



IMPRINTS 

HAREN 



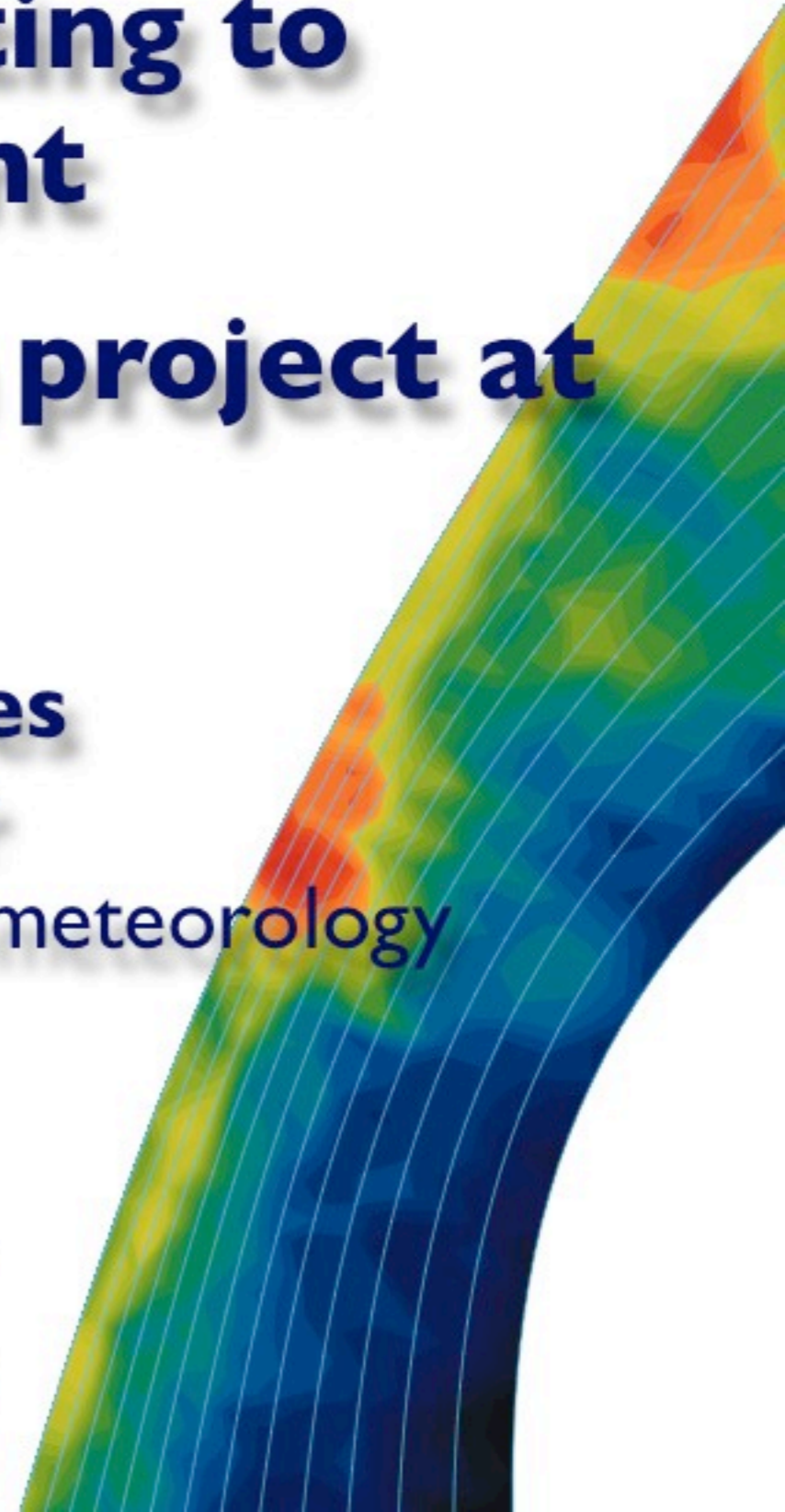
European
Civil Protection

From Rainfall Nowcasting to Hazard Assessment

HAREN: A Demonstration project at European Scale

**Daniel Sempere-Torres
and Marc Berenguer**

Center of Applied Research in Hydrometeorology
(CRAHI-UPC)
Barcelona (Spain)



Genova (Italy) on 4th of November 2011



after > 300 mm of accumulated rain in less than 24h

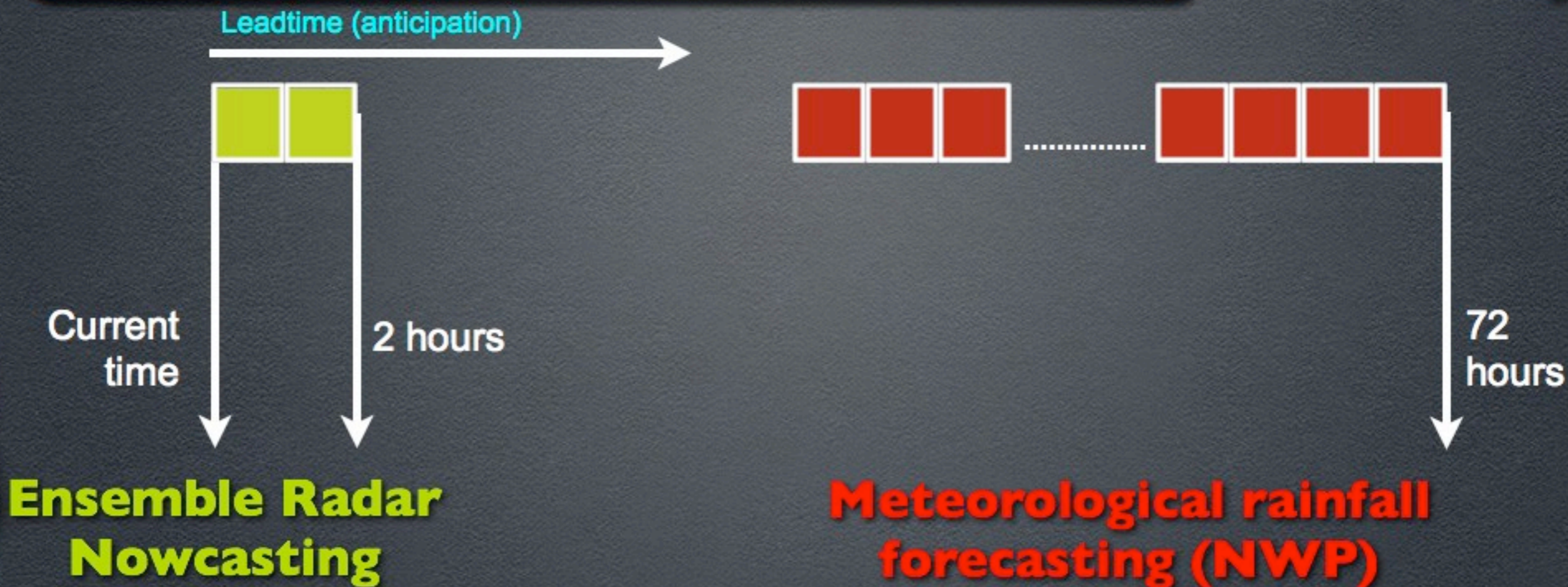
Increasing anticipation of heavy rainfalls



Meteorological rainfall forecasting (NWP)

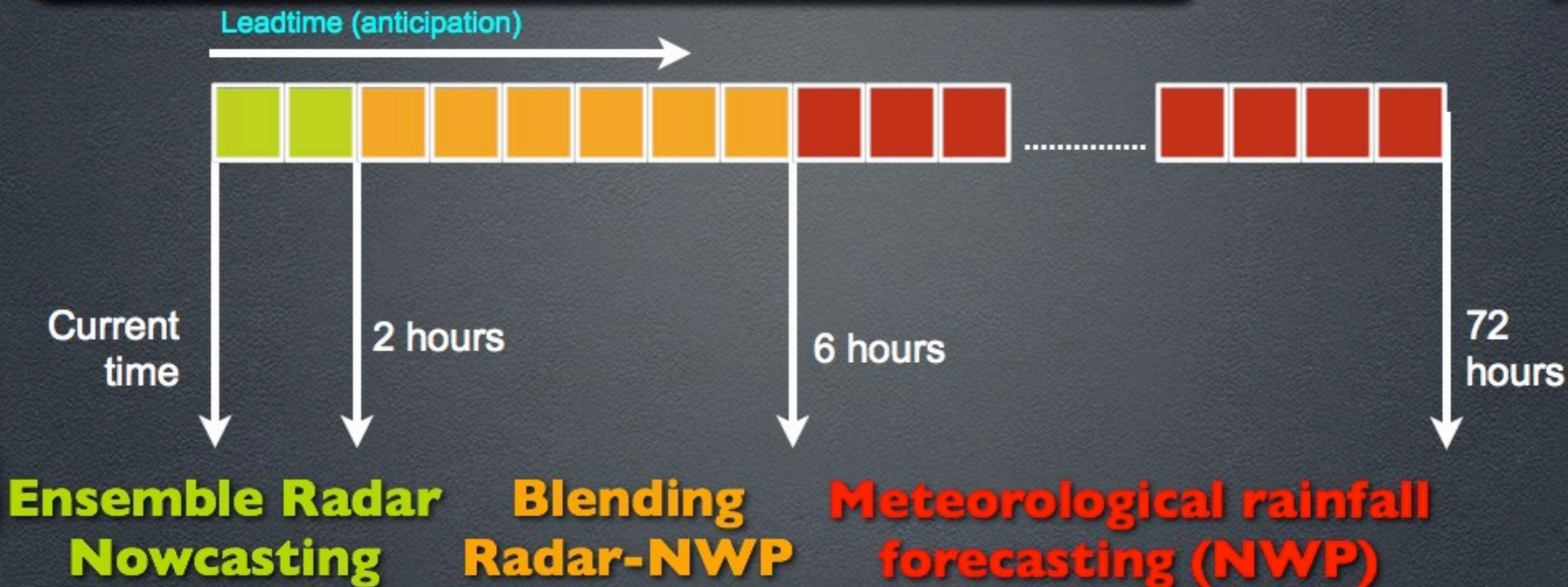
- **Adapting high-resolution meteorological model forecasts to FF & DF early warnings (from 6h to 72 h)**

Increasing anticipation of heavy rainfalls



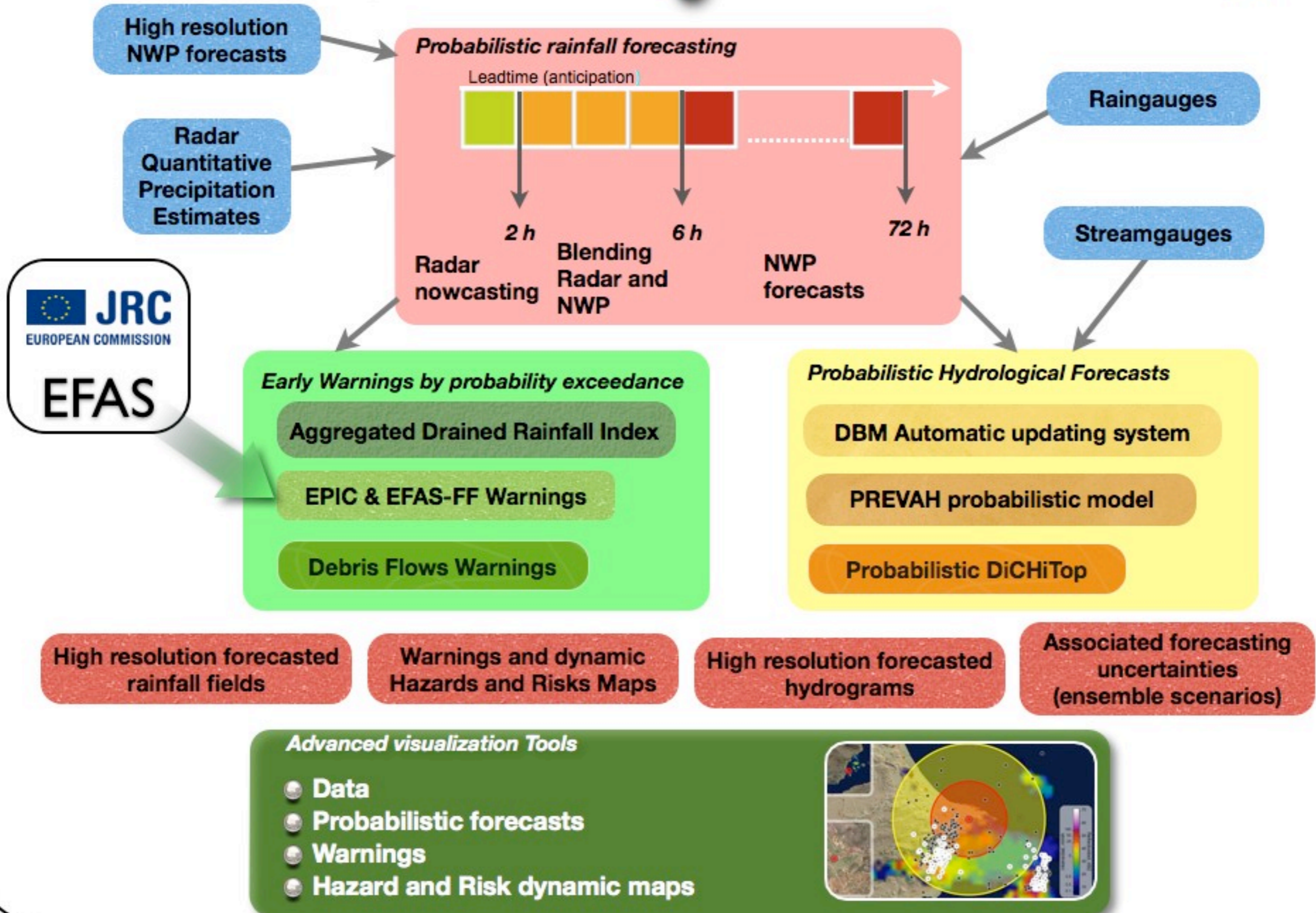
- **High resolution radar nowcasting probabilistic outputs** (ensembles) for FF & DF forecasting **(up to 2 h)**
- **Adapting high-resolution meteorological model forecasts** to FF & DF early warnings **(from 6h to 72 h)**

Increasing anticipation of heavy rainfalls



- **High resolution radar nowcasting probabilistic outputs** (ensembles) for FF & DF forecasting **(up to 2 h)**
- **Combining (blending) radar rainfall nowcasting with probabilistic NWP products** **(between 2h and 6h)**
- **Adapting high-resolution meteorological model forecasts** to FF & DF early warnings **(from 6h to 72 h)**

IMPRINTS Platform Prototype



Early Warnings by probability exceedance

- Aggregated Drained Rainfall Index
- EPIC & EFAS-FF Warnings
- Debris Flows Warnings

Probabilistic Hydrological Forecasts

- DBM Automatic updating system
- PREVAH probabilistic model
- Probabilistic DiCHiTop

High resolution forecasted rainfall fields

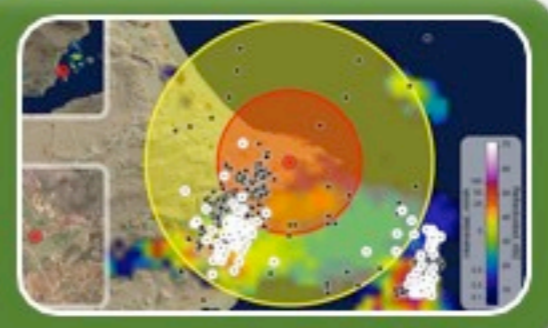
Warnings and dynamic Hazards and Risks Maps

High resolution forecasted hydrograms

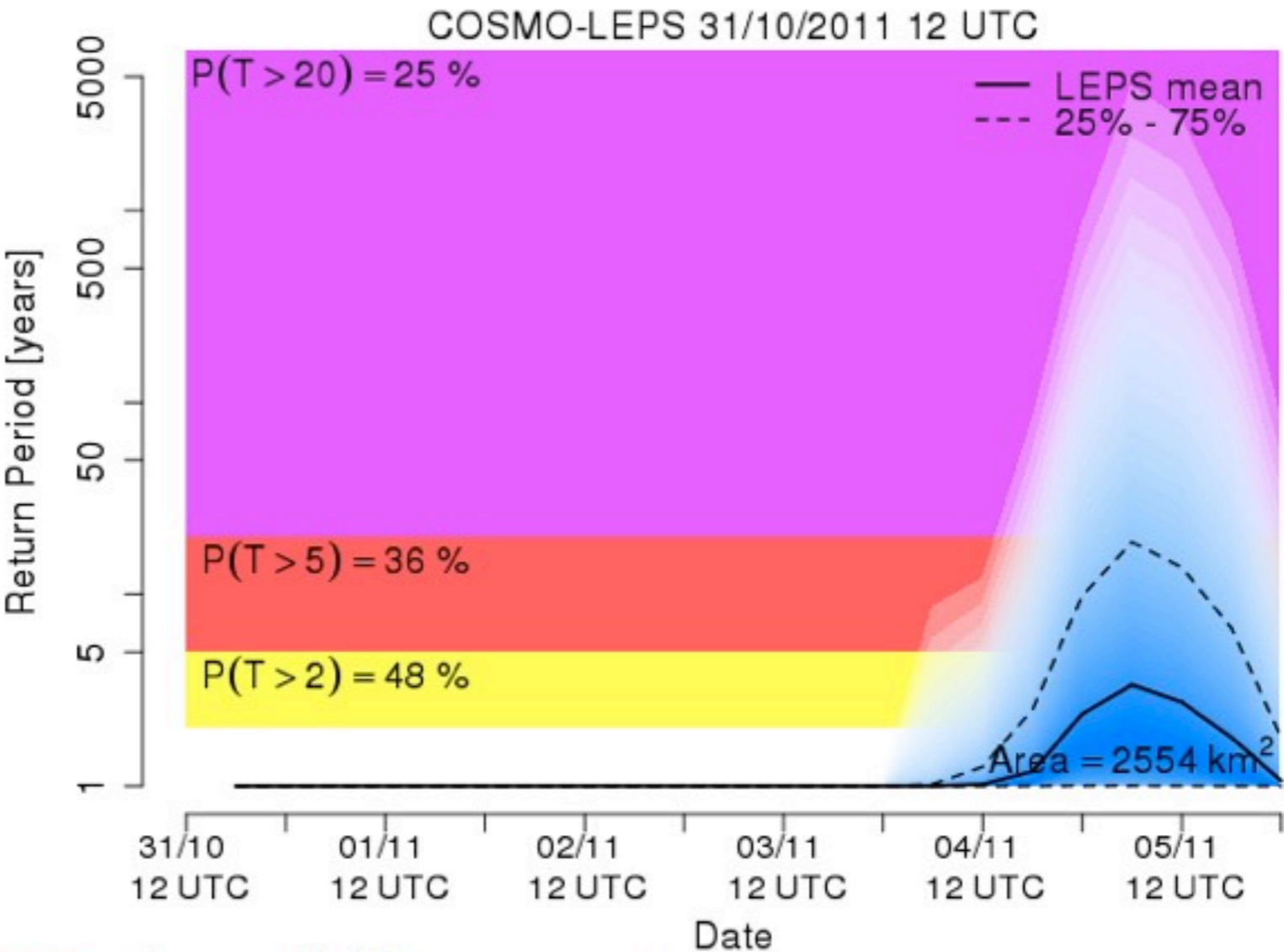
Associated forecasting uncertainties (ensemble scenarios)

Advanced visualization Tools

- Data
- Probabilistic forecasts
- Warnings
- Hazard and Risk dynamic maps

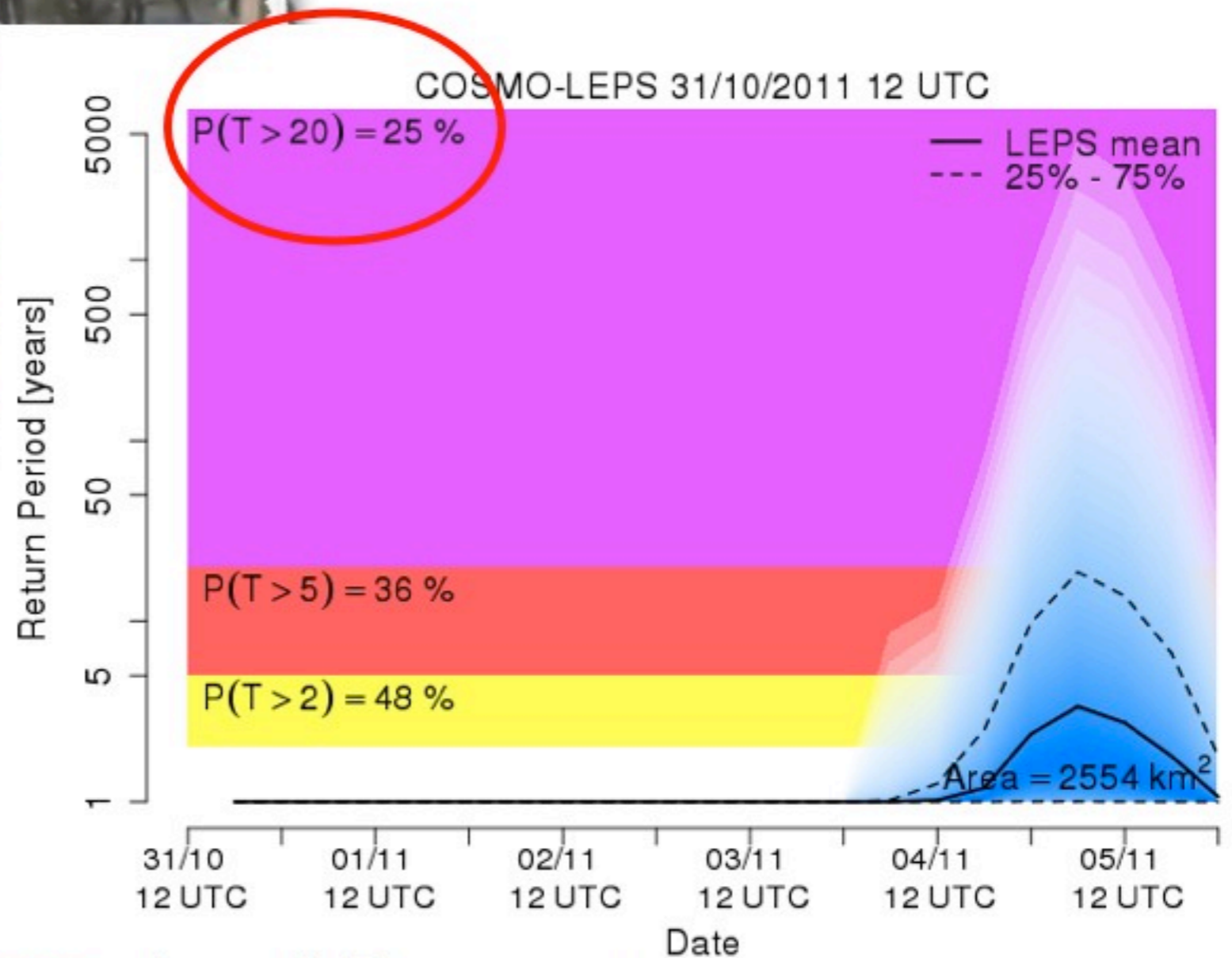


Genova (Italia) 4/11/2011



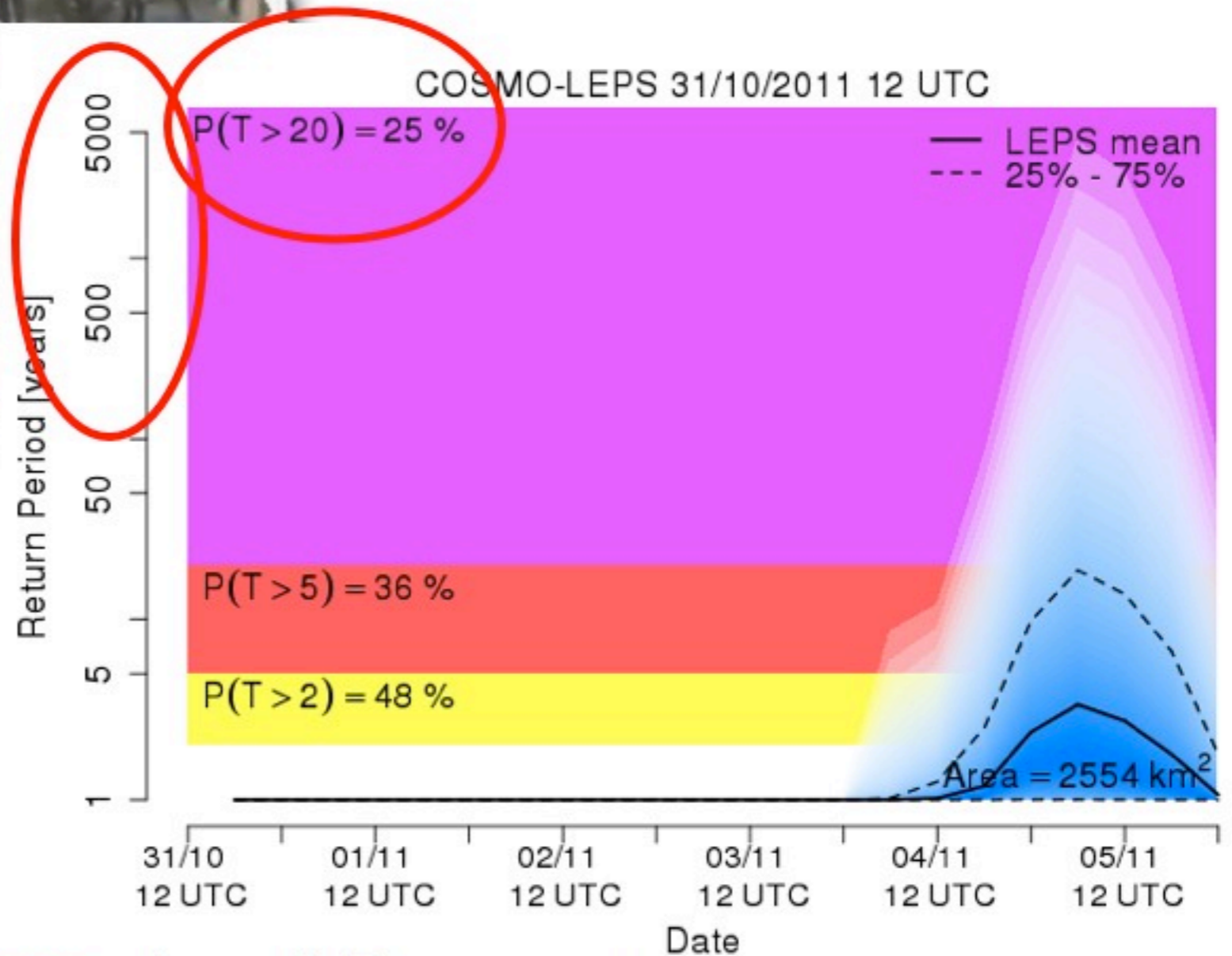
4 days ahead Forecast

Genova (Italia) 4/11/2011



4 days ahead Forecast

Genova (Italia) 4/11/2011



4 days ahead Forecast

Genova (Italia) 4/11/2011



European Commission
Joint Research Centre
 Institute for Environment and Sustainability

Legal notice | Privacy Statement | Search...

gmes EFAS

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

Home EFAS Forecasting Utilities Partners Forum Search Partners list Contact us

Sánchez-Diezma Rafael Log out

Main Menu

- Home
- EFAS Forecasting
- Utilities
- Partners Forum
- Search
- Partners list

EFAS forecasting ? Forecasts available from 2009-05-01 to 2012-06-12 (12 UTC)

<< full screen opacity << 0.9 >> Print screenshot

search for location...

2011-11-02 (12 UTC) Disclaimer

SELECTED POINT - Close all

Report an error

COSMO-LEPS 02/11/2011 12 UTC

Return Period [years]

Area = 148 km²

02/11 12 UTC 03/11 12 UTC 04/11 12 UTC 05/11 12 UTC 06/11 12 UTC 07/11 12 UTC

Date

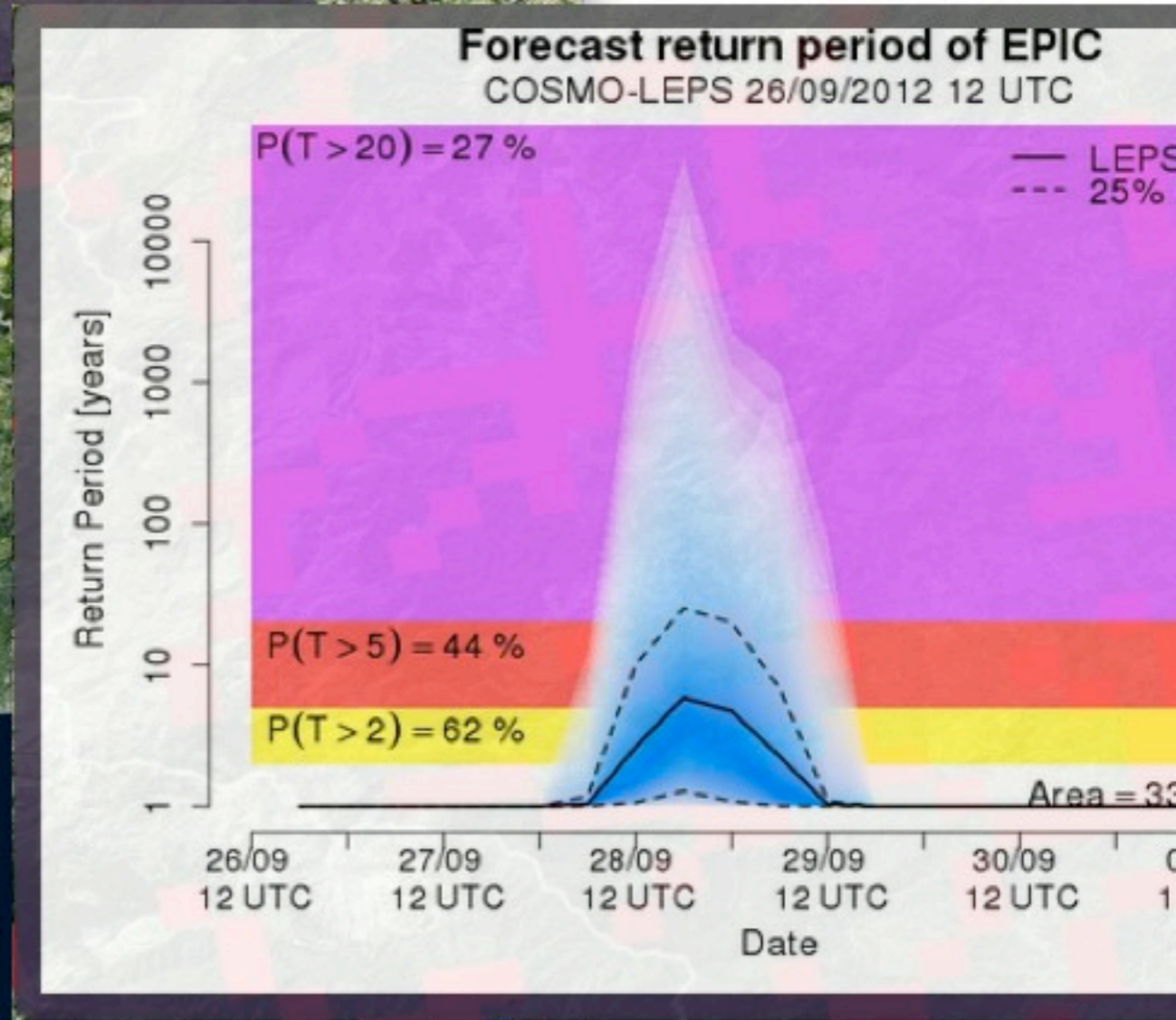
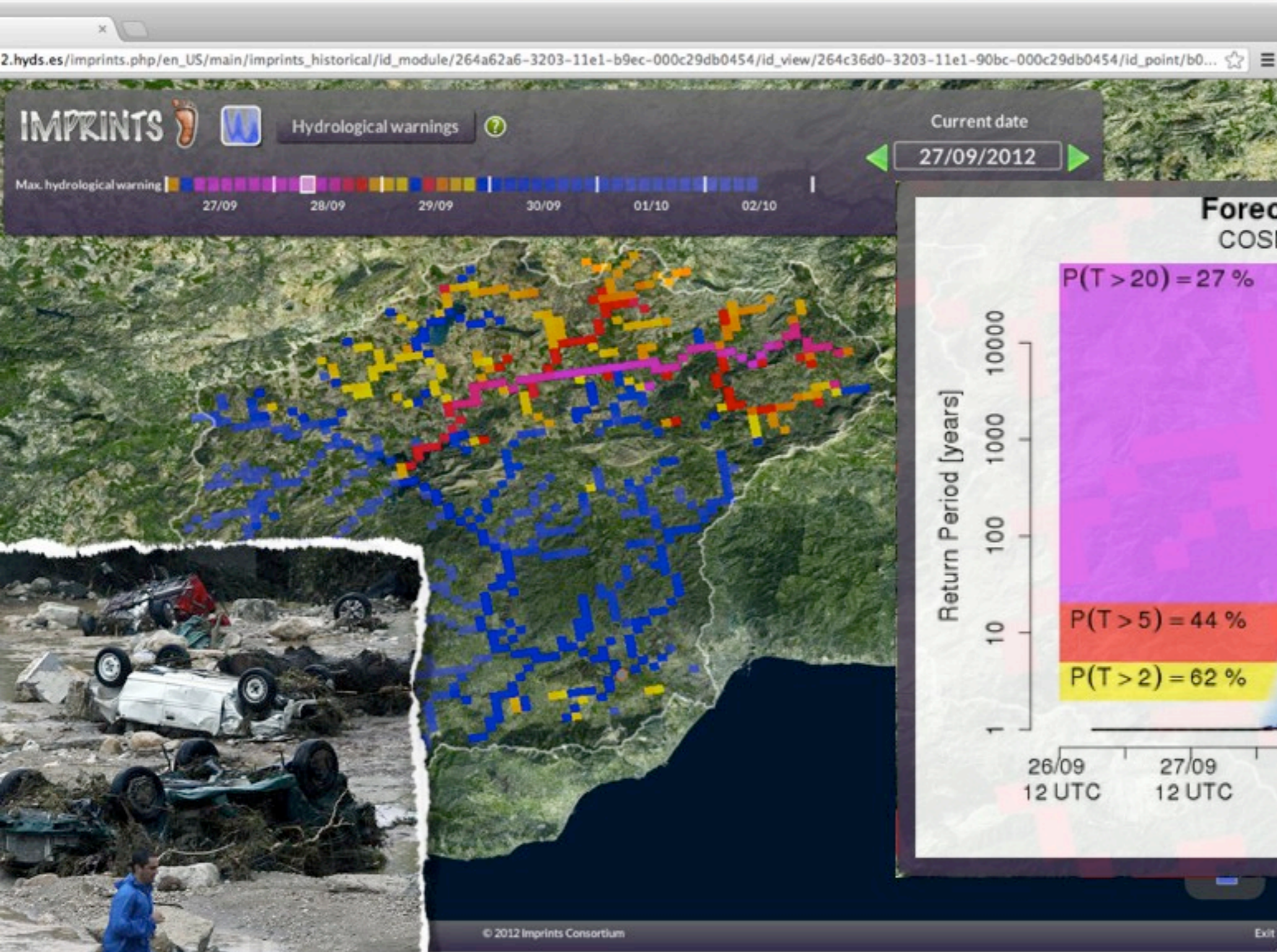
— LEPS mean
 --- 25% - 75%

$P(T > 20) = 21\%$
 $P(T > 5) = 31\%$
 $P(T > 2) = 42\%$

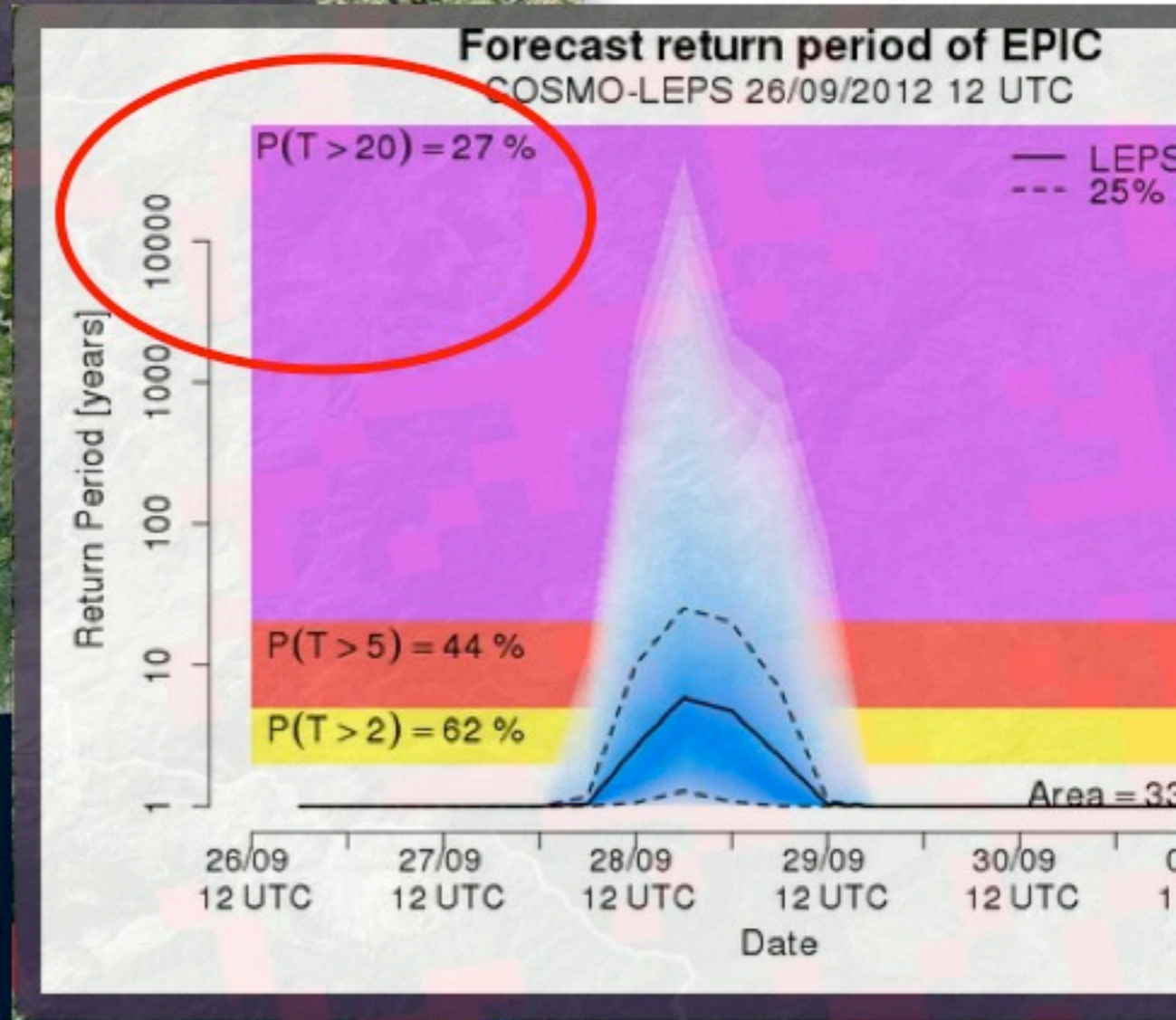
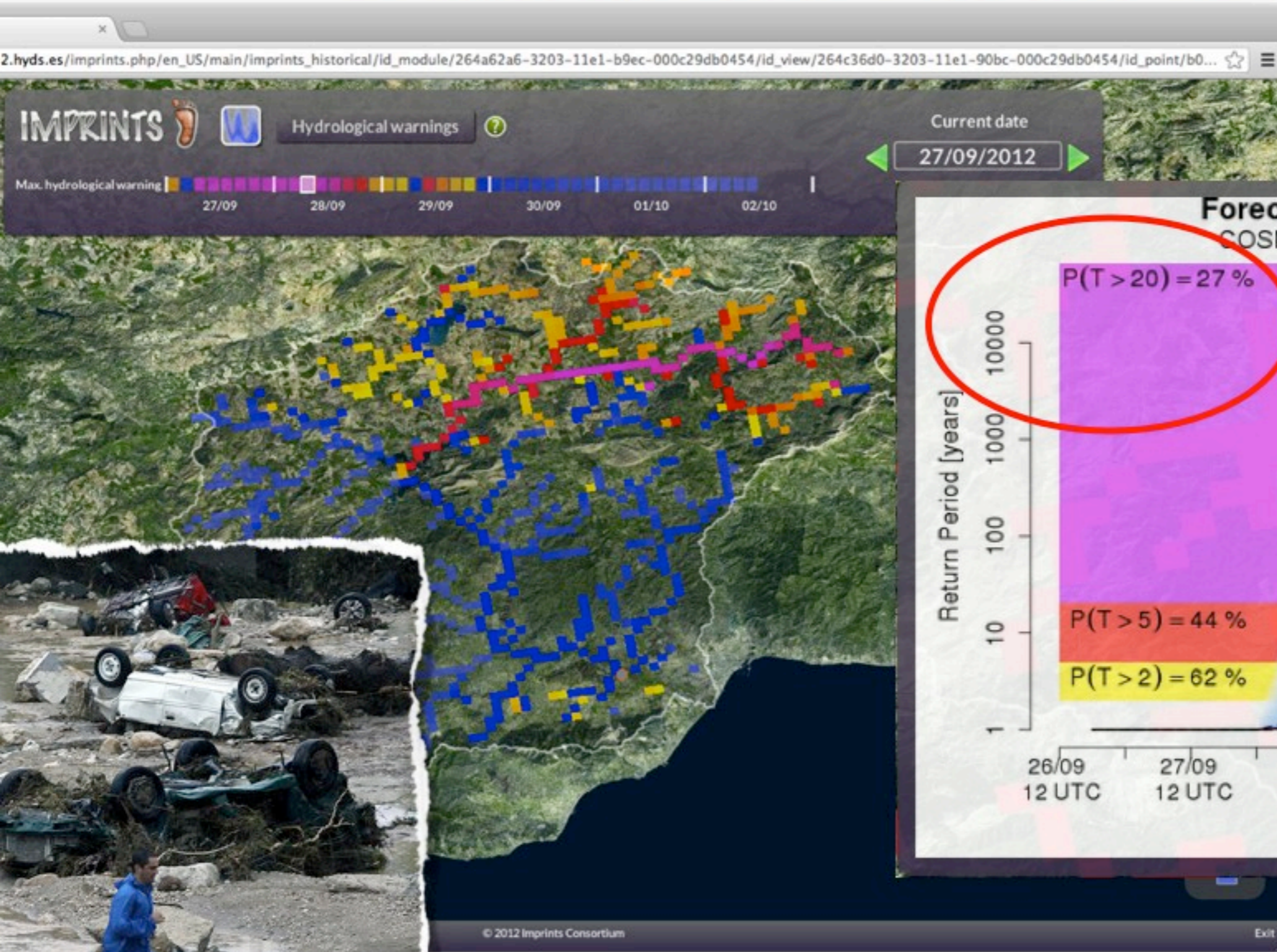
IMPRINTS testbeds
 No. COSMO Above Medium
 No. COSMO Above High
 No. COSMO Above Severe
 Medium alert - T>2 years
 High alert - T>5 years
 Severe alert - T>20 years
 EPIC above Medium

2 days ahead Forecast

Guadalhorce 28/09/2012



Guadalhorce 28/09/2012



36 hours ahead Forecast



HAREN

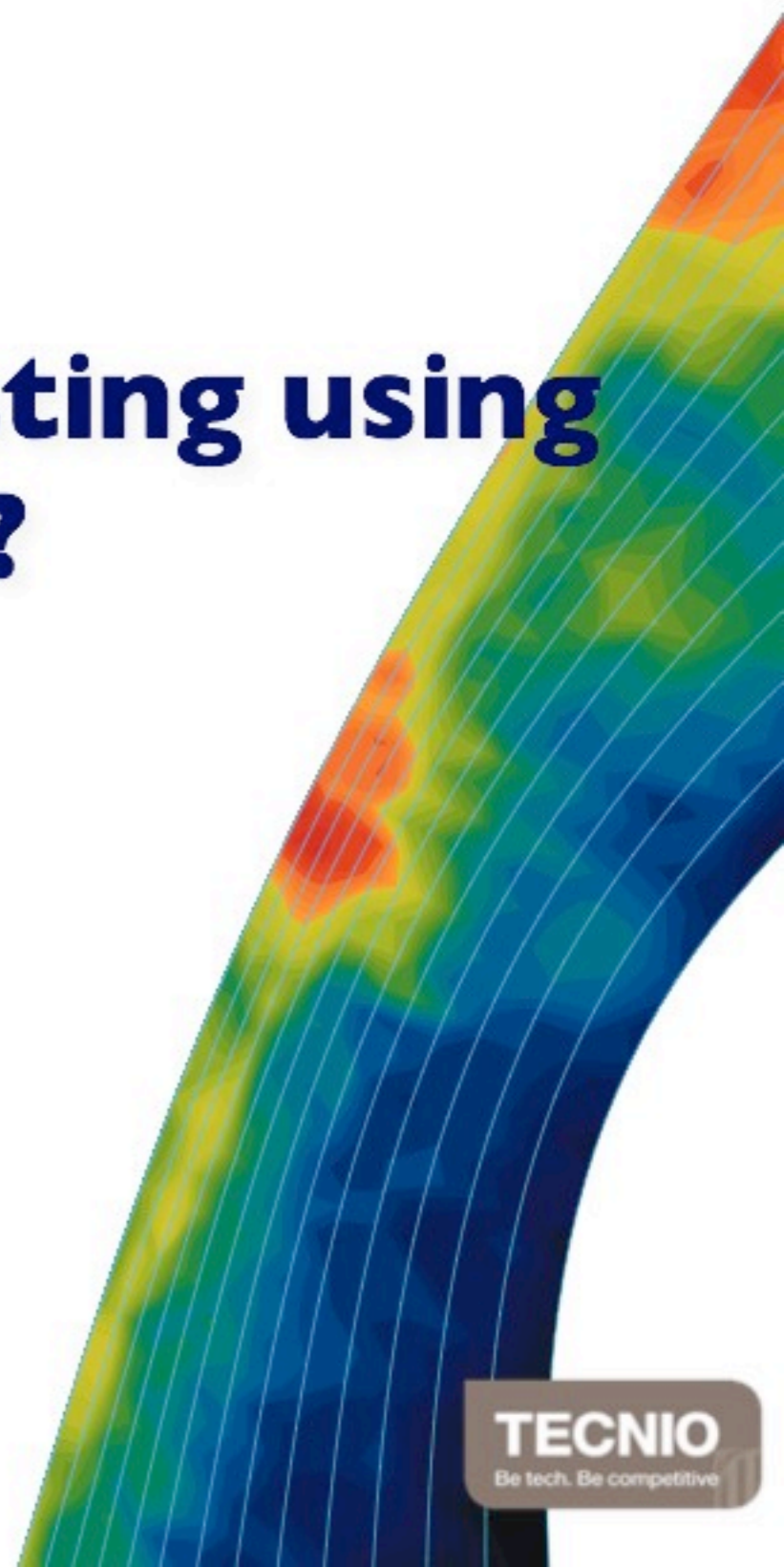


European
Civil Protection

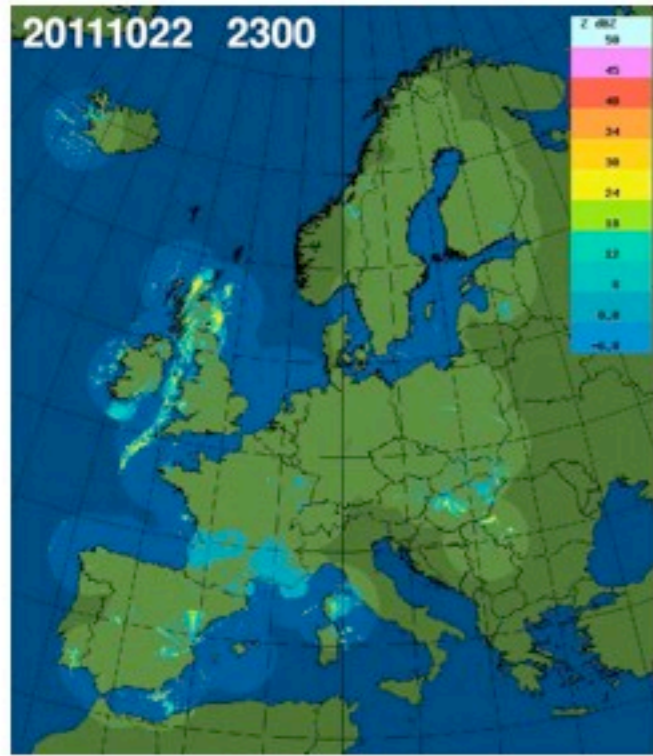
What about rainfall nowcasting using European mosaics?



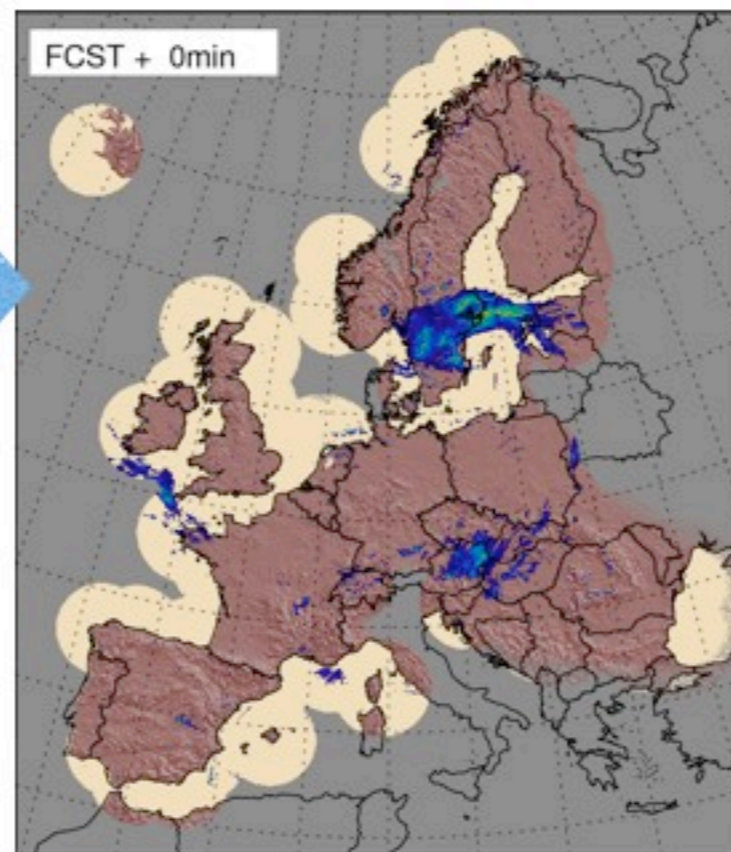
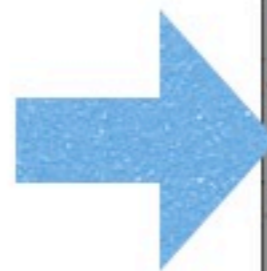
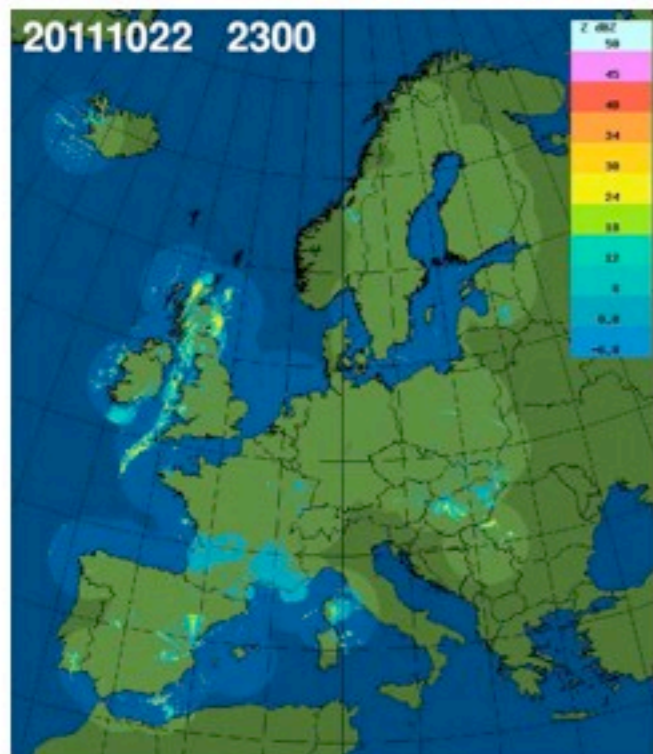
TECNIO
Be tech. Be competitive



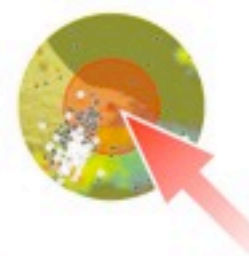
From observations



From observations

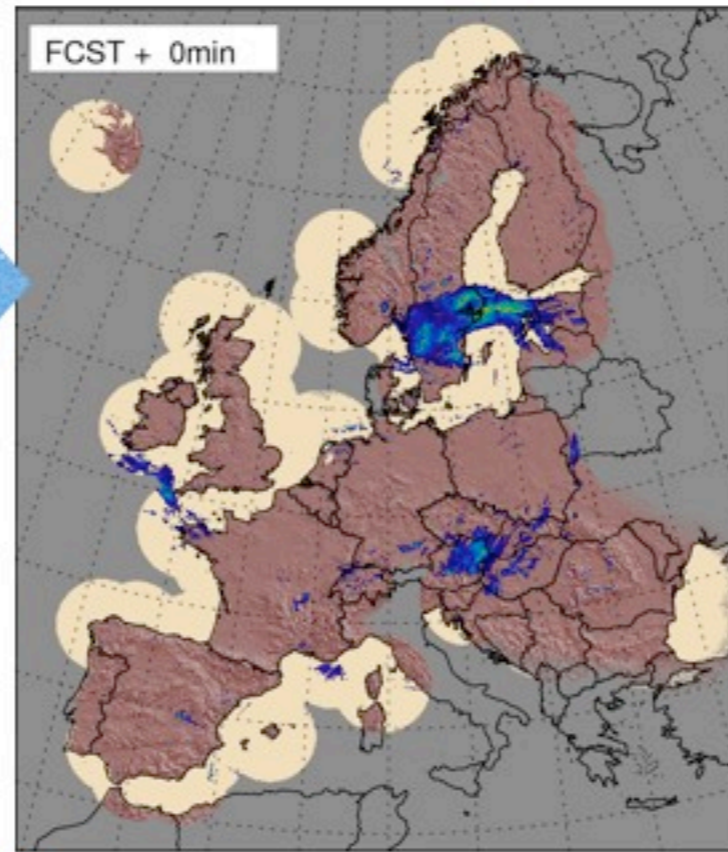
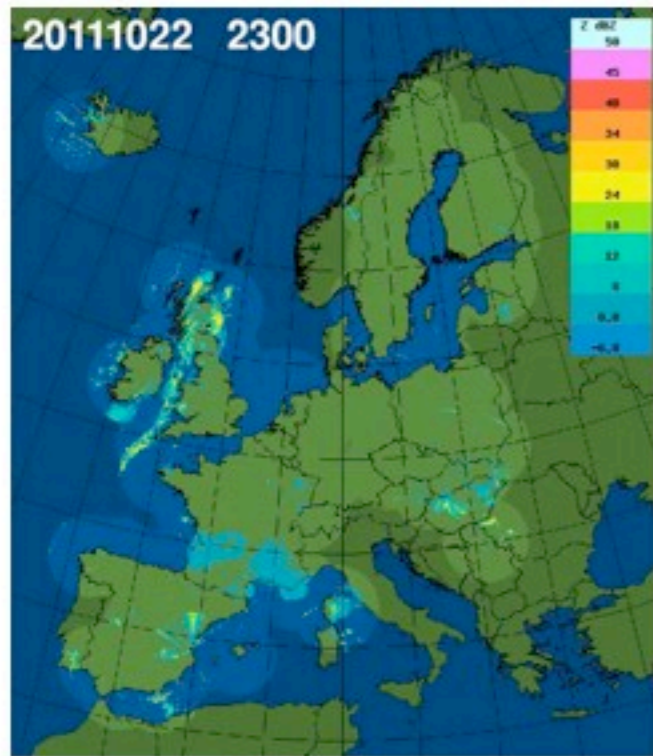


HAREN



**High resolution
rainfall nowcastings
over Europe
@2km every
15 minutes**

From observations

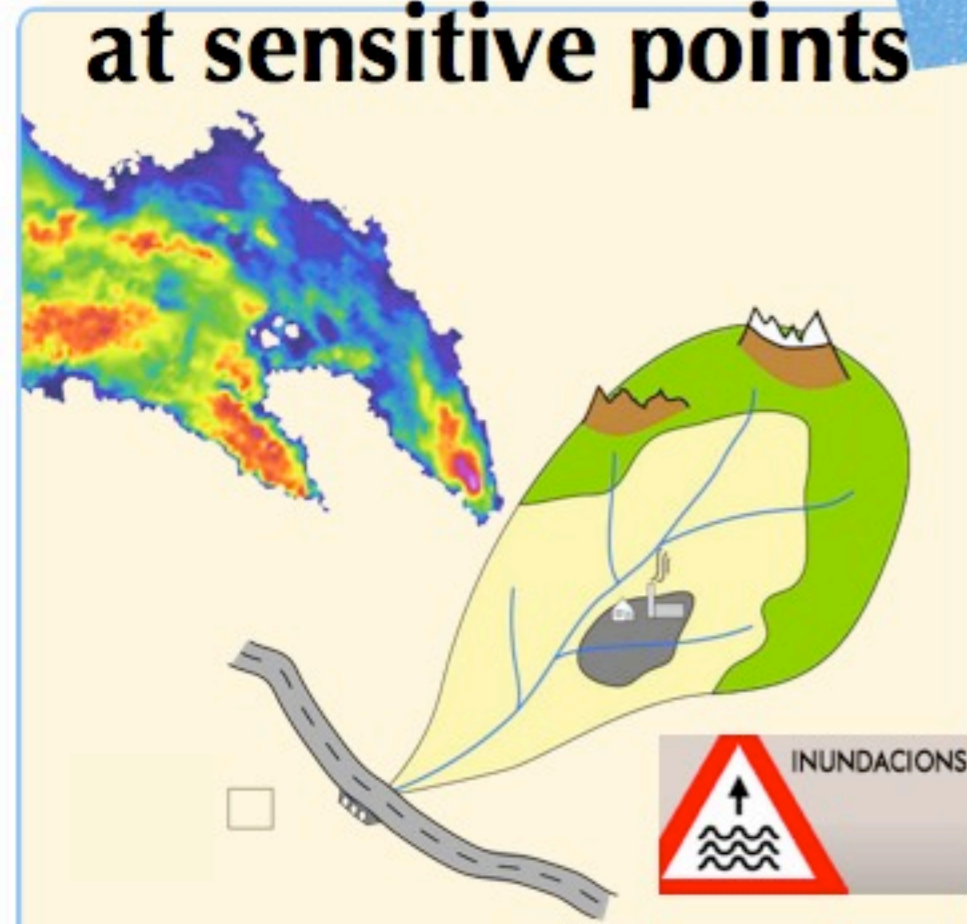


HAREN

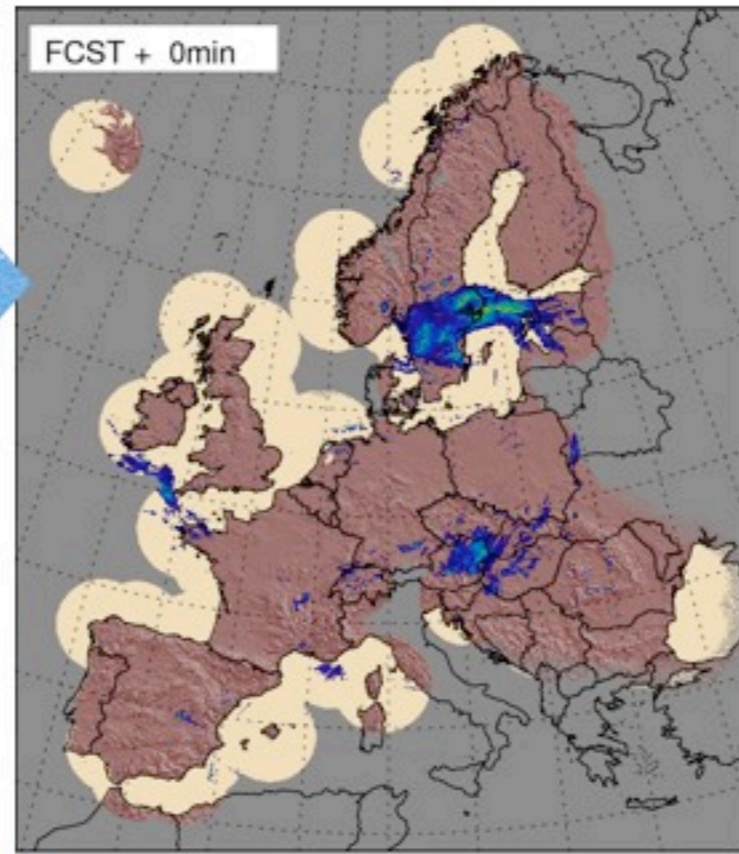
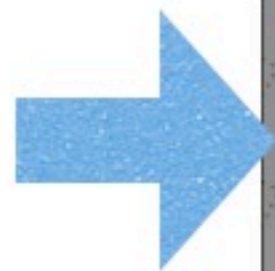
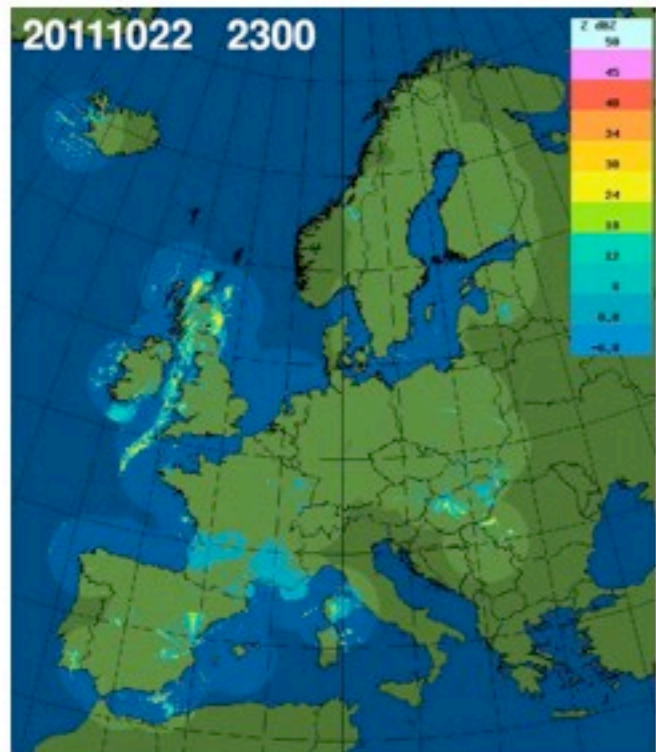


**High resolution
rainfall nowcastings
over Europe
@2km every
15 minutes**

Hazard anticipation at sensitive points



From observations

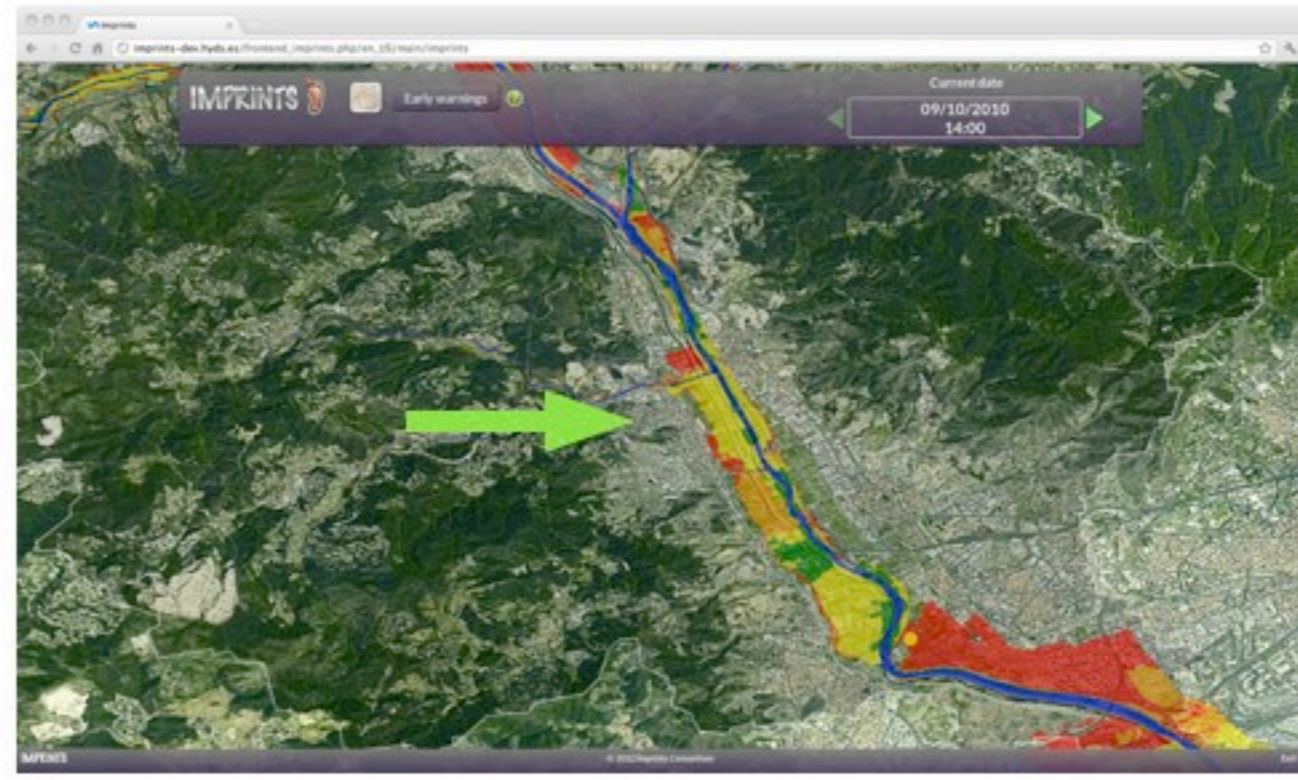
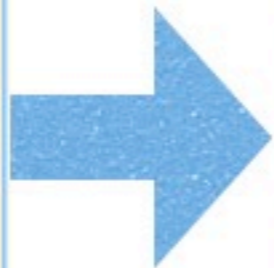
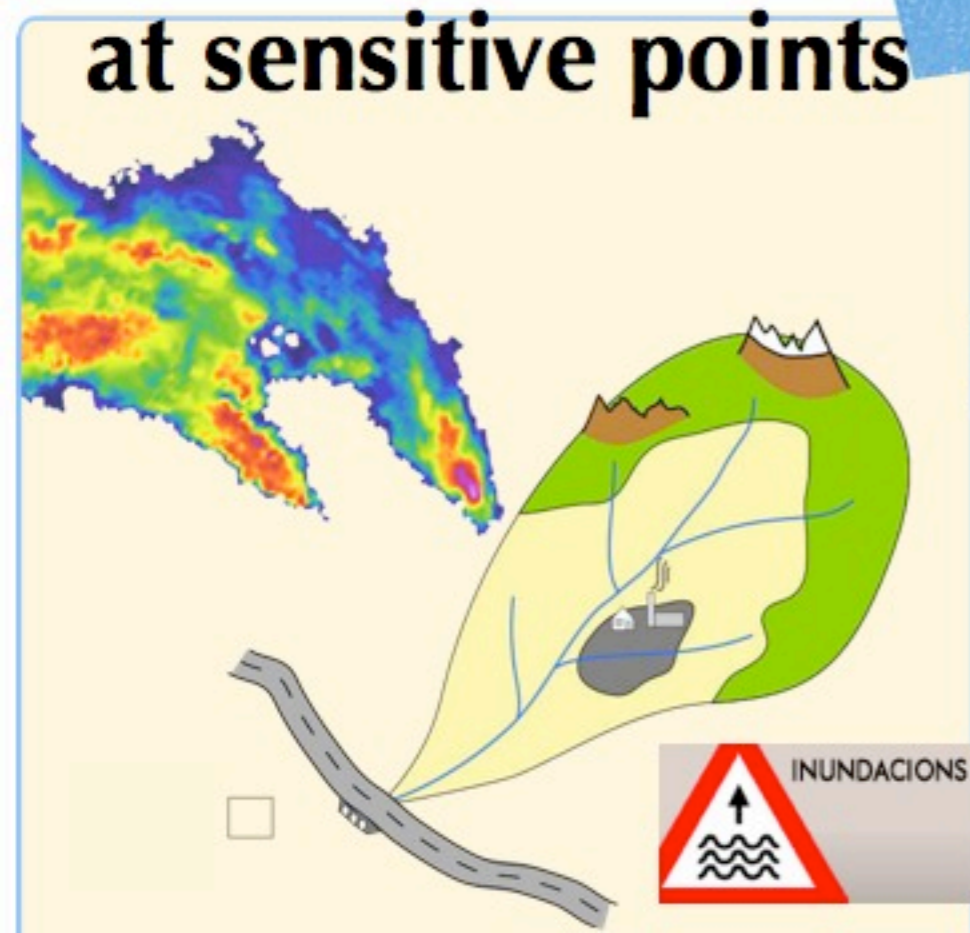


HAREN



High resolution
rainfall nowcastings
over Europe
@2km every
15 minutes

Hazard anticipation at sensitive points



Cross them with
vulnerability maps

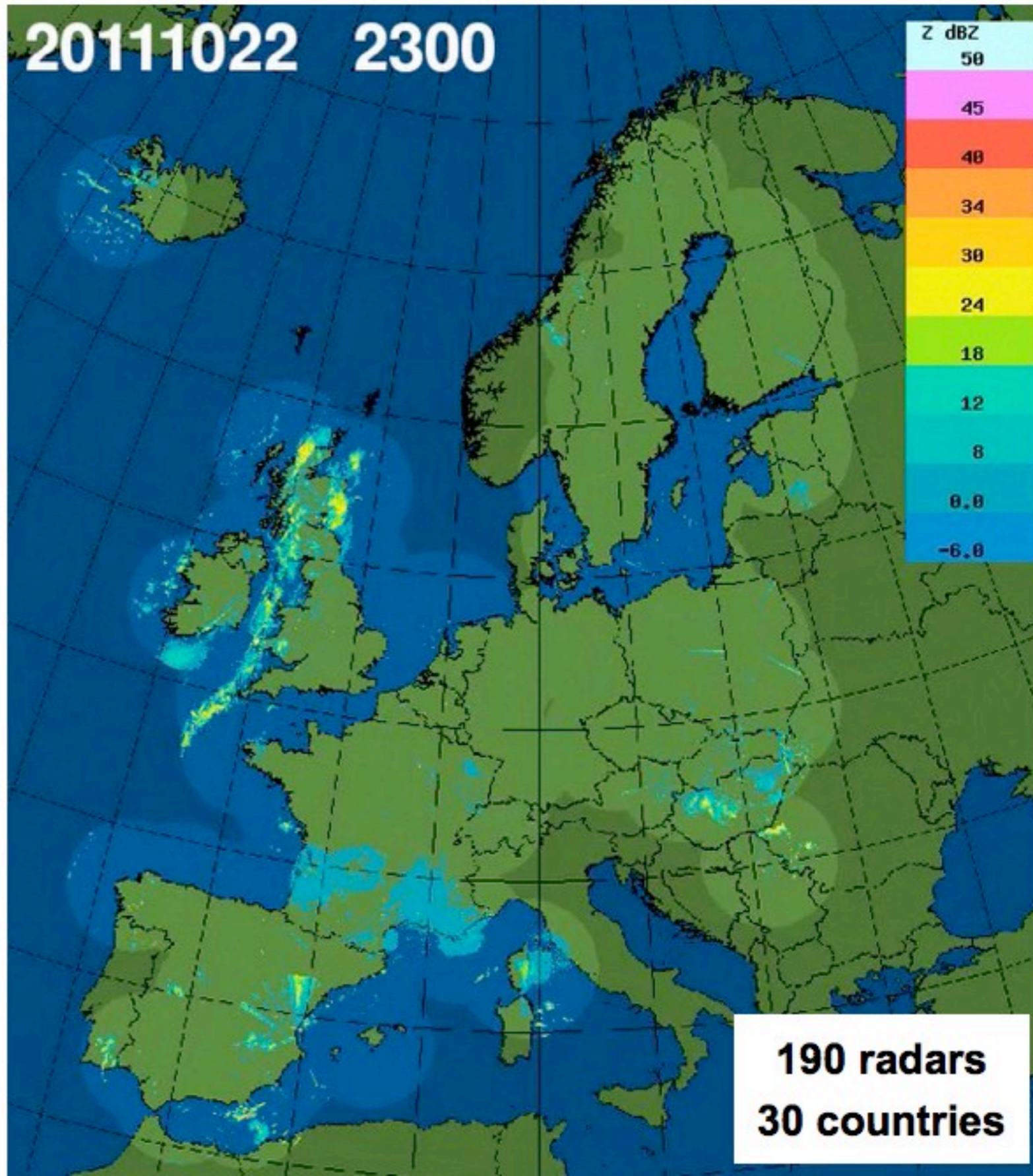
EU radar mosaic



OPERA
EIG EUMETNET PROGRAMME

OPERA radar mosaic:

- Precipitation observations over Europe @2 km and every 15 minutes.
- Operationally produced since mid 2011.



EU radar mosaic

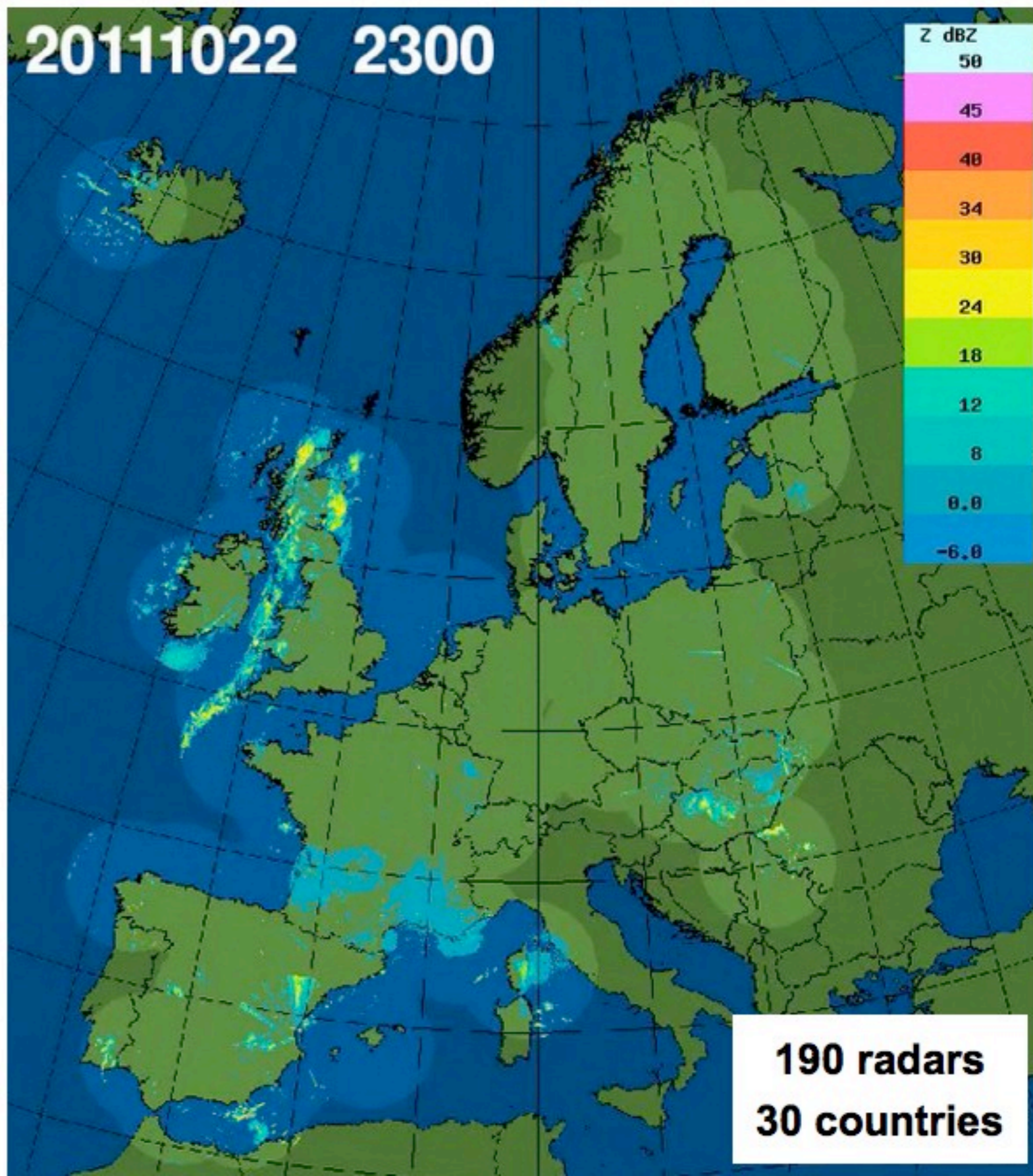


OPERA
EIG EUMETNET PROGRAMME

OPERA radar mosaic:

- Precipitation observations over Europe @2 km and every 15 minutes.
- Operationally produced since mid 2011.
- Nowcasting demonstration:
since June 2012

20111022 2300



HAREN



European
Civil Protection

190 radars
30 countries

Radar-based rainfall nowcasting

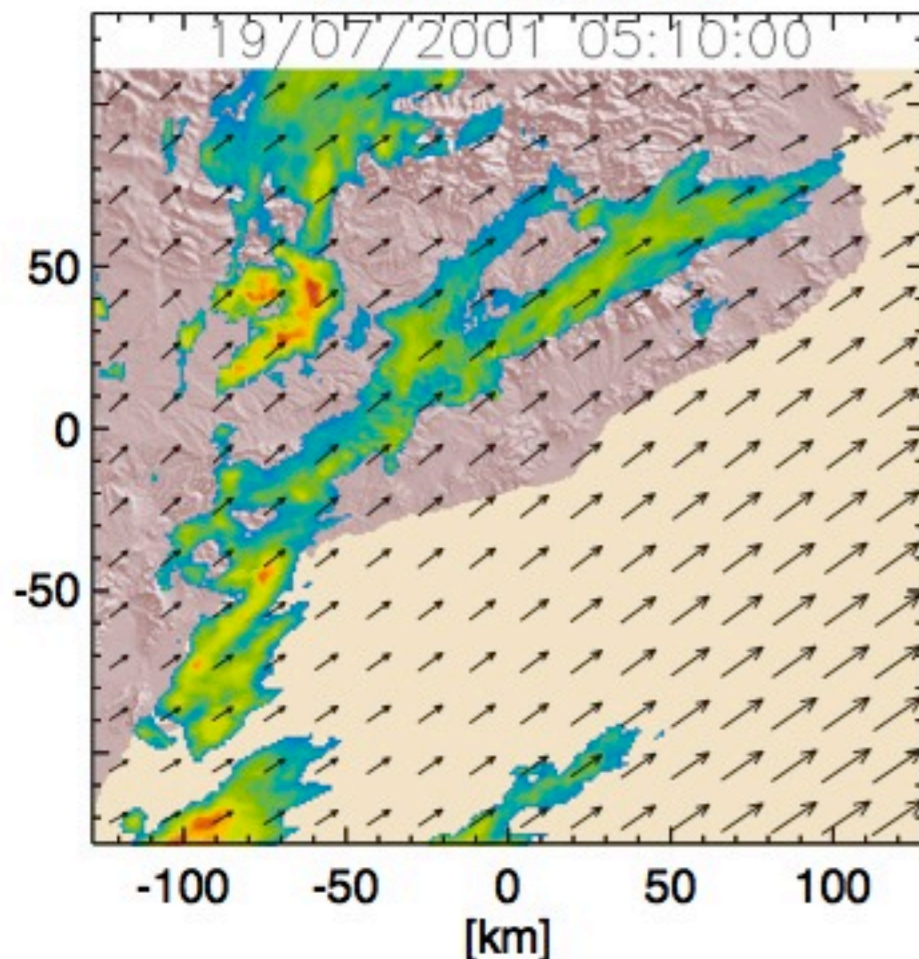
Precipitation nowcasting by extrapolation of radar observations

Radar-based rainfall nowcasting

Precipitation nowcasting by extrapolation of radar observations

I. Tracking: The motion field of rainfall is estimated from observations.

observations



Radar-based rainfall nowcasting

Precipitation nowcasting by extrapolation of radar observations

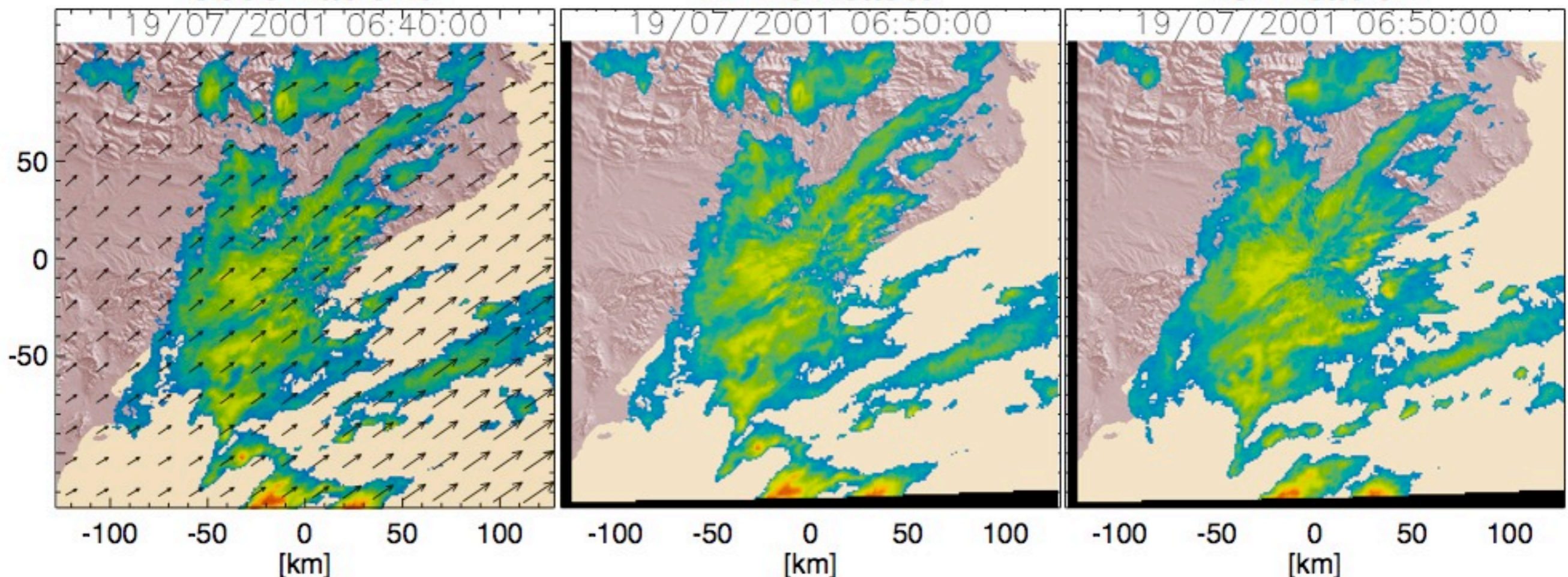
1. Tracking: The motion field of rainfall is estimated from observations.

2. Extrapolation: The most recent field is extrapolated accordingly.

observations

LP nowcasts

verification



Radar-based rainfall nowcasting

Precipitation nowcasting by extrapolation of radar observations

1. Tracking: The motion field of rainfall is estimated from observations.

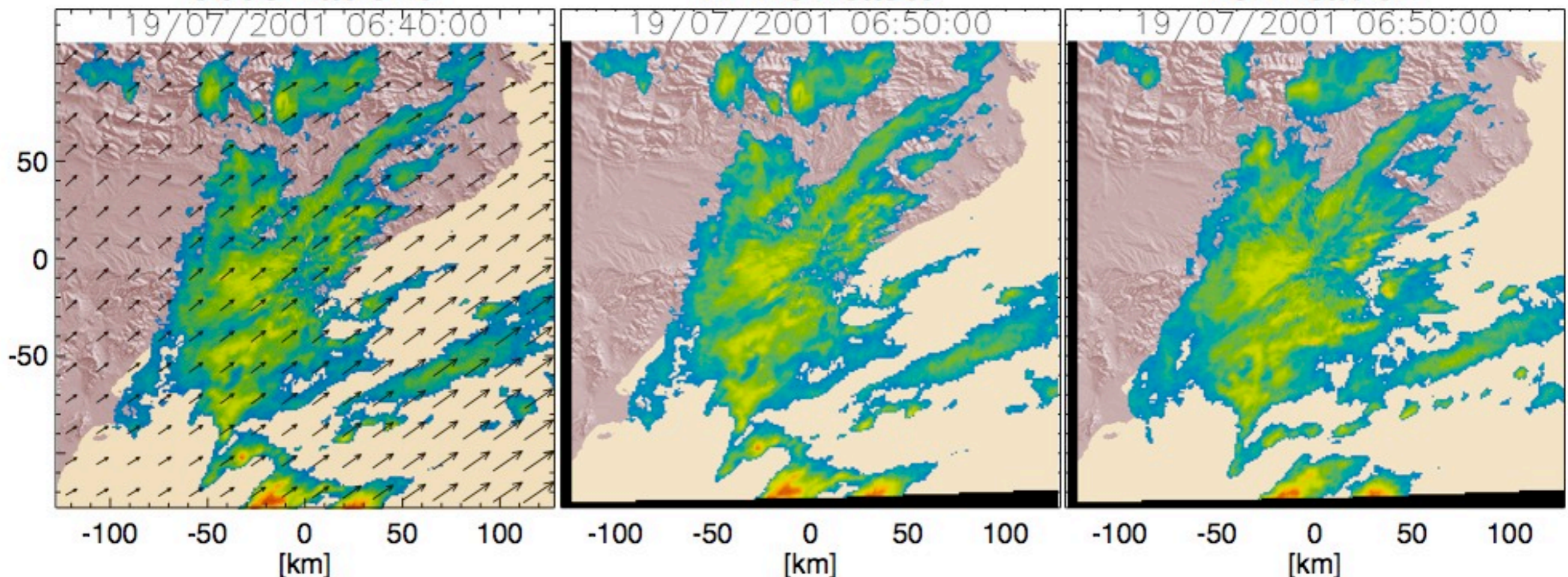
2. Extrapolation: The most recent field is extrapolated accordingly.

1 radar → up to 2 hours

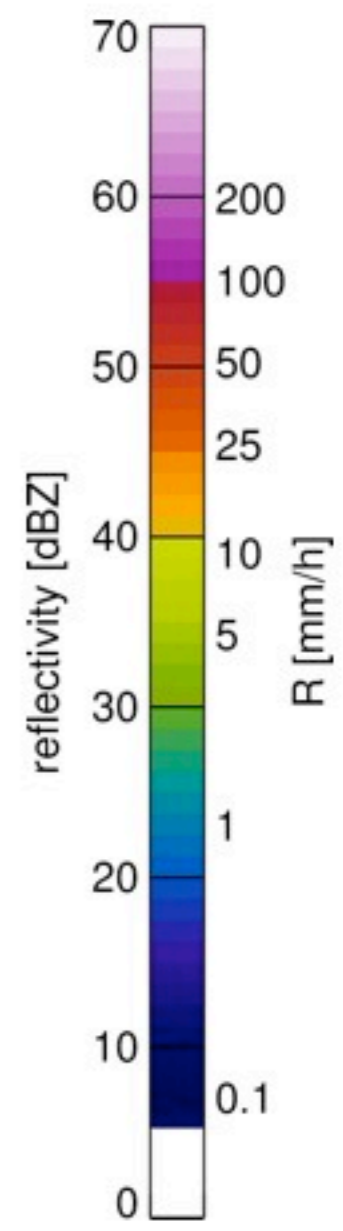
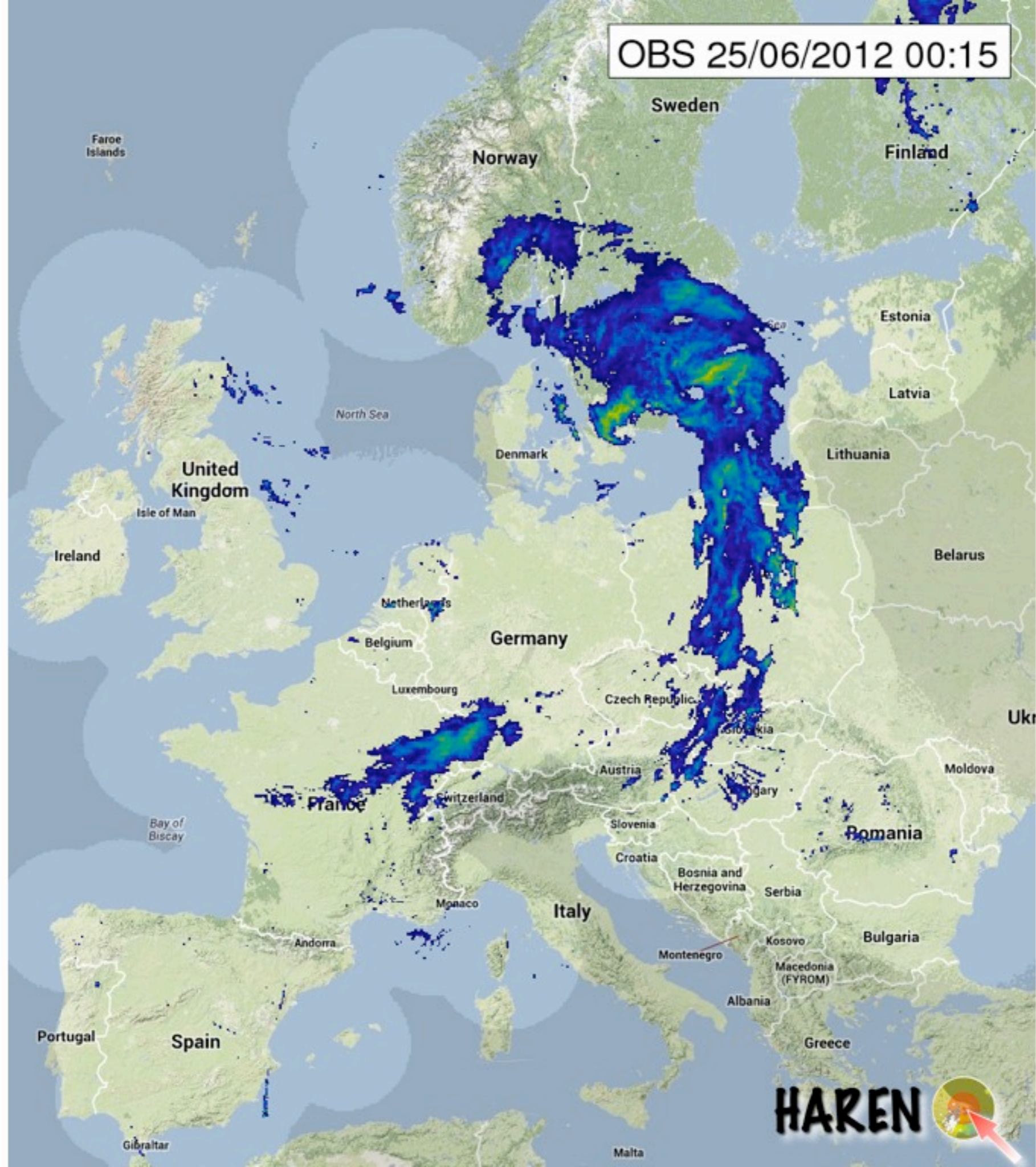
observations

LP nowcasts

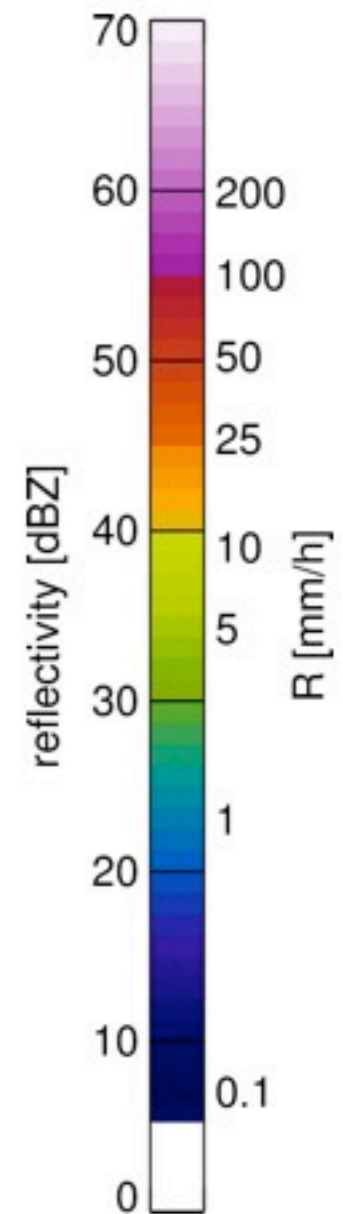
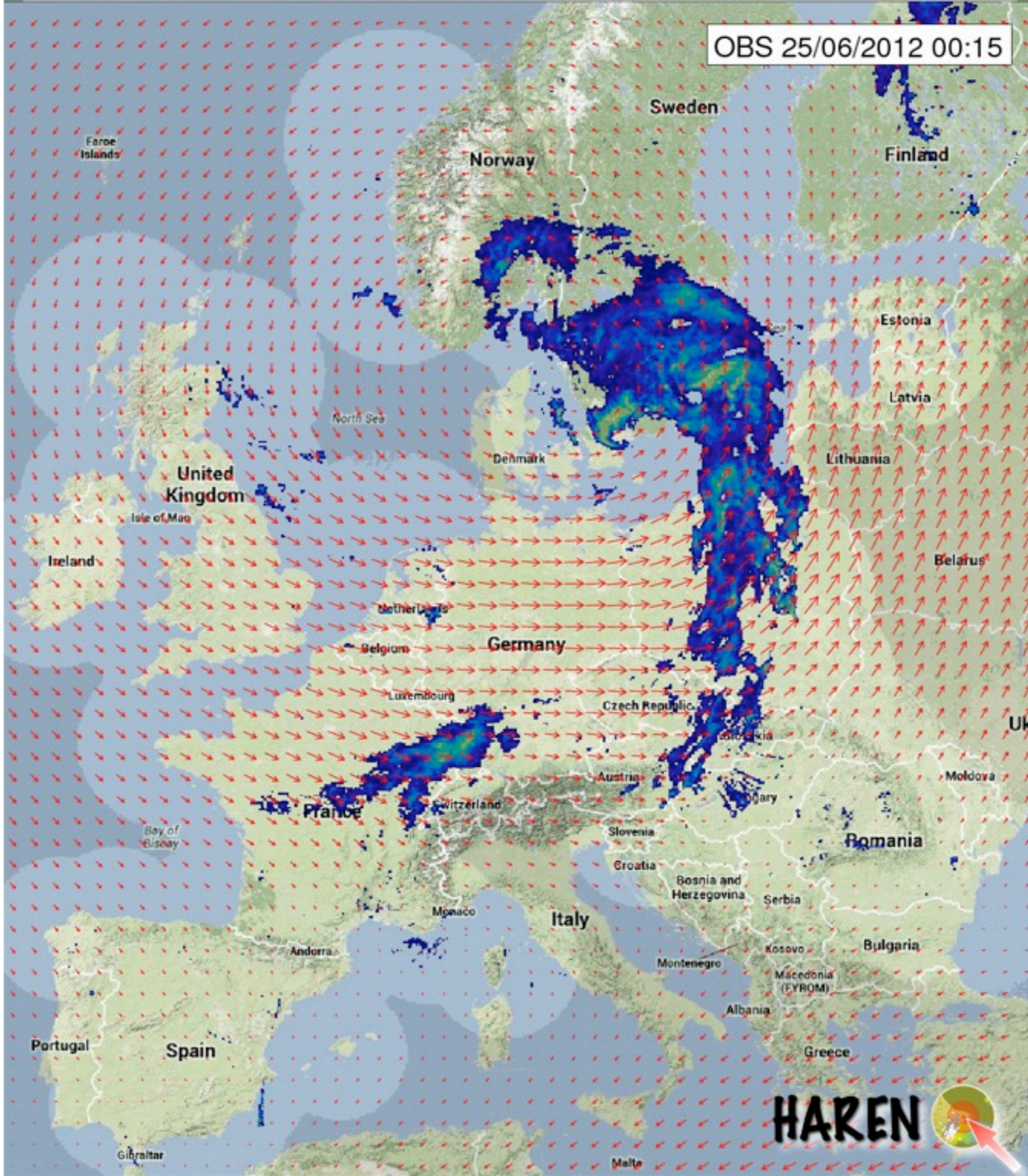
verification



OBS 25/06/2012 00:15



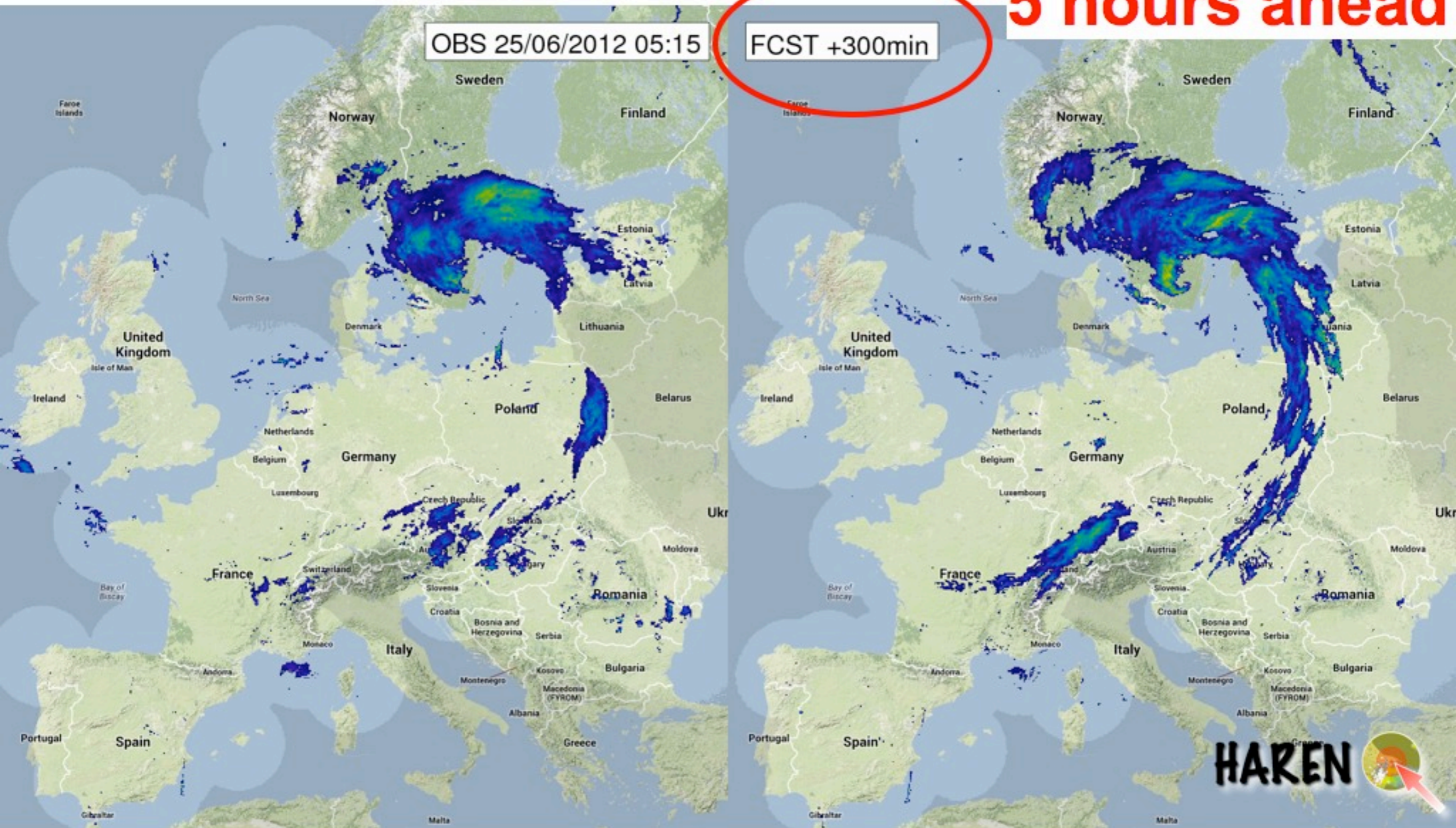
OBS 25/06/2012 00:15



European Radar Nowcasting - OPERA mosaics

Over a network of 150+ radars.

5 hours ahead

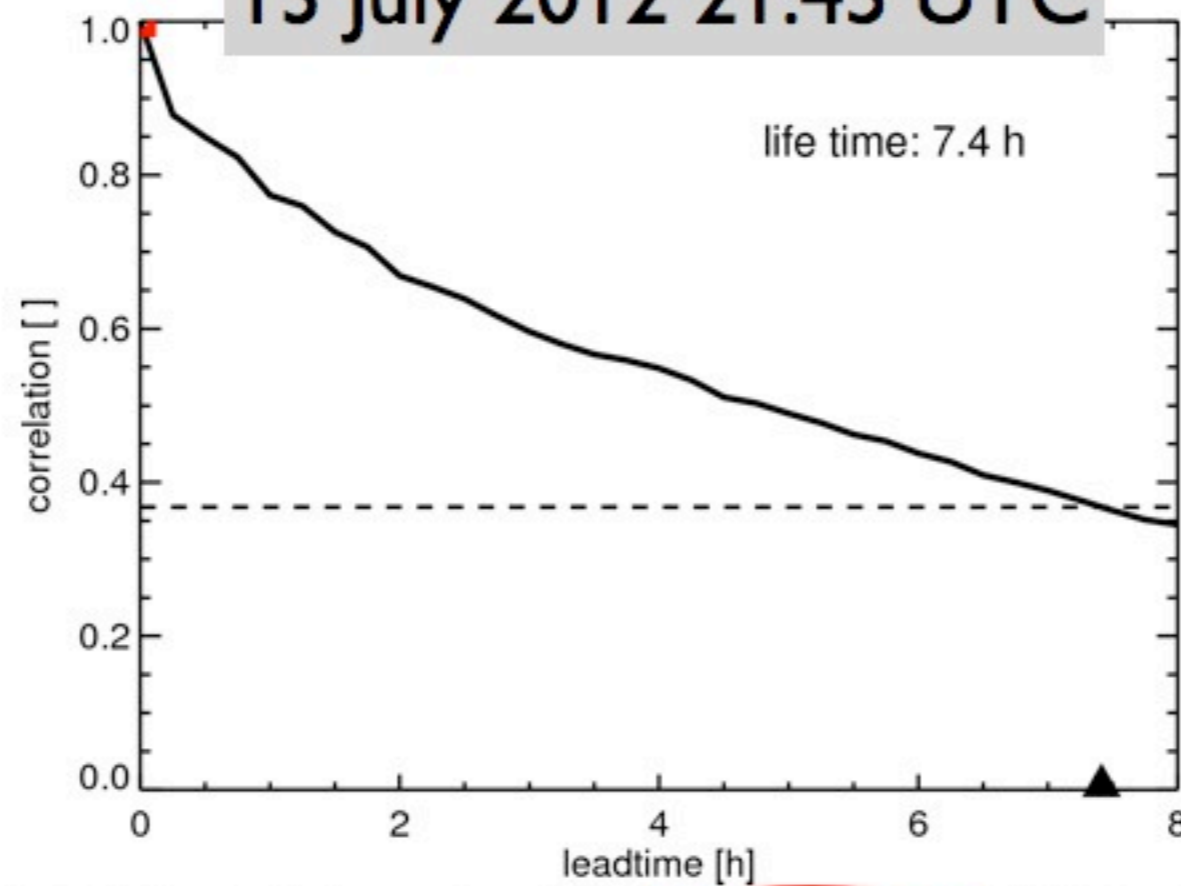


CRAHI Algorithm of nowcasting by lagrangian persistence

Berenguer et al. J. Hydrometeorology, 2005; J. of Hydrology, 2011

Nowcasting evaluation

13 July 2012 21:45 UTC

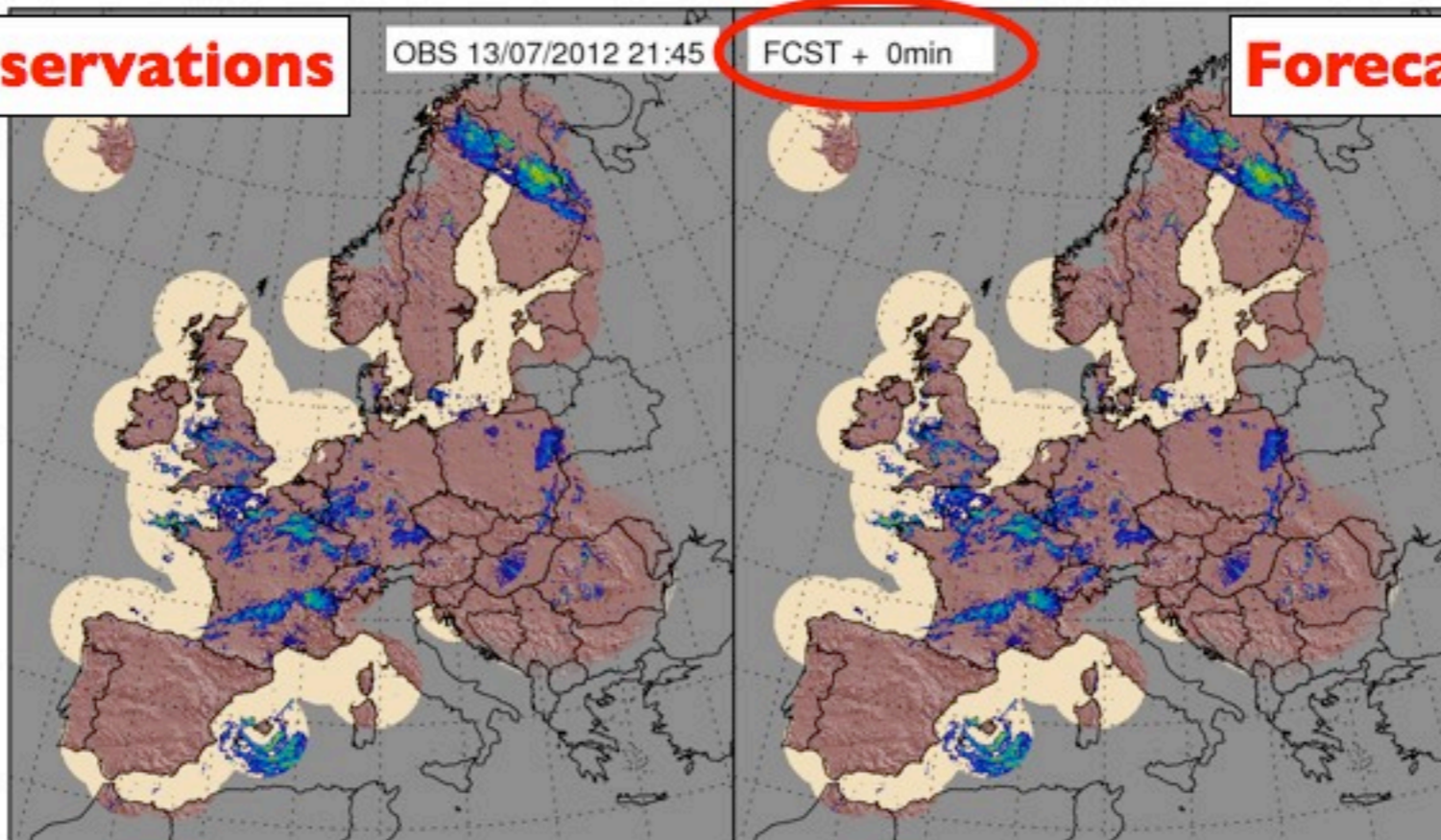


Observations

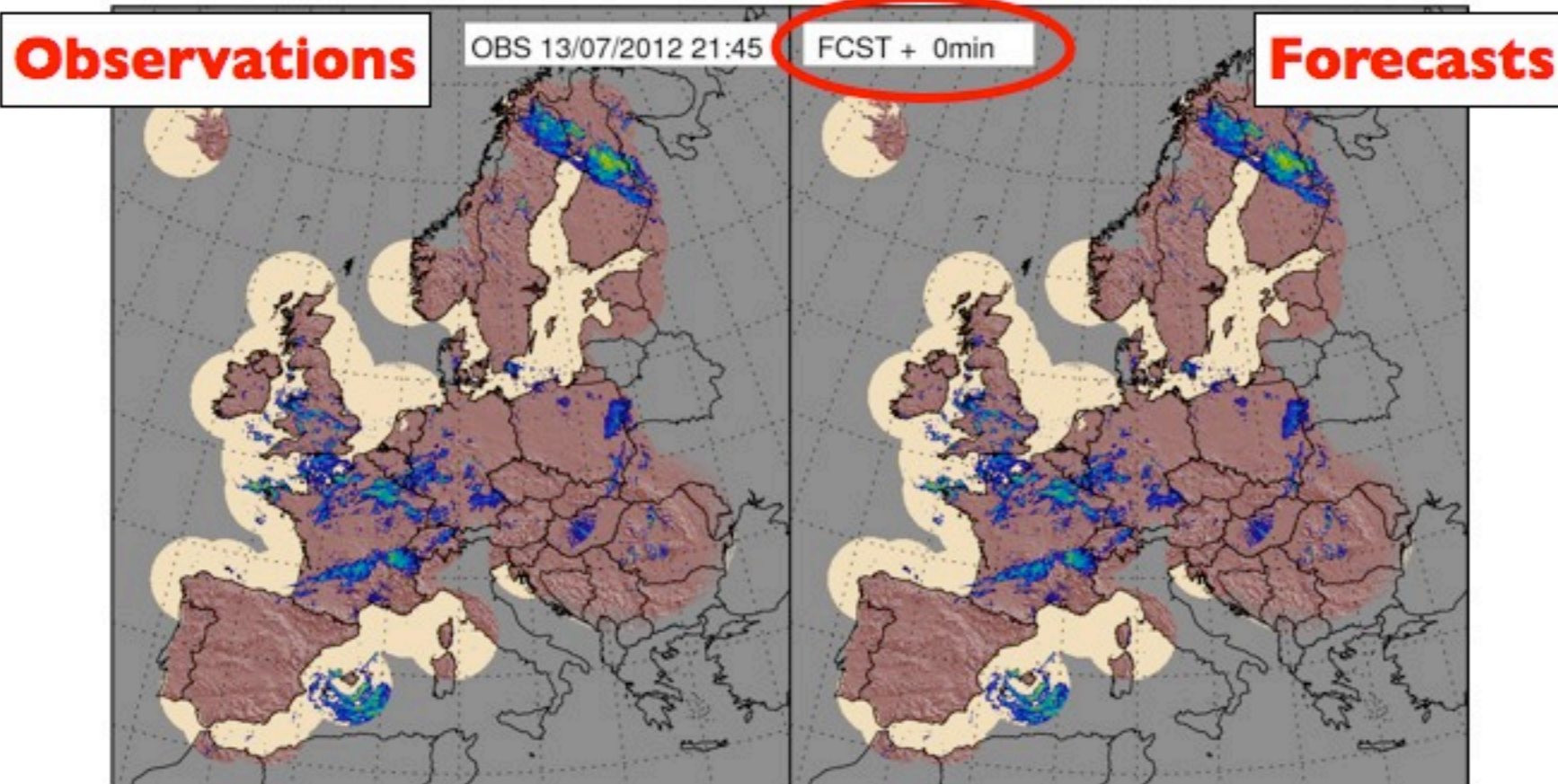
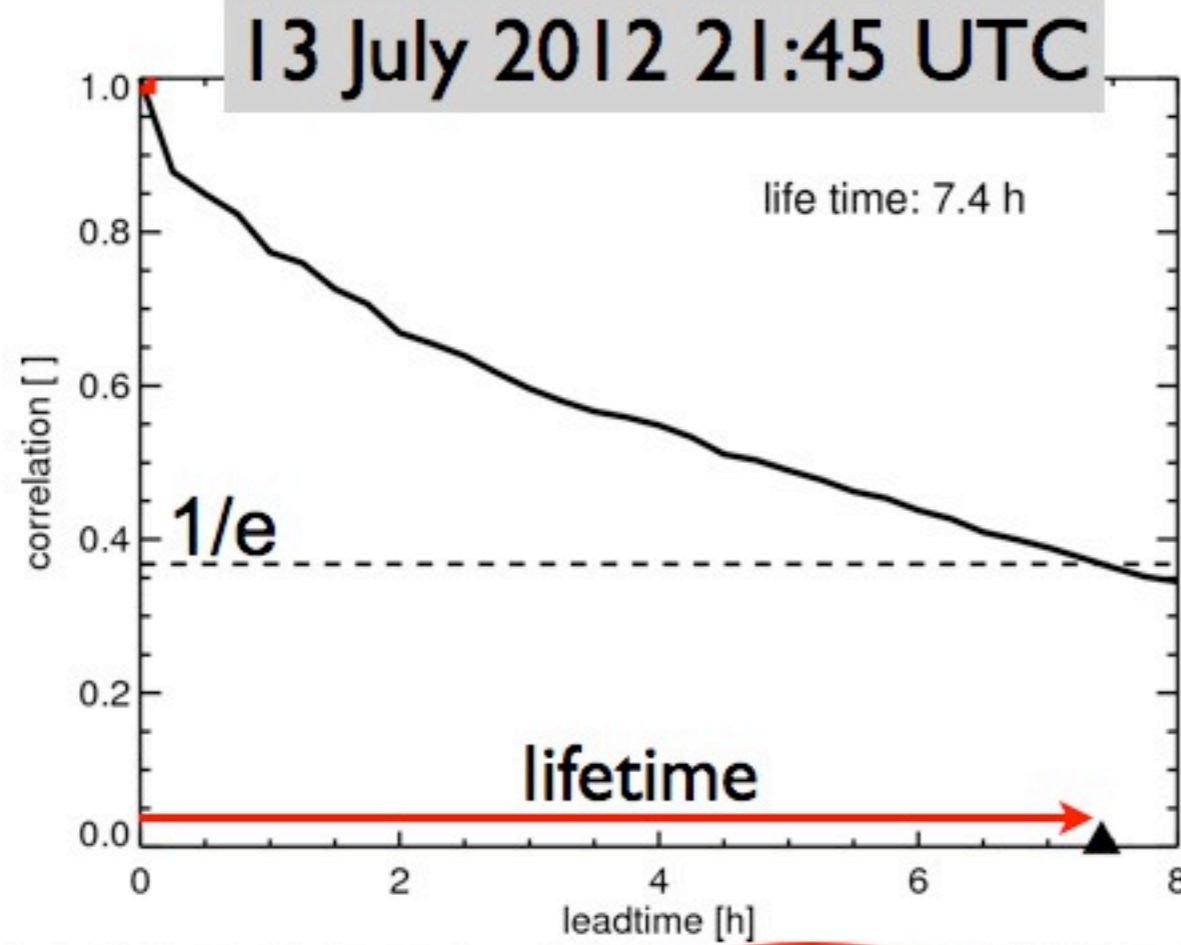
OBS 13/07/2012 21:45

FCST + 0min

Forecasts



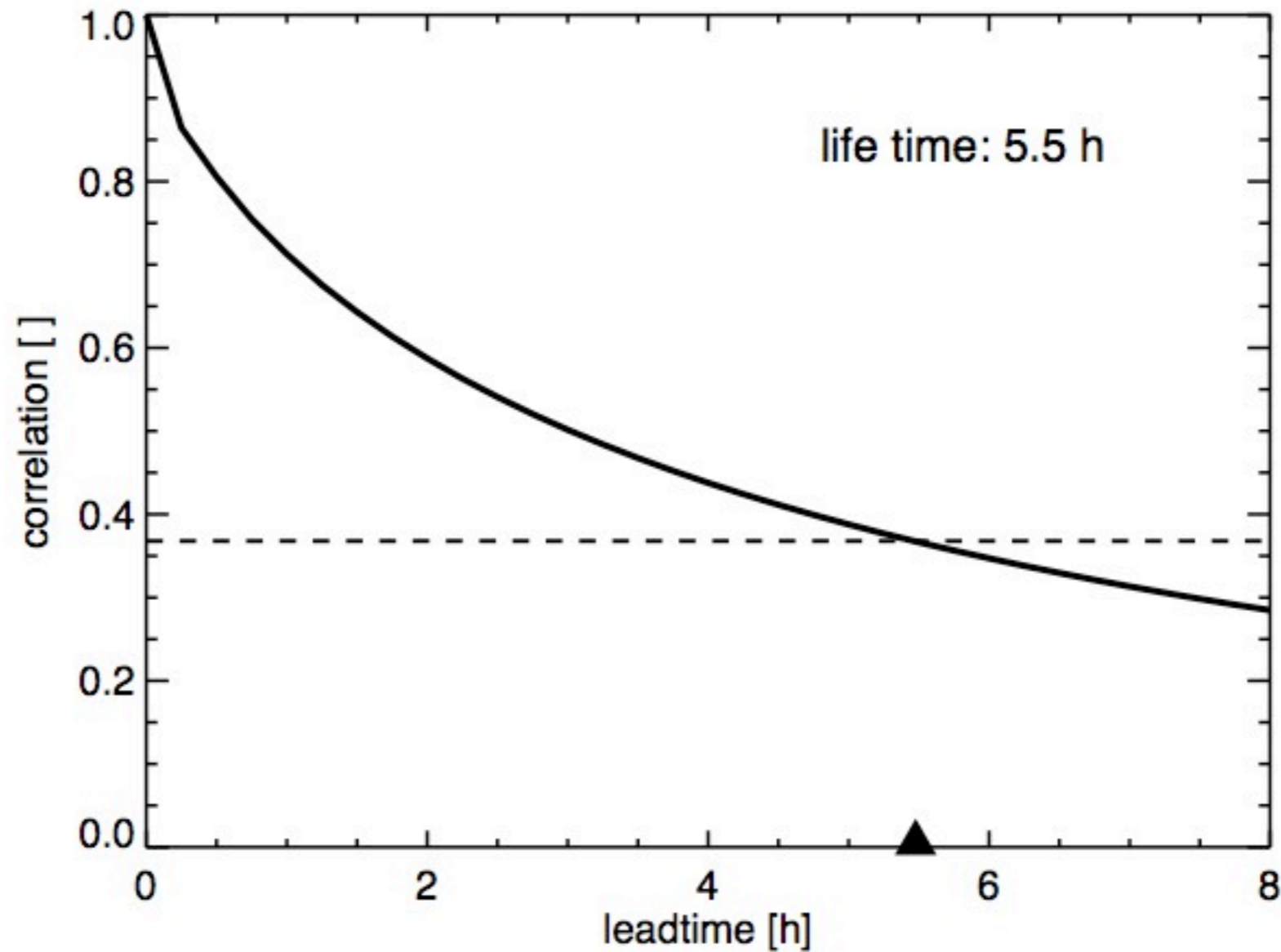
Nowcasting evaluation



Nowcasting evaluation

Mean Lifetime

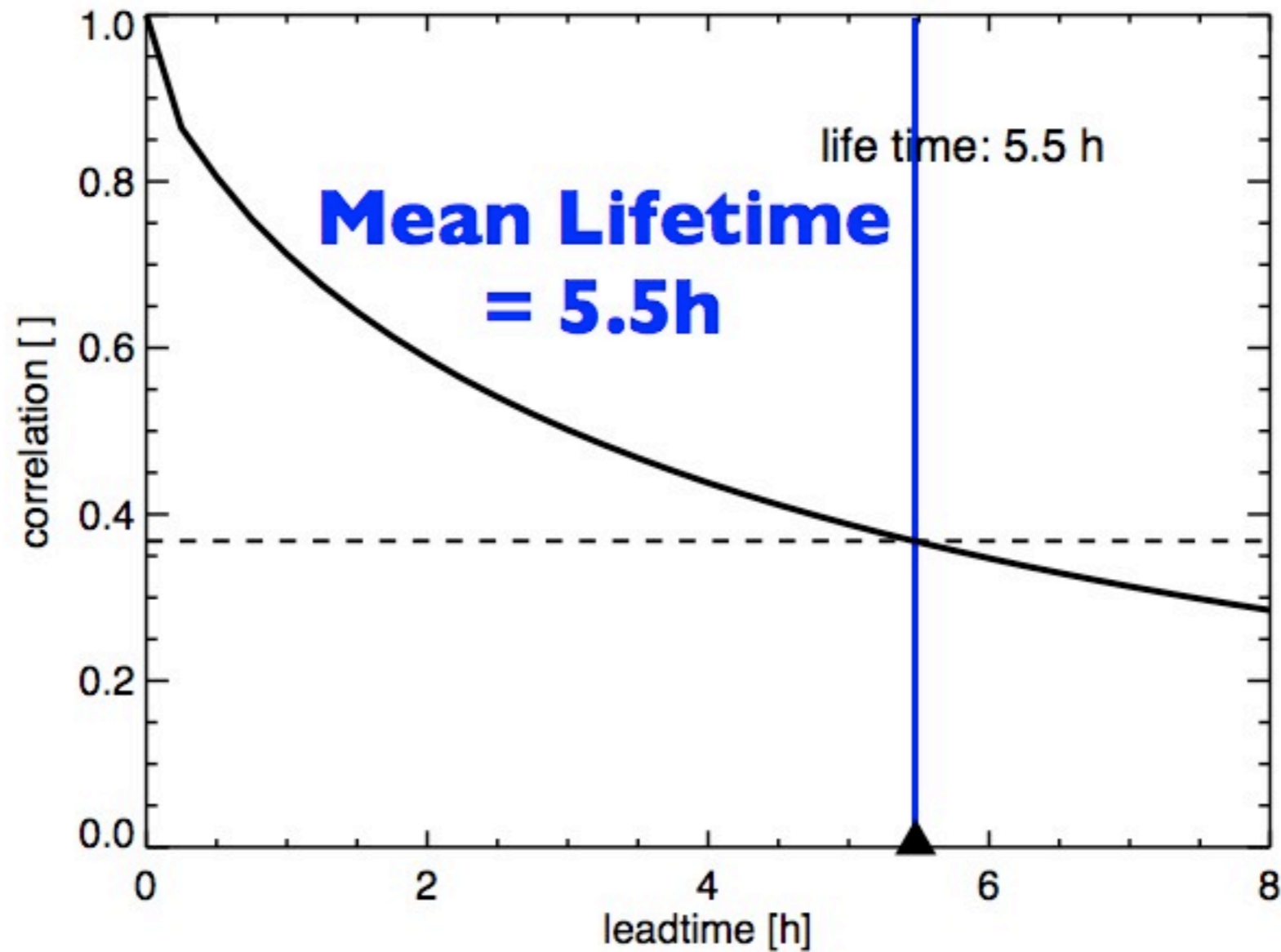
in the period **01 June - 31 July 2012**



Nowcasting evaluation

Mean Lifetime

in the period **01 June - 31 July 2012**





HAREN

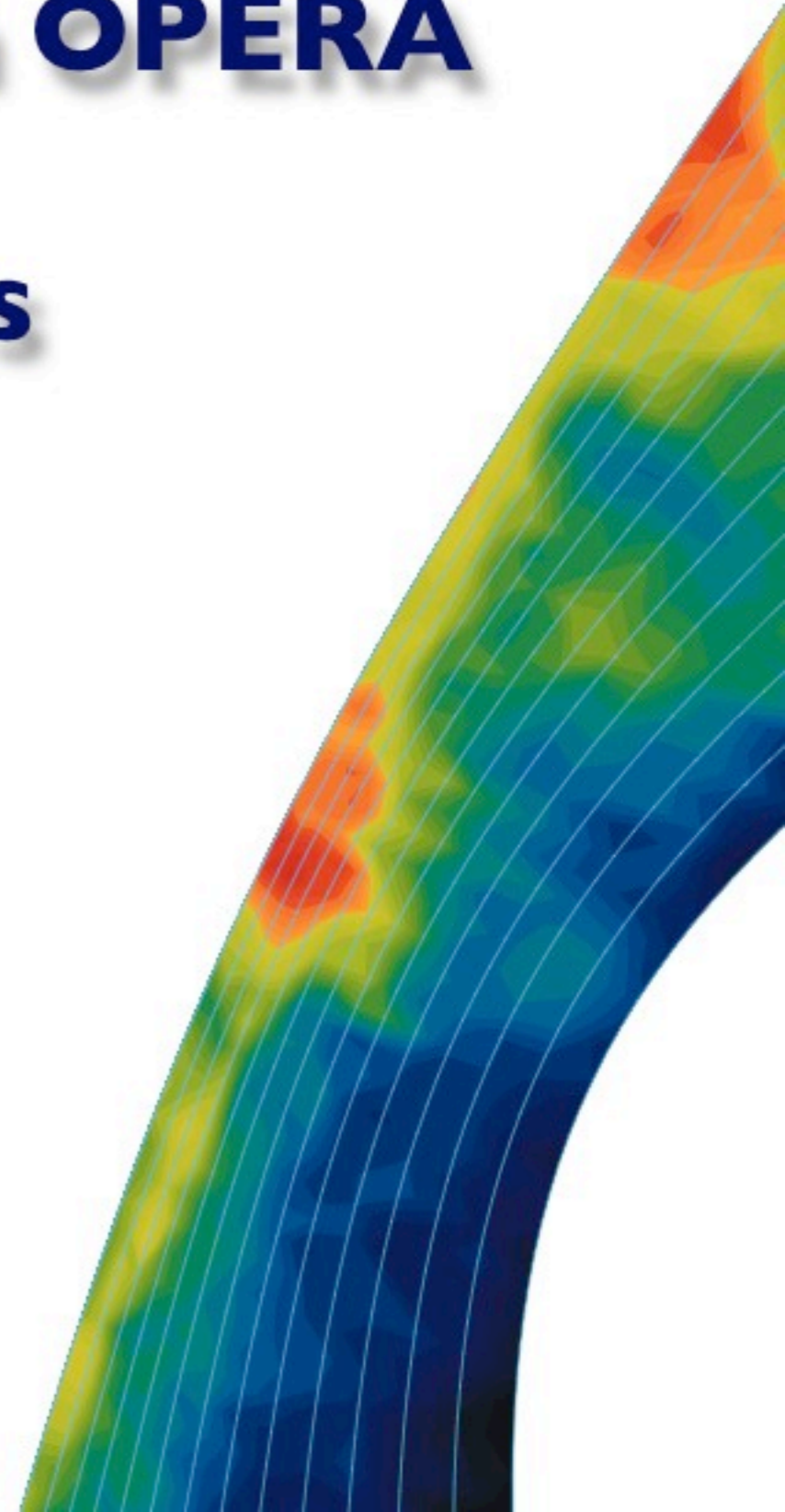


European
Civil Protection

Radar-based rainfall nowcasting at European Scale based in OPERA

HAREN products

**Nowcasting of
RAINFALL
INTENSITIES
(up to 6h)**





HAREN



European
Civil Protection

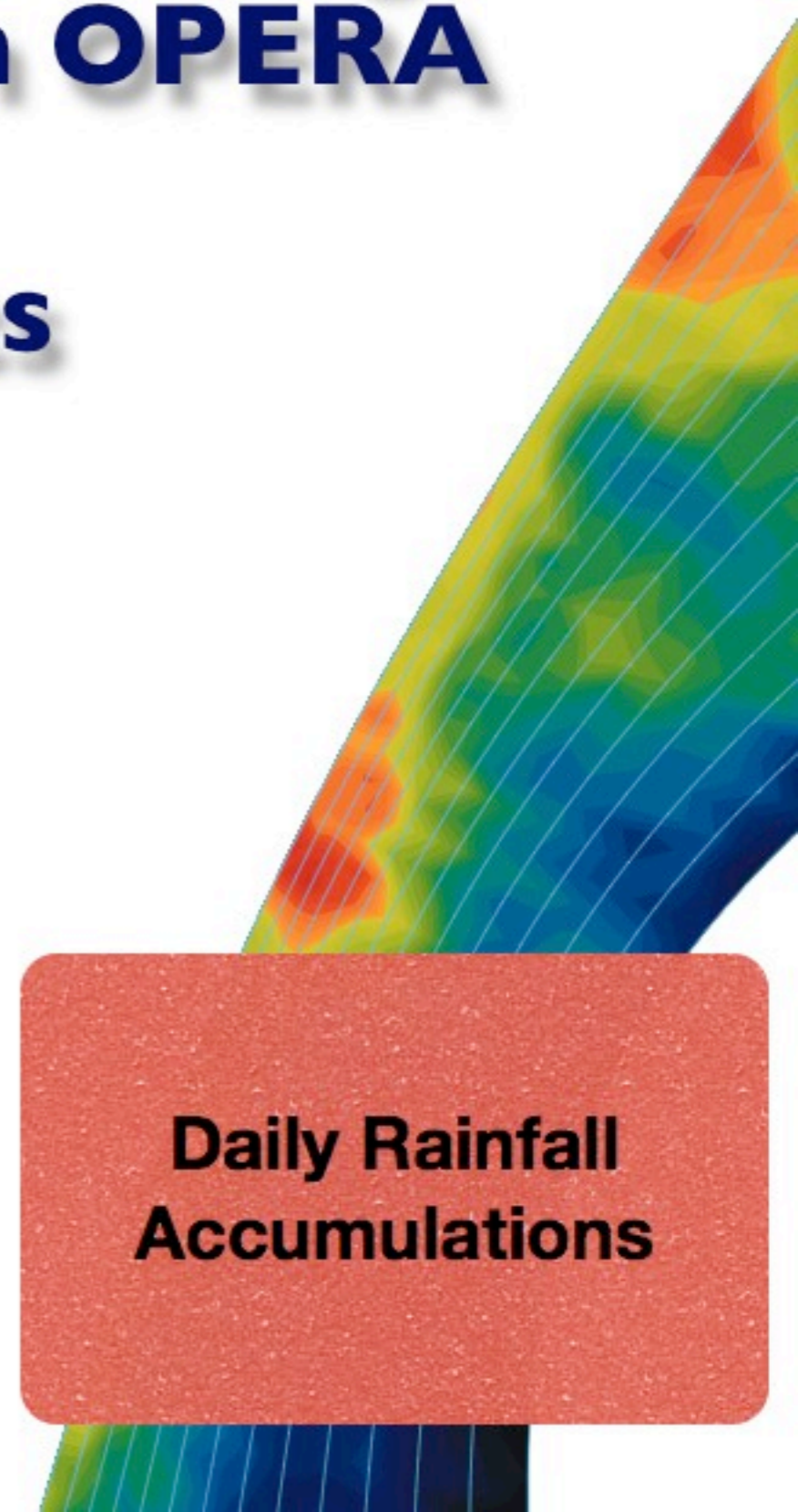
Radar-based rainfall nowcasting at European Scale based in OPERA

HAREN products

Nowcasting of
**RAINFALL
INTENSITIES**
(up to 6h)

Nowcasting of
**HOURLY RAINFALL
ACCUMULATIONS**
(up to 6h)

**Daily Rainfall
Accumulations**





HAREN



European
Civil Protection

Radar-based rainfall nowcasting at European Scale based in OPERA

HAREN products

**Nowcasting of
RAINFALL
INTENSITIES
(up to 6h)**

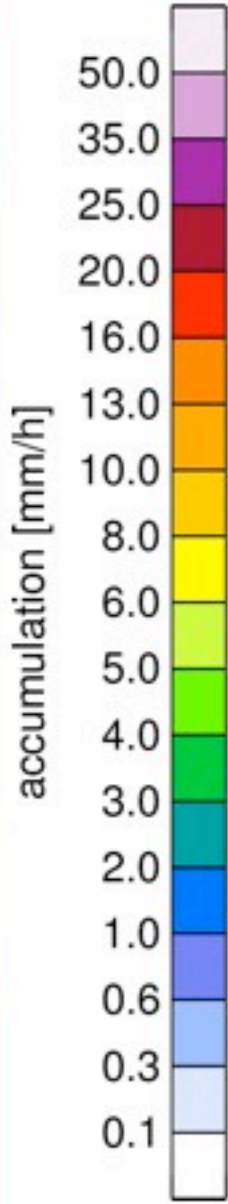
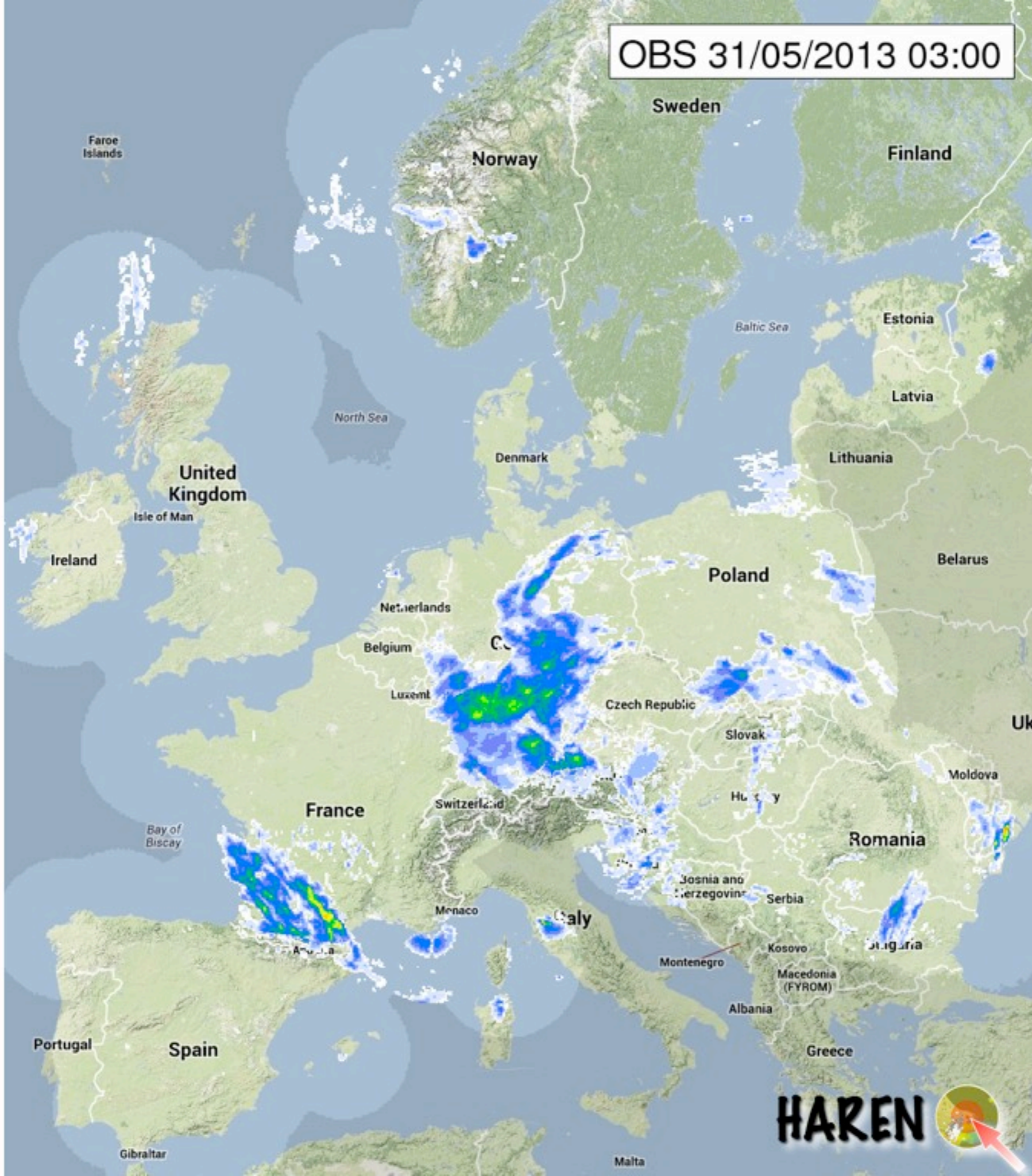
**Nowcasting of
HOURLY RAINFALL
ACCUMULATIONS
(up to 6h)**

**Nowcasting of
Hazard assessment
 $R > \text{threshold}$
(up to 6h)**

**Daily Rainfall
Accumulations**



OBS 31/05/2013 03:00



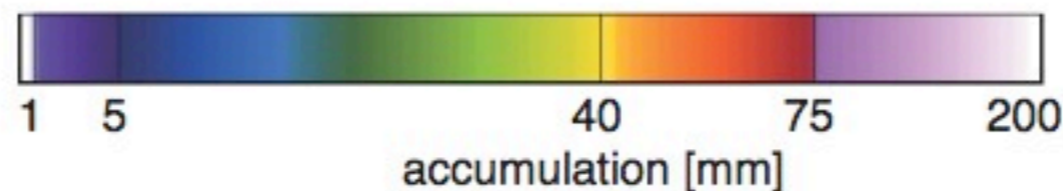
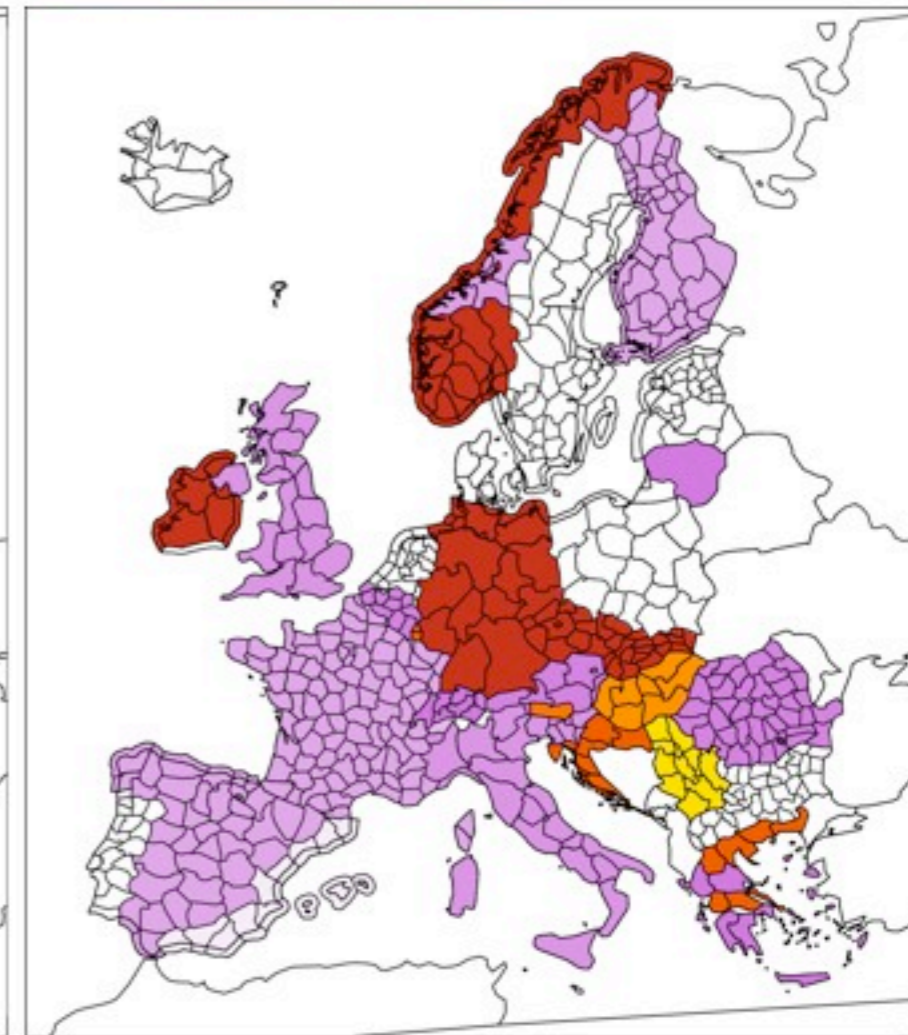
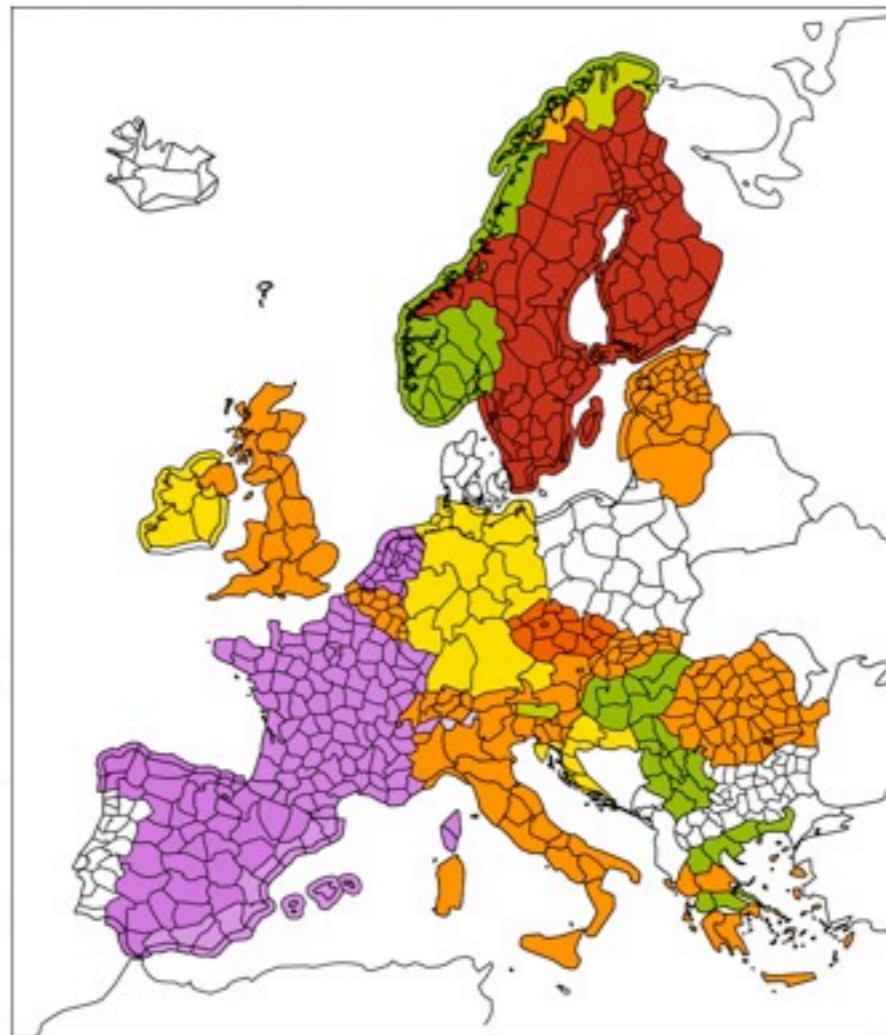
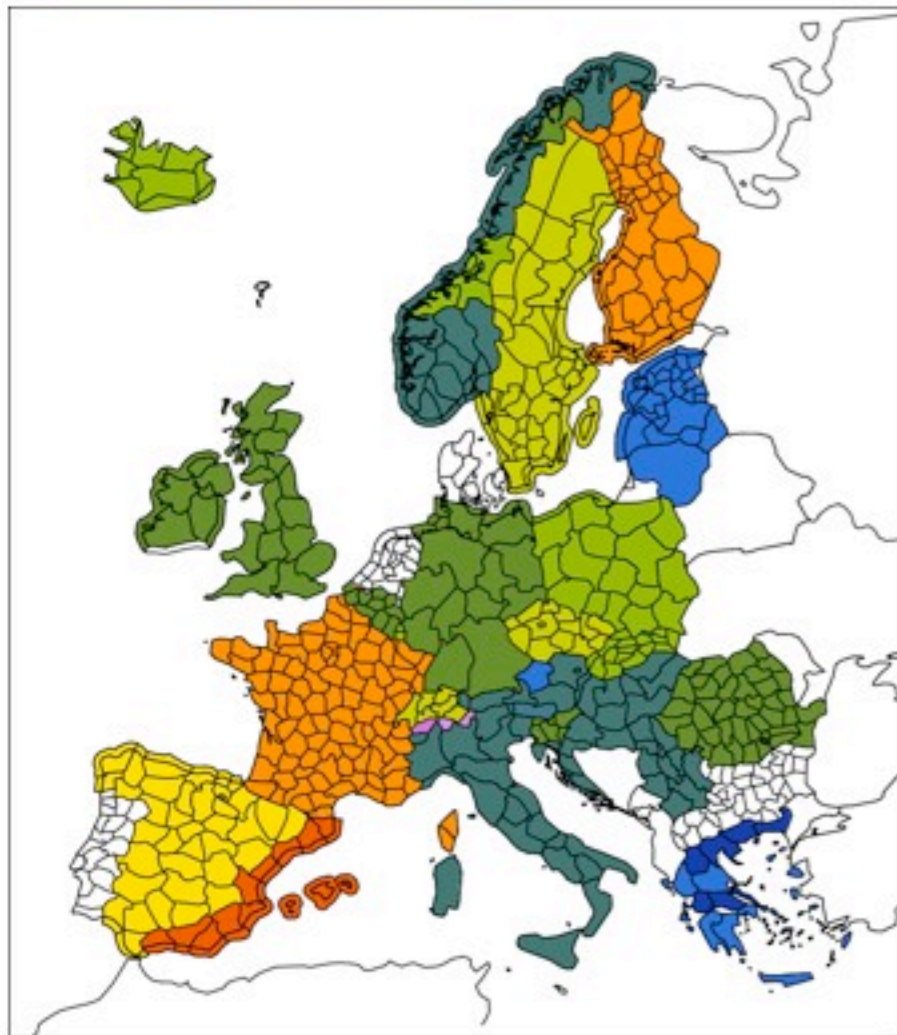
HAZARD ASSESSMENT

regional thresholds for 12-h accumulations
defined by METEOALARM

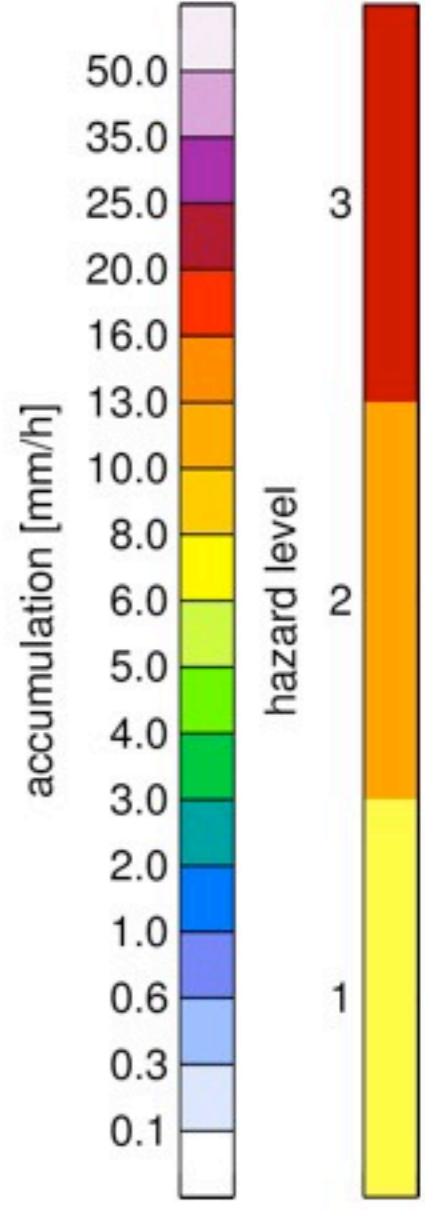
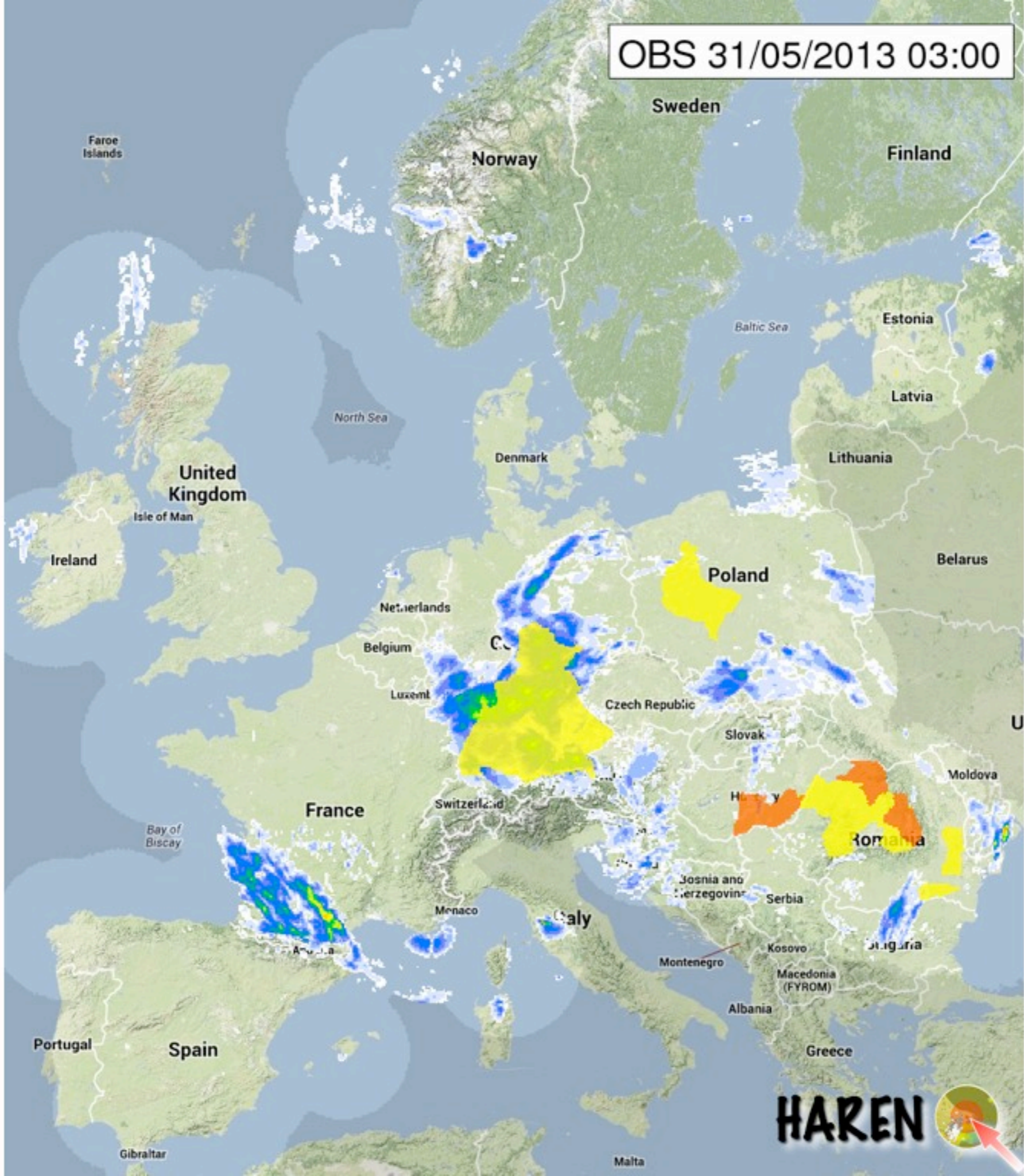
hazard level 1

hazard level 2

hazard level 3



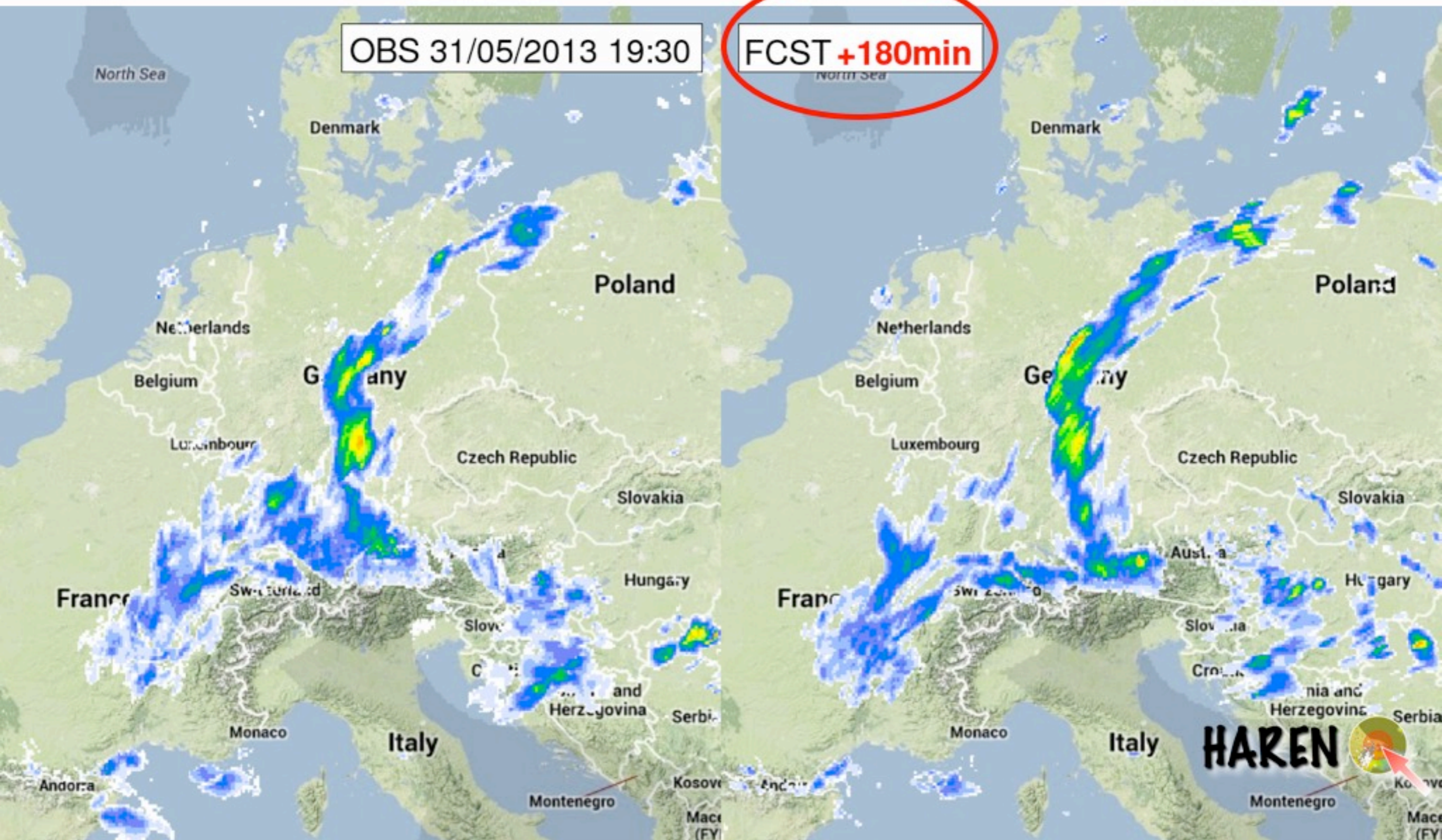
OBS 31/05/2013 03:00



HAREN

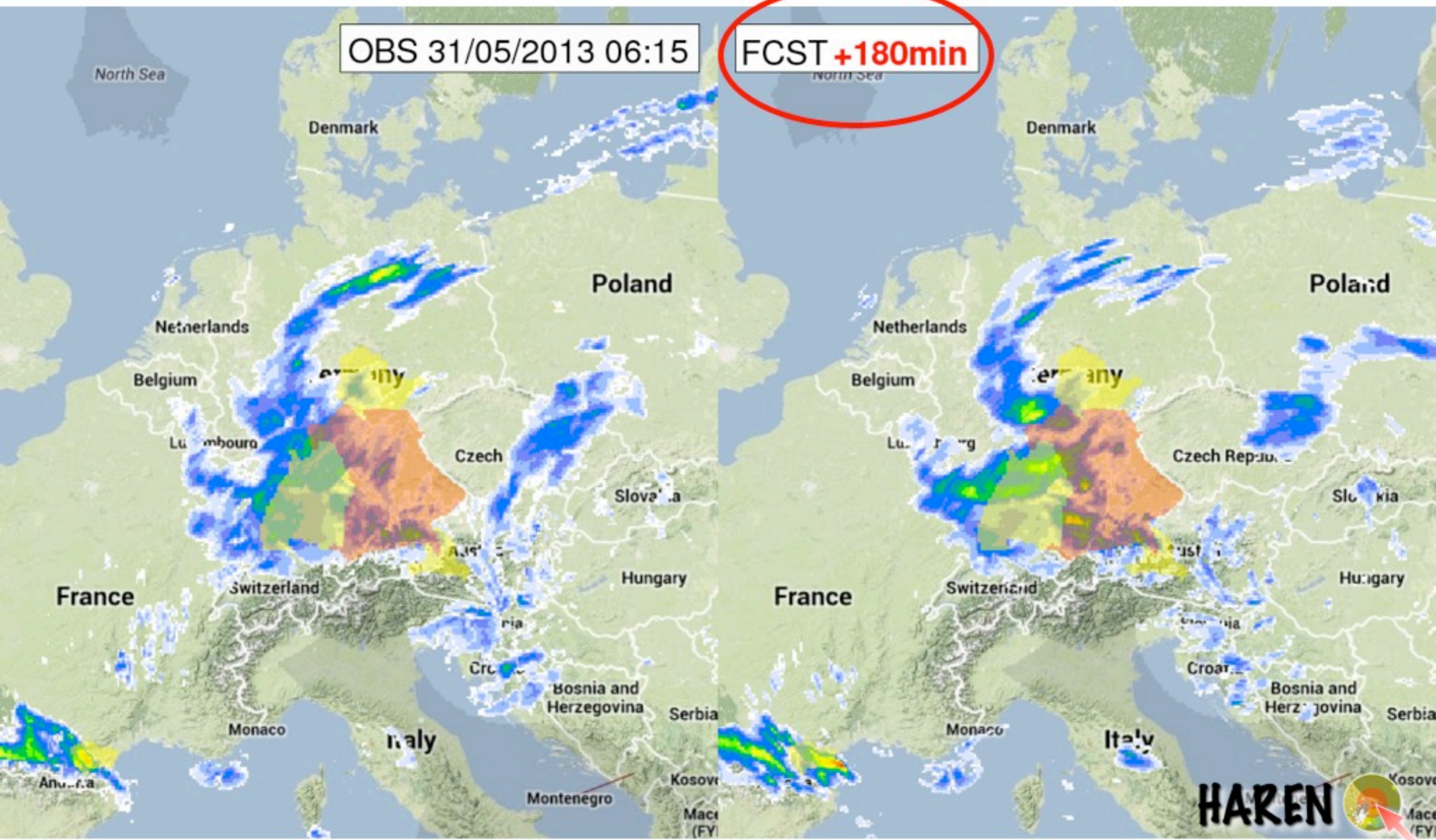
1h-accumulation rainfall nowcasts

Nowcasts @ 31 May 2013 3h ahead



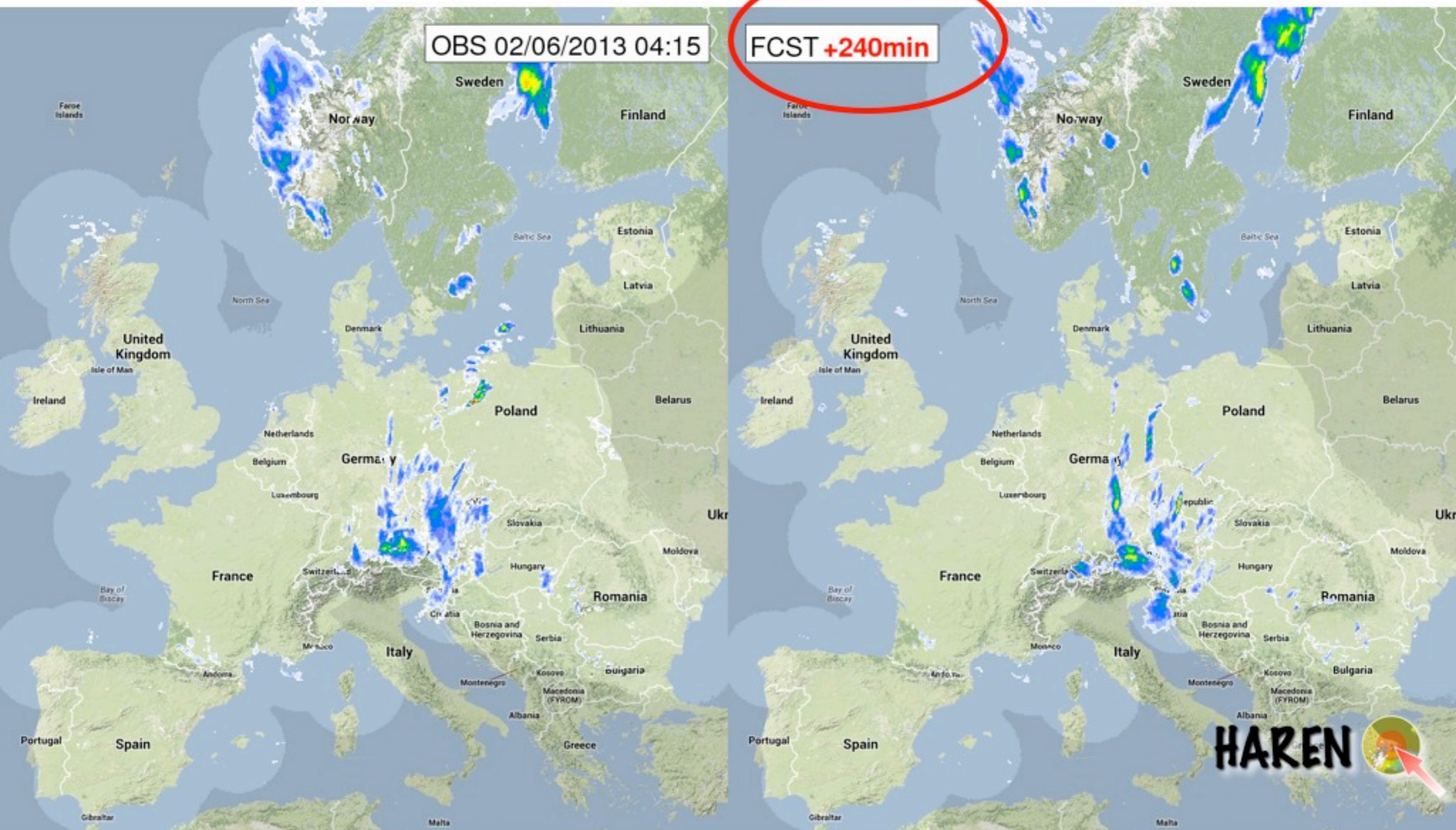
Hazard assessment based on 1h rainfall accumulations

Nowcasts @ 31 May 2013 3h ahead



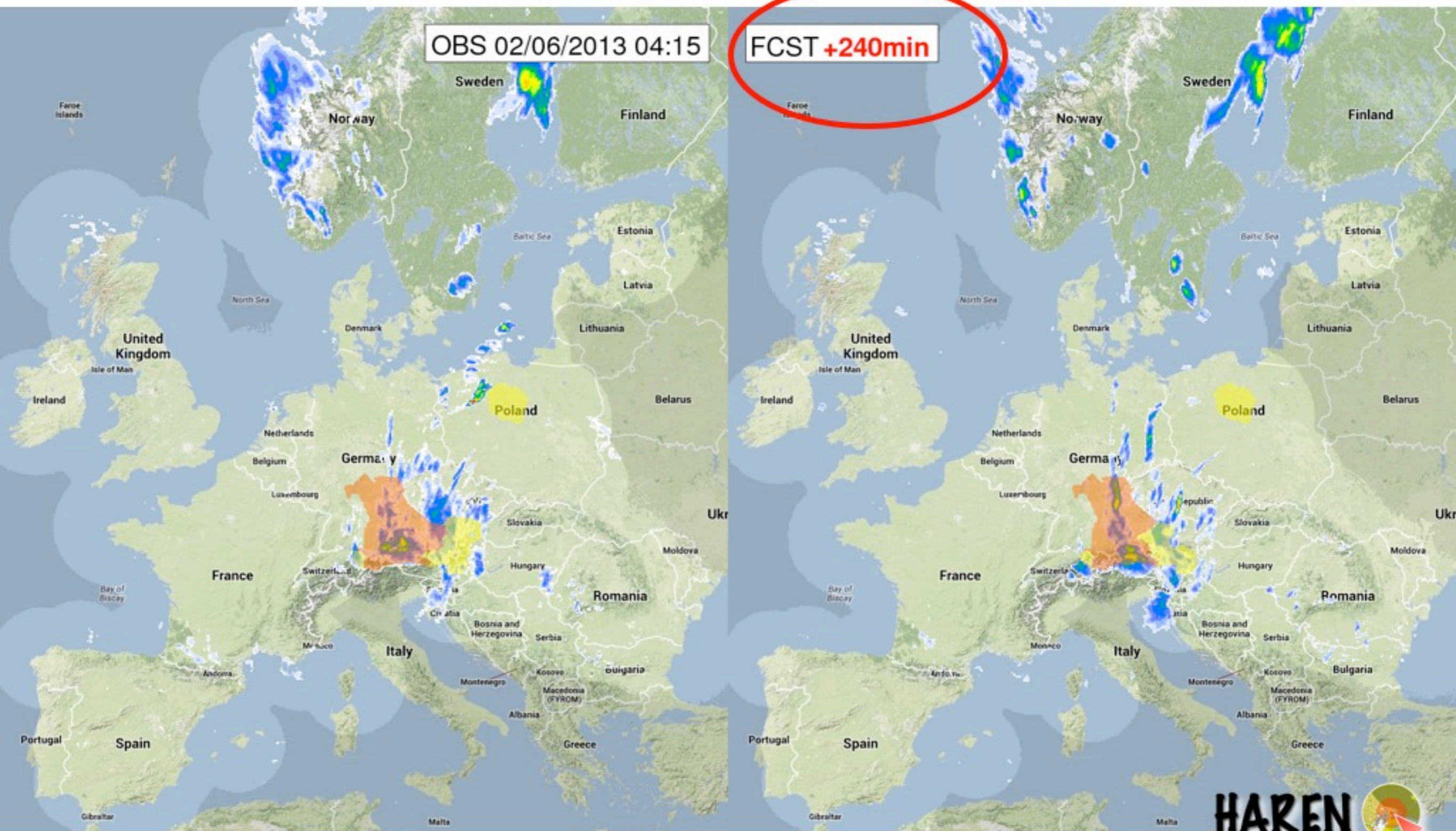
1h-accumulation rainfall nowcasts

Nowcasts @ 2 June 2013 4h ahead



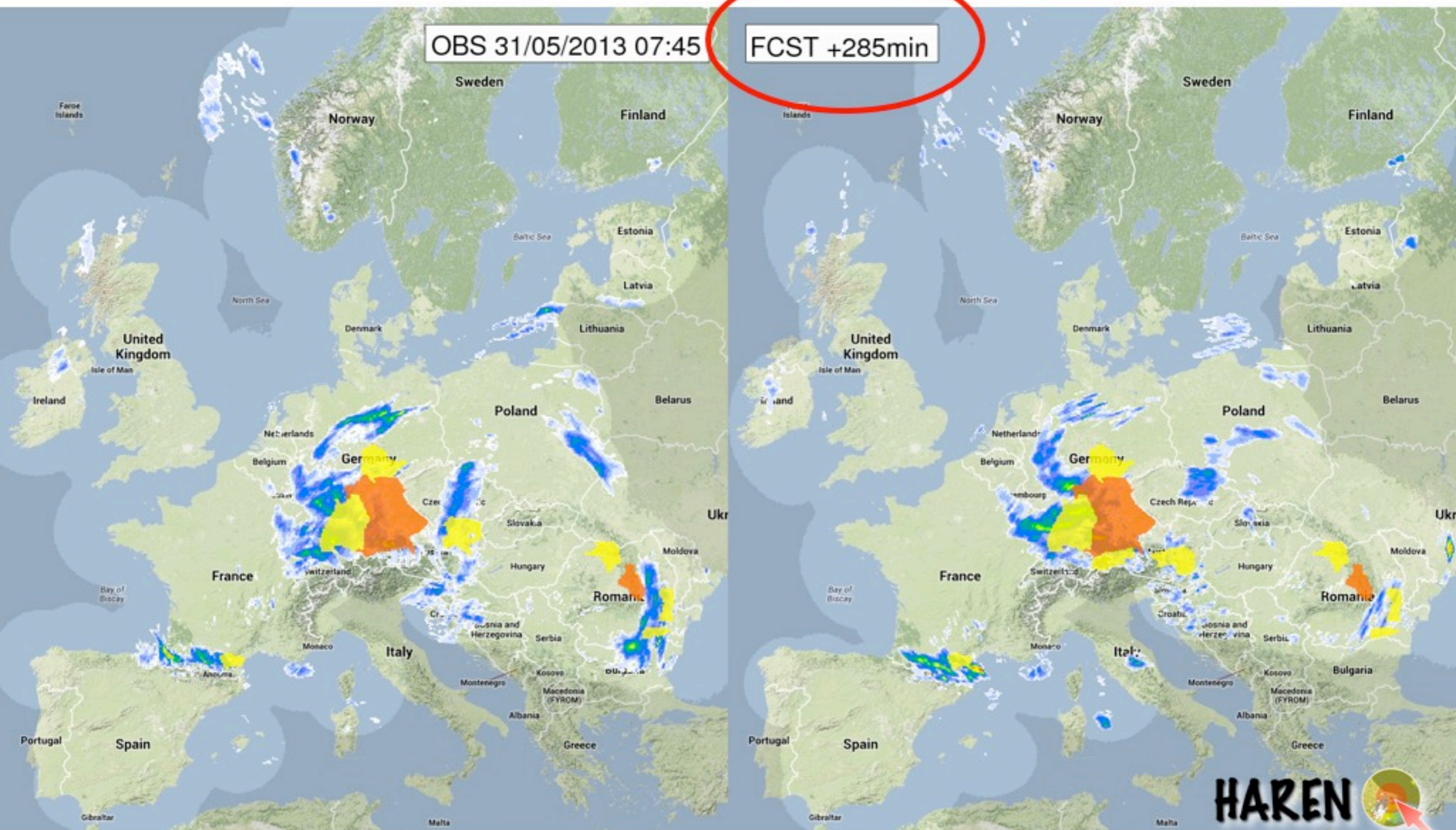
Hazard assessment based on 1h rainfall accumulations

Nowcasts @ 2 June 2013 4h ahead



Hazard assessment based on 1h rainfall accumulations

Nowcasts @ 31 May 2013 up to 6h ahead





Rainfall Nowcasting based on **OPERA COMPOSITES**

- Already produced in real-time inside the project from June 2012
- Verification by the associated stakeholders during 2013



Rainfall Nowcasting based on OPERA COMPOSITES

- Already produced in real-time inside the project from June 2012
- Verification by the associated stakeholders during 2013

**Evaluation of these products at EU Civil
Protection (Emergency Response Centre)
from March 2013**

CASE STUDY in The Netherlands

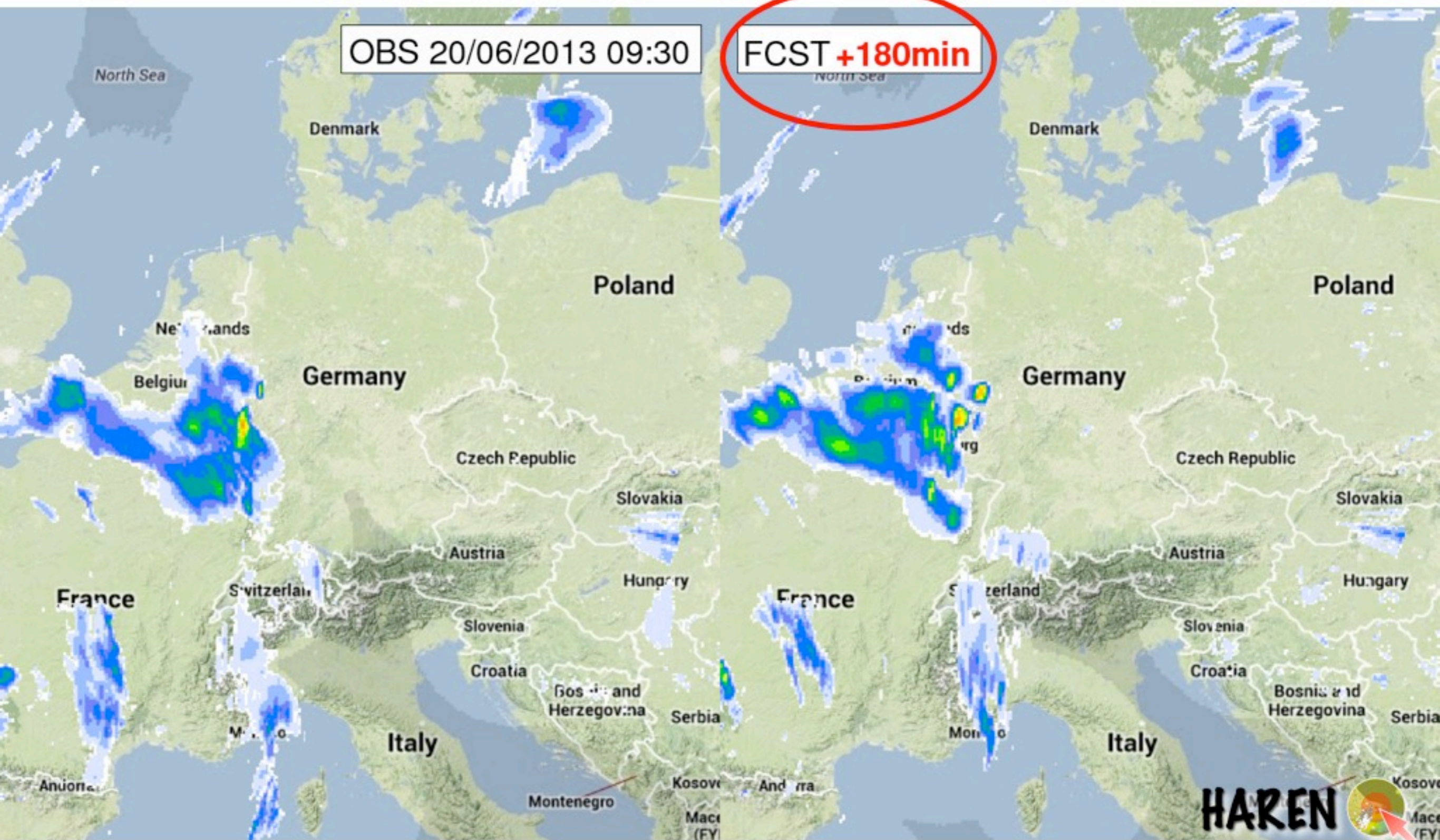
Ondertussen in het oosten van het land:
zandzakken en rubberbootjes



Noodweer in Enschede. Screenshot van WeerGroningen.

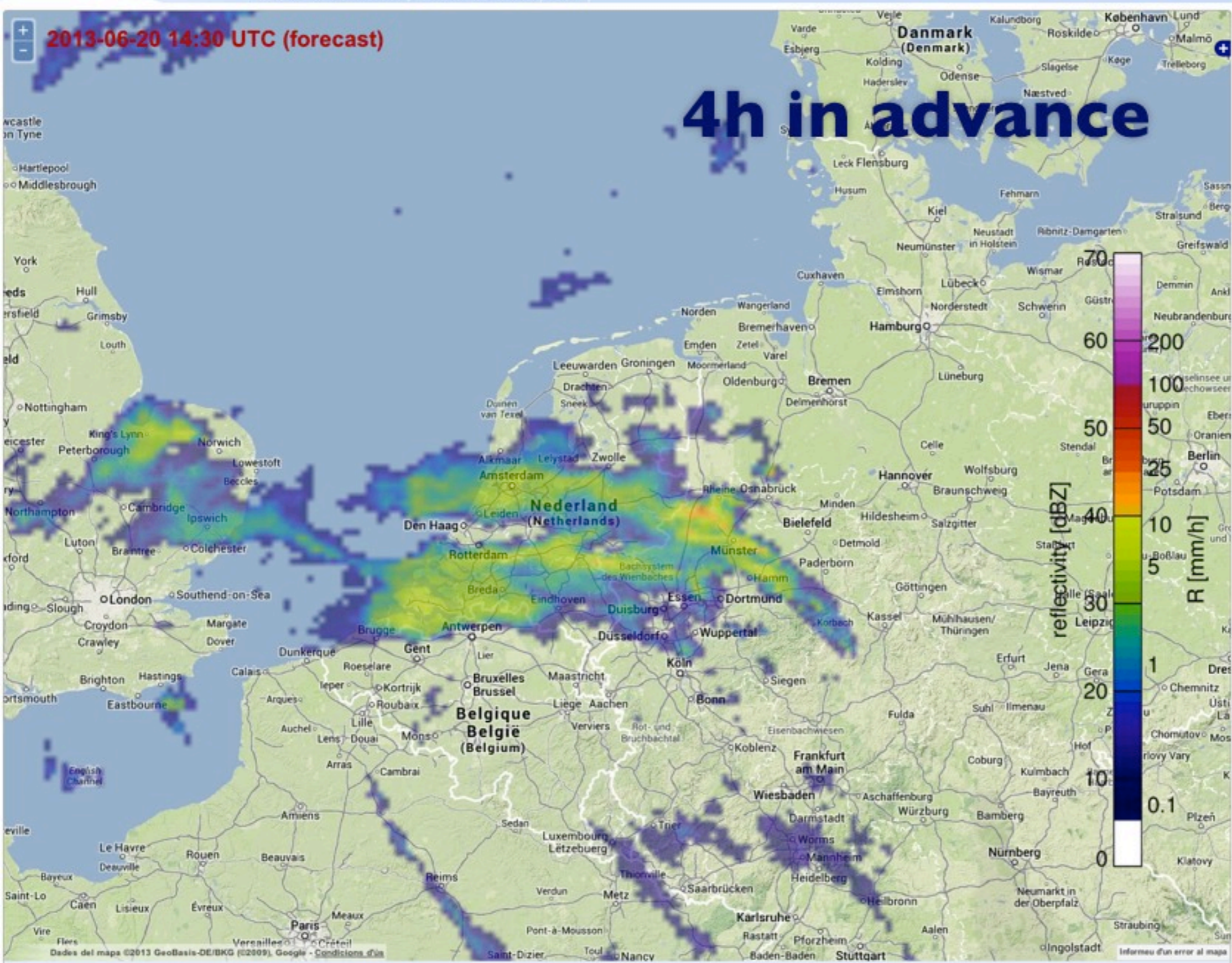
1h-accumulation rainfall nowcasts

Nowcasts @ 20 June 2013 3h ahead



2013-06-20 14:30 UTC (forecast)

4h in advance



Real Time | Historical Episode

Jun 2013

Su	Mo	Tu	We	Th	Fr	Sa
						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						

Today

Number of Frames: 32
Hour/Minute: 24 : 00 :

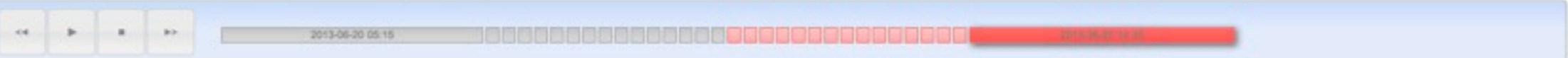
- Topographies**
- Google Physical
 - Google Streets
 - Google Satellite
 - Google Hybrid

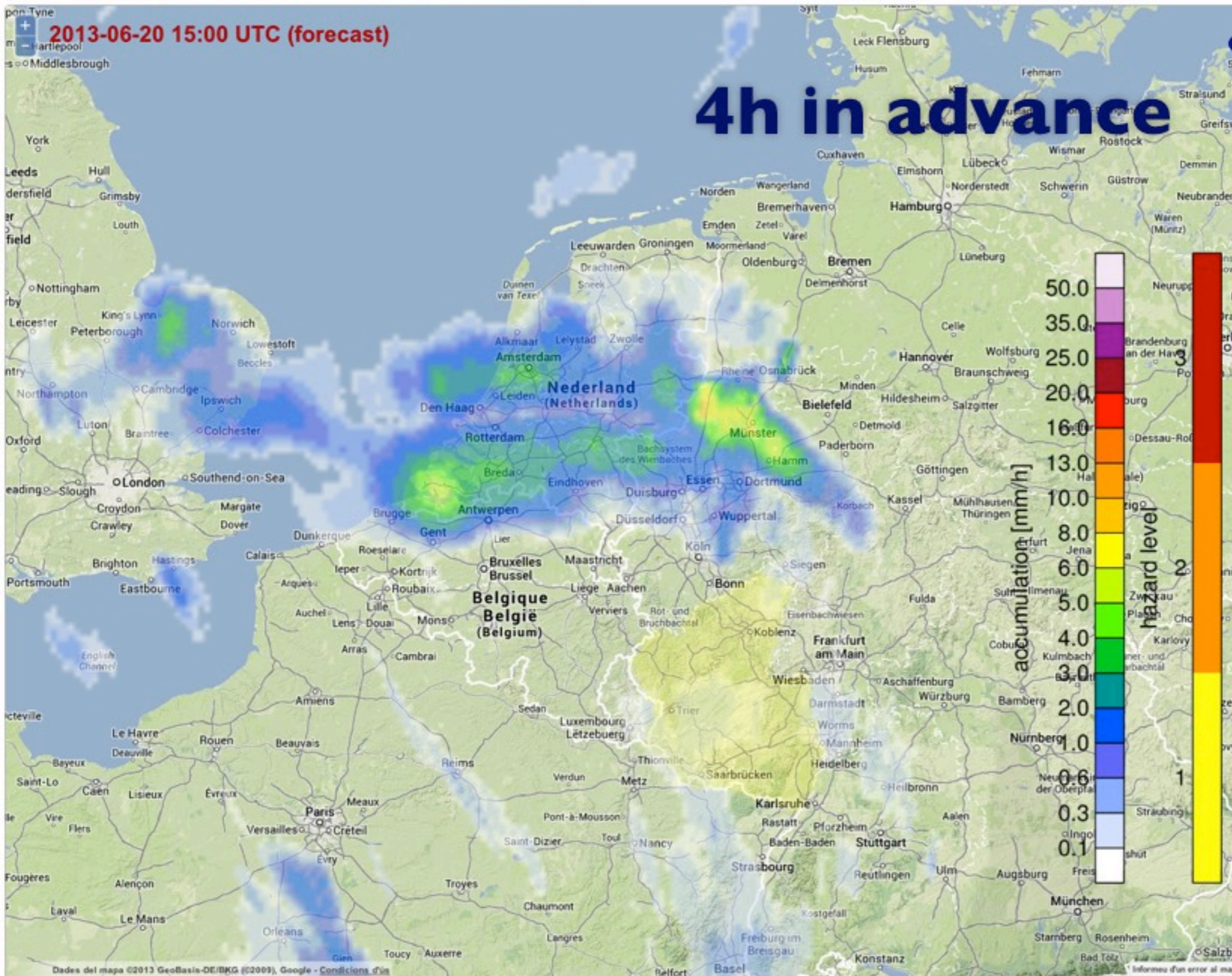
- Layers**
- Convective cells
 - Reflectivity (dBZ)
 - FMI Product

HAREN partners:



Center Lon.:0.99 Lat.:54.81 X (Km utm):109844.92 Y (Km utm):7324521.07





Real Time Historical Episode

Jun 2013

Su	Mo	Tu	We	Th	Fr	Sa
						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						

Today

Number of Frames

Hour:Minute :

Topographies

- Google Physical
- Google Streets
- Google Satellite
- Google Hybrid

Layers

- Hazard Assessment
- Accumulated Rain (1h)

HAREN partners:

Timeline: 2013-06-20 03:00 to 2013-06-20 15:30

Username:

Password:

[Log in](#)

The username haren has been disabled, register to get access.

[Register\(*\)](#)[User guide](#)

(*)Access to the HAREN platform is limited to the project partners and stakeholders and to METEOALARM and OPERA delegates.

FINNISH
METEOROLOGICAL
INSTITUTE

ZAMG

SISÄASIAINMINISTERIÖ
INRIKESMINISTERIET



European
Civil Protection

Hazard Assessment based on Rainfall European Nowcasts

HAREN



Coordinator:



Centre de Recerca Aplicada
en Hidrometeorologia

UNIVERSITAT POLITÈCNICA DE CATALUNYA

Associated Beneficiaries:



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE



ZAMG



SISÄASIAINMINISTERIÖ

Stakeholders:



Provincial Government of Lower Austria
Department for Fire Service and Civil Protection
Warning and Alert Centre for Lower Austria



In collaboration with:



OPERA
EIG EUMETNET PROGRAMME

meteoalarm
alerting europe for extreme weather