



ILMATIETEEN LAITOS  
METEOROLOGISKA INSTITUTET  
FINNISH METEOROLOGICAL INSTITUTE

# Seamless probabilistic multi-source forecasting of heavy rainfall hazards for European flood awareness



European  
Civil Protection

## SMUFF



Prevention and preparedness projects

**Flooding and weather hazards**

1 Jan 2018 – 30 Sep 2019

Project cost € 999,996. EC co-financing € 749,997

# SMUFF - Coordinating Beneficiary and Participants



**Finnish Meteorological Institute (FI)**  
Earth Observation Research  
[www.fmi.fi](http://www.fmi.fi) Co: Jarmo Koistinen



**European Centre For Medium-Range Weather Forecasts (INT)** Forecast Department  
[www.ecmwf.int](http://www.ecmwf.int)



**Mikkeli town (FI)**  
South Savo Rescue Department  
[www.mikkeli.fi](http://www.mikkeli.fi), [www.espl.fi](http://www.espl.fi)



**Universitat Politècnica de Catalunya (ES)**  
Centre de Recerca Aplicada en Hidrometeorologia  
[www.crahi.upc.edu](http://www.crahi.upc.edu)

## Non-funded Participants



**EUMETNET OPERA (INT)**



**EUMETSAT (INT)**



## SMUFF – Why is it needed?



**Climate change is increasing the occurrence of extreme events.**

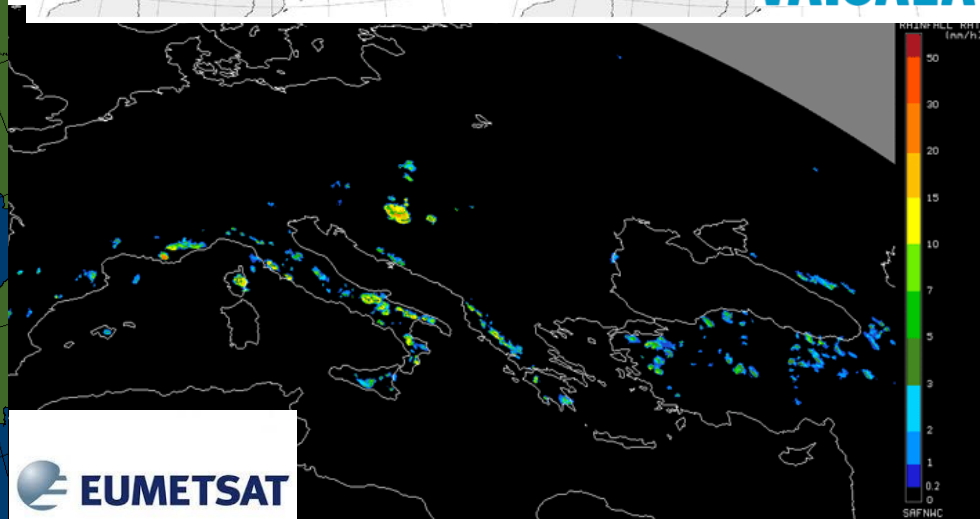
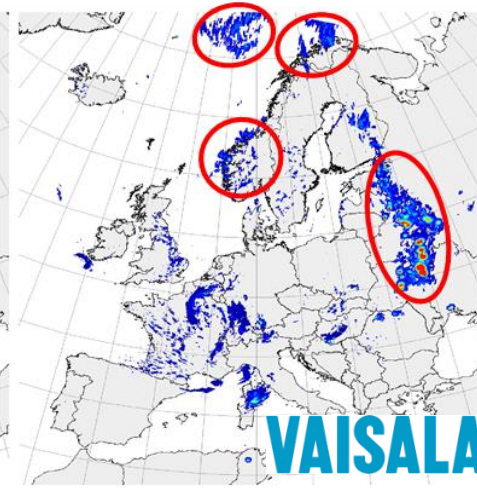
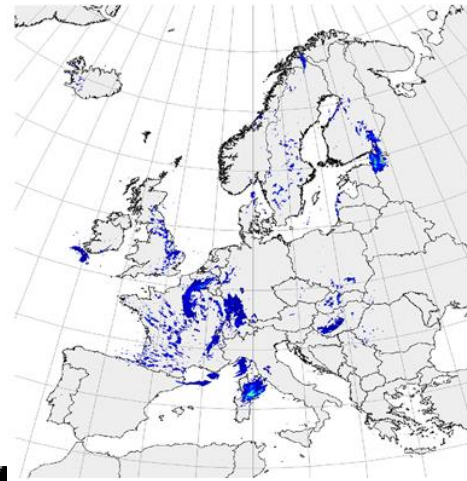
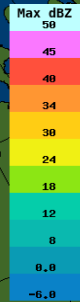
**Real-time anticipation of hazards and risks induced by heavy rainfall and flooding are of utmost importance for improved preparedness, situational awareness and decision making among Civil Protection and citizens.**

# Truly pan-European multi-source precipitation composite

- 2 x 2 km<sup>2</sup> every 15 minutes
- Precipitation from more than 160 weather radars
- Rainfall estimated from lightning density (GLD 360)
- Rainfall estimated from satellite (CRR & Prec. Water)



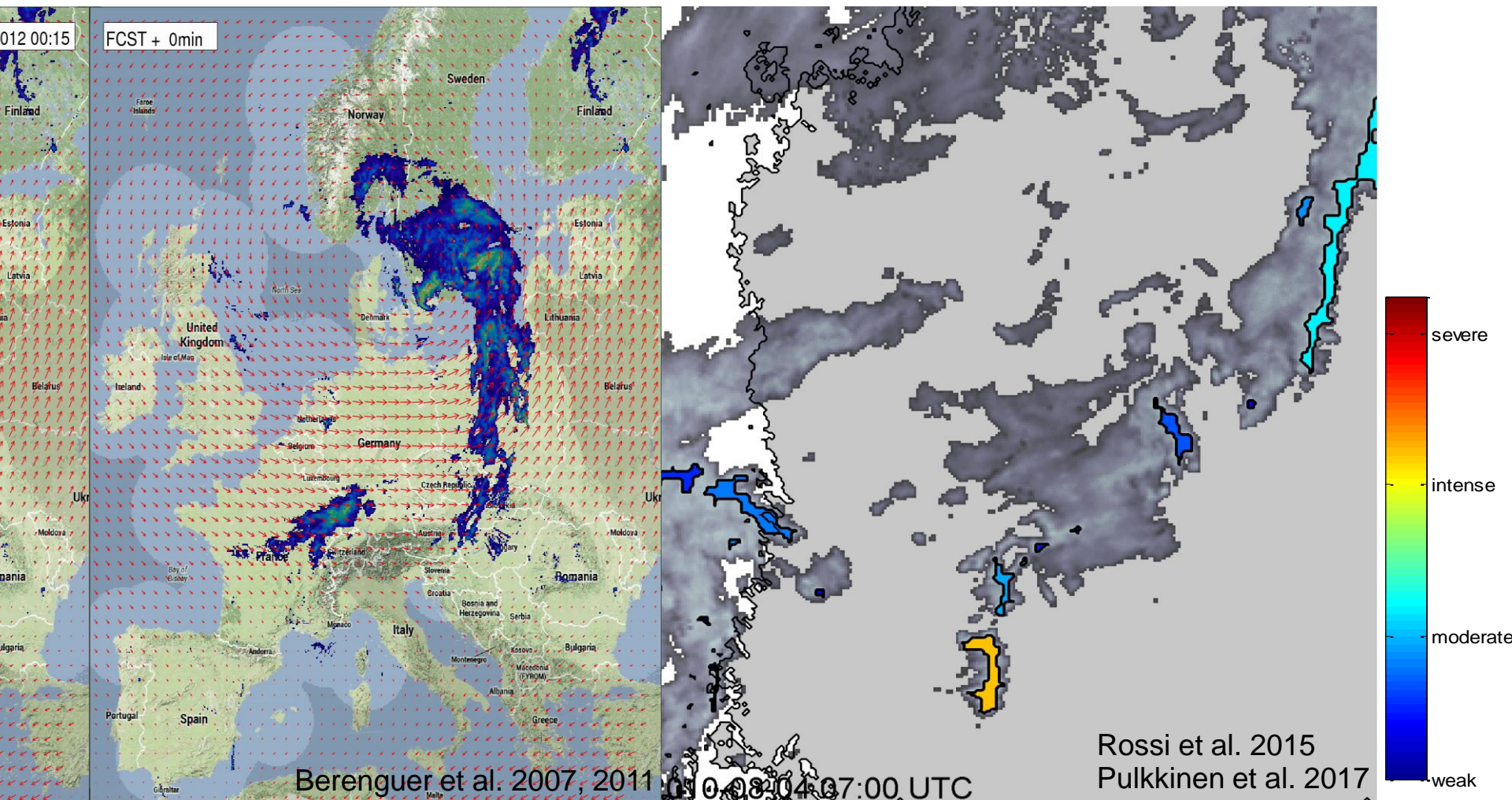
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# Probabilistic rainfall forecasts for 15 min – 5 days

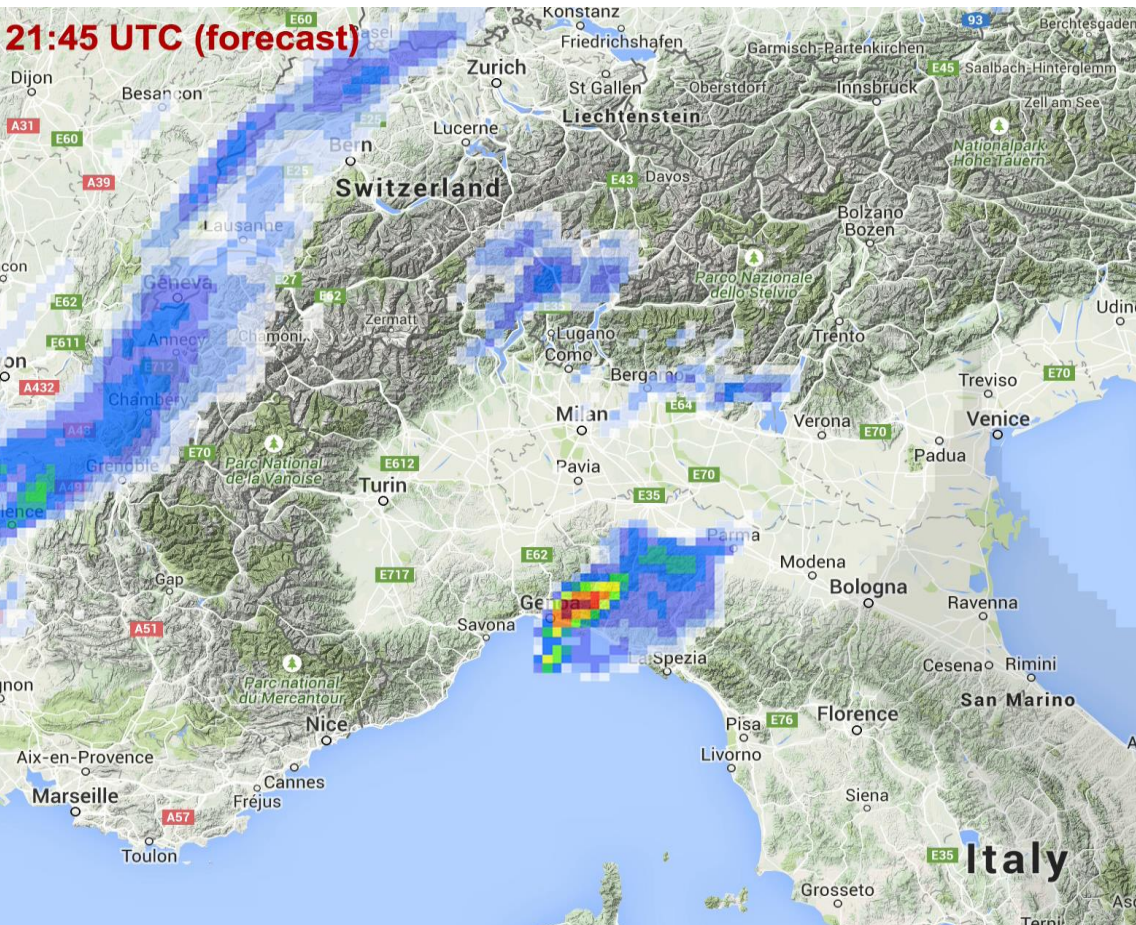
- Nowcasting convective storm hazard objects (0 - 2 h)
- Pan-European rainfall nowcasting (1 – 6 h)
- Pan-European rainfall forecasting with NWP (0 – 5 d)
- Seamless blending of nowcasts and NWP



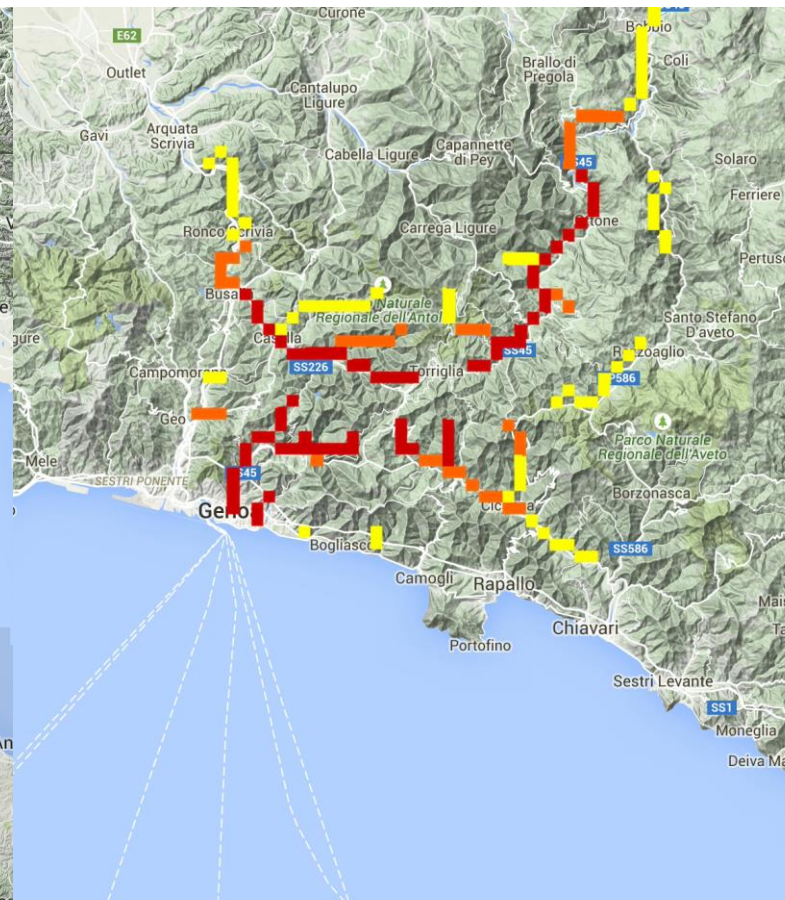


# Flash flood hazard and risk forecasts for 15 min – 5 days

- Transformation of rainfall to flash flood forecasts
- Storm water demonstration with convective nowcasts
- Simplified rapid risk forecasts utilizing exposure
- Uncertainty characterization with operational partners



Hourly accumulation updated every 15min



ERICHA flash flood hazard level updated every 15 min (9 Oct 2014)



# Integration of the products in the SMUFF and EFAS platforms

- Real-time demonstration of the products in the SMUFF platform
- Integration of the probabilistic hazard and risk forecasts to EFAS

## EUROPEAN FLOOD AWARENESS SYSTEM (EFAS)

Contact | Search on EUROPA website | Legal notice | Privacy Statement

[www.efas.eu](http://www.efas.eu)

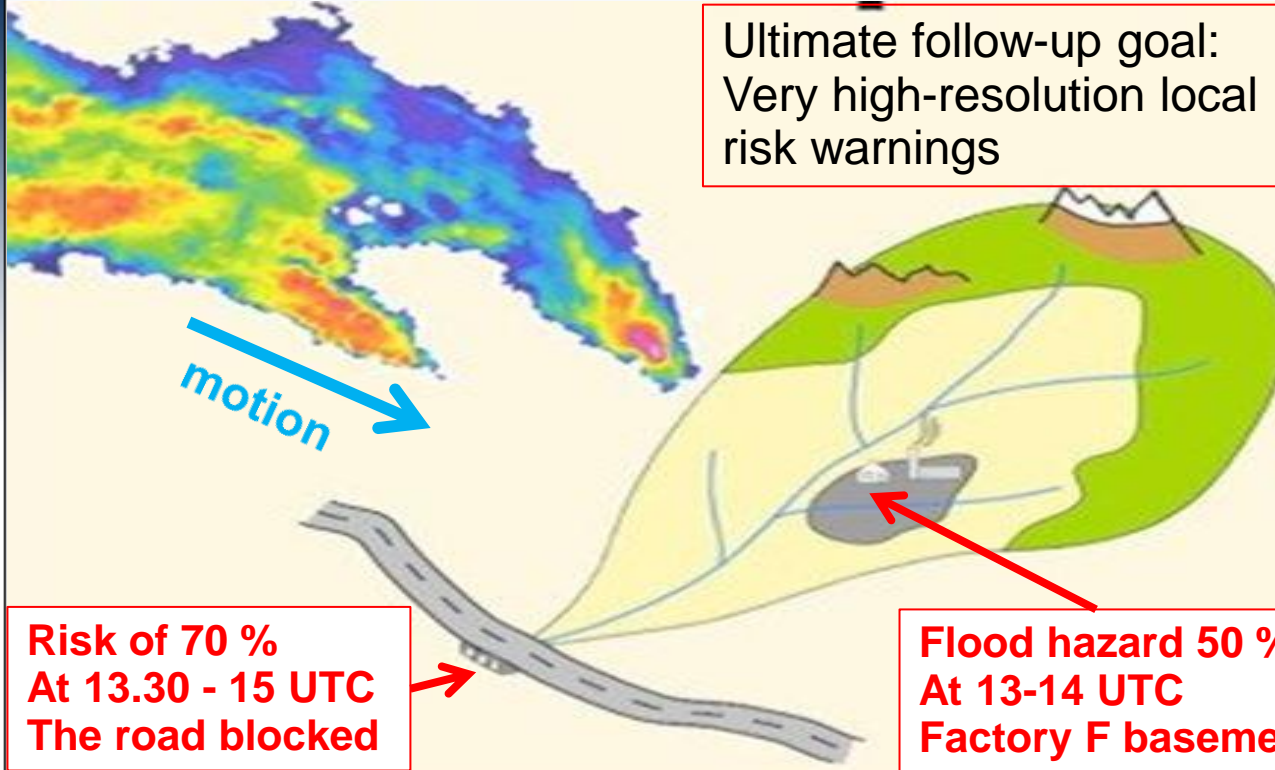
JOINT RESEARCH CENTRE

EFAS European Flood Awareness System

ECMWF

European Commission

European Commission > JRC > IES > FLOODS action > EFAS-IS



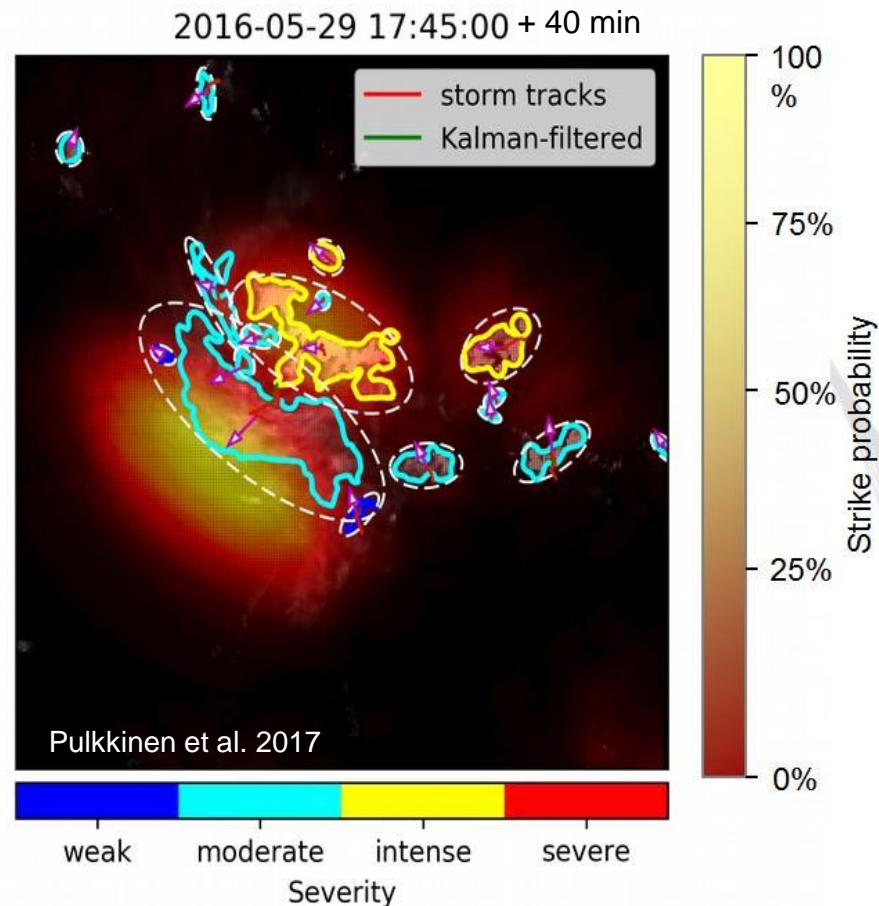
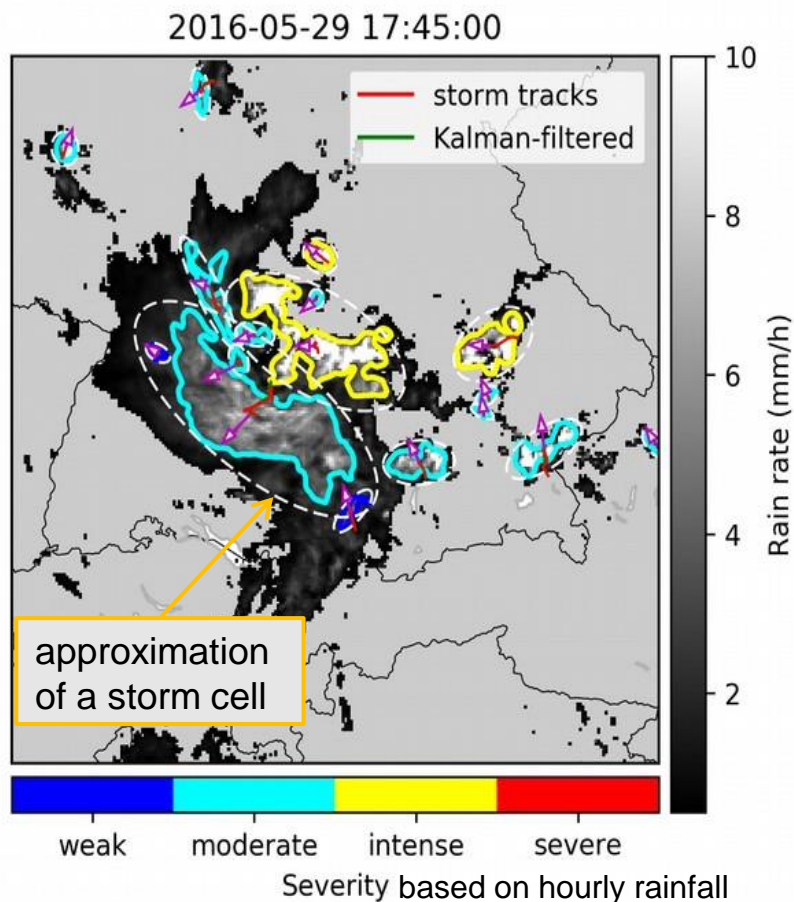
**SMUFF**  
Probabilistic seamless  
heavy rainfall and  
flash flood  
Early Warnings

Utilizes work in the  
projects

- [www.haren-project.eu](http://www.haren-project.eu)
- [www.edhit.eu](http://www.edhit.eu)
- [www.ericha.eu](http://www.ericha.eu)

# Demonstration and validation of the products among Civil Protection Agencies (CPA) & Publicity

- Evaluation and optimization of the SMUFF and EFAS products among CPA and their collaborators & scientific dissemination
- Description of the response procedures among CPA
- Organization of training for CPA and stakeholders (at ECMWF)





# DELIVERABLES

- 0.1 Project website (mo 3)
- 0.2 Intermediate project reports (mo 6, 12, 18) & CA
- 0.3 Final project report (mo 24)
  - 1.1 Report on PERC (mo 9)
  - 2.1 Report on the seamless prediction (mo 12)
  - 3.1 Report on probabilistic hazard and risk forecasting (mo 15)
  - 3.2 List of SMUFF platform products (mo 15)
  - 4.1 SMUFF products in the platform (mo 17)
  - 4.2 SMUFF operational layer in the EFAS platform (mo 19)
  - 5.1 Report on SMUFF product evaluation (mo 18)
  - 5.2 Description of response procedures among CPA (mo 18)
  - 6.1 Web streaming of the international Workshop (mo 21)
  - 6.2 Presentations of the international Workshop (mo 21)



# SMUFF – Major Events

1st Project Meeting  
Helsinki (FI), 14-15 February 2018

2nd Project Meeting  
ECMWF - Reading (UK), September 2018

3rd Project Meeting  
Barcelona (ES), March 2019

International Workshop and Training School  
ECMWF - Reading (UK), June 2019

Final Workshop  
ERCC – Brussels (BE), September 2019

[www.smuff.eu](http://www.smuff.eu)