FLASH FLOODS AND PLUVIAL FLOODING

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

REGIONE AUTONOMA DELLA SARDEGNA

MINISTERO DELL'AMBIENTE E DELLA TUTELA DEL TERRITORIO E DEL MARE

Working Group F Thematic Workshop

IMproving Preparedness and RIsk maNagemenT for flash floods and debriS flow events (2009-2012)

IMPRINTS

FP 7 Cooperation Work Programme:
Environment Collaborative Project FP7-ENV-2008-1-226555

Caroline Wittwer (SCHAPI)
representing D. Sempere and the project team

26th-28th May 2010, Cagliari, Italy

The Challenges

- **Increasing anticipation in time**
  - **Improve rainfall forecasts in space and time**
- **Increasing anticipation in effects**
  - **Improve forecasting and warning tools**
- **Introduce probabilistic forecasting**
  - **Improve decision support**
- **Increasing Preparedness**
  - **Developing appropriate management tools**

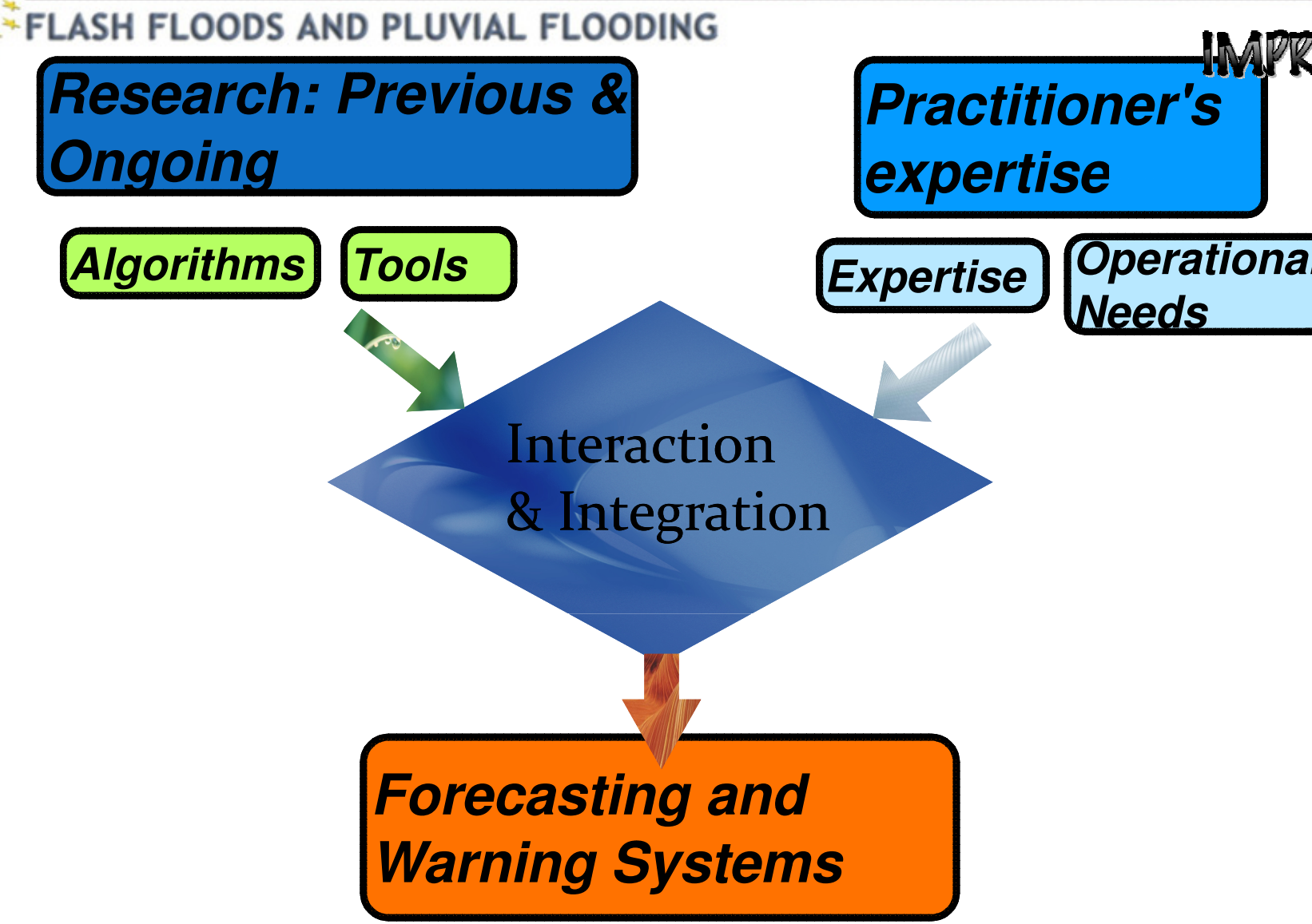
Objective

Improve preparedness and the operational risk management of FF / DF

Produce methods and tools to be used by practitioners of the emergency agencies and utility companies

Produce a prototype of the operational platform

designed to be used around the EU


Research: Previous & Ongoing
Practitioner's expertise
Algorithms
Tools
Expertise
Operational Needs
Interaction & Integration
Forecasting and Warning Systems

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Main Research Topics

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Advanced Rainfall Forecasting

- Lead times: 30 min -> 72 h

FF/DF Guidance for Risk Management

- Based on Radar and blending Forecast < 6 hours
- Based on EFAS Forecast hydrographs > 6 hours
- Adapted to 1 km2 scale in FF prone basins

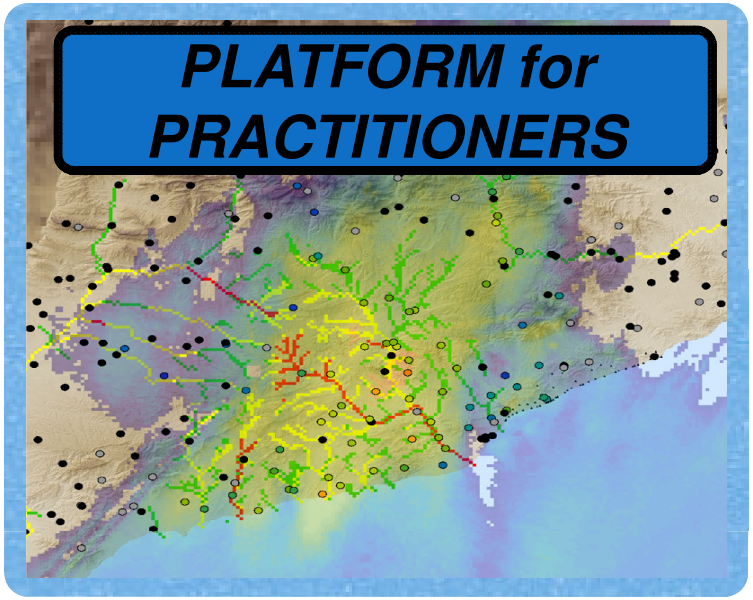
Probabilistic Hydrologic Forecasting

- Uncertainty in the hydrological models and outputs

FF/DF Early Warning using a Rule-Based system for complex processes

Assessment of Impacts induced by Future Changes

- Future rainfall, urban areas, land use, forest fires.



VERIFICATION in 6 Test-beds

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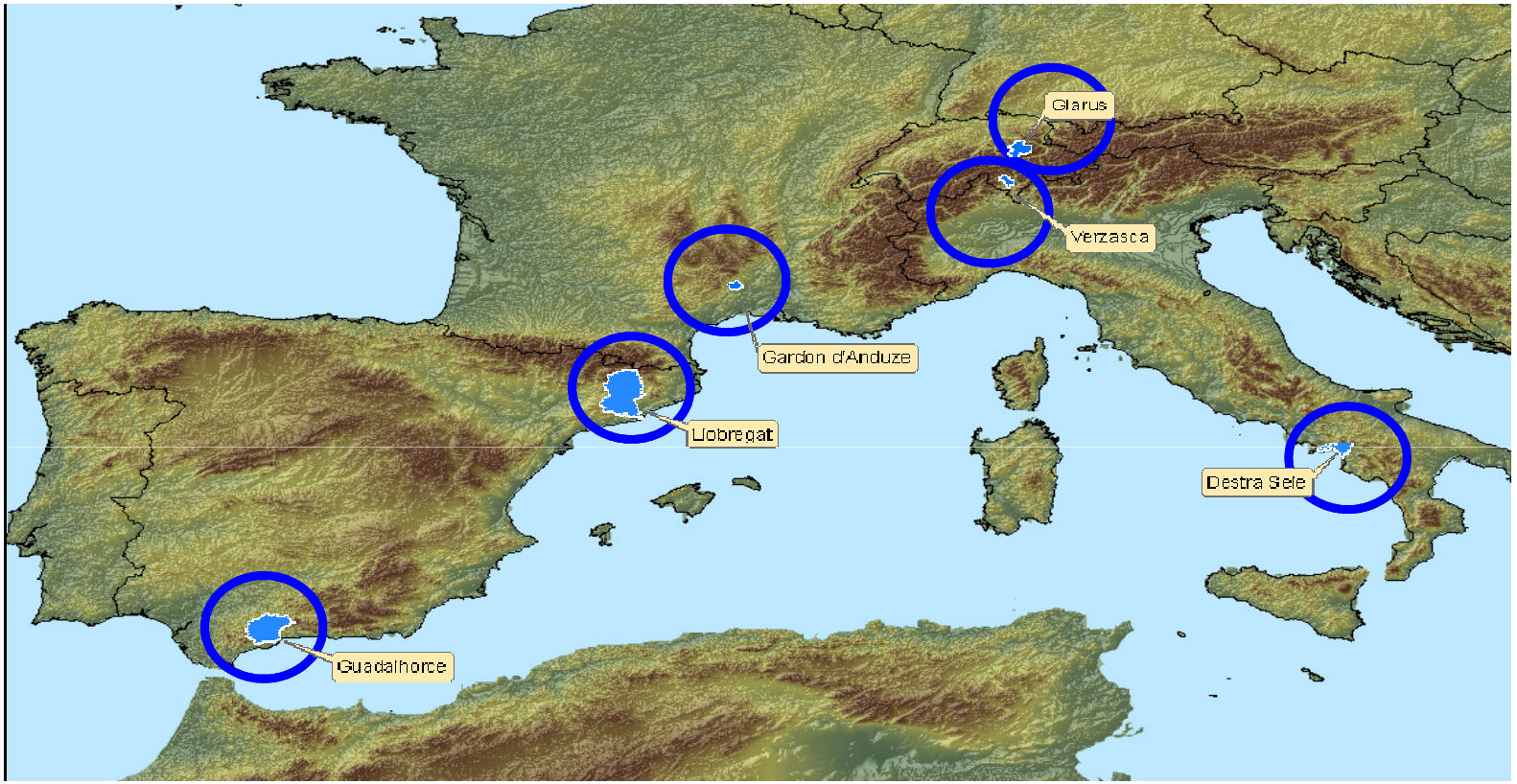

Increasing anticipation time in rainfall forecasting

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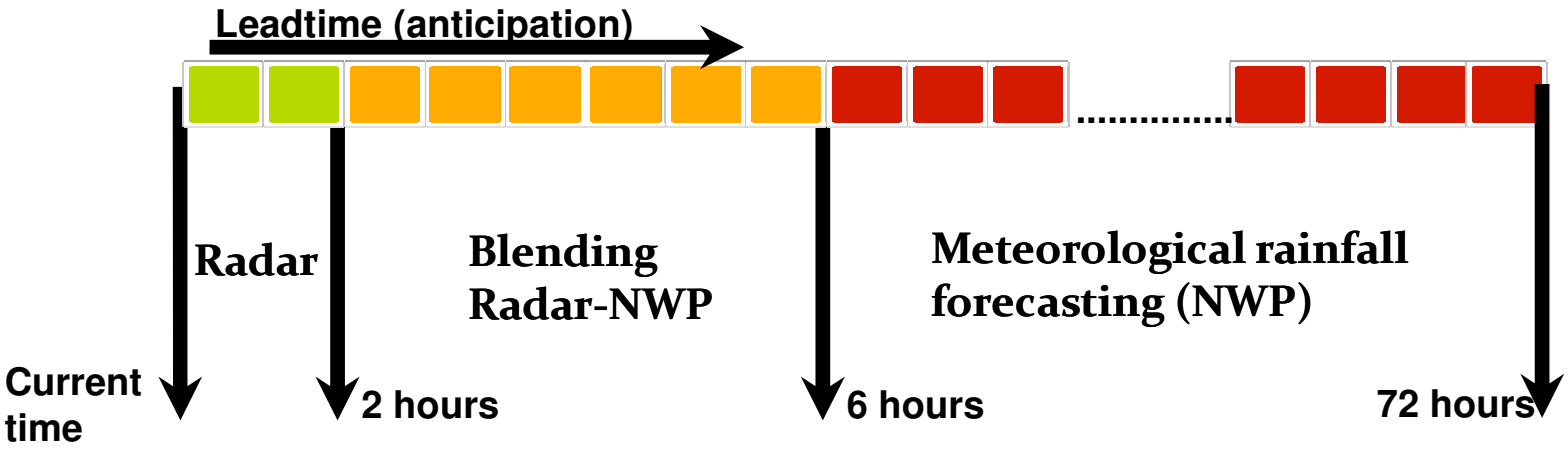

- Improve high resolution radar nowcasting probabilistic outputs (ensembles) for FF & DF forecasting (up to 2 h)
- Combining (blending) radar rainfall nowcasting with probabilistic NWP products for mid term forecasts (between 2h and 6h)
- Adapting high-resolution meteorological weather forecasts to their use for FF & DF early warnings (from 6h to 72 h)

FF & DF early warning systems

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High resolution probabilistic Early Warning System at 1km resolution up to **6h lead time**

- **Rainfall nowcasting, based on radar+COSMOLEPS data (leadtime < 6 hours). Aggregated rainfall in river cells.**
- **Reference thresholds based on available rainfall statistics , representing hazard**
- **Issuing Hazard-based flood Warning: Exceeding thresholds in river cells**

Low computational time
FF Guidance system
...not a classic hydrological model

FF & DF early warning systems

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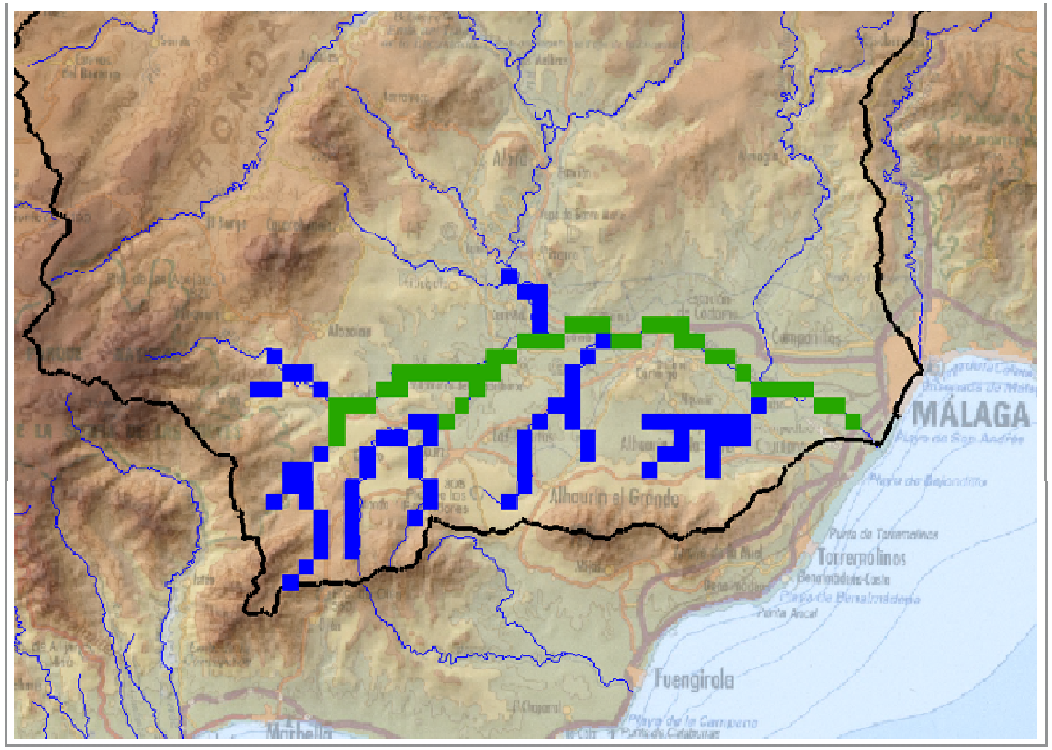
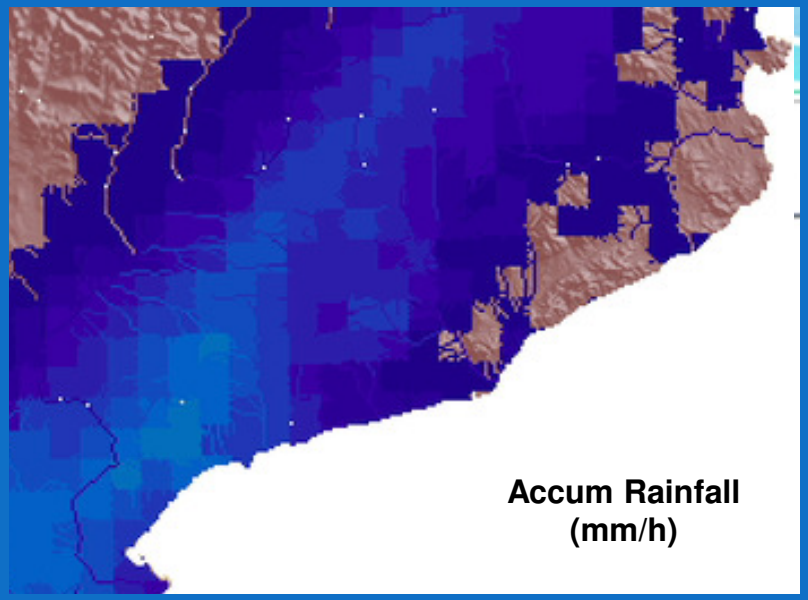
High resolution probabilistic Early Warning System
at 1km resolution up to **6h lead time**



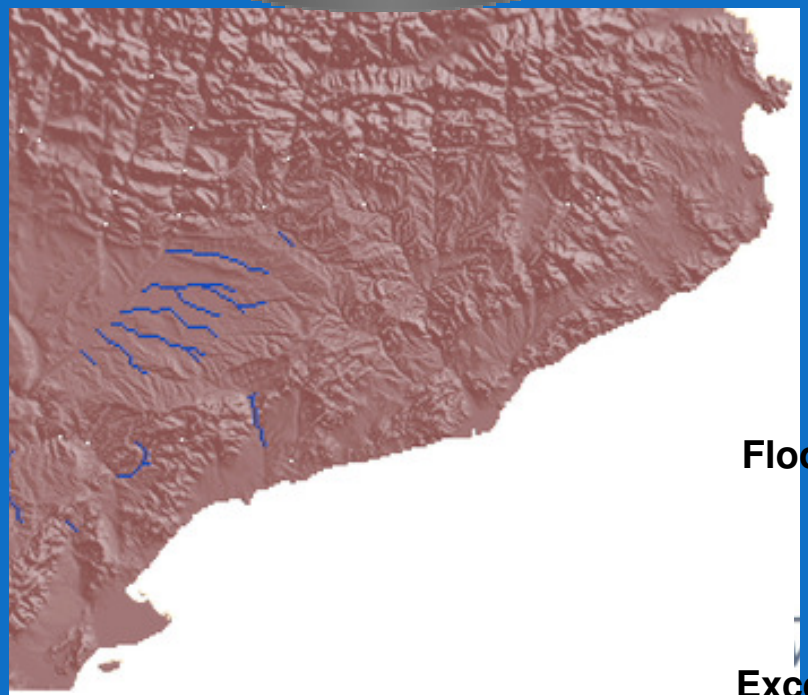
Guadalhorce basin (Malaga) 16/02/2010

Example of PFFGS 1 km Source: CRAHI

Flood Warning Exceeded Return Period T(years)



COSMOLEPS
Member 1



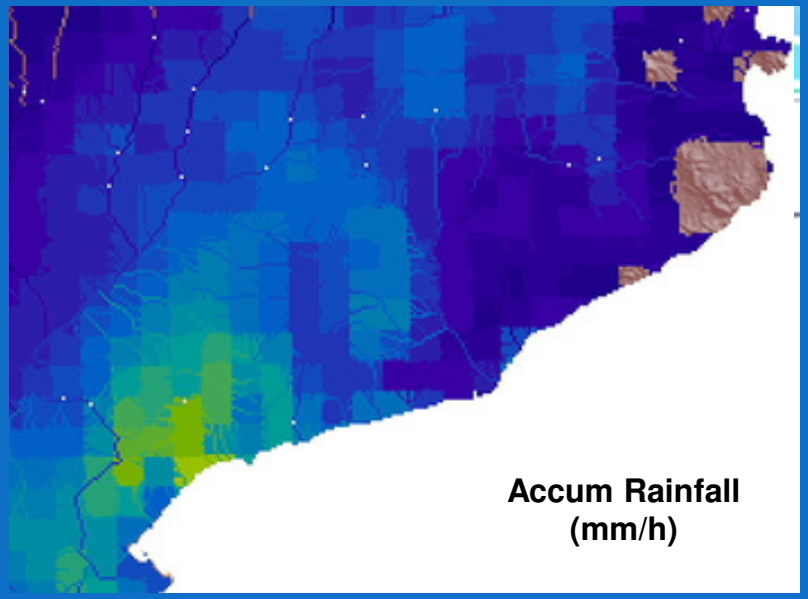
Example of
PFFGS 1 km
Source: CRAHI

Adaptation of COSMOLEPS 7 km to the probabilistic Early Warning System

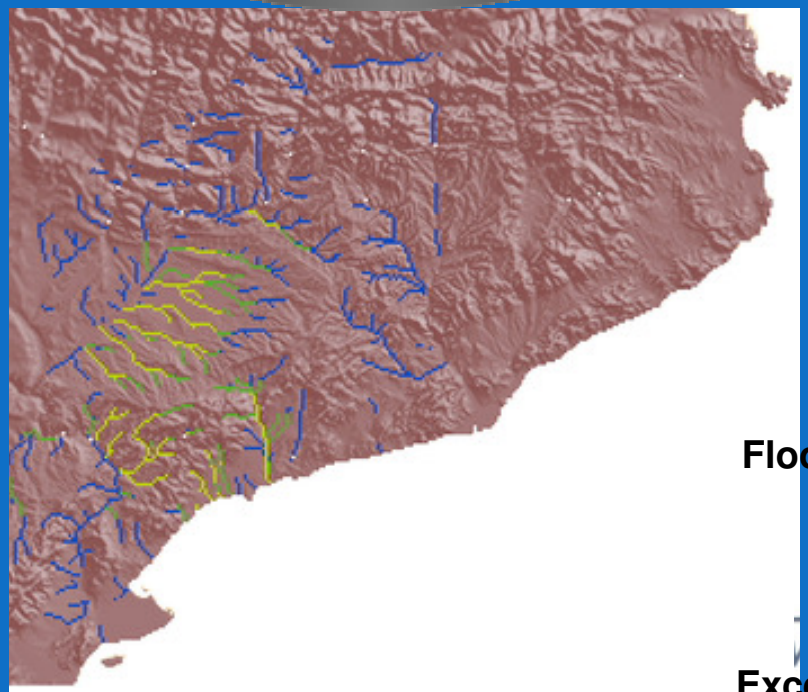
Catalonia domain

Flood Warning

Exceeded Return Period T(years)



COSMOLEPS
Member 1



Adaptation of COSMOLEPS 7 km to the probabilistic Early Warning System

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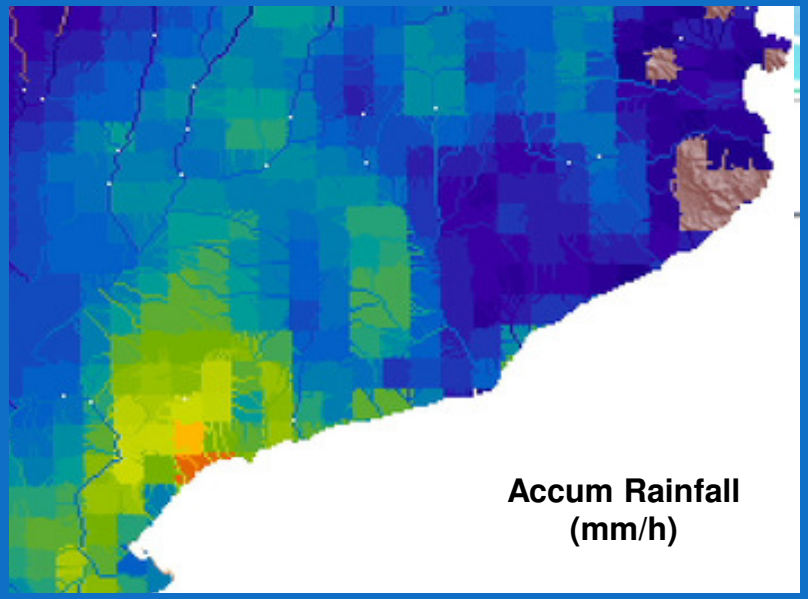
Flood Warning

Exceeded Return Period T(years)

Example of PFFGS 1 km Source: CRAHI



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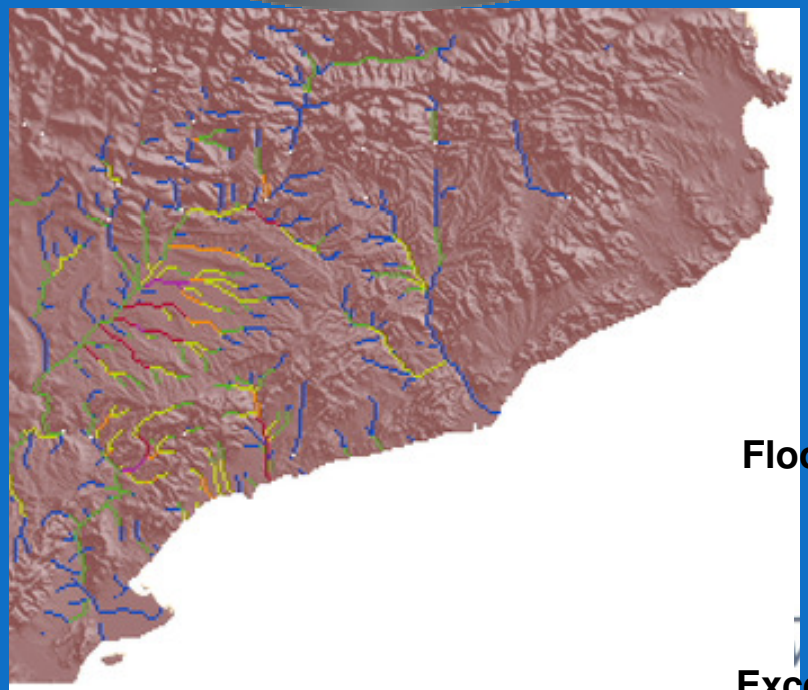


Adaptation of COSMOLEPS 7 km to the probabilistic Early Warning System

Catalonia domain

Flood Warning

Exceeded Return Period T(years)

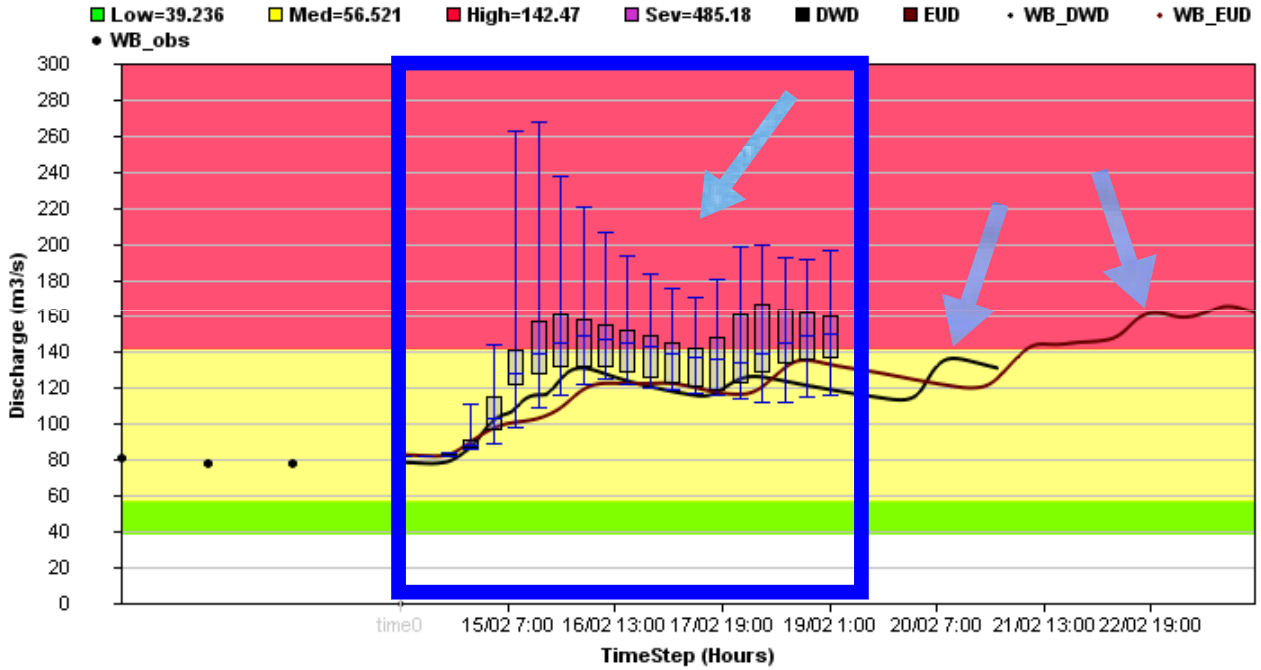
Example of PFFGS 1 km Source: CRAHI

FF & DF early warning systems

Adaptation of **EFAS (European Flood Alert System)** to FF & DF prone areas at 1 km resolution using COSMO-LEPS **up to 72 h lead time**

Deterministic Forecasted Hydrograms > 72h leadtime

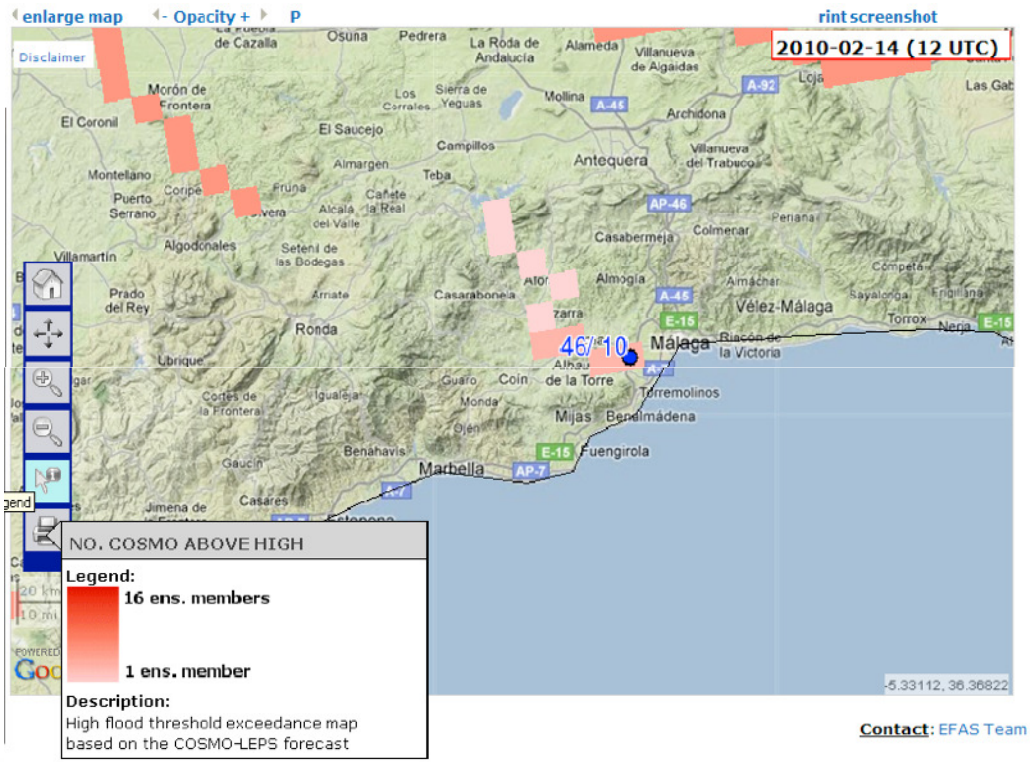
Probabilistic COSMO-LEPS Hydrograms (in blue) < 72h leadtime



Hydrograph Guadalhorce basin (Malaga) 16/02/2010. Source: Joint Research Center

FF & DF early warning systems

Adaptation of EFAS (European Floods Alert System) at 1 km resolution using COSMO-LEPS **up to 72 h lead time**



Probabilistic flood forecast:

number of discharge ensembles above a flood threshold

Example of Current EFAS 5 km
Source: Joint Research Center

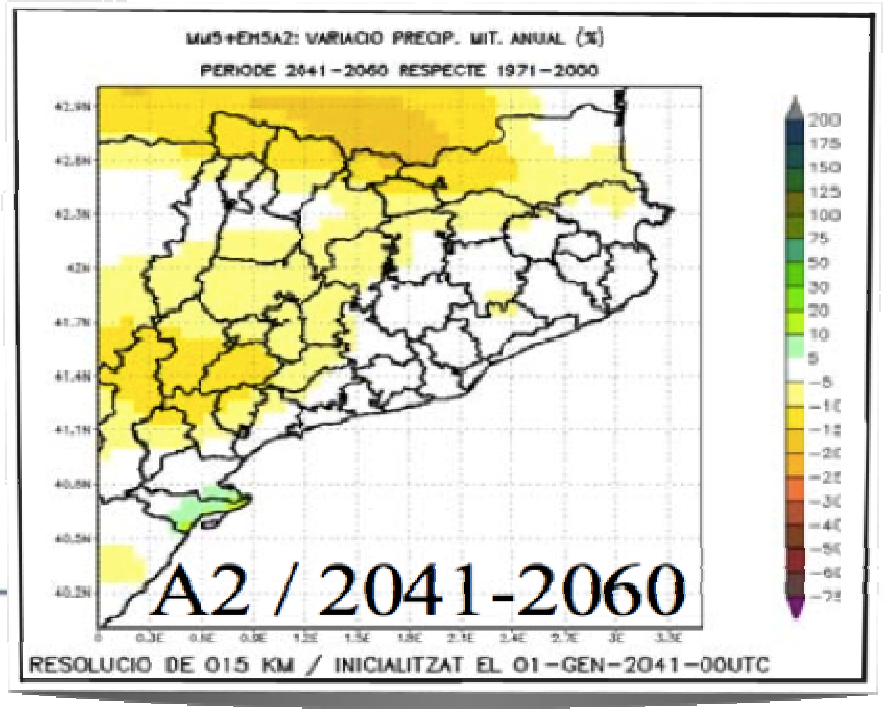
Analyzing impact of future changes

- Adapt a methodology to prepare scenarios **of** rainfall at high space-time resolution **consistent with climate change scenarios**
- Develop a methodology to estimate scenarios of **potential future socioeconomic** and **land use changes** on FF & DF prone areas
- Develop a methodology to include FF & DF **impact of forest fires risk**

Rainfall projections

Annual variation of Precipitation (%)

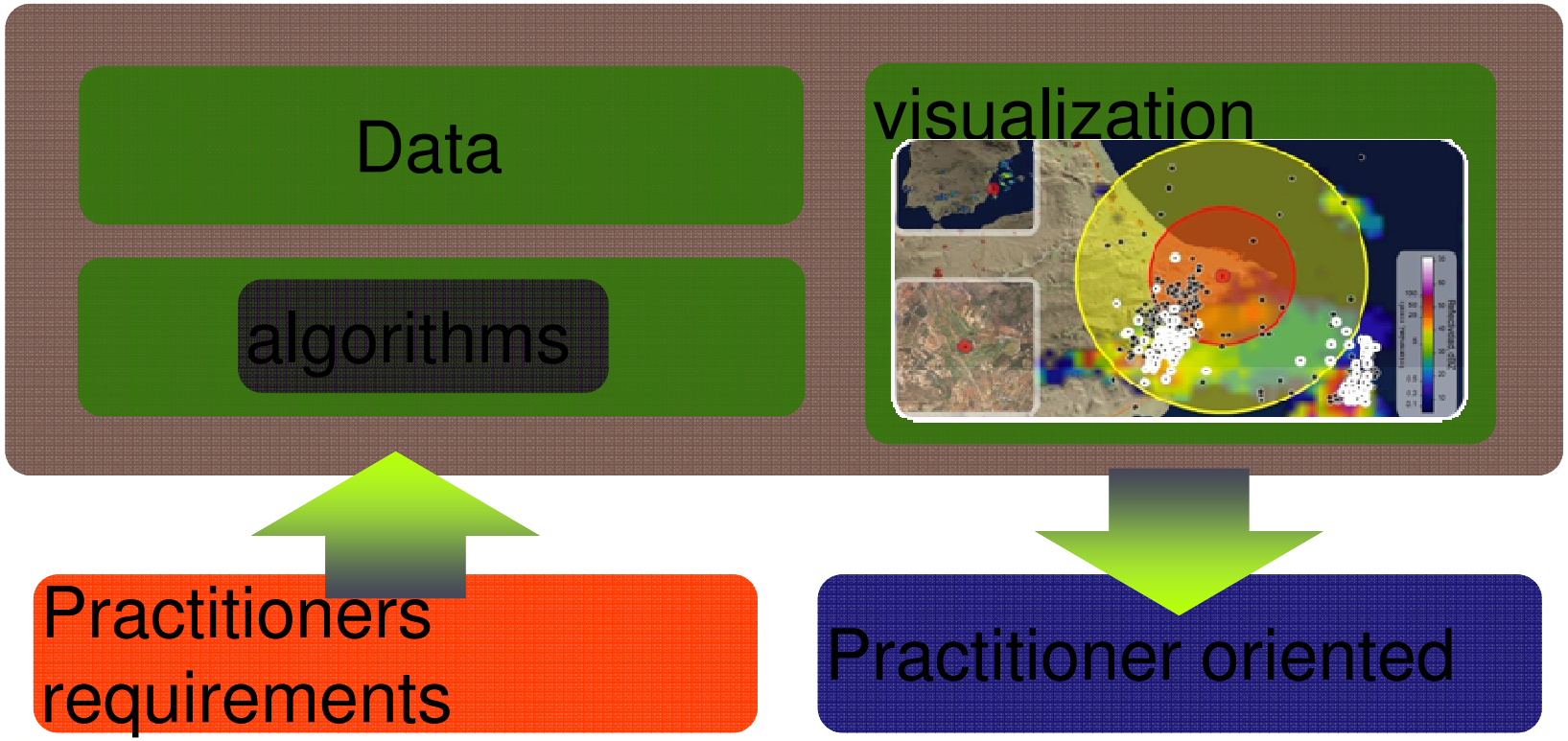
Period: 2040-2060
Scenario: A2



Catalonia domain, Source:SMC

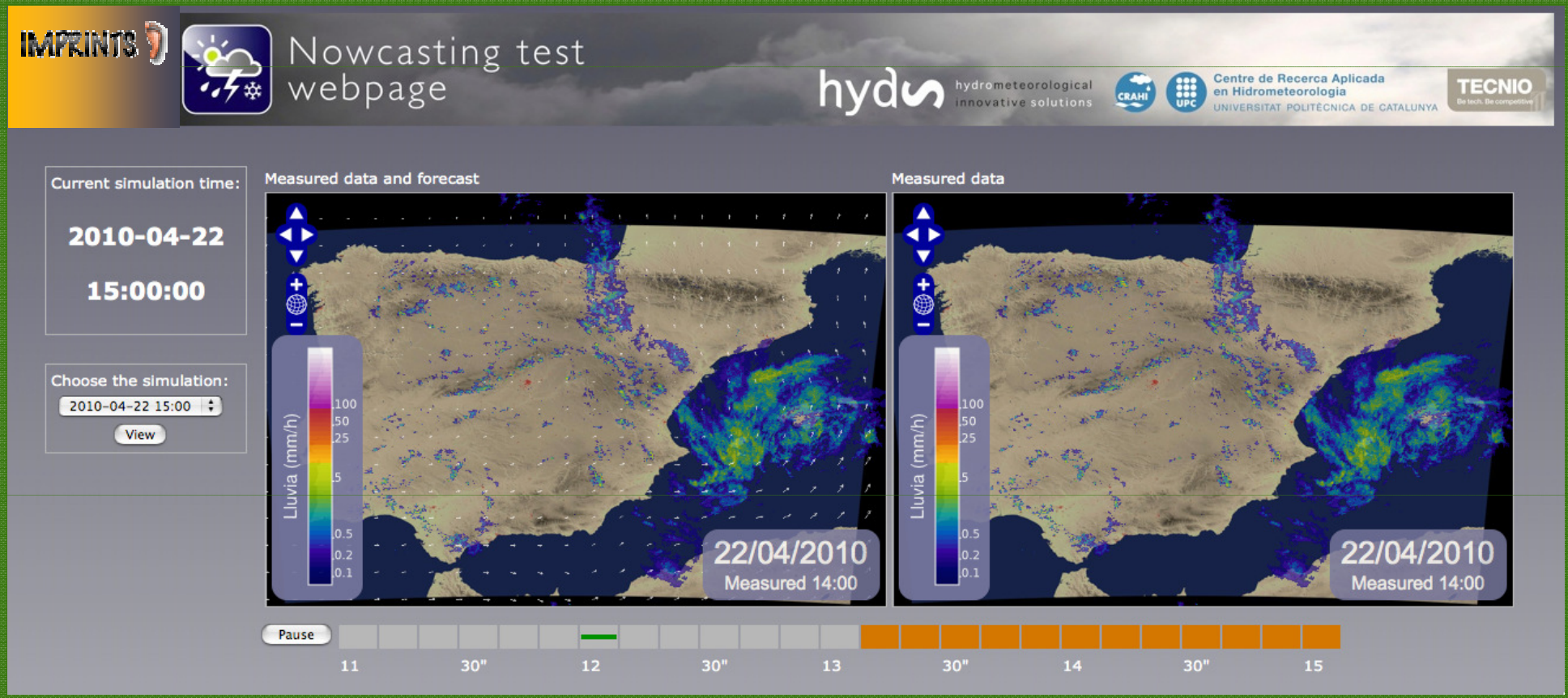
Practitioner's Tool

- **Development of a prototype of the operational FF & DF forecasting platform**



Practitioner's Tool

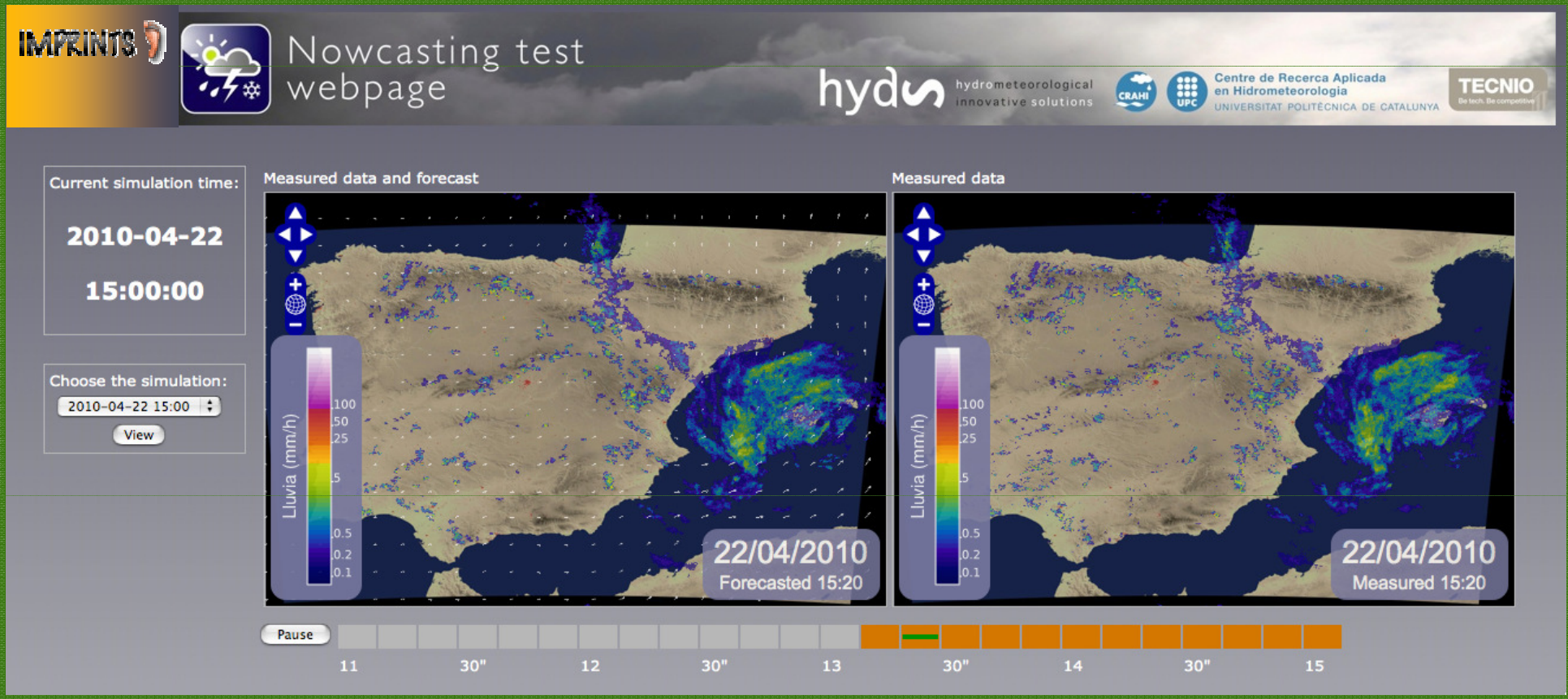
visualization: webpage User Interface



Source: HYDS, Beta version

Practitioner's Tool

visualization: webpage User Interface



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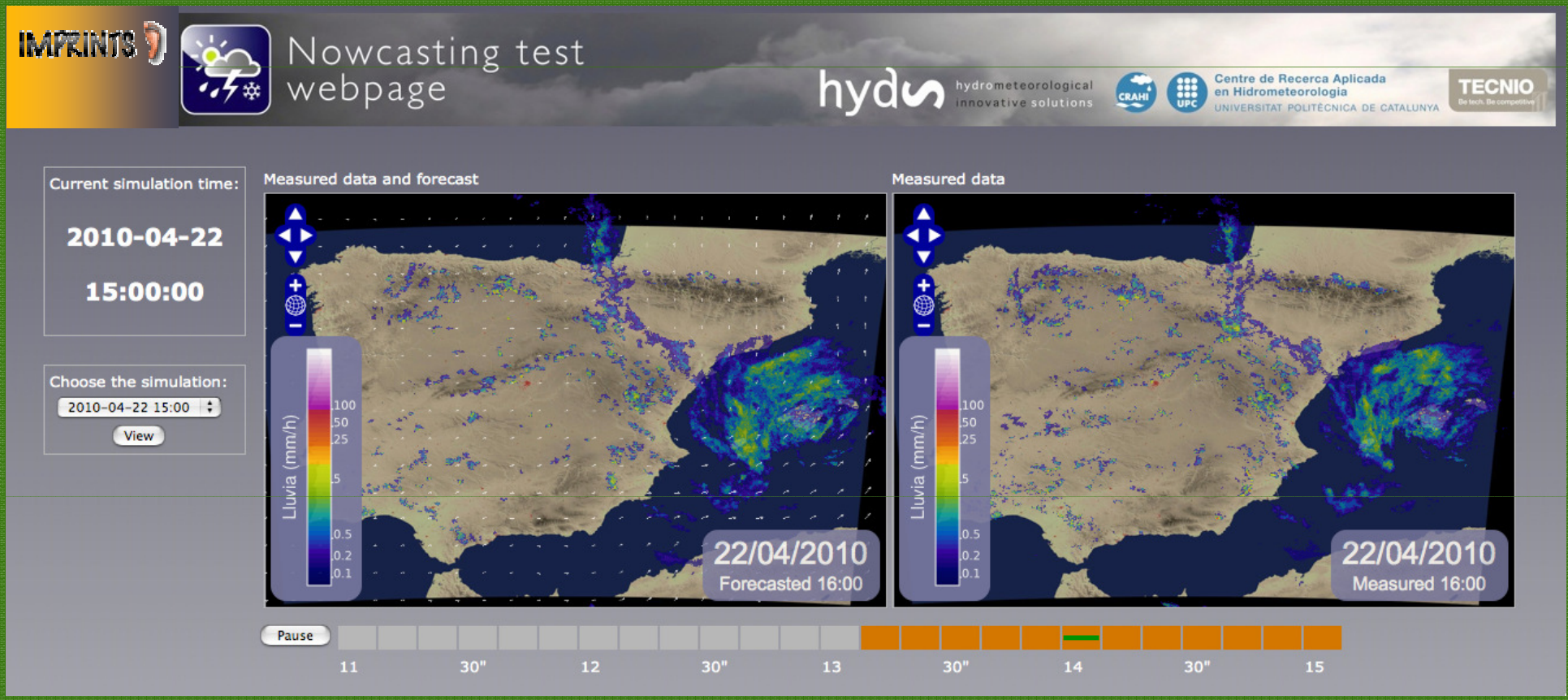
Practitioner's Tool

visualization: webpage User Interface



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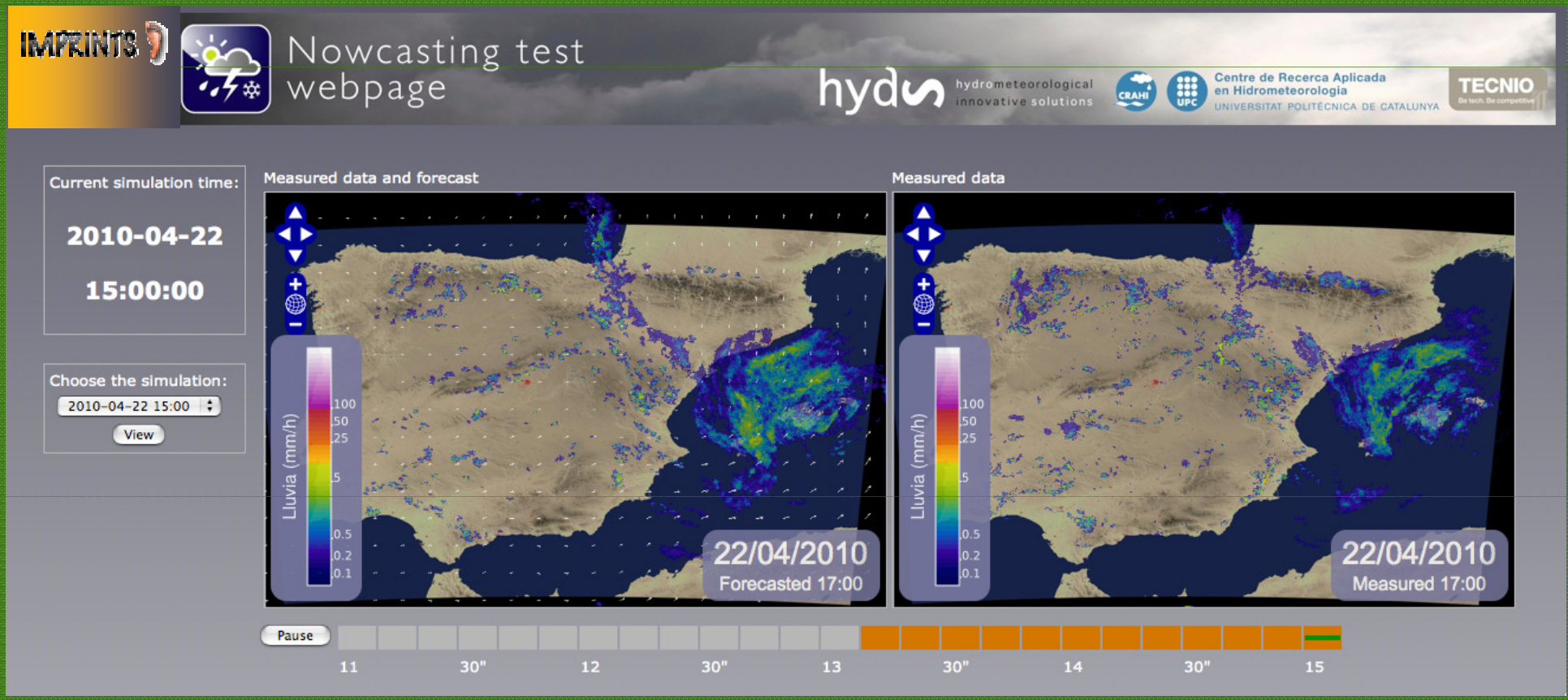

Source: HYDS, Beta version

Practitioner's Tool

Expected Tools:

- Radar ensemble nowcasting
- Probabilistic FF & DF early warning system
- Merging (radar + NWP) ensemble forecasting
- Hydrological probabilistic FF forecasting system
- Areas of high FF & DF potential risk
- Rule-based probabilistic FF & DF forecasting system

Planned Workshops regarding the Implementation of the European Flood Directive

1st IMPRINTS Workshop

Barcelona (Spain) 17th June 2010

Civil Engineering School of Barcelona

2nd Salerno (Italy) Debris flow oriented

3rd Glarus (Switzerland) Alpine area oriented

4th Nimes (France) Mediterranean area oriented

Development Partners

www.imprints-fp7.eu

- Universitat Politècnica de Catalunya (UPC, ES)
- MeteoSchweiz (CH)
- Joint Research Center (JRC, EC)
- Lancaster University (ULANC, UK)
- Swiss Federal Institute for Forest, Snow and Landscape Research (WSL, CH)
- Wagenigen University (WU, NL)
- Technological Centre of Water (CETAQUA, ES)
- University of Salerno (CUGRI, IT)
- University of Kuazulu-Natal (UKZN, South Africa)
- Meteorological Service of Catalunya (SMC, ES)
- Hydrometeorological Innovative Solutions (HYDS, ES)

Operational Partners

- Water Agency of Catalunya (ACA, ES)
- SCHAPI (FR)
- Glarus Kanton Emergency Department (GLARUS, CH)
- Autorità di Bacino in Destra Sele (AdBDxSele, IT)
- VERZASCA S. A. (CH)
- AET (CH)
- Emergencies Agency of Andalucia (EGMASA, ES)

Working Group F Thematic Workshop

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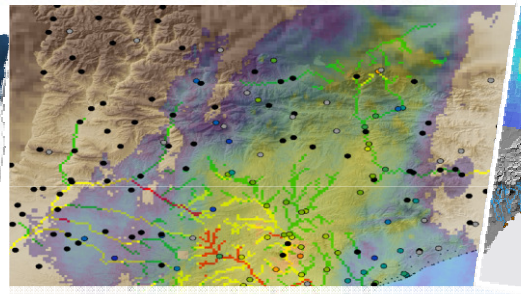

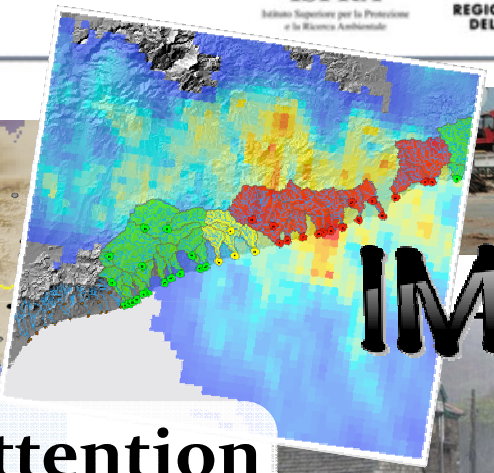

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Thank you for your attention

For any information, contact the project coordinator

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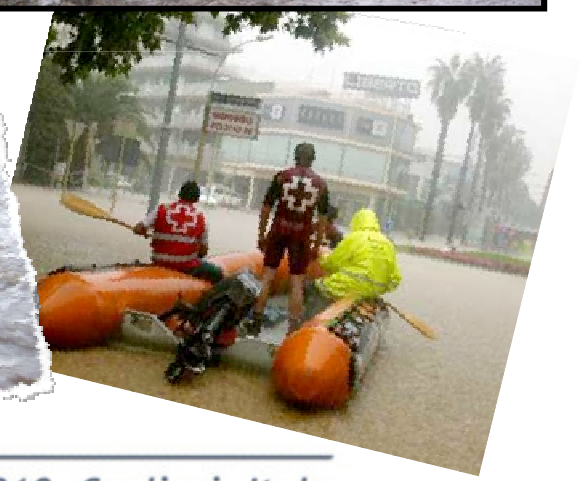
imprints@imprints-fp7.eu



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