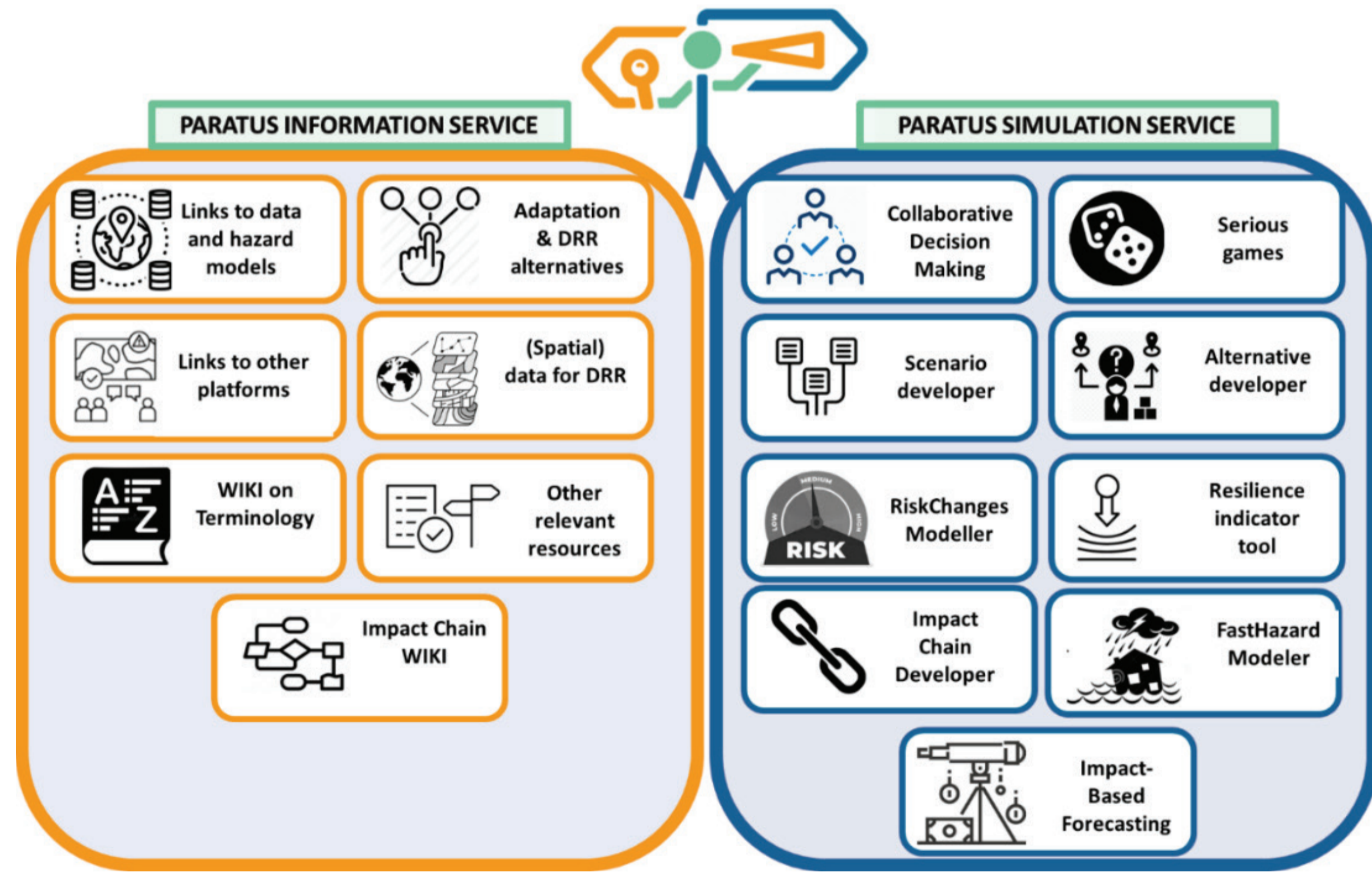
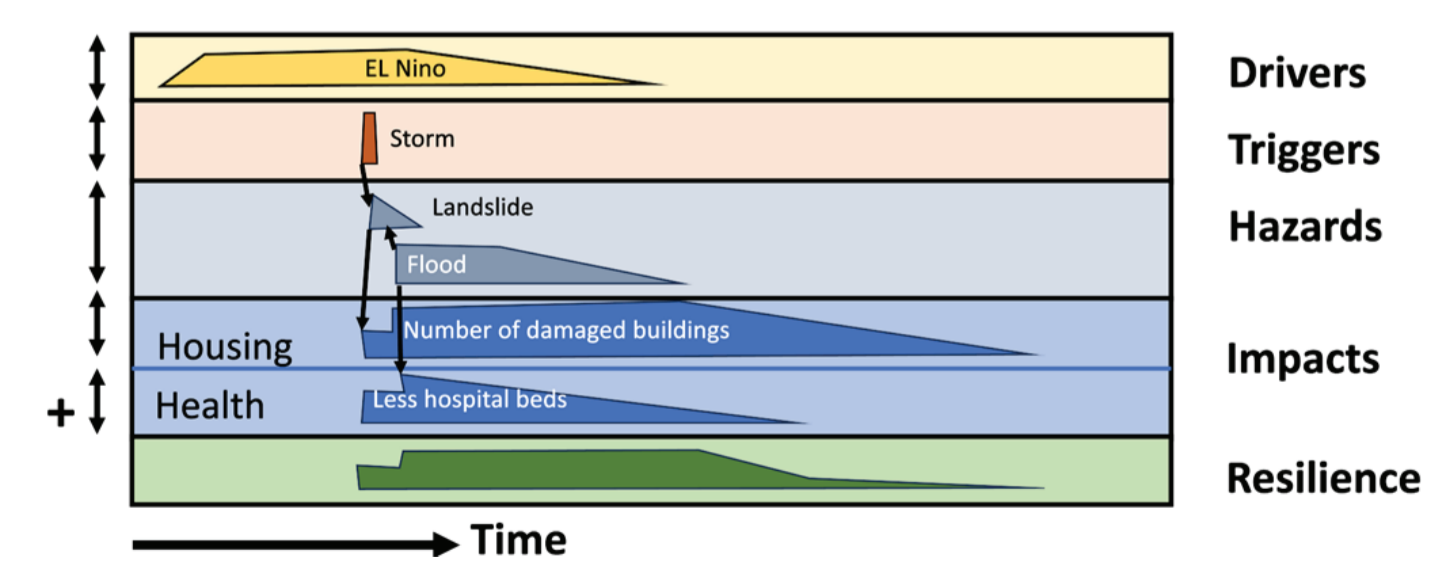
**FastSlide.org** simulates slope stability, by estimating the soil depth, analysing the slope stability and the volume of potential landslides, and modelling the runout of landslides.



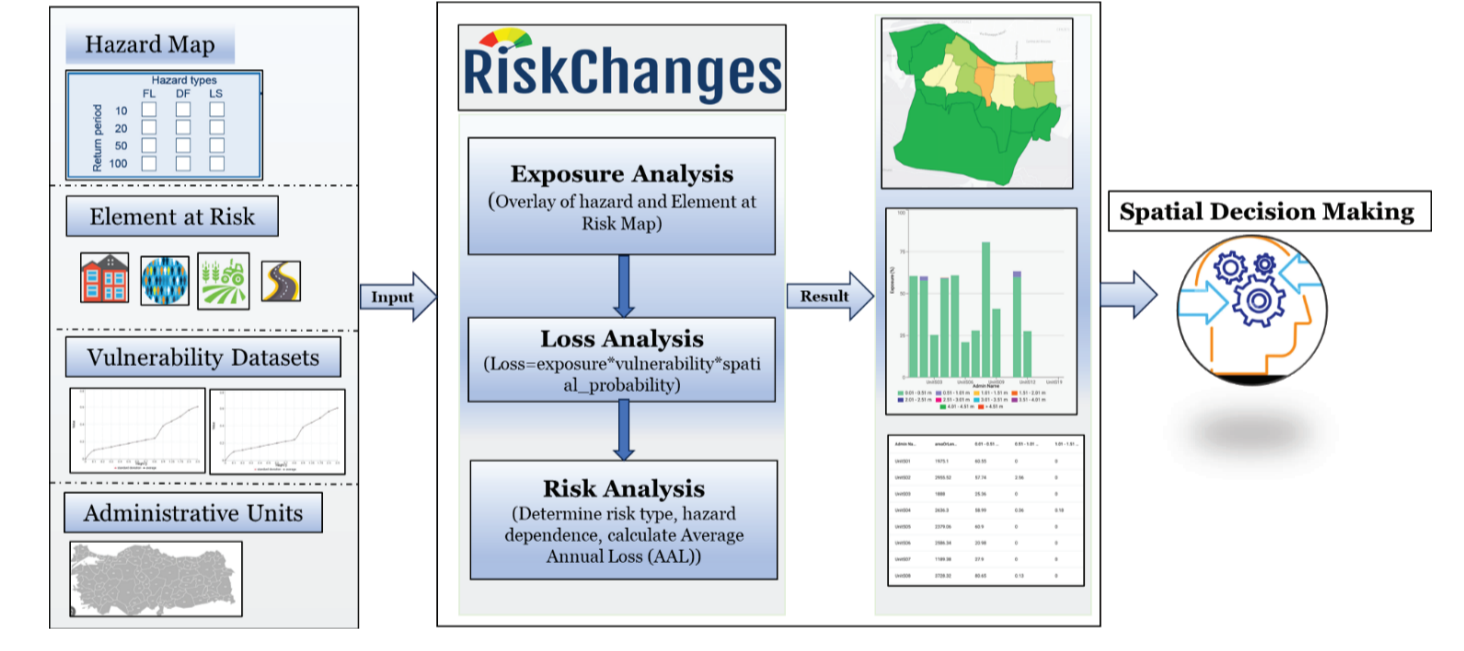
**Impact Chain WIKI.** We are developing a tool that allows to query impact chains, to link it with metadata and with maps.



**Impact Scenario Analyzer.** We are developing the concept of Impact Scenarios. This is a tree-like graphical representation to better understand and quantify how multi-hazard events are triggered and interrelated, and how they cause cascading impacts in different sectors, over time, allowing to represent the resilience of a component, sector or system



**Multi-Hazard Risk Assessment tool. RiskChanges.org** is a Spatial Decision Support System for the analysis of current and future multi-hazard risk at local level, in order to select optimal risk reduction alternatives.



**Collaborative mapping tool.** We have developed an Open Geospatial Interactive Tool (OGITO) to support collaborative spatial planning processes with a mappable. To develop such open-source software tool, we combined human-centred design and Agile software development principles in a co-design effort with intended users and stakeholders. We are now exploring the integration of the FastFlood tool into the OGITO tool.

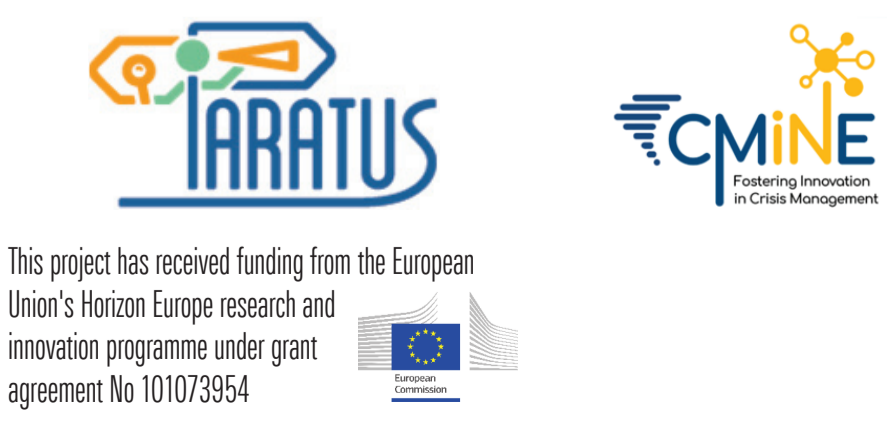


Users can develop their own impact chain of past events, or future disaster events, which is used as a basis for quantifying direct damage and prioritizing secondary losses in different sectors. Several tools for hazard assessment will provide fast estimations of multiple hazards and can be linked to the impact chains. The exact number of components and the final structure of the platform will be determined iteratively through a series of stakeholder consultations, following a user-centered design. The platform is designed flexibly to be able to support stakeholders that work in different sectors, geographic settings, and interacting hazards, and at the same time to address (a number of) their needs for analyzing the impact of compounding multi-hazard events with cascading impacts.

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For more information  
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<https://www.paratus-project.eu/>  
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