



# Mitigating the hydrometeorological risk in the Adriatic sea: from research to application

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Project Coordinator



**CETEMPS**

*Integration of remote sensing techniques and numerical  
modeling for the forecast of severe weather*

University of L'Aquila





# Outline of the presentation

- Introduction
- ADRIARadNet in brief
- Benchmarks, results and outcomes
- Dissemination and outreach
- Capacity building and clustering
- Conclusion



# The ADRIARadNet project

**ADRIARadNet** is the acronym of

**ADRI**atic integrated **RAD**ar-based and web-oriented information processing system **NET**work to support hydro-meteorological monitoring and civil protection decision.

## The ADRIARadNet project

- **Design and coordination:** since its first idea, by CETEMPS and Region Abruzzo
- **Official start:** October 1, 2012 (Duration: 3 years)
- **Total budget:** 2.668.183 €
- **2nd Call:** Priority 3 Measure 3.3 (Communication network)
- **Team:** 8 partners from Italy, Albania and Croatia



# Who are the 8 Partners ?



**Centre of Excellence  
CETEMPS**  
University of L'Aquila  
(Italy)



**Branch of CIMA  
Research Foundation**  
(Albania)



**Polytechnic University of  
Tirana Institute of  
GeoSciences, Energy,  
Water and Environment**  
(Albania)



**Beep Innovation**  
(Italy)



**Abruzzo Region  
Civil Protection**  
(Italy)



**Marche Region  
Civil Protection**  
(Italy)



**Ministry of Interior  
Civil Emergence**  
(Albania)



**Dubrovnik  
Neretva County**  
(Croatia)



## Context - Prevision and prevention

### Focus motivations/needs behind the project

1. The **hydro-meteorological research and technology** is relevant from a scientific and social point of view and can be better exploited for monitoring needs
2. The knowledge of understanding and forecast the impacts of **extreme hydro-meteorological events** is becoming an urgent challenge (e.g., flash floods, extended floods)
3. The results of the hydro-meteorological research coupling with an advanced ICT system can be very useful to for **civil prevention and protection purposes**
4. End-users (**local and regional civil protection services**) should be involved in the project requirements and evaluation











# ADRIARadNet work plan

**The overall project objective has been carried out through 7 WPs. Each WP is subdivided into one or more actions:**

- WP1:** Management and Financial coordination
- WP2:** Communication and dissemination
- WP3:** User-oriented requirements and guidelines for Adriatic hydrometeorological decision support systems
- WP4:** Integrated system for Adriatic hydro-meteorological radar-based monitoring and model-based forecasting
- WP5:** Design and implementation of Adriatic web-based information network and data-sharing platform
- WP6:** Demonstration and assessment campaign in Italian central Adriatic area
- WP7:** Demonstration and assessment campaign in Balkan southern Adriatic area



# Main role of each partner in the project

	Responsible of the Management Coordination (WP1) and development of integrated system (WP4)
	Responsible of the Web based information network (WP5)
	Responsible of the demonstration campaign in Italian Adriatic area and responsible for radar acquisition (WP6)
	Responsible of the demonstration campaign in Balkan Adriatic area and responsible for radar acquisition (WP7)
	Co-Responsible of the development of integrated system (WP4) and the demonstration campaign in Balkan area (WP7)
	Responsible of the Financial Management (WP1)
	Responsible for User-oriented requirements and guidelines (WP3) and responsible for radar acquisition (WP7)
	Responsible of Communication and dissemination (WP2) and responsible for radar acquisition (WP6)



## Main outcomes achieved by ADRIARadNet

- (1) **Enhanced Adriatic observational network** made by 4 X-band mini-radars and others ground sensors for extreme weather monitoring
- (2) **Operational warning system** coupling hydro-meteorological numerical modeling and observational data assimilation, from ground and satellites, tuned to the local territory
- (3) **Integrated ICT web-GIS platform (Dewetranet)** for data sharing and consultation for supporting civil protection decisions on hydro-meteorological risk and assessment
- (4) **Testing the integrated system** by means of ADRIAX campaigns (CAO and SAO) in the Adriatic regions



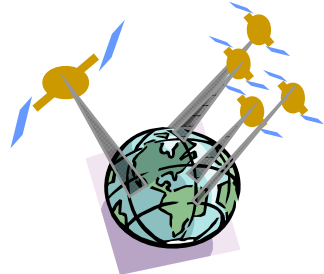


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# The ADRIARadNet integrated system



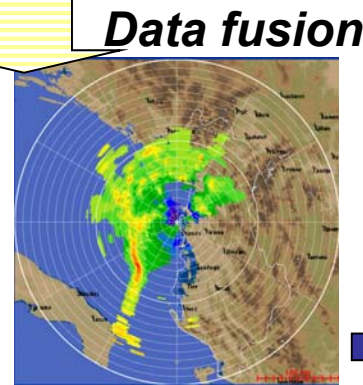
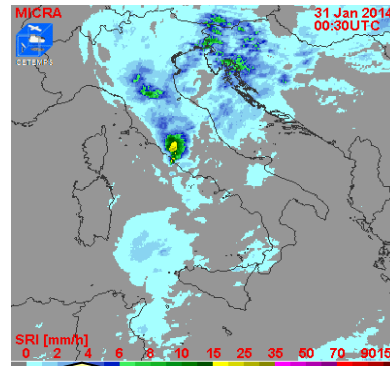
**MICRA  
Satellite data**



**X band weather  
radar data**



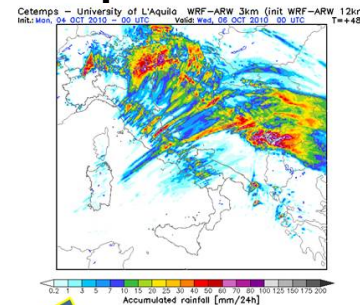
**Raingauge/Disdrometer  
in-situ network data**



**Data fusion**

**Data assimilation**

**WRFAdria  
Atmospheric Modeling**



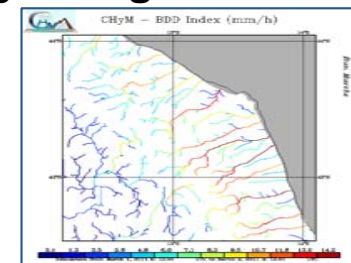
**Data assimilation**

**Dewetranet  
Monitoring  
integrated platform**



**Dewetranet  
Forecast,  
Analysis and  
Warning**

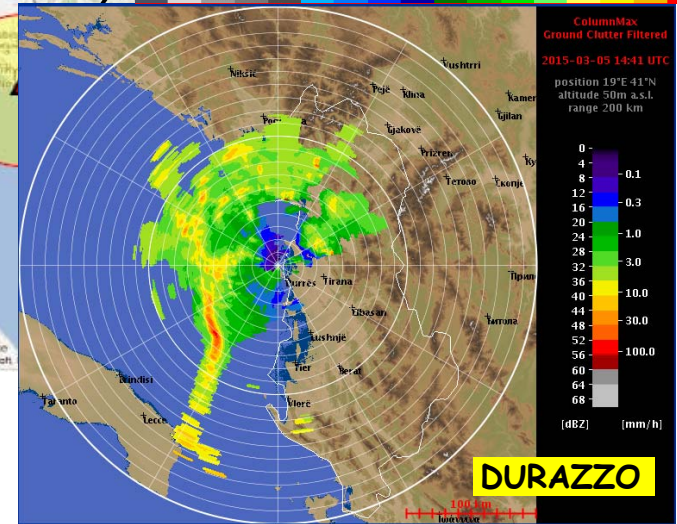
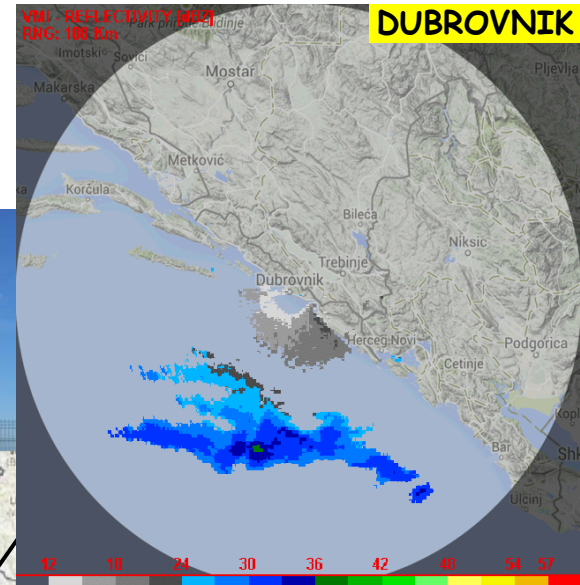
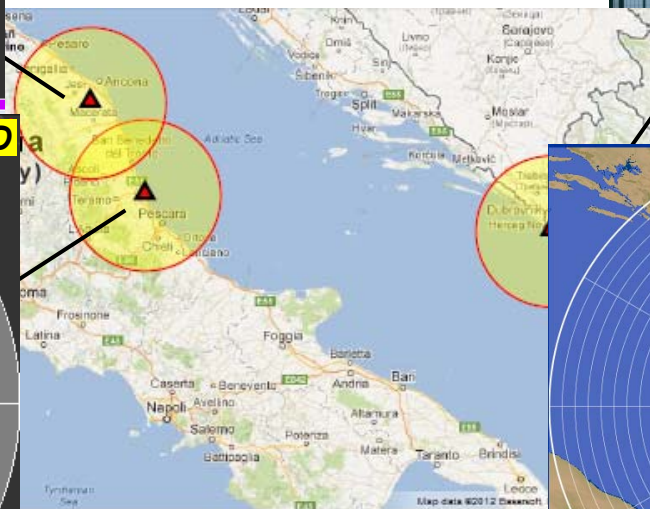
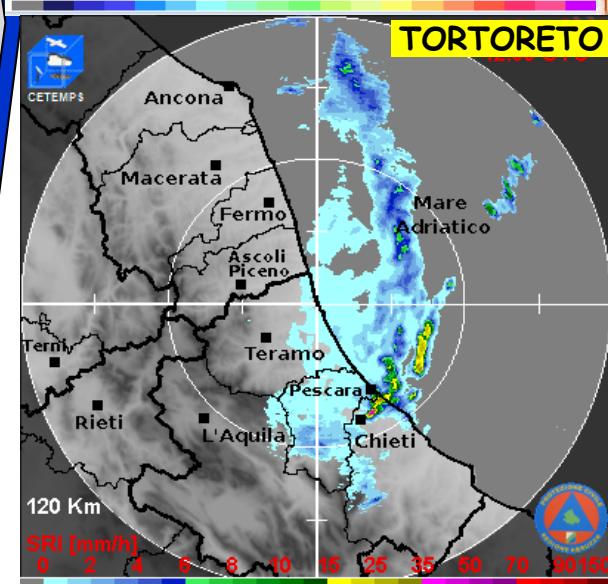
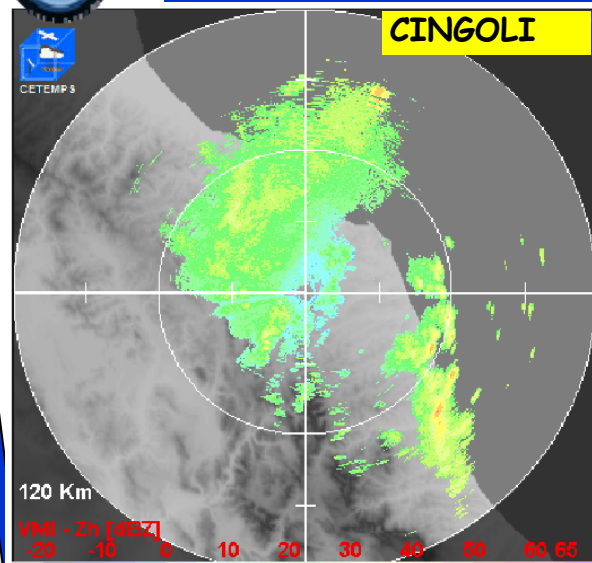
**CHyM  
Hydrological model**



**Dissemination  
to communities  
and public**

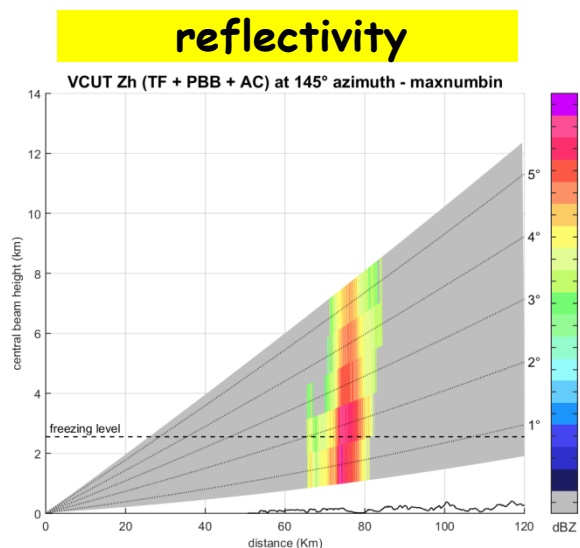
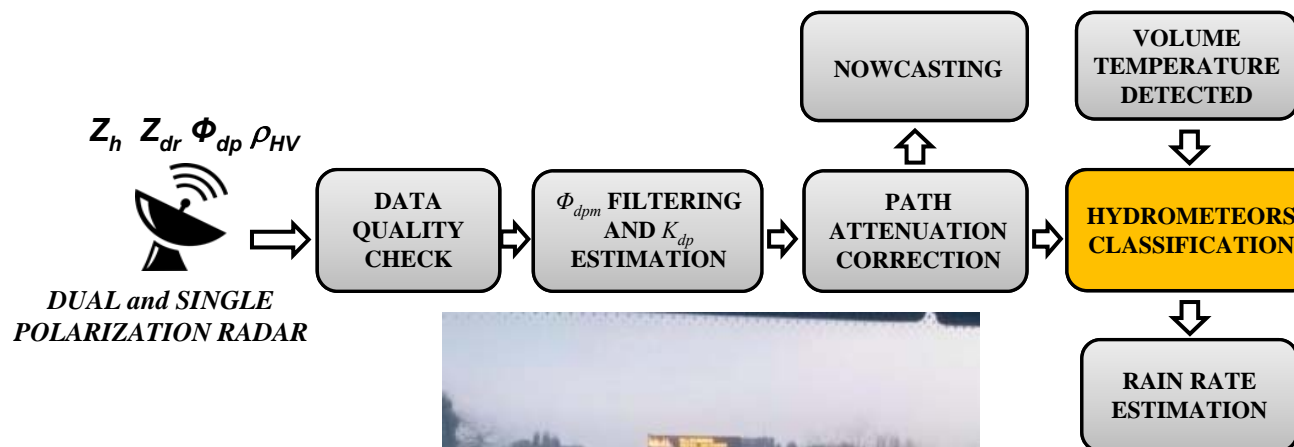


# 1a. The installed X-band mini-radars

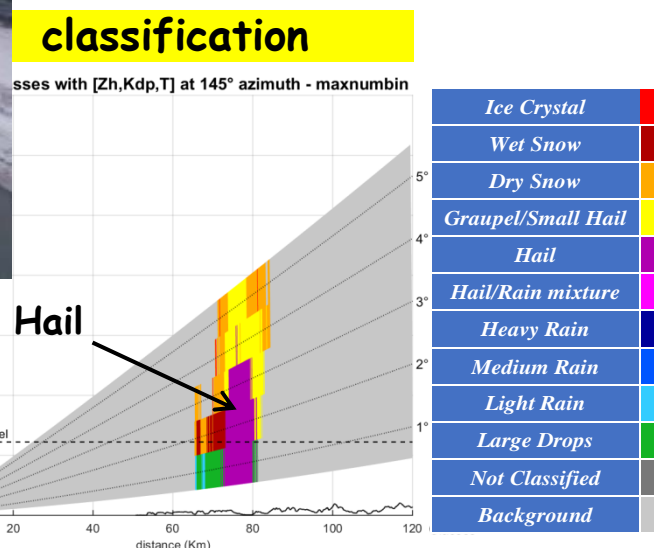




# 1b. Radar processing chain (RadAdria)



Wet s



**Tortoreto - March 26, 2015**

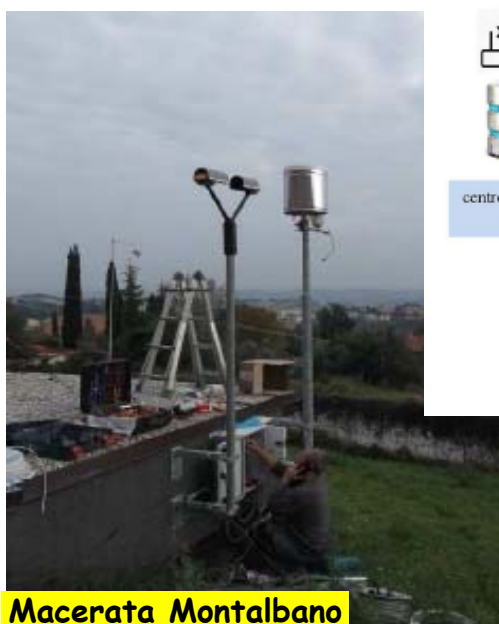




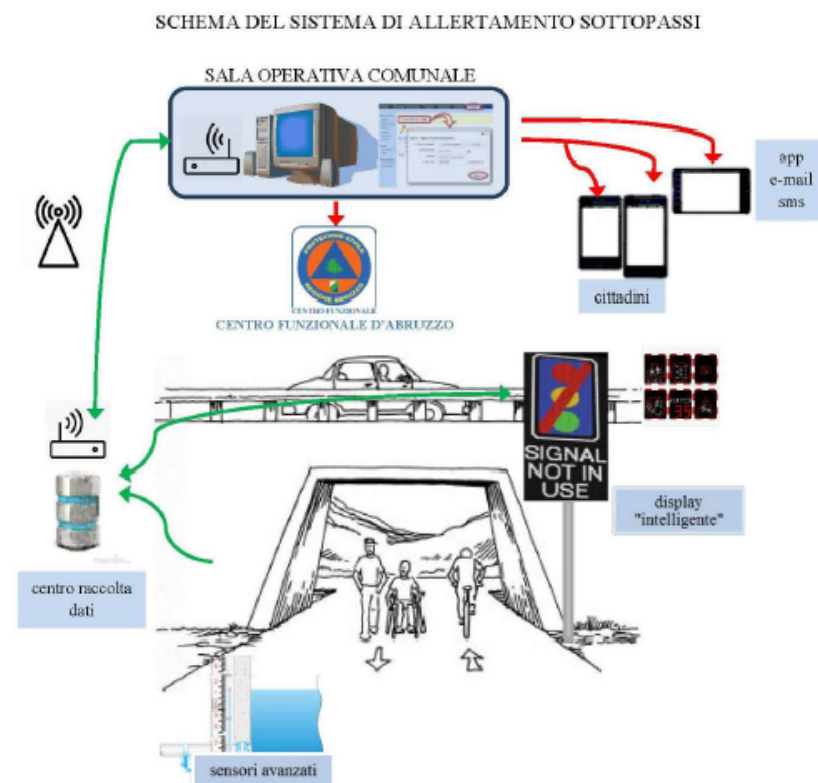
# 1c. Disdrometers and underpass sensor



Cupramontana



Macerata Montalbano

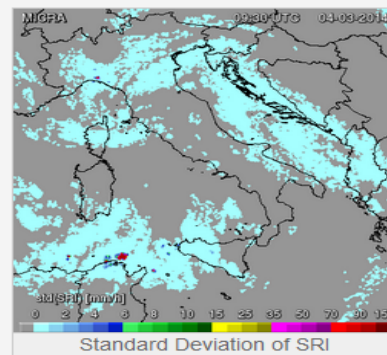
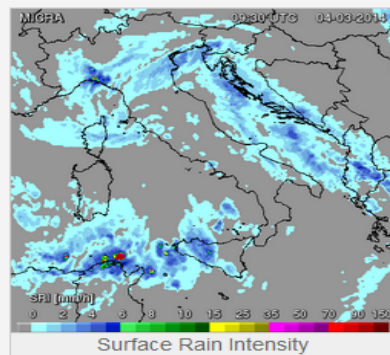




# 1d. Rainrate from Meteosat (MICRAAdria)

The operational MICRAAdria products are published in near-real-time at project web-site

## Rain rate estimation from MSG based on MICRAAdria algorithm



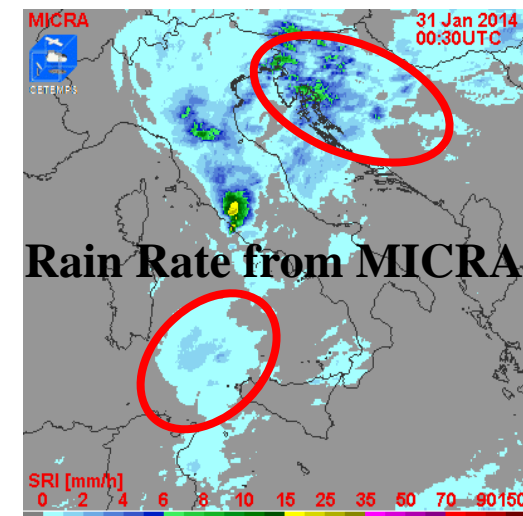
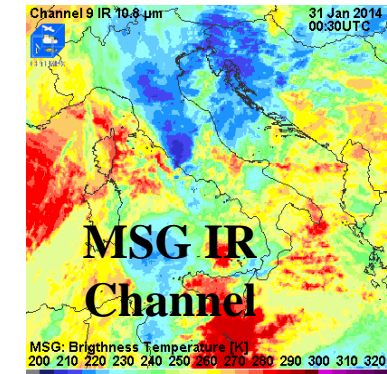
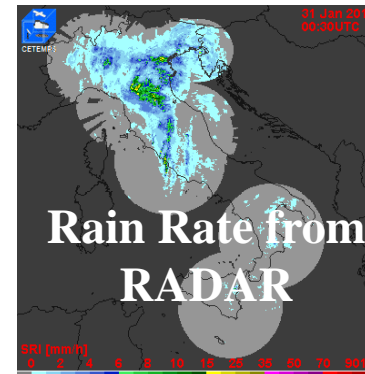
MICRAAdria is the Microwave-Infrared Combined Rainfall Algorithm (MICRA) implemented for the AdriaRadNet project. MICRAAdria provides the following products:

- the estimated Surface Rain Intensity (SRI) [mm/h]
- the standard deviation of the estimated SRI [mm/h]

The latter gives a measure of the estimate confidence: the higher the std(SRI) the lower confidence is given to the estimated SRI.

### IMPLEMENTATION DETAILS:

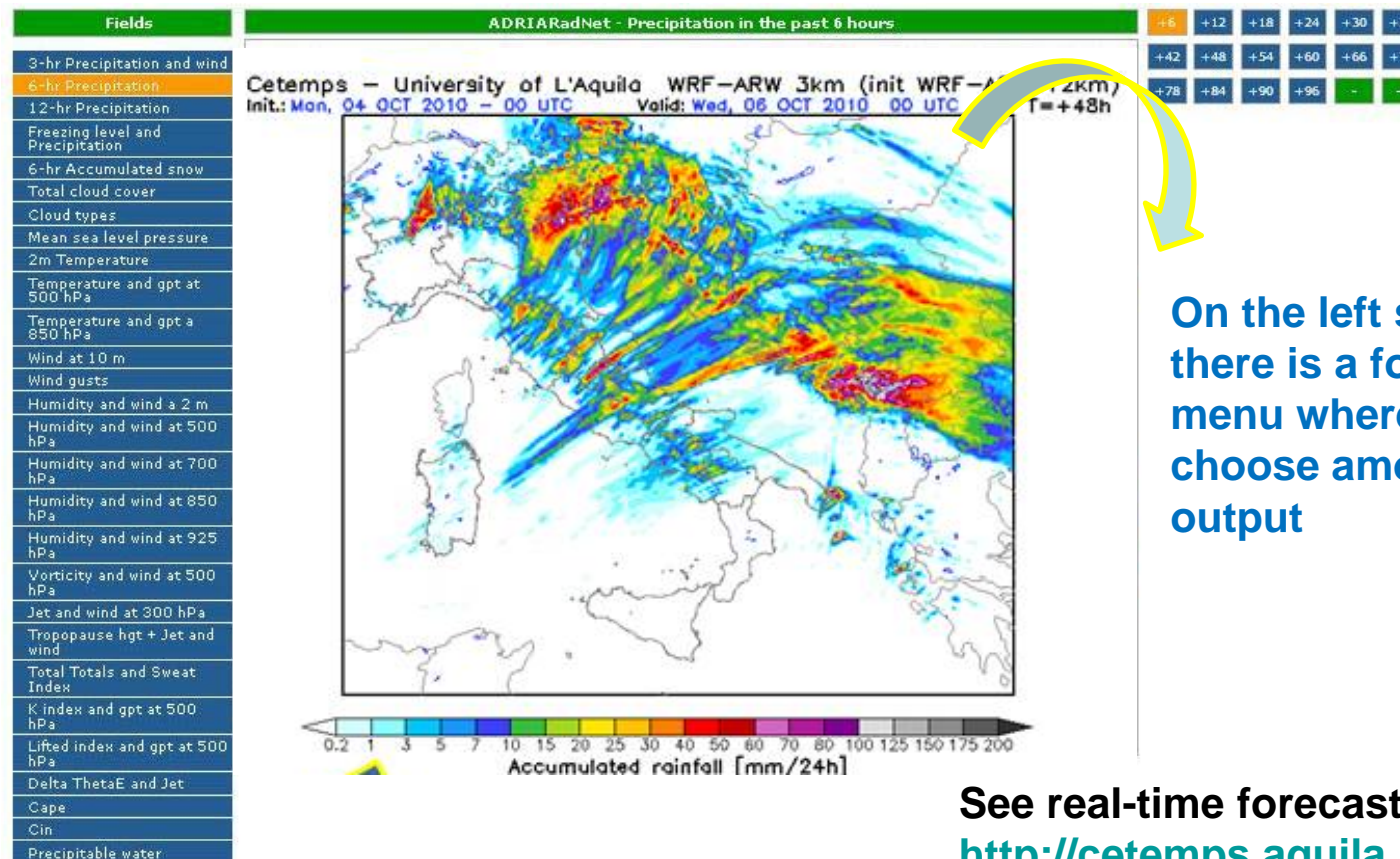
**MICRA-ADRIA home page website**





## 2a. Meteorological modeling (WRFAdria)

Currently the high spatial resolution meteorological model (WRF) is running over target area, assimilating both conventional observations (Synop and Temp) and available radar data.



See real-time forecast at:

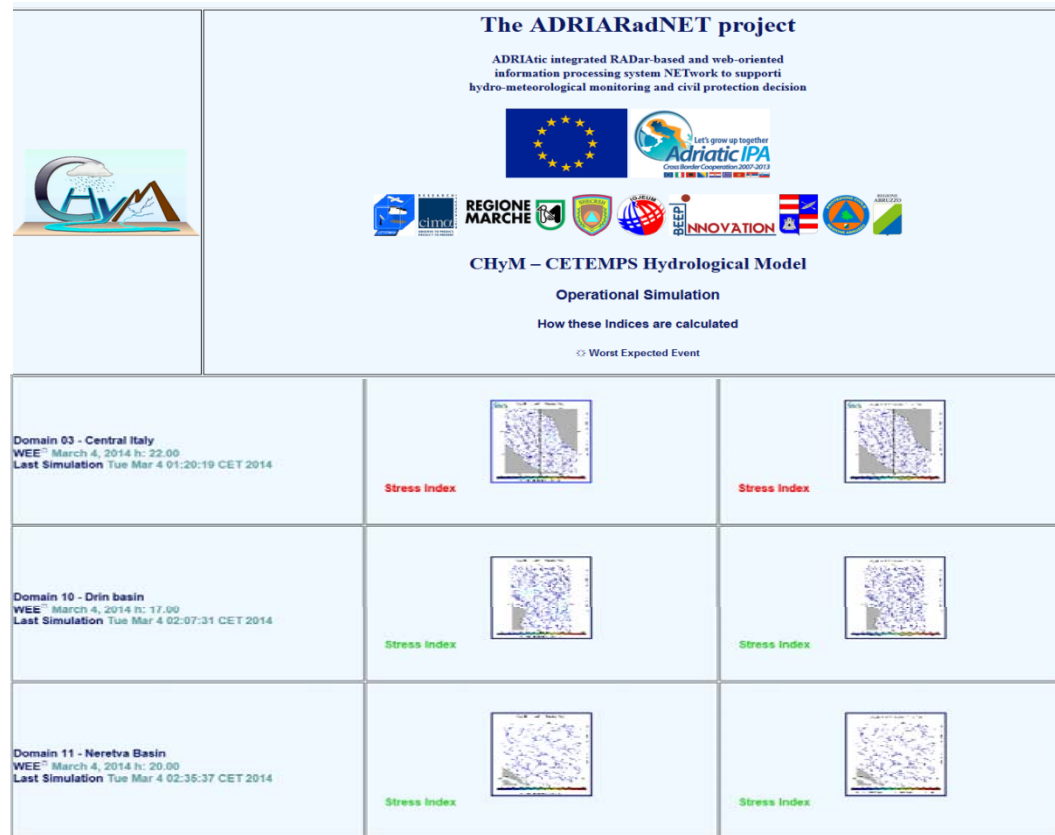
<http://cetemps.aquila.infn.it/adriaradnet/>



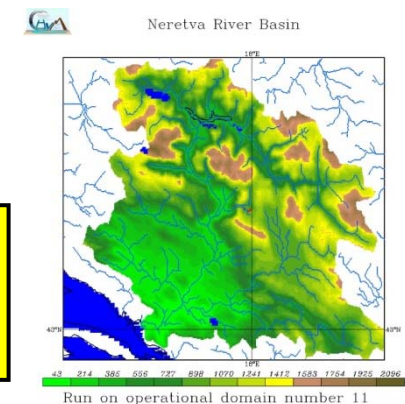


## 2b. Hydrological model outputs (CHyM)

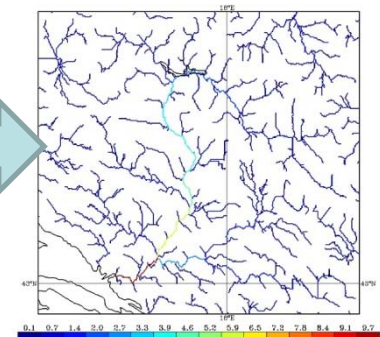
Currently the hydrological model (called CHyM) is running in Central Italy and Neretva and Albanian domain forced by WRF rainfall forecast data.



**Example of  
NERETVA  
Basin Output**



Total drained area (thousand of km<sup>2</sup>)



See real-time forecast at:

<http://cetemps.aquila.infn.it/adriaradnet/>



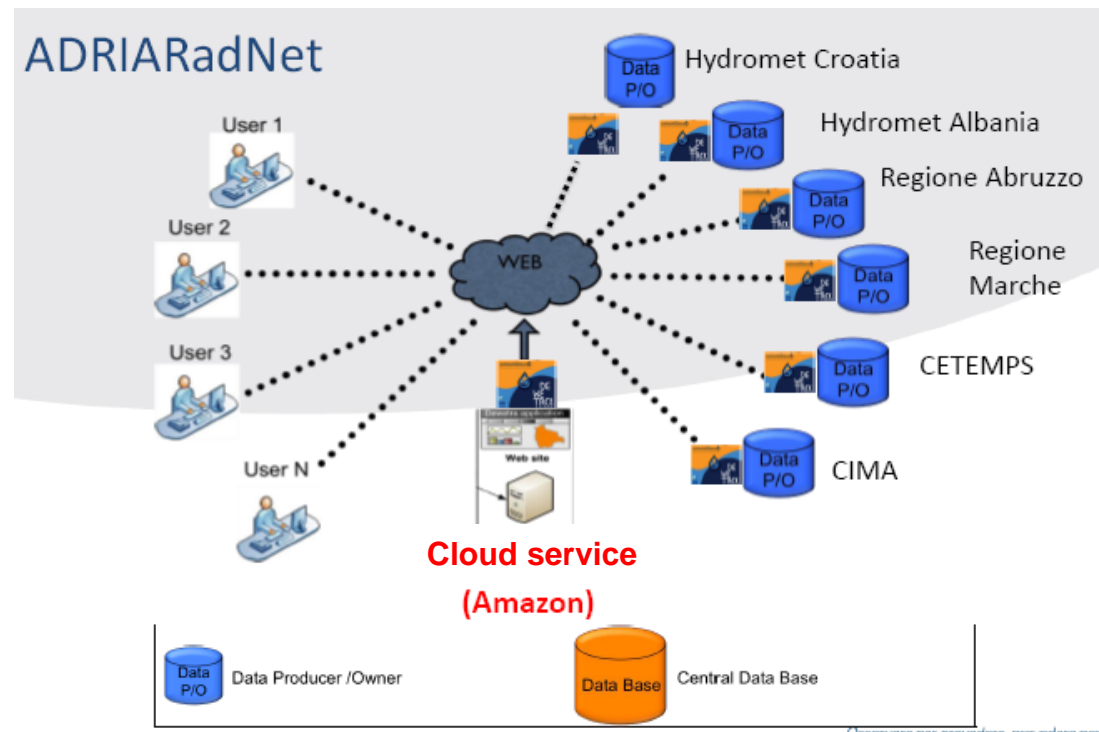


## 3a. ICT Web-based Dewetra platform

The new ICT data exchange platform is a Web-based GIS application to ensure capillary distribution of information. It is an essential tool for public usefulness due to its capability to handle complex scenarios and integrate inhomogeneous components.

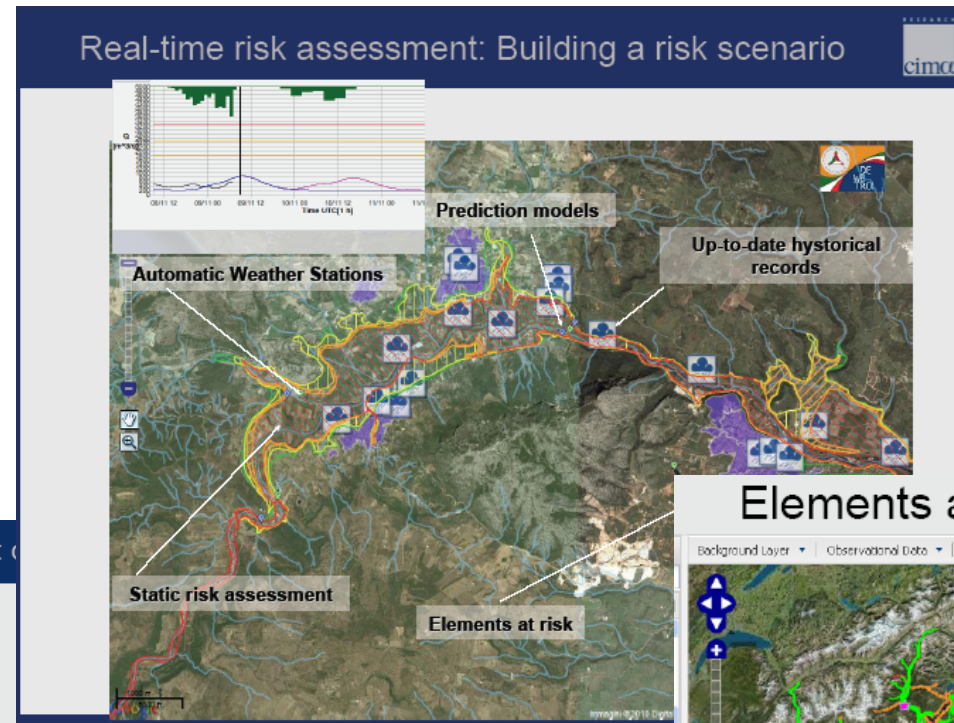


**DewetraNet home page website**





## 3b. Example of DewetraNet outputs

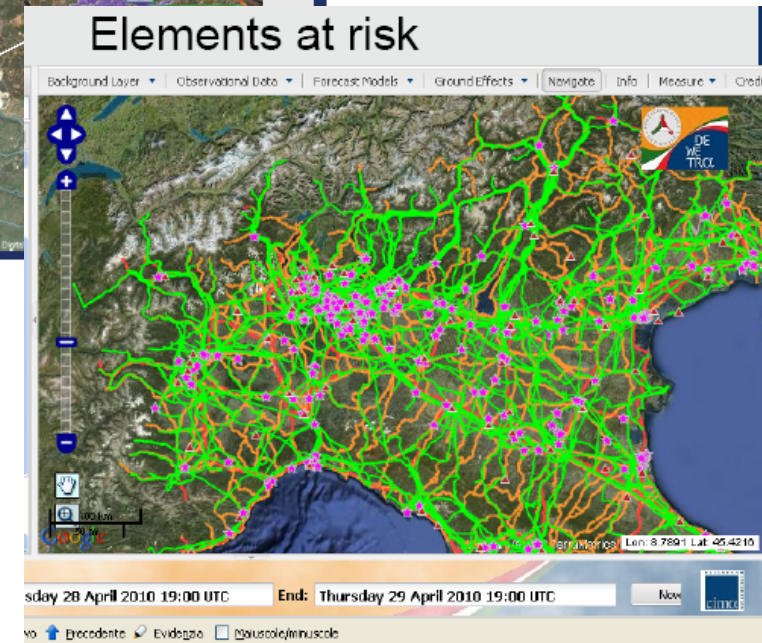
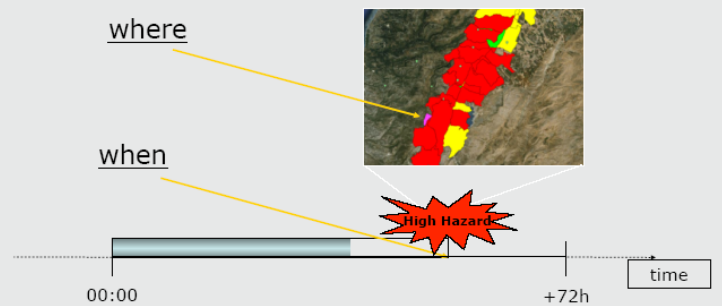


Real-time hazards assessment:

- Real-time observation
- Short range forecast (+72h)

where

when







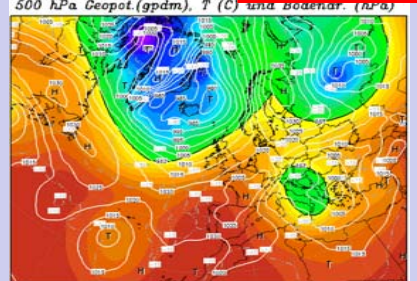
# 4a. ADRIAX Campaign CAO (Central Adriatic Observation)

Start: September 1<sup>st</sup>, 2014  
End: December 15<sup>th</sup>, 2014

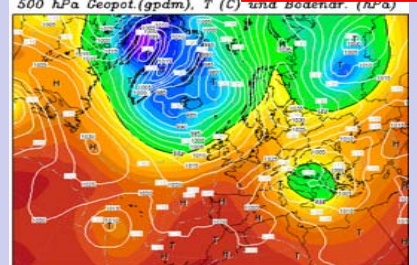
**IOP4 October 23<sup>rd</sup>-24<sup>th</sup>, 2015**

## Synoptic

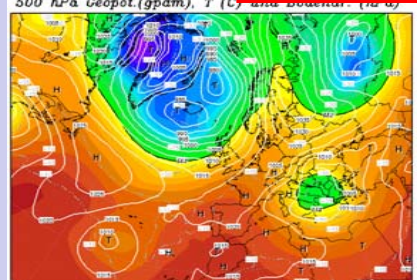
Init: Thu, 23 OCT 2014 00Z Valid: Thu, 23 OCT 2014 06Z



Init: Thu, 23 OCT 2014 00Z Valid: Thu, 23 OCT 2014 12Z



Init: Thu, 23 OCT 2014 00Z Valid: Thu, 23 OCT 2014 18Z

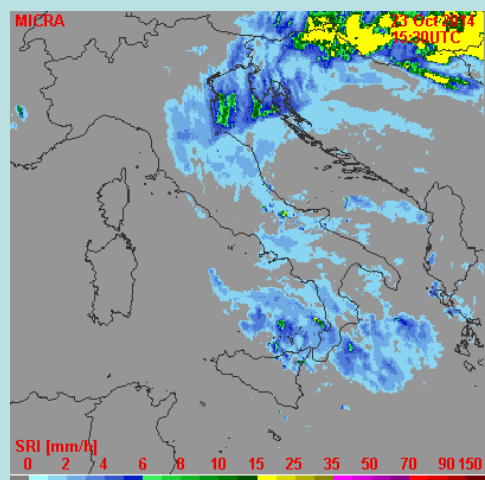


## Observations

### Cingoli RADAR



### MICRAAdria



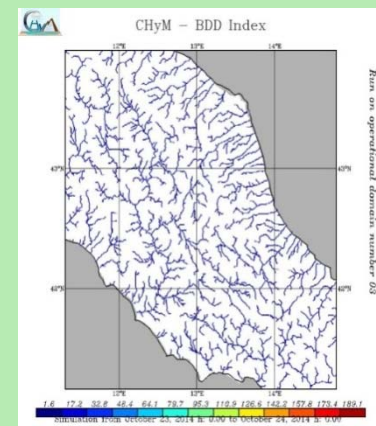
## Numerical Modelling

### WRF-ADRIA

Data: 24/10/14 00 UTC - 24/10/14 12 UTC  
Sensor: Raingauge  
Cumulative Rainfall: last 12 h  
Interpolator: GRISD Ver. 2  
Value Filter: All Values  
Spatial Resolution: Native



### CHyM-Adria





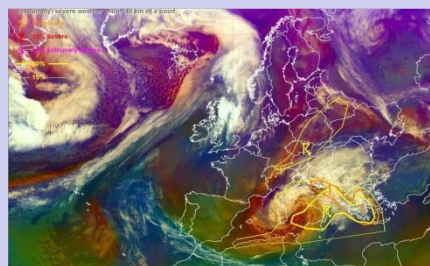
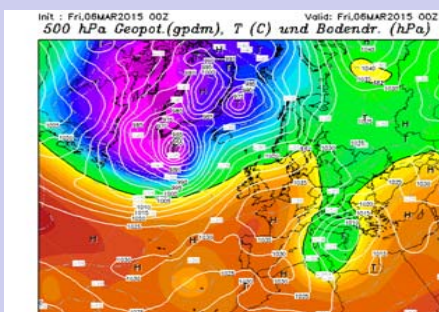
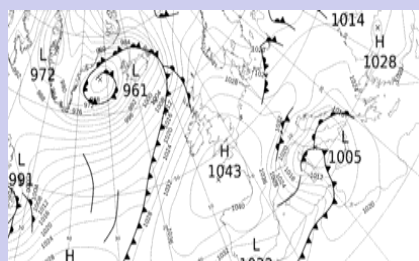


# 4b. ADRIAX Campaign SAO (Southern Adriatic Observation)

Start: March 1<sup>st</sup>, 2015  
End: May 31<sup>th</sup>, 2015

**IOP1 March 5<sup>th</sup>-6<sup>th</sup>, 2015**

## Synoptic

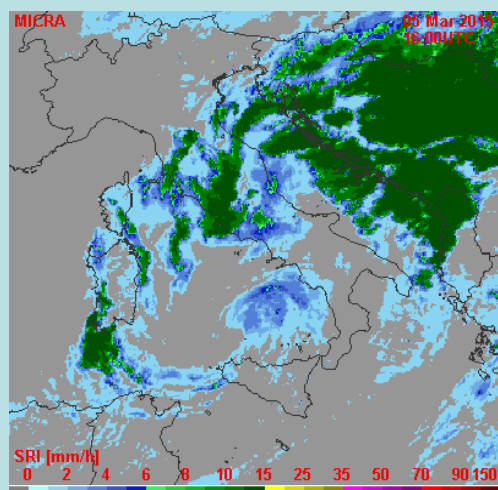


## Observations

### Durres RADAR

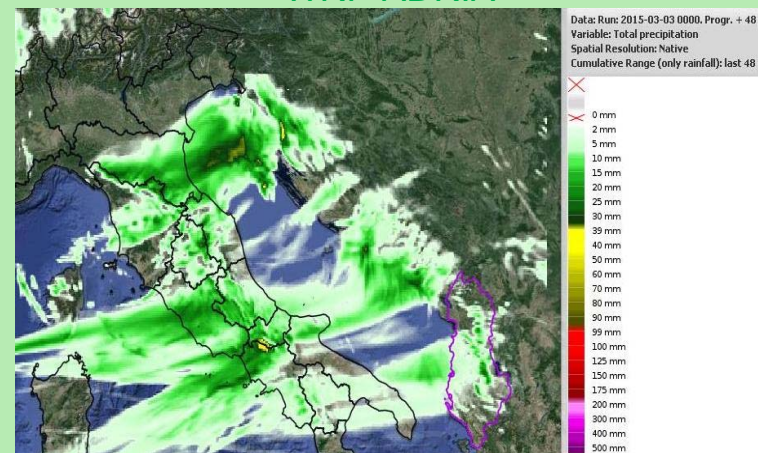


### MICRA

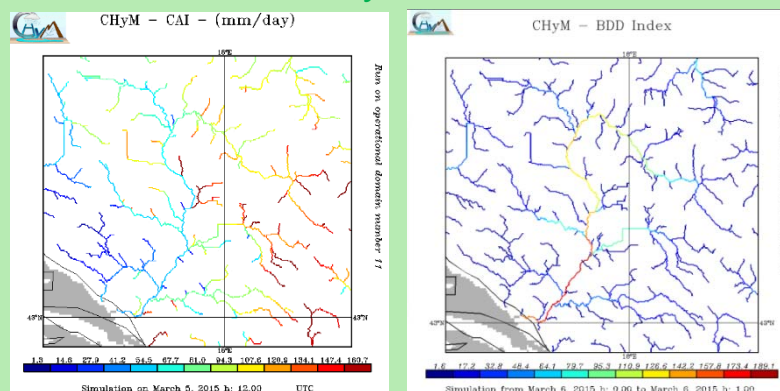


## Numerical Modelling

### WRF-ADRIA



### CHyM-Adria



### Neretva Basin



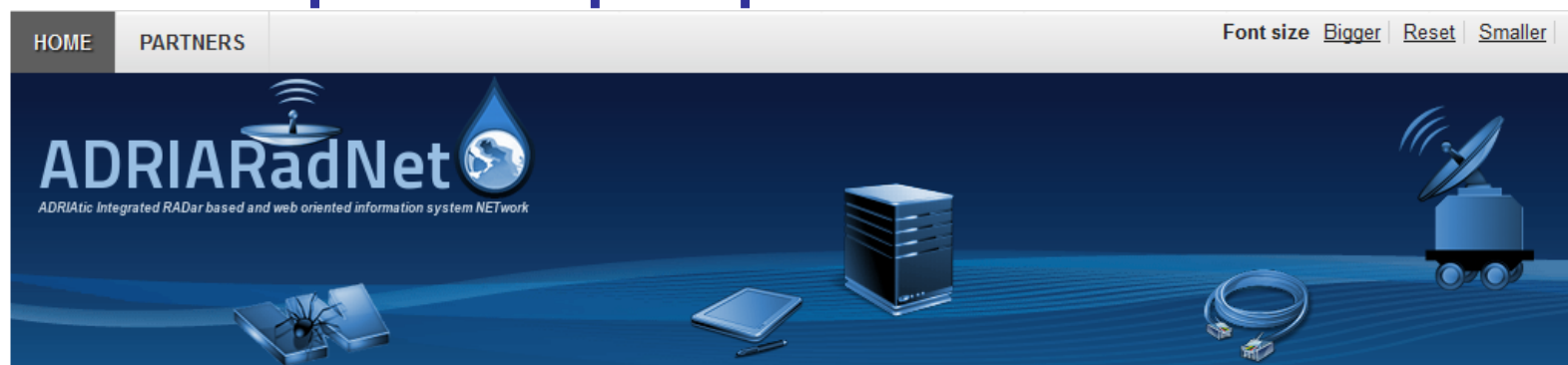
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# ADRIARadNet project web-site

<http://cetemps.aquila.infn.it/adriaradnet/>



You are here: Home

## About the Project

ADRIARadNet is the acronym of ADRIatic integrated RADar-based and web-oriented information processing system NETWORK to support hydro-meteorological monitoring and civil protection decision.

ADRIARadNet is a project cofunded by the European Union, [Instrument for Pre-Accession Assistance \(IPA\)](#).



## Project Aims

## Programme

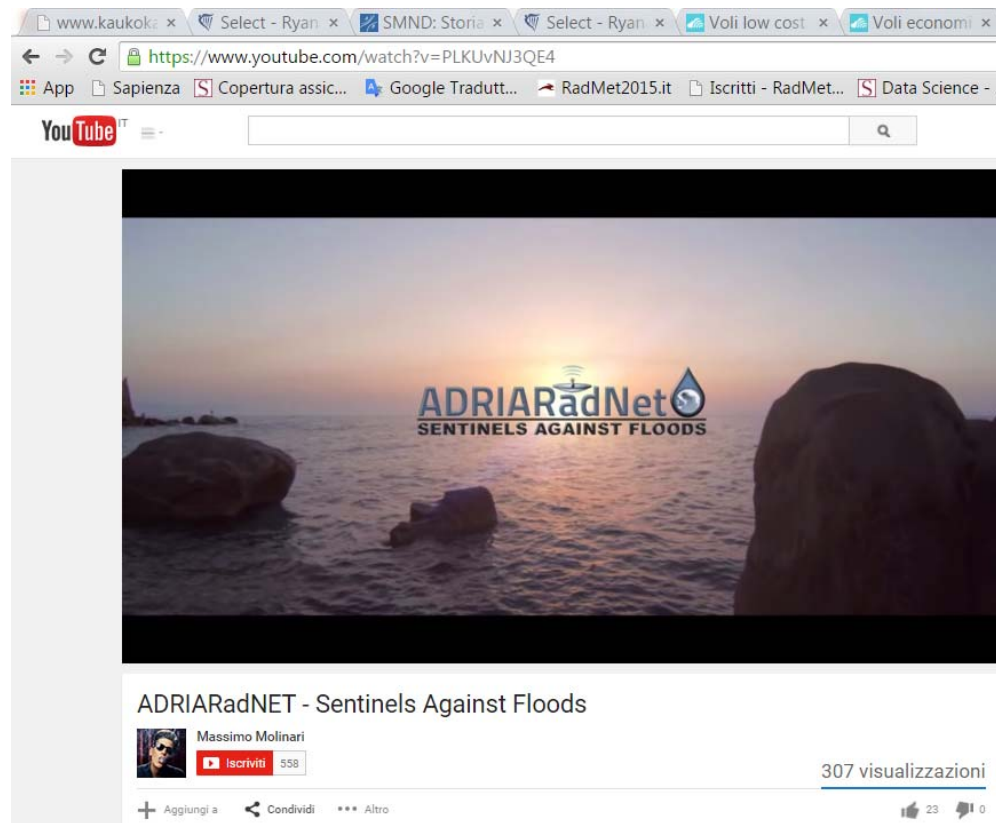
- Home
- Project Details
- Kick-off Meeting in L'Aquila
- Second Project Meeting at Tirana
- Third Project Meeting at Ancona
- Fourth Project Meeting at Dubrovnik
- Radar Tenders Purchase
- Newsletters

***Where you can find more information about the project***



# ADRIARadNet dissemination

- **Semesterly project newsletter**
- **Public conferences** in L'Aquila, Ancona, Dubrovnik, Tirana
- **Video «Sentinels against floods» on YouTube**



- **Presentations in technical-scientific symposia**
- **Demonstration activities**
- **Training of civil protection staff**
- **International summer school in 2013**



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# 1. Improving ADRIARadNet systems

- **Improvement goals:** the developed DSS can be improved by strengthening: a) its technical performance; b) the deployed instruments; c) processing algorithms.
- **Decision support system (DSS) improvement proposal**
  - Initialization and validation of **forecast models** using larger datasets (ground data, radar nets, extra RAOB)
  - **Algorithm optimization** and new useful radar products development (composite, satellite merging)
  - **ICT platform** (loops, interface, mobile version, cloud) with new NAS and server enhanced performance
  - **New radar installations** to cover a broader Adriatic area
  - Adding a **hydraulic modeling** within the processing chain



## 2. Enhancing ADRIARadNet demonstration

- **Further demonstration goals:** further testing of products, systems and tools, developed by ADRIARadNet, for new field campaigns in an operational context.
- **DSS Further demonstration proposal**
  - **Systematic validation** using refined instruments (other measurements, ground data, river flow)
  - Extended **field campaigns** to cover annual variability
  - **End-user** shared and cooperative exercise
  - Tuning of **information flow** for decision support
  - Update of **civil protection plans** at regional and local level using project demonstrations



### 3. Strengthening ADRIARadNet outreach

- **Outreach goals:** transfer the capacity and knowledge developed by ADRIARadNet project to other Adriatic countries and stakeholders that are not part of the projects.
- **ADRIARadNet outreach proposal**
  - Extend capacity **to other IPA countries** (e.g., Montenegro, Greece, Slovenia) and communities
  - Clustering with **other projects for multi-risk approach**
    - Hydrogeo risk as a IT-platform layer within DSS
    - Exploitation of DSS/model products for coastal sea
    - Airport traffic meteo hazard and building resilience

The **CapRadNet project**: submitted to EUSAIR IPA-targeted call on 11 March 2016



# Thanks for your attention by ALL Partners

L'AQUILA



TIRANA



ANCONA



DUBROVNIK



**ADRIARadNet**  
Sentinels against floods