European Union
Civil Protection and
Humanitarian Aid

The TAMIR Project and the link to EFAS

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ECMWF

KYMPE
KYMENLAAKSON PELASTUSLAITOS

Background & Aims

"Between 1980 and 2019, weather and climate-related extremes accounted for around 81 % of total economic losses caused by natural hazards in the EEA member countries."

− EEA. 2021. Economic losses from climate-related extremes in Europe. IND-182-en

Natural disaster risks EU may face:

1. *Flooding*
2. *Extreme weather*
3. *Forest fires*

− EC. 2017. Overview of Natural and Man-made Disaster Risks the European Union may face.

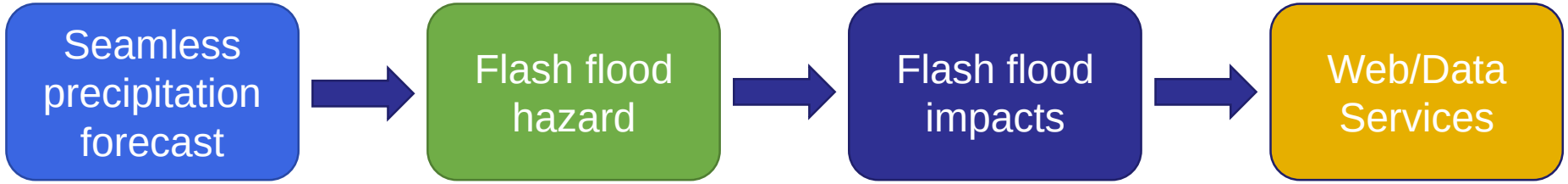
TAMIR main goal:

Enhance the response capacity in emergencies caused by convective and heavy rainfall events by developing rapid risk assessment products and IT tools for improved ***impact forecasting*** *to support decision making.*

TAMIR Development Overview

Develop flash flood impact forecast products to display on EFAS website

- 1-arcmin resolution with **all** EFAS domain coverage (EFASNext grid)
- 1 hour timestep for first 5 hours lead time, 6 hourly timestep thereafter up to **120 hours lead time**
- Forecast updated every 1 hour with new information



- Blend ensemble radar and NWP
- Account for precipitation type
- Bias correct precipitation

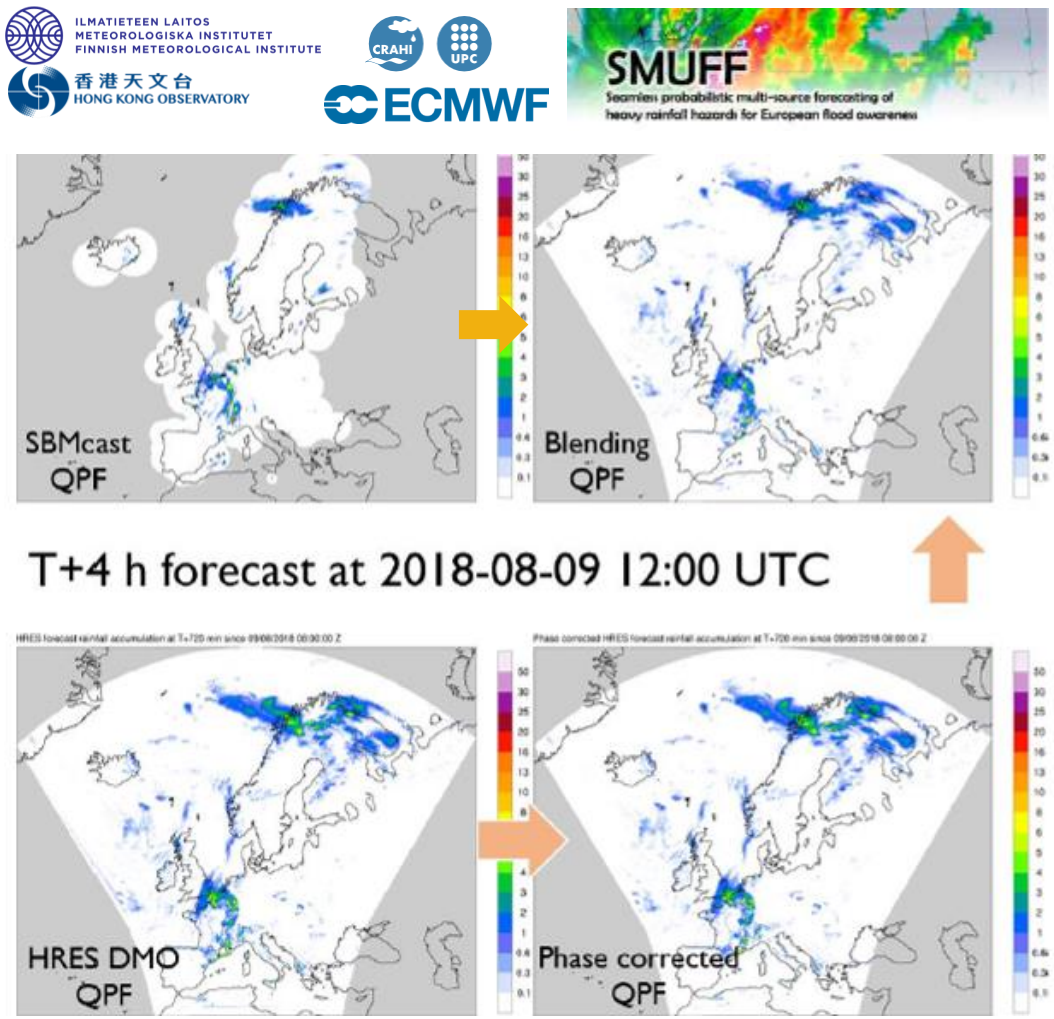
- Calculate flash flood hazard using EPIC method
- Climatological thresholds based on radar and NWP data

- Create pan-European combined exposure dataset
- Overlay exposure and flash flood hazard to show where impacts are possible

- Demonstrate new products via project webviewer
- Integrate final products to EFAS

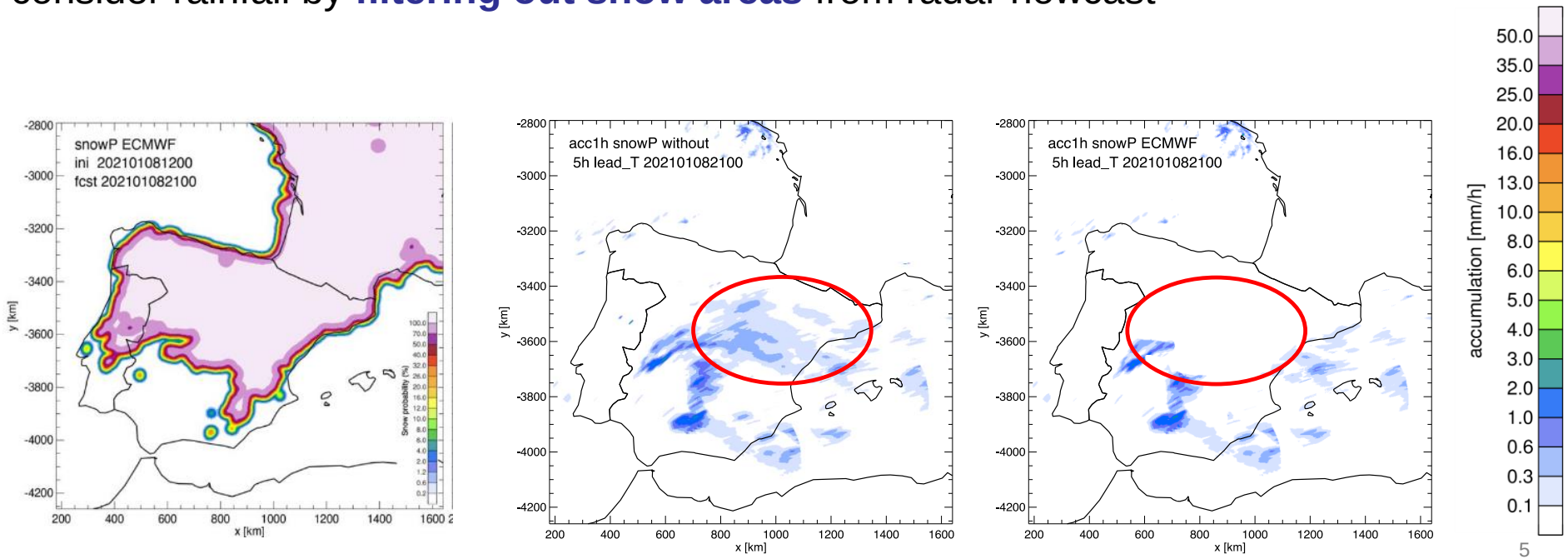
Seamless Precipitation Forecasts

- 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
- NWP is bias corrected and phase shifted to match radar data
- Lead time dependent weighting between radar and NWP over first 5h, afterwards only NWP is used = seamless forecast
- Blending procedure performed once per hour, when new radar data become available and uses the most recent NWP forecast
- Result is used to calculate flash flood hazard using EPIC approach



Estimating Precipitation Type

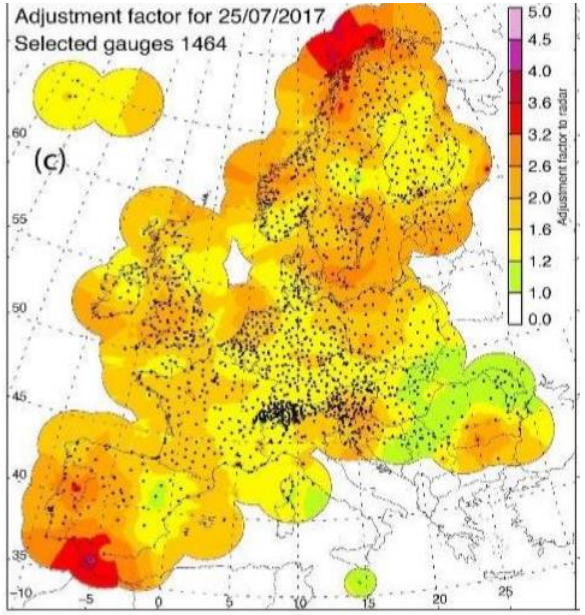
- OPERA 1 h accumulation product is based on single Z-R conversion
  - ➔ no information of precipitation type
- Precipitation type retrieved with FMI algorithm applied to ECMWF IFS
  - ➔ only consider rainfall by **filtering out snow areas** from radar nowcast

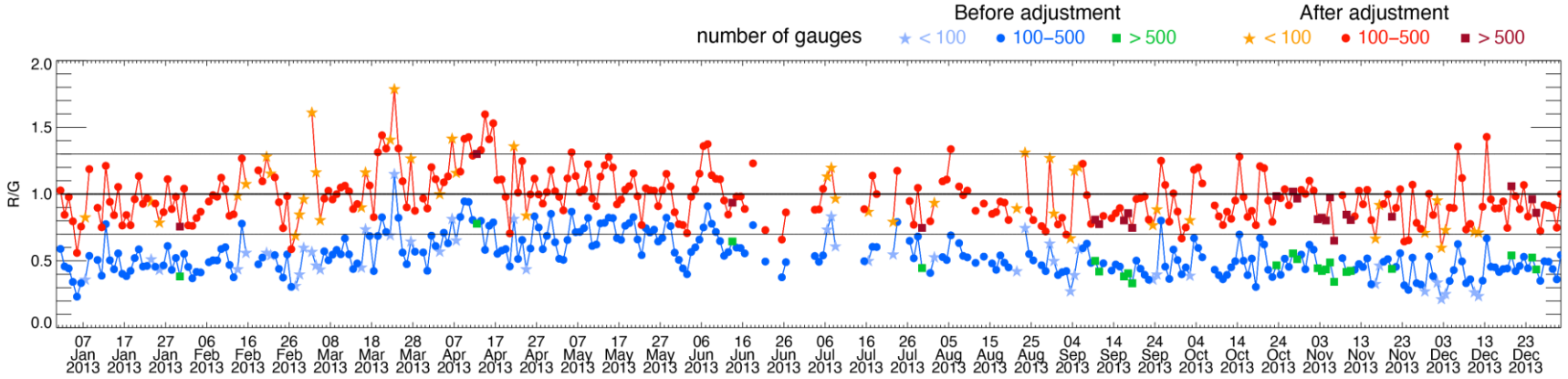


5 h lead time nowcast *Nowcast without the contribution of snow*

Gauge Adjustment to OPERA Precipitation Composite

- Radar-based rainfall estimate typically underestimates rainfall amount on the ground due to radar measurement geometry
- **Real-time gauge-adjustment**[1] used to improve radar QPE in TAMIR
- Adjustment shown to improve radar QPE (results for 2013 below)



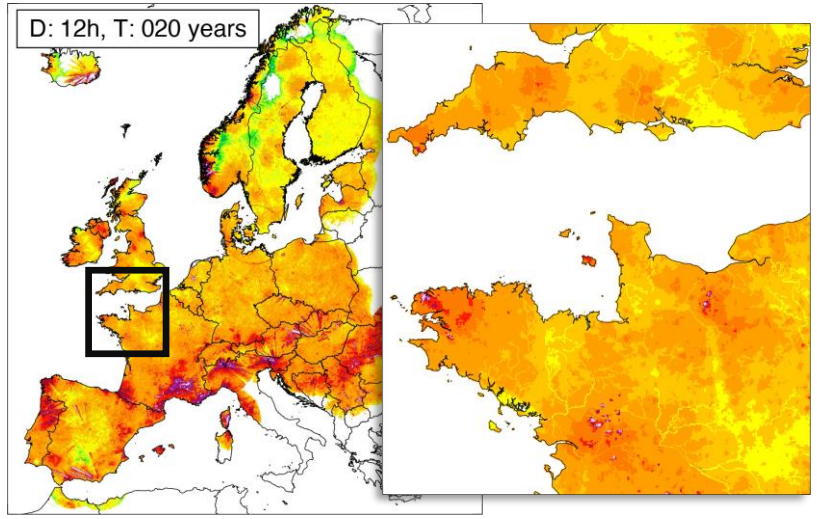


[1] Park et al. 2019. Long-term analysis of gauge-adjusted radar rainfall accumulations at European scale. https://doi.org/10.1016/j.jhydrol.2019.03.093

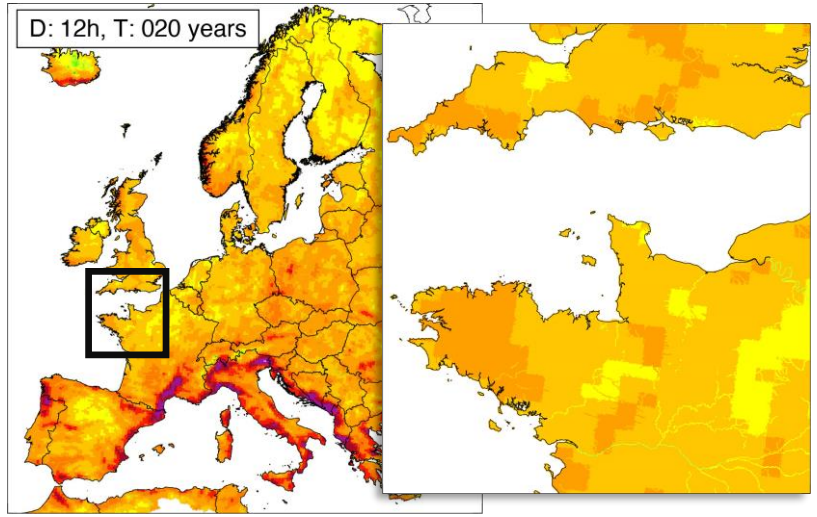
Flash Flood Hazard Forecasting

- Basin-aggregated rainfall forecasts converted to flash flood hazard by comparison with IDF values derived from long-term rainfall datasets
  - Same as EPIC method in EFAS

➔ **Improved radar and NWP thresholds** for seamless FF hazard assessment

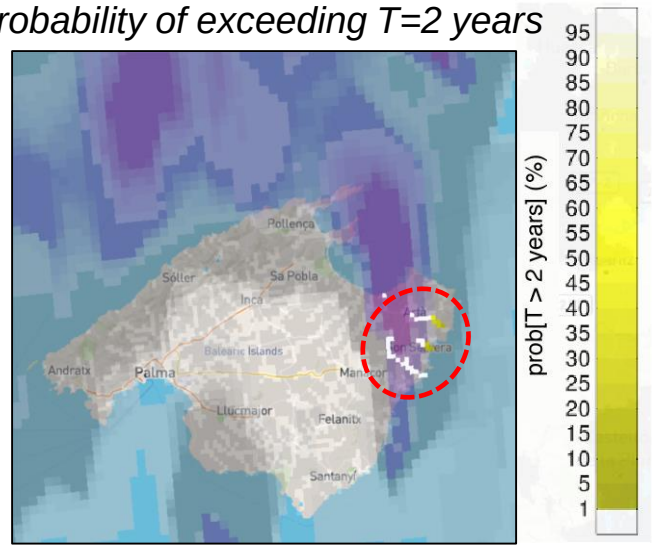


8 years of gauge-adjusted OPERA radar mosaics used for durations 1, 3, 6, 12 and 24 h



20 years of ECMWF IFS NWP reforecasts used for durations 6, 12 and 24 h

Probability of exceeding T=2 years

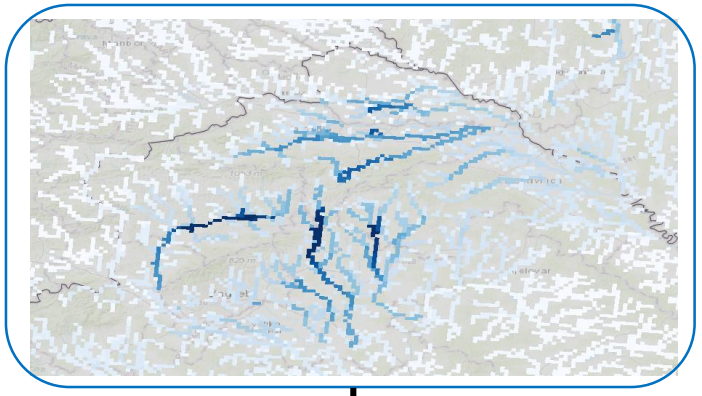


Mallorca (Spain), 9 Oct 2018

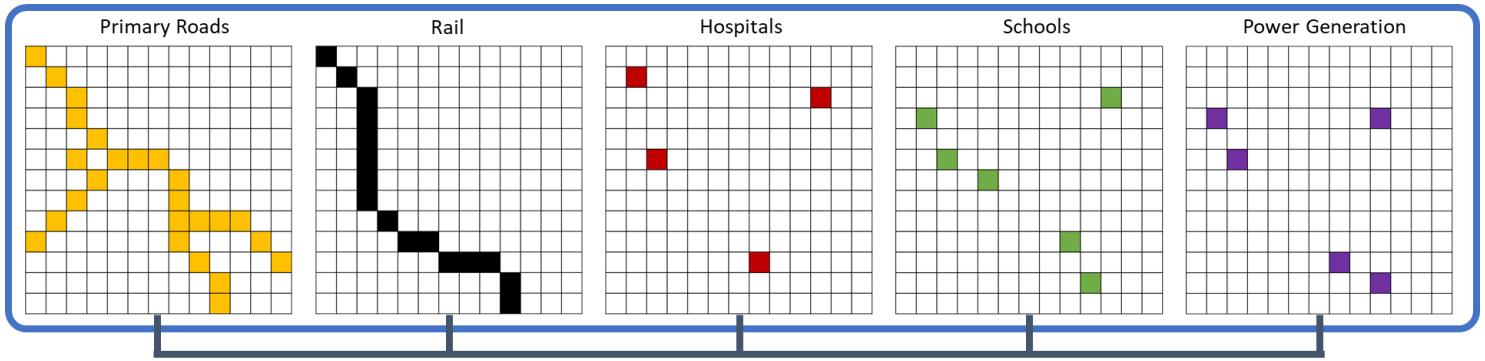
Flash Flood Impact Forecasts

- 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			

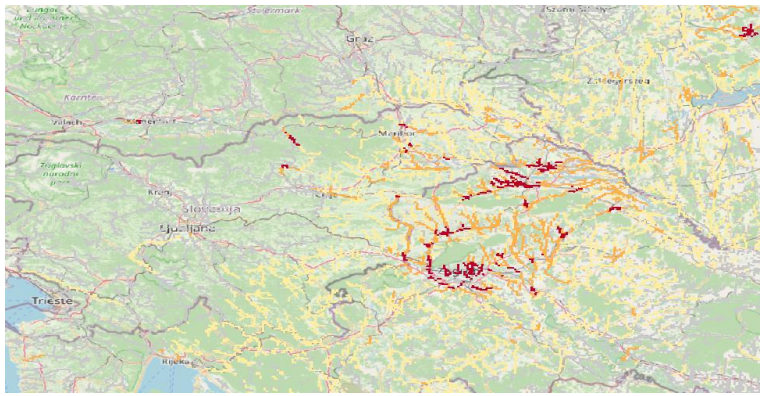
Severe Impacts

Major Impacts

Moderate Impacts

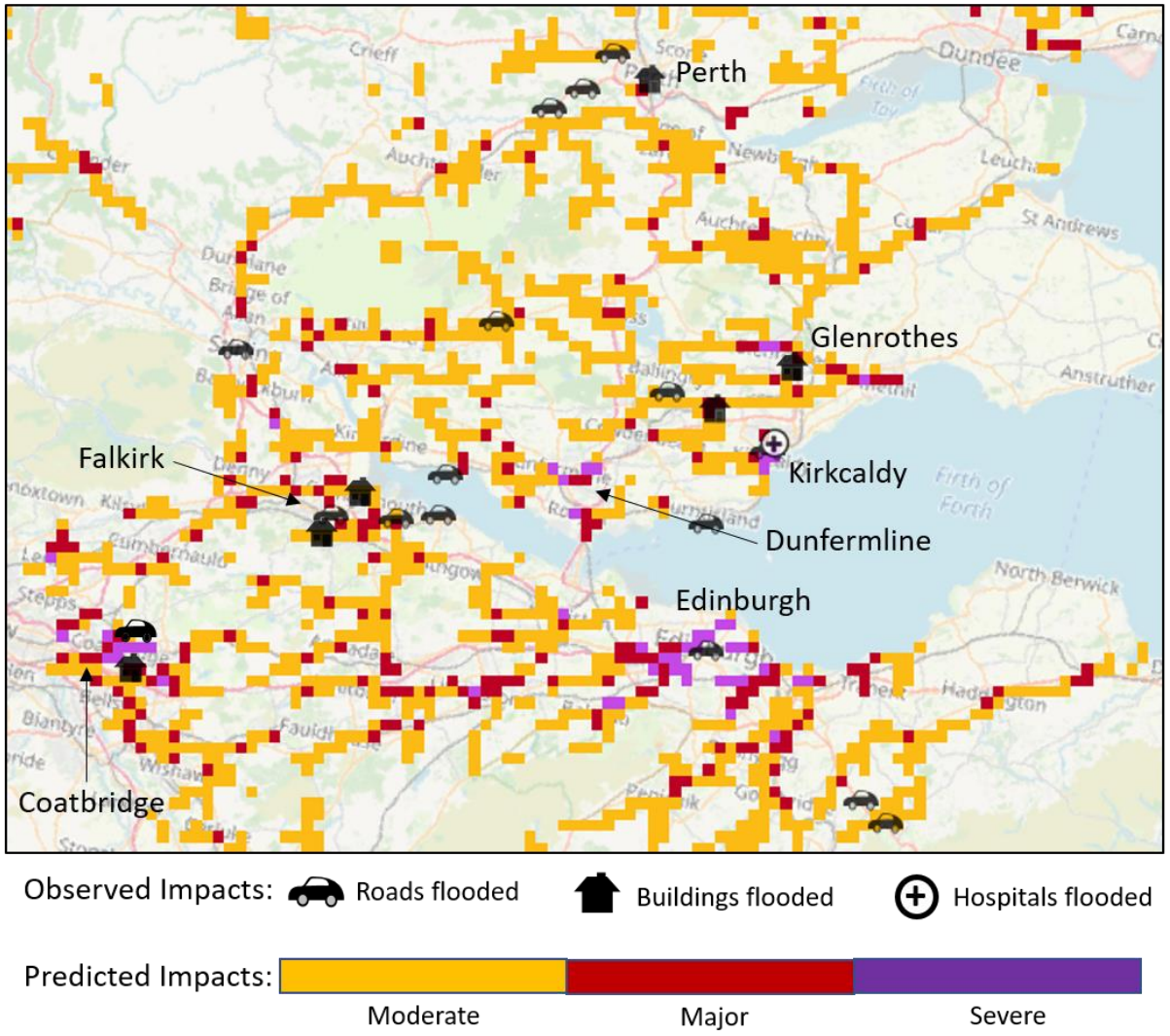
Low Impacts

Flash Flood Impact Forecast



Flash Flood Impact Forecasts

- Forecasted impacts can highlight areas requiring high priority during relief efforts
- Difference between *Major* and *Severe* impacts driven by presence of health and education facilities
- Impacts to critical arterial road networks sometimes underestimated
  - Need to consider vulnerability

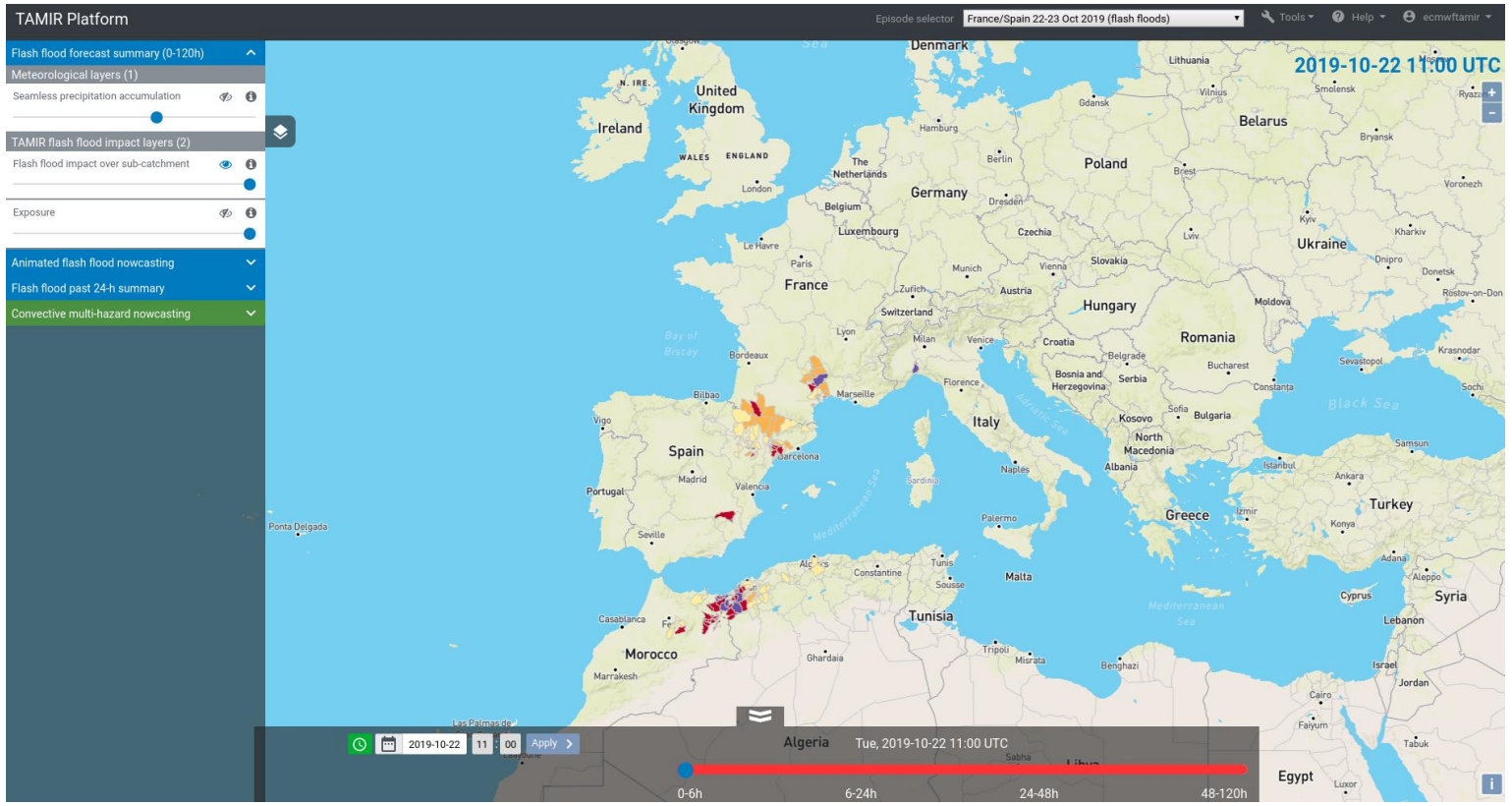


Product Demonstration and Release to EFAS

Pan-European demonstration

- **End of Jun 21**: Mock-up / prototype product(s) for a selected event shared as WMS-T and/or shown on prototype platform
- **Jul-Sep 21**: Collecting feedback from users regarding product format and features (time step, visualization, etc. …)
- **Oct-Dec 21**: Updated products on selected user-defined case studies accounting for user feedback
- **Jan-Feb 22**: Setting-up of quasi-operational suites for TAMIR products
- **Mar-May 22**: **Prototype TAMIR products available in EFAS-IS and as web services**

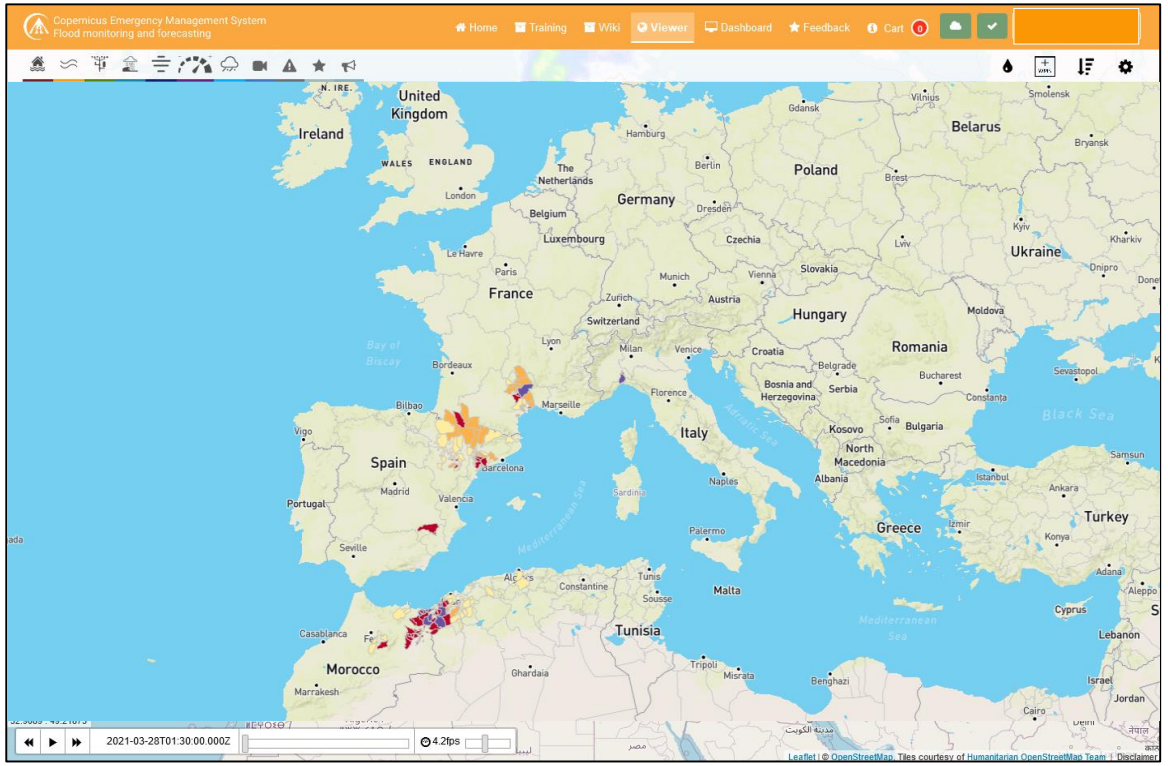
TAMIR project demonstration platform



Product Demonstration and Release to EFAS

- Products available on EFAS:
  - Animated forecast products – e.g. Flash flood impacts
  - Lead time summary products – e.g. Flash flood impact – by sub-catchment
  - Previous 24 hour summary products – e.g. Maximum flash flood impact
- Products also available as web services
  - e.g. WMS
  - Users can display products in own web viewers

EFAS web map viewer



Conclusions

European Union
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- TAMIR products will bring 1-arcmin pan-European flash flood impact forecasts into EFAS
- 1 hour timestep for first 5 hours, updated every hour
- Useful for rapidly developing storms and to highlight areas most at risk of impacts
- Products available on EFAS as well as via web services (WMS)

Thank you! Questions?

www.tamir-project.eu

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