



# EARLY WARNING DEMONSTRATION OF PAN- EUROPEAN RAINFALL-INDUCED IMPACT FORECASTS

## LAYMAN'S REPORT



## Project details

**PROJECT TITLE:** Early Warning demonstration of pan-European rainfall-induced impact forecasts

**NUMBER:** 101101229 — EDERA — UCPM-2022-PP

**DURATION:** 01 February 2023 - 31 January 2025

**TOTAL BUDGET:** 1,173,954.78 EUR

**EU FINANCIAL CONTRIBUTION:** 997,861.55 EUR

**COORDINATOR:** Universitat Politècnica de Catalunya

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## Partners



**Centre de Recerca Aplicada  
en Hidrometeorologia**  
UNIVERSITAT POLITÈCNICA DE CATALUNYA



**ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE**



**Agencia de Medio Ambiente y Agua  
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Consejería de Agricultura, Pesca, Agua y  
Desarrollo Rural  
Consejería de Sostenibilidad,  
Medio Ambiente y Economía Azul



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# Coordination and cooperation during storms, heavy rainfall and flood events

Heavy rain and severe storms can cause a range of natural disasters — such as floods, landslides, and debris flows — that affect people and communities across Europe, often even crossing national borders.

To deal with these challenges, emergency management policies are shifting toward a more proactive and risk-based approach, [strengthening cooperation between civil protection agencies](#), especially when disasters affect several regions at once, and [improving coordination among agencies at local, national, and international levels](#) to ensure faster and more effective responses.

The EDERA project worked to [improve the early warning systems used by Civil Protection agencies to support decision-making](#) during storms, heavy rainfall, and flood events. To achieve this, EDERA developed [multi-hazard, impact-based forecasts that cover all of Europe](#) — making use of the latest advances in hazard observation, forecasting technologies, and data on exposure and vulnerability.



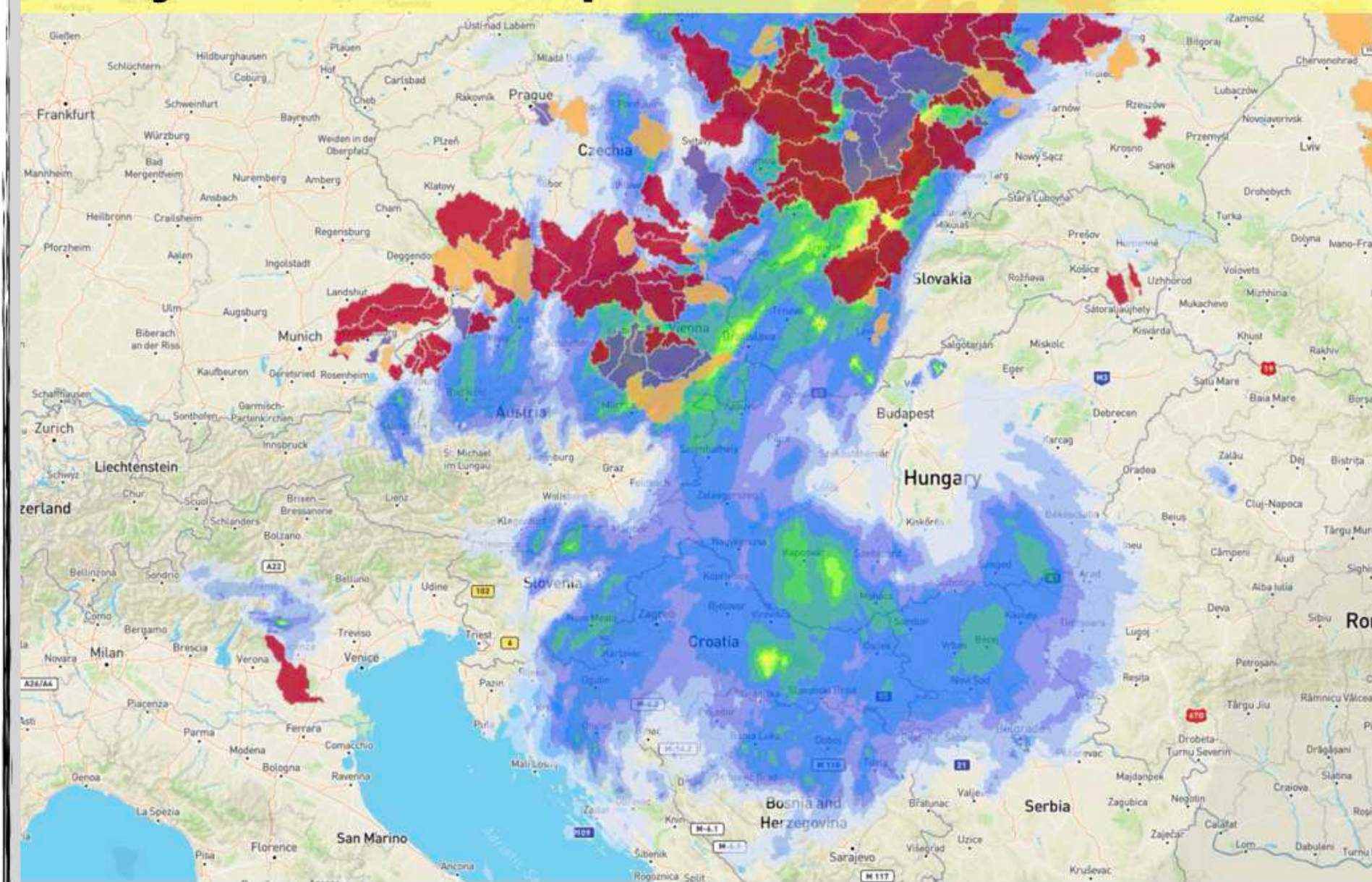
# — Impact forecasts for decision-making —

EDERA's goal was to improve the ability to predict and prepare for storm, heavy rainfall and floods over Europe.

The project developed and tested new forecasting tools that can warn of storm and flooding impacts across Europe in real time.

It focused on making these forecasts useful for civil protection agencies, helping them act faster and more effectively during extreme weather events.

## 5-day flash flood impact forecasts



### On the river network (basins: 10 - 2000 km<sup>2</sup>)

With probabilistic precipitation forecasts combining

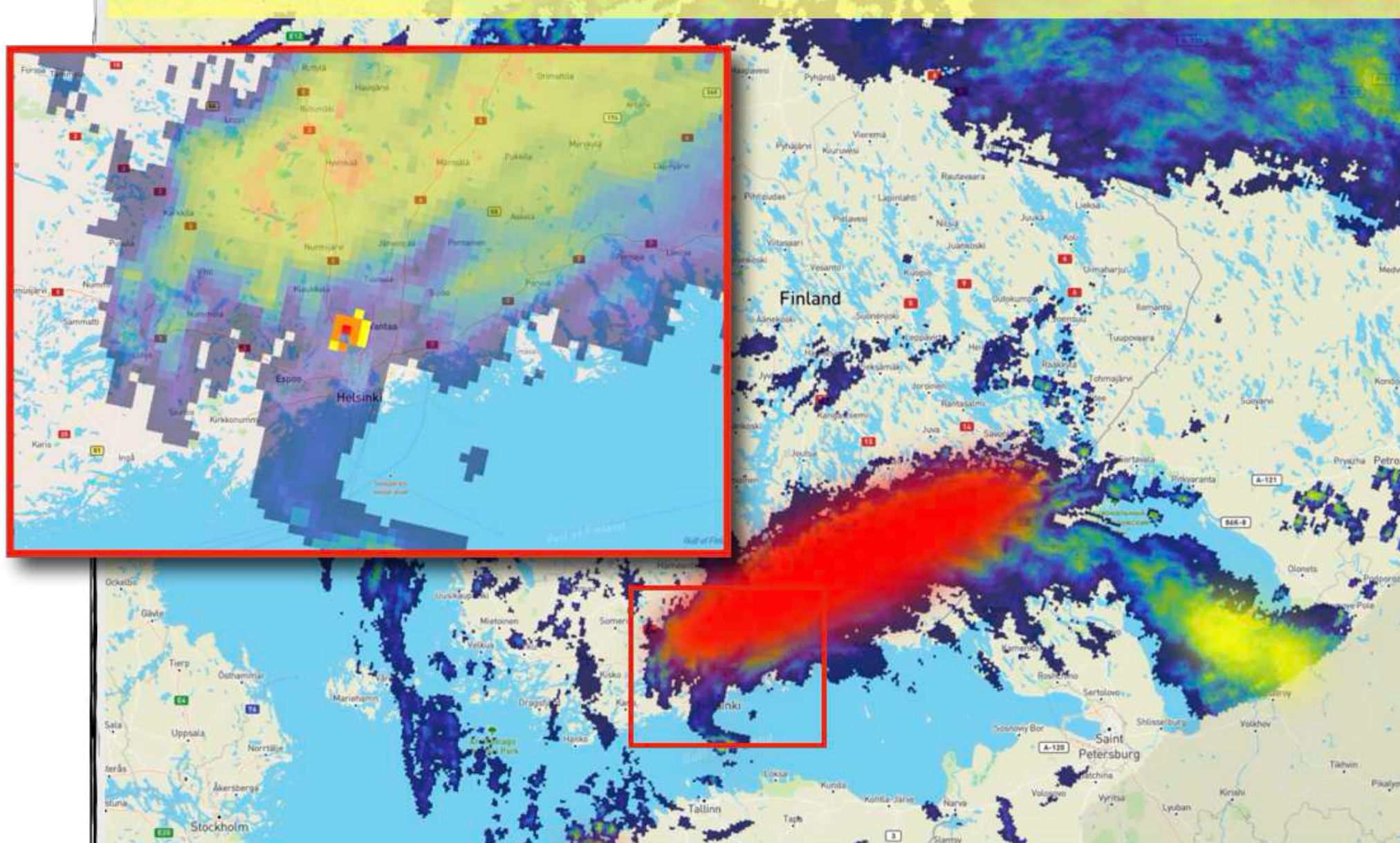
- Radar-based forecasts
- Weather forecasting model outputs

Flash flood hazard by calculating rainfall over the sub-catchments.

Flash flood impact by combining hazard with exposed population and infrastructures.



## 3-hours storm forecasts



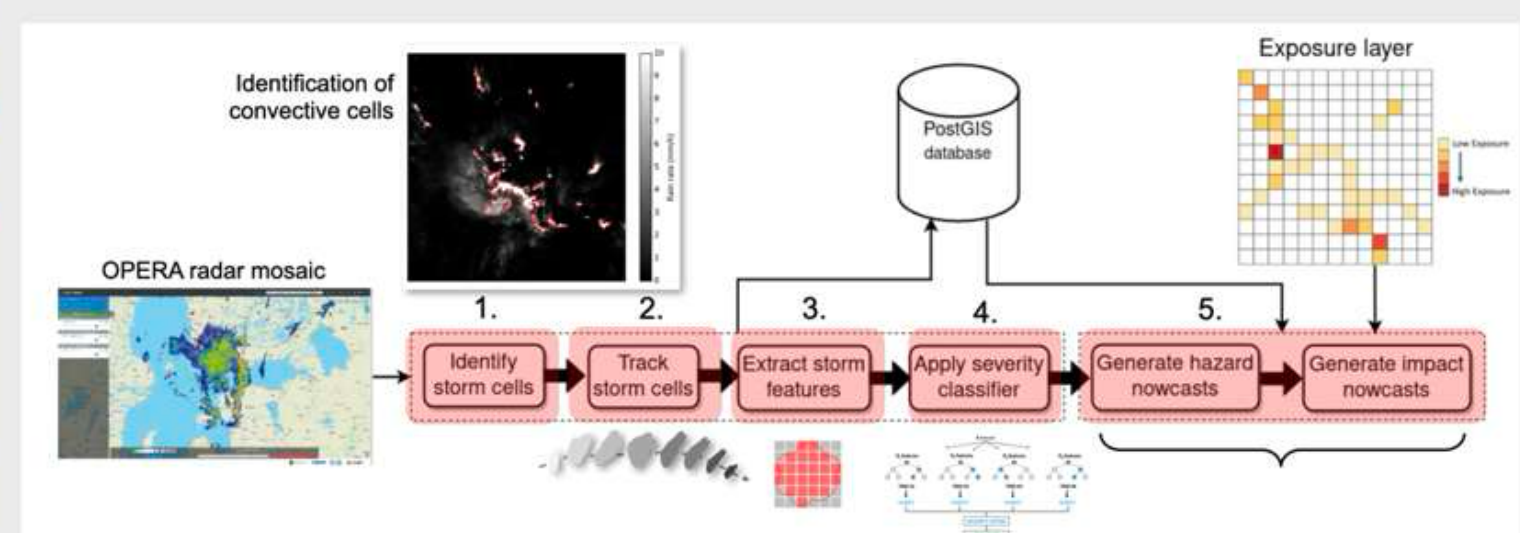
### With European coverage.

Storm hazard based on radar rainfall forecasts & Machine Learning:

- Identification of storms.
- Hazard levels for hail, lightning, rainfall and wind.
- Trained against the Severe Weather reports.

Storm impact assessment with exposure.

Urban floods forecasts.



## Demonstration with end users

EDERA conducted a 15-month demonstration, during which the products of the project were tested in real time by end users with emergency management competences during storms, heavy rainfall and flood events.

The goal of the demonstration was to evaluate the added value of the developed tools for improved decision making, cross-border cooperation and coordination among the relevant authorities.

- From August 2023 to October 2024.
- EDERA products available in real time.
- With the participation of 18 stakeholders.
- Integration of local products and datasets.
- Notifications adapted to end users.
- At two levels:
  - Over Europe, focusing on the most severe events, and
  - In two pilot sites (ES-PT and FI+), where end users were more actively involved.
- 3 training workshops.

### ES-PT pilot site

**National Authority of Emergency and Civil Protection**  
CIM Coimbra Region  
Portuguese Institute of Sea and Atmosphere  
Portuguese Agency of Environment

**Directorate-General for Civil Protection and Emergencies**  
**Environment and Water Agency of Andalusia**  
Civil Protection of Andalusia  
Civil Protection of Galicia  
Secretariate General of Interior, Emergencies and CP (Extremadura)  
Civil Protection of Puente Genil  
Association of CP operators of Andalusia  
Agency of Security and Emergencies of Valencia  
Civil Protection of Catalonia  
State Agency of Meteorology

### FI+ pilot site

**Finnish Meteorological Institute**  
Helsinki Rescue Department  
Kymenlaakso Rescue Services  
North Karelia Rescue Department  
Finnish Environment Institute

# — Real-time compound impact forecasting —

The products generated by the project were made available to civil protection agencies to complement the existing data and tools.

The result is a number of information layers that need to be combined for decision making during severe events.

EDERA **notifications**, combining multiple datasets, were designed **to warn end users when significant events are forecasted.**



Hydrometeorological forecasts

- Official weather warnings.
- Gauge-adjusted radar rainfall.
- Probabilistic rainfall forecasts (up to 5 days).



Convective storms, severe winds

- Storm hazard forecasts (up to 3 hours).
  - Hail.
  - Wind gusts.
  - Heavy rain.
  - Lightning.
- Storm impact forecasts (up to 3 hours).



Floods, flash-floods, debris flow and landslides

- Pluvial flood nowcasts.
- Flash flood hazard forecasts (up to 5 days).
- Flash flood impact forecasts (up to 5 days).
- EFAS flood forecasts.
- EFAS rapid risk assessment.
- Other flow observations & forecasts.



Exposure and vulnerability

- Combined exposure map (1km):
  - Population density.
  - Transportation networks.
  - Energy, health, education infrastructures.
- Flood hazard maps.
- Critical points in flood areas.
- Other critical points..

Integrated through tailored notifications

**Notifications Updates**

This email provides you with the latest updates on potential warnings related to your area. For more information you can access our [platform](#).

**Regions with new information:**

The following regions have received new notifications.

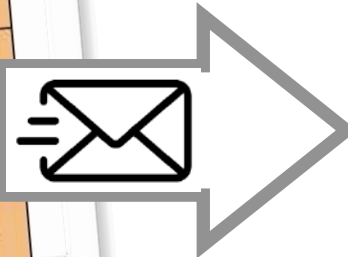
- New level 3 warning for Almería.
- New level 3 warning for Granada.
- New level 2 warning for Granada.
- New level 3 warning for Málaga.

**Active notifications:**

Detailed list of currently active notifications.

| Warning Type | Source                                                | Area                     | Level | Start time             | End time                  |
|--------------|-------------------------------------------------------|--------------------------|-------|------------------------|---------------------------|
| Flood        | Edera product notification (Impact)                   | Málaga                   | 3     | March 30, 2024, 7 p.m. | March 31, 2024, midnight  |
| Flood        | Edera product notification (Impact)                   | Granada                  | 3     | March 30, 2024, 7 p.m. | March 30, 2024, 10 p.m.   |
| Flood        | Edera product notification (Impact)                   | Almería                  | 3     | March 30, 2024, 7 p.m. | March 30, 2024, 11 p.m.   |
| Coastalevent | Official Warning (AEMET. State Meteorological Agency) | Costa - Litoral gaditano | 2     | March 31, 2024, 1 a.m. | March 31, 2024, 6:59 a.m. |
| Coastalevent | Official Warning (AEMET. State Meteorological Agency) | Costa - Estrecho         | 2     | March 31, 2024, 1 a.m. | March 31, 2024, 7:59 a.m. |
| Coastalevent | Official Warning (AEMET. State Meteorological Agency) | Costa - Ceuta            | 2     | March 31, 2024, 2 a.m. | March 31, 2024, 6:59 a.m. |
| Flood        | Edera product notification (Medium range impact)      | Granada                  | 3     | March 31, 2024, 6 a.m. | April 1, 2024, 6 a.m.     |
| Flood        | Edera product notification (Medium range impact)      | Málaga                   | 2     | March 31, 2024, 6 a.m. | April 1, 2024, midnight   |

Example of EDERA notification email



# ———— Main results of the project ————

## Europe-wide storm and urban flood forecasts

Using radar rainfall, severe weather reports and machine learning, the tools for storm nowcasting from the previous DG-ECHO project TAMIR were expanded to cover all of Europe. These were used to forecast the hazard associated with severe wind, large hail, heavy rain and lightning and their potential impacts.

Also using radar rainfall as main ingredient, a new product predicts floods in urban and highly impermeable areas across Europe.

## Notifications of multi-hazard impact forecasts

The project proposed a strategy to combine the products for the multiple hazards tackled by the project (storms, heavy rainfall and different types of floods) through notifications adapted to each end user, including information of exposed elements.

## Evaluation of the EDERA developments

The conclusions from the end users analyses show that they generally valued the EDERA developments (specially the Flash flood forecast summary layers and the Storm impact layers) for decision making during storms, heavy rainfall and flood events.

The predicted storm hazard locations are useful for lead times up to 1 hour; and the flash flood forecasts were able to identify of the most severe flash floods over Europe from August 2023 to October 2024 at least 48 h ahead.

The analyses show (i) the benefit of using together the flash flood forecast (for small catchments) with river flood forecasts, and (ii) the limitations of the impact forecasts in areas with low population densities.

## Training and public engagement

Three training workshops were held in Finland, Portugal and Spain to present the developments of the project to end users. A final EDERA workshop was organised in Brussels (January 2025).

In total, more than 120 participants representing institutions from 14 EU Member States attended the events organised by the project.



Helsinki (FI) Training Workshop, Oct 2023



Quarteira (PT) Training Workshop, Oct 2023



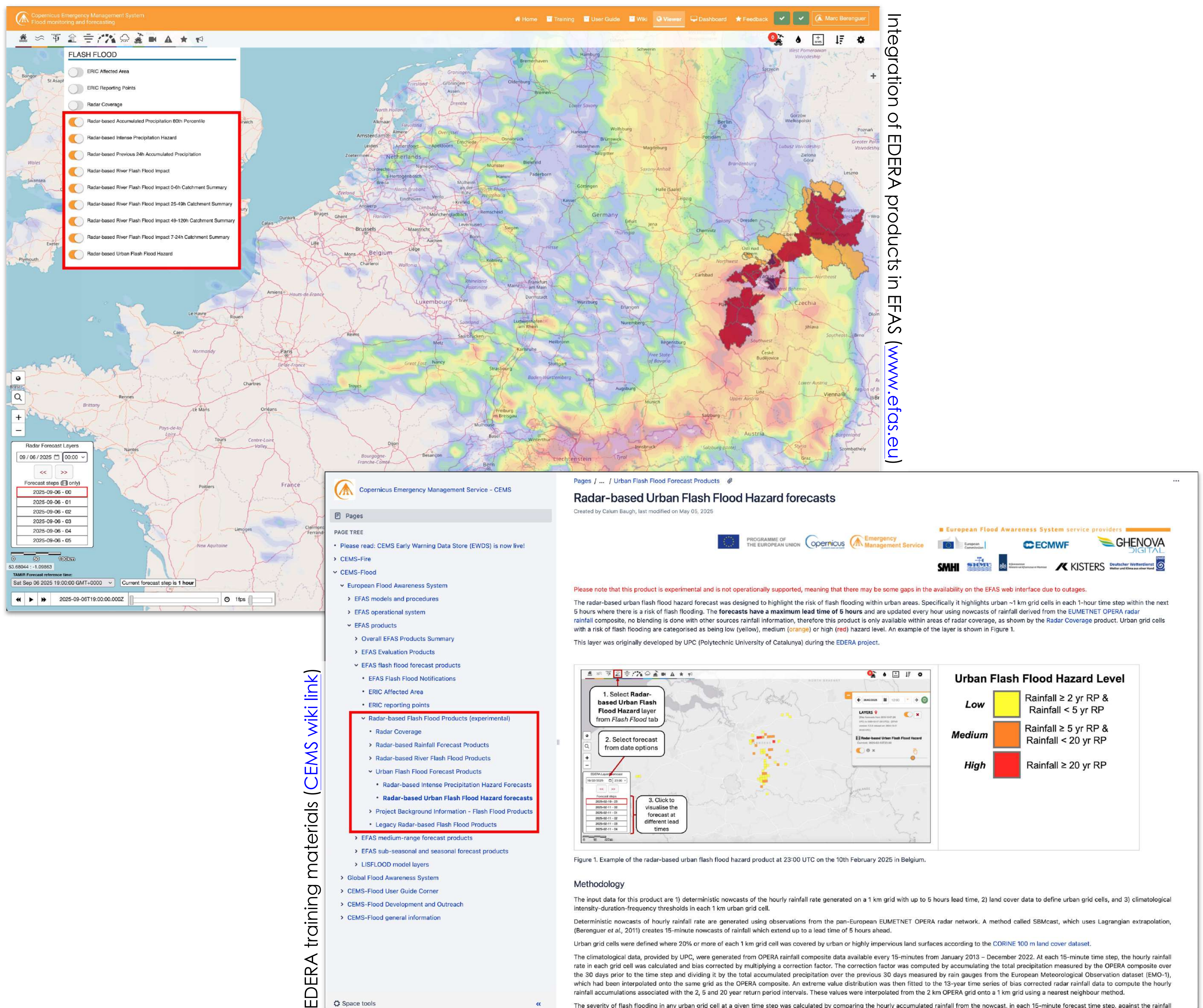
Madrid (ES) Int. Training Workshop, May 2024

———— Beyond the project's duration ————

EDERA transferred the rain and flash flood forecasting products, which are now part of the European Flood Awareness System (EFAS), the Copernicus Emergency Management Service for floods.

E-learning materials and videos are available for users to learn how to use and interpret the forecasts.

This ensures the project's innovations continue operating beyond its end, benefitting emergency managers across Europe.





[www.edera-project.eu](http://www.edera-project.eu)



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