

A photograph of a construction site. In the foreground, a worker in a red helmet and dark clothing is walking. In the background, there are other workers, a red excavator, and a red utility vehicle. The ground is covered in dark soil and debris. The scene is set within a large, open structure, possibly a tunnel or a large hall under construction.

# Building a safe haven for our society against natural hazards

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UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH

# Who I am ?

1994 Earth Sciences at ETH Zurich

- Debris flow (Swiss Alps)

1999 Ph.D. in Geological Sciences at UPC-CSIC

- Volcanic landslides (Canary Islands)

2001 – present at UPC

- Rainfall-induced landslide
- Soil erosion
- Impacts of future changes



*Colorado 2019*



*La Palma 2021*

# On-going projects:



UPC-leader of two EU-projects related to natural hazards:

- PARATUS: [www.paratus-project.eu](http://www.paratus-project.eu)
- The-HuT: [www.thehut-nexus.eu](http://www.thehut-nexus.eu)

USGS



PI of two national projects on impacts of future changes (landslide/soil erosion)

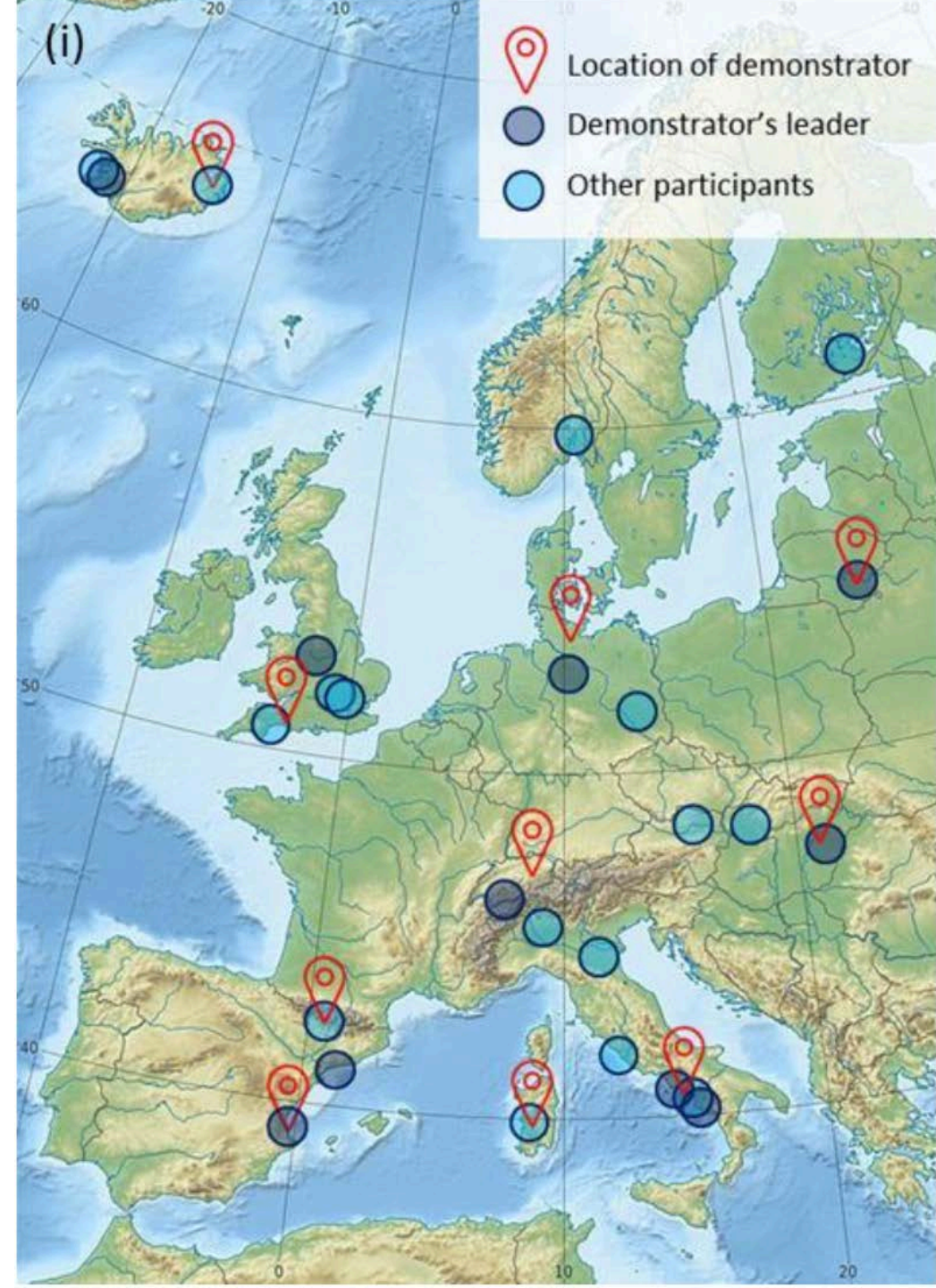
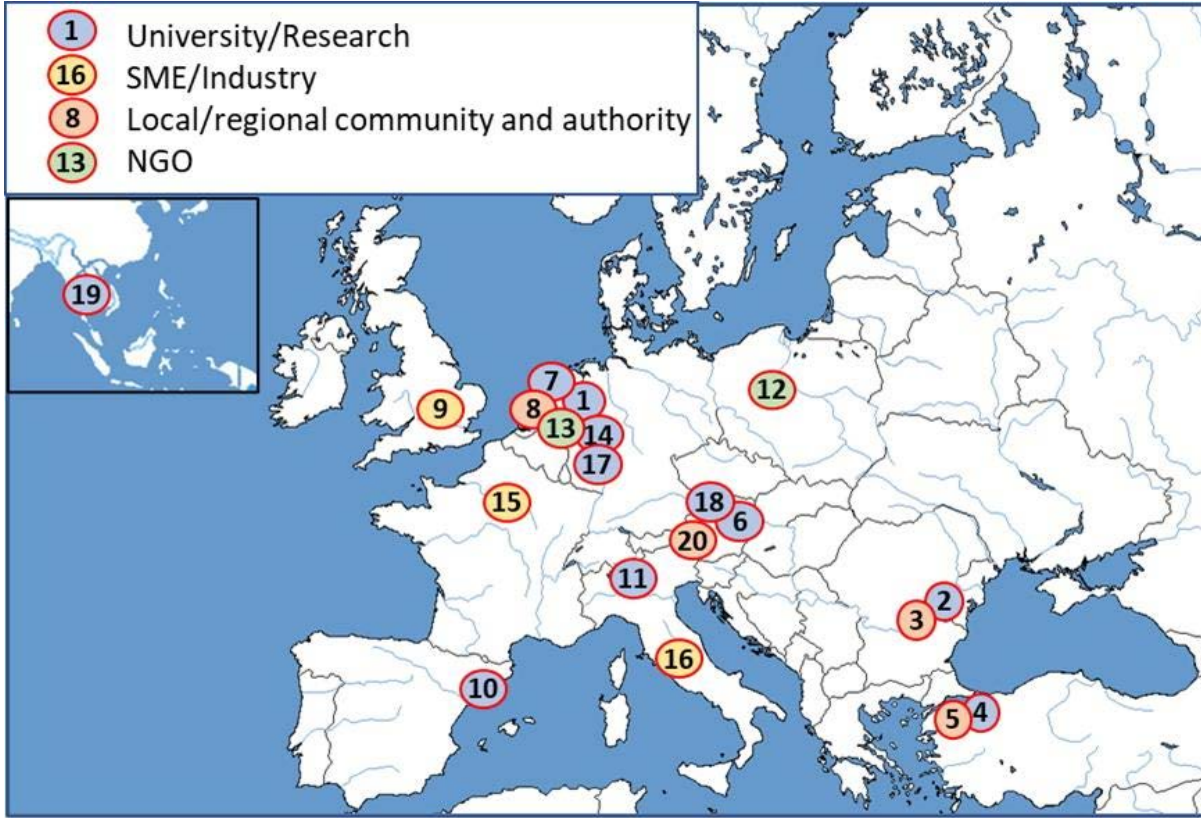
- EROSLOP



- SED4BUD



# EU-projects:



# Study sites and hazards

**ALPS**  
**Multi-hazards:** floods, landslides, droughts, avalanches  
**Impact in sectors:** cross border transportation, economic sectors, land use planning

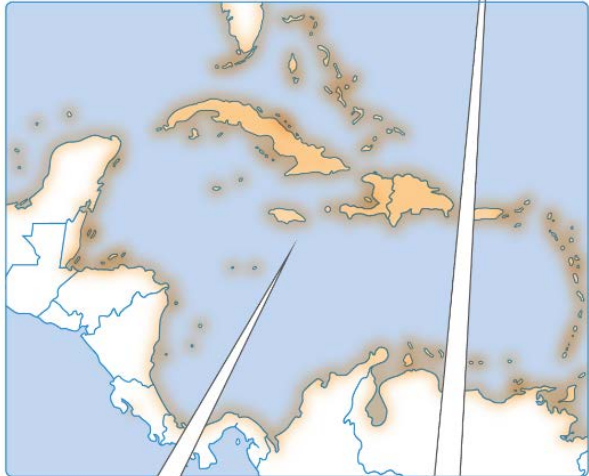
**ROMANIA**  
**Multi-hazards:** earthquakes, floods, landslides, droughts, pandemic  
**Impact in sectors:** response planning, insurance, public financial management, health



*PARATUS*

**ISTANBUL**  
**Multi-hazards:** earthquakes, Covid-19, heatwaves, fires  
**Impact in sectors:** megacity, housing, disadvantaged groups, cultural heritage, economic sectors

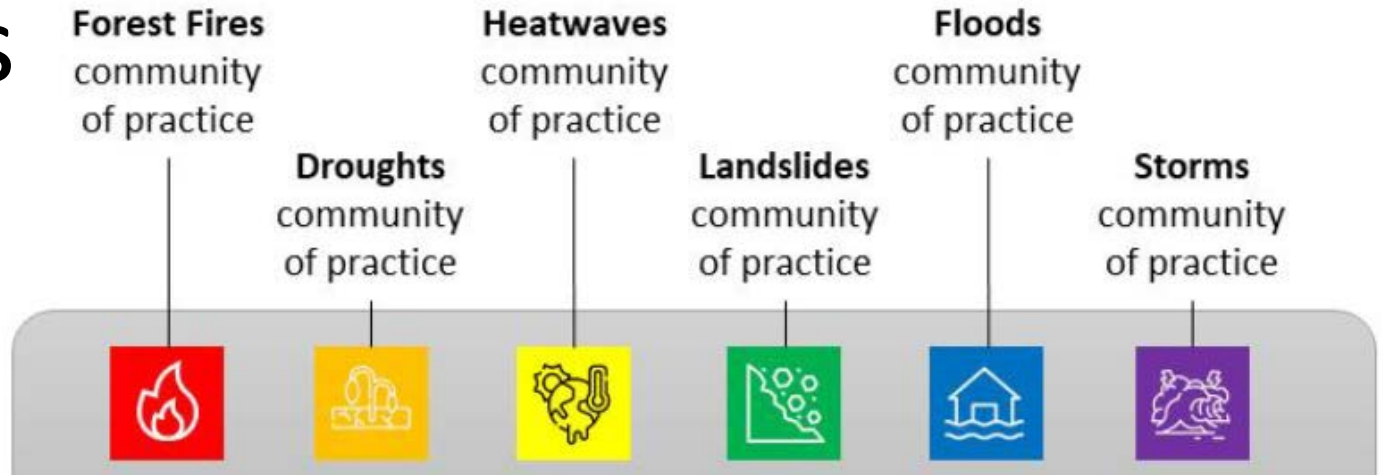
**CARRIBEAN**  
**Multi-hazards:** tropical storms, volcanoes, space weather, earthquakes  
**Impact in sectors:** humanitarian, preparedness, telecommunication, tourism, cross-border transport



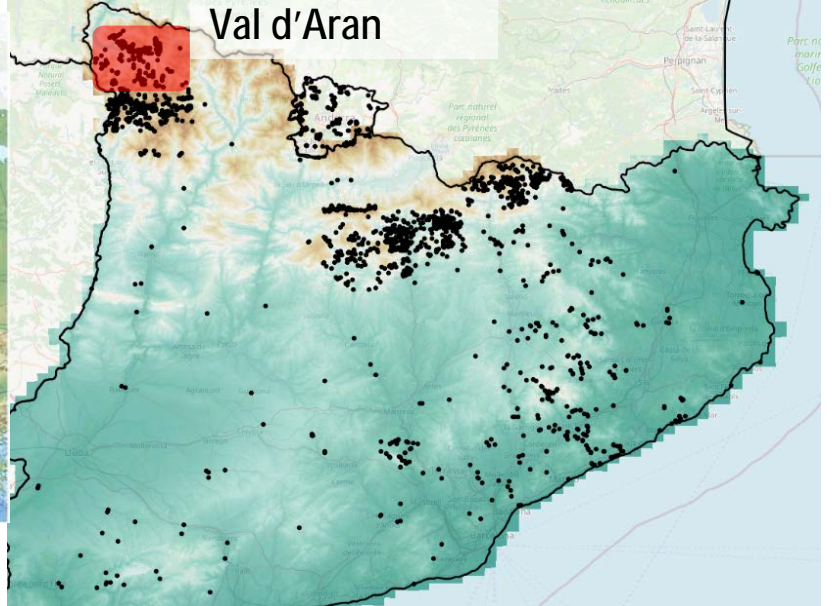
**Climatic hazards:**

**Earthquakes**

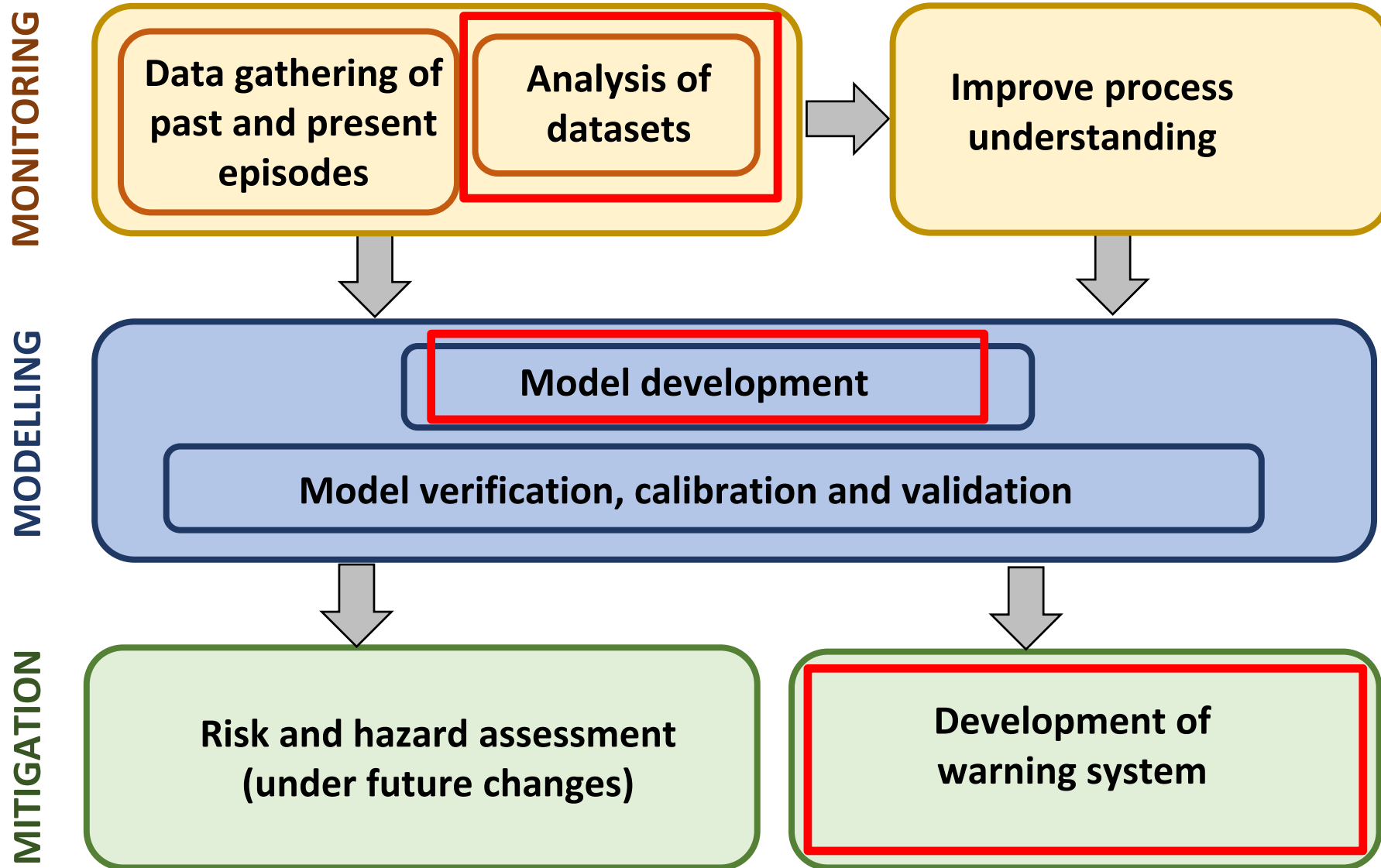
**Volcanoes**



*The-Hut*

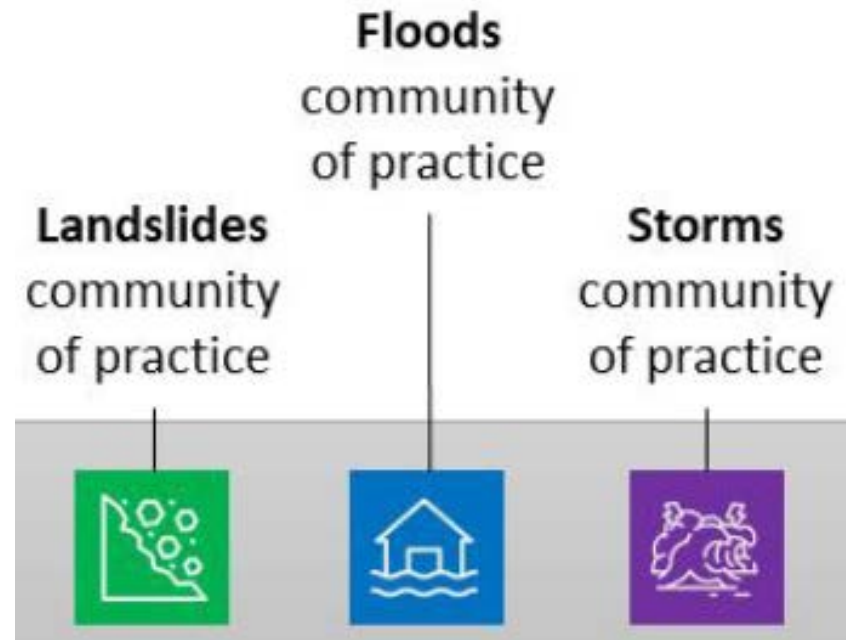


# General workflow in our research group



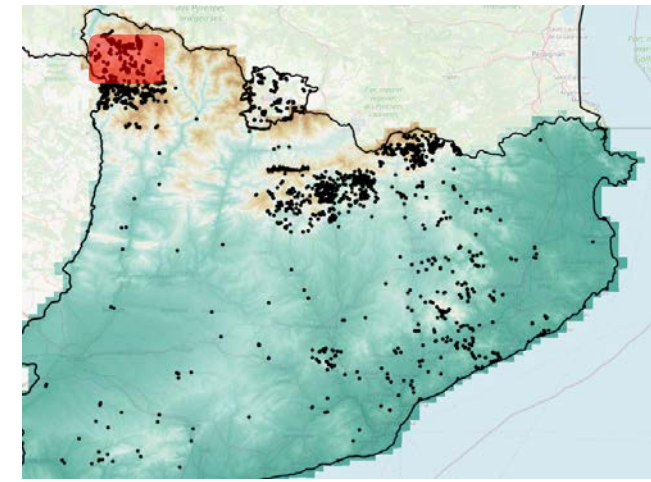
# Is Catalonia affected by natural hazards?

→ Two important recent examples regarding hydro-geomorphologic hazards



# Val d'Aran (Central Pyrenees)

Exceptional flood and landslide episode in June 2013



→ Losses exceeding 100 million EUR  
*Victoriano et al. (2016)*



ICGC

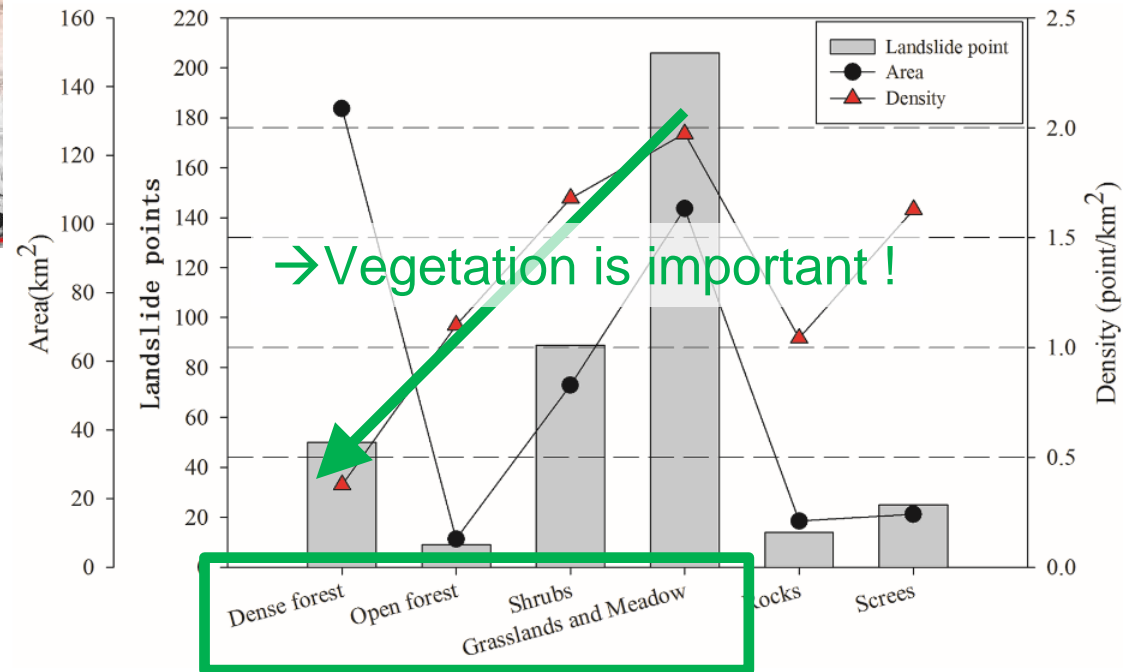
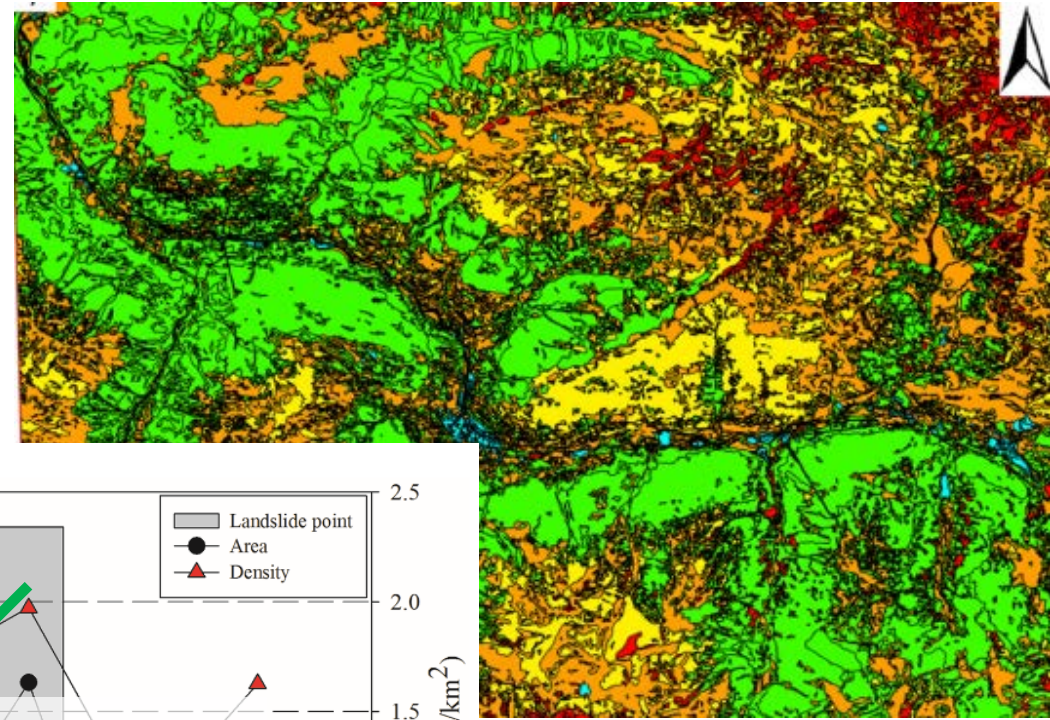
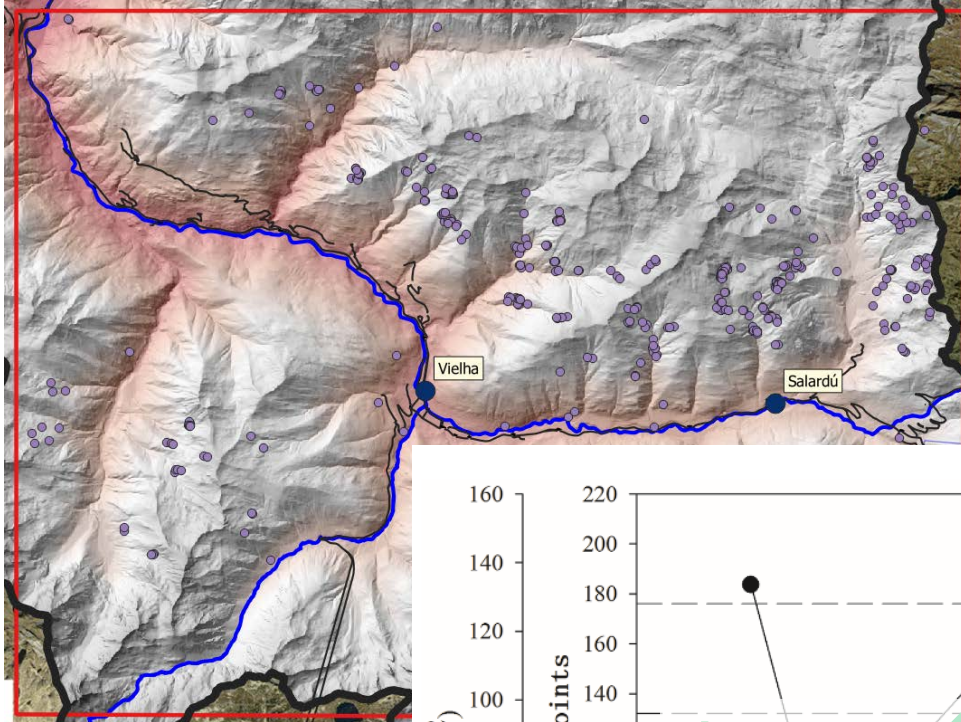


El Pais



# Val d'Aran: data analysis

- Landslide inventory: the effect of vegetation on landslide occurrence



# Gloria storm 2020

Catastrophic storm causing coastal damages, floods and landslides in January 2020

→ Losses exceeding 500 million EUR



*El Periódico*

## Tallada la carretera entre Soses i Aitona per esllavissades a conseqüència del temporal Gloria

22/01/2020 - 20.02 | Actualitzat 22/01/2020 - 20.01



Pia general d'un conjunt de roques tallant la carretera entre Soses i Aitona, al Segrià, el 22 de gener del 2020. Imatge cedida pel Servei Català de Trànsit. (Horizontal)



*El País*

# How we can protect the society against natural hazards?

## Types of risk mitigation strategies

### Active mitigation measures



Parque Fluvial del Besò (Aj. Barcelona)



Portainé

### Passive mitigation measures

→ Early Warning Systems (EWS)

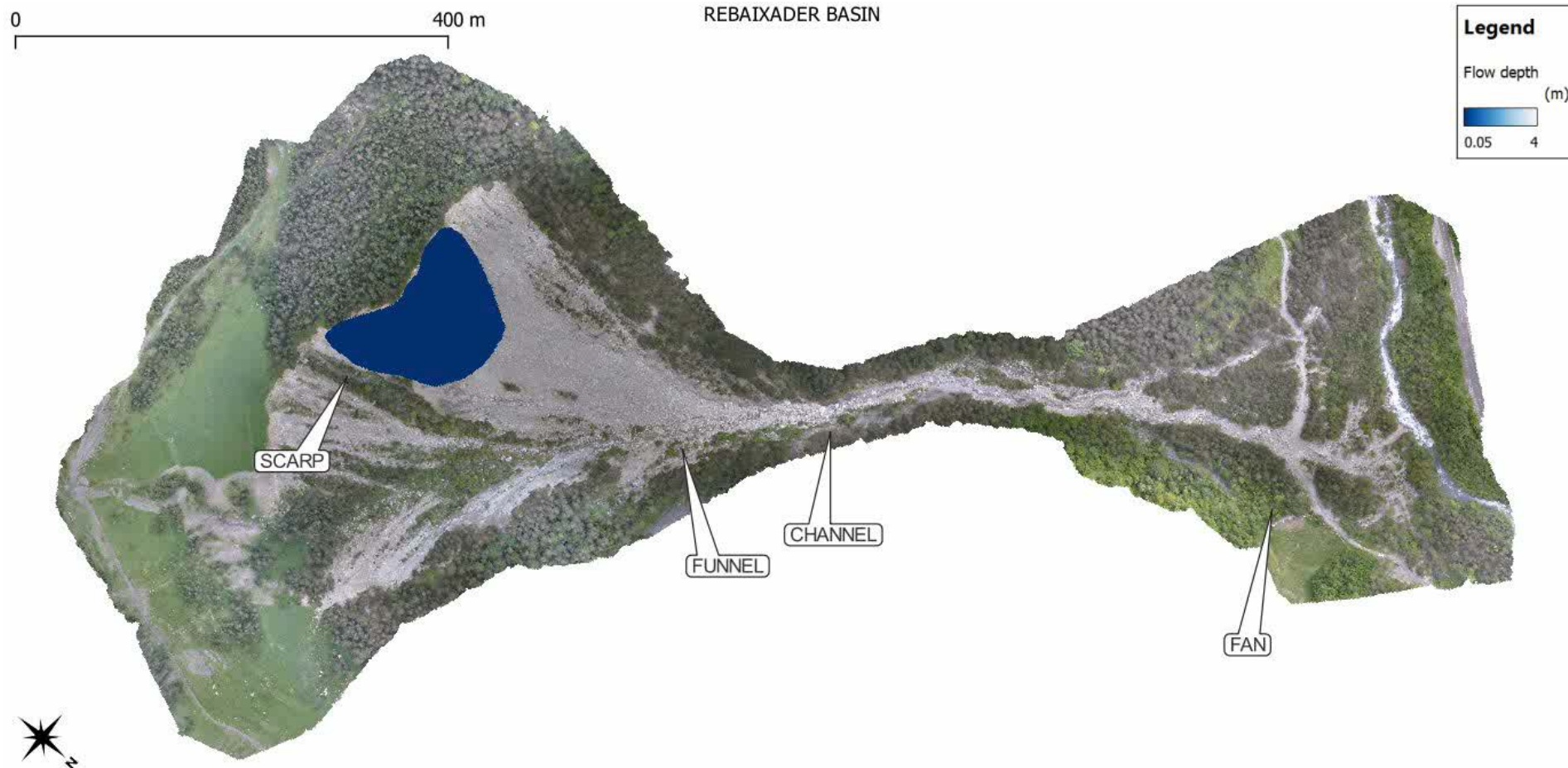
# Active mitigation by monitoring and modelling

## *Torrential floods in Pyrenees*



Peak: about 12:09:10 (00:28)

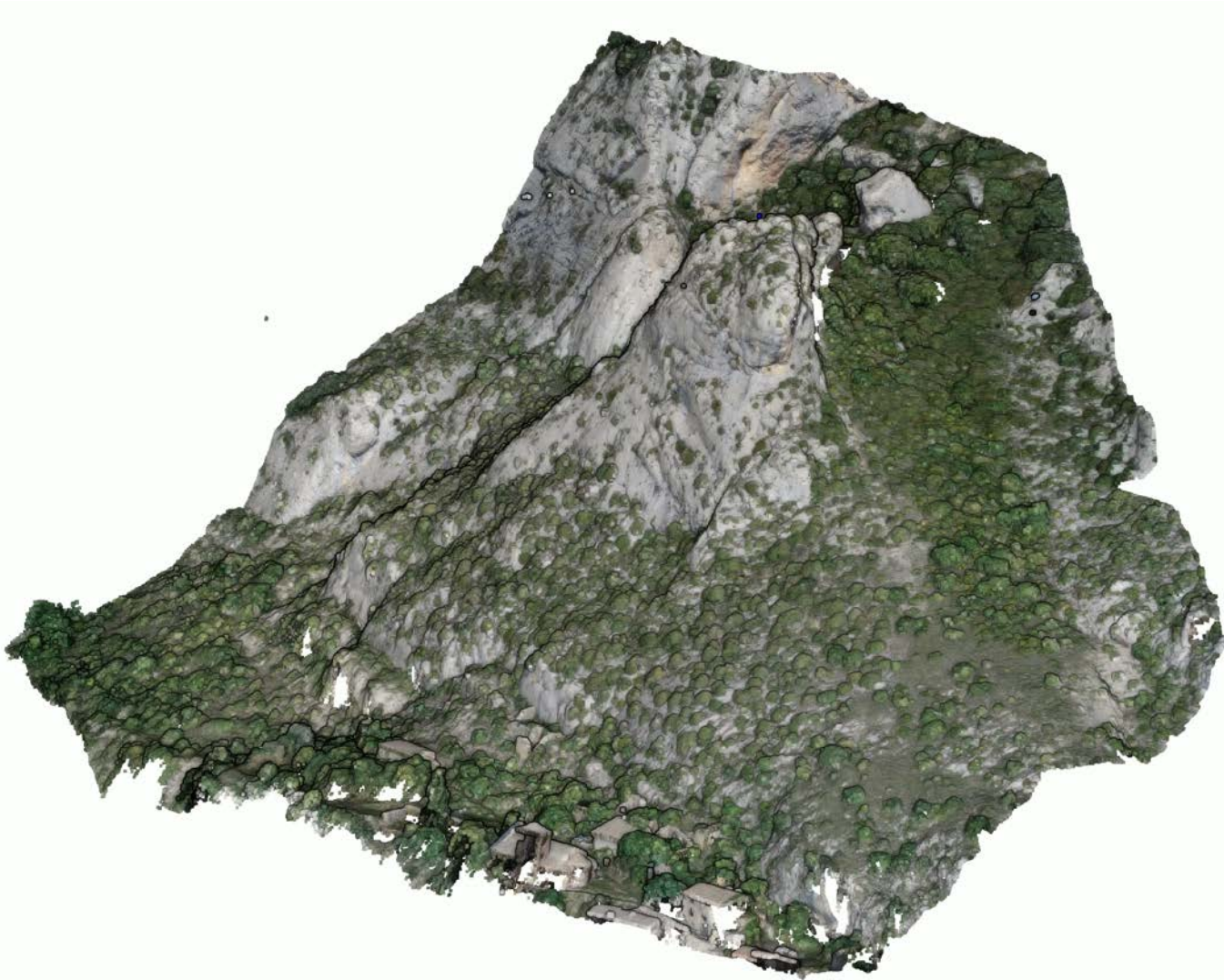
# Active mitigation by monitoring and modelling *Torrential floods in Pyrenees*



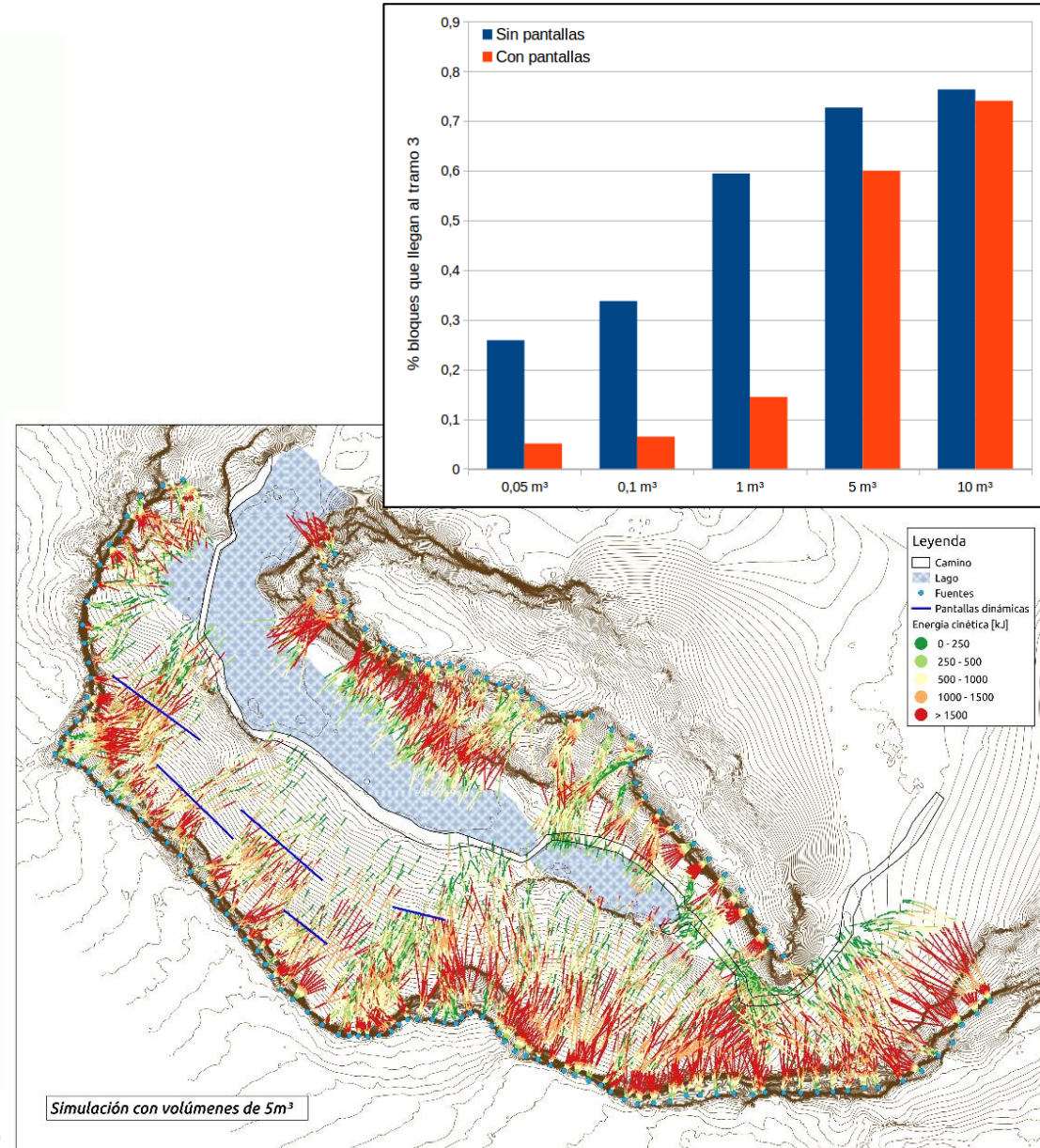
- Back-analysis of 2020 debris flow recorded by our monitoring system

# Active mitigation by monitoring and modelling

## Rockfall



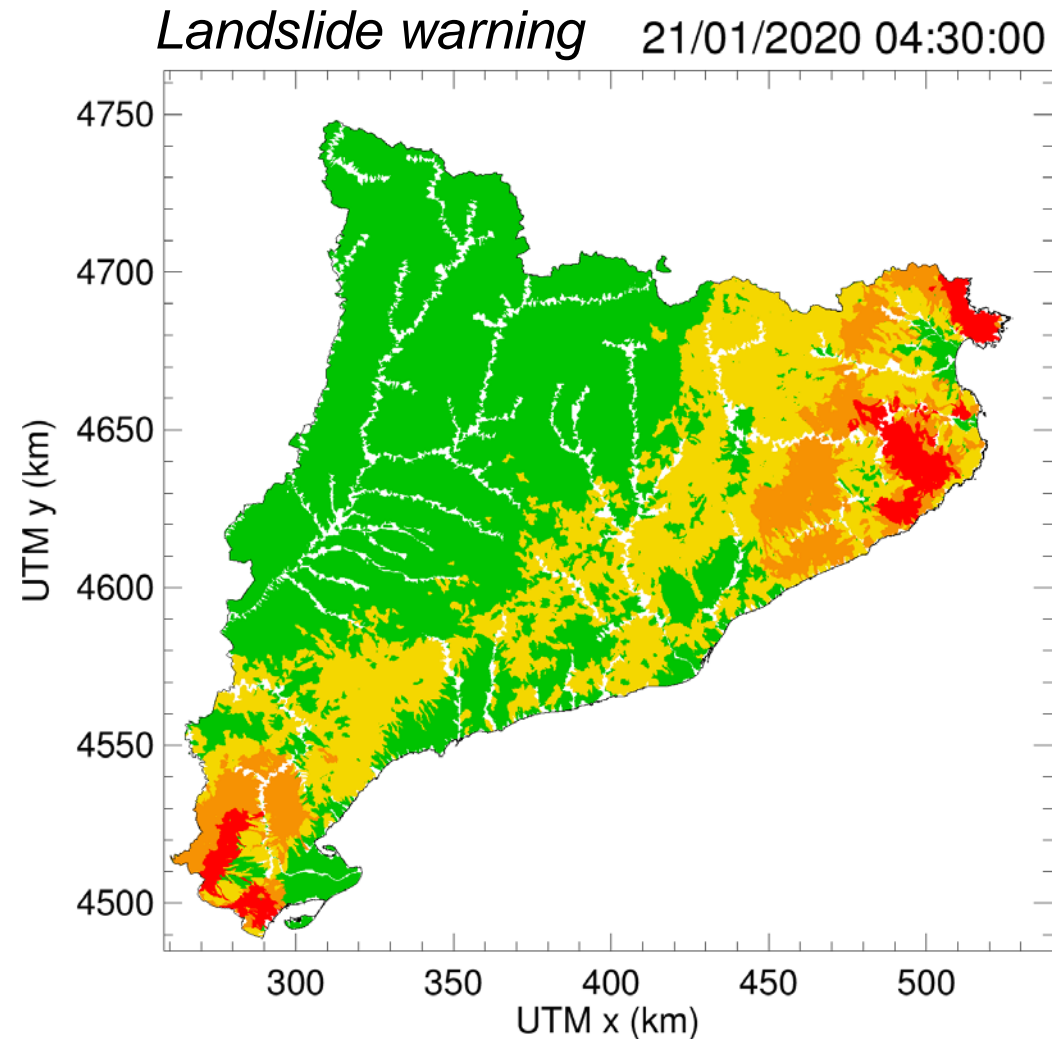
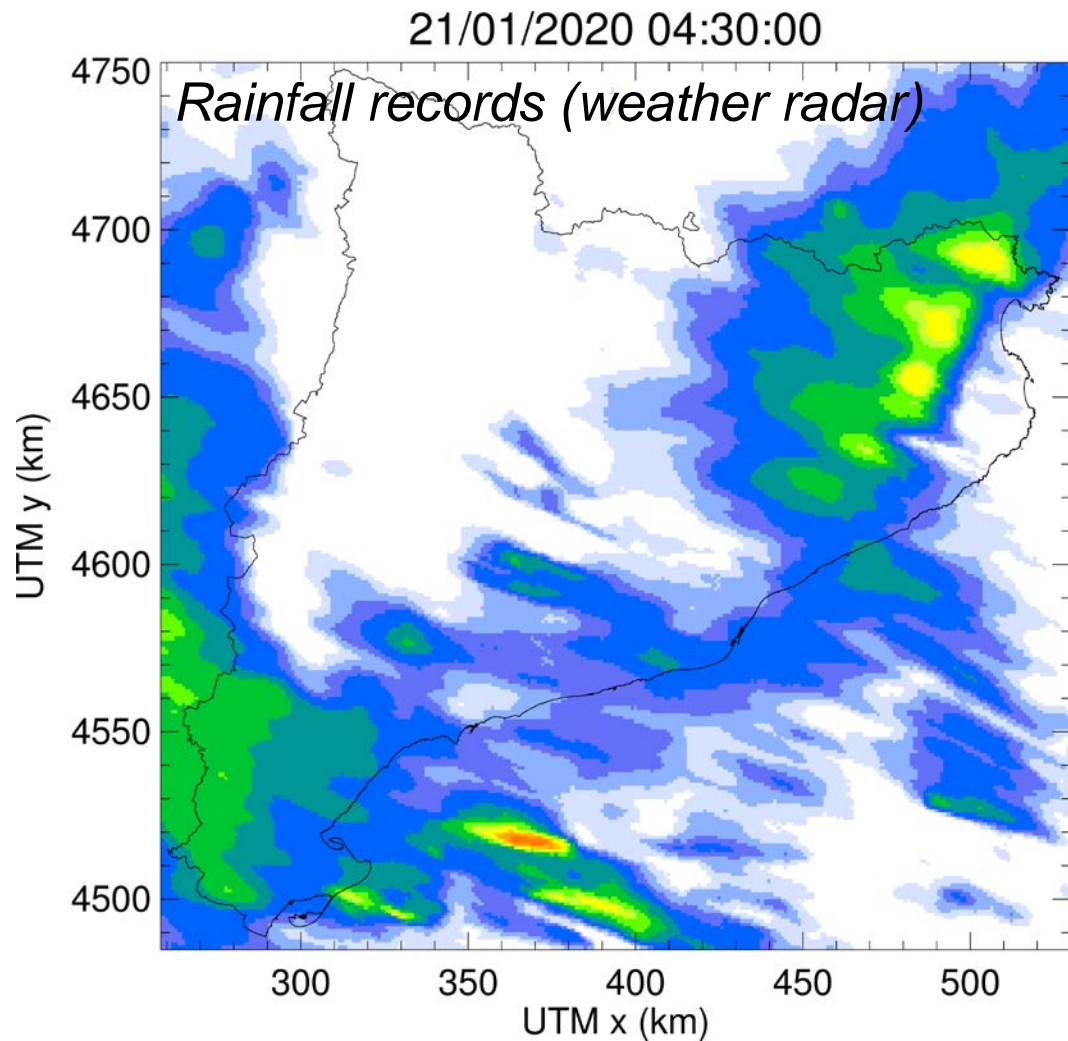
Lantada & Matas (2022)



Lantada (2022)

# Passive mitigation: Catalan Landslide EWS

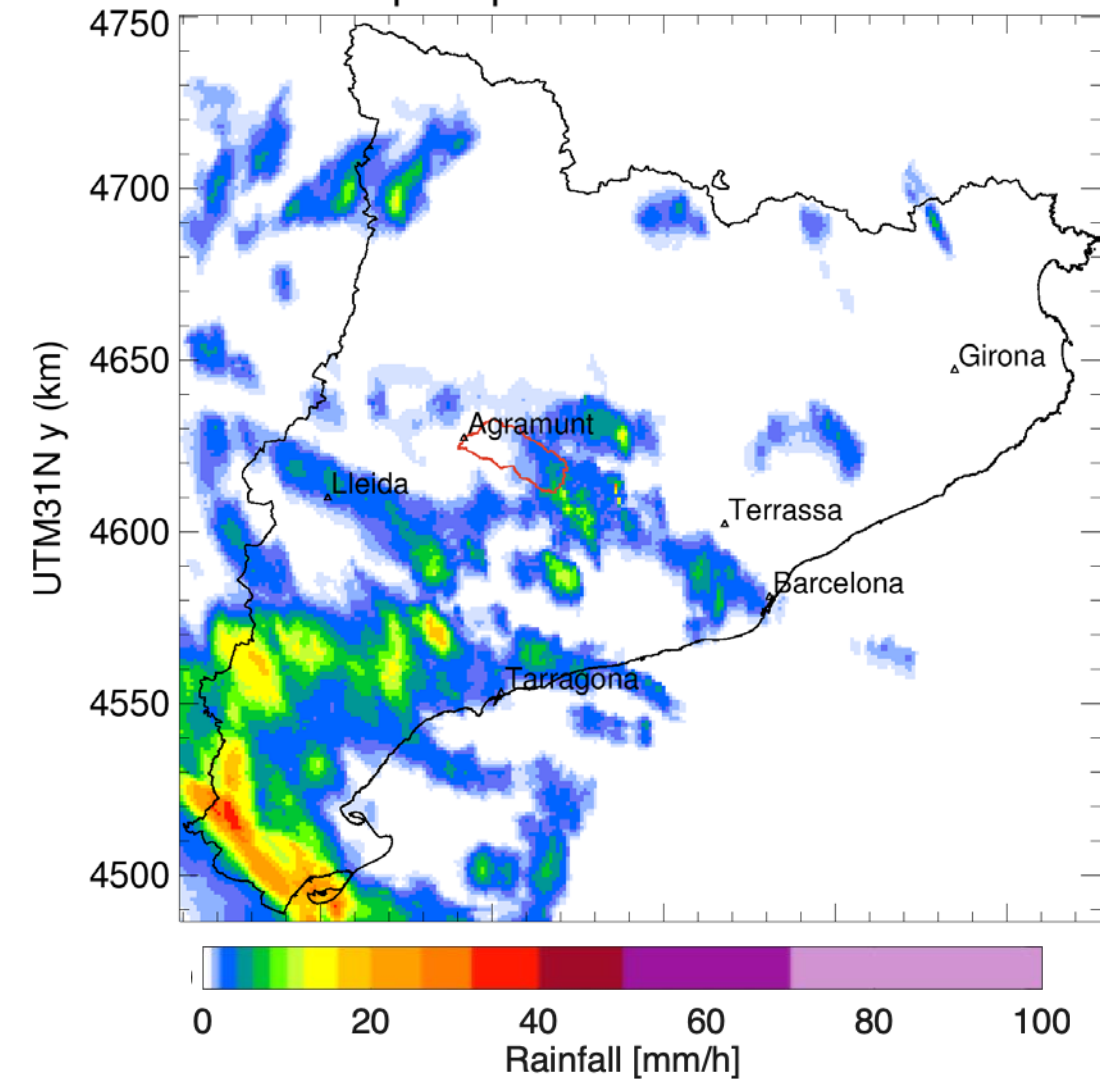
Example of Gloria storm (2020)



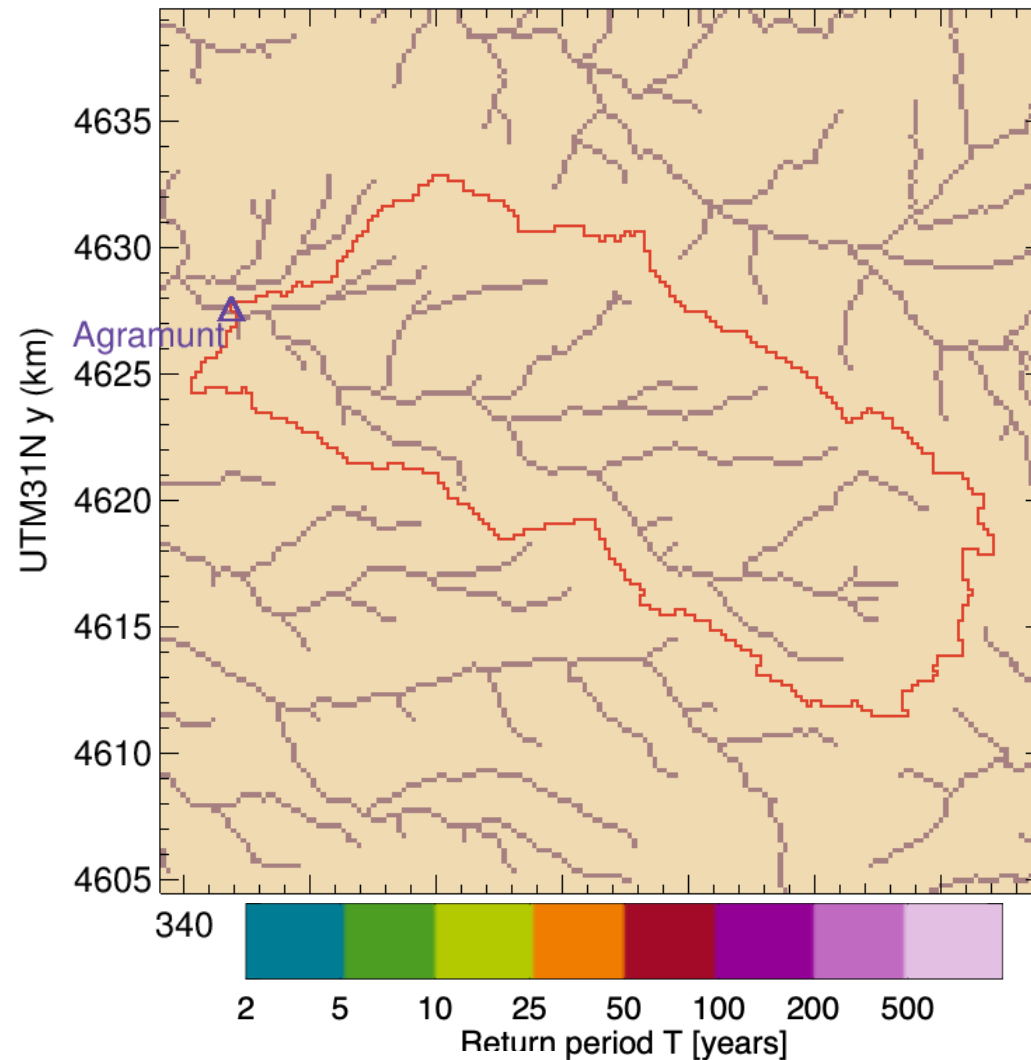
➤ Now testing phase with geological survey

# Passive mitigation: Flash Floods (ERICA-tool)

Observed precipitation - 02/11/2015 12:00:00



Modelled hazard - 02/11/2015 12:00:00



ERICA partners:



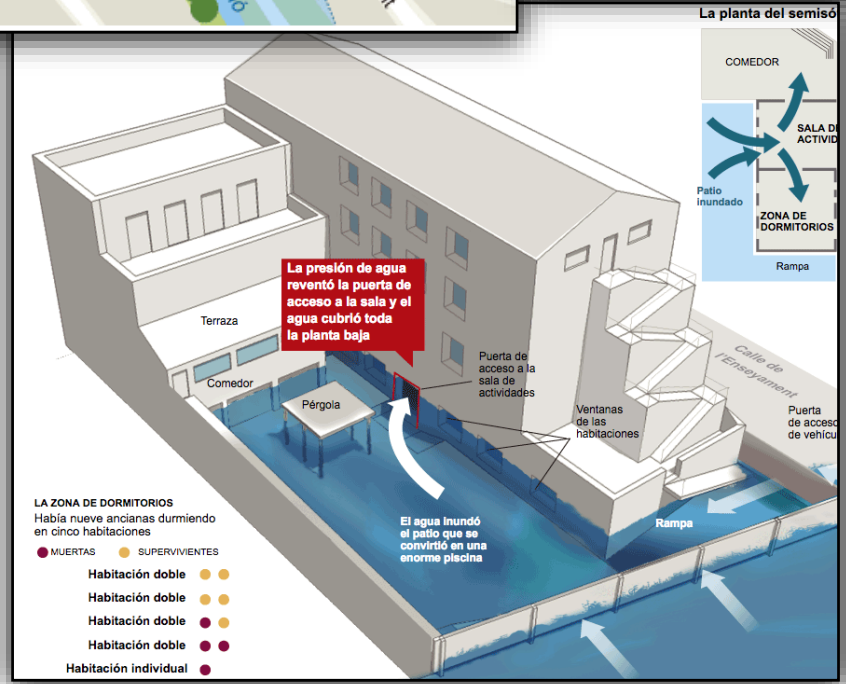
ERICA stakeholders:





# Final goal: building a safe haven

avoid episodes like the flash flood of Agramunt in 2015



## Impacts:

- 5 casualties
- Significant economic damage

A landscape photograph showing a mountain valley. In the foreground, there is a wide, rocky riverbed filled with light-colored stones and boulders. The middle ground is dominated by dense green forests on the slopes of the valley. In the background, a large, light-colored scree slope or talus fan rises, partially covered by sparse vegetation. The sky is clear and blue.

**moltes gracies – many thanks**

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