



ANYWHERE



www.anywhere-h2020.eu

ANYWHERE tools to support more efficient response through activation of self-protection FRMPs (Flood Directive)





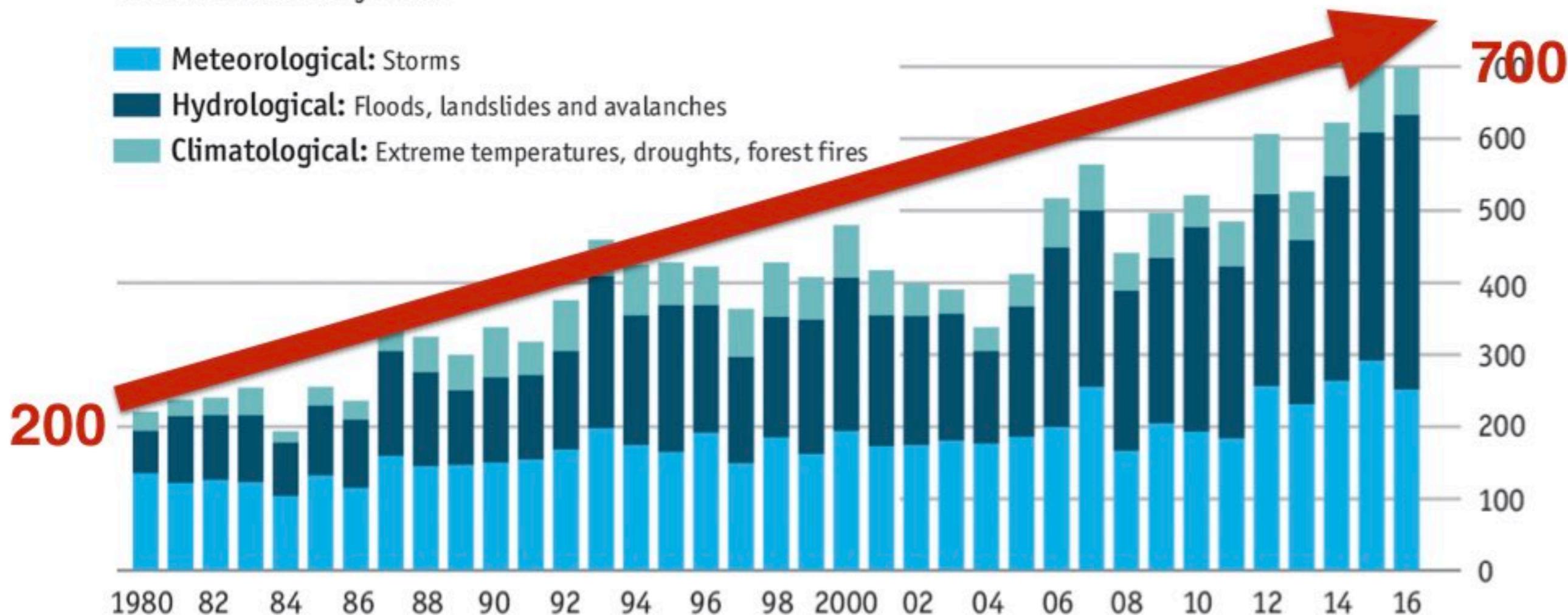
Storms and Floods: challenges for a better management in a changing environment

A rising tide

Natural disasters by cause

- Meteorological: Storms
- Hydrological: Floods, landslides and avalanches
- Climatological: Extreme temperatures, droughts, forest fires

> x3 from 1980



Source: Munich Re

How to support EMCs?



CHANGE OF PARADIGM:
*From RE-ACTIVE to
PRO-ACTIVE RESPONSE*

*Advanced detection and
response*

*Translate best adapted
METEOROLOGICAL
FORECASTS into IMPACT
FORECASTS*

*Connect them to the local
needs to SUPPORT
DECISION MAKING in
EMERGENCY COMMAND
CENTRES*

How to support EMCs?



**Translate best adapted
METEOROLOGICAL
FORECASTS into *IMPACT*
*FORECASTS***

**Multi Hazard
Early Warning System
MH-EWS products**



Hydrometeorological forecasts



Floods, flash-floods, debris flow and landslides



Weather-induced forest fires



Droughts



Heatwaves and weather-induced health impacts



Convective storms, severe winds



Storm surges



Snowfall



MULTI-HAZARD EARLY WARNING SYSTEM

Harness the power of
operational D



A4EU OPERATIONAL PLATFORM

ness toolkit, Designed and
First Responder

www.anywhere-h2020.eu/catalogue

- | | | |
|---|---|---|
|  Accumulated rainfall forecasts |  Daily total precipitation probability |  Extreme Forecast Index |
|  Most probable precipitation type |  Observed daily rainfall accumulation |  Probability of precipitation type |
|  Radar-based rainfall accumulation forecasts |  Radar-based rainfall accumulation probability |  Deterministic gust forecast |
|  Wind gust probability |  Average daily temperature |  Flash flood hazard forecasts |
|  Flash flood impact forecast |  Landslide and debris flow hazard forecast |  River flood impact forecasts |
|  Probabilistic river flood hazard forecasts |  Simulated snow accumulation |  Simulated soil moisture |
|  Burned area |  Fire Danger early warning |  Fire Danger Index |
|  Rate of spread |  Fire Weather Index |  Build Up Index |
|  Duff Moisture Code |  Drought Code |  Fine Fuel Moisture Code |
|  Initial Spread Index |  Drought in precipitation |  Drought in precipitation-
evapotranspiration |
|  Drought in soil moisture |  Drought in runoff |  Drought in discharge |
|  Drought in groundwater |  European air quality forecasts |  Heatwave Index (UTCI) |
|  Deterministic gust forecast |  Wind gust probability |  Convective storms |
|  Storm surge sea level |  Storm surge inundation hazard |  Storm surge hazard level |
|  Safe Corridor Width |  Deterministic snow and hoar load | |



**Translate best adapted
METEOROLOGICAL
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FORECASTS**

**Multi Hazard
Early Warning System
MH-EWS products**

www.anywhere-h2020.eu/catalogue



ANYWHERE 



European
Civil Protection

How we can support decision making at operational control centers during flood emergencies?



Riverine Floods (Coastal too):

- LONG time responses
(**days**)
- **We know WHERE**
 - Mapping of risk can be done
 - Defence and structural measures are possible
 - **PLANNING is CRUCIAL**
- **We know WHAT TO DO**
 - River restoration
 - Floodplain recuperation
 - EVACUATION can be done

Flash and Pluvial Floods:

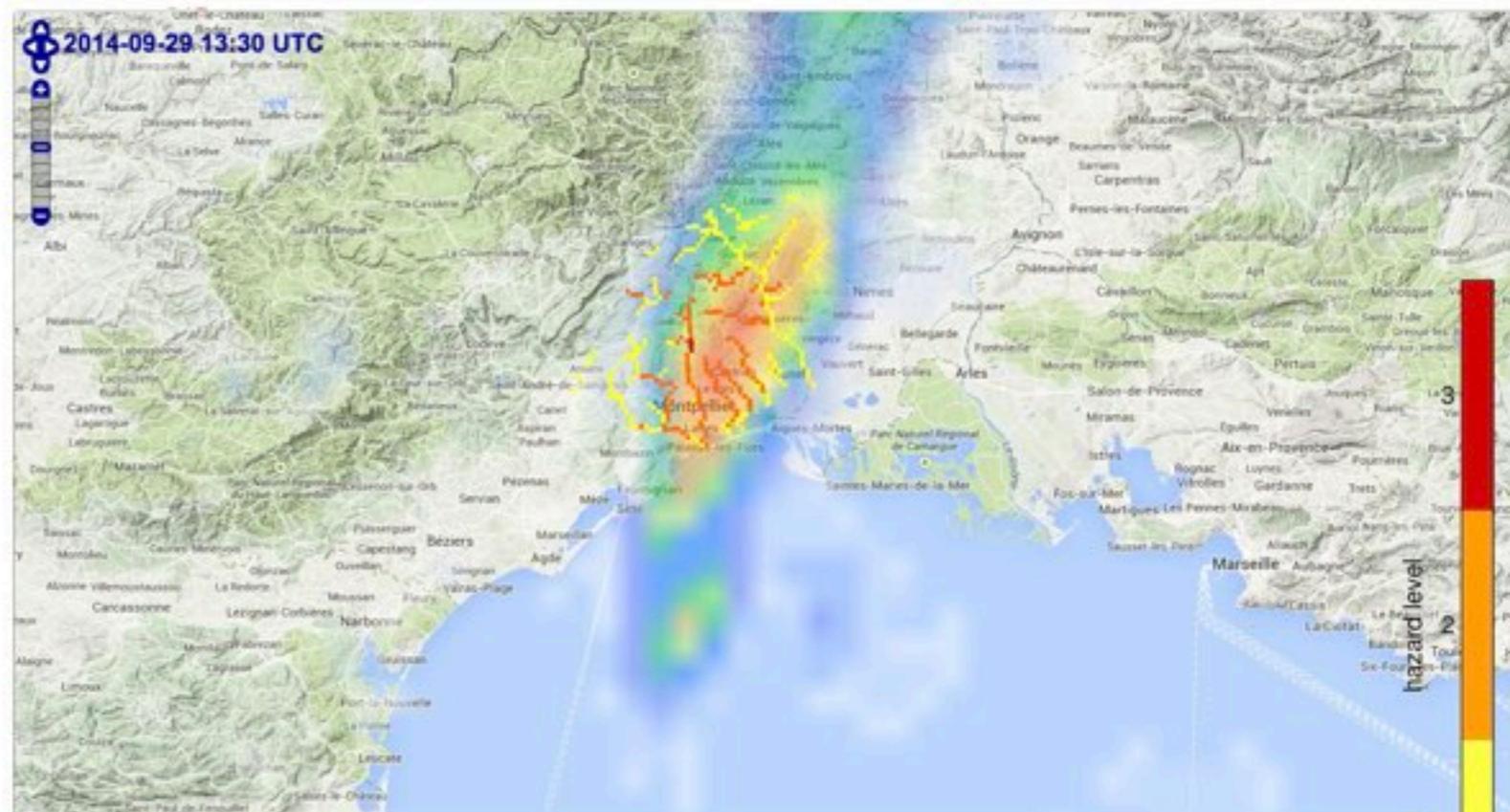
- **SHORT** time responses
(**several 1/4 h**)
- **Can be ANYWHERE**
 - Probability increasing with CC + increase of HEAVY RAINS + increase of URBANIZATION
 - Structural measures are out of question
 - **REAL-TIME MANAGEMENT of the RESPONSE is CRUCIAL**
- **We DON'T KNOW** what to do! **Need of a NEW PARADIGM**
 - **CITIZENS** involvement
 - **SELF-PROTECTION Flood Risk Management Plans**

How to support EMCs?



**Translate best adapted
METEOROLOGICAL
FORECASTS into *IMPACT*
FORECASTS**

Forecasting impacts: Flash Flood Impacts



**Flash Flood impact forecasting in
any 1-km² of EU with 2h
anticipation**



Catalogue of ANYWHERE Products for Hazard Forecasting and Impact Localization due to Weather and Climate Events



Multi-Hazard Early Warning System



A4EU Operational Platform

www.anywhere-h2020.eu/catalogue

At 1km over the entire EU, at 200m in pilot sites

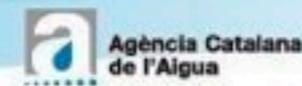
FF-EWS CONCEPT First developed in Catalonia for the Water Agency and **OPERATIONAL SINCE 2006**



Català Castellano English



OPERATIONAL CENTER
Catalonian Water Agency



Dades d'avui Pluja Mapa d'avisos Històrics



Mapa d'avisos

Detecció d'indrets on cal posar-hi una atenció especial.

Avisos Hidrològics

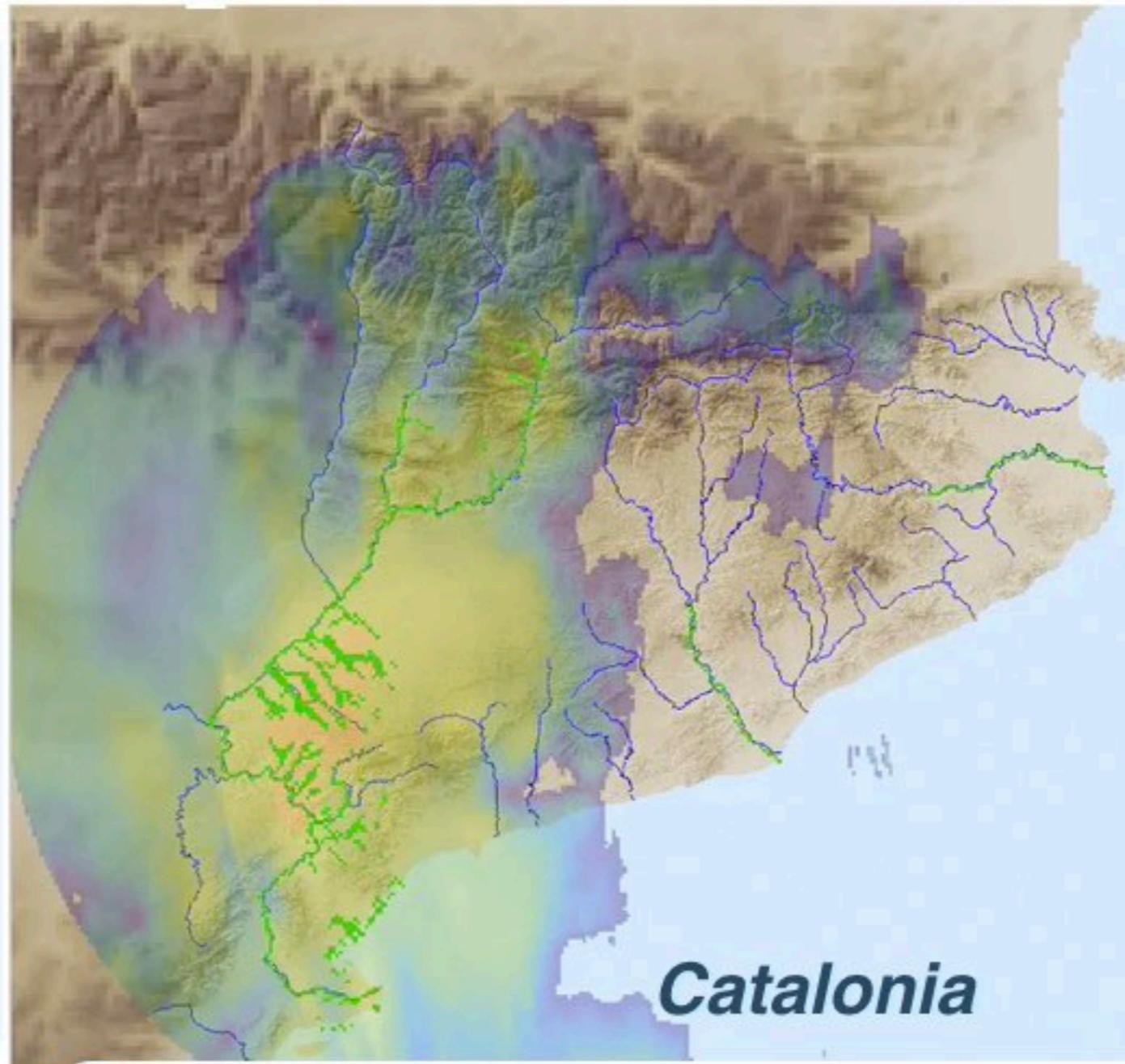
Aigua acumulada

Aigua al riu

Avisos Meteorològics

Avisos (SMC)

Estat Hidrologia:



Perill (T2)
Alerta (T1)
Activació (T0.5)
Consigna

00:30 UTC
02/11/2008
Hora Inici: 00:00
Hora Fi: 00:00
X (Km_{UTM}): 521
Y (Km_{UTM}): 4642

0:00 4:48 9:36 14:24 19:12 0:00

Informació de les capes | Gestió de capes

- (100%) Alerta pluja agregada
- (100%) Acum30
- (31%) Acum30 combi
- Capa Rius
- (100%) Acum1dia
- (100%) Comb1dia
- (100%) Comb30
- (100%) Alerta pluja puntual
- (100%) Topografia2
- QPresente

Transparencia

Catalonia

<http://aca-web.gencat.cat/aetr/aetr2/>



2006: FF-EWS operational at Water Agency of Catalonia

2009-2012

FP 7 Cooperation Work Programme: Environment
Collaborative Project

IMproving Preparedness and Risk maNagement for flash floods and debris flow events

IMPRINTS 

FP7-ENV-2008-1-226555
January 2009 - November 2012

EC FP7 PROJECT COORDINATED BY



Centre de Recerca Aplicada en Hidrometeorologia
UNIVERSITAT POLITÈCNICA DE CATALUNYA

2012

EPIC
(now ERIC)
Index of Flash Flood Hazard into EUROPEAN FLOOD AWARENESS SYSTEM (EFAS)

BASED ON NWP

2012-2017



Hazard Assessment based on Rainfall

European Civil Protection **Prevention & Preparedness Projects**

European Demonstration of a rainfall and lightning...

European Civil Protection **Prevention & Preparedness Projects**

Integrating a European Rainfall-Induced Hazard Assessment system (ERICHA)

ERICHA

<http://www.ericha.eu>

Coordinator: Centre de Recerca Aplicada en Hidrometeorologia, UPC

Stakeholders: European Civil Protection, OPERA, ECMWF, JRC, ies, VAISALA

Associated Beneficiaries: SISÄMINISTERIÖ, INRIKESMINISTERIET

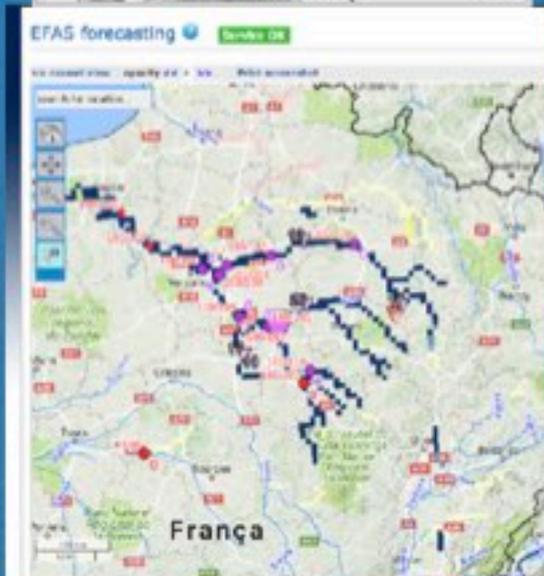
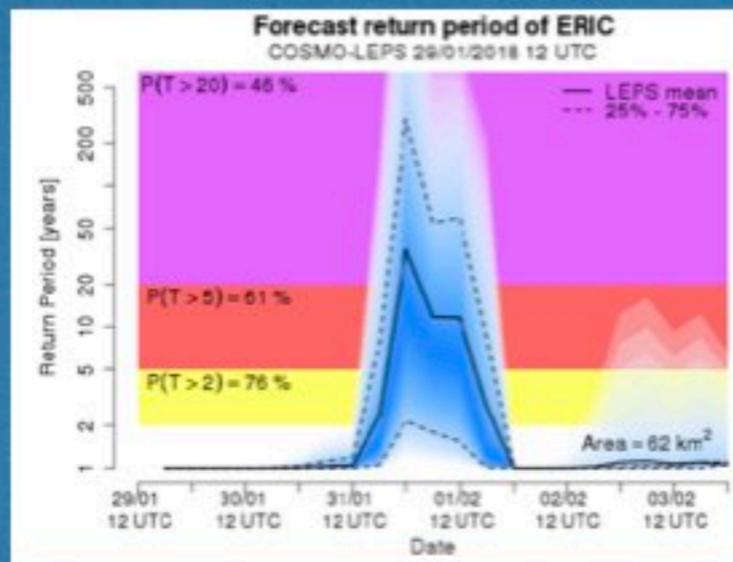
2017

Flash Flood Hazard Warning BASED ON OPERA DATA into EFAS ERICHA

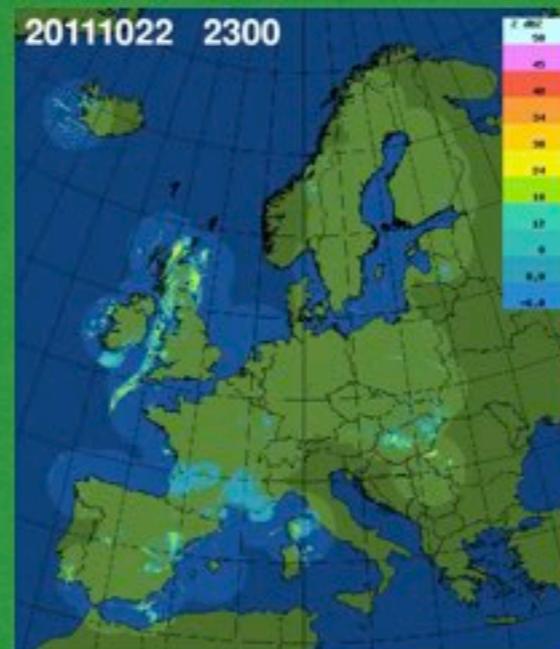
BASED ON RADAR

EUROPEAN FLOOD AWARENESS SYSTEM (EFAS)

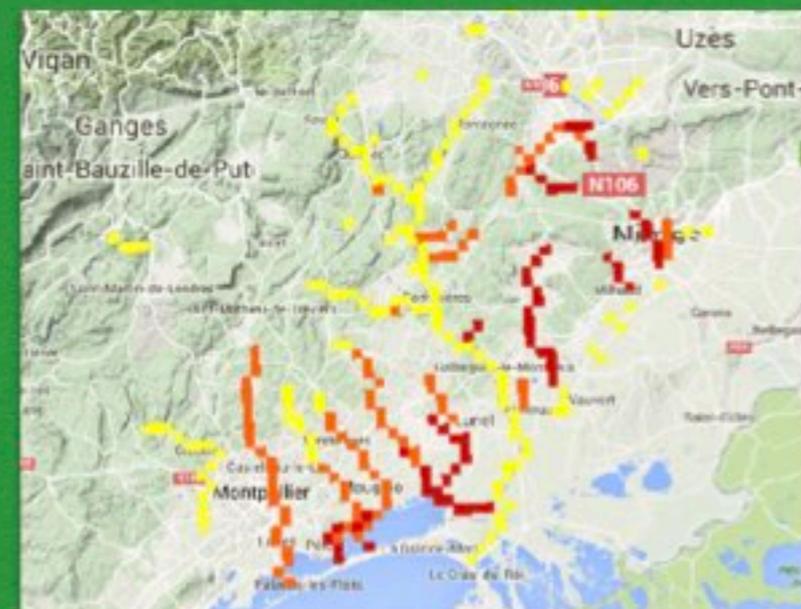
FROM 72h to 6h ahead NWP forecasts



FROM 6h to 2h ahead RADAR BASED Nowcasting



ERICHA FLASH FLOOD INDICATOR



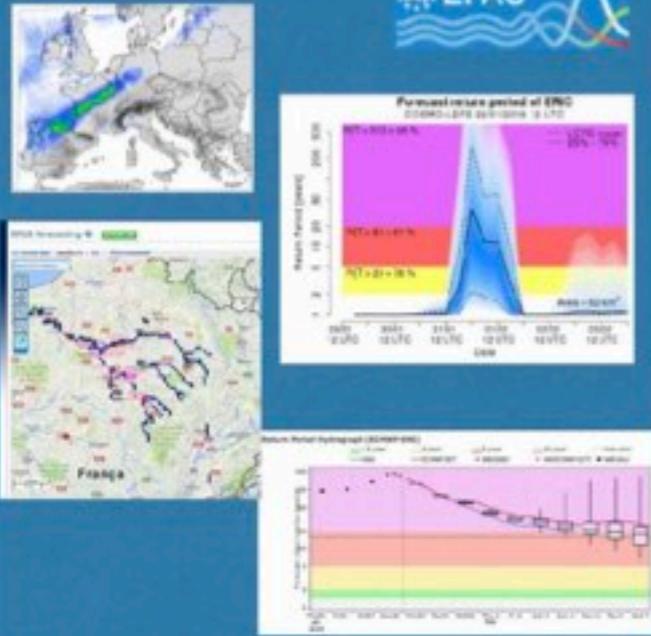
EFFS

IMPRINTS

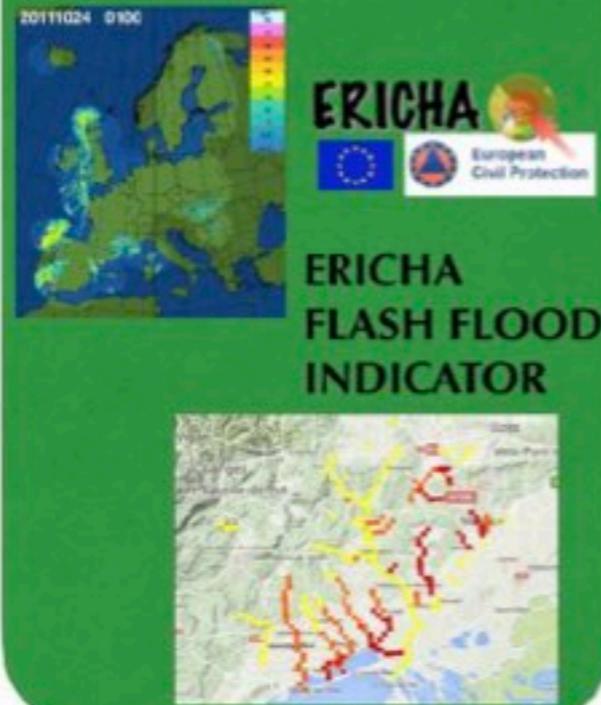
MULTI HAZARD EARLY WARNING SYSTEM

EUROPEAN FLOOD AWARENESS SYSTEM (EFAS)

FROM 72h to 6h ahead
NWP forecasts



FROM 6h to 2h ahead
RADAR BASED Nowcasting



@ 200 m
resolution



CIVIL PROTECTIONS
More efficient RESPONSE

SELF-PROTECTION FRMPs
Citizens / Activities

ANYWHERE A4EU capabilities



Integrate IMPACT FORECASTS with local layers to SUPPORT DECISION MAKING in EMERGENCY COMMAND CENTRES



112 Calls

- Last 30 min
- (30, 60] min
- (60, 90] min

112 calls and crowdsourcing

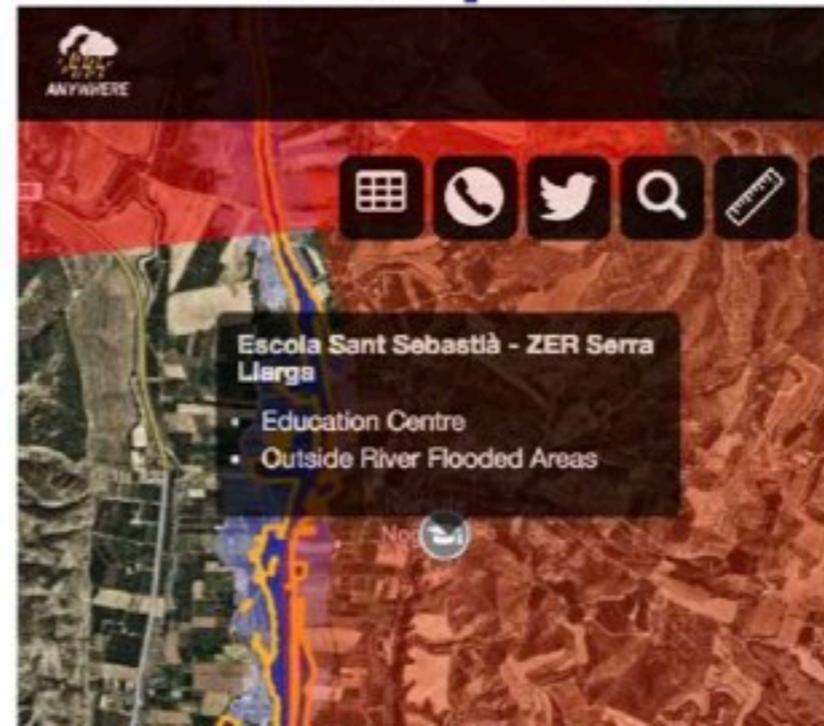
EU Flood Directive Risk Maps



Automatic activation of critical points



Meteorological Forecasting



Local sensors



ANYWHERE A4EU capabilities



Integrate IMPACT FORECASTS with local layers to SUPPORT DECISION MAKING in EMERGENCY COMMAND CENTRES



112 Calls

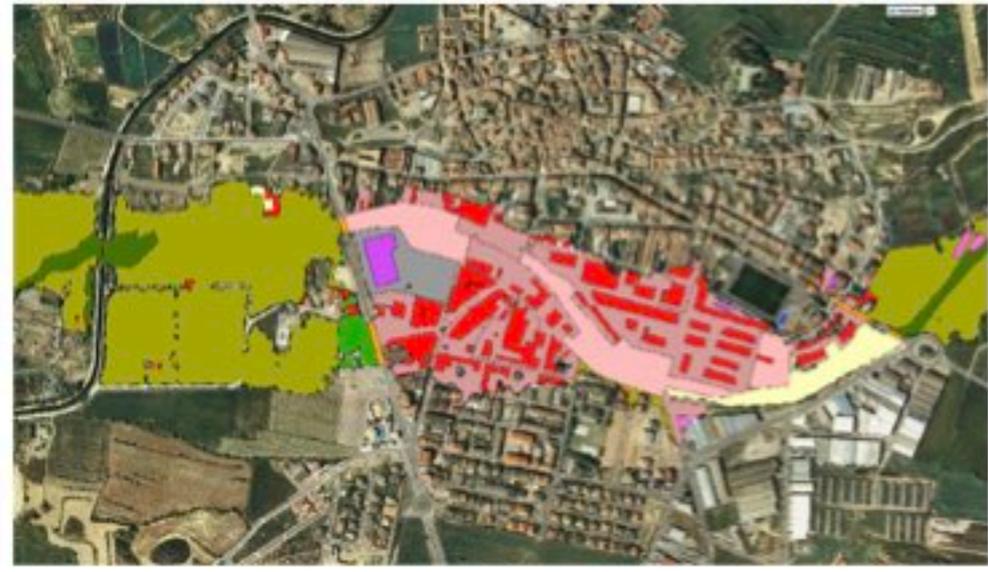
- Last 30 min
- (30, 60] min
- (60, 90] min

112 calls and crowdsourcing

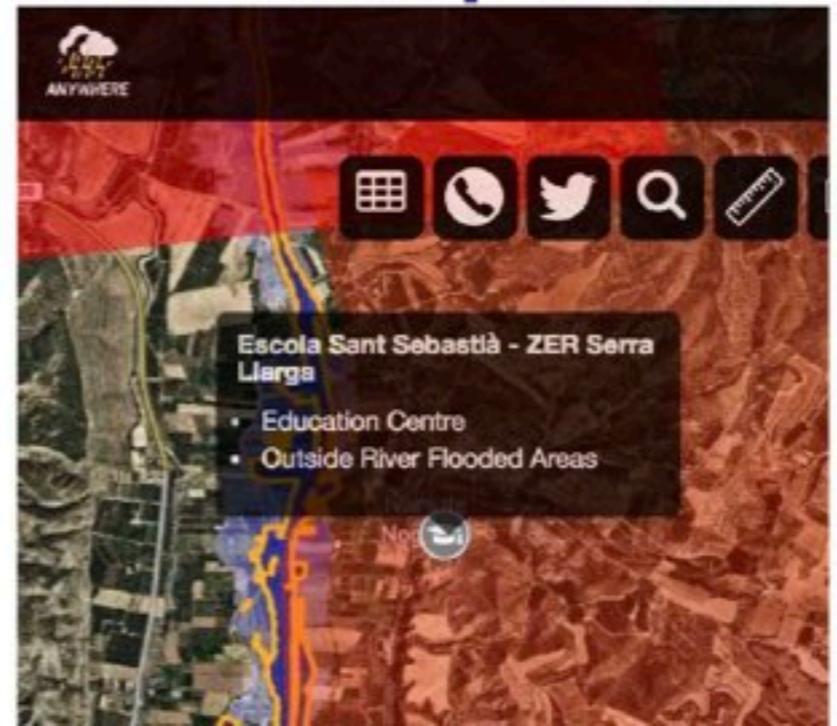
EU Flood Directive Risk Maps



Vulnerability Maps



Automatic activation of critical points



Local sensors

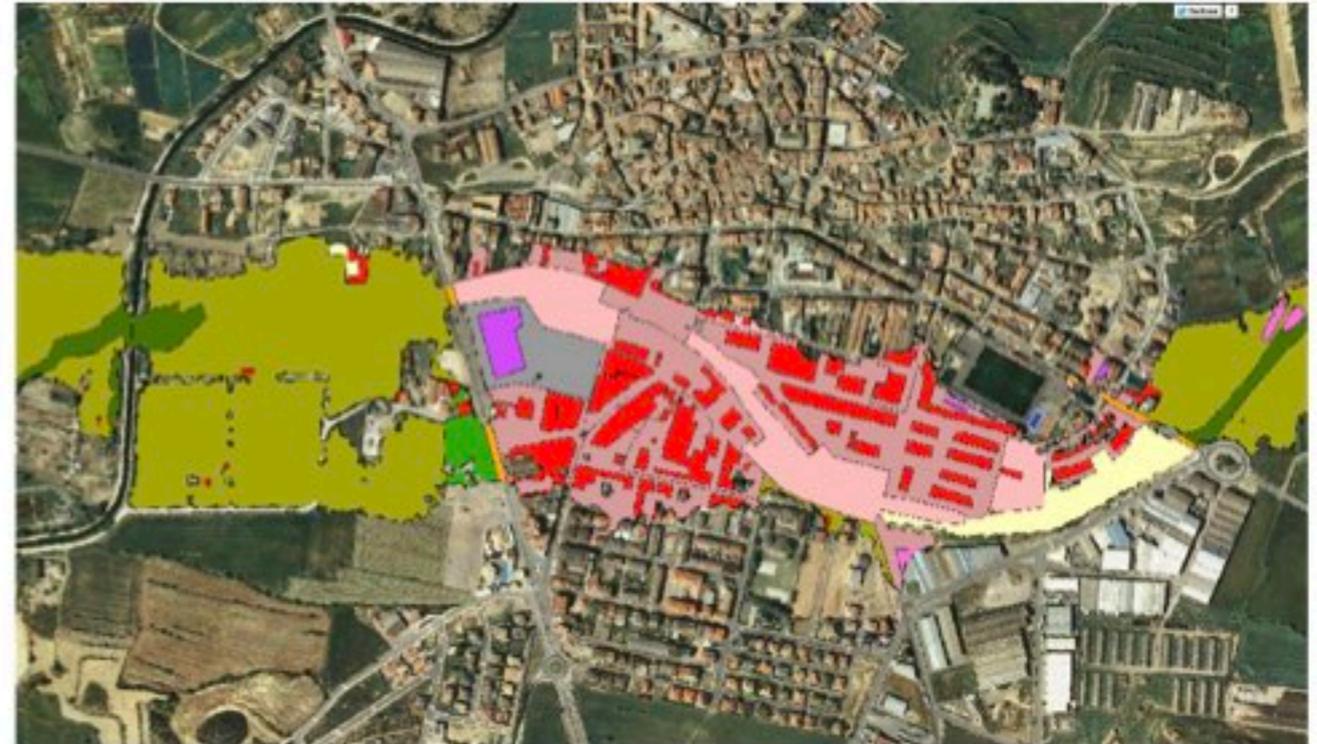


ANYWHERE A4EU capabilities



*Integrate IMPACT FORECASTS with local layers to **SUPPORT DECISION MAKING** in EMERGENCY COMMAND CENTRES*

Vulnerability Maps



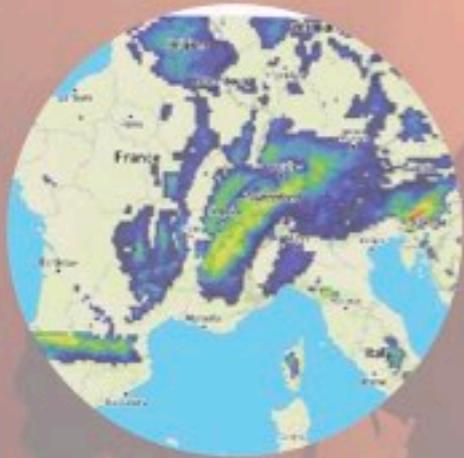
From EU scale to BUILDING scale



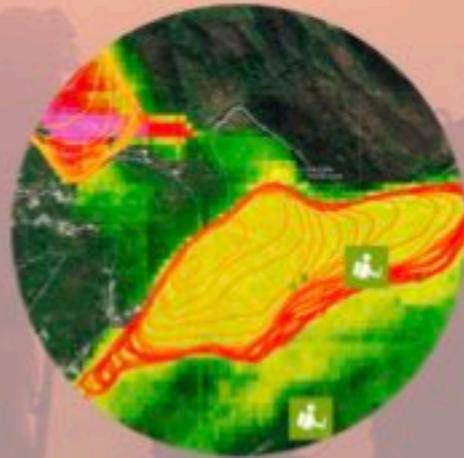
Meteorological Forecasting

KEY TOOL For Flood Risk Management Plans in the EU FLOOD DIRECTIVE

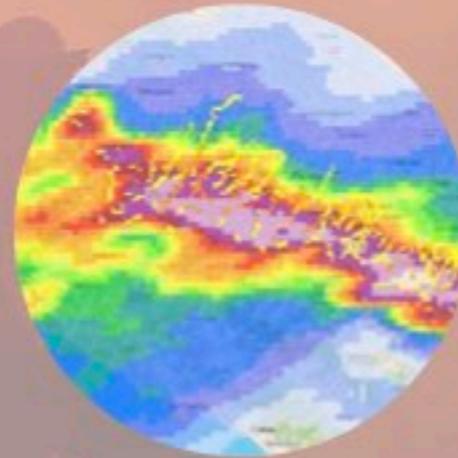
The ANYWHERE approach based on **impact forecasting** represents a disruptive innovation in the field of the **climatic emergencies operational management**



Meteorological forecasts



Hazard forecasts



Impact forecasts

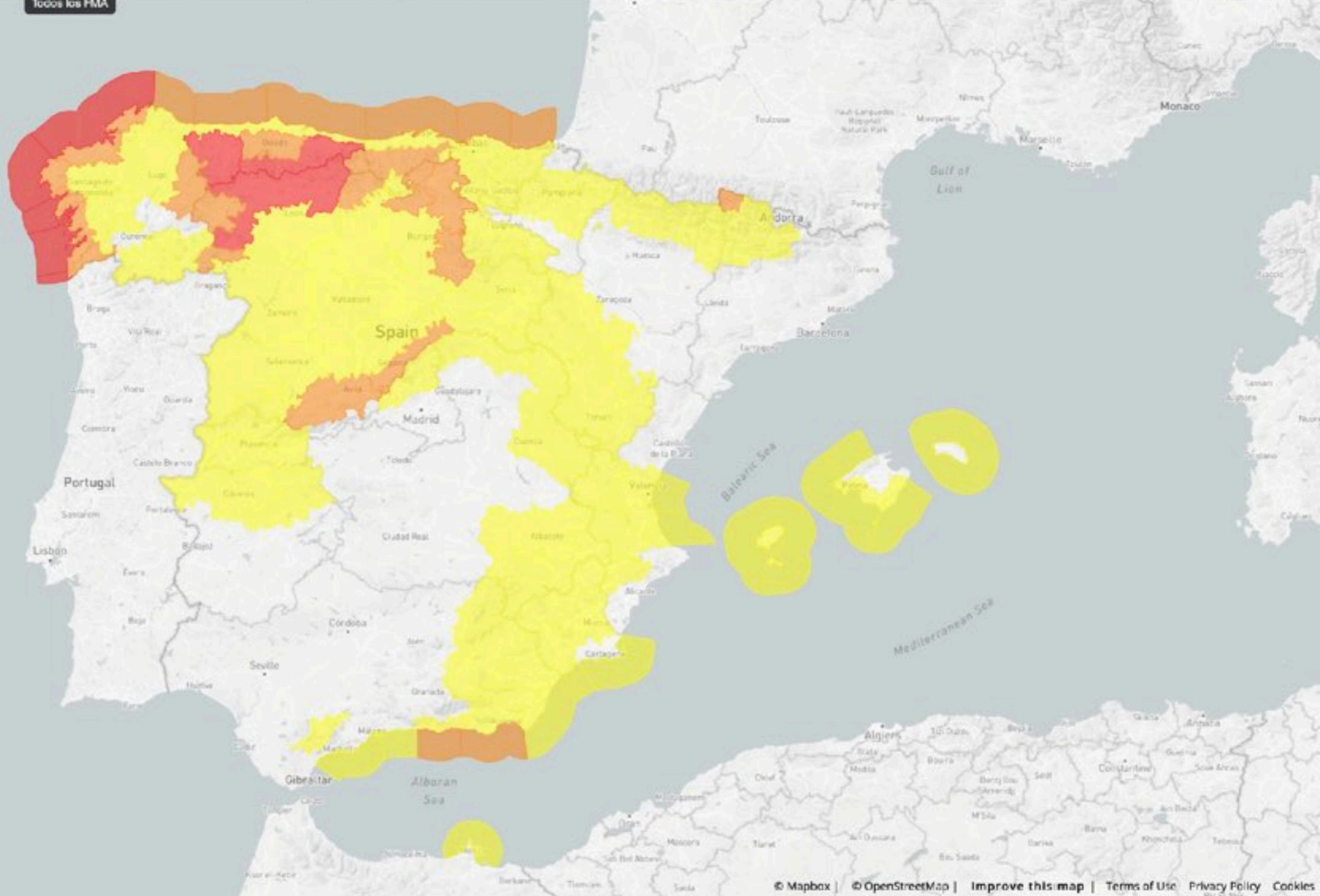


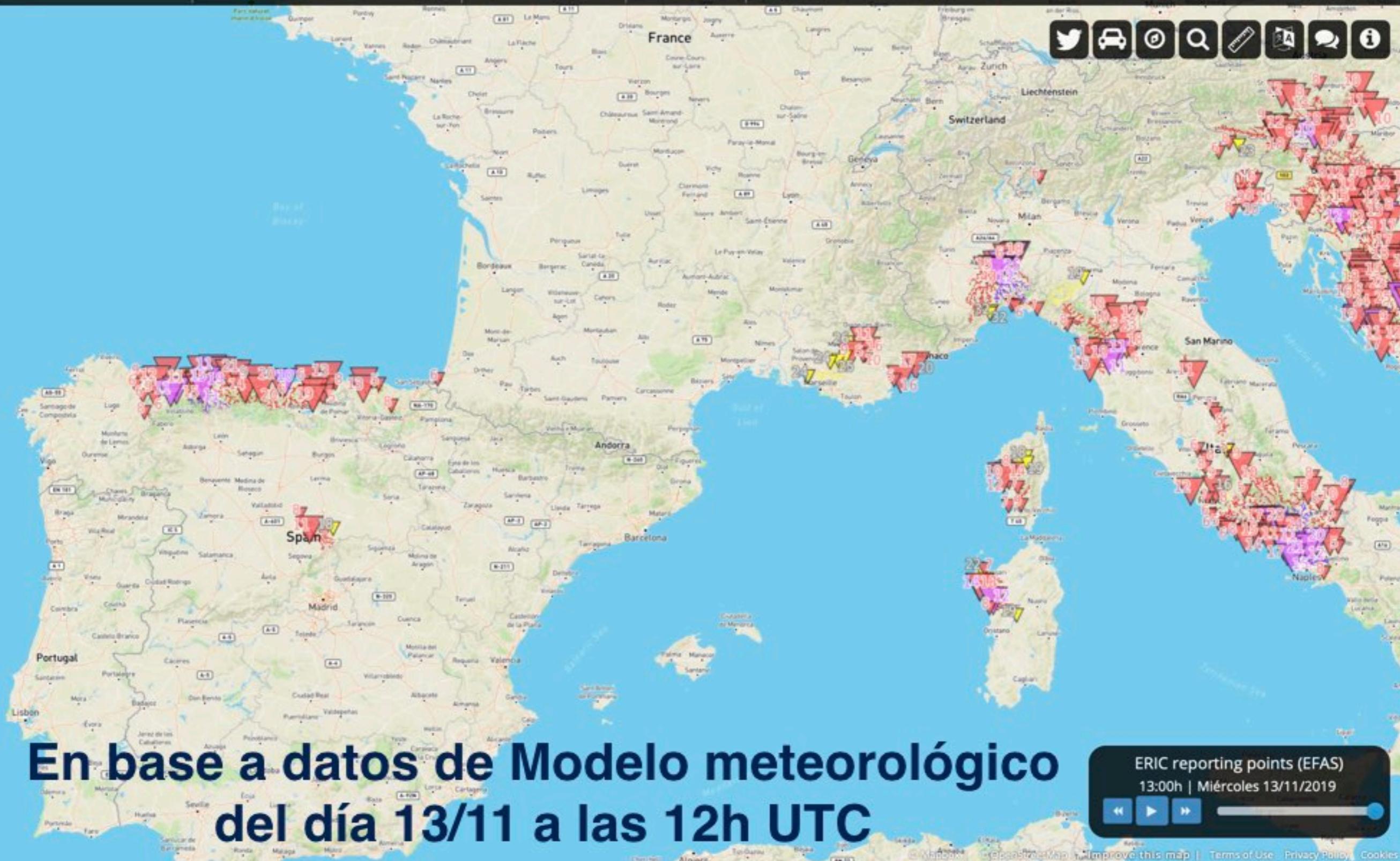
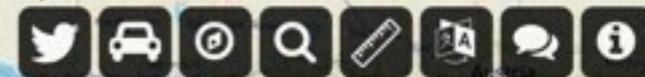
Actionable decisions



Operational solutions

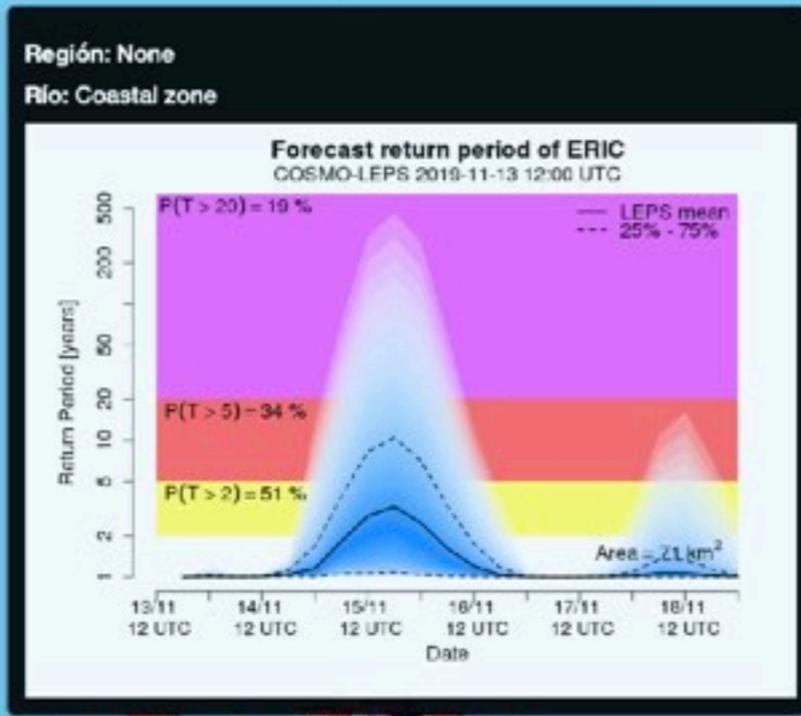
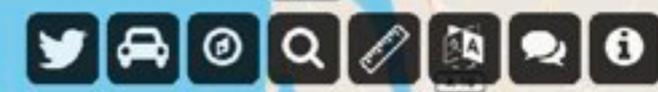






En base a datos de Modelo meteorológico del día 13/11 a las 12h UTC

ERIC reporting points (EFAS)
13:00h | Miércoles 13/11/2019



ERIC reporting points (EFAS)
13:00h | Miércoles 13/11/2019

12:45

4G

Connexió no segura — a4cat.hydsd



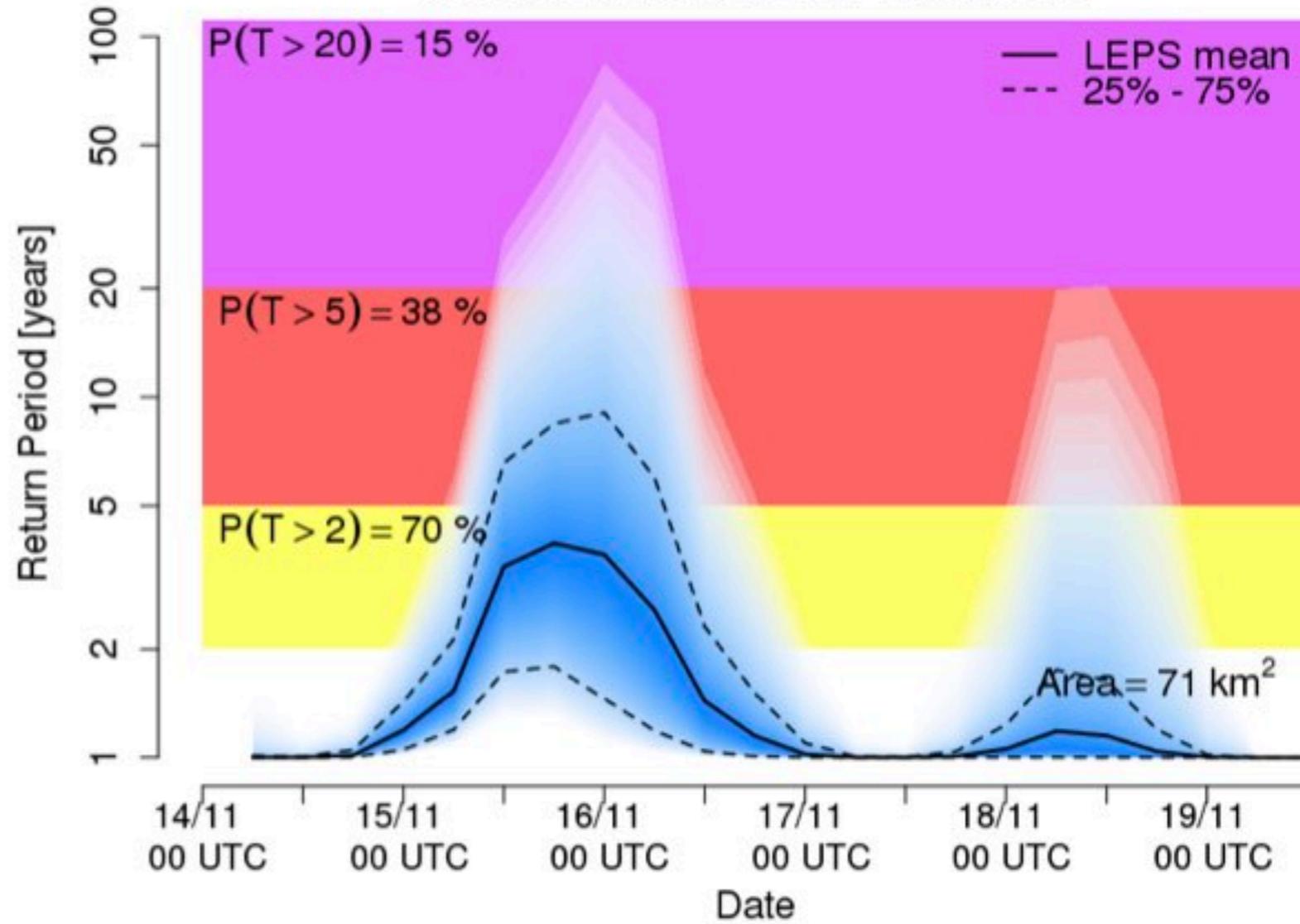
ERIC reporting points (EFAS)

01:00h | Dijous 14/11/2019



Forecast return period of ERIC

COSMO-LEPS 2019-11-14 00:00 UTC



Actualización del Modelo el 14/11 a las 00h UTC



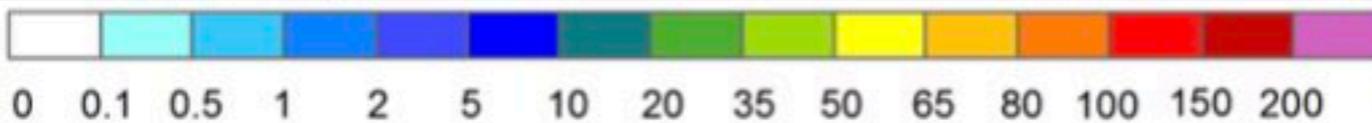
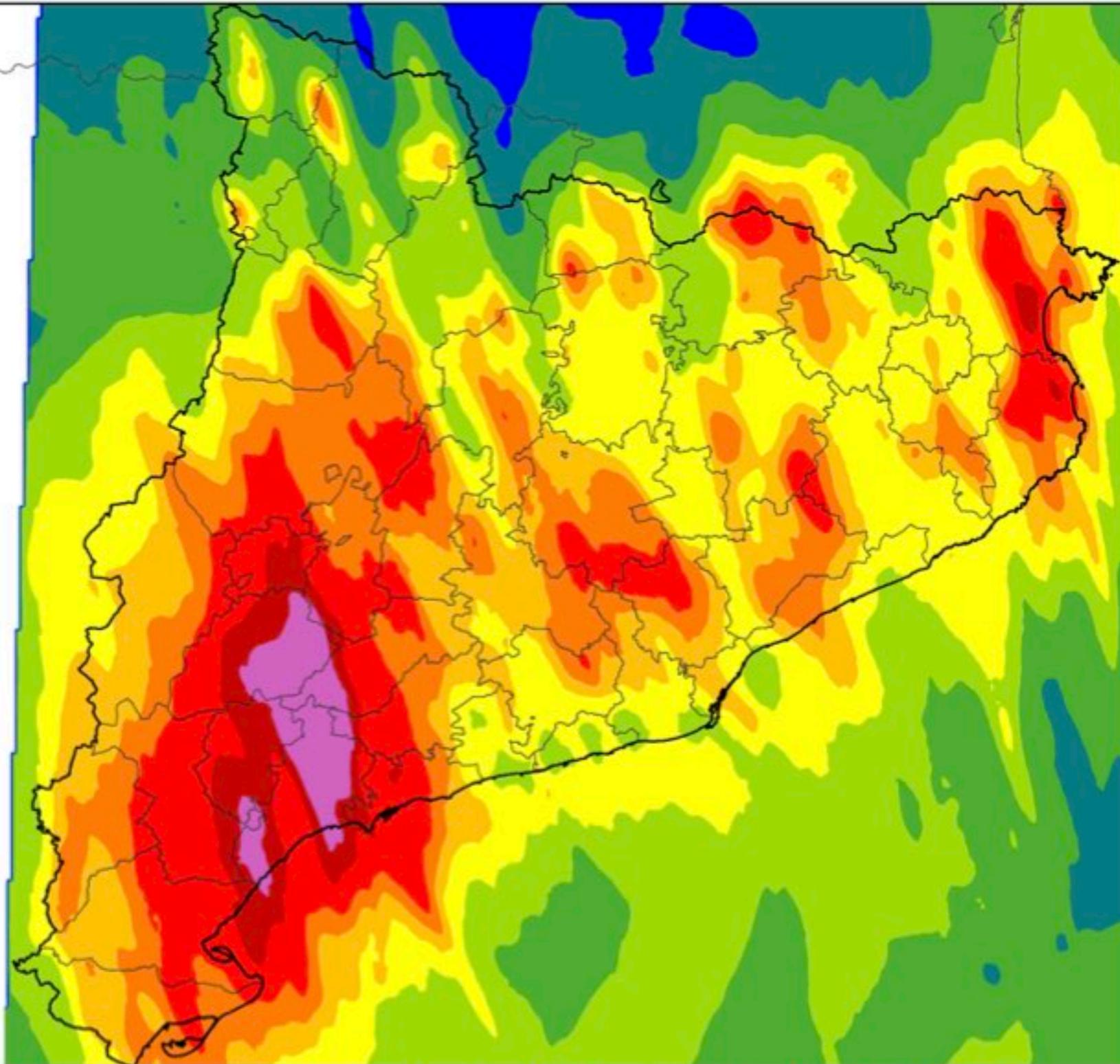
Estimació de la precipitació acumulada (mm)

22 i 23 d'octubre de 2019 (fins a les 6h)

S'obté combinant les dades dels radars de la XRAD i dels pluviòmetres de la XEMA

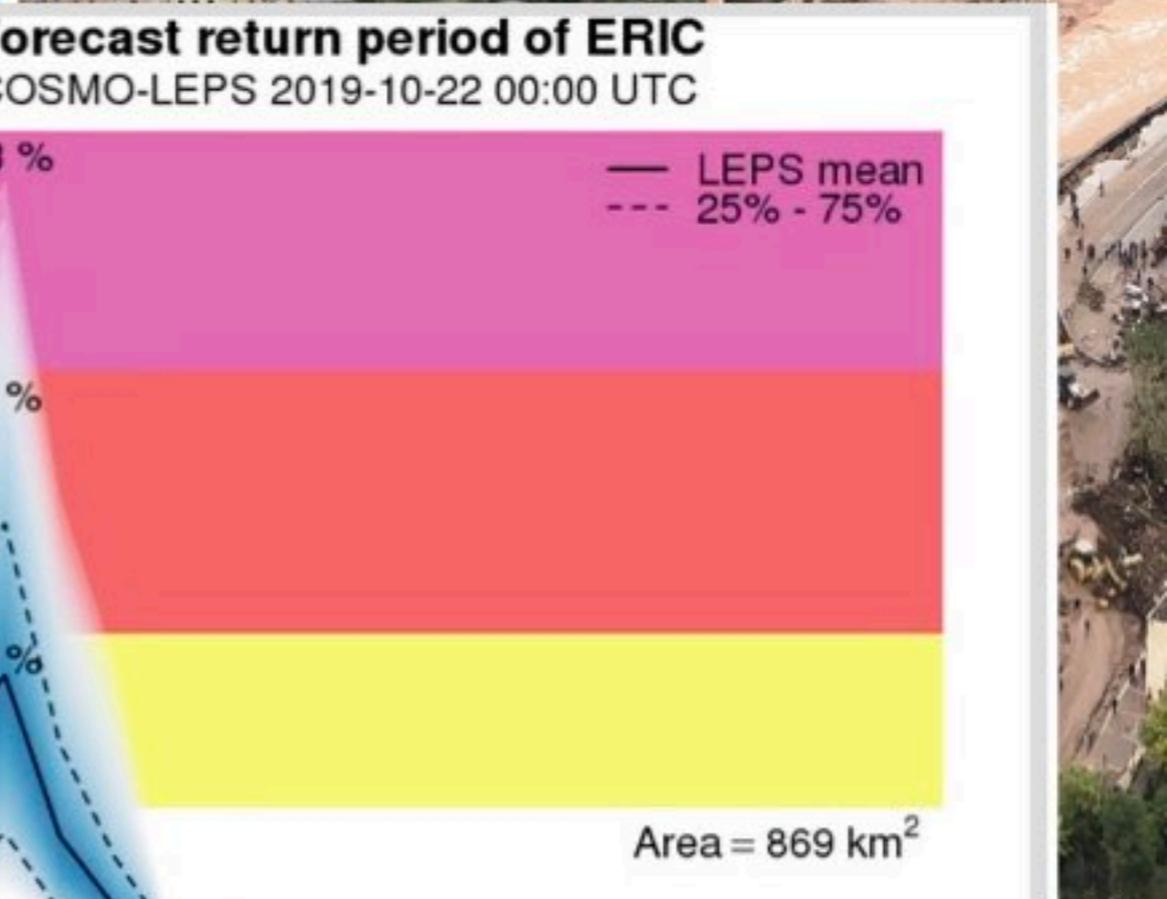
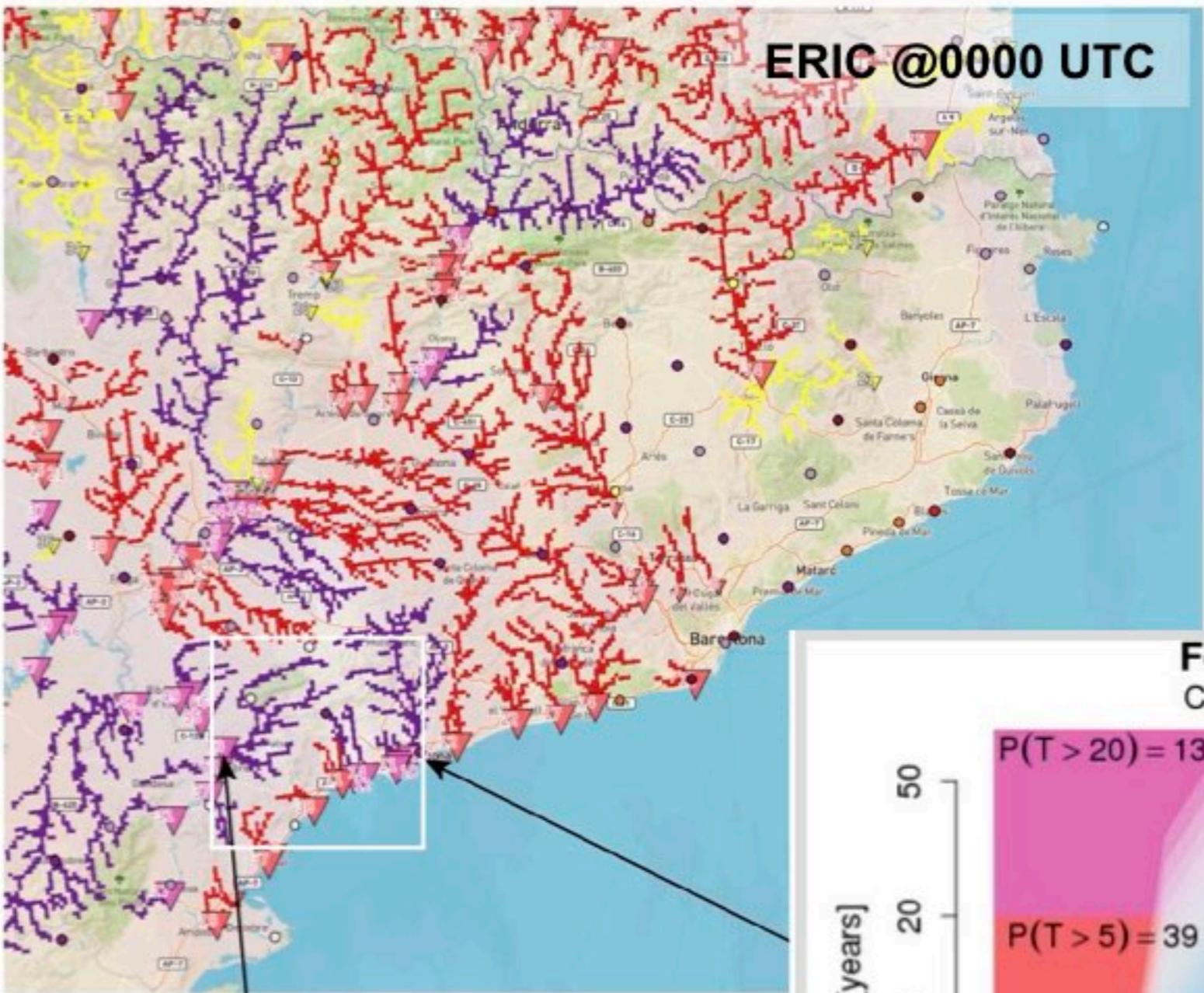
22-23

October 2019 Catalonia Event accumulated rainfall



Servei Meteorològic de Catalunya

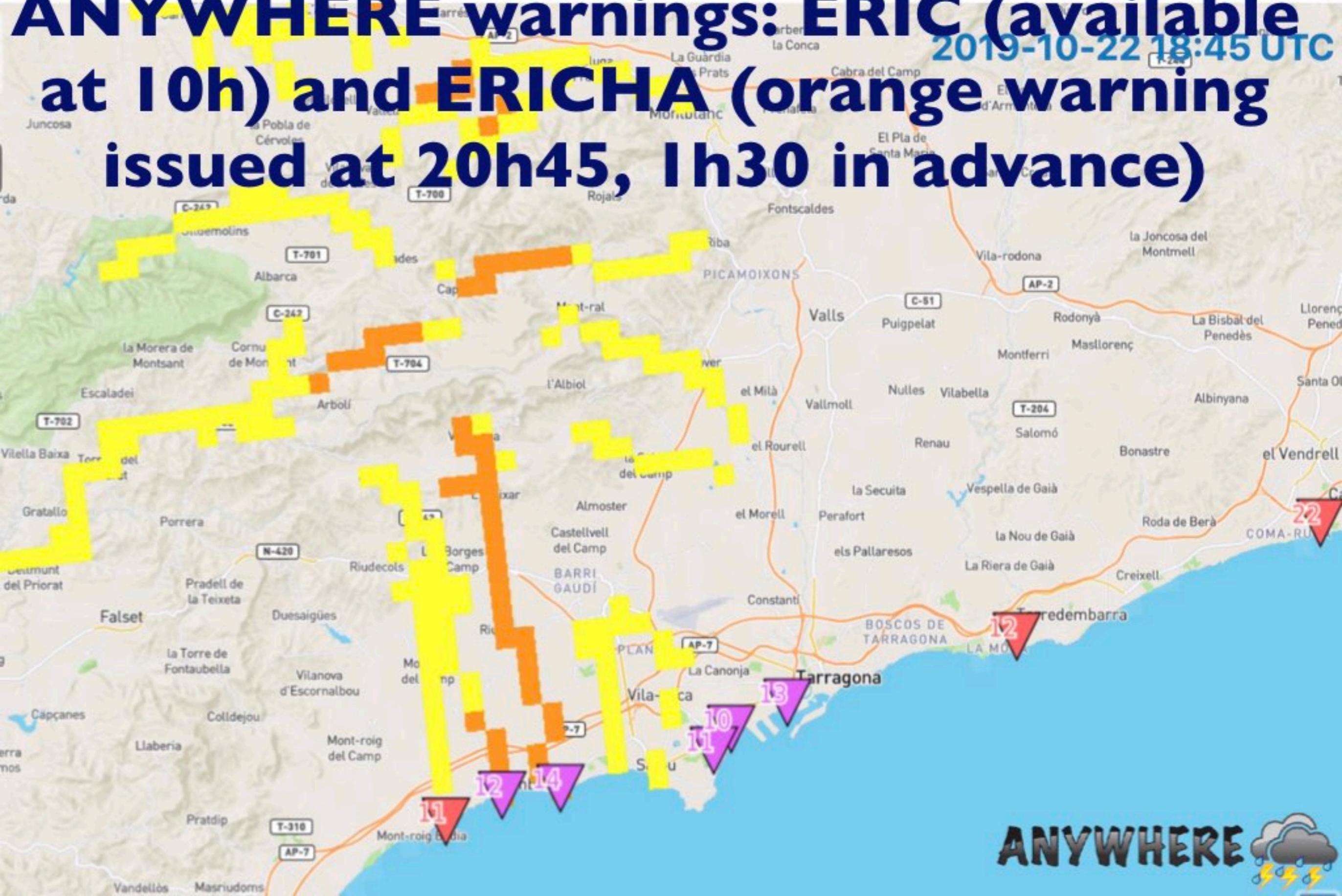




22 October 2019 Flash Flood

ANYWHERE warnings: ERIC (available at 10h) and ERICHA (orange warning issued at 20h45, 1h30 in advance)

2019-10-22 18:45 UTC



ANYWHERE

22 Oct 2019 @22:15

 Montblanc (riu) ✕

Tipus: aforament

Xarxa: ACA

Coordenades: 347766 4580851 31T

Codi Estació: 430862-001

Riu: RIU FRANCOLÍ

Municipi: MONTBLANC

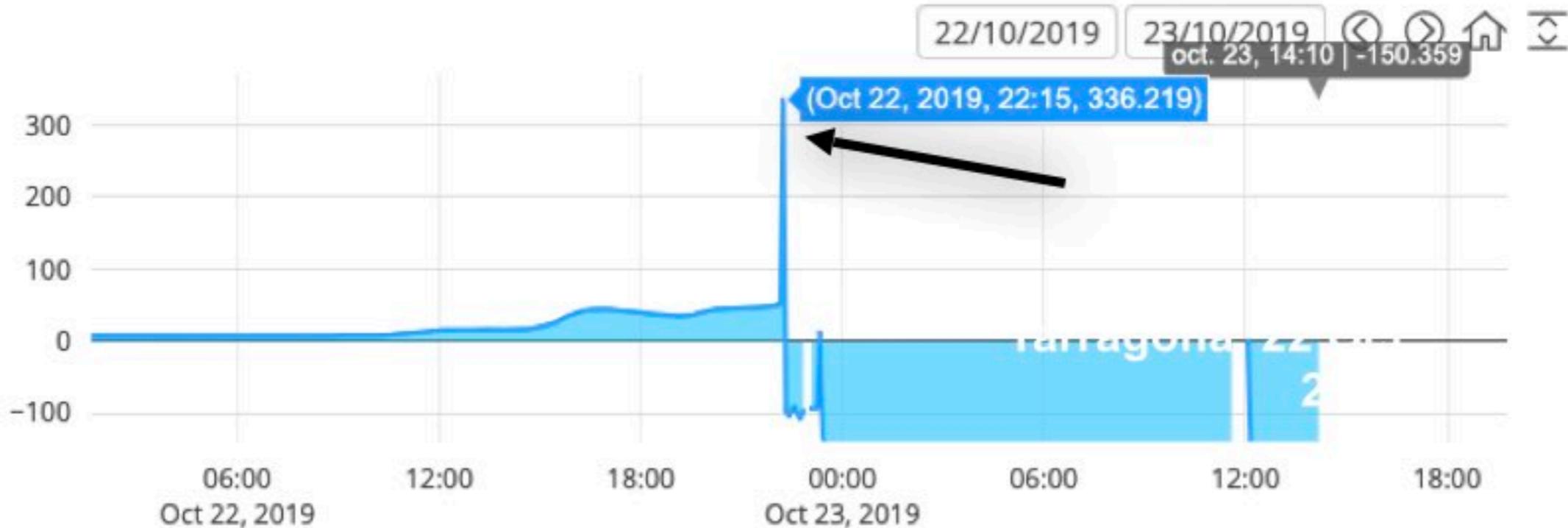
Comarca: CONCA DE BARBERÀ

Conca: EL FRANCOLÍ



Gràfiques - dissabte 26, octubre 2019

cabal nivell



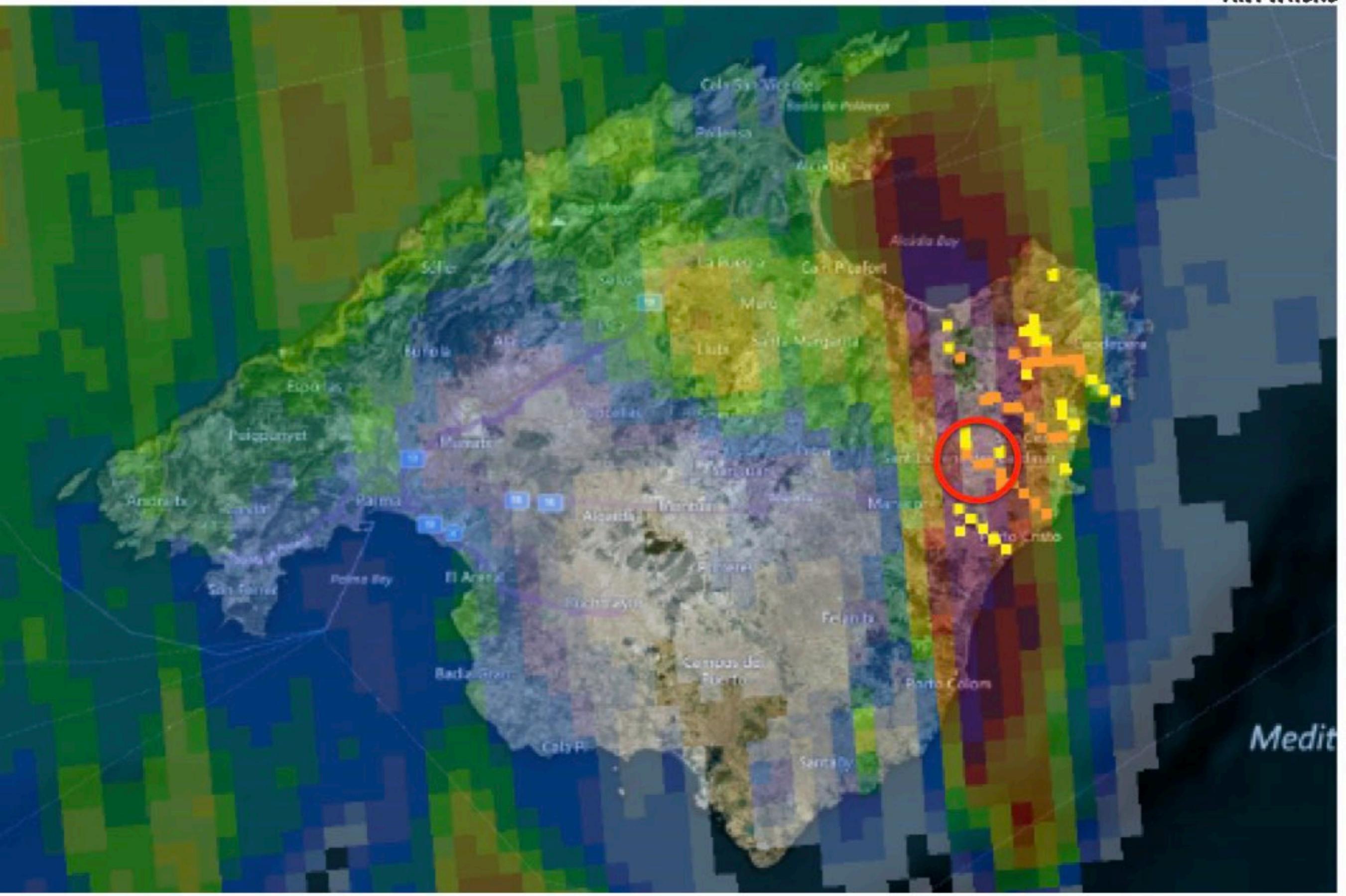
9 October 2018 Mallorca Event

Heavy rainfall (>200 mm in few hours) caused flash floods, mainly in the village of Sant Llorenç des Cardassar.

13 fatalities, 600 residential houses affected, over 90 M€ in damages

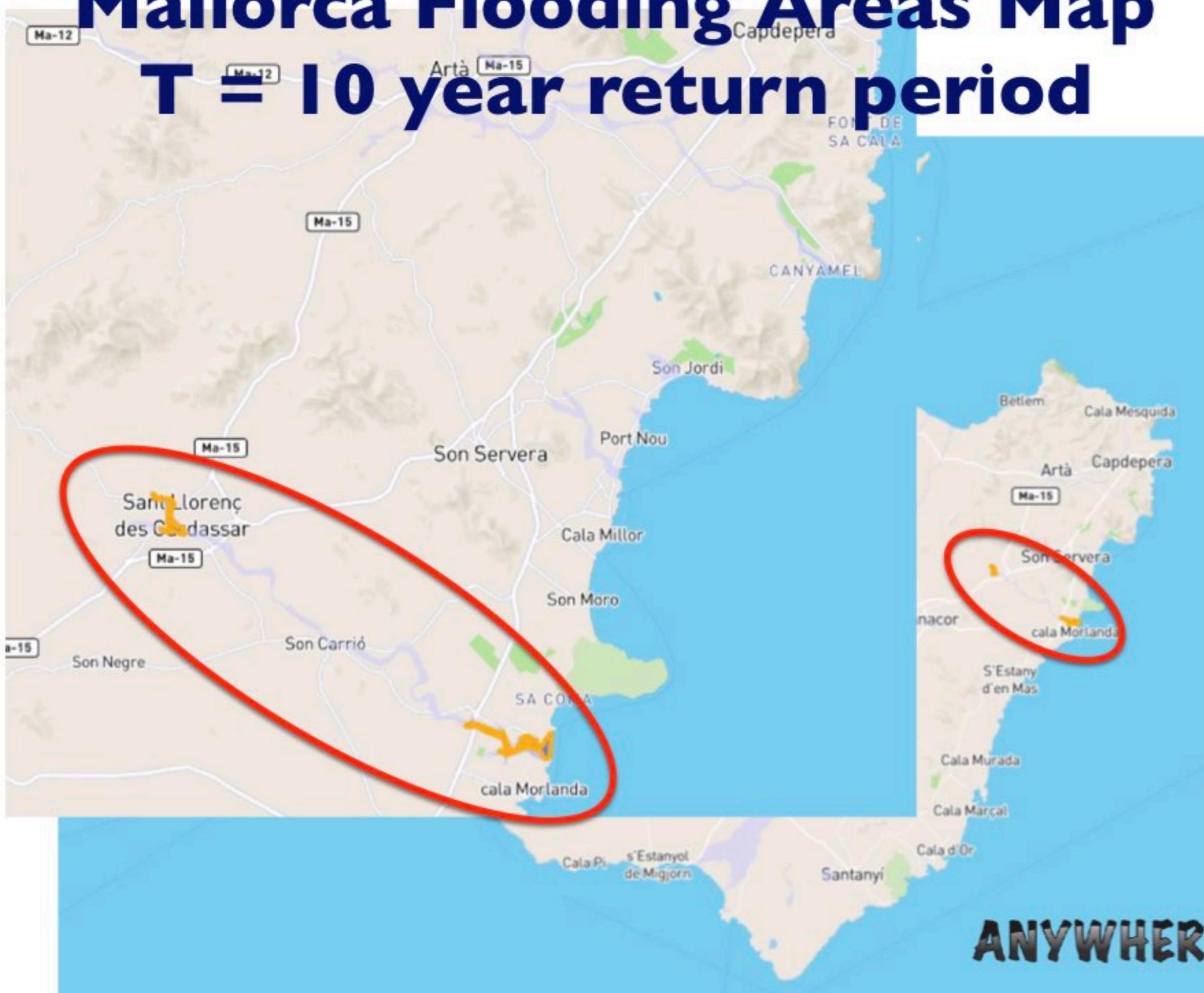


9 October 2018 Mallorca Event



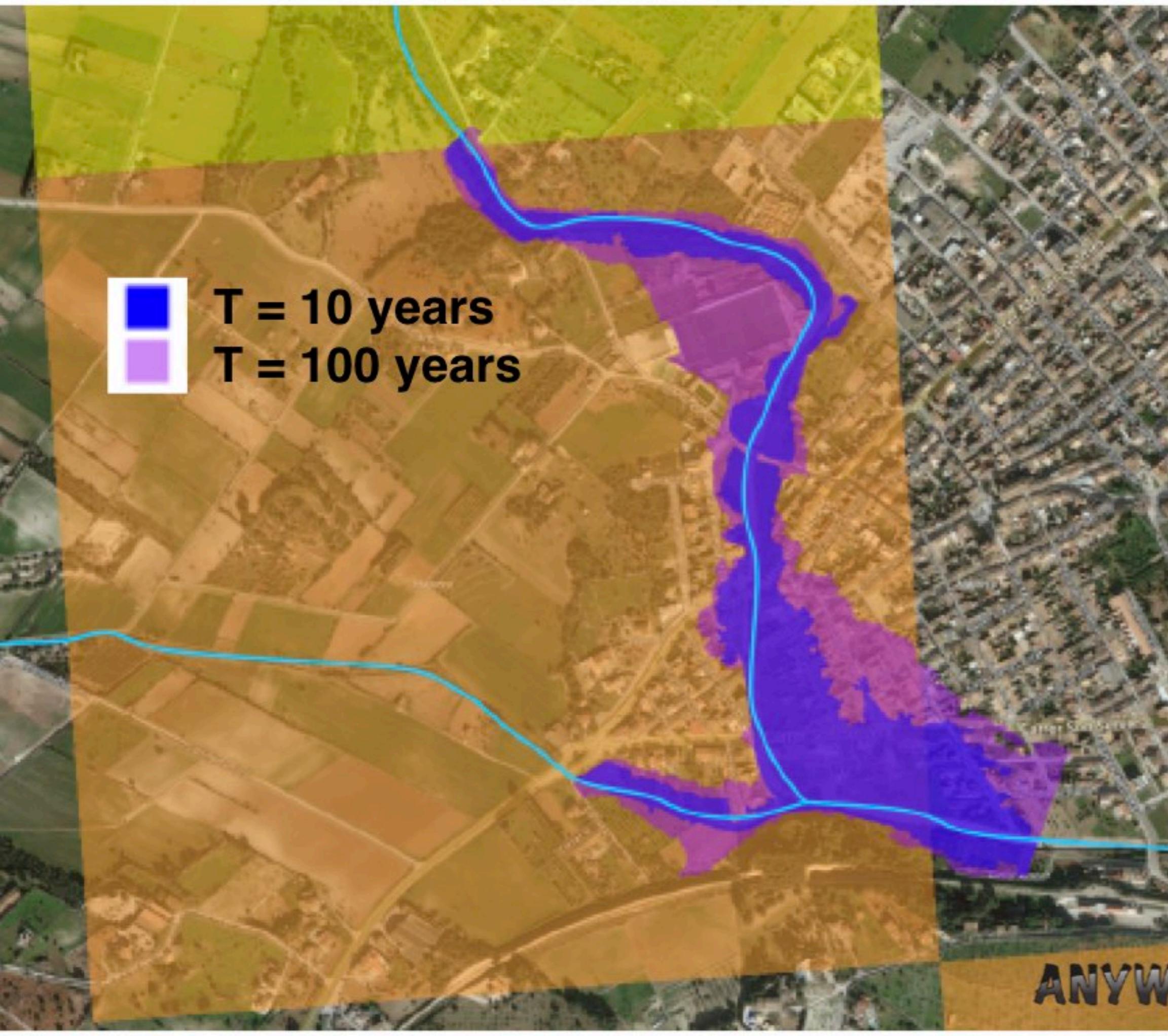
Mallorca Flooding Areas Map

T = 10 year return period



nt

 T = 10 years
 T = 100 years





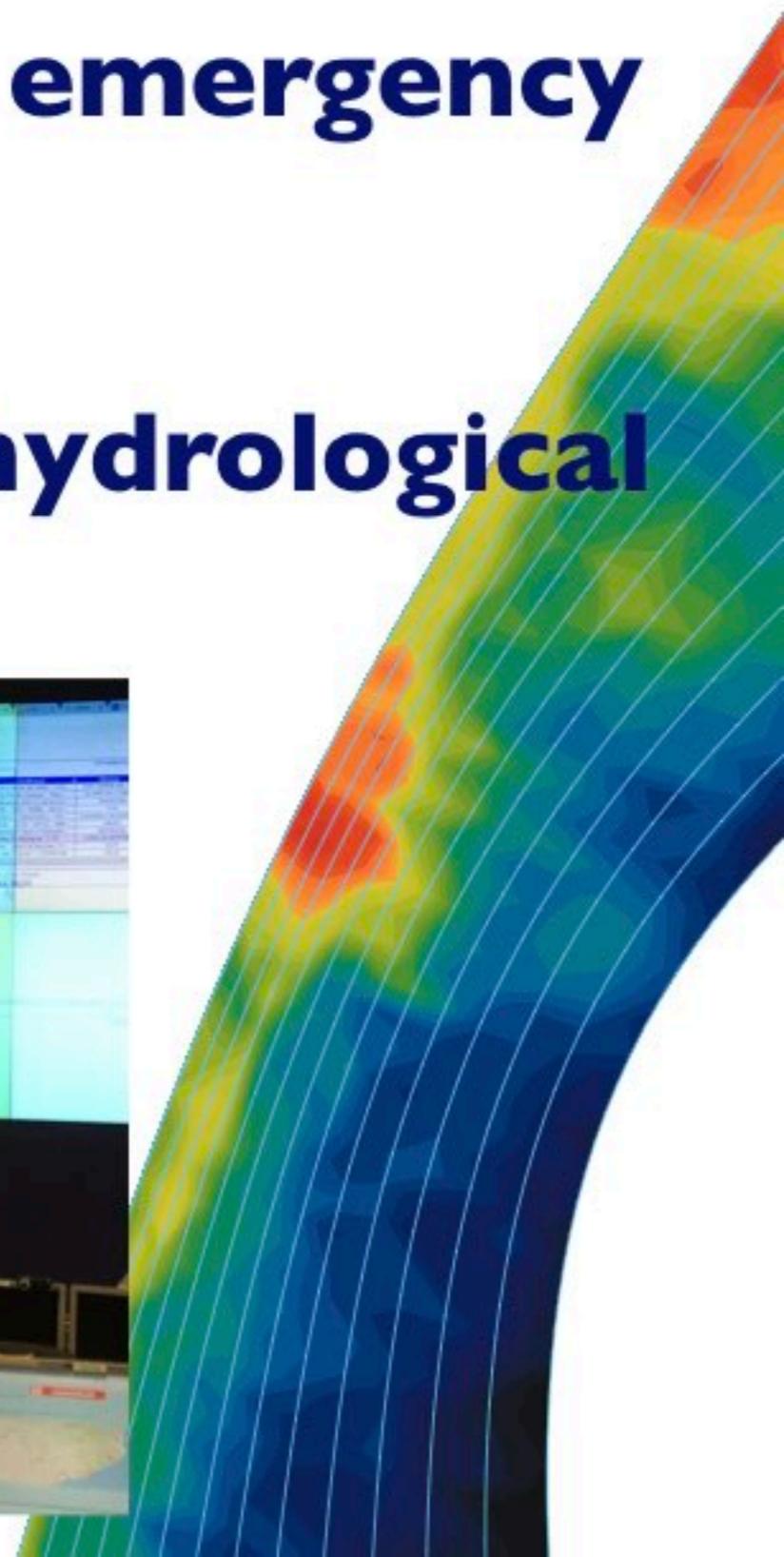
H2020-DRS-I-2015-700099

ANYWHERE



Is it good enough to support emergency management?

How it compares with a full hydrological model ?



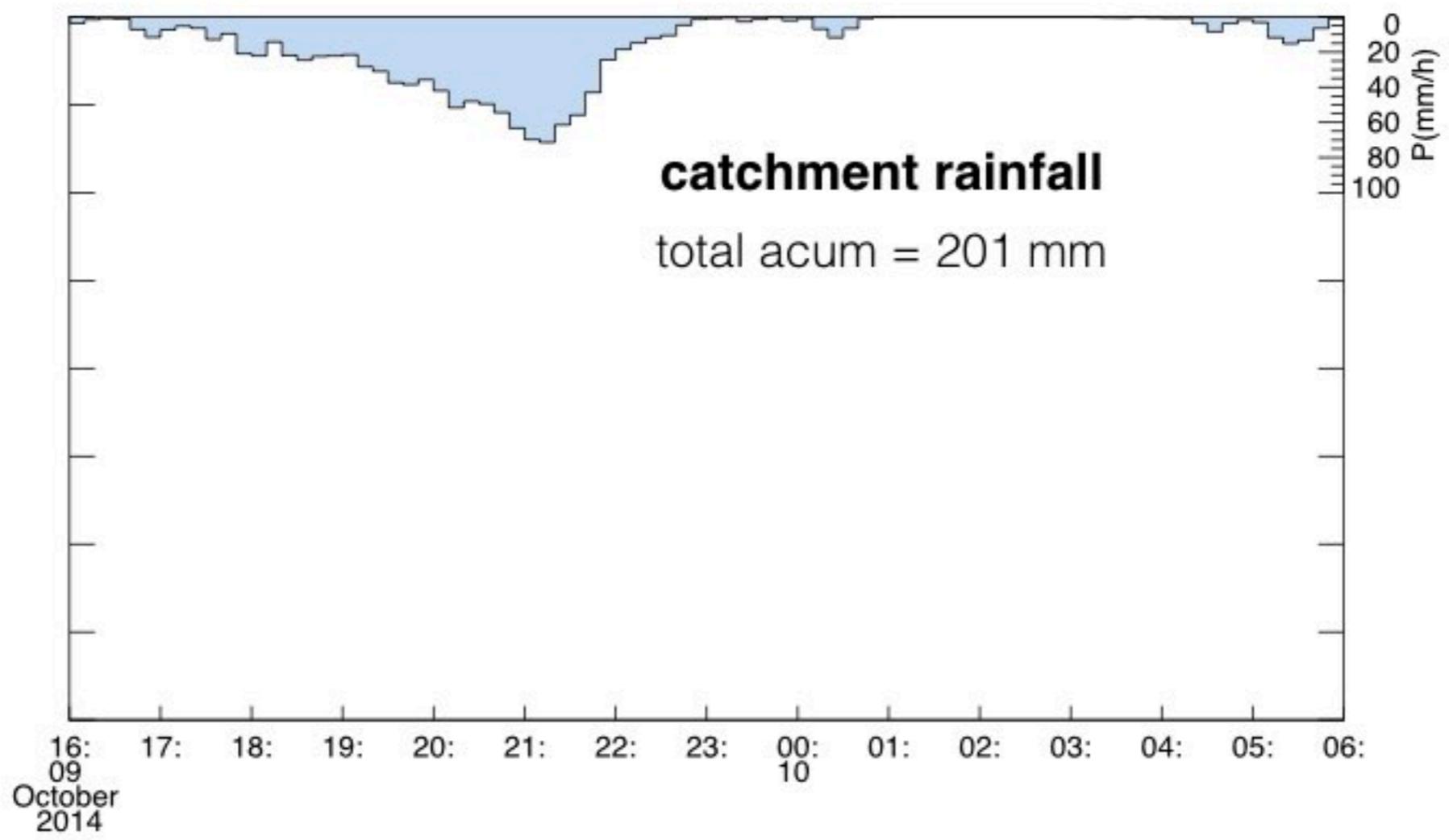
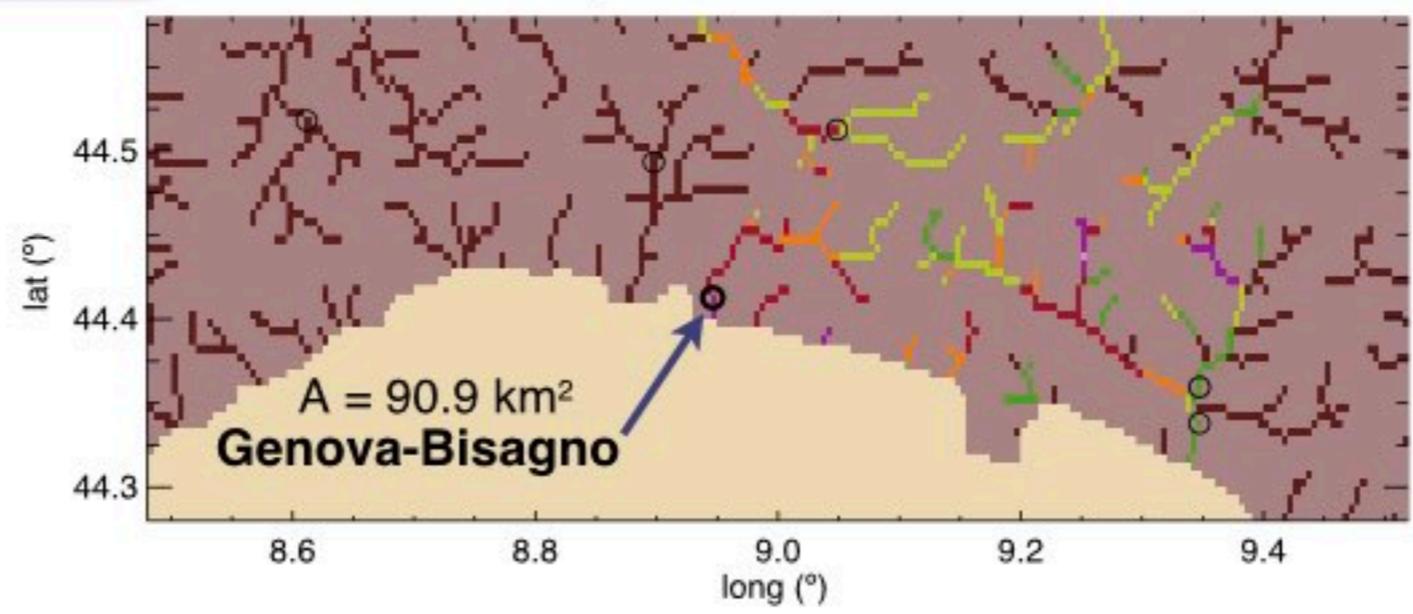
Genova (Italy) on 10th of October 2014



after > 300 mm of accumulated rain in few hours

9th-10th October

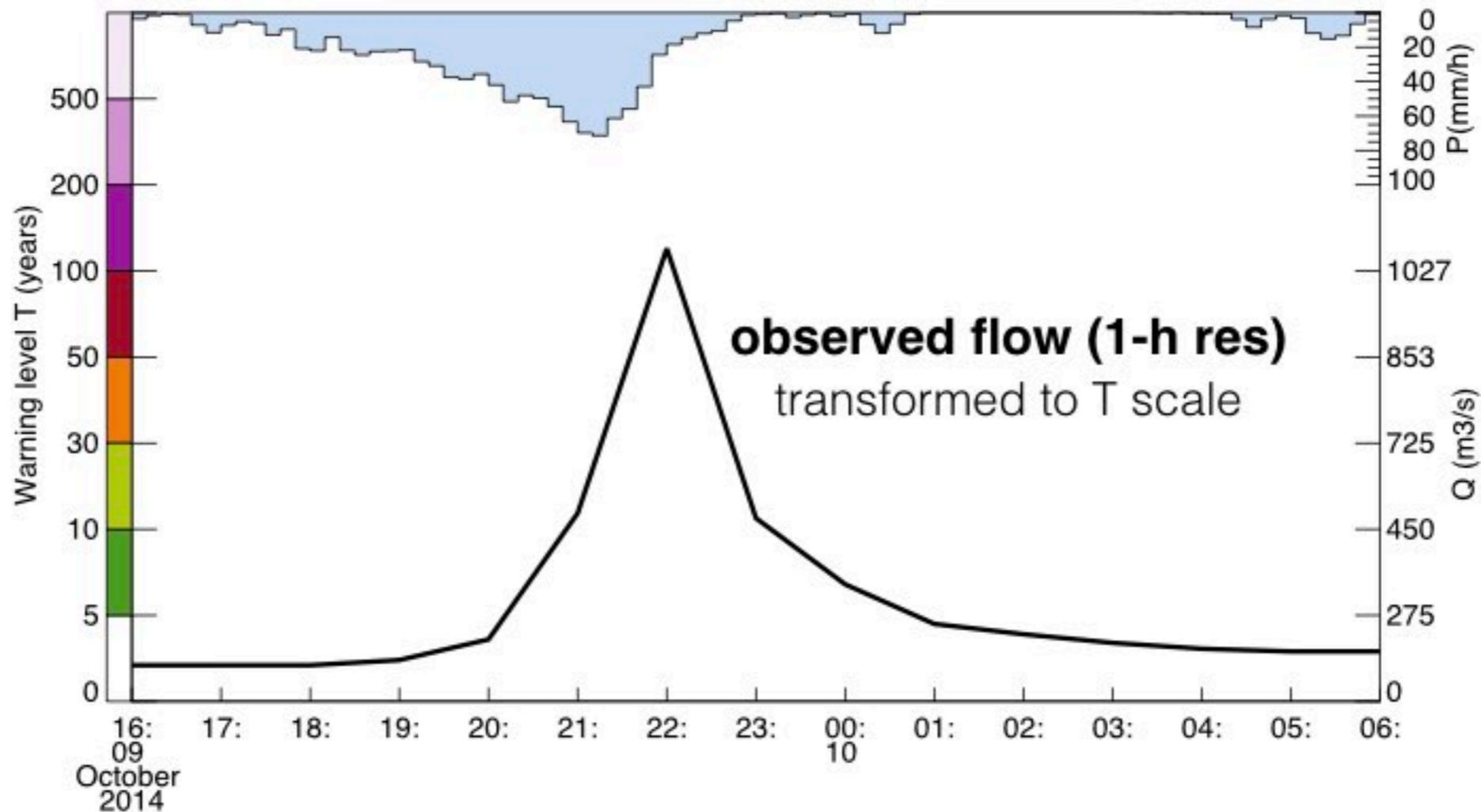
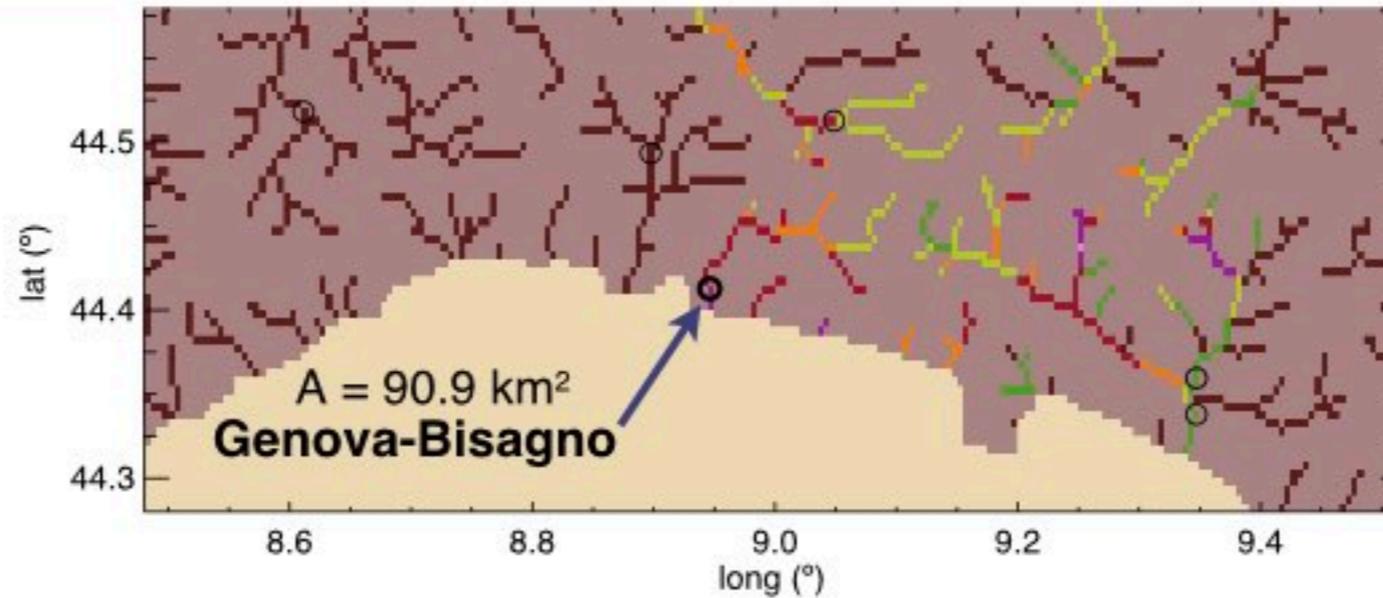
Control points: time series



Comparison of two early warning systems for regional flash flood hazard forecasting. Journal of Hydrology, 572: 603-619. May 2019

9th-10th October

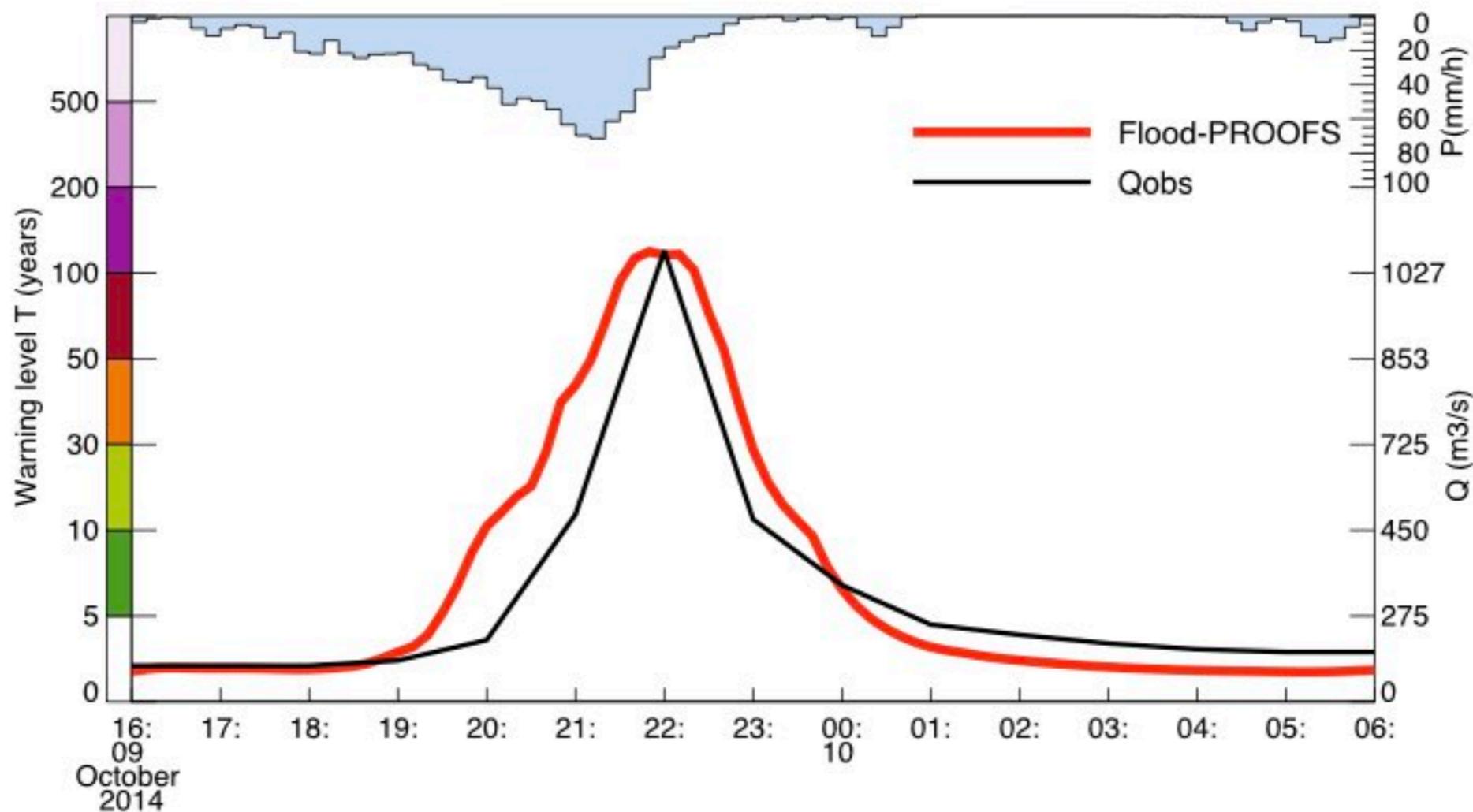
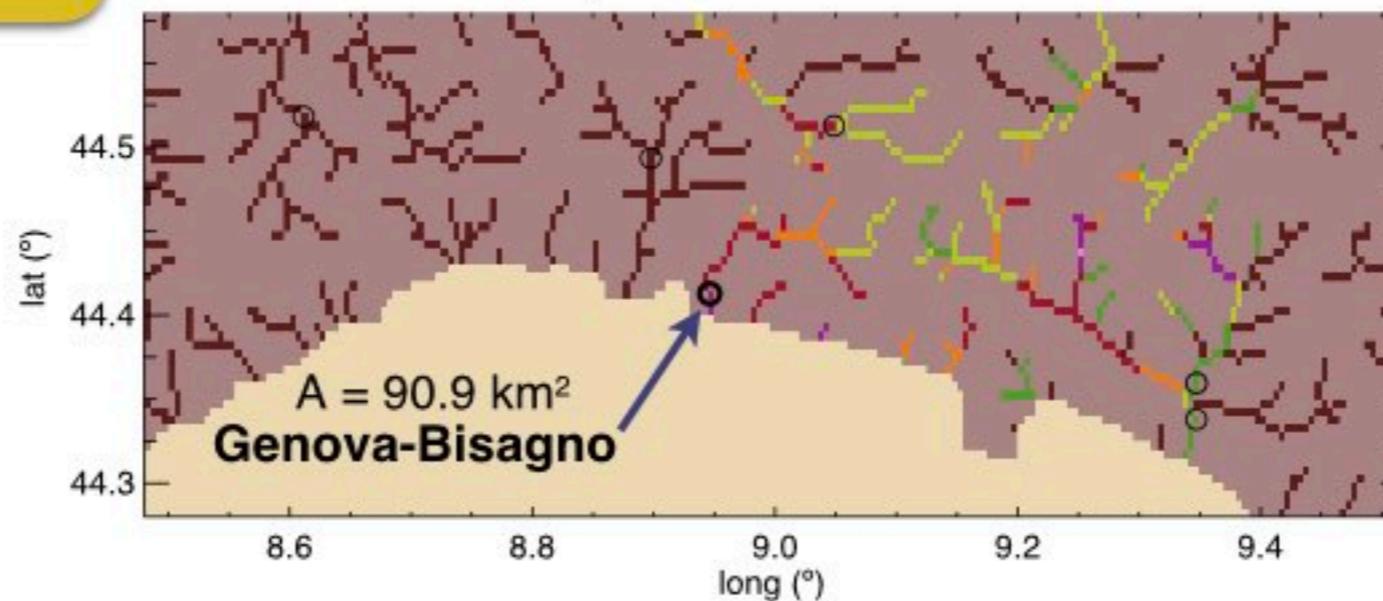
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9th October

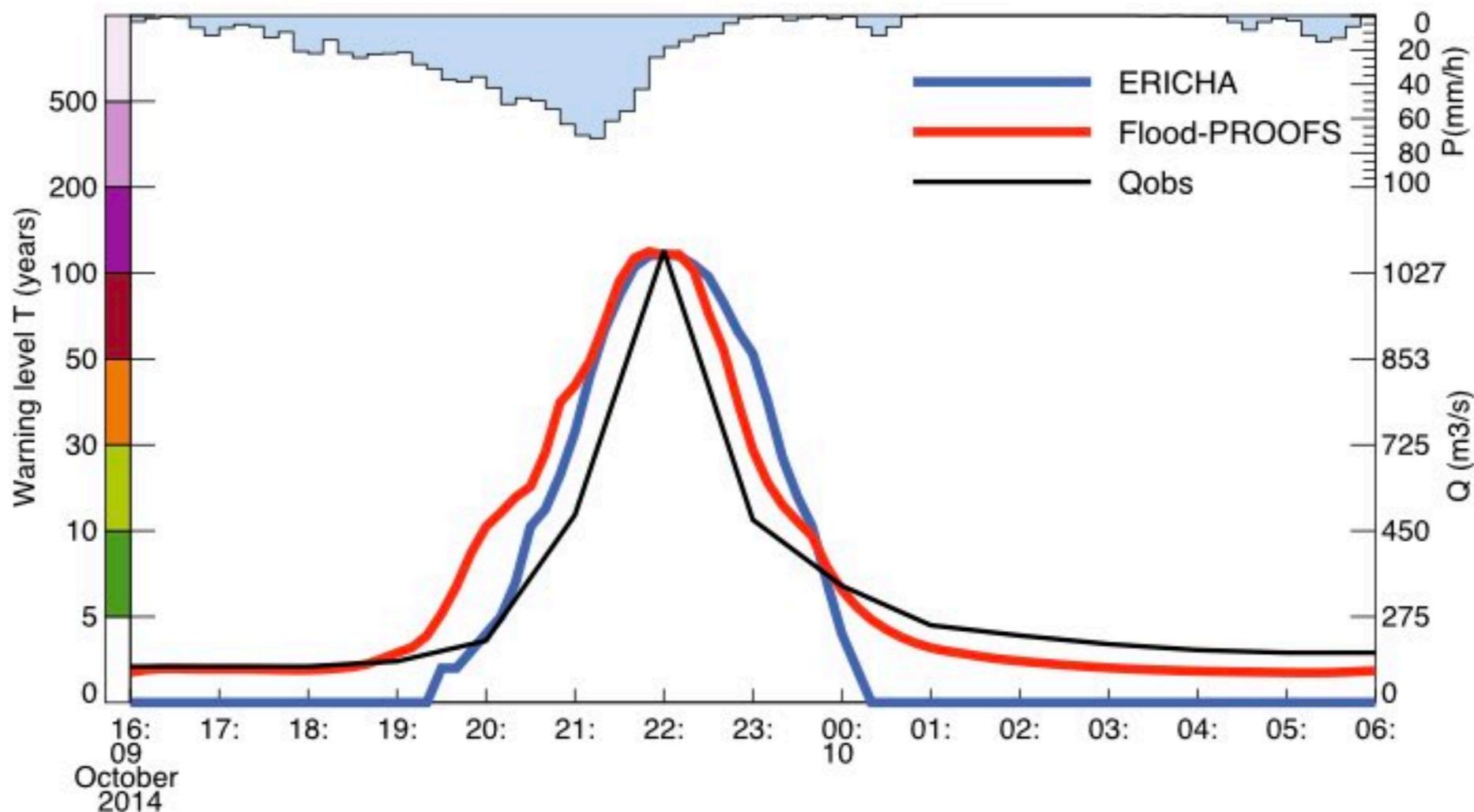
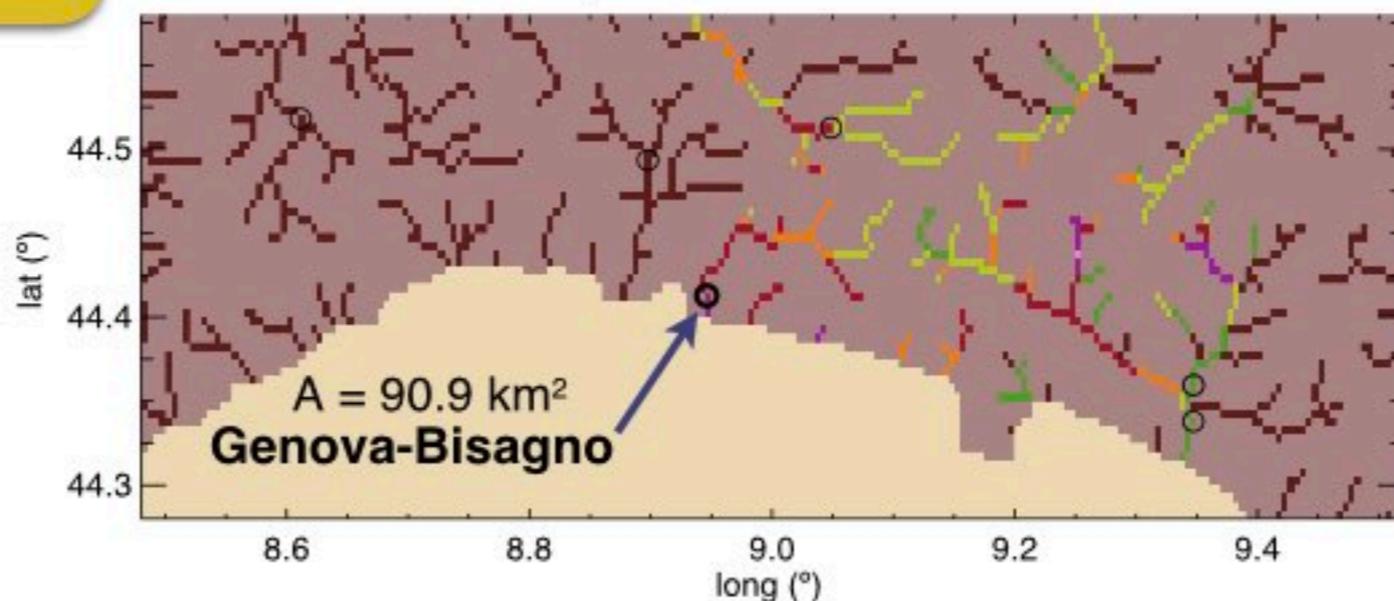
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