EDERA
Early warning Demonstration of pan-European rainfall-induced impact forecasts

Co-funded by the European Union

GUIDED DEMONSTRATION OF EDERA PLATFORM & PRODUCTS

Loulé, 21 Nov 2023

Centre de Recerca Aplicada en Hidrometeorologia
UNIVERSITAT POLITÈCNICA DE CATALUNYA

ECMWF

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FINNISH METEOROLOGICAL INSTITUTE

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

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Real-time EDERA platform

4 groups of dynamic layers.

- Flash flood forecast summary (0-120 h)
- Storm impact (0-3 h)
- Animated flash flood nowcasting (0-6 h)
- Daily summary

Static layers

Warnings

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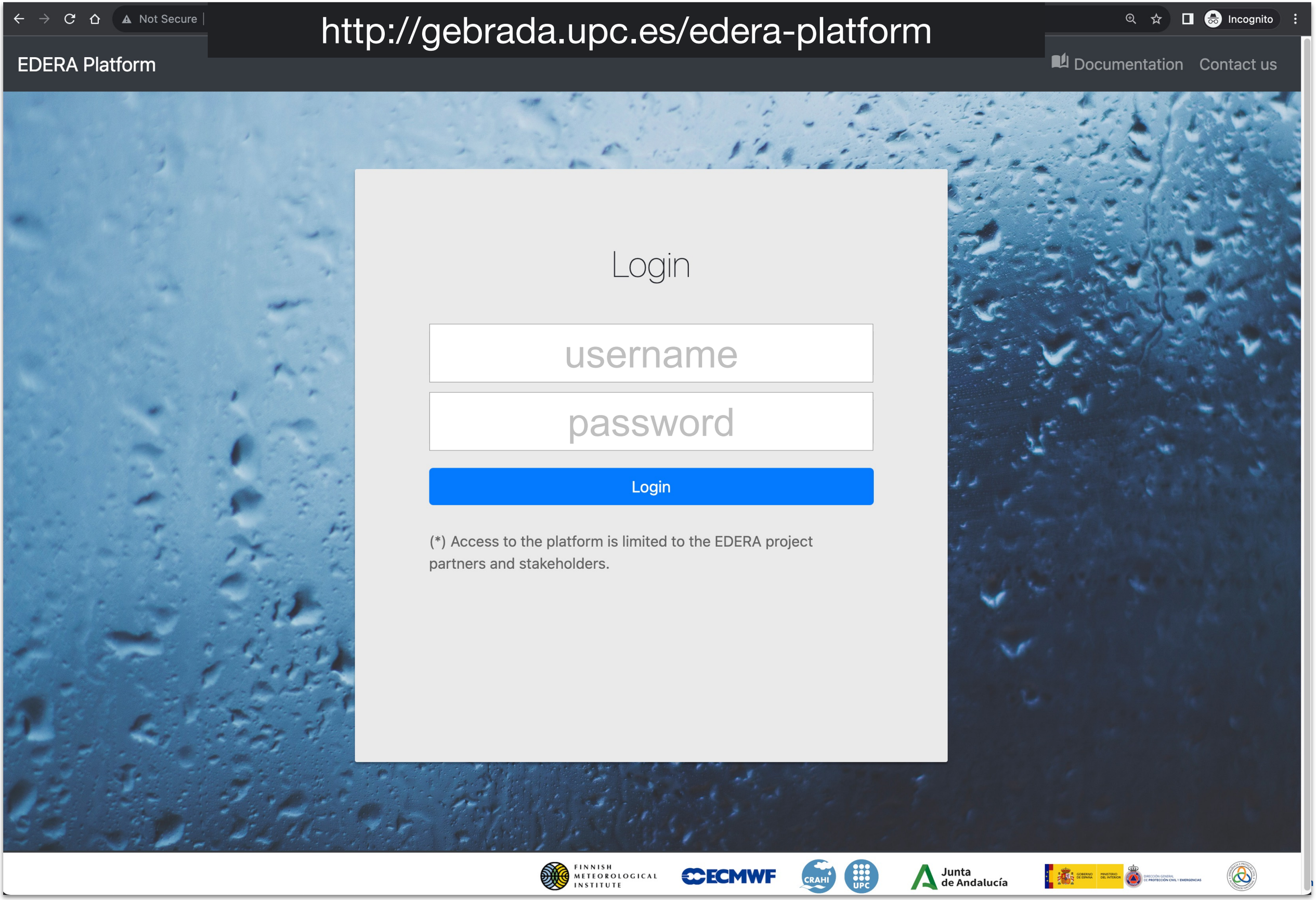
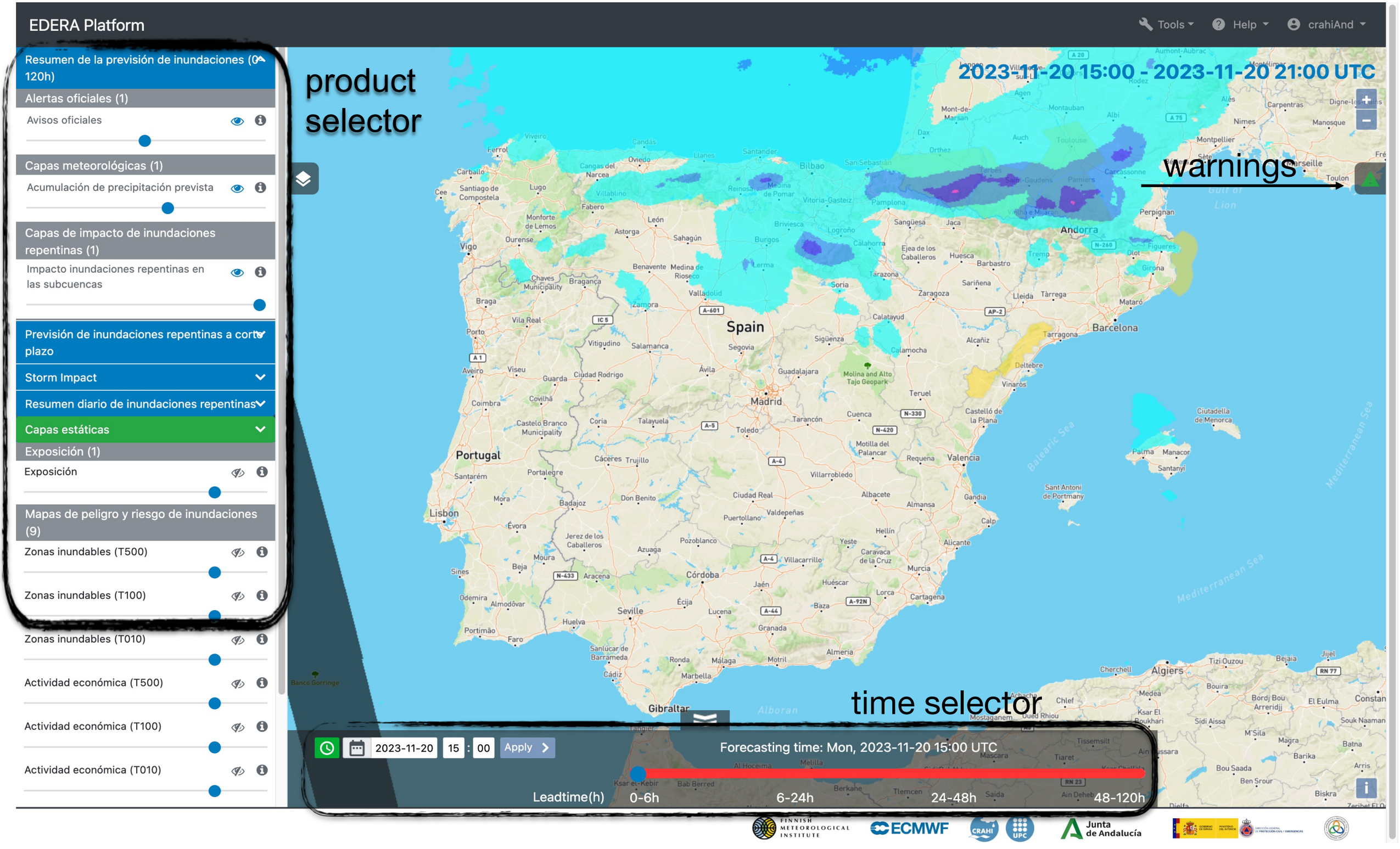
Real-time EDERA platform



Real time EDERA web-based platform



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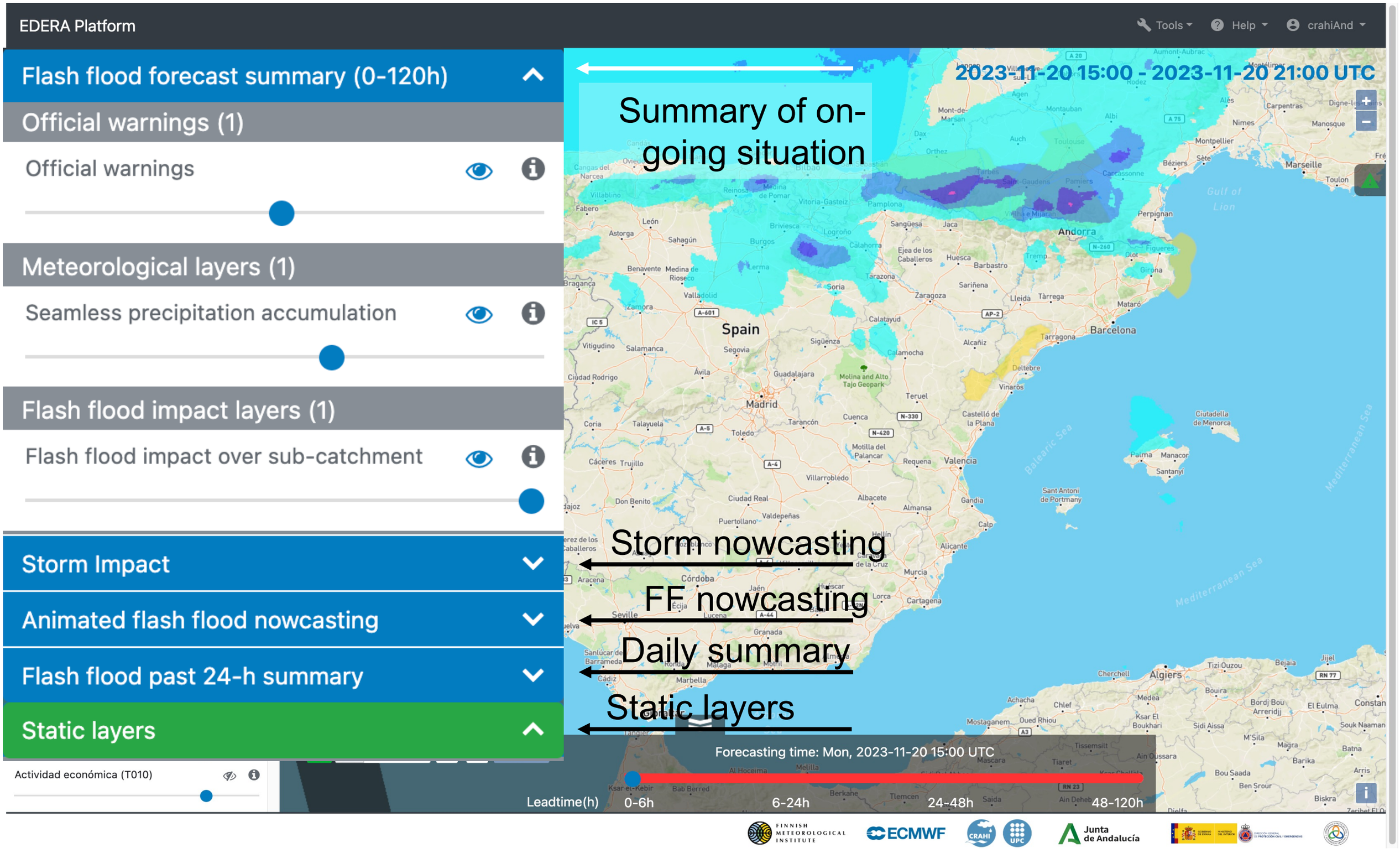
Product selector



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Date & time selector

EDERA Platform

Tools Help crahiAnd

Resumen de la previsión de inundaciones (0-120h)

Alertas oficiales (1)

Avisos oficiales

Capas meteorológicas (1)

Acumulación de precipitación prevista

Capas de impacto de inundaciones repentinas (1)

Impacto inundaciones repentinas en las subcuencas

Previsión de inundaciones repentinas a corto plazo

Storm Impact

Resumen diario de inundaciones repentinas

Capas estáticas

Exposición (1)

Exposición

Mapas de peligro y riesgo de inundaciones (9)

Zonas inundables (T500)

Zonas inundables (T100)

Zonas inundables (T010)

Actividad económica (T500)

Actividad económica (T100)

Actividad económica (T010)

2023-11-20 15:00 - 2023-11-20 21:00 UTC

Aug 2023

Mo	Tu	We	Th	Fr	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Today Done

2023-11-09 09 : 00 Apply

Forecasting time: Mon, 2023-11-20 15:00 UTC

Leadtime(h) 0-6h 6-24h 24-48h 48-120h

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Date & time selector

EDERA Platform

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Resumen de la previsión de inundaciones (0-120h)

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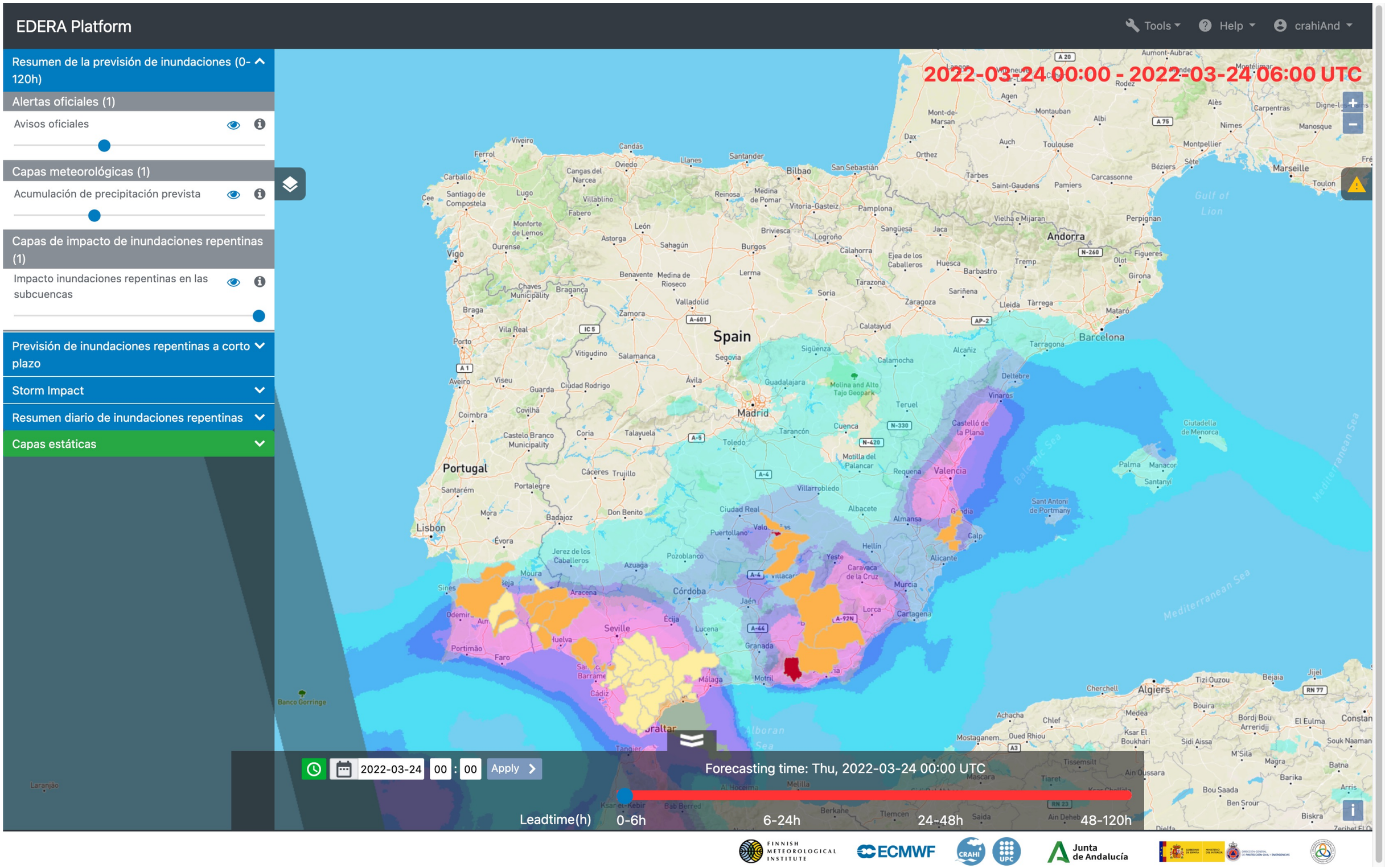
Flash flood forecast summary (0-120h)



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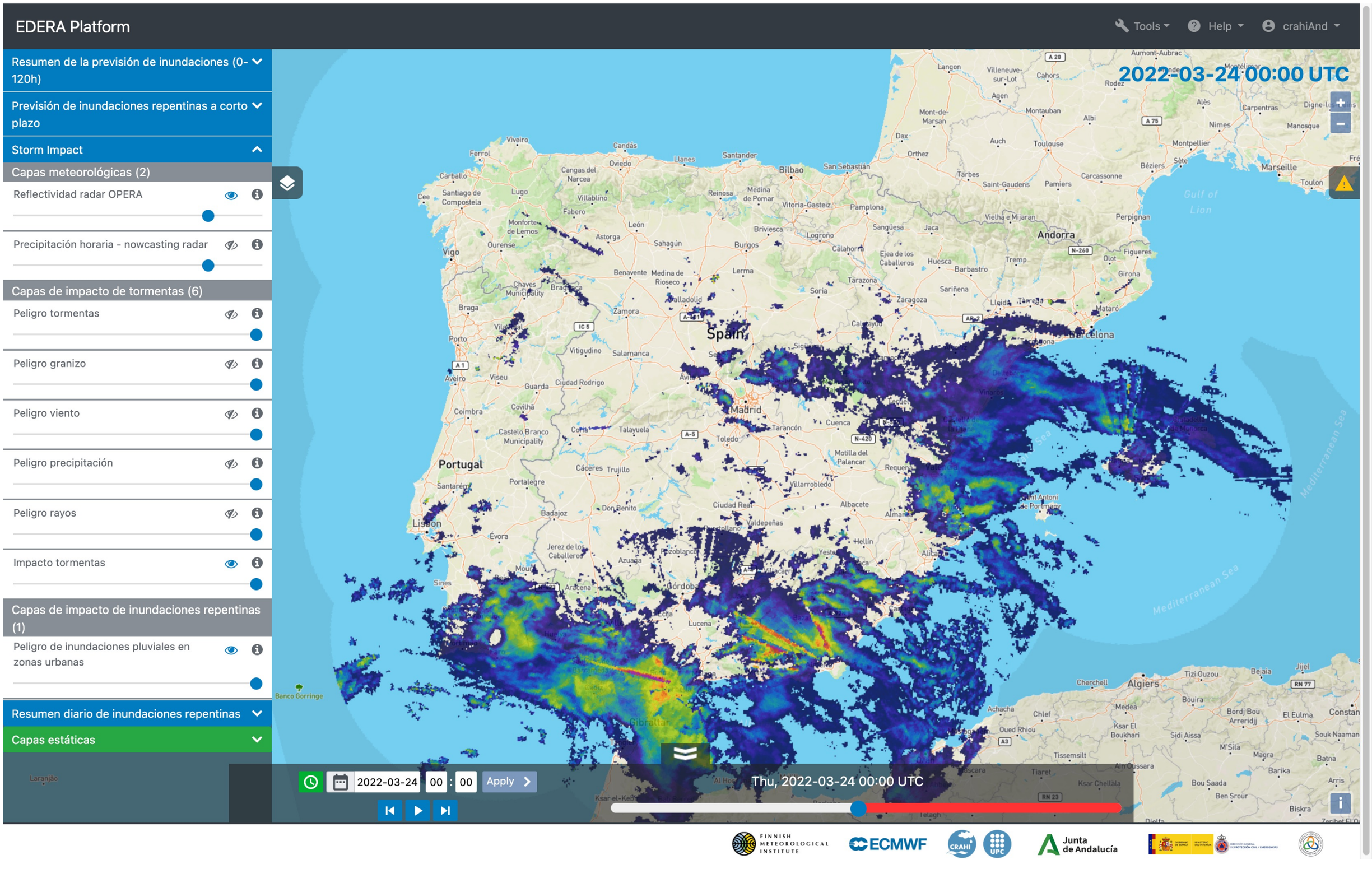
Storm impact nowcasting (0-3h)



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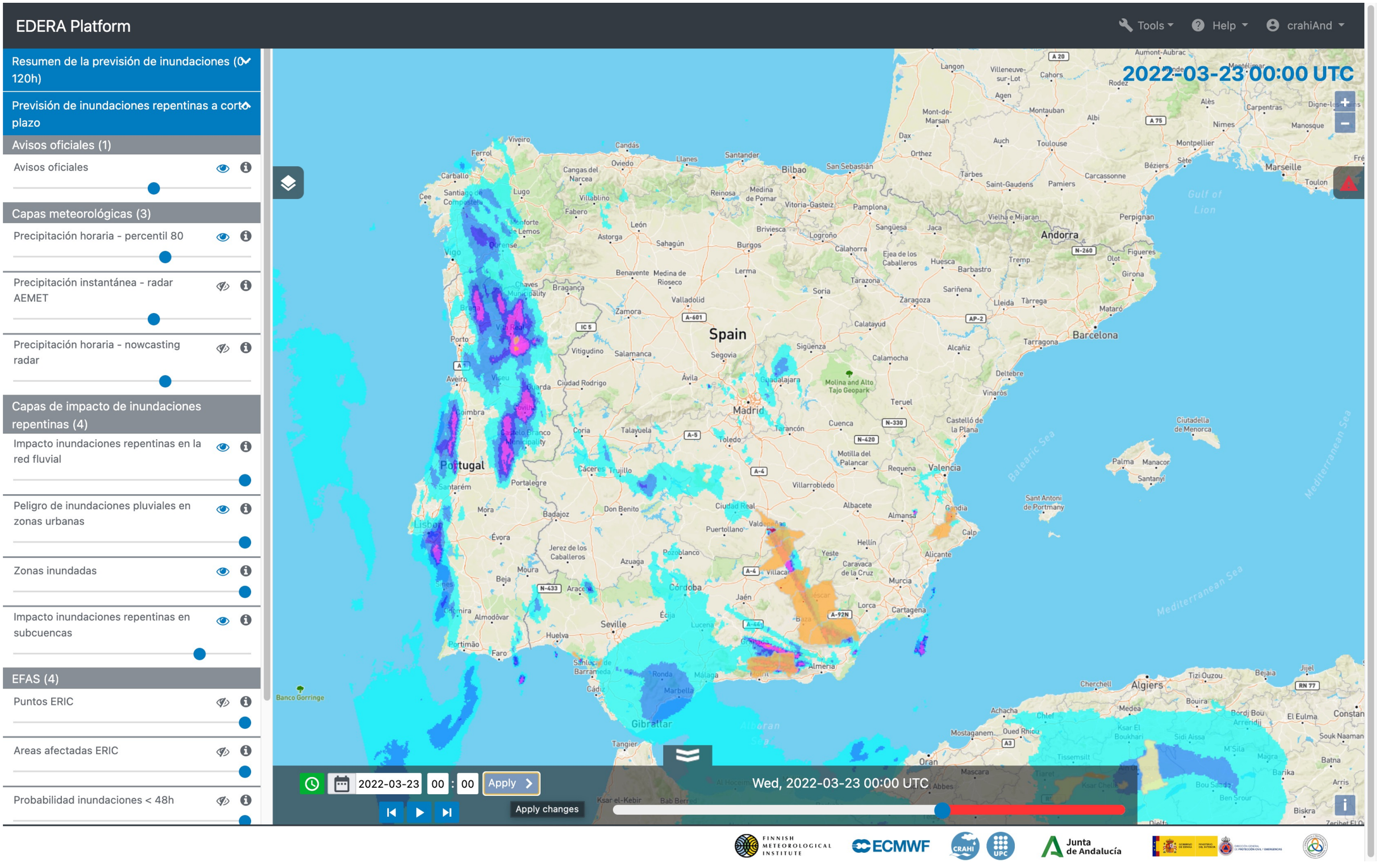
Animated flash flood nowcasting



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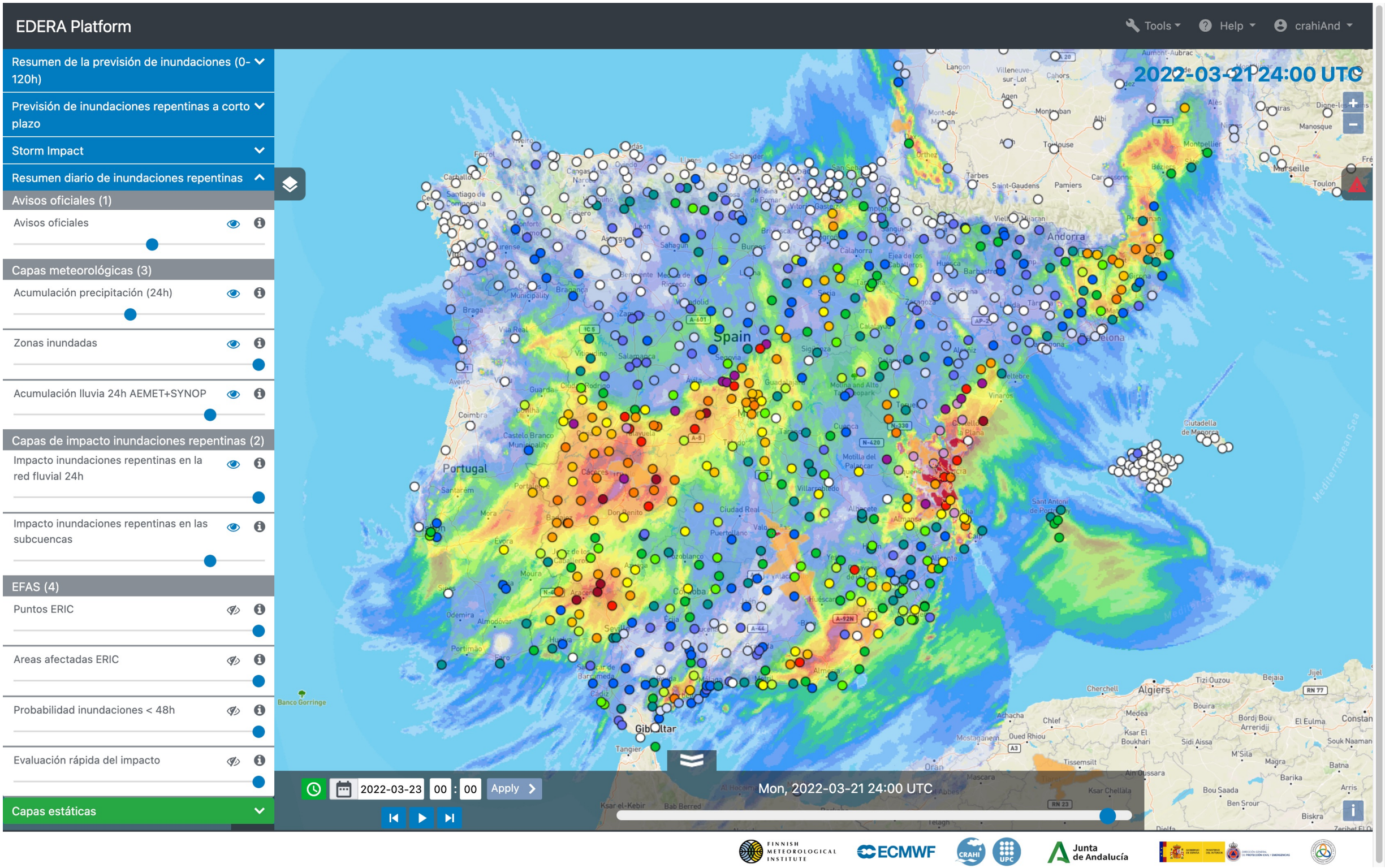
Daily summary



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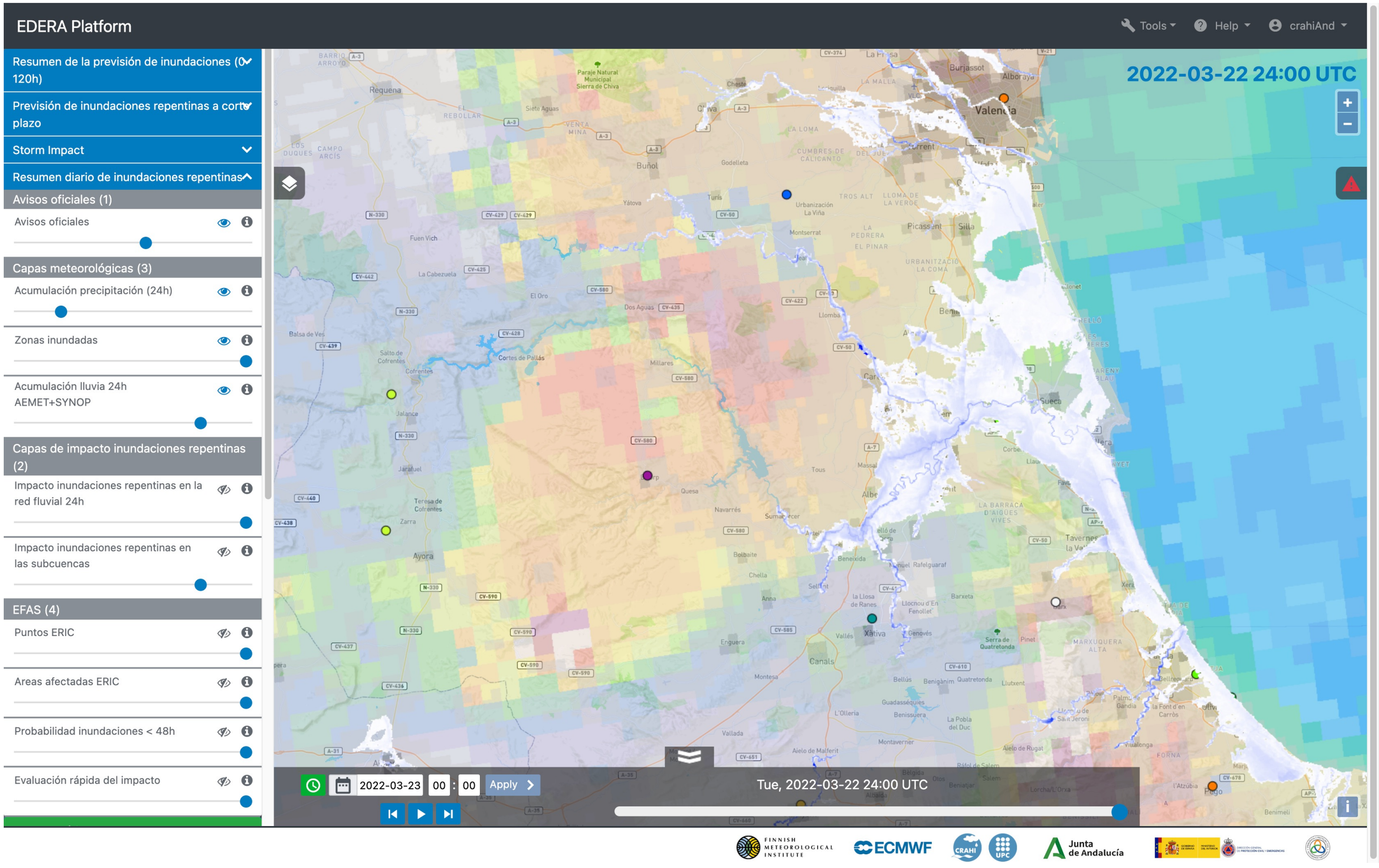
Static layers



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EDERA Flash Flood Forecast Summary Products

An Introduction

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Flash flood forecast summary products

EDERA Platform

Tools

Flash flood forecast summary (0-120h)

Official warnings (1)

Official warnings

Meteorological layers (1)

Seamless precipitation accumulation

Flash flood impact layers (1)

Flash flood impact over sub-catchment

Storm Impact

Animated flash flood nowcasting

Flash flood past 24-h summary

Static layers

Exposure (1)

Exposure

Flood hazard and risk maps (3)

Flood Area (T1000)

Flood Area (T050)

Flood Area (T010)

MeteoAlarm

2023-09-01 15:00 - 2023

Selected feature information

Official Warnings

Rain in Litoral norte de Valencia

Time & Duration

From: 2023-09-02 08:00:00+00 UTC

To: 2023-09-02 21:59:59+00 UTC

Severe rain warning. Litoral norte de Valencia

One-hour accumulated precipitation: 40 mm. Podrían acumularse 60-70 mm en algunos puntos en un período de tres o cuatro horas.

Be prepared. Take precautions and keep up to date with the latest weather forecast. Severe damages to people and properties may occur, especially to those vulnerable or in exposed areas.

2023-09-01 09 : 00 Apply

Forecasting time: Fri, 2023-09-01 09:00 UTC

Leadtime(h) 0-6h 6-24h 24-48h 48-120h

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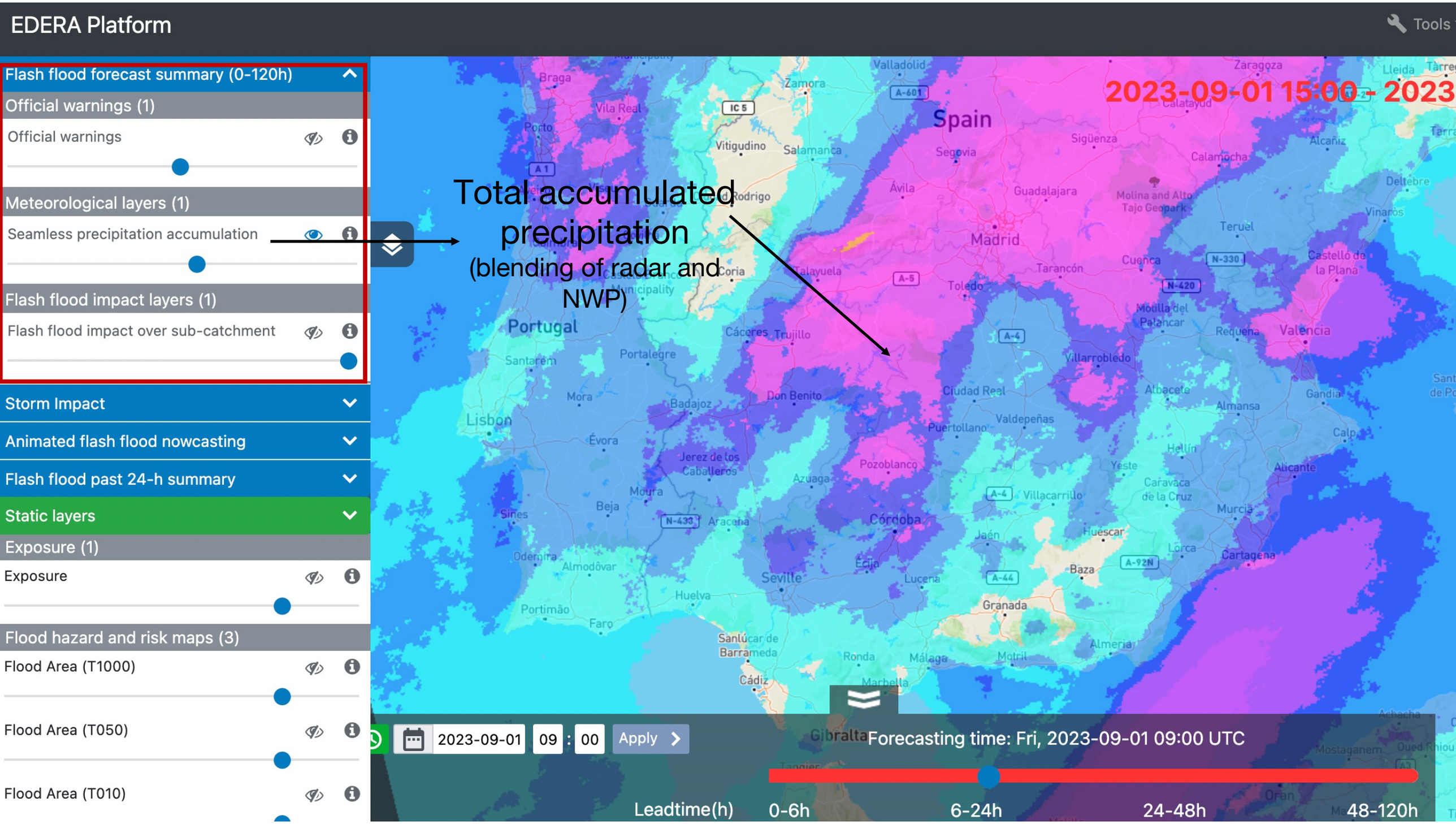
Flash flood forecast summary products



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Seamless Precipitation Accumulation: Method

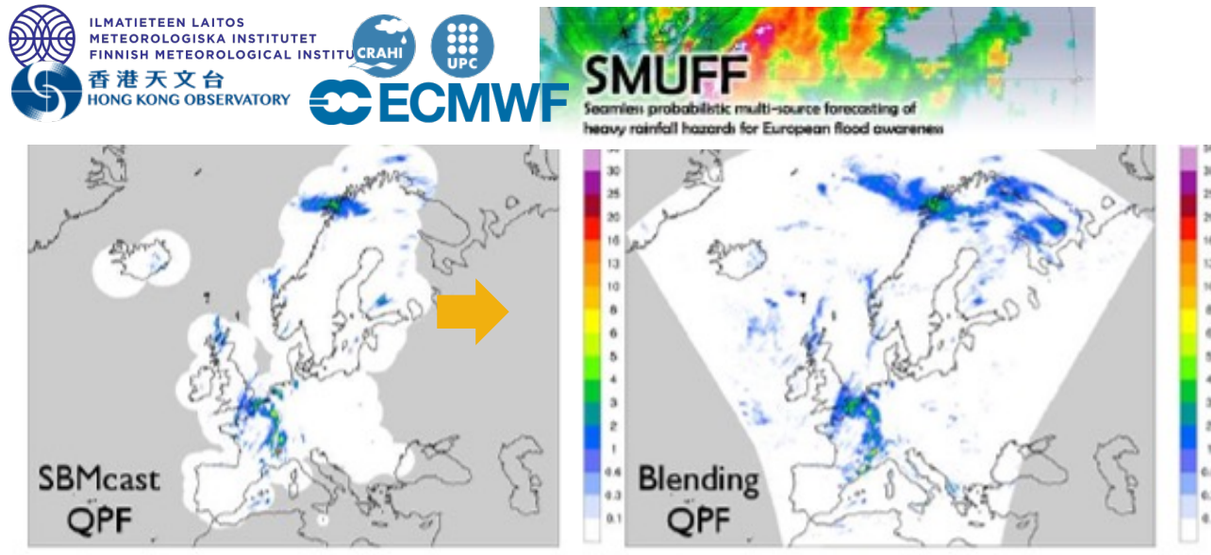
Blending of radar nowcasts of precipitation with medium range NWP

Radar:

- 2 km pan-European OPERA network
- Updated hourly
- Nowcasts up to 5h ahead
- 20 member ensemble

NWP

- ECMWF 51 member ensemble
- Updated x4 per day
- 18 km resolution
- 120h lead time



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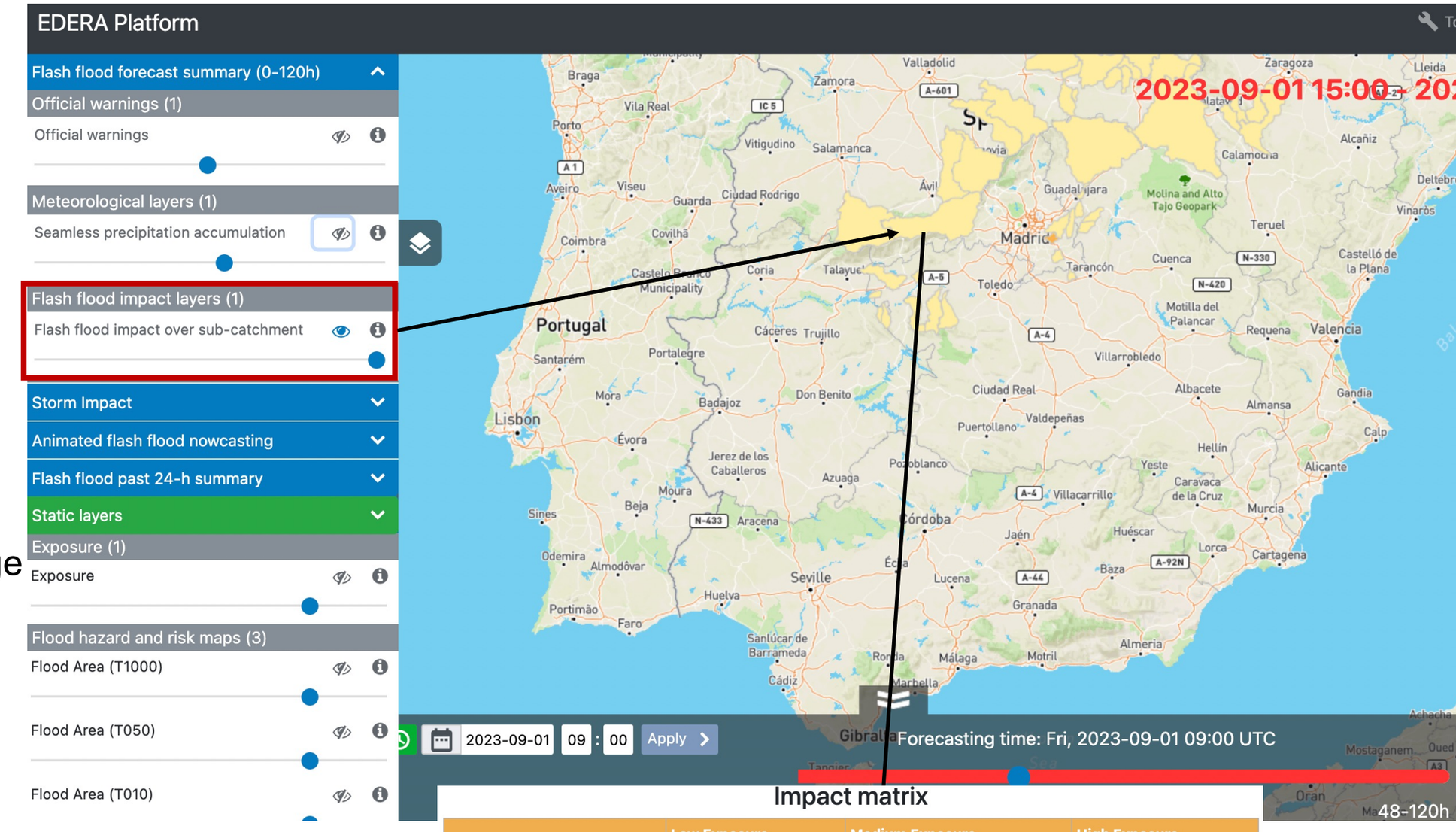
Flash flood forecast summary - Flash flood impact over sub-catchment

Update, time range and timestep:

- Hourly update
- 4 decision making periods
  - 0-6h nowcasting
  - 6-24h sub-daily
  - 24-48h short range
  - 48h-5d medium range

Maximum impact within lead time (across 90th percentile of catchment)

4 impact categories



Pop-out window

Impact matrix

	Low Exposure	Medium Exposure	High Exposure
High Likelihood			
Medium Likelihood			
Low Likelihood	✓		

Exposure information

	#
Total population affected	**450**
Education facilities affected	
Health facilities affected	**1**
Energy generation facilities affected	
Time of the event peak	**2023/09/02 06:00:00**

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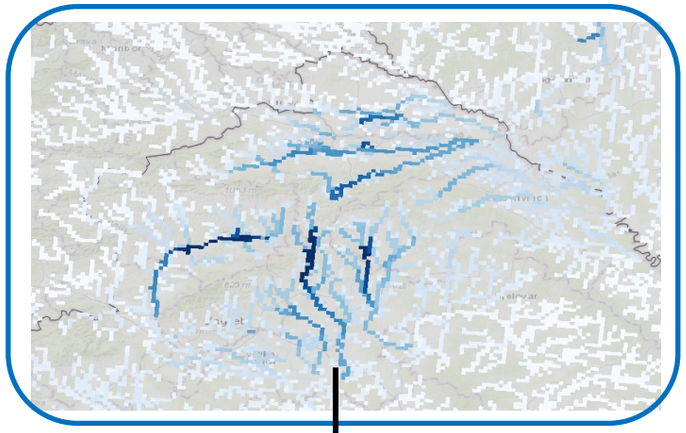
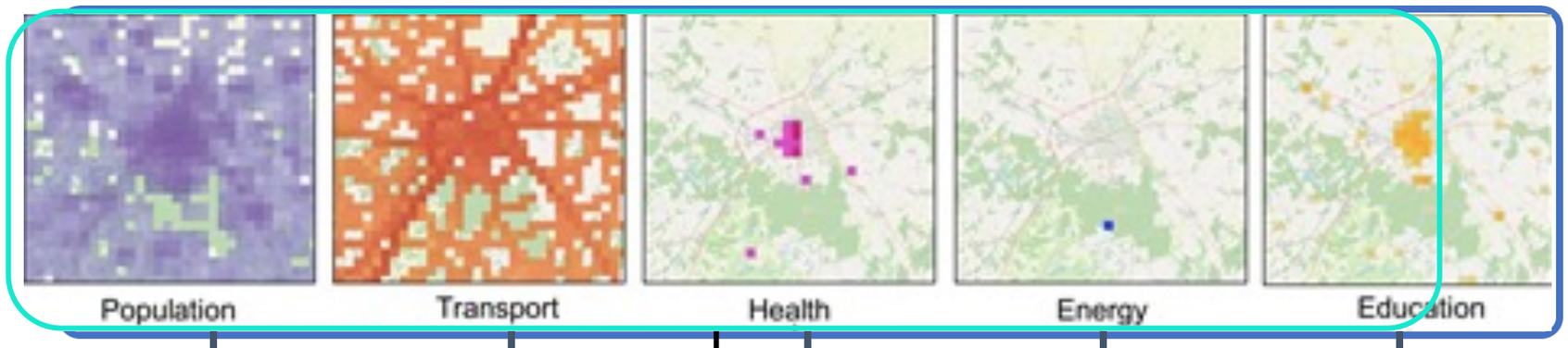
Flash Flood Impact: Methodology

Highlight which areas might have greatest flood impacts

Flash Flood Hazard Forecast (EPIC)



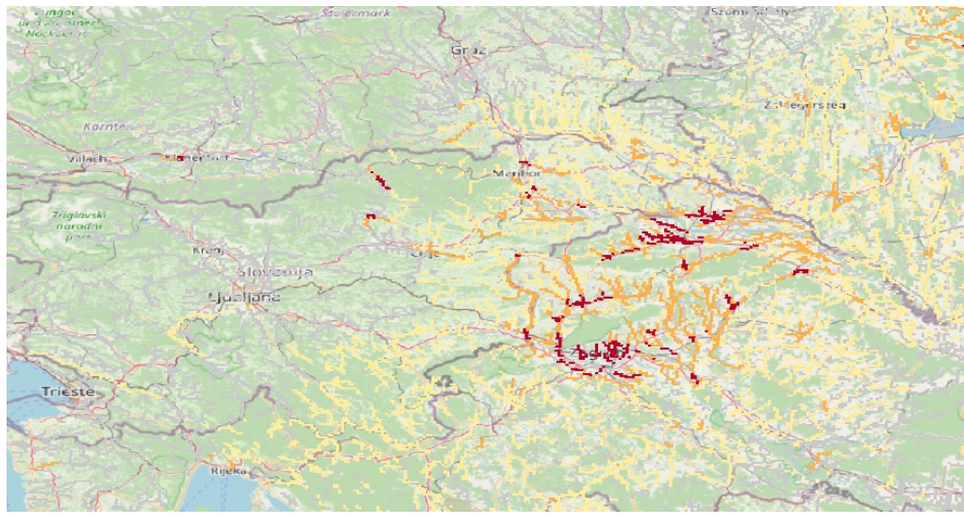
Combined Exposure (from OpenStreetMap, HARCI-EU)



	Low Exposure	Medium Exposure	High Exposure
High Likelihood			
Medium Likelihood			
Low Likelihood			

- Severe Impacts
- Major Impacts
- Moderate Impacts
- Low Impacts

Flash Flood Impact Forecast



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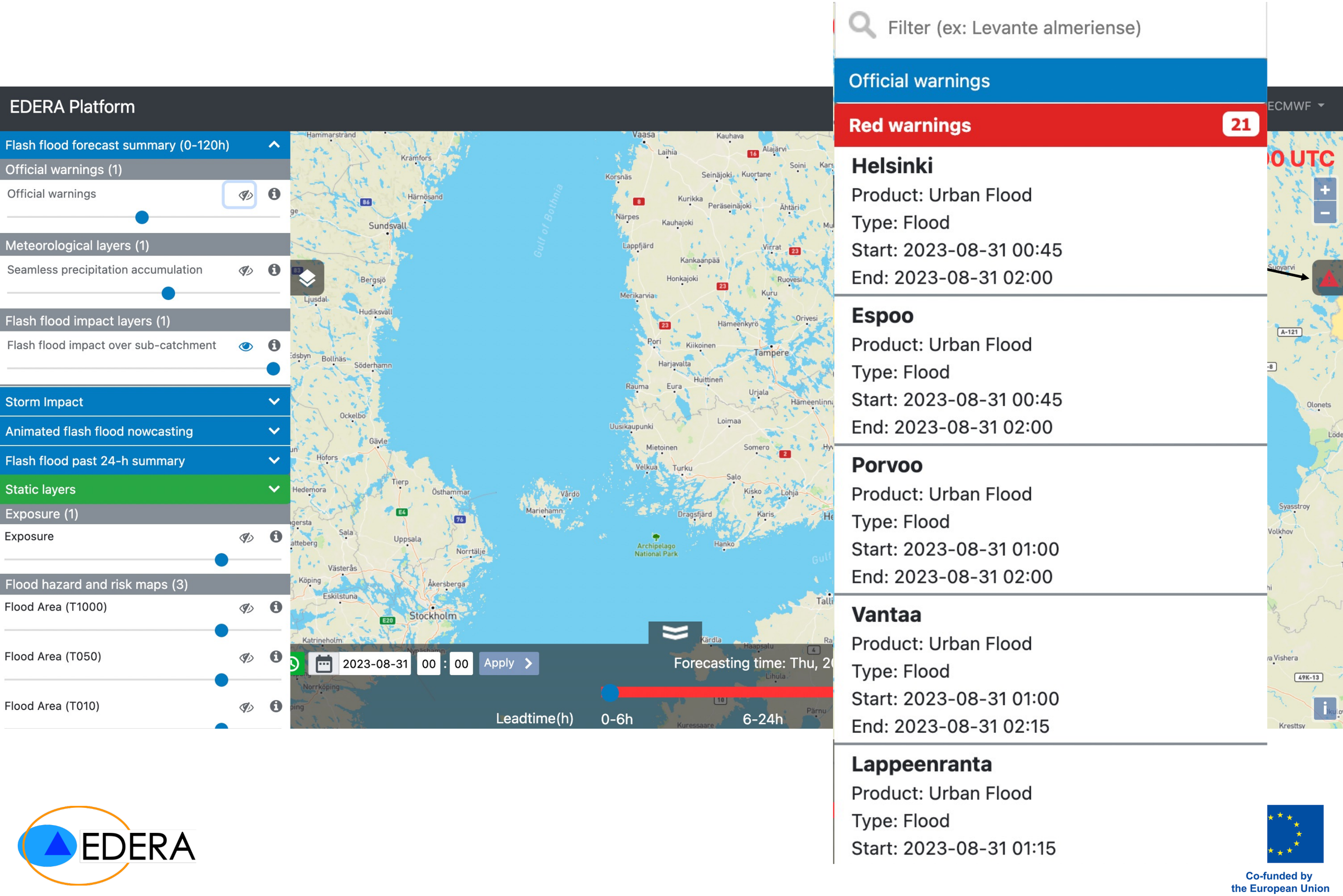
Flash flood forecast summary - Notifications



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EDERA Convective Hazard and Impact Nowcast Products

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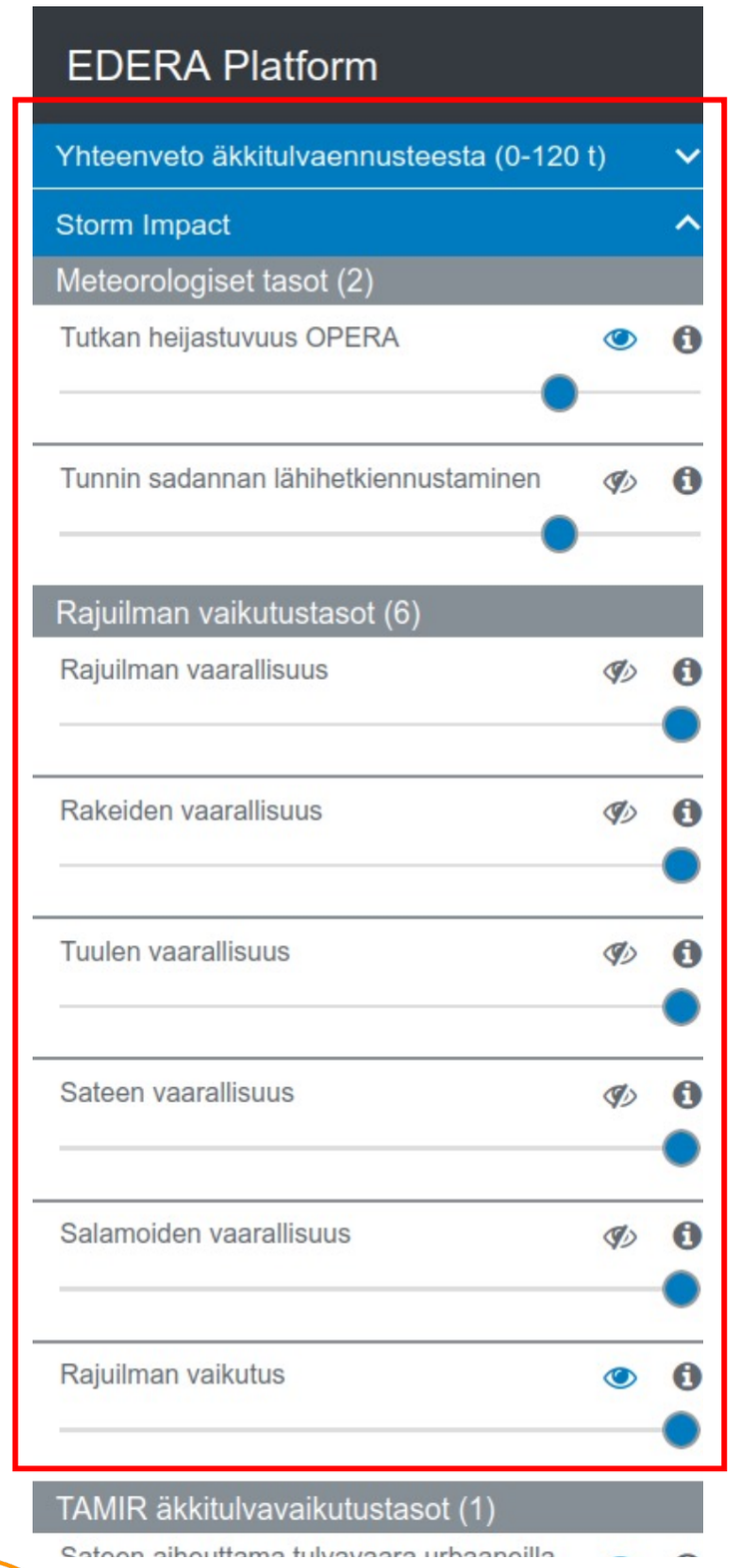
EDERA Convective Layers



Meteorological layers:
- Radar reflectivity (OPERA)
- Hourly rainfall accumulation nowcast

Purpose: give information about instantaneous rain rate and future accumulated rainfall

Hazard nowcast layers:
- Overall storm hazard category
- Hazard category for each subtype: hail, wind, precipitation, lightning

Purpose: give information about hazard potential of storm cells

Storm impact layer

Purpose: give the above information weighted by exposure

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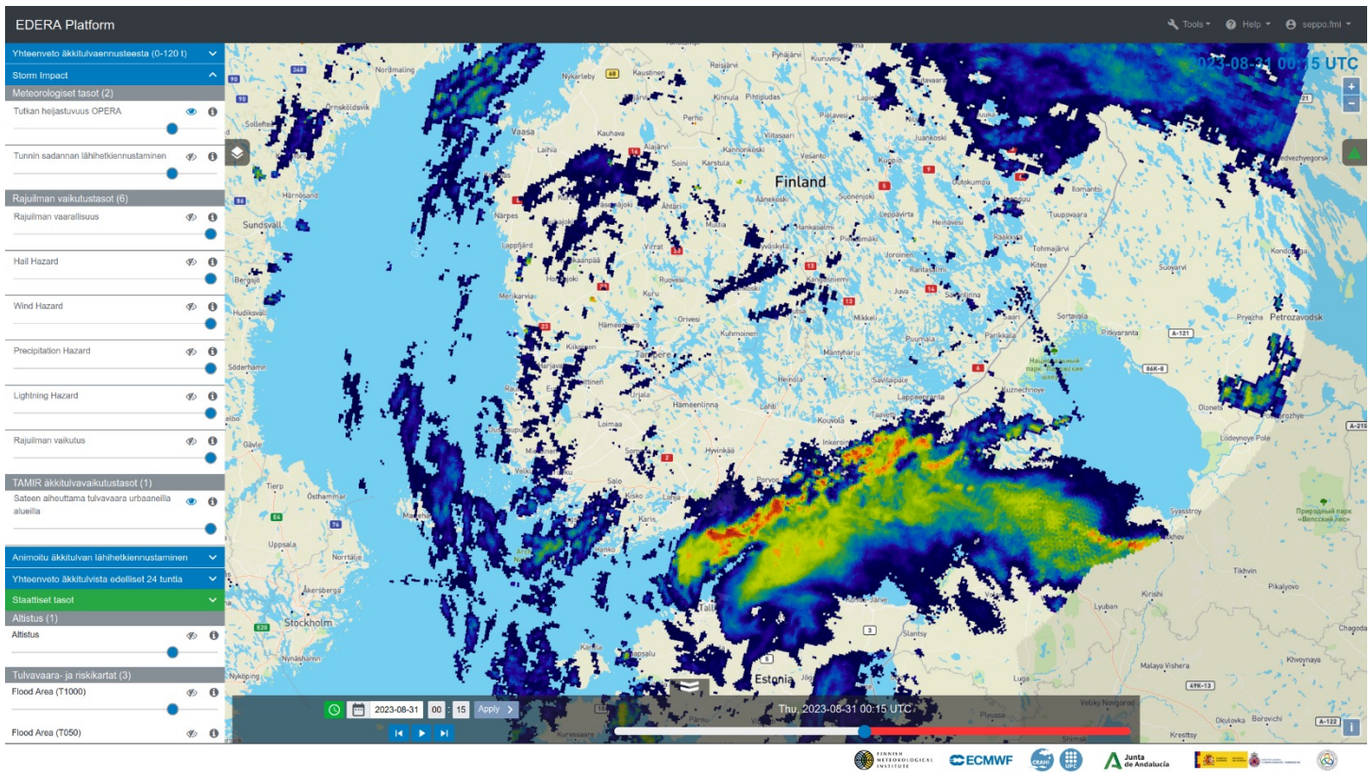
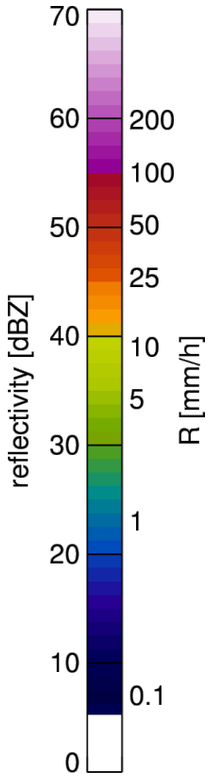
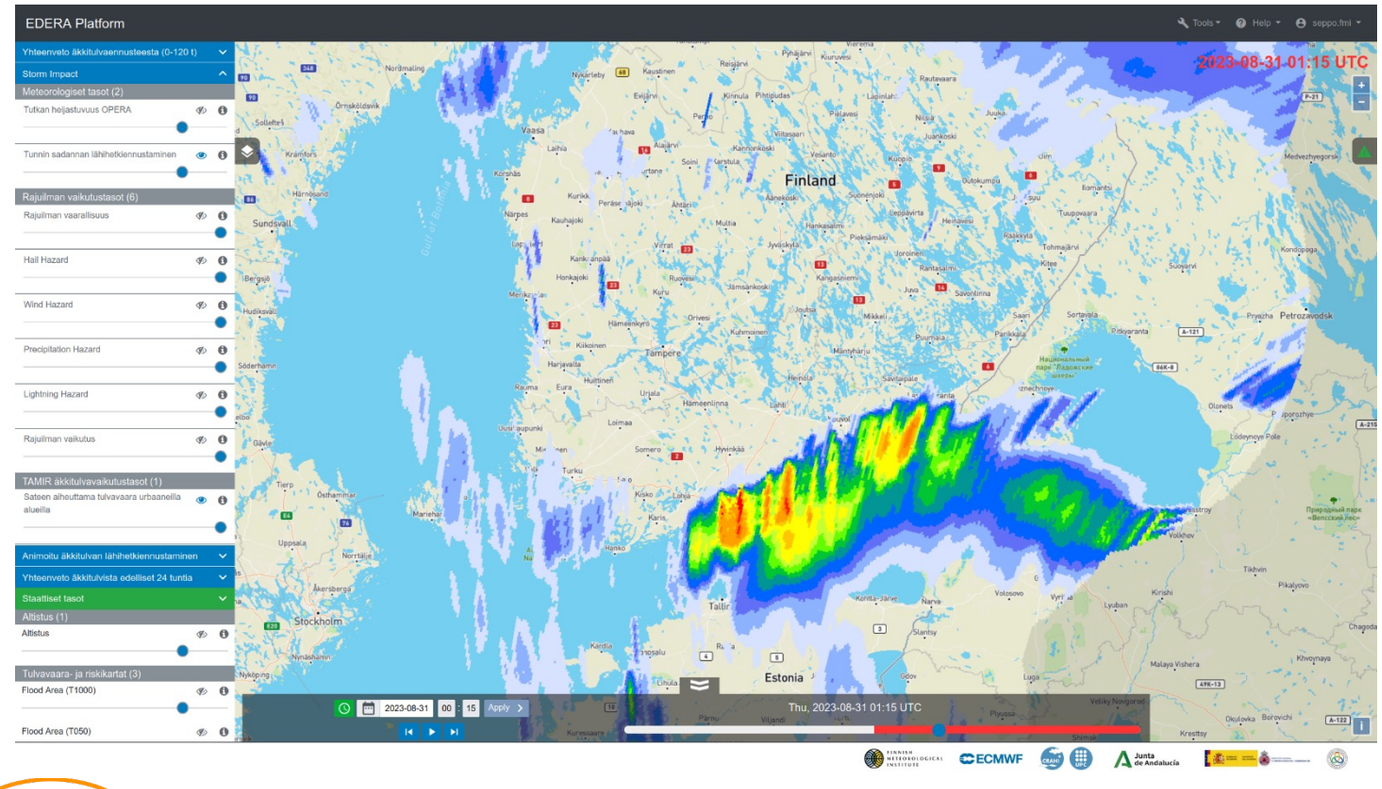
Precipitation Layers

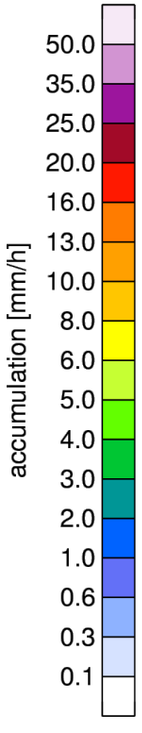




Composite of radar-measured reflectivity values

- Reflectivity is converted to rain rate (mm/h)
- Spatial resolution of 2 km
- Generated every 15 minutes





Nowcast of hourly rainfall accumulation

- Generated by extrapolation of radar images
- Every 15 minutes to next 4 hours
- Spatial resolution of 2 km

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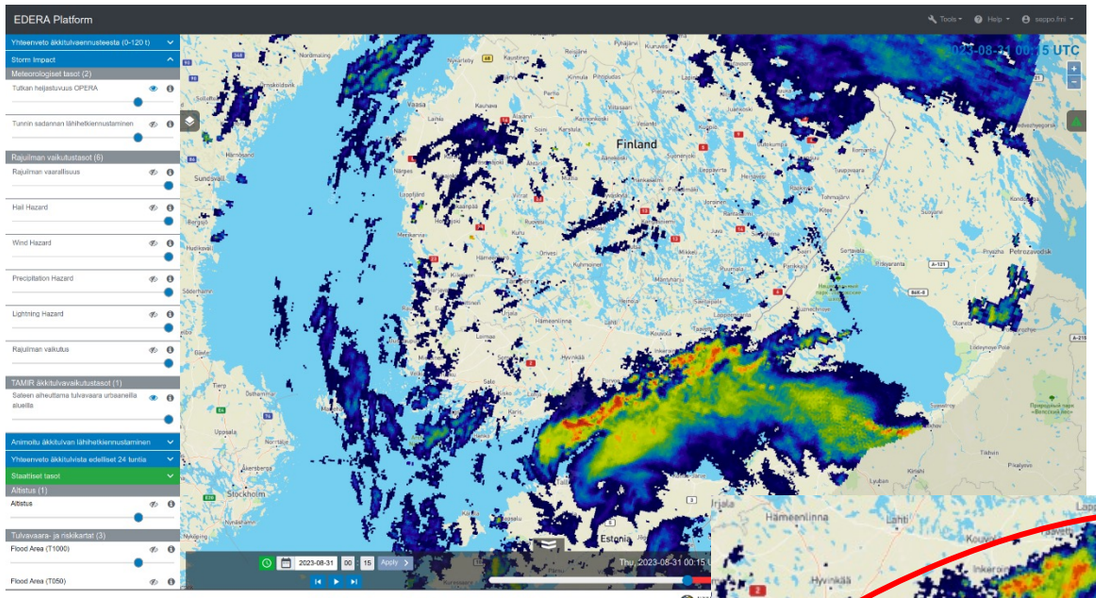
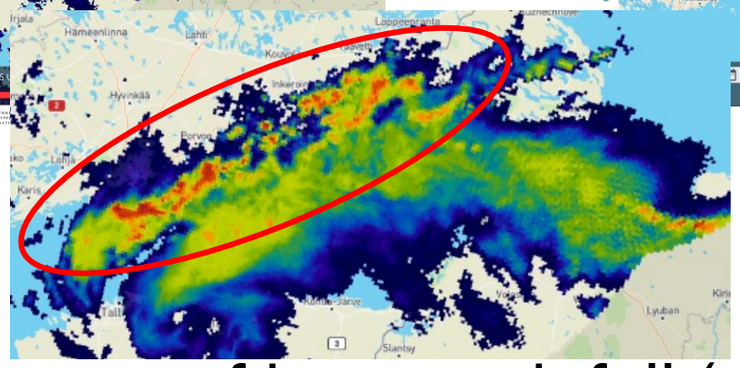
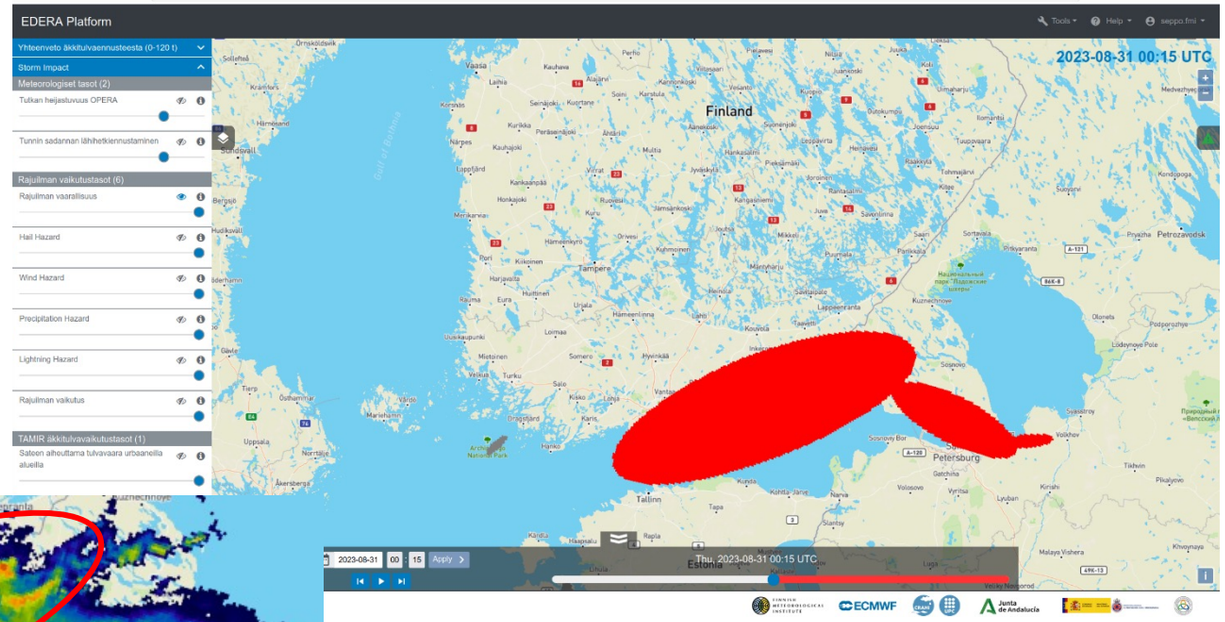
The Combined Hazard Nowcast Layer



Radar reflectivity





Hazard nowcast
(present time)

- Ellipses fitted to areas of heavy rainfall (reflectivity over 35 dBZ)
- Each ellipse is assigned a hazard class by using a machine learning model
- 4 hazard categories based on climatological thresholds
- The overall hazard category is the maximum of the 4 sub-categories
- Additional layers for each hazard type

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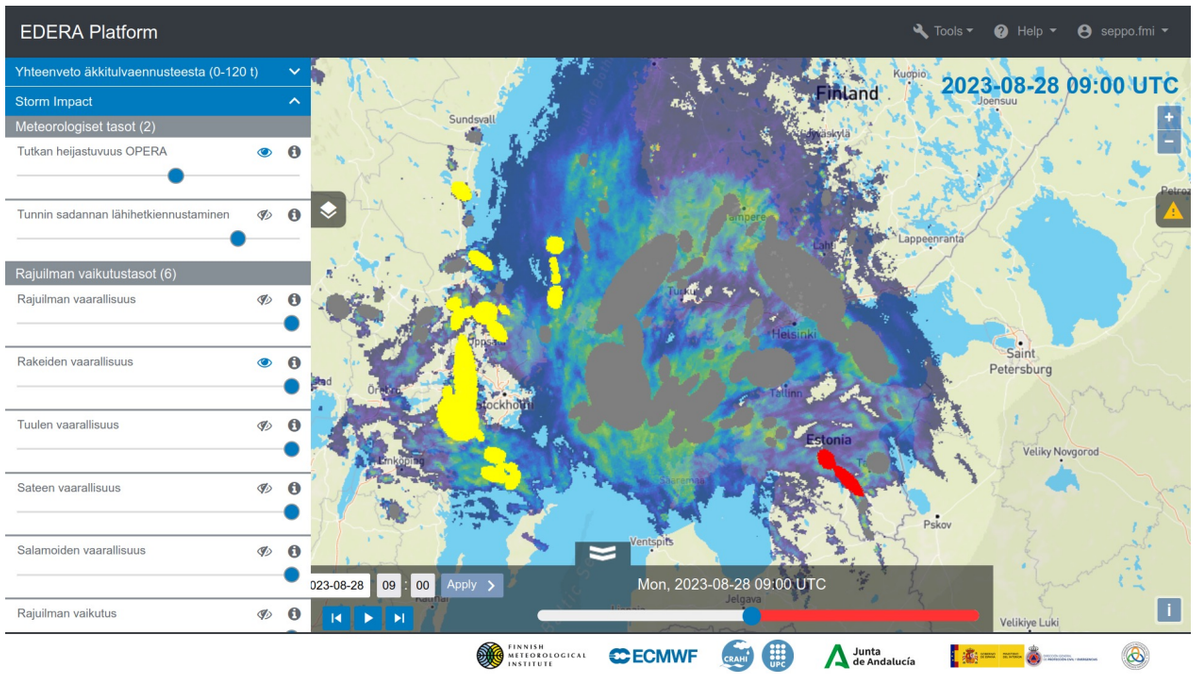
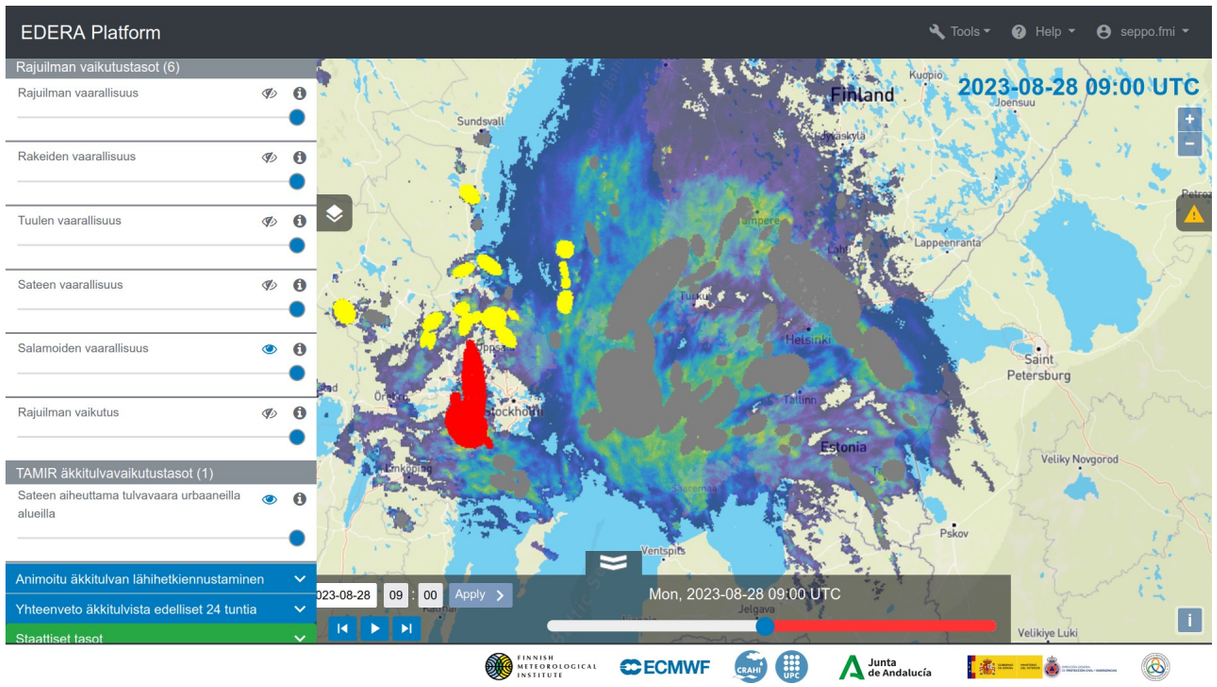
Layers for Multiple Hazard Types

August 28th 2023

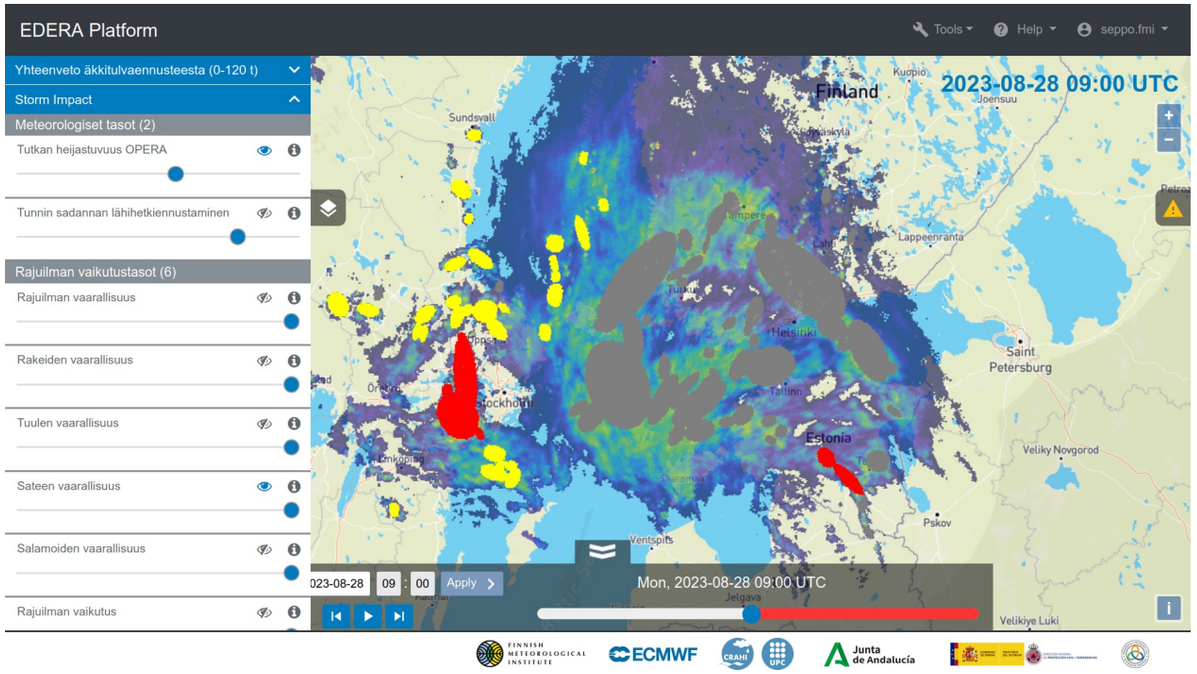
Hail



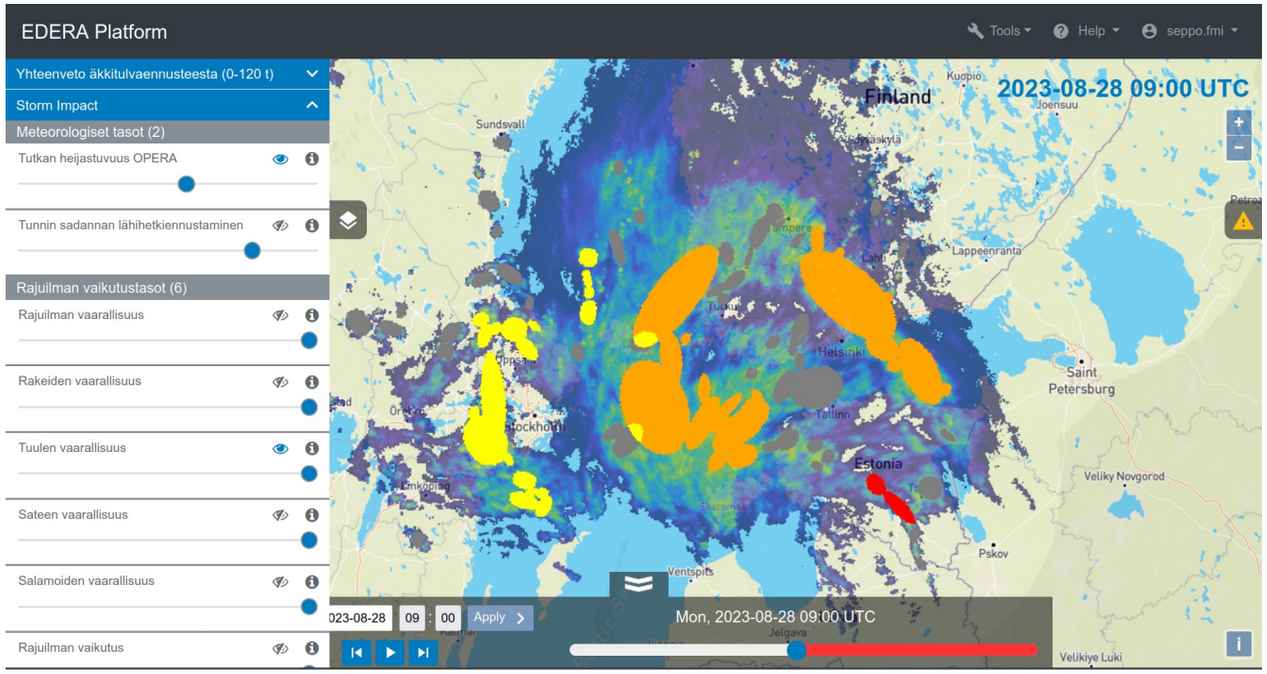
Lightning



Precipitation



Wind



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Machine learning models are trained for each different hazard type

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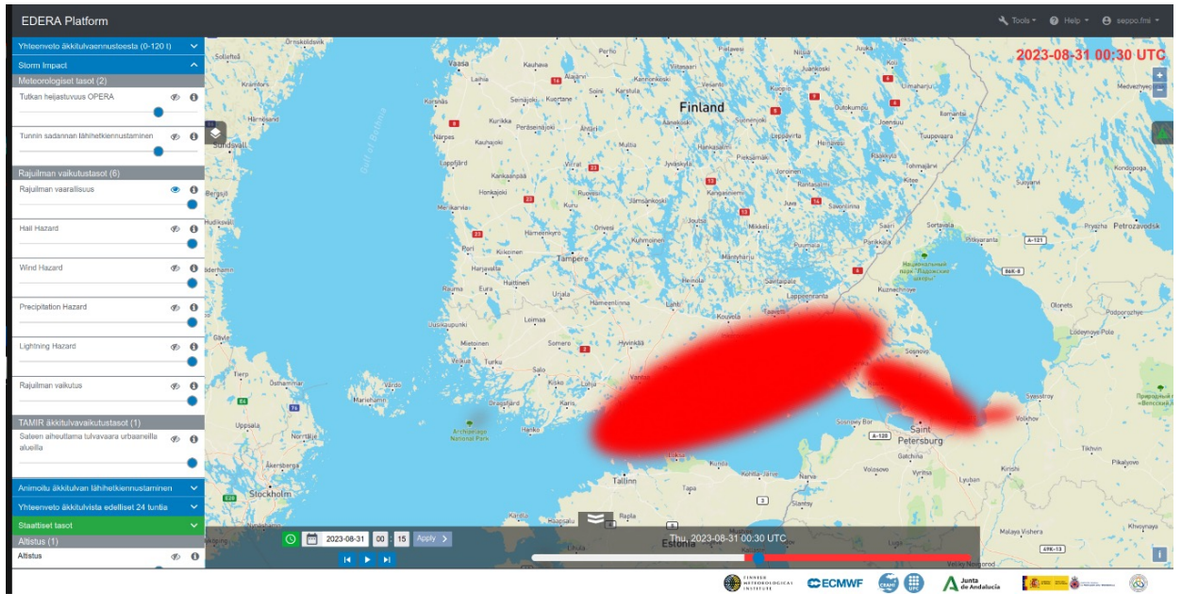
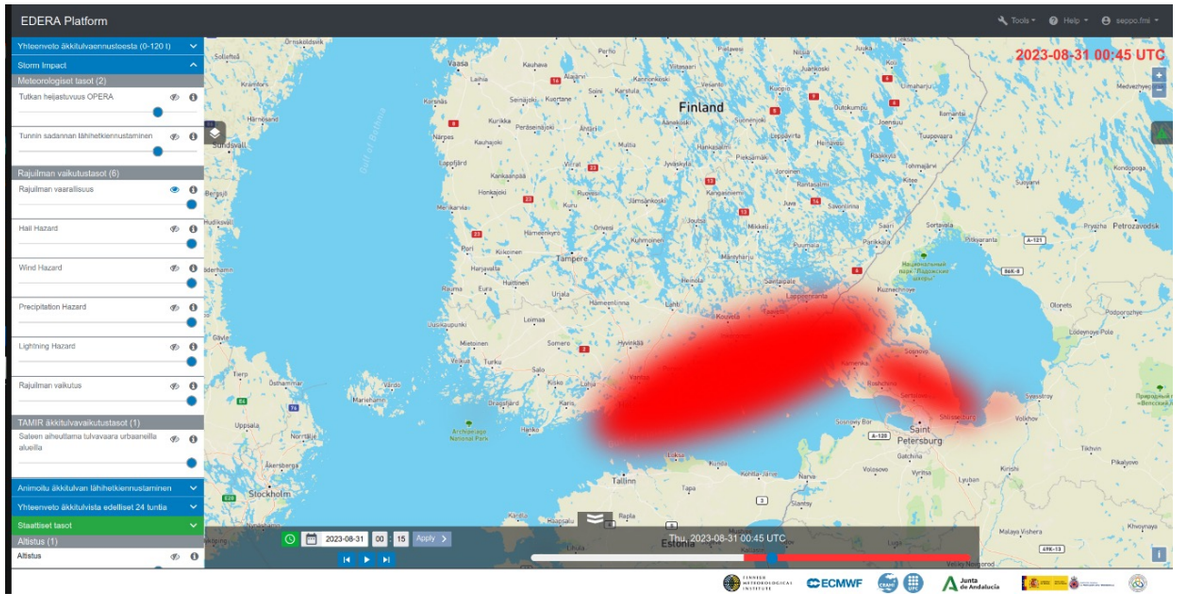
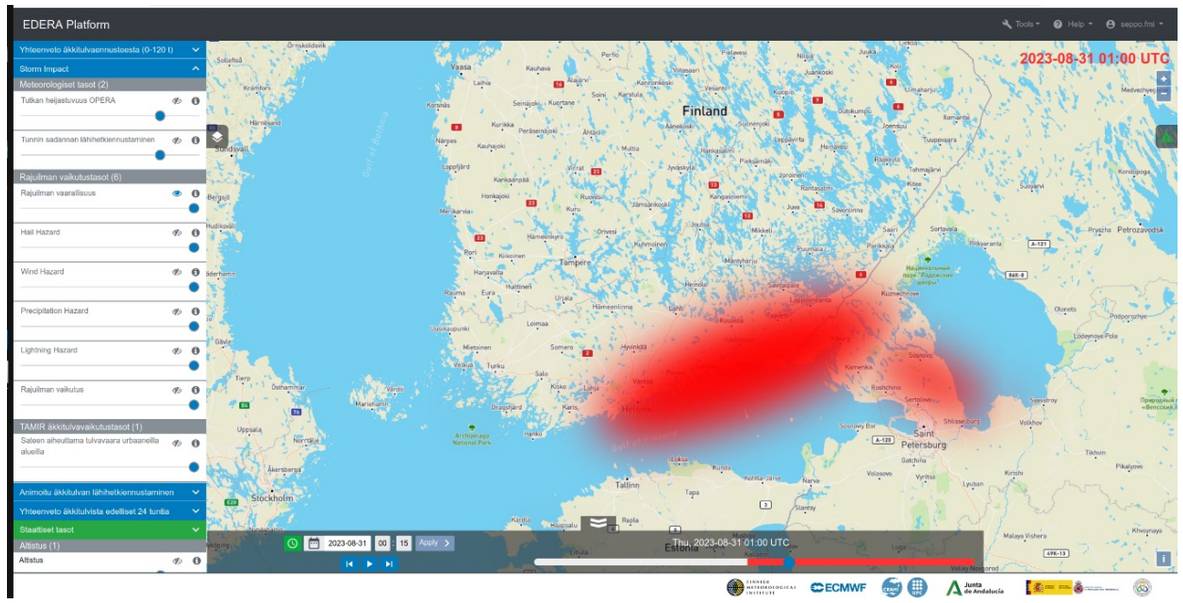
Uncertainty Representations



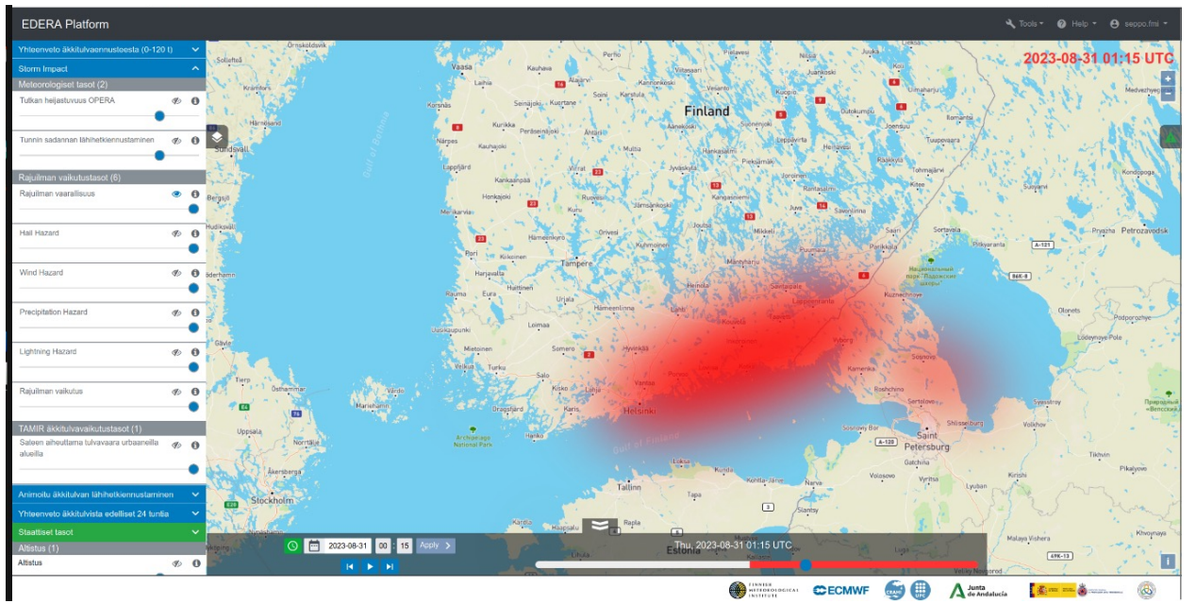
Next 15 minutes



Next 30 minutes

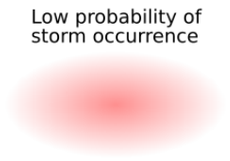


Next 45 minutes



Next 60 minutes

- The nowcast layers show future storm positions
- Storm hazard level does not change during the forecast time window
- Uncertainty in the nowcasts is visualized by increasing spread and transparency of the ellipses



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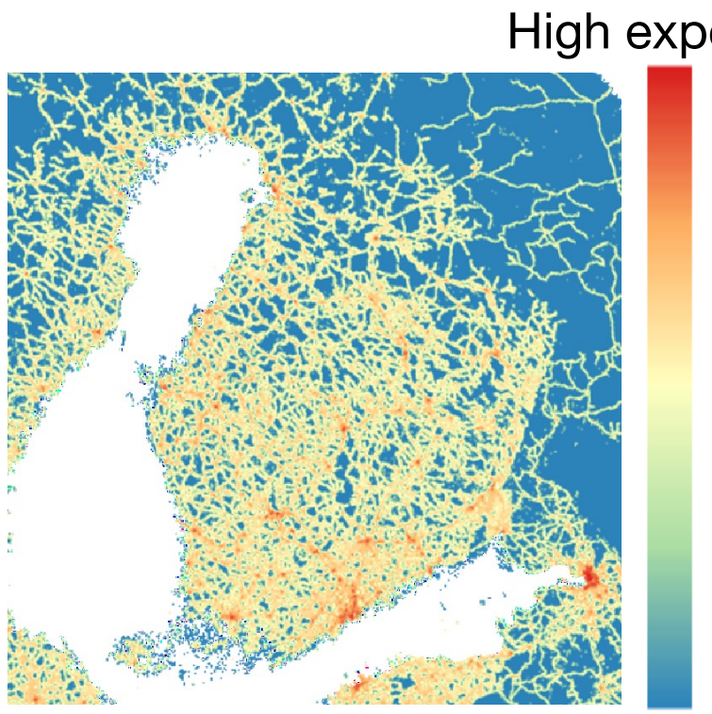
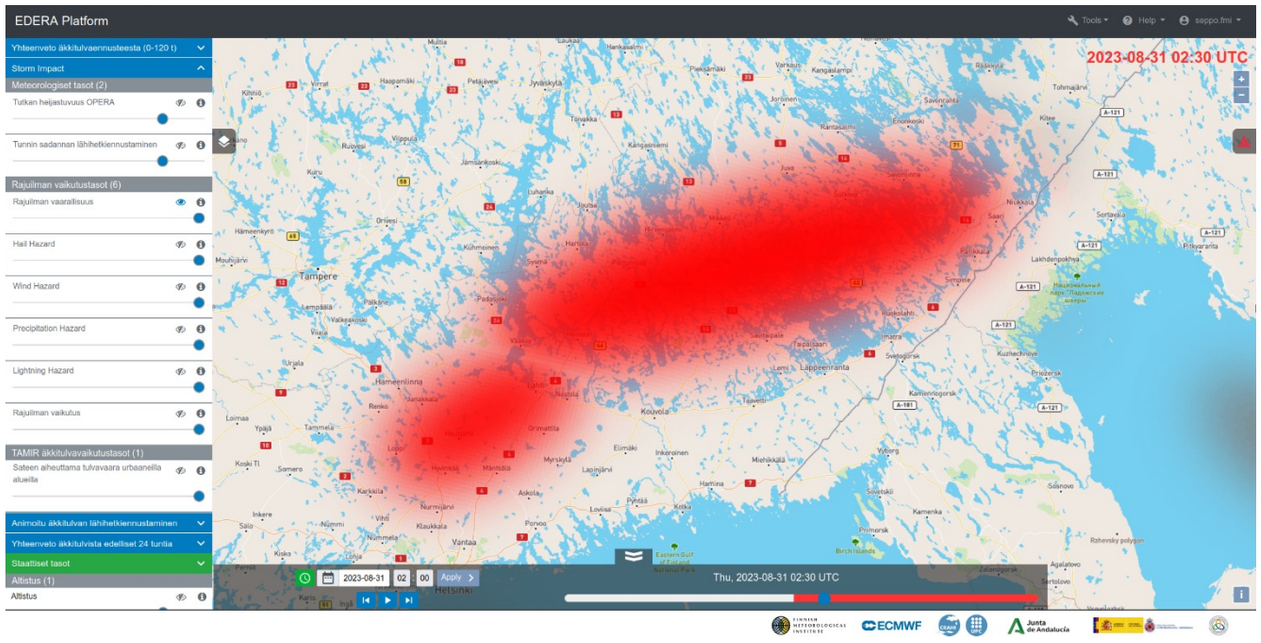
Convective Impact Nowcasts

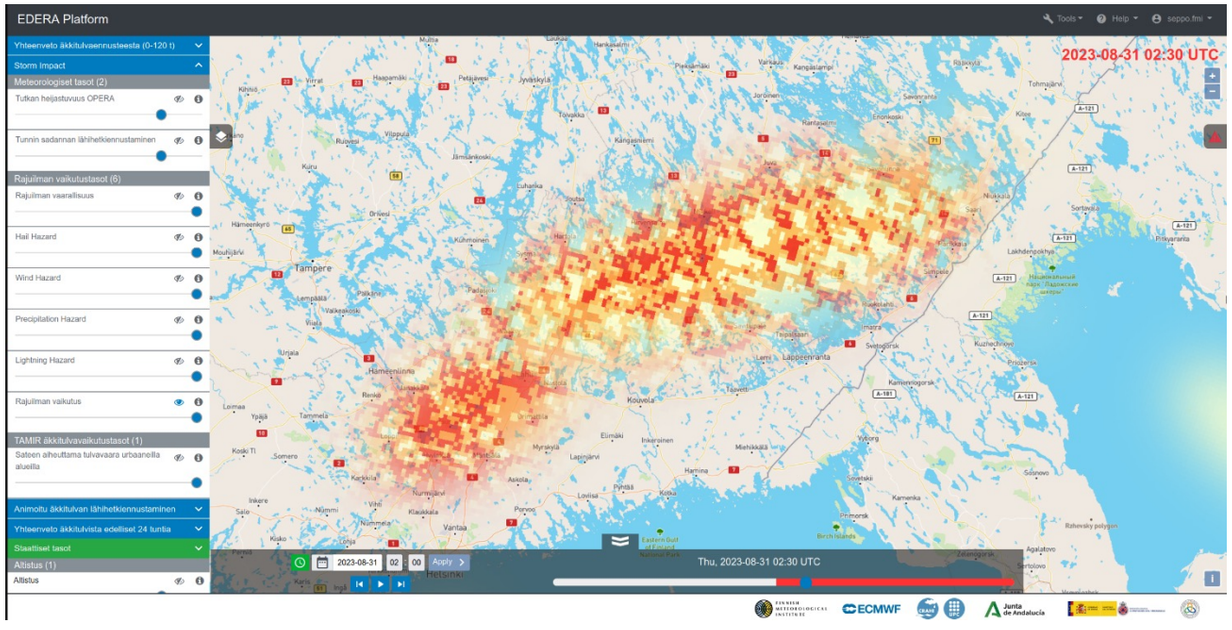
- Hazard nowcasts are combined with exposure layer to give weight to vulnerable areas
- We use pan-European exposure layer provided by ECMWF
- Exposure raster provided by HARCI-EU and JRC: combination of population, health, education, transport and energy-related exposures



impact = hazard * exposure



Hazard nowcast



Impact nowcast

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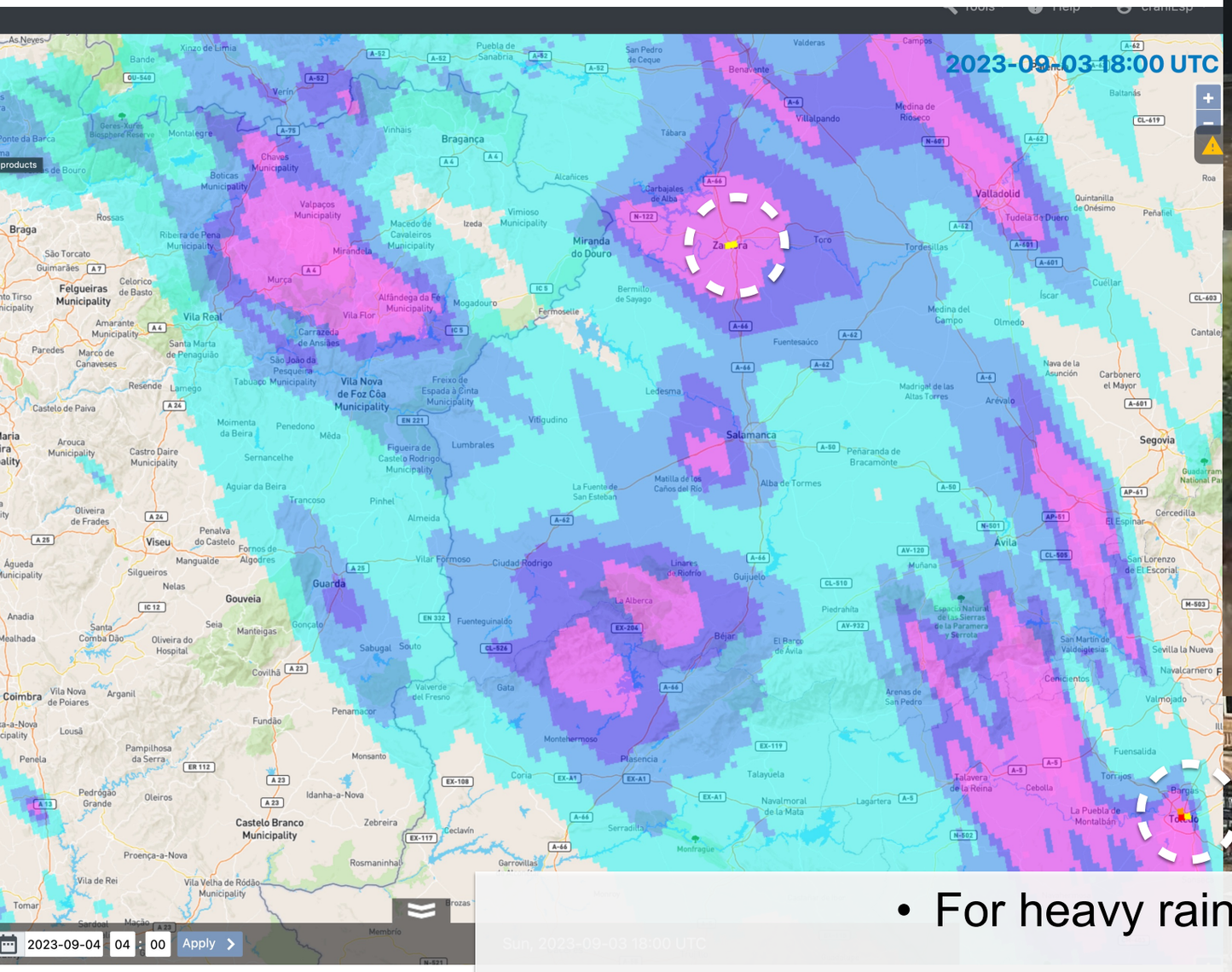
Pluvial floods product



- For heavy rain in urban areas
- Running in real time with radar-based nowcasting (up to 6h)
- Based on comparing real-time with climatology of 1-h accumulations

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EDERA Animated Flash Flood Nowcasting Products

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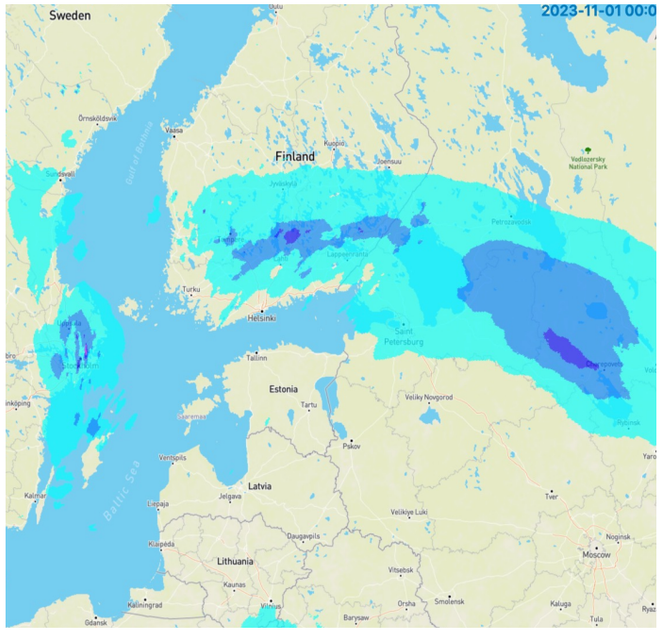
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

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

GOBIERNO DE ESPAÑA
MINISTERIO DEL INTERIOR
DIRECCIÓN GENERAL DE PROTECCIÓN CIVIL Y EMERGENCIAS

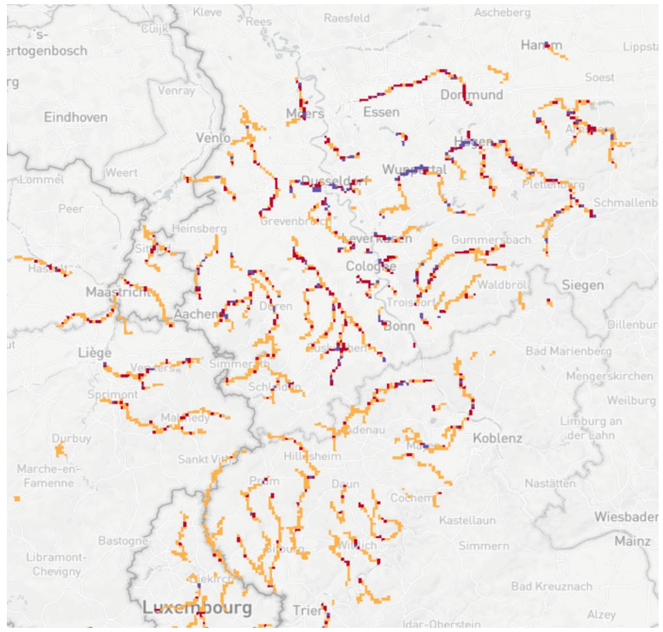
EMERGÊNCIA E PROTEÇÃO CIVIL
AUTORIDADE NACIONAL

EDERA Flash Flood Impact Products



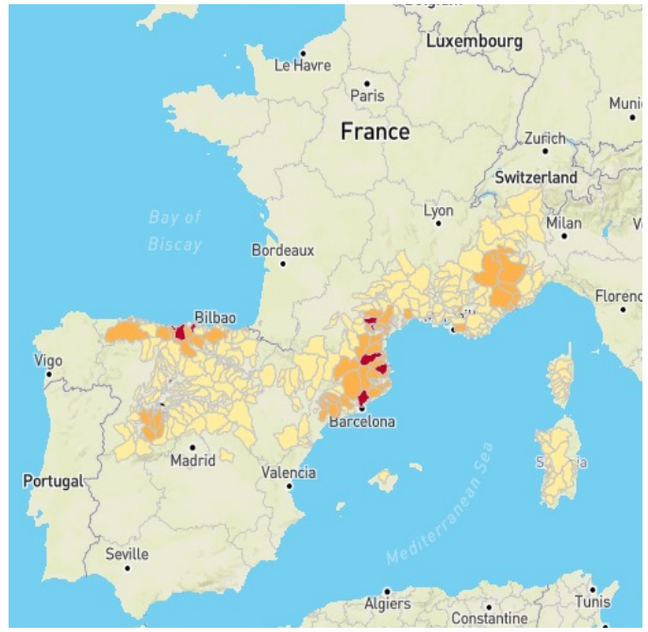
Summary precipitation

Summary and animated layers showing total precipitation per timestep up to 5 days



Flash flood impact

Summary and animated layers showing expected flash flood impact category up to 5 days for 4 decision-making periods



Catchment flash flood impact

Summary layers showing expected flash flood impact category per river catchment up to 5 days for 4 decision-making periods

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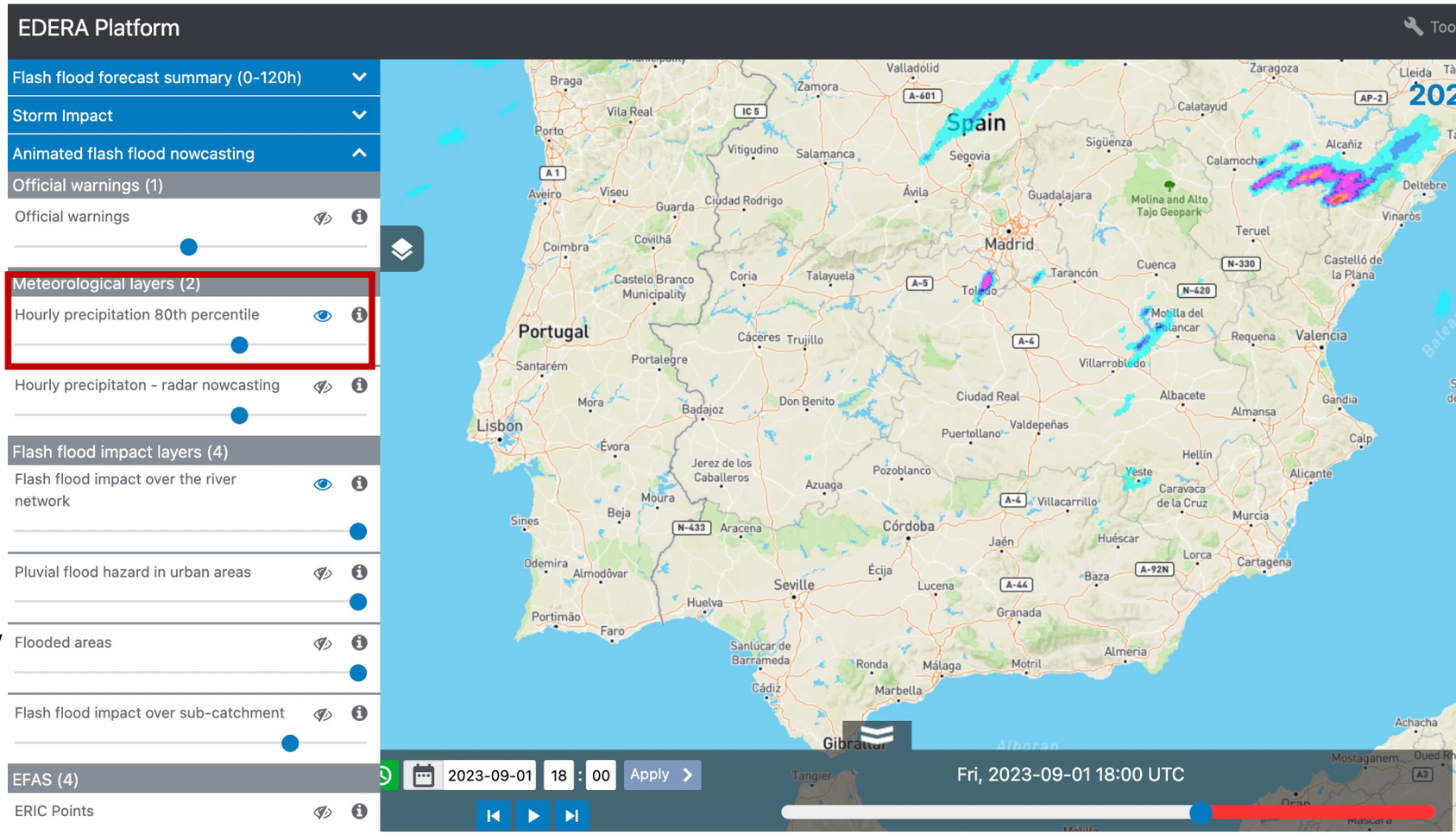
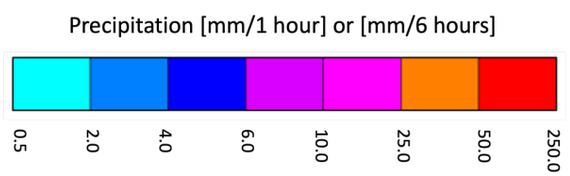
Animated flash flood nowcasting - Total precipitation 80th percentile

Update, time range and timestep:

- Hourly update
- Range: up to 6 hours
- Hourly time step for 0-6h. Driven by blending of radar nowcasting and NWP
- Hourly past precipitation. Driven by radar and NWP blends



Probabilistic based product which summarises ensemble forecast



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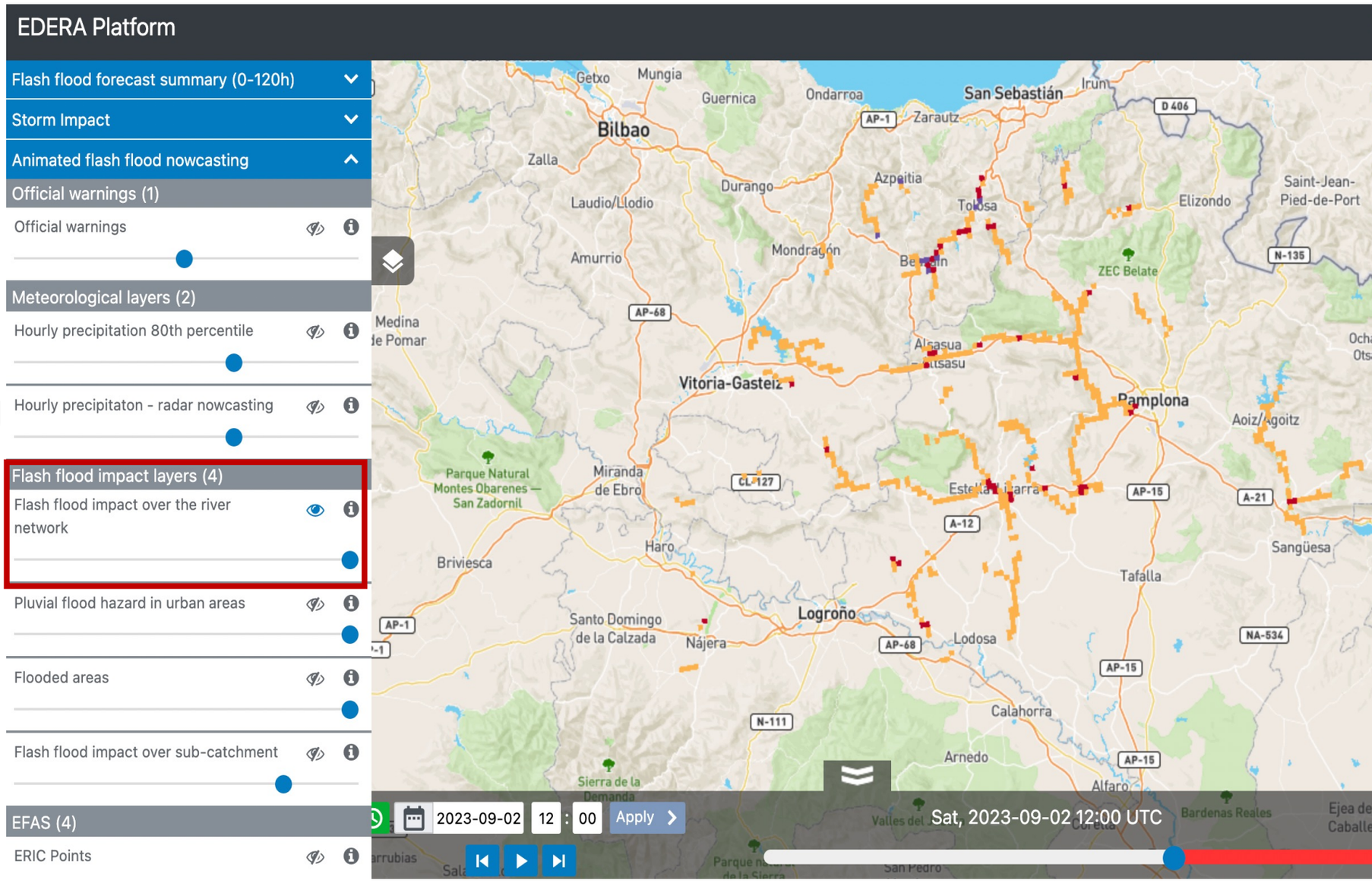
Animated flash flood nowcasting - Flash flood impact over river network

Update, time range and timestep:

- Hourly update
- Range: up to 6 hours
- Hourly time step for 0-6h. Driven by blending of radar nowcasting and NWP

1-km river channel network

4 impact categories



	Low Exposure	Medium Exposure	High Exposure
High Likelihood			
Medium Likelihood			✓
Low Likelihood			

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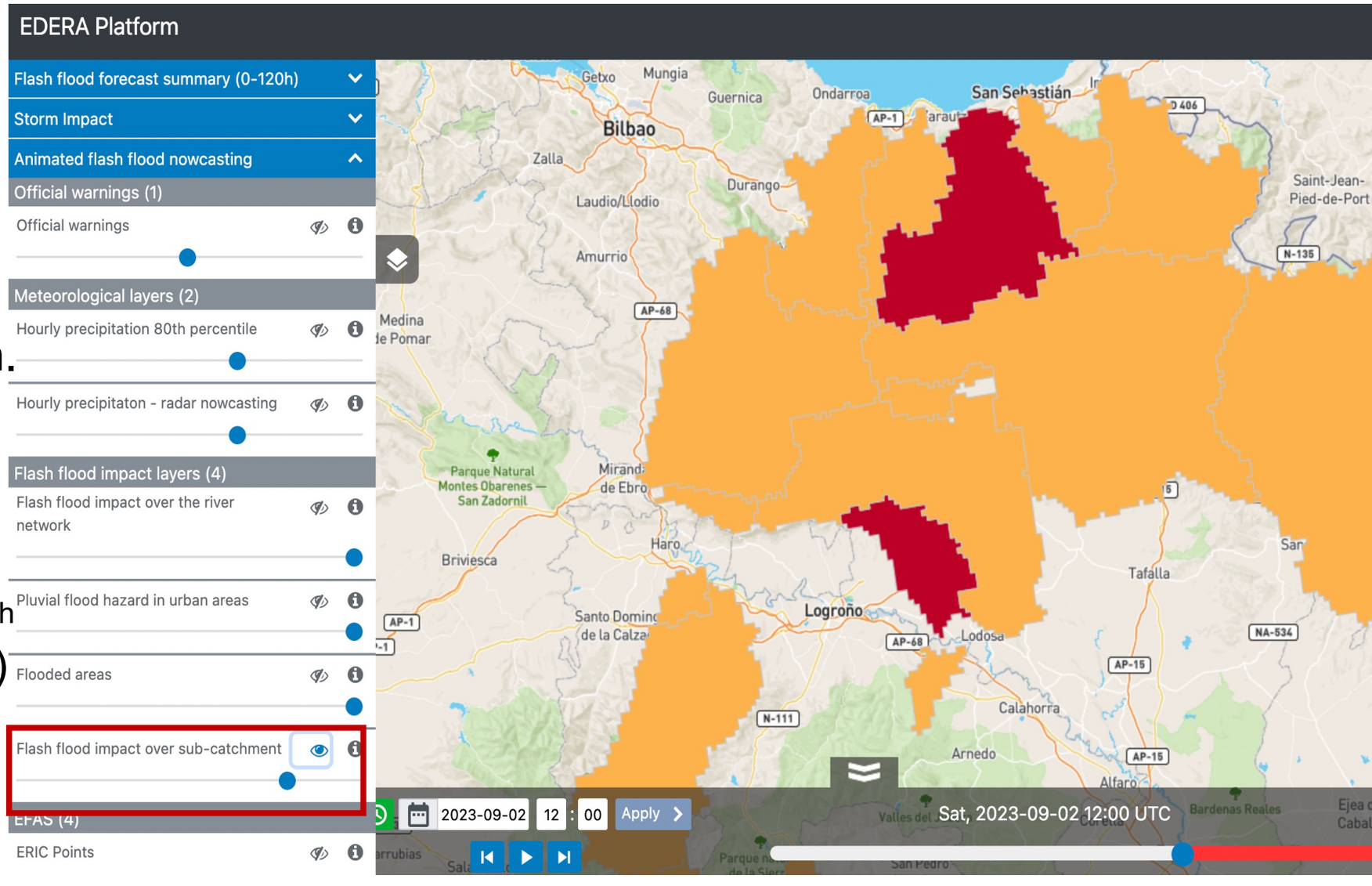
Animated flash flood nowcasting - Flash flood impact over sub-catchment

Update, time range and timestep:

- Hourly update
- Range: up to 6 hours
- Hourly time step for 0-6h. Driven by blending of radar nowcasting and NWP

Sub-catchment summary (90th percentile of river network cells)

4 impact categories



	Low Exposure	Medium Exposure	High Exposure
High Likelihood			
Medium Likelihood			✓
Low Likelihood			

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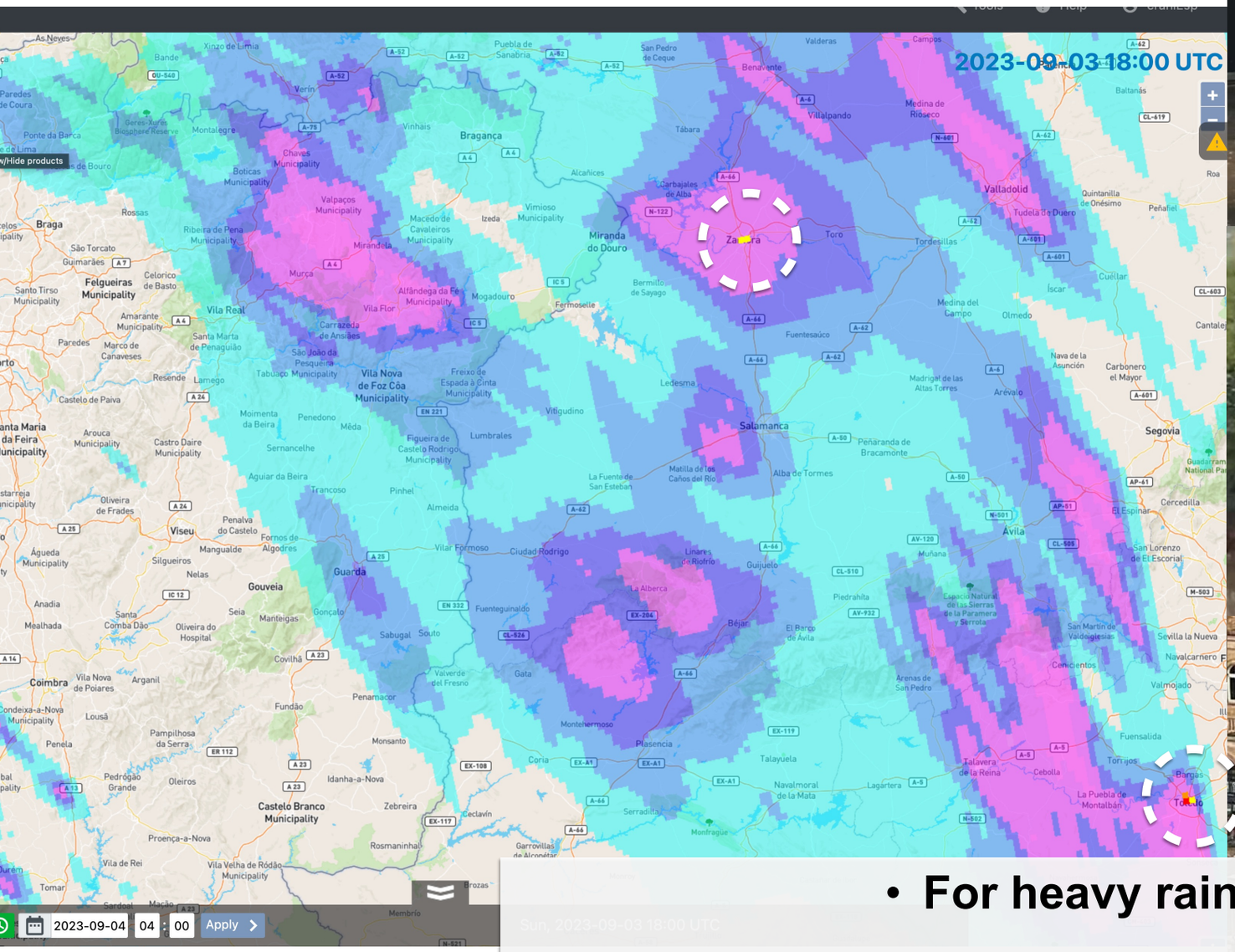
Pluvial floods product



- For heavy rain in urban areas
- Running in real time with radar-based nowcasting (up to 6h)
- Based on comparing real-time with climatology of 1-h accumulations

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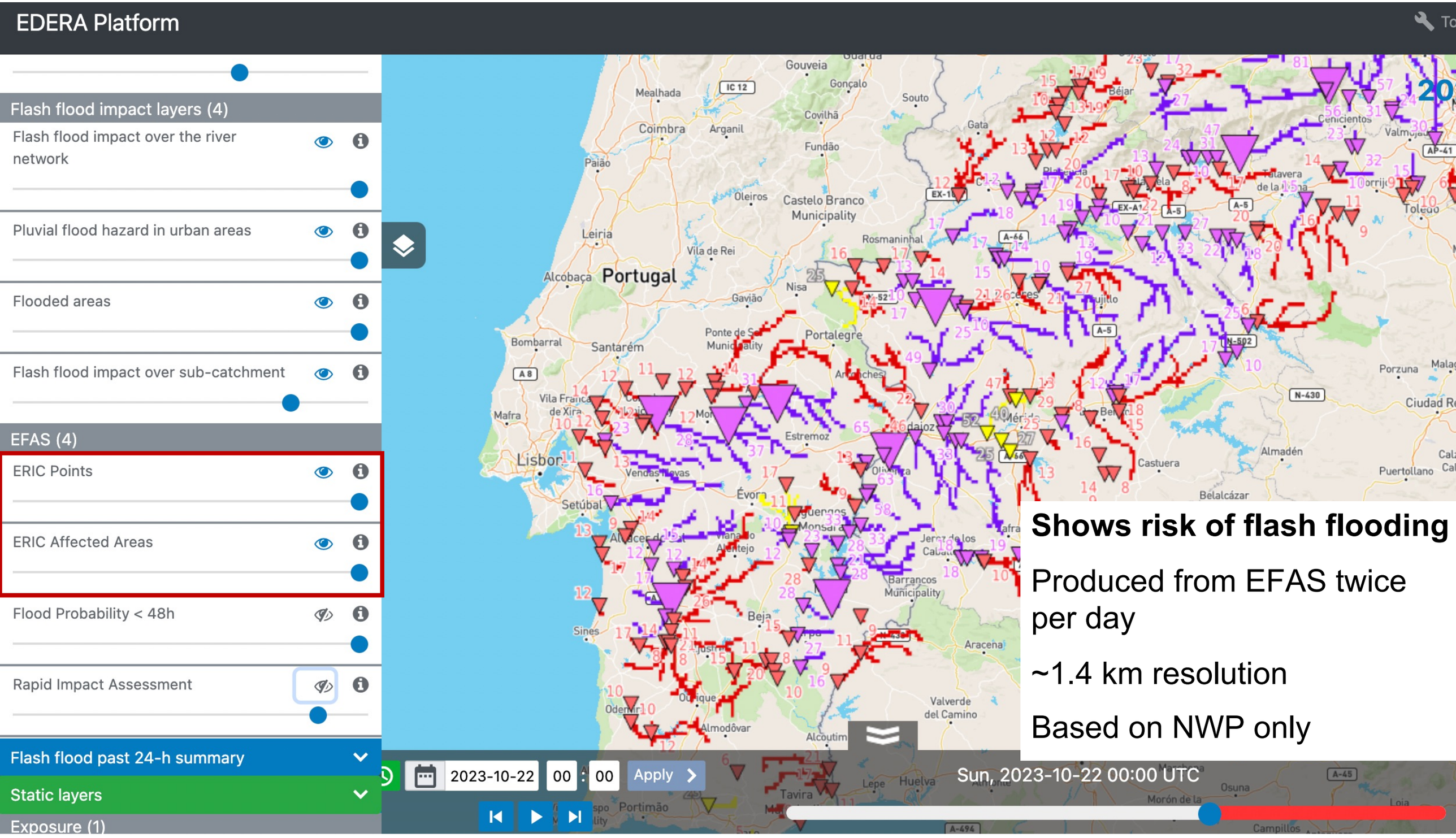
Animated flash flood nowcasting – ERIC layers



Shows risk of flash flooding

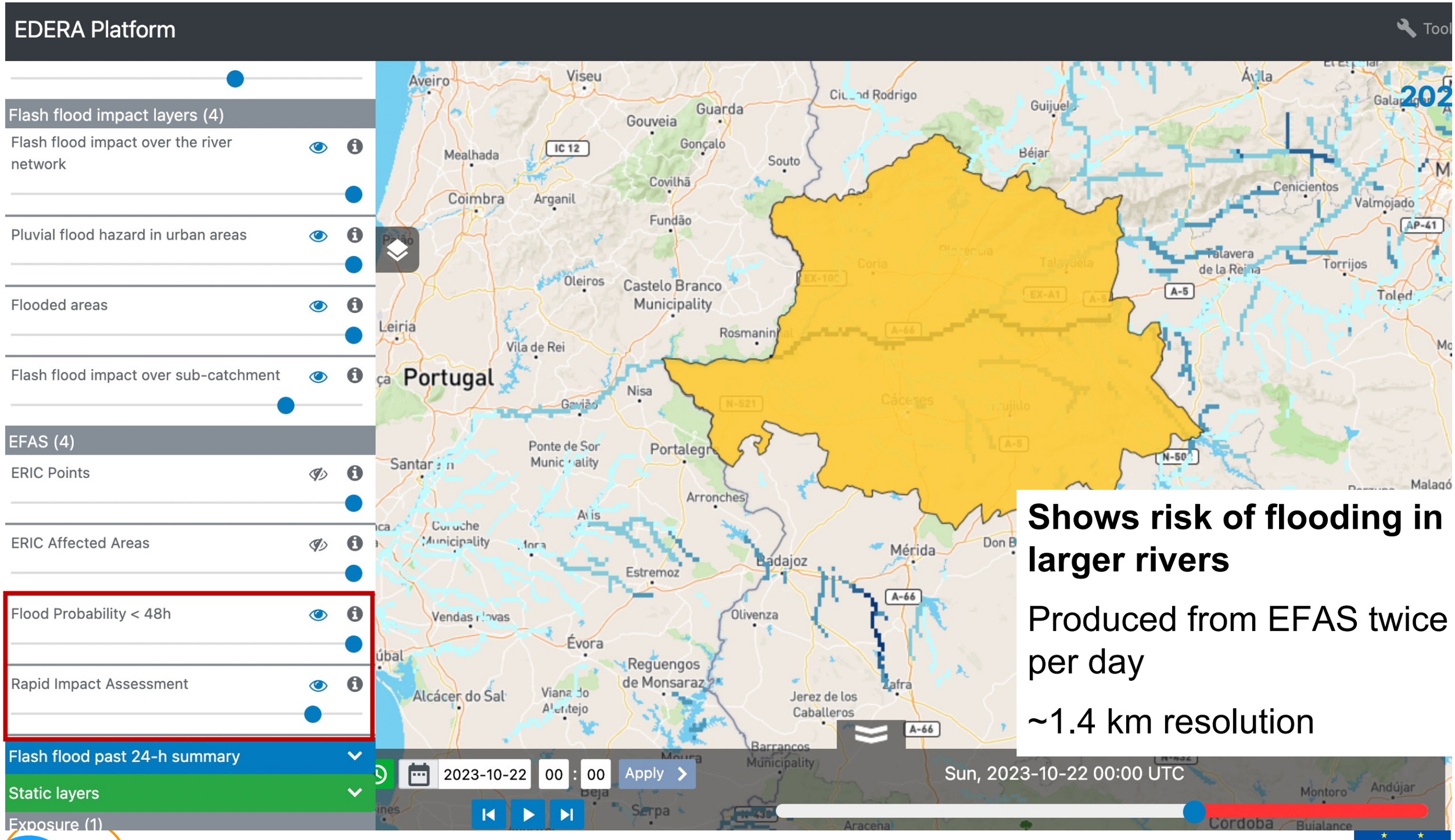
Produced from EFAS twice per day

~1.4 km resolution

Based on NWP only

Co-funded by the European Union

Animated flash flood nowcasting – Rapid Impact Assessment & Flood Probability <48h



Shows risk of flooding in larger rivers

Produced from EFAS twice per day

~1.4 km resolution

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