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

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Early warning Demonstration of pan-European Rainfall-induced impact forecasts

meeting with JRC - 02 Feb 2024

Centre de Recerca Aplicada en Hidrometeorologia
UNIVERSITAT POLITÈCNICA DE CATALUNYA

ECMWF

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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

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DIRECCIÓN GENERAL DE PROTECCIÓN CIVIL Y EMERGENCIAS

EMERGÊNCIA E PROTEÇÃO CIVIL
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Project summary

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

- **Duration:** 01 Feb 2023 - 31 Jan 2025 (24 months)
- **Website:** www.edera-project.eu
- **Partners:**

  Universitat Politècnica de Catalunya (ES)

  European Centre for Medium-range Weather Forecasts (INT)

  Finnish Meteorological Institute (FI)

  Environment and Water Agency of Andalusia (ES)

  Directorate-General for Civil Protection and Emergencies (ES)

  National Authority of Emergency and Civil Protection (PT)

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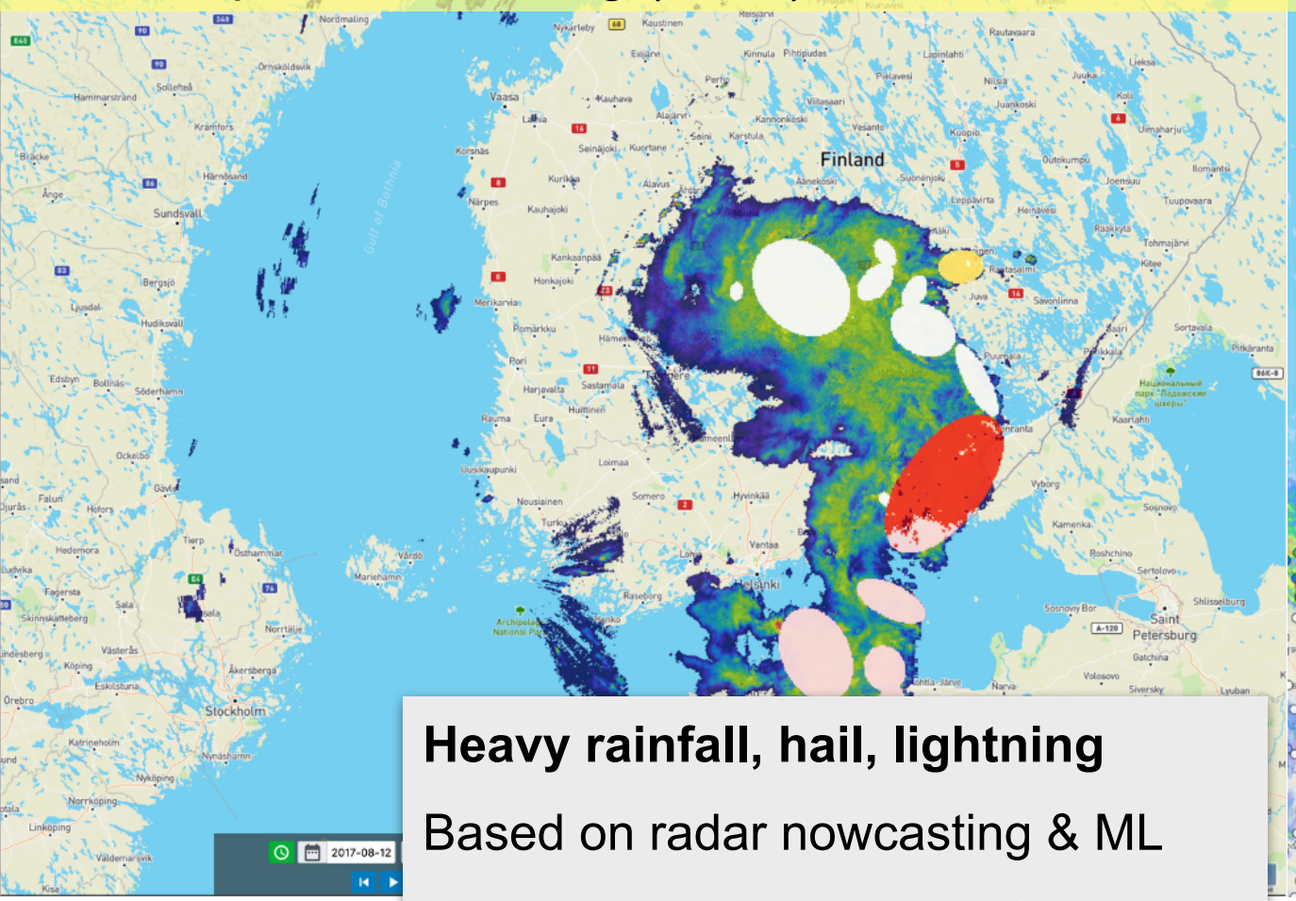
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Main objective

Integrating forecasts of the impacts due to storms and heavy rainfall into the operational EWSs of national, regional and local CPAs, fostering sharing information and cooperation of CPAs during cross-border events and coordination between CPAs.

Impact forecasting during storms and heavy rainfall events

Storm impact nowcasting (0-3 h).



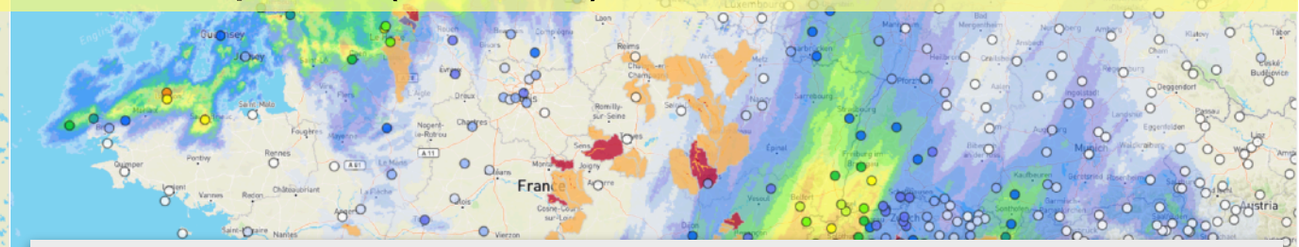
Heavy rainfall, hail, lightning

Based on radar nowcasting & ML

Extended to European scale

European-wide exposure.

Flood impacts (0-120 h).



Flash floods (basins 10 - 2000 km²)

Resolution: 1 h, 1 km - Update: 1 h

Blended precipitation forecasts → Flash flood hazard → Flash flood impacts

- Using probabilistic nowcasting & NWP.
- Seamless blending in the first 6 hours

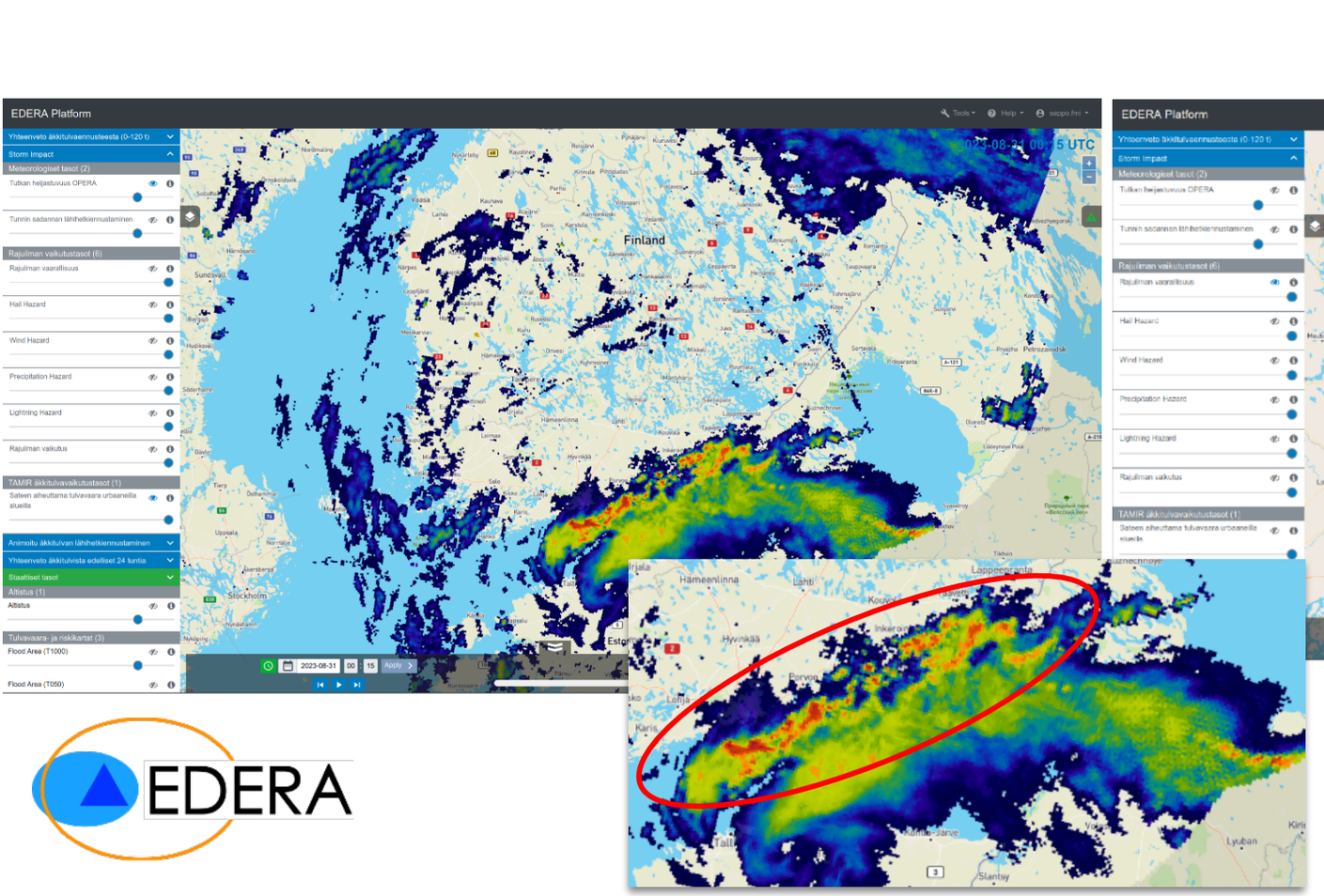
- Basin-aggregated precipitation on the drainage network (1 km).
- Hazard assessment by comparison with climatological thresholds.

- By combining hazard with exposure.

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Storm hazard and impact nowcasting

- Extended to European scale.
- Identification of areas of heavy rainfall.
- **Hazard level** assigned by using a machine learning model.
- 4 hazard levels based on climatological thresholds.

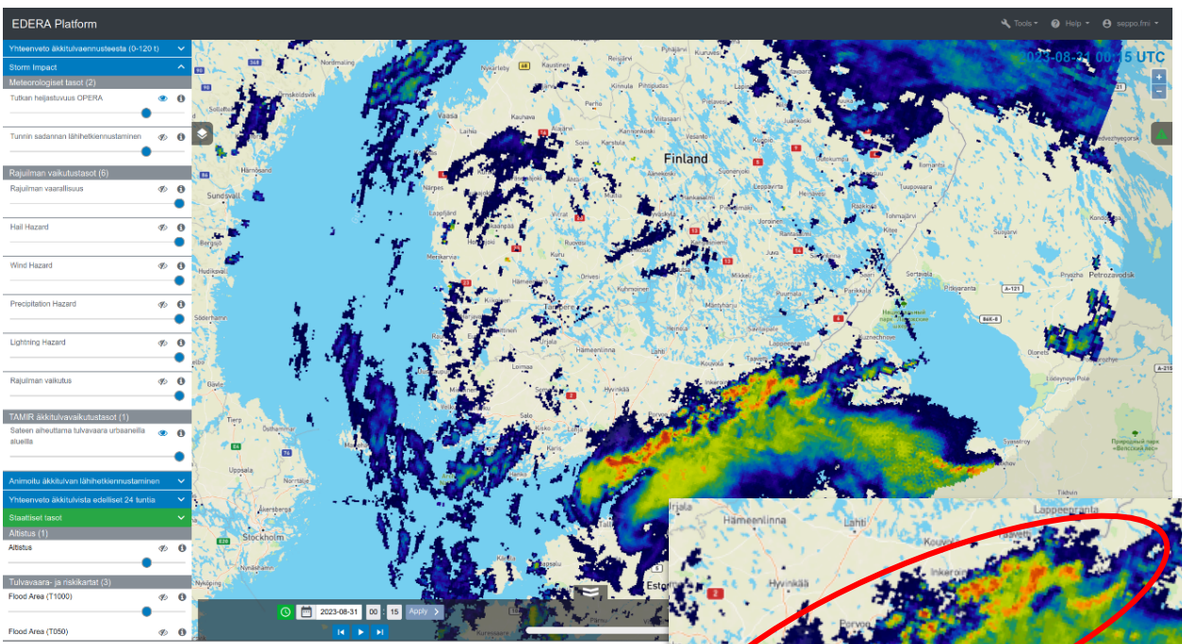


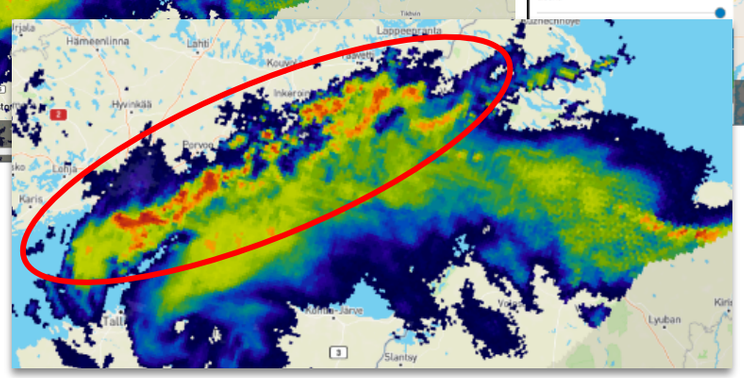
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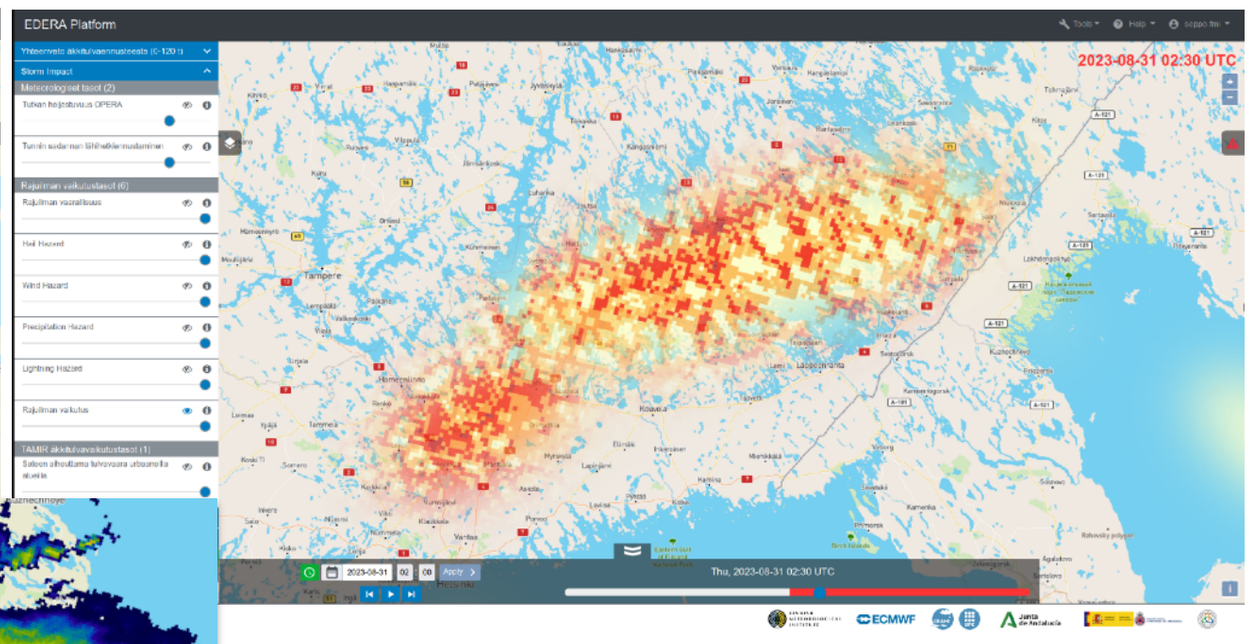
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Storm hazard and impact nowcasting

- Extended to European scale.
- Identification of areas of heavy rainfall.
- **Hazard level** assigned by using a machine learning model.
- 4 hazard levels based on climatological thresholds.
- **Impact level** combining hazard nowcasts with exposure layer to give weight to vulnerable areas.
- Based on a 1-km European exposure layer provided by ECMWF.
- Exposure combining population, health, education, transport and energy-related exposures.







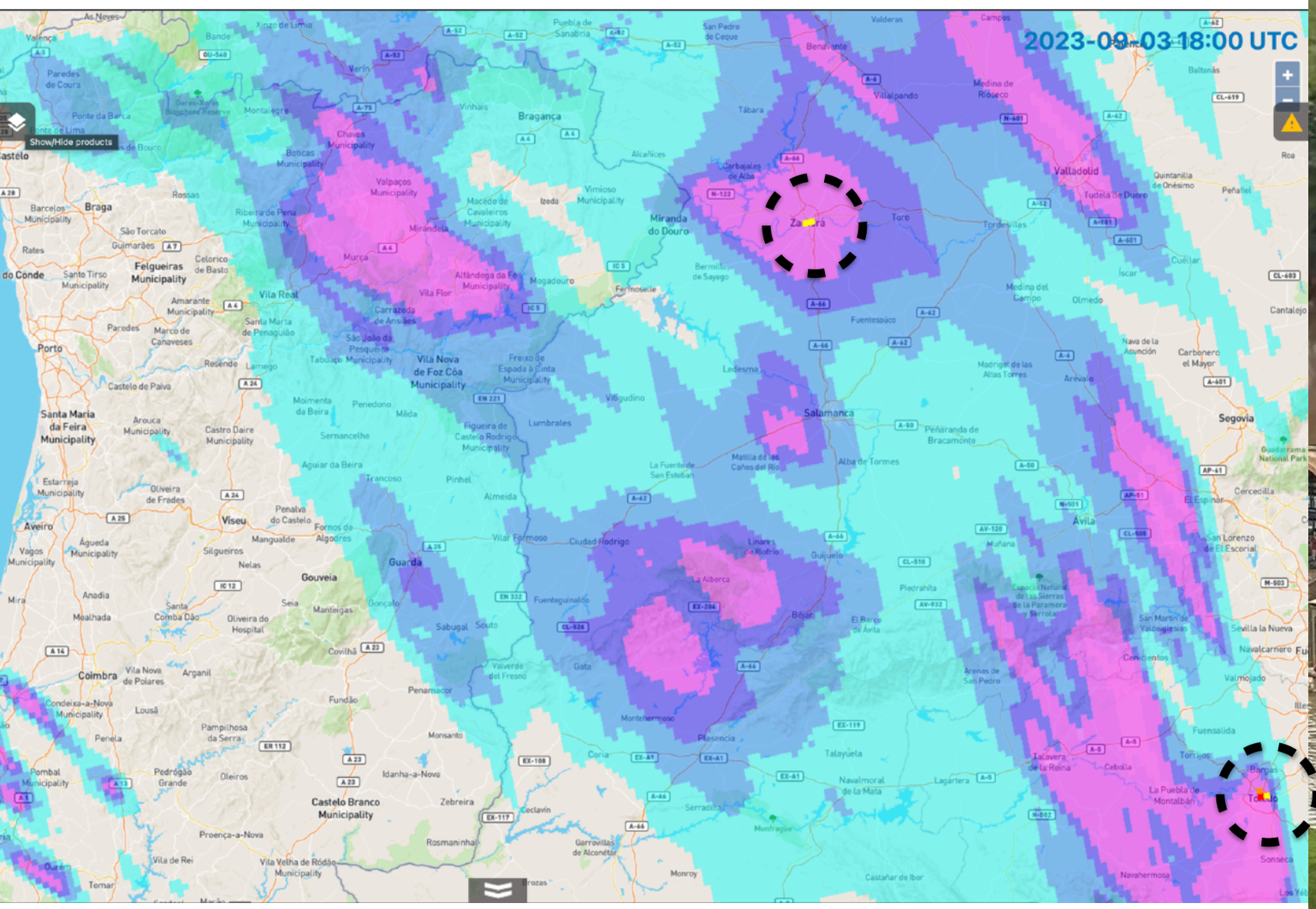


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Pluvial floods nowcasting

- 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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Notifications

Design of notifications based on the EDERA hazard/impact forecasting products:

- Expanding the format of EFAS notifications and adapted to the end-user.
- Notifications by groups of products
- Including exposure & vulnerability datasets.

EDERA notification

Notification Details

- Country(ies): **Finland**
- Administration Region(s): **Kymenlaakso**
- River(s): **Kymijoki**
- Likely peak of event: **Friday 13th October 2023 – 06:00 UTC**
- Probability to exceed a 2-year return period threshold: **90%**

Impact Information

- Total population potentially affected: **10000**
- Maximum impact category: **Severe**

Additional Information:

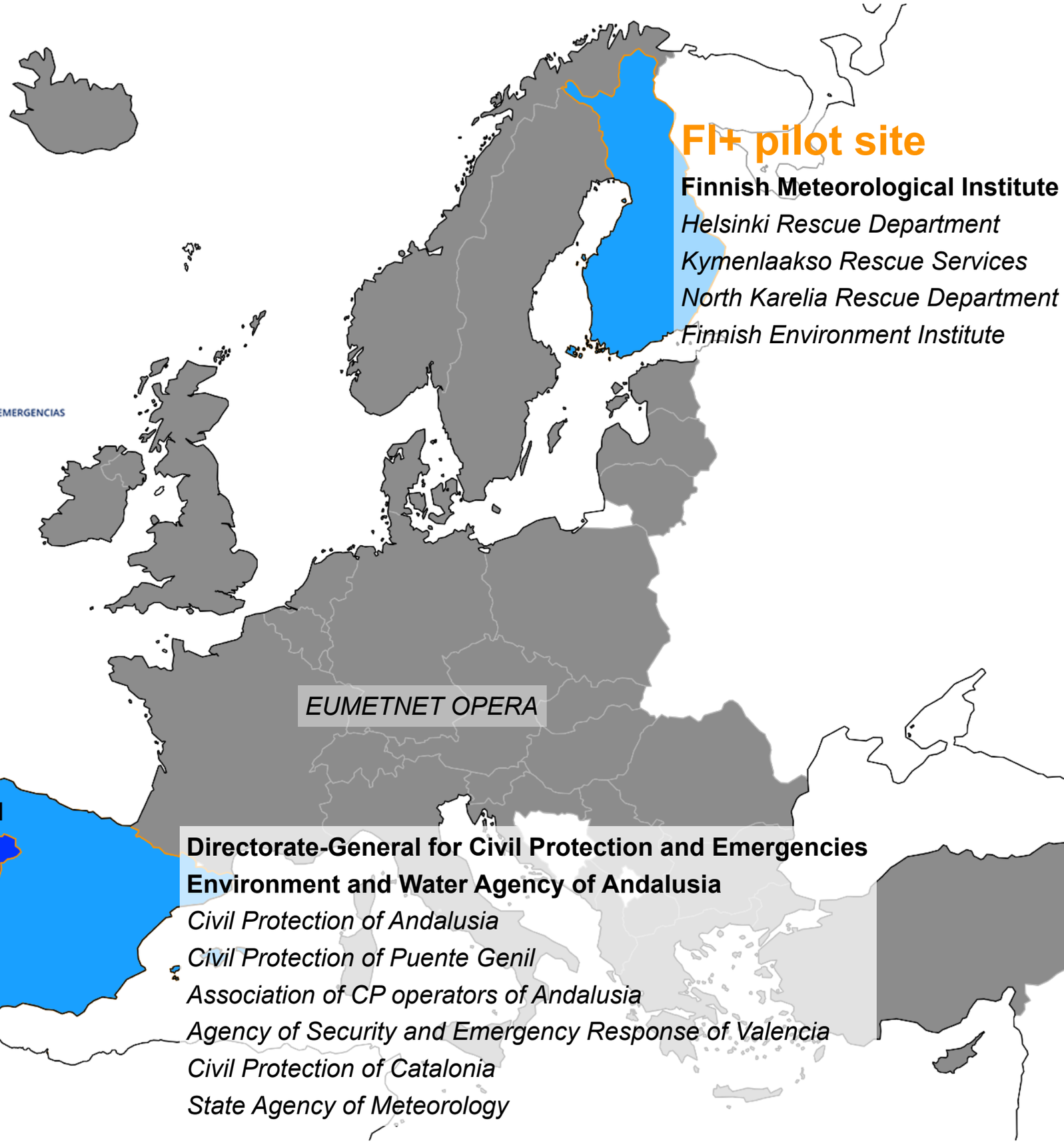
- Forecast date: **2023-10-13 00 UTC**

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

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EDERA pilot sites



FI+ pilot site

Finnish Meteorological Institute

Helsinki Rescue Department

Kymenlaakso Rescue Services

North Karelia Rescue Department

Finnish Environment Institute

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 Puente Genil

Association of CP operators of Andalusia

Agency of Security and Emergency Response of Valencia

Civil Protection of Catalonia

State Agency of Meteorology

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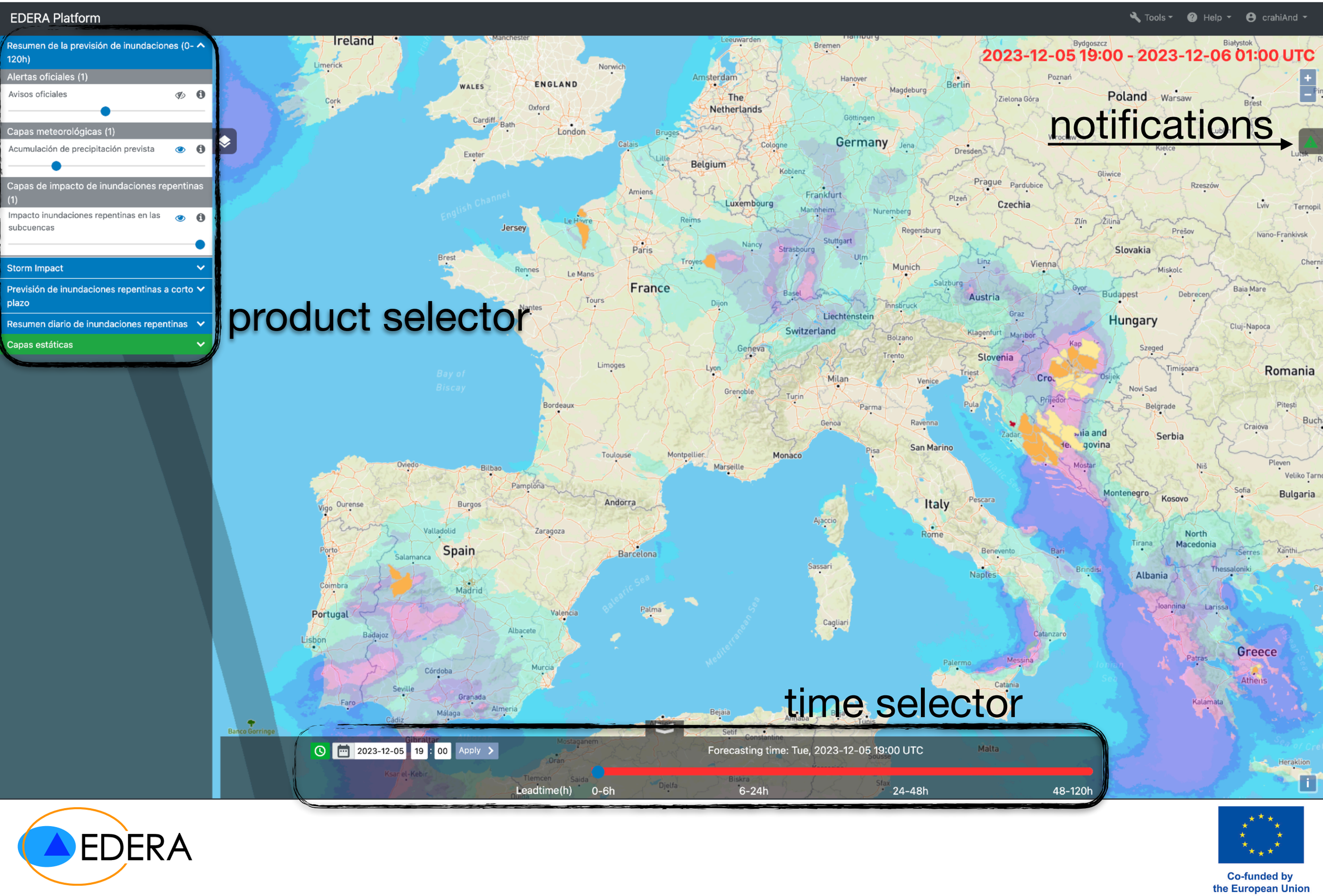
EDERA demonstration

- August 2023 – October 2024.
- With the participation of end users.
- Access to the products in real time through
  - + EDERA web-based platform.
  - + WMS
- Integration of *local* products/information (exposure, vulnerability, obs…)
- Notifications adapted to the end user.
- Evaluation with end users (feedback about the products, functionalities and results during events).
- Recommendations for coordination and cooperation between CPAs.
- Local training workshops.

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EDERA demonstration



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Training and guidance

Local training at the pilot sites

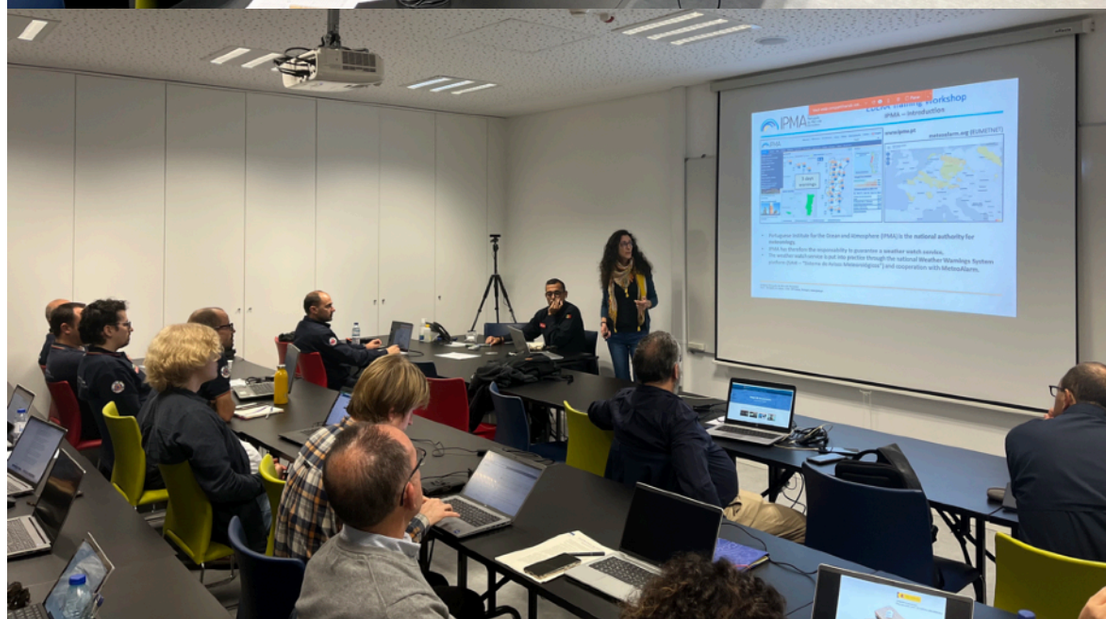
- Presentation of the features and products.
- Discussion on the flow to use the implemented products.
- Design/configuration of notifications (email & SMS).
- Collecting feedback from end-users (through the platform and via frequent meetings).
- Need for further training (technical staff).

Other

- Preparation of e-learning materials.
- International workshop in Madrid (May 2024).







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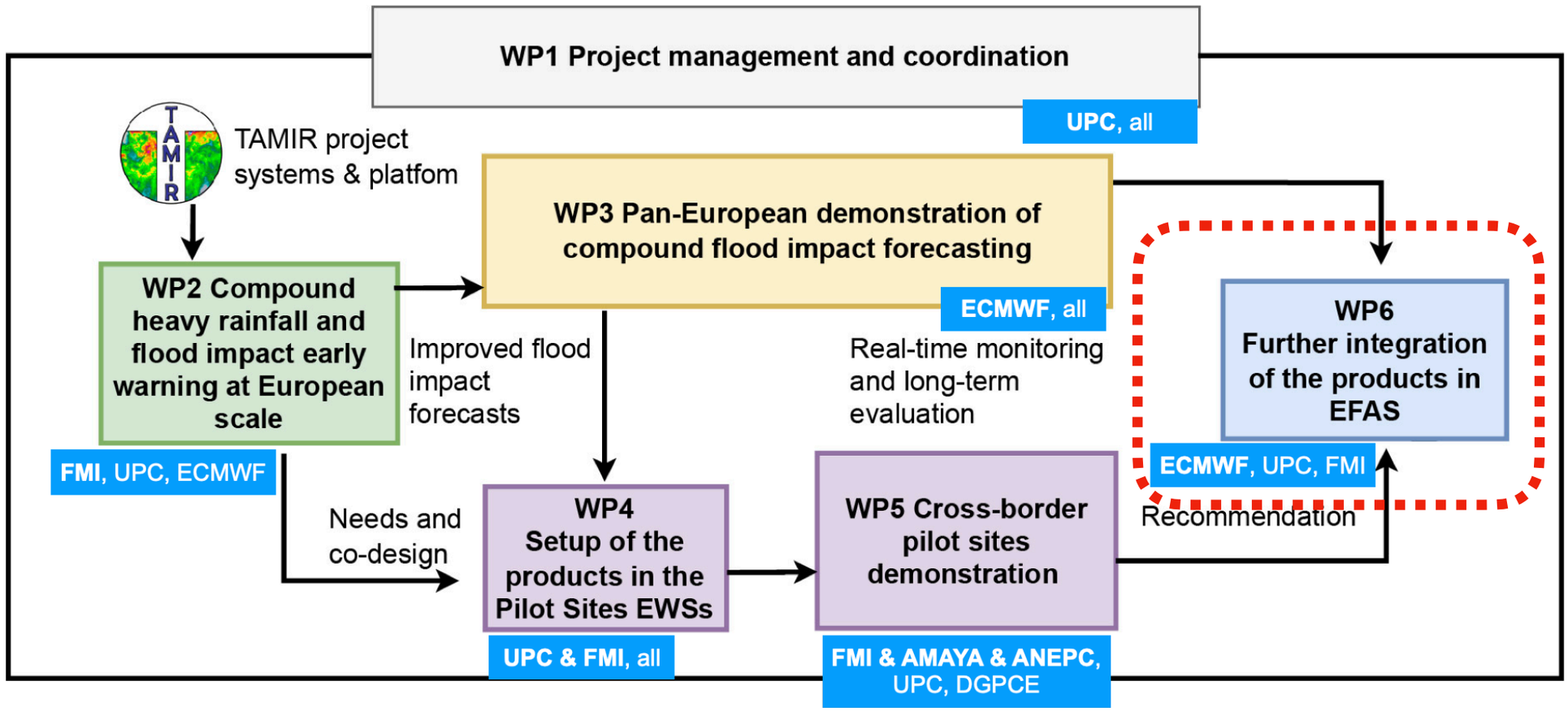
Participation of JRC

As stakeholder

Following the advancements of the project

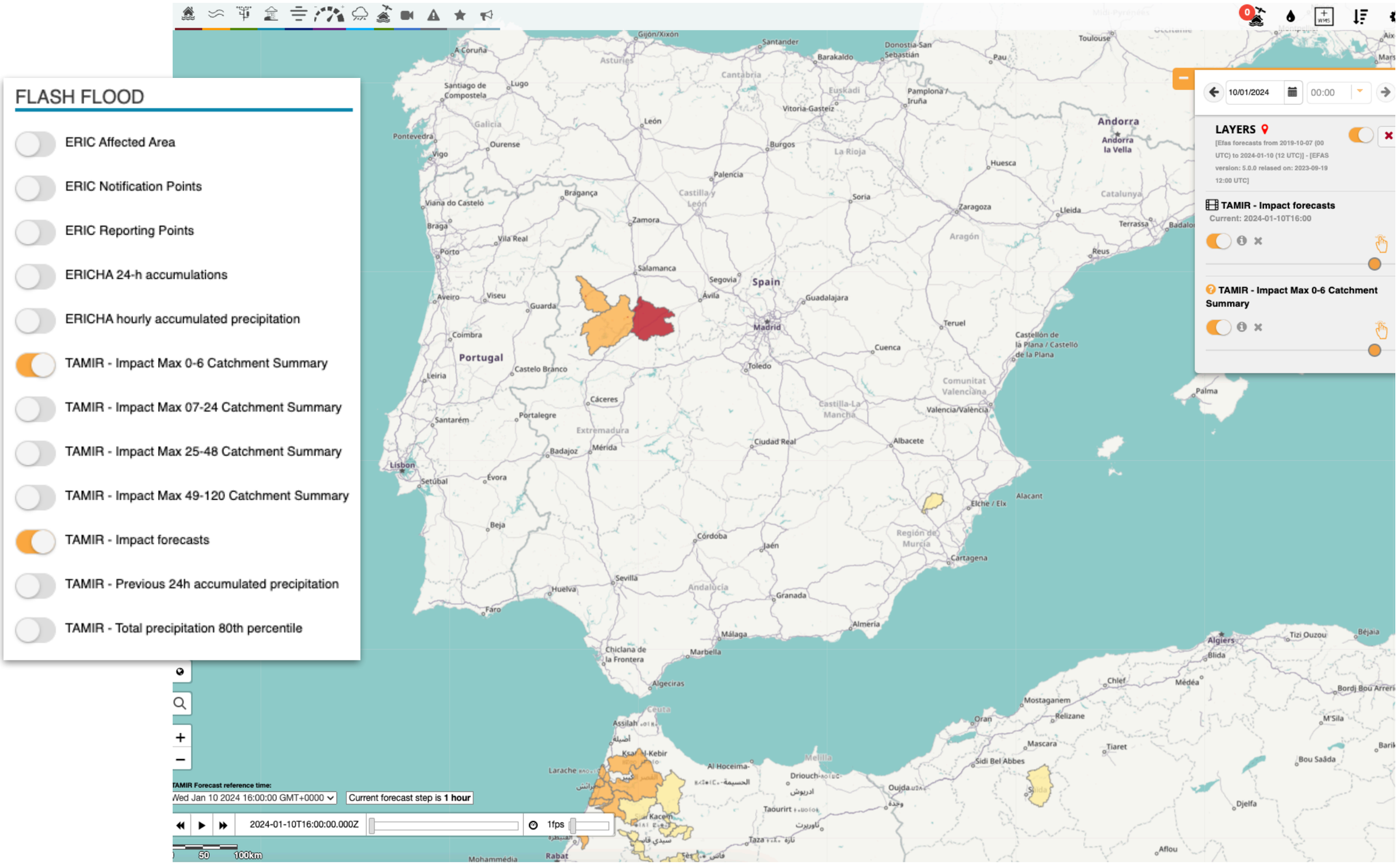
Participating in the project activities (May and Dec 2024)

Design of product integration in EFAS



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What Products are already in EFAS?



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What Products are already in EFAS?

D6.1: Quasi-operational EDERA forecasting dissemination chain
Due: Oct 2024

Product Group(s)	**Product Name**
Flash flood forecast summary (0-120 h)	Flash flood impact over sub-catchment
Animated flash flood nowcasting	Hourly precipitation – 80th percentile
	Flash flood impact over the river network
	ERIC points
	ERIC affected area
	Flood probability <48 h
	Rapid impact assessment
Flash flood past 24 h summary	Precipitation accumulation (24 h)

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What Additional Products are to be Added?

- Based on the outcomes from the workshop – user feedback
- Trade off vs need to minimise the number of new layers in EFAS

Product Name	**Creator**
Hourly precipitation – radar nowcasting	UPC
Precipitation Hazard	FMI
Pluvial flash flood hazard in urban areas	UPC
Exposure	ECMWF
Flooded areas	UPC

review of the status of ERICHA - TAMIR / EDERA products

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Opportunity of radar QPE for EFAS initial conditions

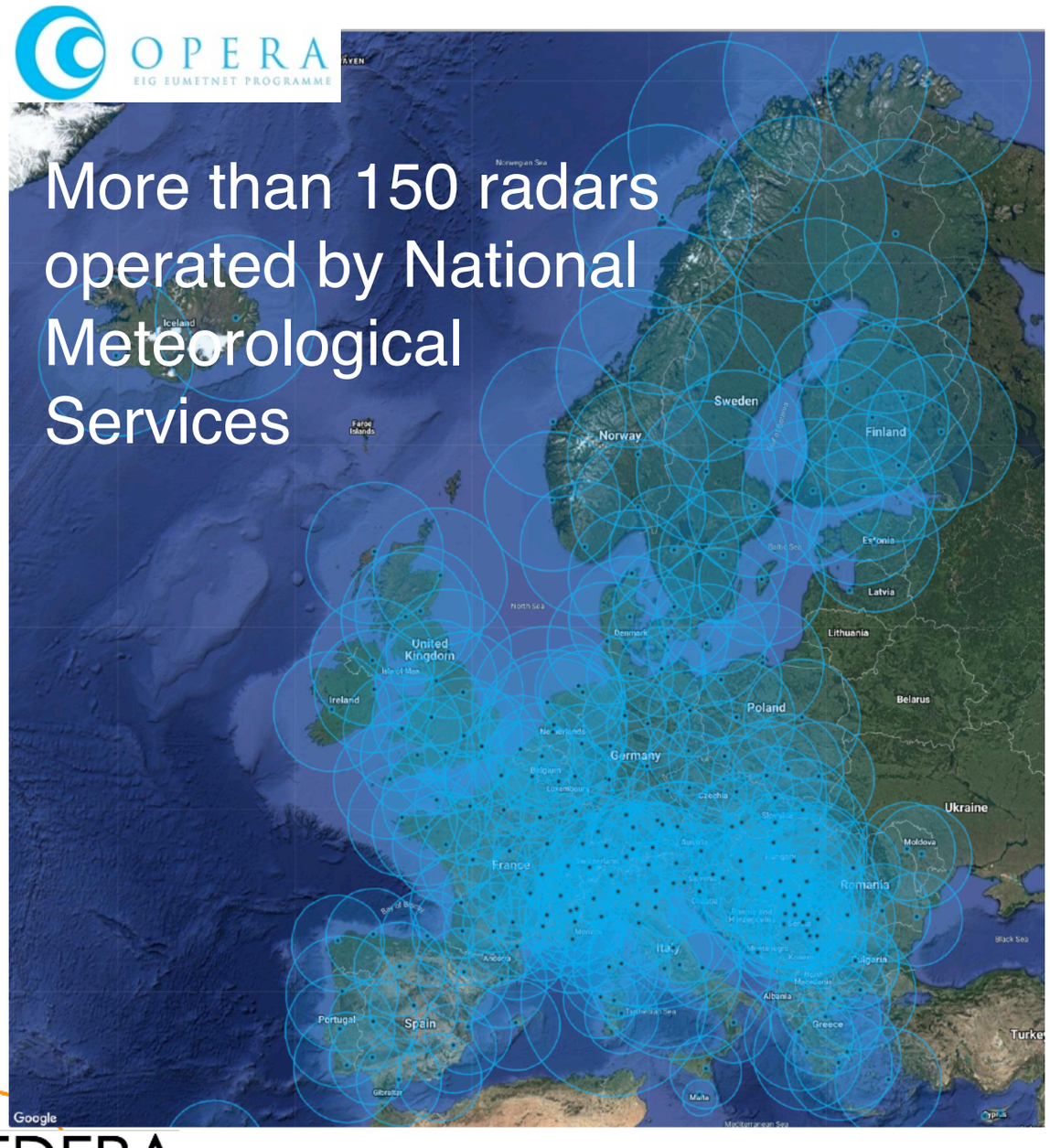
- Using gauge-adjusted OPERA 1-h accumulations
- Available 2013-2023
- Over the EFAS 1-arcmin grid

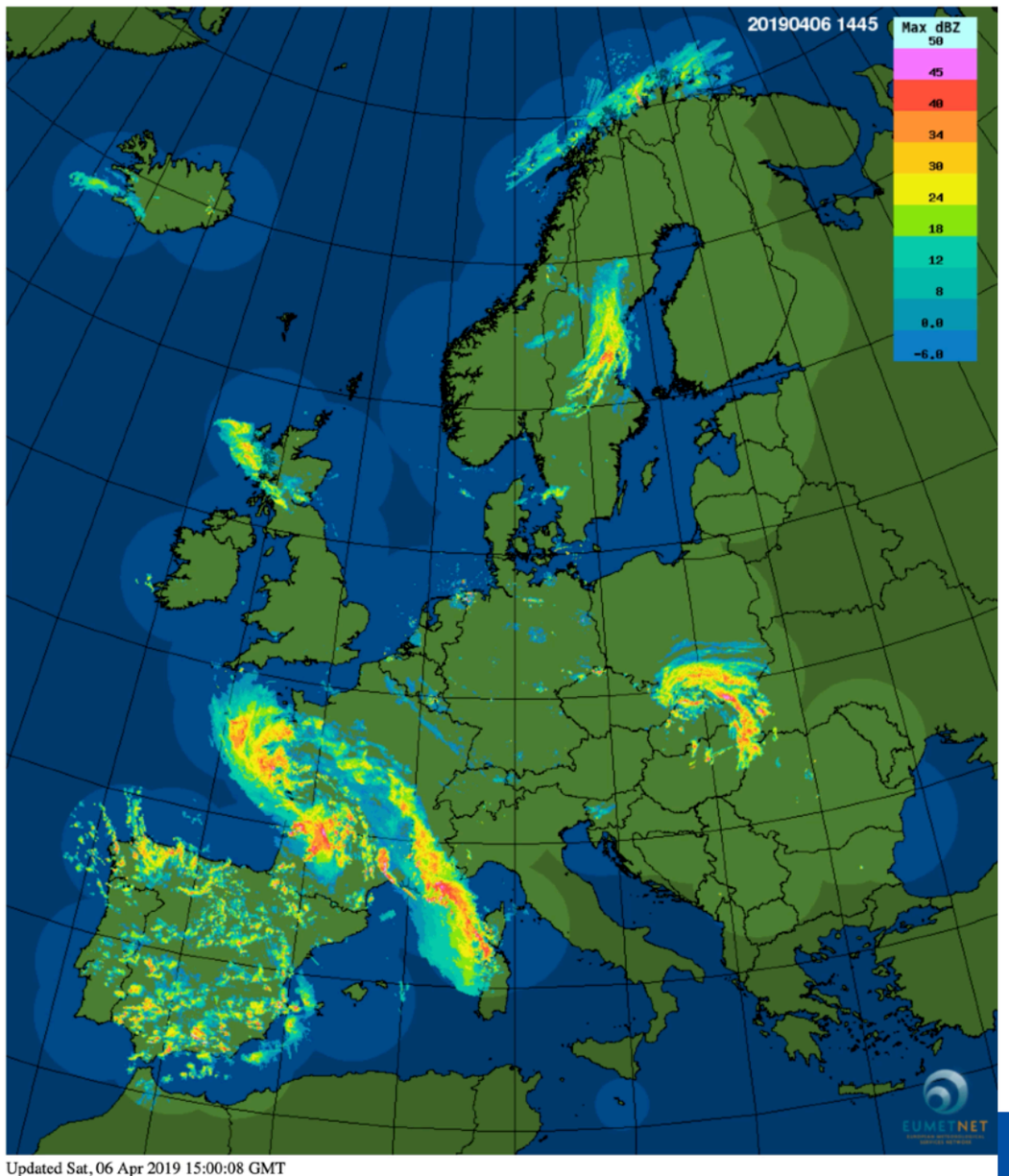
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OPERA radar precipitation

The EUMETNET Operational Program for the Exchange of weather Radar information (OPERA) provides high-resolution precipitation observations (2 km and 15 minutes) at European scale since mid 2012.





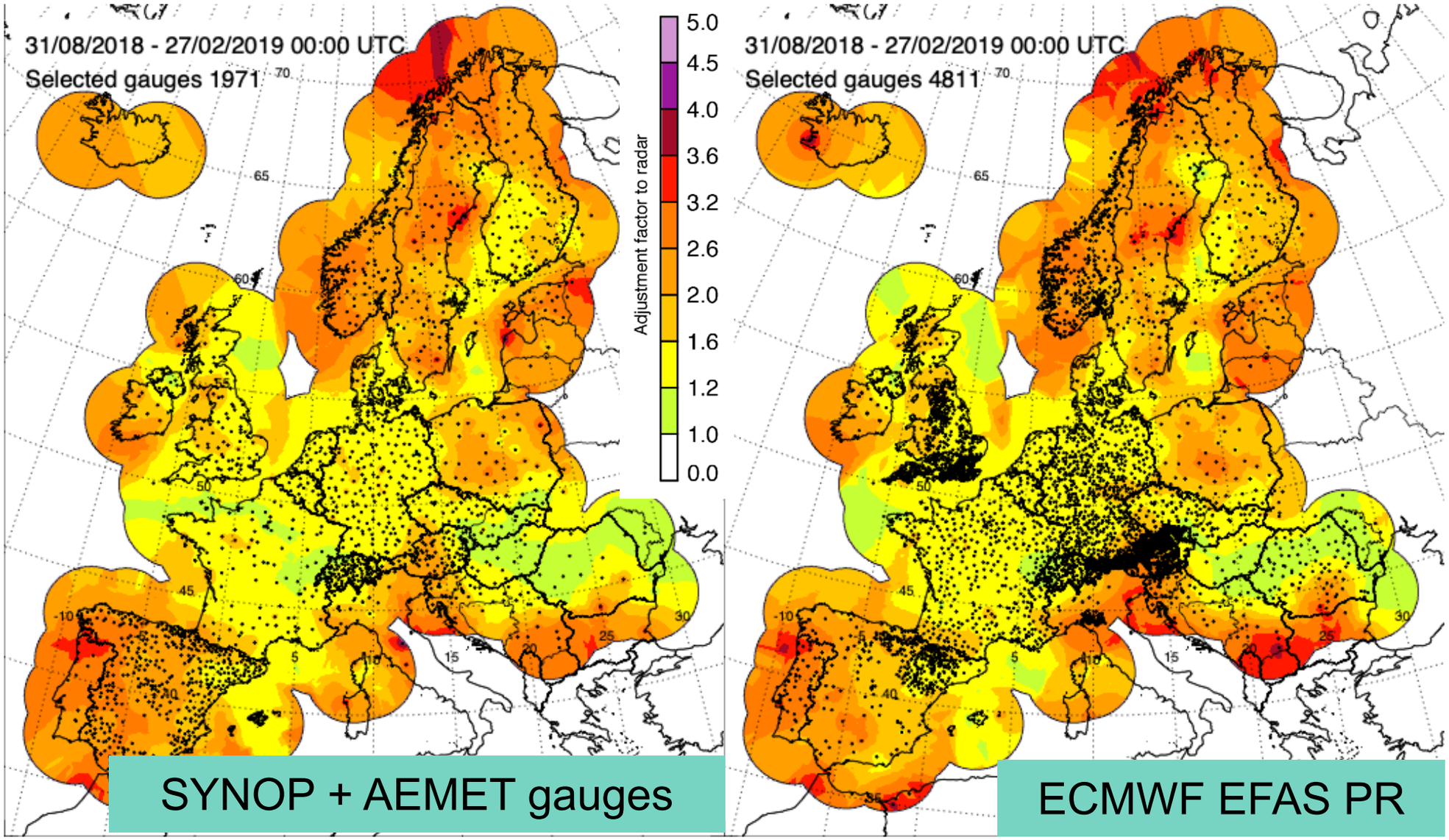
Updated Sat, 06 Apr 2019 15:00:08 GMT

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Radar – Gauge adjustment

Daily adjustment factor map based on the long-term comparisons over valid points of Radar and Gauges (more than 7 rainy days within the 180 days' horizon).



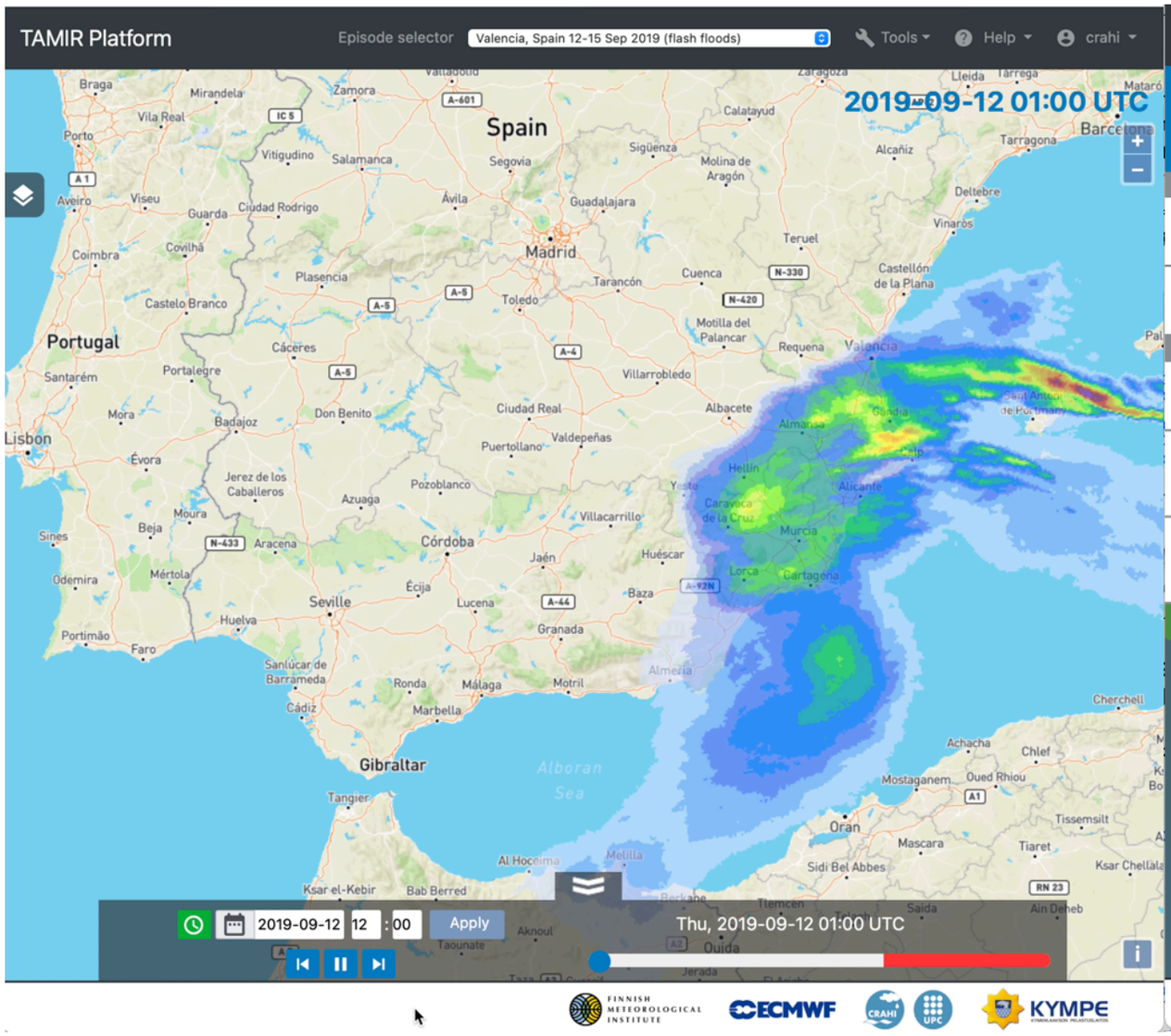
Park, S., Berenguer, M., Sempere-Torres, D., 2019: Long-term analysis of gauge-adjusted radar rainfall accumulations at European scale. J. Hydrol.,573, 768-777.

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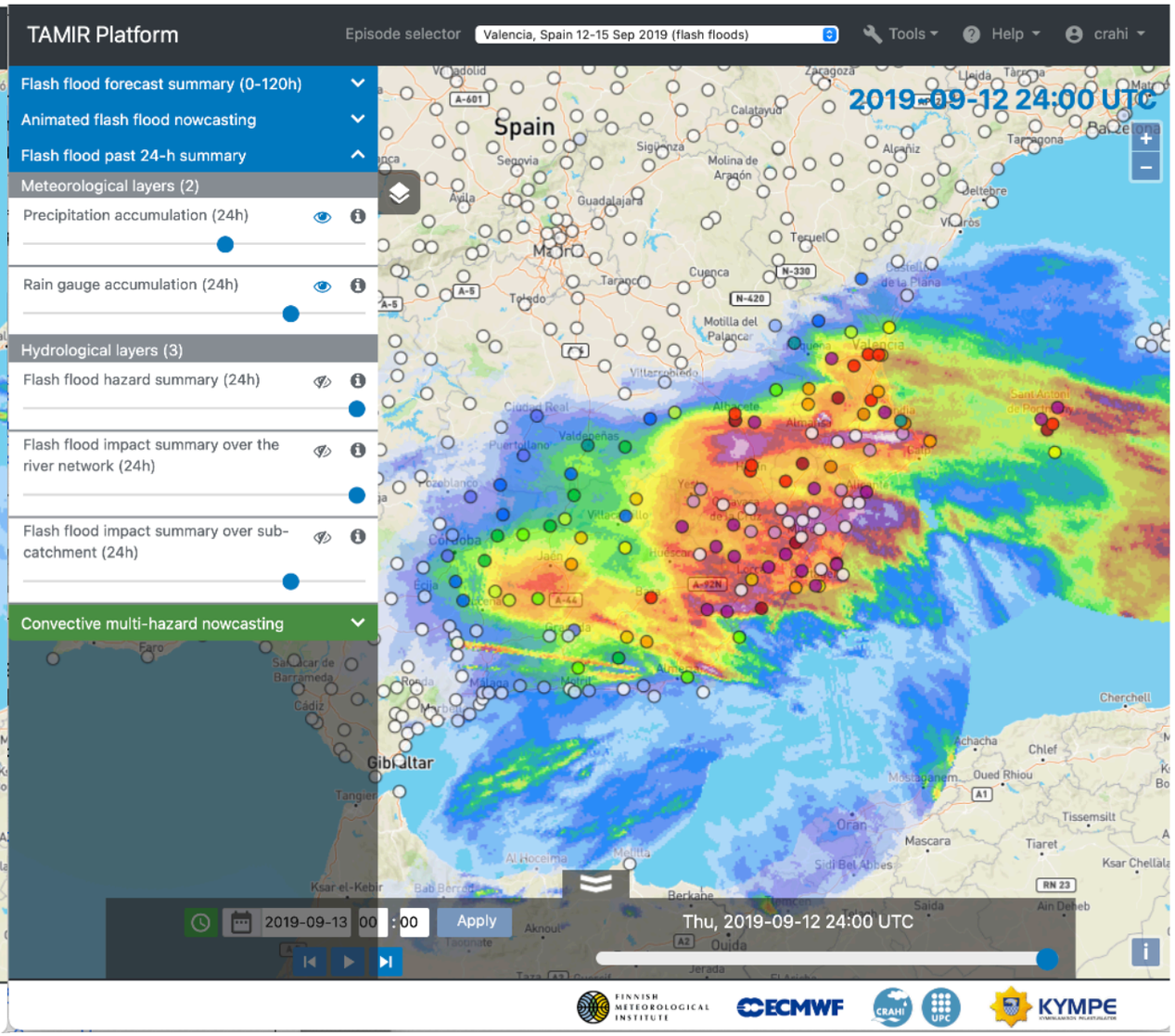
Gauge-adjusted OPERA accumulations

Available from 2013 to 2023.

1-h accumulations



24-h accumulations

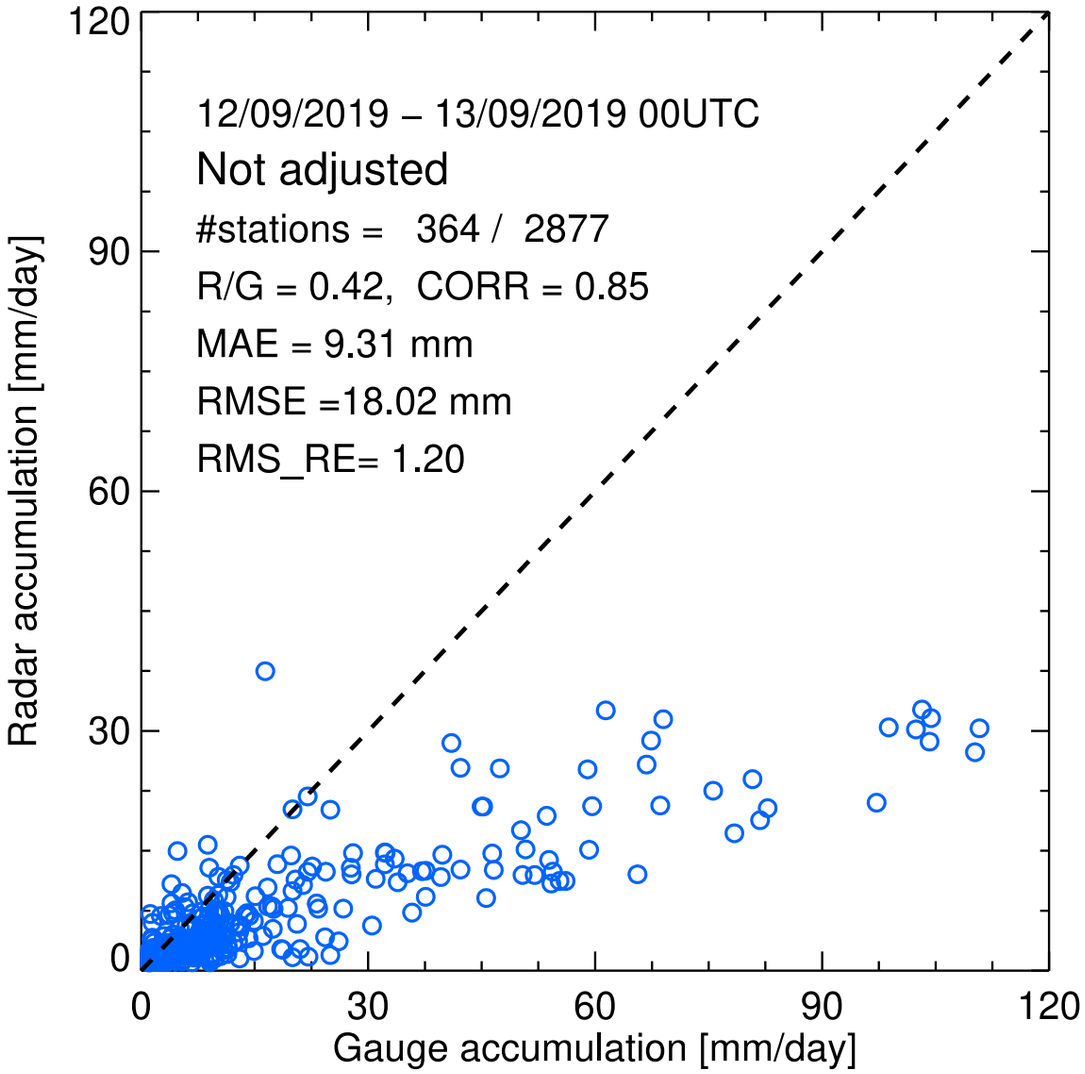


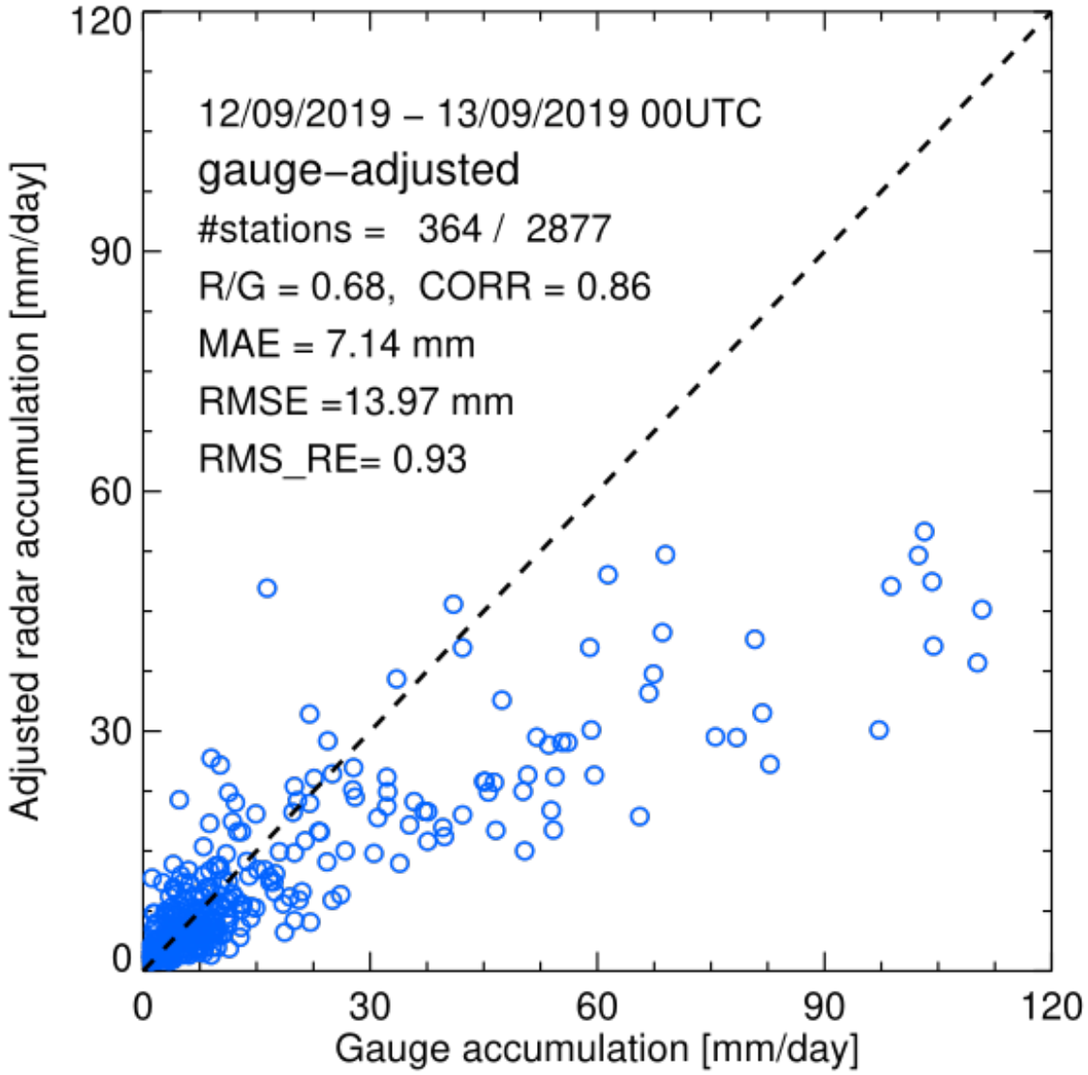
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Monitoring of OPERA accumulations

Available from 2013 to 2023.



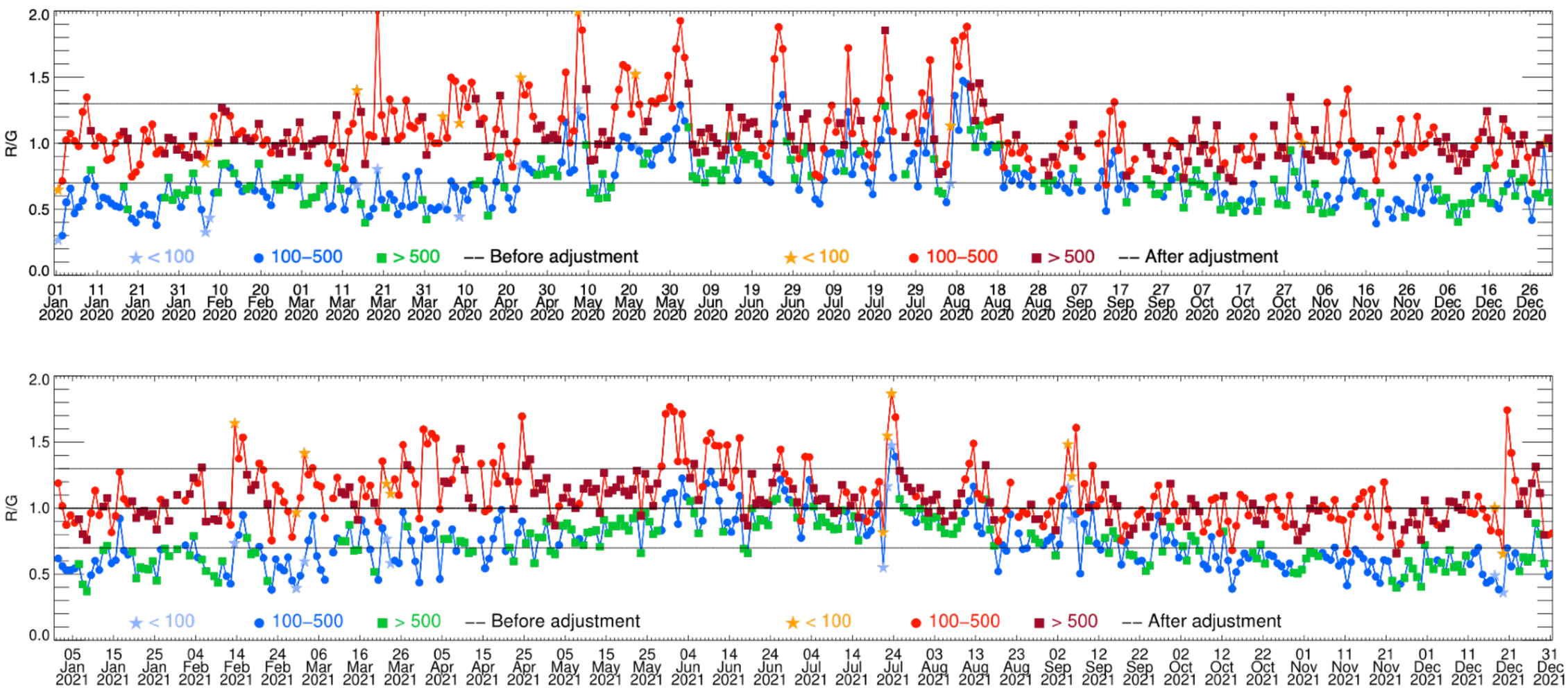


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Monitoring of OPERA accumulations

Available from 2013 to 2023.



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Opportunity of radar QPE for EFAS initial conditions

- Using gauge-adjusted OPERA 1-h accumulations
- Available 2013-2023
- Over the EFAS 1-arcmin grid

2 stages:

1) Interpolation of radar QPE at gauge locations using the AWD method (py2gp library)
2) Strongly filtered (and re-estimated) radar QPE.

Current situation and envisioned deadlines:

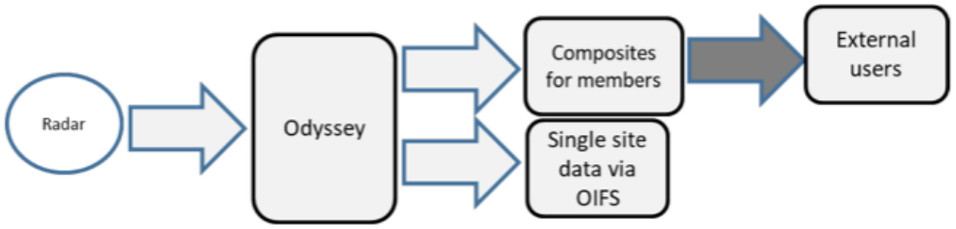
- Codes and QPE maps available (6h, 24h accumulations)
- Rain gauge observations needed.
- First version by Jun 2024 - final version by Dec 2024

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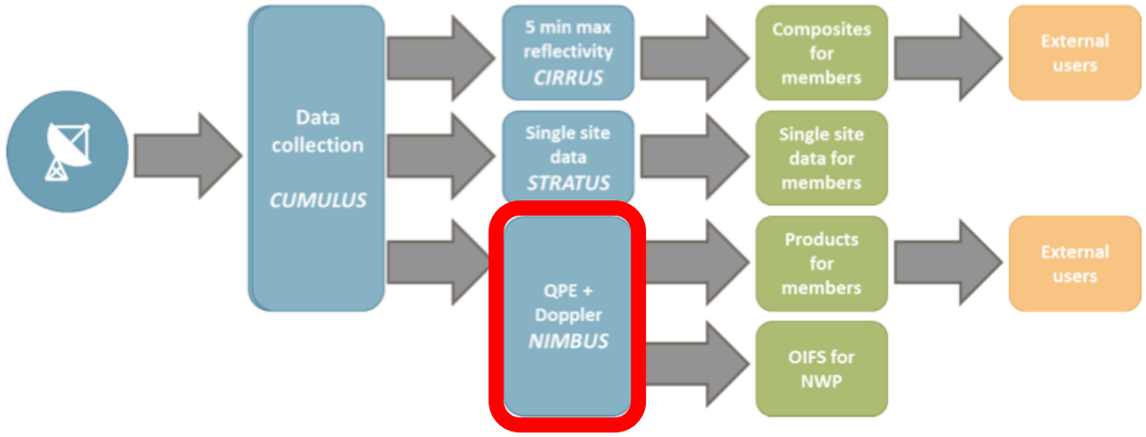
EUMETNET OPERA phase 6 (2024-2028)

The new production lines in OPERA (2019-2023)



NIMBUS 15-minute Rain Rate Composites
Testing is still ongoing (expected date to be fully operational in April)

Inputs to the radar-based flash flood indicator:
Odyssey 15-minute Rain Rate Composites



Courtesy of the OPERA community

von Lerber, A., Goreta, M., Haase, G., Jurašek, M., Karsisto, P., Klink, S., Koutek, M., Leijnse, H., Meyer, V., Müller, C., Nicolau, T., Park, S., Peura, M., Radojevic, M., Stephan, K., Tüchler, L., and Vodarić Šurija, B.: OPERA5 – the renewal of the production lines, EMS Annual Meeting 2023, Bratislava, Slovakia, 4–8 Sep 2023, EMS2023-325, https://doi.org/10.5194/ems2023-325, 2023)

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