RISC-KIT: Resilience-Increasing Strategies for Coasts – toolKIT

Ap van Dongeren
Deltares

2016 Water JPI Exploratory Workshop,
Dublin – 14th November 2016

Project background: Coastal flood risks in Europe

- Recent and historic low-frequency, high-impact events demonstrated coastal risk (Xynthia, 2010; Xaver/St. Nicholas storm, 2013; St. Agatha storm in the Adriatic, 2014; Mediterranean flash floods 2014, 2015)

La Faute sur Mer, FR

Sandy, NY

Cinque Terre, IT

1953 Flood, NL, BE, UK

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Coastal flood risk in Europe and beyond

- Coastal zones will experience increased risk of flooding, erosion and damage due to the combination of
  - Increased hazards due to climate change
  - Ongoing coastal development
  - Without adaptation, flood damage on European coasts increase up to 11 billion Euros per year (IPCC, AR 2014)

- Coastal authorities need to
  - Assess risk in coastal regions
  - Develop a Disaster Risk Reduction (DRR) strategy

RISC-KIT questions:

- Where on the coast are hotspot areas of higher risk?
- What is the impact of future coastal hazard scenarios?
- What are effective Disaster Risk Reduction (DRR) measures at a hotspot?
- How can DRR measures best be implemented?

And

- What are the socio-cultural and historic aspects of DRR measures?
- Can a generic approach be applied across Europe, in data-rich and data-starved environments?

RISC-KIT: develop and apply tools

- 18 partners of different disciplines
- 10 case study sites in Europe
- Local end-user at each case study site

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RISC-KIT Project Outcomes

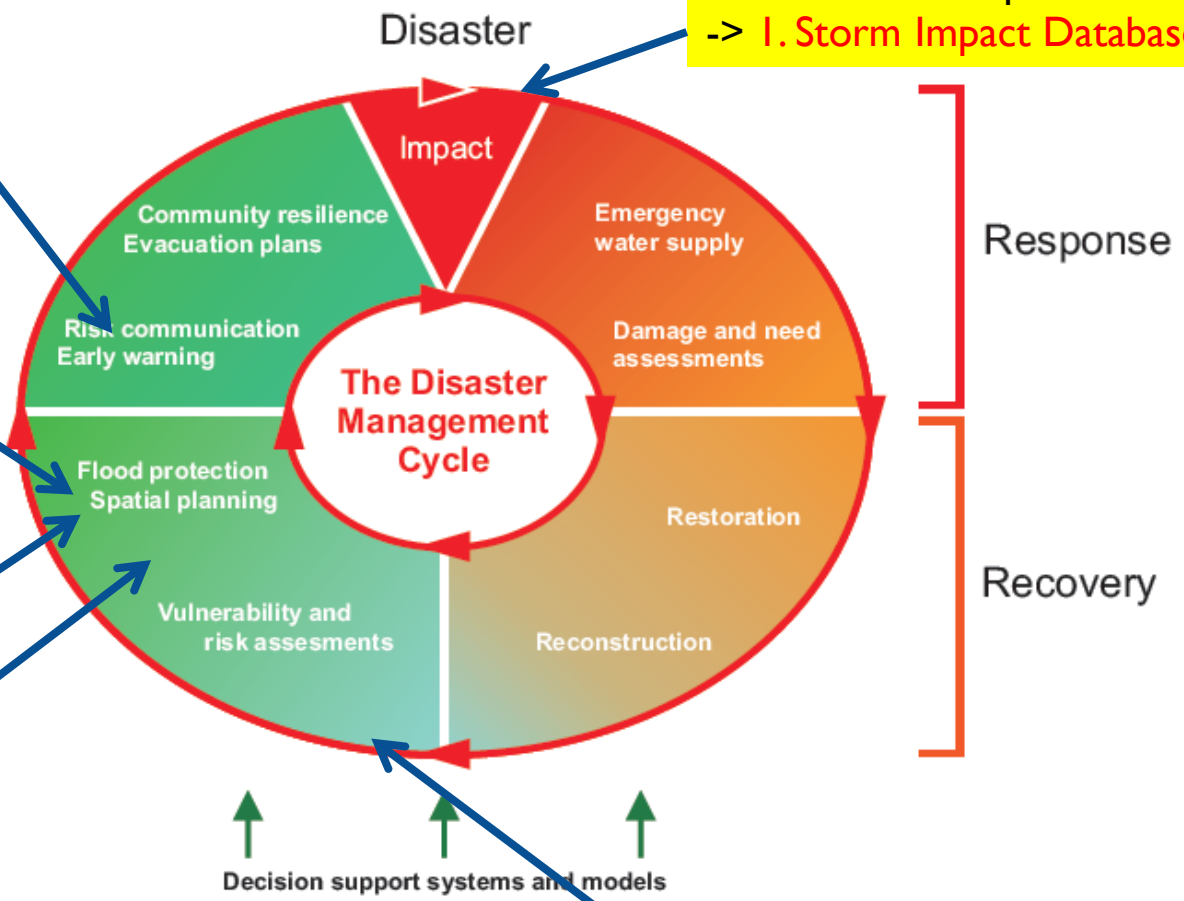
How do you warn residents? –
> 4. EWS Hotspot tool

How do you involve stakeholders? –
> 5. MCA guide

What are effective solutions? –
> 4. Hotspot tool

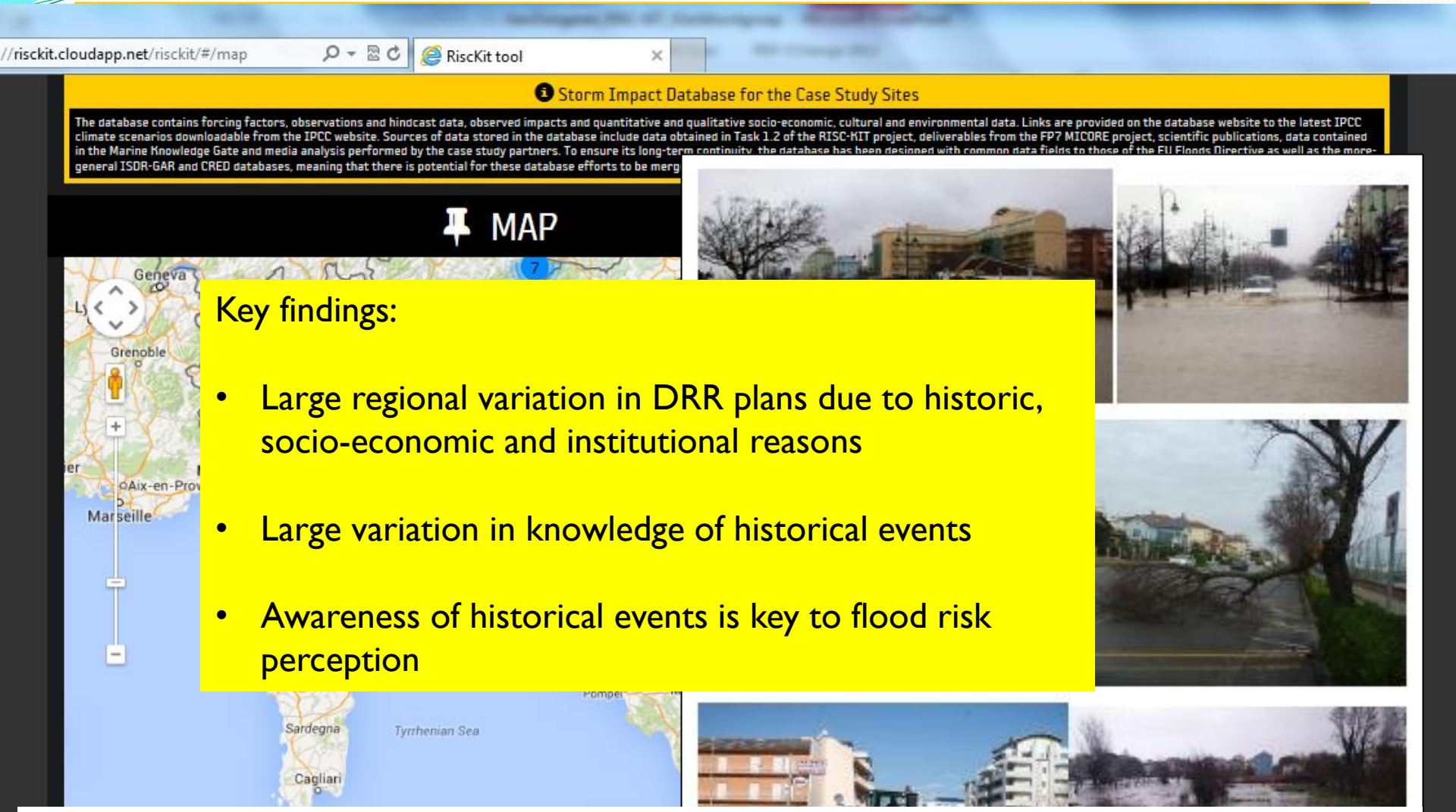
What are potential solutions and social dimensions?
-> 3. Web-based management guide

What was the impact of an event?
-> 1. Storm Impact Database



Where are the hotspots? -> 2. Coastal Risk Assessment Framework

1. Storm impact database



Key findings:

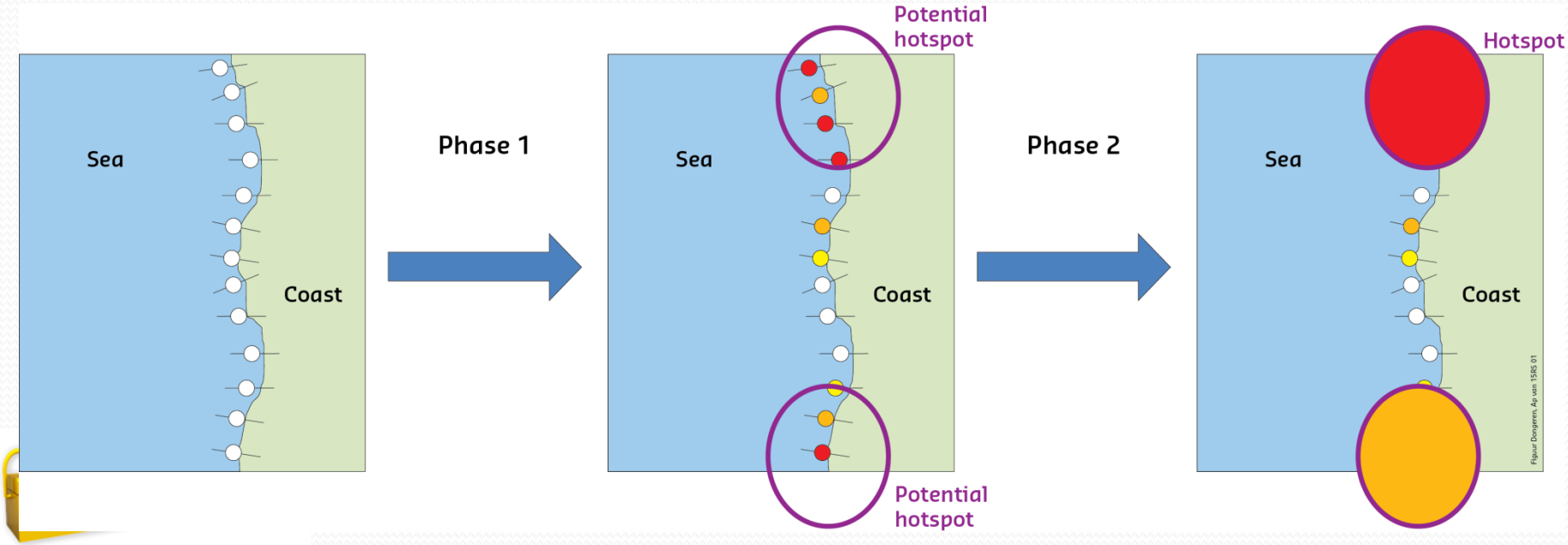
- Large regional variation in DRR plans due to historic, socio-economic and institutional reasons
- Large variation in knowledge of historical events
- Awareness of historical events is key to flood risk perception

Database at risckit.cloudapp.net/risckit/#/

2. Coastal Risk Assessment Framework

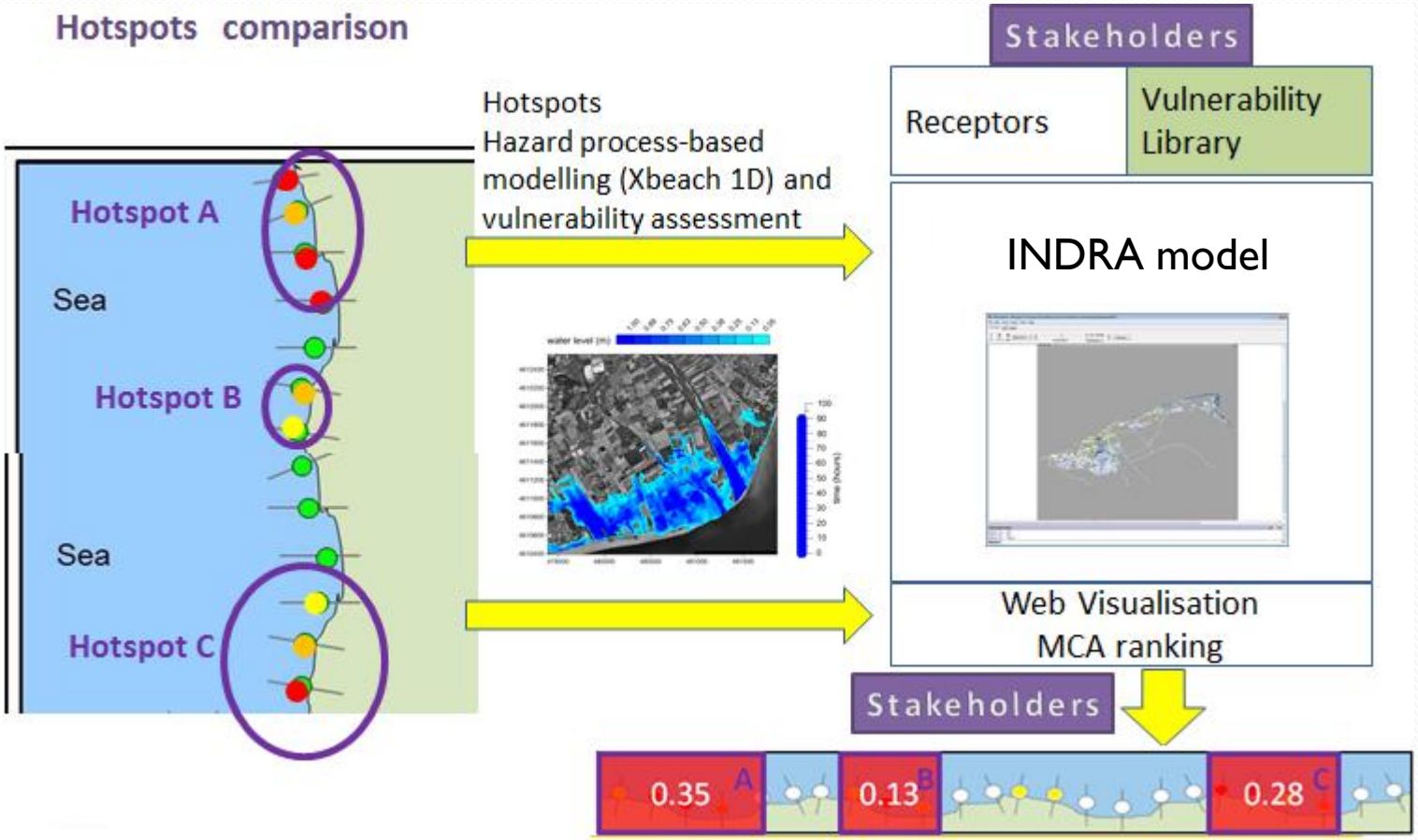
Identify - at the regional scale (100's km) - present and future hot spot areas of coastal risk

- CRAF1: phase 1 to identify potential hotspots using empirical (simple) rules
- CRAF2: phase 2 to select hotspot using advanced tools
- Results stored in a web-viewer.



CRAF Phase 2

To compare identified hotspots at regional scale by scoring and ranking the potential impacts using a suite of models (Xbeach1D – 2D flood model – INDRA) and a multi-criteria analysis



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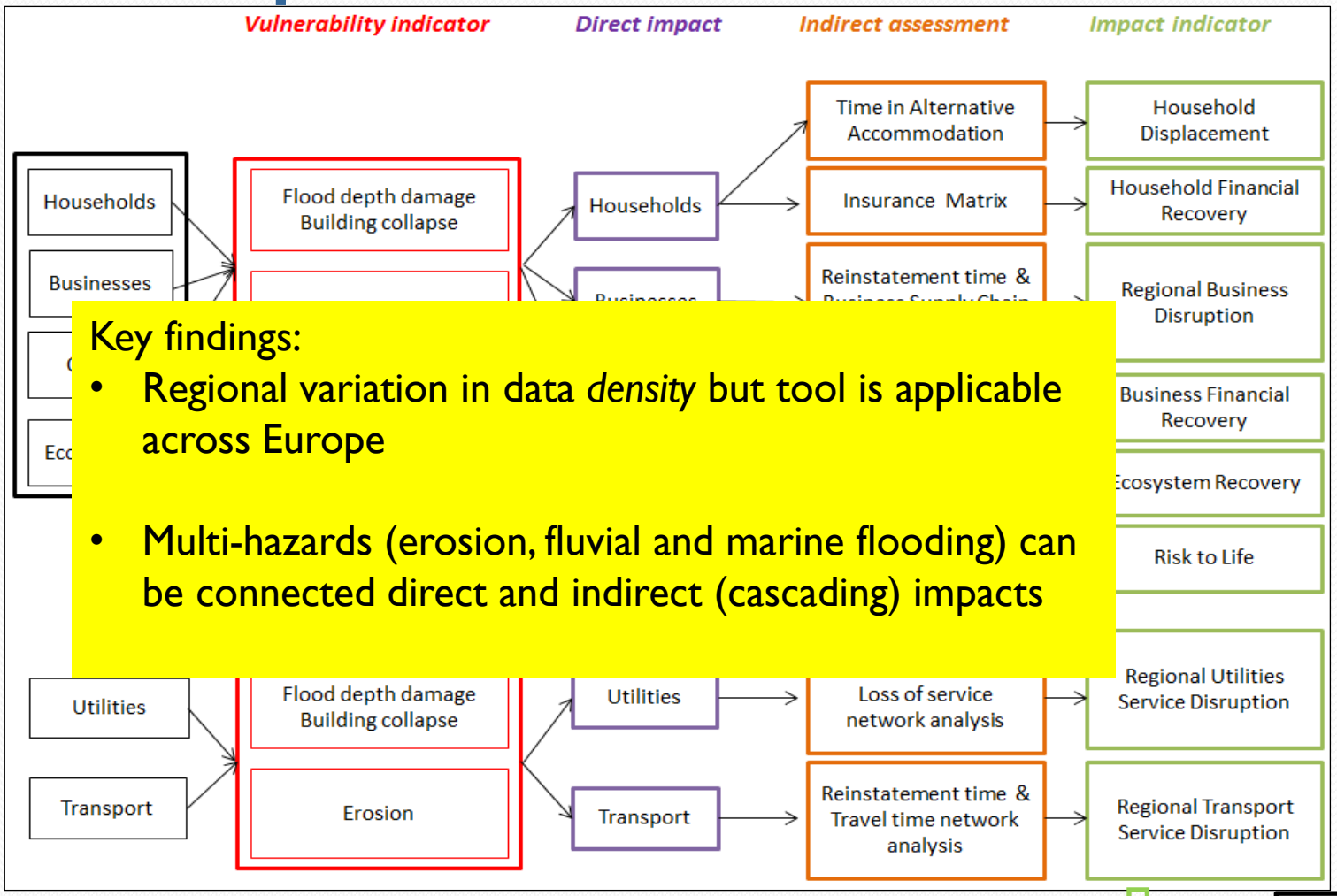
Connecting assets to hazards to direct and indirect impacts



Key findings:

- Regional variation in data *density* but tool is applicable across Europe
- Multi-hazards (erosion, fluvial and marine flooding) can be connected direct and indirect (cascading) impacts

INDRA MCA

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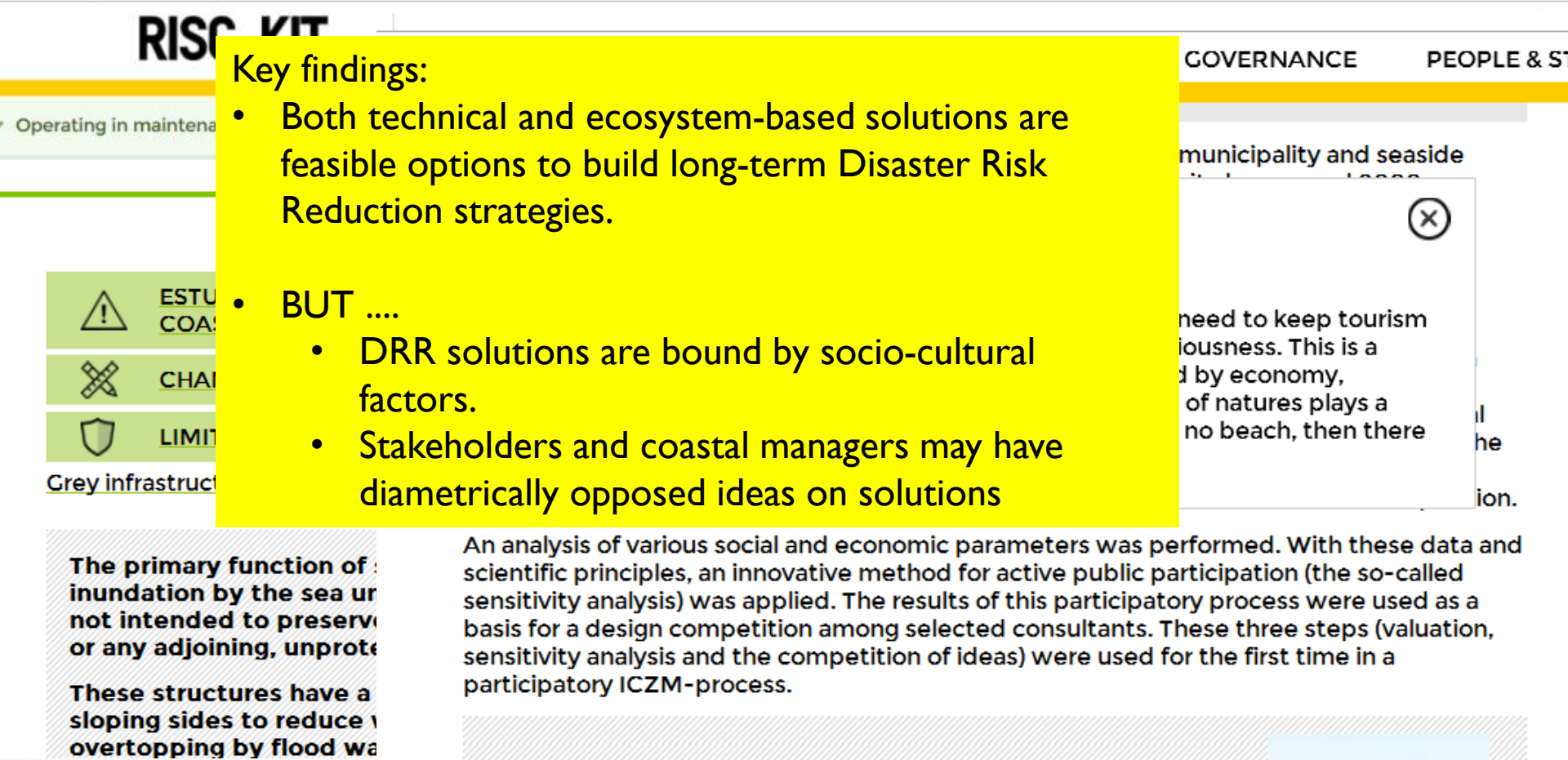
3 - Web-based management guide

Background information for coastal management approaches at all the study sites on:

Coastal measures, governance, people & stories



Key findings:

- Both technical and ecosystem-based solutions are feasible options to build long-term Disaster Risk Reduction strategies.

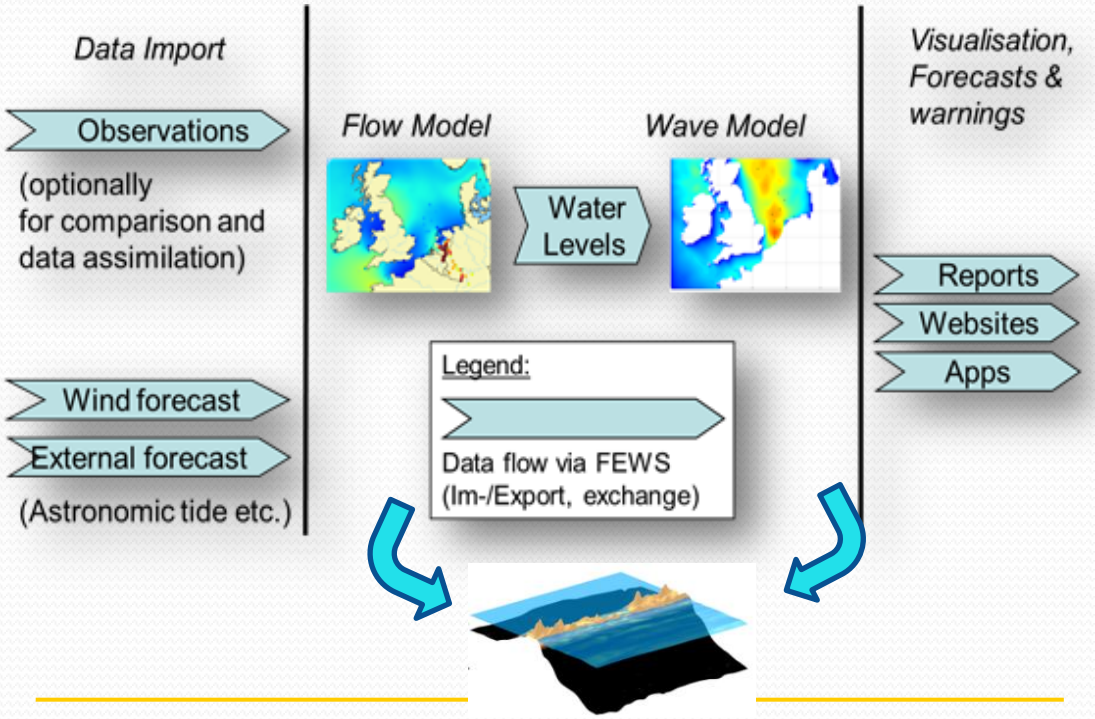
- BUT ....
  - DRR solutions are bound by socio-cultural factors.
  - Stakeholders and coastal managers may have diametrically opposed ideas on solutions

4. Hotspot (EWS/DSS) tool

Quantitative, high-resolution Hotspot Tool to be used

- Ex-ante: evaluate the effectiveness of DRR measures in hot spots (with a scale of 10's of kms) ex-ante
- Real-time: as part of Early Warning System

- Based on FEWS system
- Originally developed for river floods
- Now for seas and coasts.



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4. Ex-ante hotspot tool

- During planning/assessment phase 100s of model simulations can be run, connecting
  - Hydro-meteo forcing (storm characteristics)
  - Geo-morphologic setting

Key findings:

- Assessment of the effectiveness of DRR solutions is feasible using complex process-based models
- Results can be tabulated and presented in a Bayesian Network

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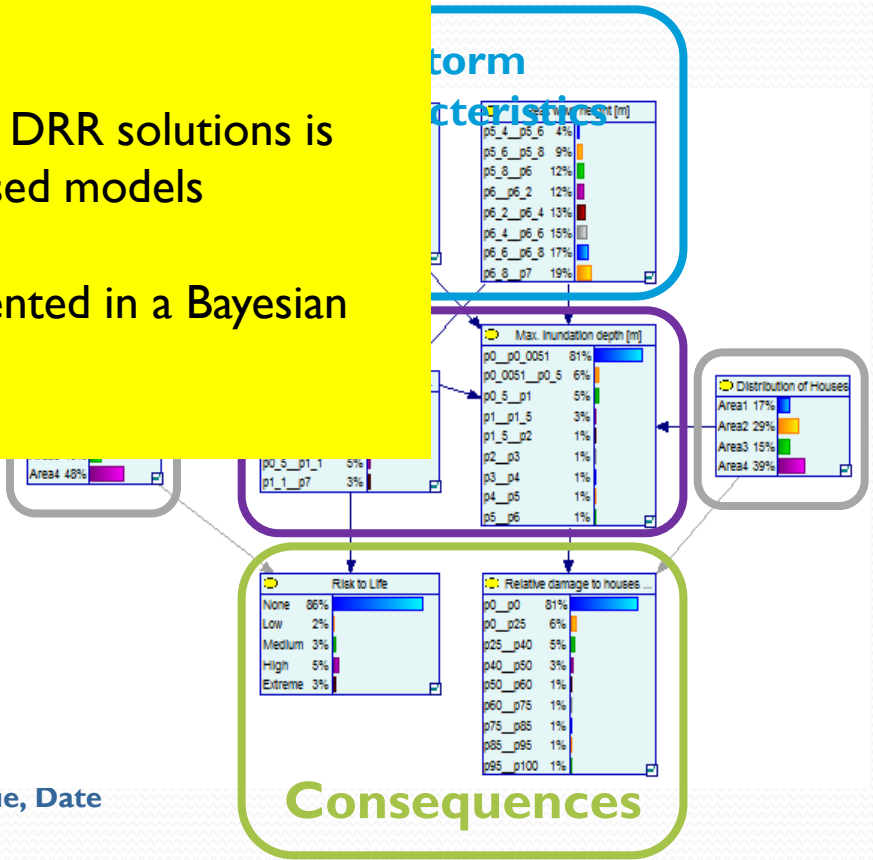
- Interactive and efficient communication tool



Example: Praia de Faro, PT

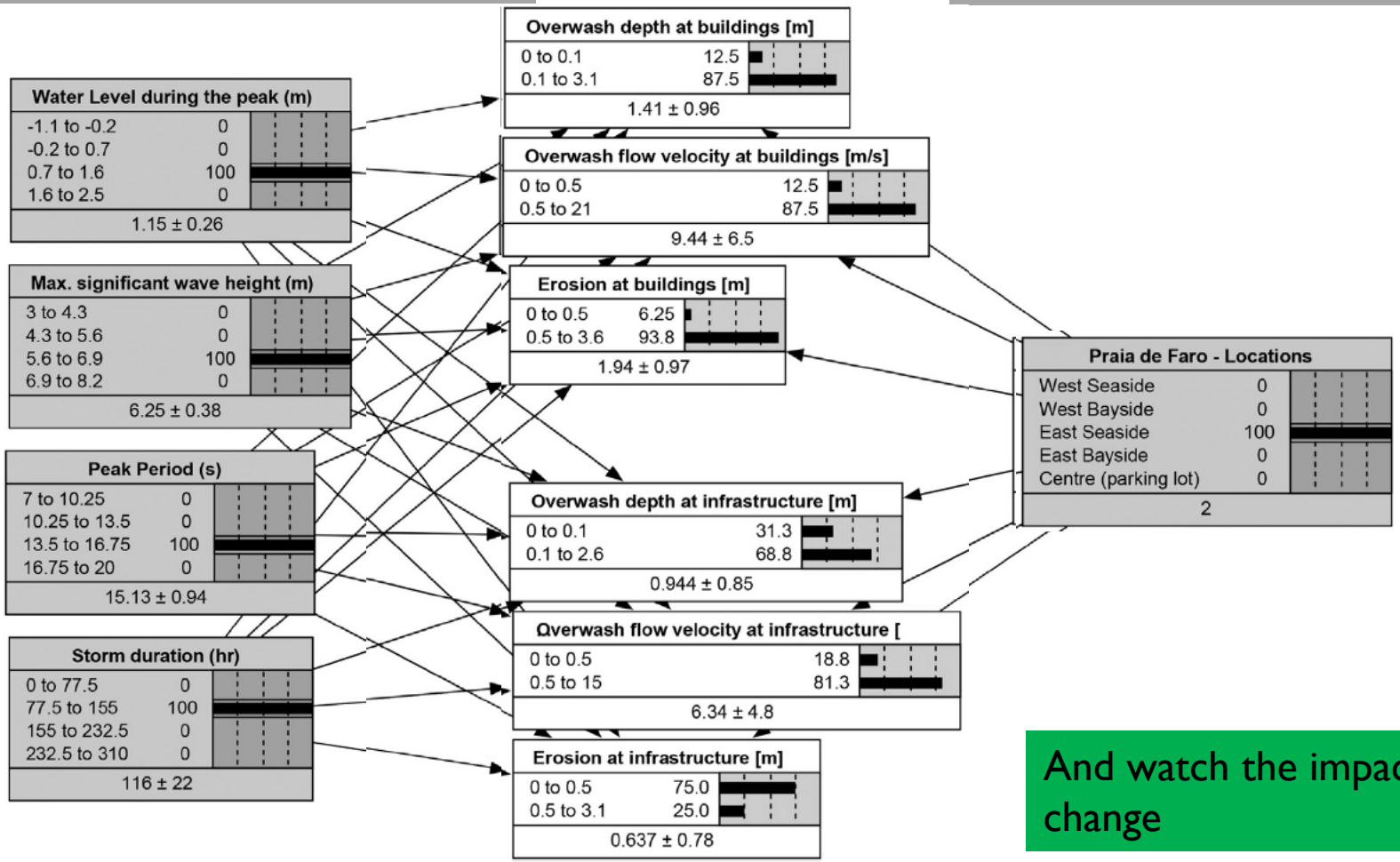
Hydro-meteo forcing

onshore impact

site characteristics

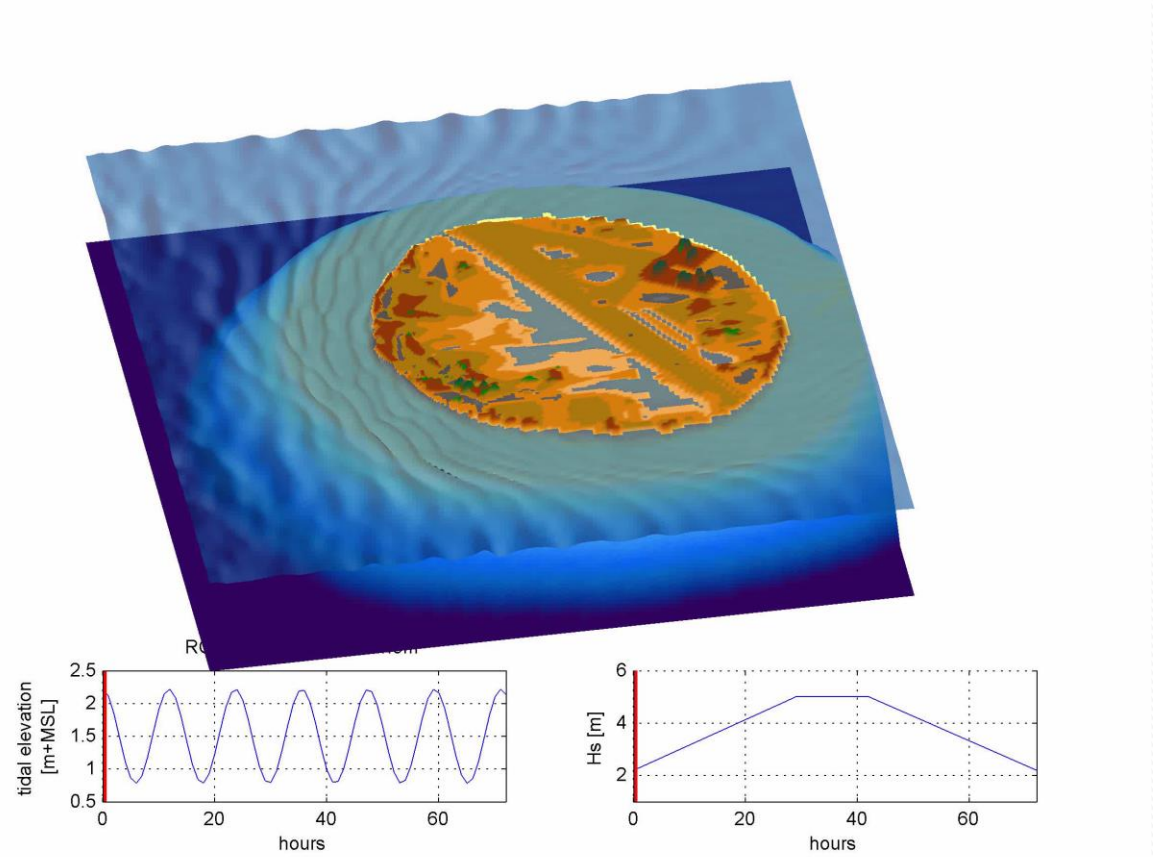
Constrain forcing to a particular storm

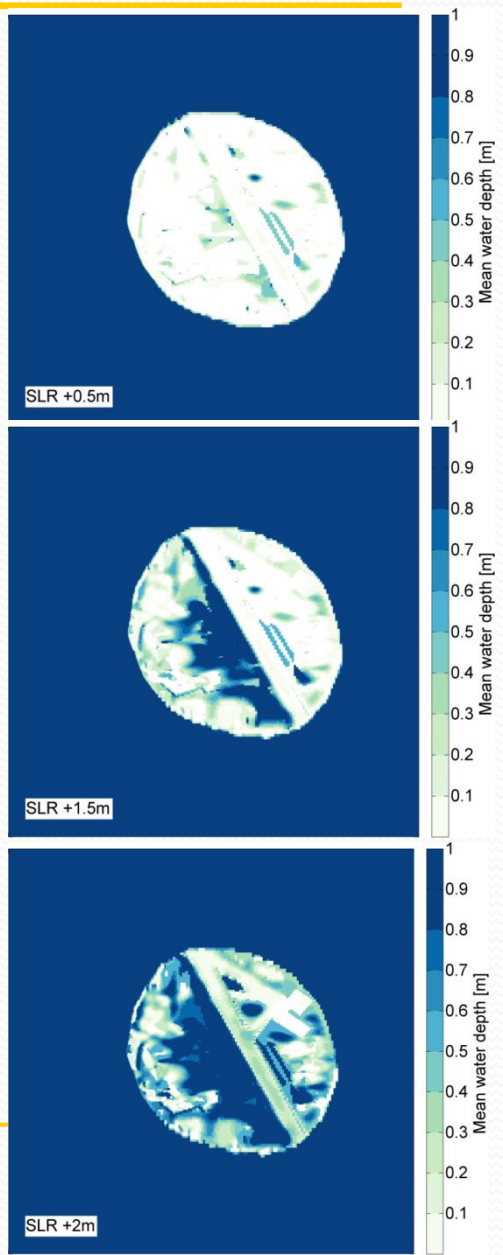
Consider one particular location



And watch the impacts change

Coastal flooding and groundwater: small islet





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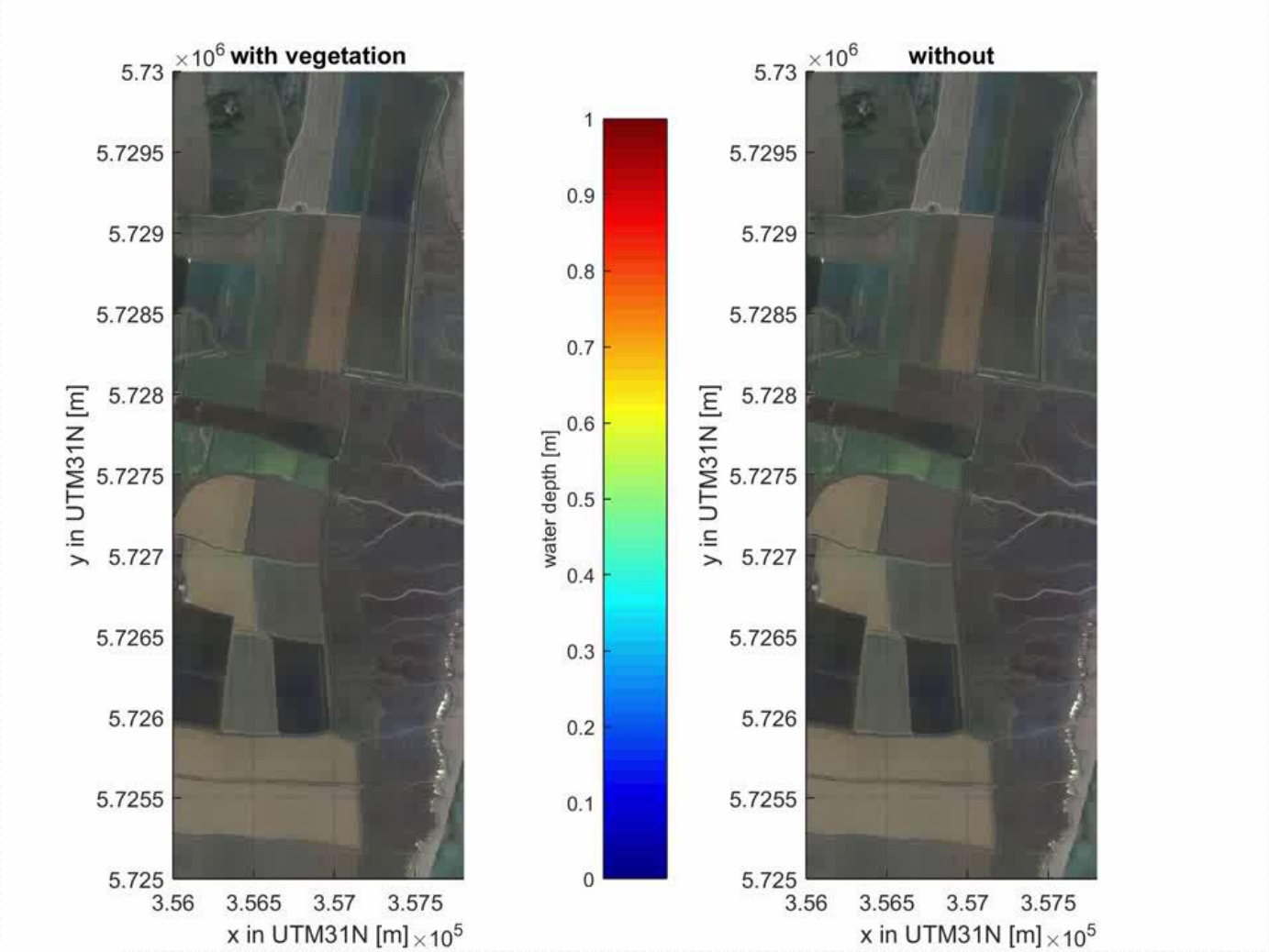
Coastal flooding in England



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5. Multi-Criteria Analysis Guide

- MCA helps stakeholders evaluate the effectiveness combinations of DRR measures and prioritize options.
- MCA sessions held in all case study sites
- U

Key findings:

- Communicating project results using a simple guide yields meaningful responses from end users.
- Adapting DRR strategies to local historical and socio-cultural priorities through stakeholder inclusion can lead to greater adoption and more effective implementation of policies.

Algarve, PT

Varna, BG

Liguria, IT

Synergies with the Water JPI Theme 5

5.1.5. **Mitigating water stress in coastal zones**

- Developing a systemic approach to comprehensive coastal zone management based on monitoring and modelling. Integrating the different uses on coastal zones to prevent degradation of water quality and quantity. Demonstrating the feasibility of aquifer storage and recovery by using various sources of water. Evaluating inter-seasonal freshwater storage possibilities in existing aquifers.
- Developing novel geophysical and hydrogeophysical models for the characterisation of 75 water bodies on a finer scale. Models will include water supply and demand scenario builders and DSSs.
- Monitoring and dynamic modelling of artificial recharge and natural infiltration.
- Establishing management plans for the prevention of pollution in coastal and inland waters.
- Measuring coastal and inland water quality.
- Evaluating the effect of measures to deal with salt intrusion, eutrophication and land use change.
- Achieving better coordination between the WFD and the Marine Strategy Framework Directive. To this end, a better understanding of sources and impacts of nutrient emissions discharged from the land to the sea will be required.

Key Knowledge Gaps

- Integrated process-based modelling from hazards to impacts: from marine and fluvial flooding to effects on groundwater and aquifers and water supply

- Challenges:
  - Pathways of surface and ground water flows
  - Resolution of different time scales of processes -> coupling of models
  - Connecting hazards to direct and indirect impacts (INDRA)
  - Visualization of results for assessment by non-technical experts
  - Collection of historical impact data for validation

- Impacts:
  - Multi hazard assessments and evaluation of mitigation measures
  - Management plans for the prevention of pollution
  - Resilience in ground water supply

Synopsis and project details:

- **RISC-KIT tool kit contains**
  - Coastal risk database of current and historic data
  - CRAF: Regional-scale assessment of coastal risks
  - Web-based management guide of potential DRR measures and management practices
  - Evaluation of DRR measures and Early Warning with Hotspot Tool
  - Multi Criteria Analysis guide to evaluate solutions

- **All software is free-ware and/or open-source**
- **See www.risckit.eu for details**

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