



## Flash-floods, landslides and urban inundations: integration of Large Scale Monitoring Networks and Local Early Warning Systems

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*Todi, Italy, 25 August 2023*

# CAE HEADQUARTER



Bologna

# MISSION

- Our mission is to contribute to creating a world that is more prepared to the risks that communities face with regards to multiple natural events, thanks to our unique mix of expertise, innovation and commitment.
- For this reason, we have been designing, creating and servicing reliable and effective systems for real-time monitoring, decision-making support and alerts during emergencies. Our solutions are used both to mitigate the risk associated with extreme weather events and their effects on the ground and to mitigate the impact of wildfires, as well as monitoring water resources even from the quality point of view.
- We continuously invest in developing reliable, innovative and interoperable technologies useful to preserve the territory and to safeguard the population. As well as being leader in Italy, where we are recognised for the specific customer care we provide, we supply technologies and services all around the world through a growing network of international partners.

# OUR TEAM



- 111 employees
- 25 engineers
- 45 technicians
- 200 induced employment



**SALES**  
*(14 employees)*



**INNOVATION AND TECHNOLOGY**  
*(21 employees)*



**OPERATIONS**  
*(44 employees, out of which 8 are localized)*



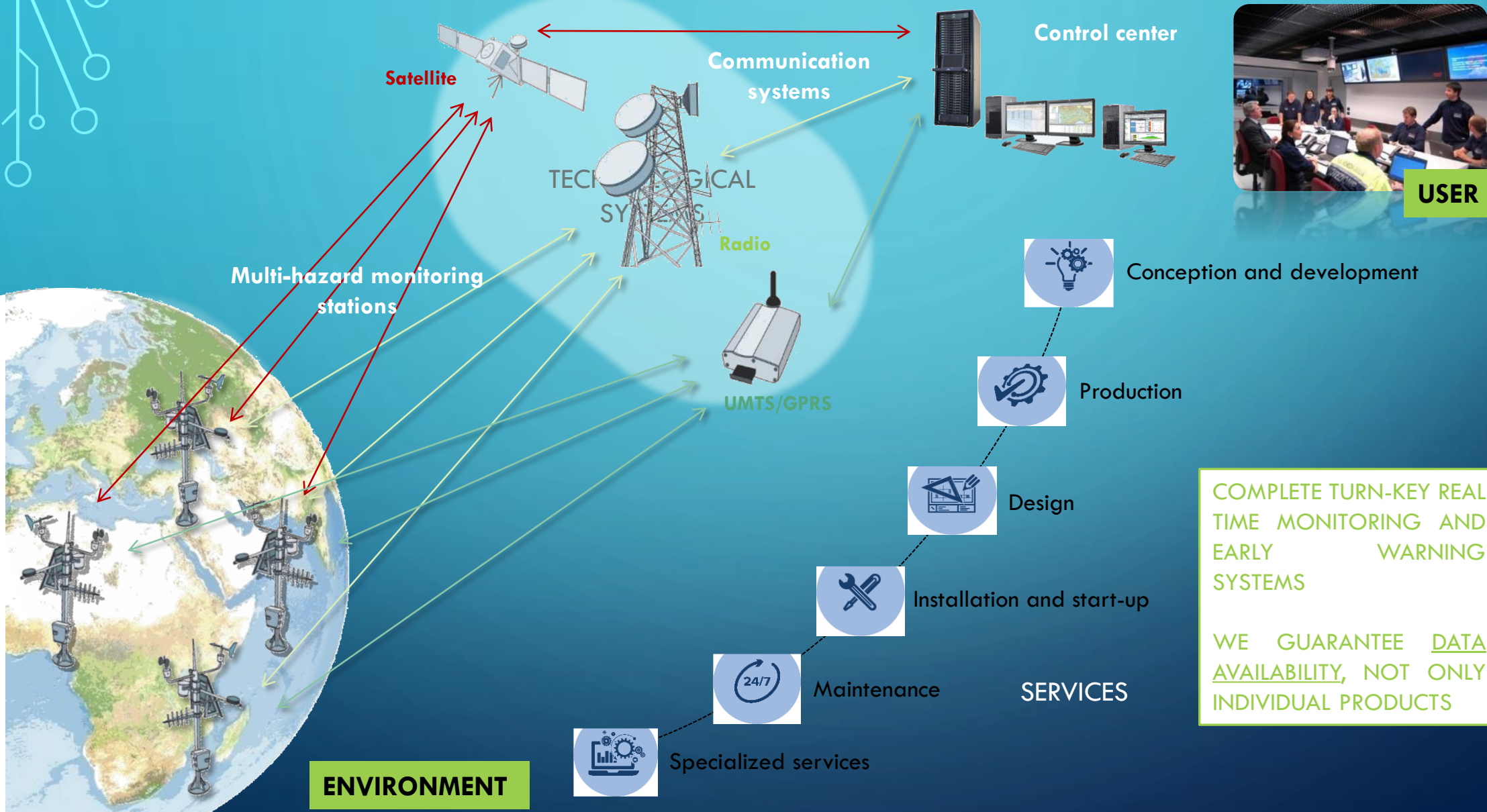
**SUPPLY CHAIN**  
*(21 employees)*



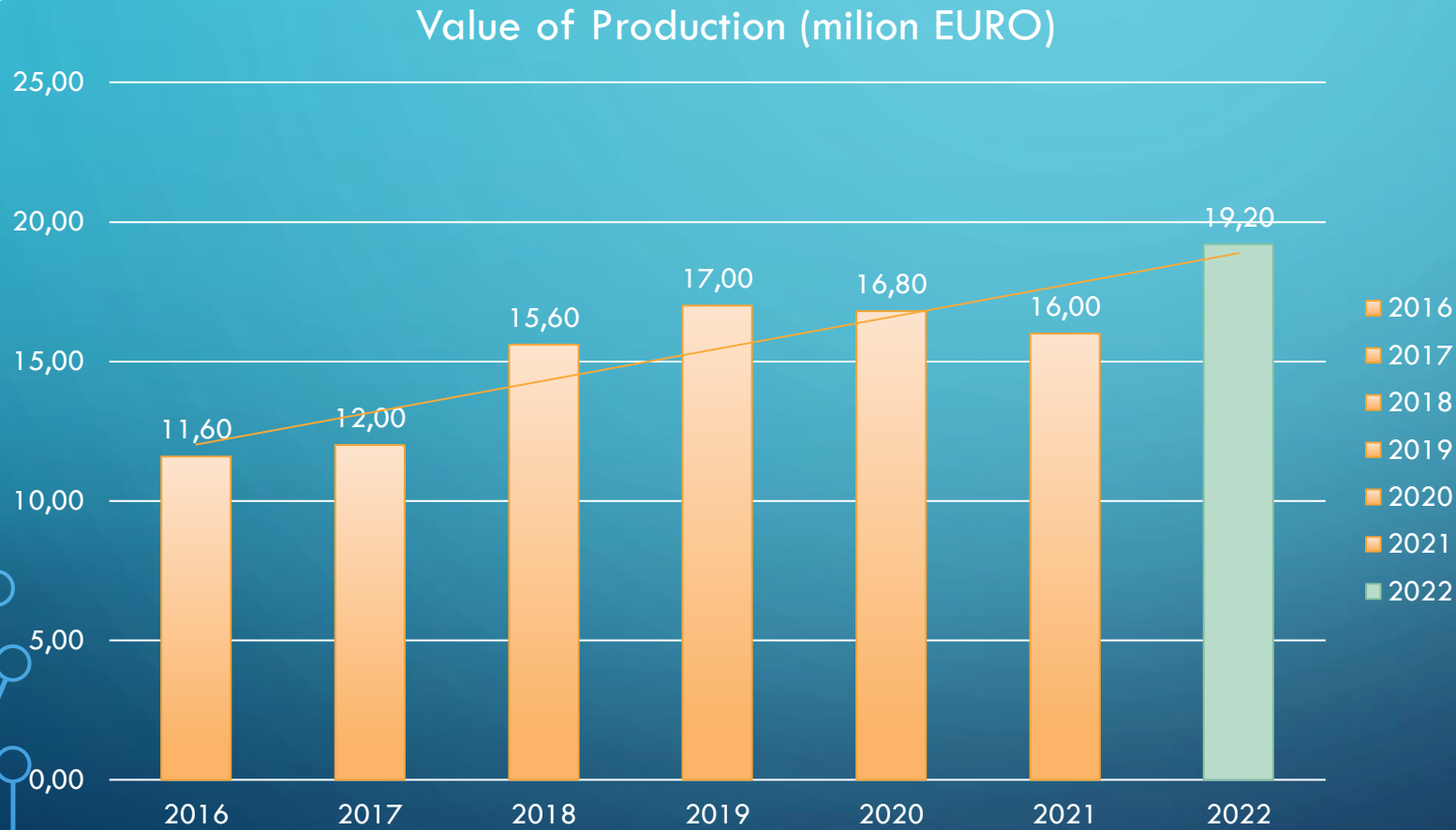
**STAFF, AFC, HR**  
*(11 employees)*

**Directors  
39 to 51  
Years old**

# Business model – the «CAE» Concept of System System & Service Integrated Approach



# TURNOVER AND STAFF BETWEEN 2016 AND 2022

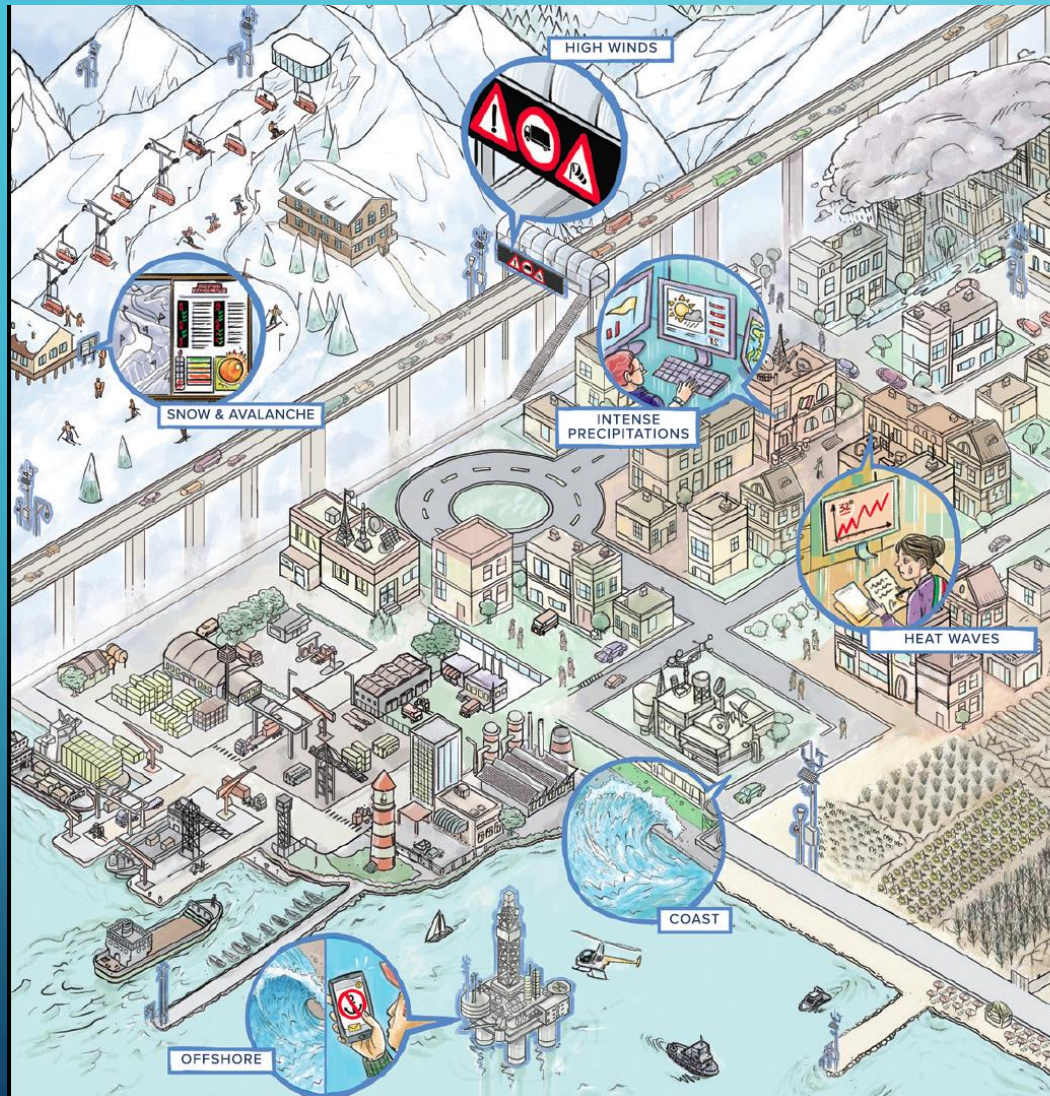


**2016**  
92 employees



**2022**  
111 employees

# Natural Hazards & Risk Scenarios (1/5)



## RISK DUE TO EXTREME WEATHER EVENTS

WE OFFER SOLUTIONS TO MITIGATE THE EFFECT OF THE GLOBAL WARMING WHICH ACCELERATES AND ACCENTUATES THE NUMBER AND INTENSITY OF WEATHER EVENTS. MEASUREMENT RELIABILITY IS GUARANTEED BY SCRUPULOUS APPLICATION OF WMO GUIDELINES.

### INTENSE PRECIPITATIONS

The solutions proposed permit the management of alarms and mitigation of the risk associated with the most extreme phenomena. This is done using real-time precipitation intensity measurements, providing maximum precision from the very first minute.

### HEAT WAVES

Our systems supply data for calculating climatic discomfort indexes and identifying risk situations resulting from heat waves, so as to alert the population in advance and prevent health issues.

### HIGH WINDS

In the event of high winds, the system alerts the authorities and automatically manages the alarms, for example stopping traffic access to viaducts. The sturdy instruments can operate correctly up to speeds typical of hurricanes.

### OFFSHORE MONITORING

The systems installed on offshore platforms supply weather and climate data about sky and sea conditions. They help with guidance for vessel docking and helicopter take off and landing.

### COASTAL MONITORING

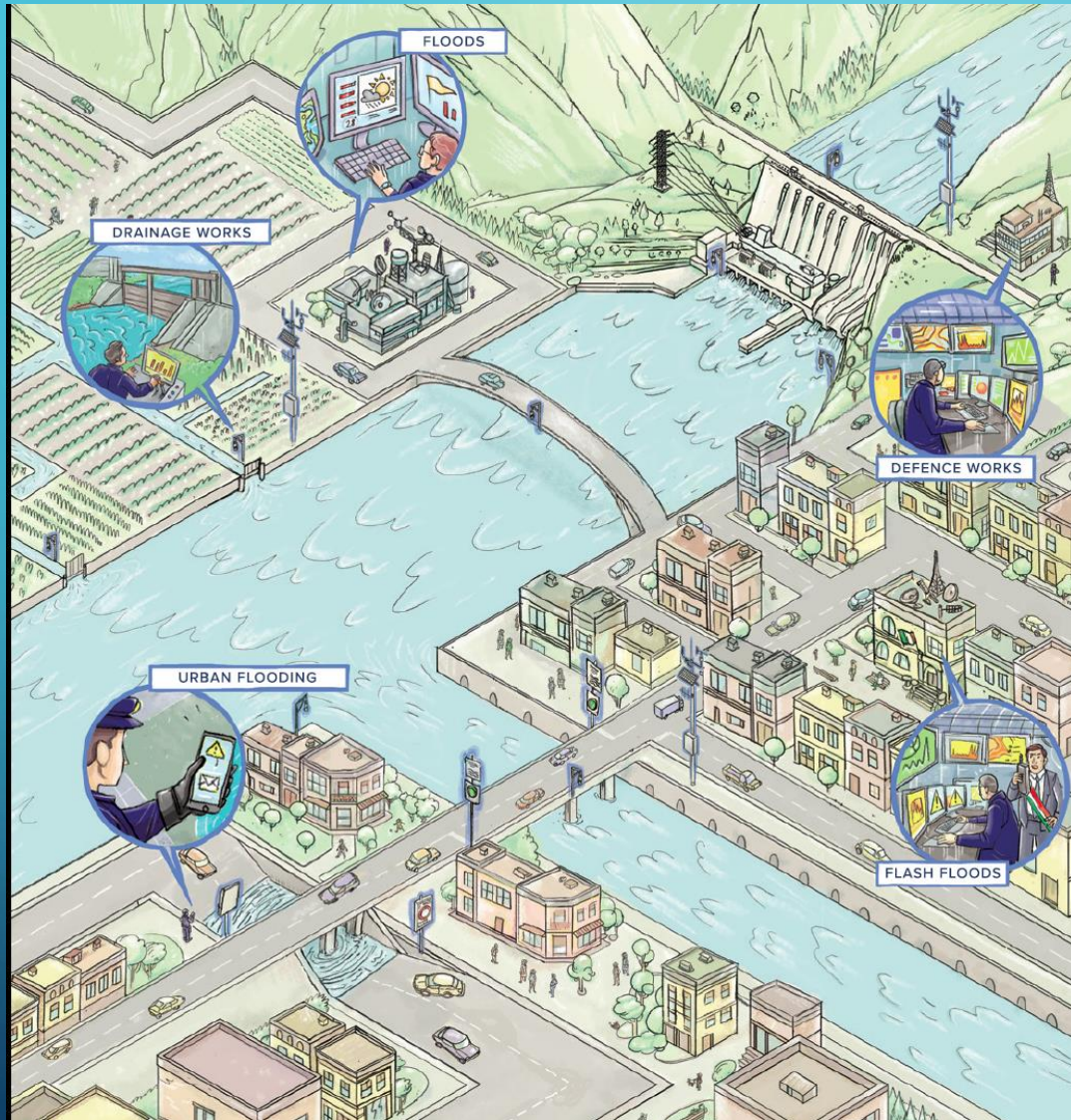
We provide systems that generate measurements useful for guiding vessels into port, for sending out alerts in the event of stormy seas and coastal flooding and aiding analysis of coastal erosion and movement of sandbanks on the seabed.

### SNOW AND AVALANCHE

Our systems help to mitigate the risk of avalanches and to analyse the contribution of snow melting to downstream river flood waters.



# Natural Hazards & Risk Scenarios (2/5)



## WATER AND HYDROLOGICAL RISK

WE COME UP WITH SOLUTIONS FOR MITIGATING THE EFFECTS OF WATER AND HYDROLOGICAL RISK USING NETWORKS THAT MEASURE A VARIETY OF QUANTITIES IN REAL TIME, USEFUL ON ONE HAND FOR FEEDING FORECASTING MODELS FOR SUPPORTING DECISION-MAKING AND ON THE OTHER HAND, RELATIVE TO PRE-SET THRESHOLDS, FOR ACTIVATING NOTIFICATION AND ALERTING SYSTEMS.

### FLOODS

The solutions we put forward provide real-time monitoring of large basins, feeding the forecasting models precisely and with lasting reliability.

### FLASH FLOODS

To mitigate the risk of flash floods, we propose solutions for real-time monitoring of parameters such as river and precipitation levels. They also automatically manage alarms and alerts for the competent authorities.

### DEFENCE WORKS

We suggest the integration of non-structural work that complements defence works such as embankments, dykes, storage basins, etc. These allow monitoring of the status of works and their operation over time, as well as supporting staff in emergencies.

### DRAINAGE WORKS

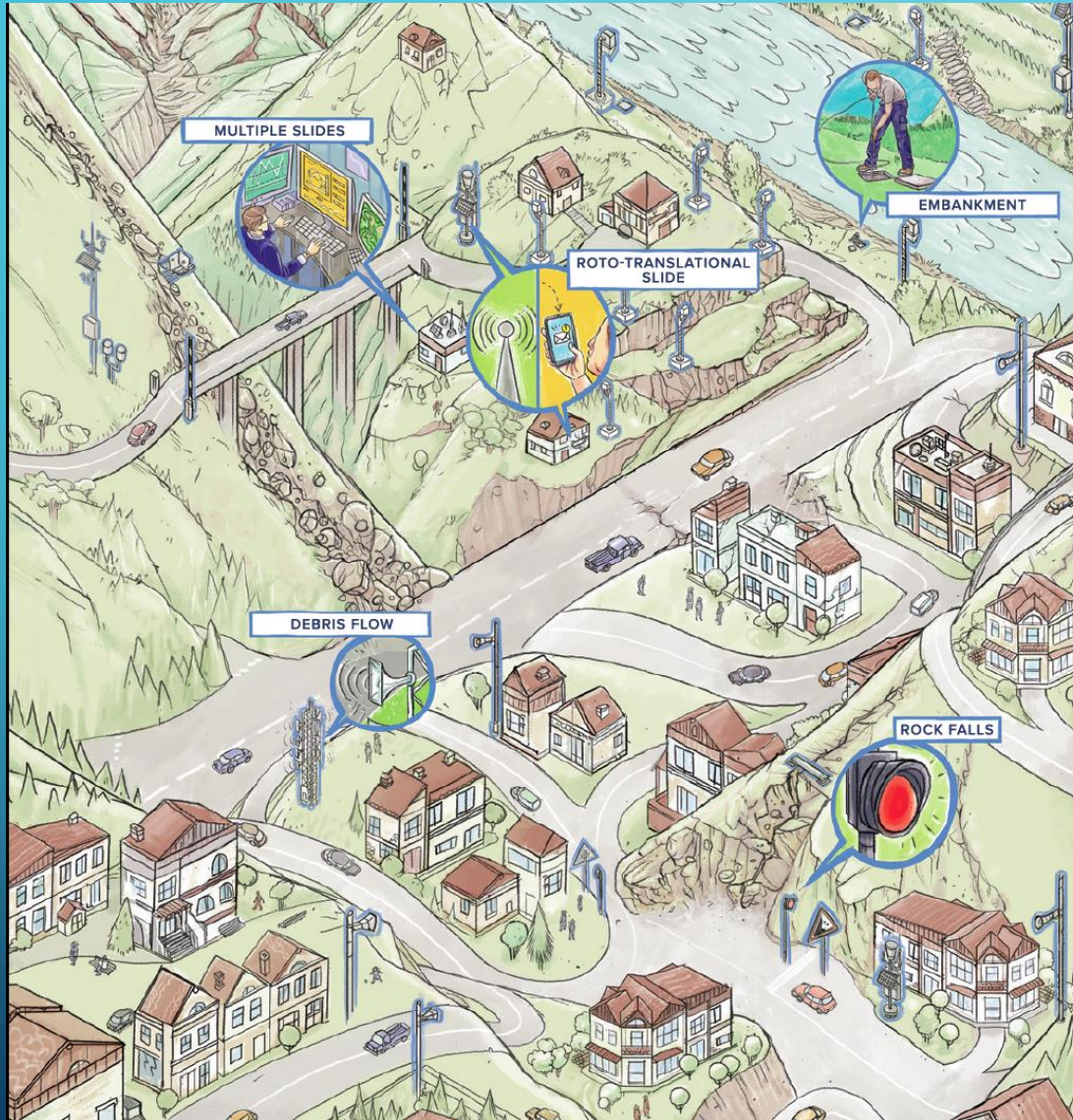
We propose flexible solutions that, due to their interoperability, are interfaceable with the respective systems of drainage associations for automatic control of floodgates, pumps and barriers.

### URBAN FLOODING

Increasingly common heavy rains have brought a rise in the number of urban areas at risk of flooding; underpasses are the most vulnerable infrastructures. We provide solutions that allow automatic transit blocking, by activating special signals (bars, traffic lights, variable message signs) and alerting of staff responsible.



# Natural Hazards & Risk Scenarios (3/5)



## GEOLOGICAL AND HYDROGEOLOGICAL RISK

WE OFFER SOLUTIONS TO MITIGATE THE GEOLOGICAL AND HYDROGEOLOGICAL RISK. THESE SYSTEMS ARE CAPABLE TO ALERT THE POPULATION AND USE NETWORKS OF WIRELESS SENSORS DISTRIBUTED OVER THE TERRITORY IN SELF-CONFIGURING MESH NETWORKS.

### MULTIPLE SLIDES

In areas with many different types of landslides, we suggest integrated monitoring and alerting solutions, centralising in a single operations room the real-time control and analysis of multiple instability events.

### ROTATIONAL AND TRANSLATIONAL SLIDES

Our systems allow continuous, real-time remote checking of the most significant parameters for slope stability, such as precipitation, deformation profile, piezometric levels and structural deformations.

### DEBRIS FLOW

The monitoring systems proposed monitor many parameters, including critical instability trigger conditions, debris transit, leading edge height, erosion/deposit rate and the average speed of slides between multiple measuring stations, as well as activating the alerting devices provided.

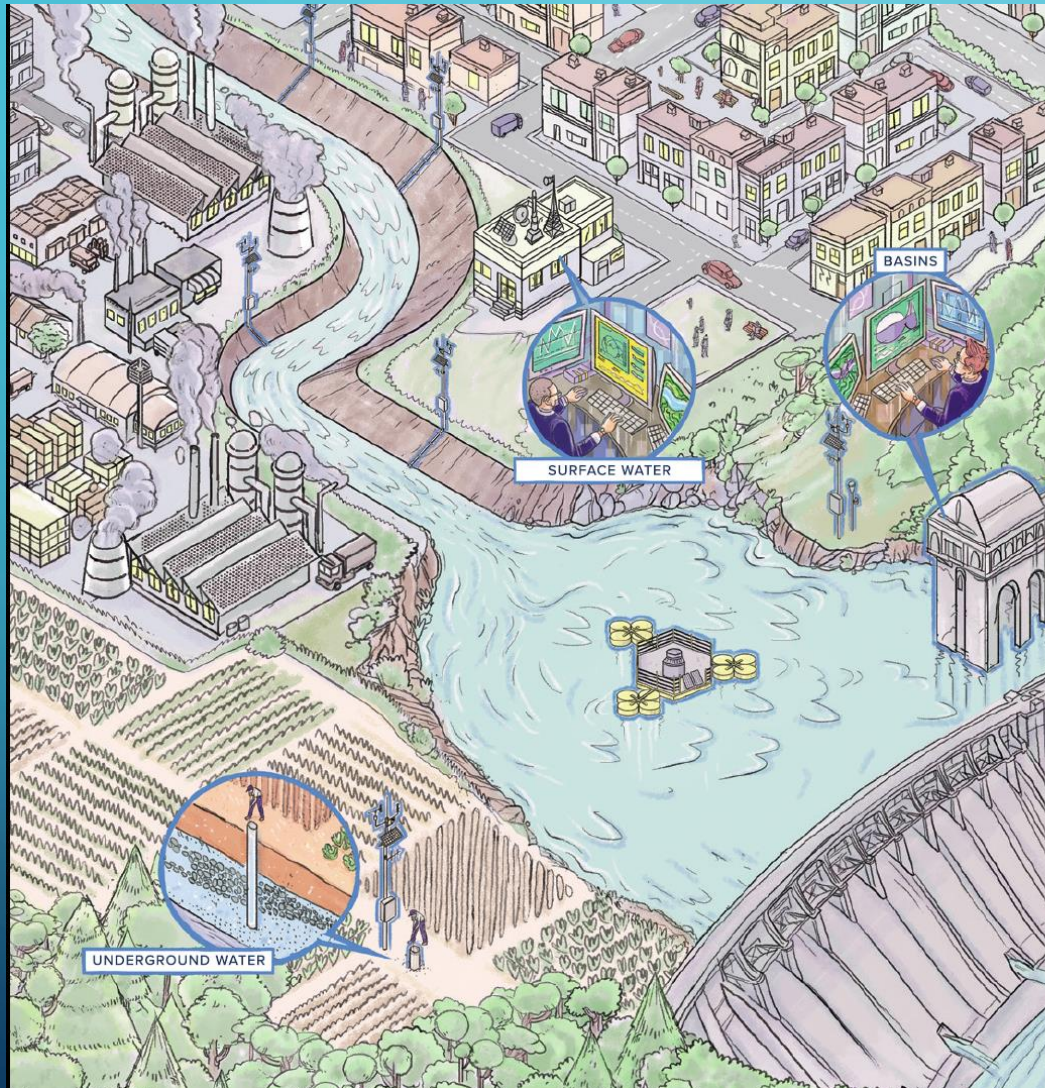
### ROCK FALLS

We present solutions for checking meteorological parameters that affect rock face stability and for verifying the status of deformations, which may generate falls on rock faces with deep fractures.

### EMBANKMENT INSTABILITY

The systems proposed allow the study of imbibition and filtration dynamics of specific sections of embankments in response to floods. The data collected allow the management of emergency situations and the planning of any reinforcing works, checking their effectiveness.

# Environmental Hazards & Risk Scenarios (4/5)



## RISK DUE TO POLLUTION OF WATER RESOURCES

CAE OFFERS SOLUTIONS TO MITIGATE THE EFFECTS OF POLLUTION OF WATER RESOURCES. OUR SYSTEMS MEASURE CHEMICAL - PHYSICAL PARAMETERS IN LAKES, RESERVOIRS, WATERCOURSES AND AQUIFERS, SO THAT OPERATORS CAN BE ALERTED IF PRE-SET CRITICAL LEVELS ARE EXCEEDED.

### WATER QUALITY IN THE BASINS

We propose systems that automatically measure, multiple times a day, the most significant water quality parameters at different depths. That helps to identify the correct height for drawing the water with the best characteristics for potabilisation.

### POLLUTION OF SURFACE WATER

The systems for checking and monitoring surface bodies of water involve continuous and unmanned measuring of some of the most important chemical - physical parameters for evaluation of the water quality index. The system allows the sending of alarms to operators when critical thresholds are exceeded; it records acquired data and relevant events for documentation.

### POLLUTION OF UNDERGROUND WATER

We provide solutions that can be installed at depth for real-time monitoring of aquifer water quality and quantity. The values can be used both to estimate the quantities of underground reserves, and to determine the potential for using them for irrigation or drinking water.

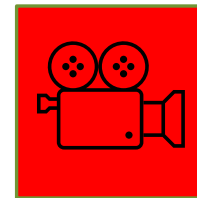


# Environmental Hazards & Risk Scenarios (5/5)



## RISK DUE TO BUSH FIRES

WE SUPPLY SYSTEMS THAT MITIGATE THE RISK OF BUSH FIRES BY CALCULATING GEOREFERENCED RISK INDEXES, RAPIDLY IDENTIFYING IGNITION AND FORECASTING THEIR SPREAD OVER THE TERRITORY. THIS SET OF INSTRUMENTS KEEPS THE POPULATION SAFE AND CAN AID PROMPT AND EFFECTIVE ACTION BY THE AUTHORITIES FOR PUTTING OUT THE FLAMES.



### IGNITION RISK INDEXES

The system provides risk indexes that highlight the likelihood of fires starting, taking into account the territory's characteristics, the type and distribution of vegetation, anthropic activities and relevant meteorological parameters, such as moisture in the soil, wind and air temperature.

### EARLY IDENTIFICATION OF FIRE

The solution offered autonomously identifies the ignition of a fire and calculates its coordinates using the combination of visible and thermal images. It also allows powerful zooming to check and validate automatic alarms and to trace fire detection back to previous stages.

### FORECAST SYSTEM FOR PROPAGATION OF THE FLAME FRONT

CAE systems include forecasting models that can show the probable propagation of the flame front on georeferenced maps, for easier planning of interventions using equipment and personnel.



# CAE IN FIGURES

## Total production since 1977...

- 7.000 automatic stations in real time
- 750 UHF radio repeaters
- 4.300 water level sensors
- 4.800 automatic precipitation gauges
- 550 wireless nodes for local connection

## Today in Italy...

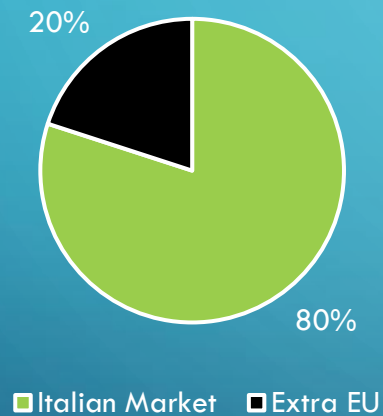
- **37 networks and 2.600 automatic stations currently under maintenance**
- **15.000 measurement sensors** guaranteed with >98% data availability in near real time
- **53 landslides** equipped with monitoring and early warning systems covered by CAE maintenance services



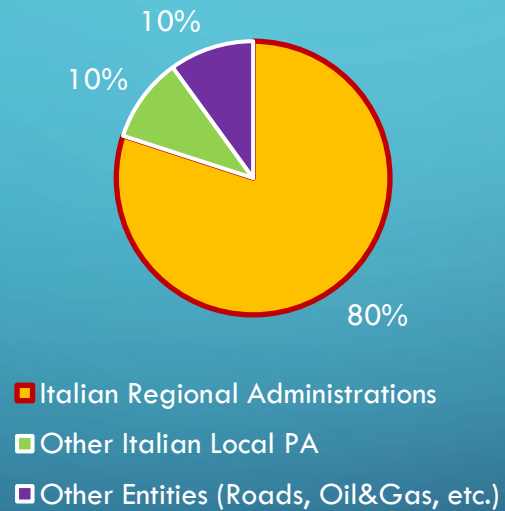
Countrywide operations, leader  
in 14 Regions

# OUR MARKET SEGMENTATION: «MULTI-HAZARD REAL TIME MONITORING AND EARLY WARNING SYSTEM»

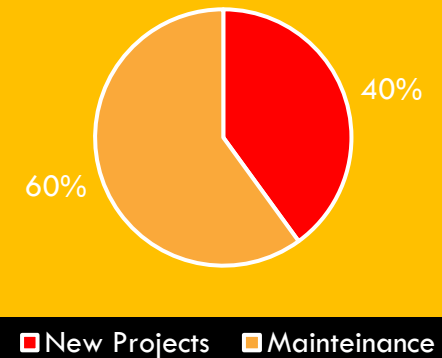
## Clients



## Italian Market



## Italian Regional Administrations



# INTERNATIONAL PROJECTS: THE LEADERSHIP IN VIETNAM

**2009**

**Italian ODA Project -  
Improving Flood Forecasting  
and Warning Systems in  
Vietnam – fase I**

**75 AWS**

**UHF + 2G**

- 42 HYDRO+RAIN GAUGES
- 15 RAIN GAUGES
- 1 MARINE
- 17 METEOROLOGICAL

**5 PROVINCIAL CENTERS**

**1 REGIONAL CENTRE**

**1 NATIONAL CENTRE**

**2012**

**World Bank - Strengthening  
capabilities of flood warning and  
monitoring in CuuLong delta river**

**101 AWS**

**Satellite + 2G**

- 89 Hydro + Rain Gauges
- 12 Meteorological

**14 ADCP**

**13 Provincial Centers**

**1 Regional Centre**

**2016**

**World Bank - Managing  
Natural Hazards Project (C2-  
TB5b)**

**43 AWS**

**2G/3G**

- water level
- rain gauge
- staff gauge

**10 provincial data collection  
and operation center**

**Integration of the information  
system with Southern  
Hydromet Center**



# INTERNATIONAL PROJECTS: THE LEADERSHIP IN VIETNAM

2017

**World Bank - Vietnam  
Managing Natural Hazards  
Project (comp. 3)**

**2G/3G**

**14 Automatic Stations**

- water level
- rain gauge

**8 of 14 also include**

- Camera
- Surface water speed radar sensor
- Water temperature

**River discharge calculation.**

**Integration to the Nha Trang  
Regional Centre**

2018

**Italian ODA Project -Improving  
Flood Forecasting and Warning  
Systems in Vietnam – fase II**

**2G/3G**

**114 AWS**

- 83 Rain Gauges
- 13 Meteorological
- 1 Marine
- 17 Hydro + Rain Gauge

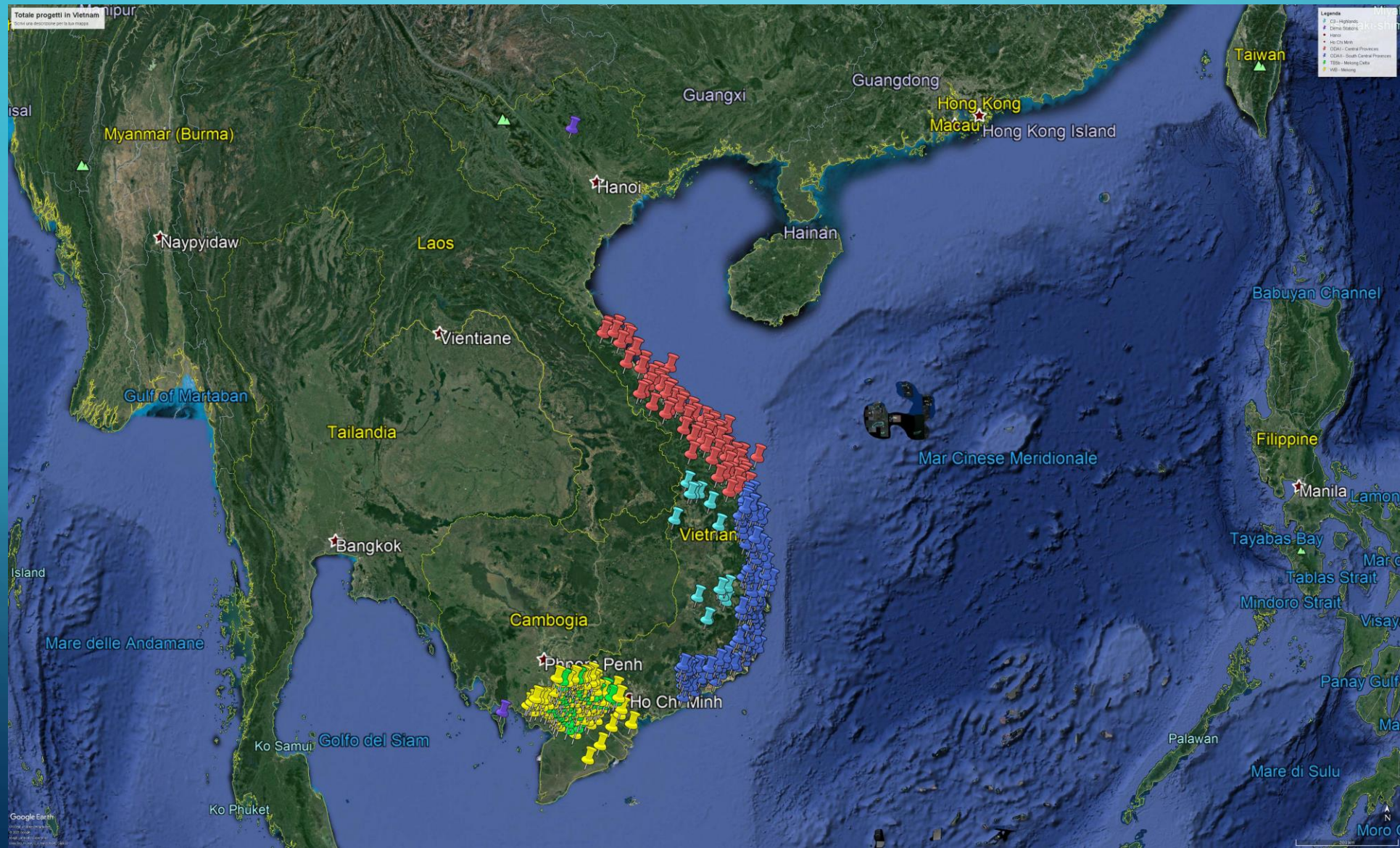
**4 Provincial Centers**

**1 Regional Centre**

**1 National Centre**



# International Projects: the leadership in Vietnam





# Prime Minister and Ministry of Environment of Vietnam visiting the booth of CAE



## CELEBRATING 75 YEARS OF THE VIETNAM METEOROLOGICAL AND HYDROLOGICAL SECTOR AND THE HANDOVER CEREMONY OF PROJECT ODA2

*October 2020*

On October 2<sup>nd</sup> and 3<sup>rd</sup> in Hanoi, CAE and its Representative Office took part in the exhibition "Use of hydrometeorological applications in forecasting and alerting for the socio-economic development", one of a series of events on the occasion of the 75th Traditional Day of Hydrometeorological sector of Vietnam.

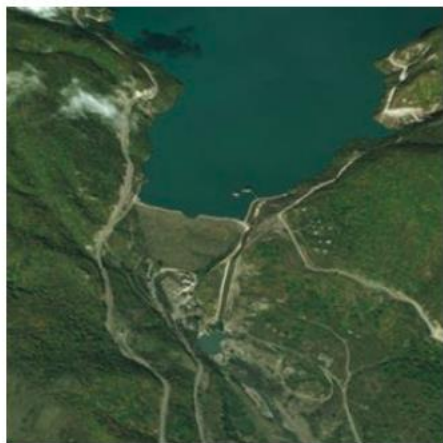
# RECENT INTERNATIONAL PROJECTS



## TRAVELING TO BUENOS AIRES

*January 2017*

35 rain gauges manufactured by CAE are currently on the way to Buenos Aires. These sensors will be implemented into the new hydro-meteorological monitoring network for flood early warning and drought monitoring.



## DAMS: EMERGENCY PLANS, ALERT AND PUBLIC SAFETY SYSTEMS. THE CASE OF ZHINVALI IN GEORGIA

*April 2018*

CAE participates in the implementation of a monitoring and alerting system for the Zhinvali dam in Georgia. The purpose of the system is to protect the population in the area, which extends north of Tbilisi, the Georgian capital with over 1 million inhabitants.

## Recent International Projects



### VIETNAM: REAL-TIME RIVER DISCHARGE MEASUREMENTS AND NEW MONITORING STATIONS TO PREVENT AND MANAGE FLOODS

*November 2018*

Once again, Italian technology has been chosen to implement a World Bank project in Vietnam. The public call for tenders was directed to local firms only and the works were let out on contract to a historical partner of our Bolognese firm. The works include the supplying and installation of 14 new stations equipped with automatic hydrometers and rain gauges, remote connected to the Nha Trang Regional Centre.



### MALDIVES: GREEN LIGHT TO THE EXPANSION OF THE NATIONAL METEOROLOGICAL MONITORING NETWORK WITH 25 NEW STATIONS AND CONTROL CENTERS

*January 2018*

The project CAE is about to implement consists in the "turnkey" supply of 25 new weather stations, located in the various islands and in the airports which are about to be built in the Maldives. These stations will use the MHAS technology and each of them will be equipped with sensors in order to measure wind speed and direction, rainfall intensity and quantity, atmospheric pressure, air temperature and humidity

# RECENT INTERNATIONAL PROJECTS



## FLOOD FORECASTING AND WARNING SYSTEM IN THE SOUTH-CENTRAL PROVINCES OF VIETNAM

*March 2019*

The strengthening of the flood forecasting and warning system in Vietnam was contracted to CAE by National Hydro-Meteorological Service of Vietnam (NHMS) - Ministry of Natural Resources and Environment of Socialist Republic of Vietnam. The project is financed by the Italian Agency for Development Cooperation and consists in the “turn-key” supply and installation of 114 among meteorological, hydrological, rainfall and oceanographic automatic stations and several control centres.



## GREEN LIGHT TO THE IMPLEMENTATION OF THE NEW HYDROLOGICAL AND UHF COMMUNICATION NETWORK IN SERBIA

*July 2019*

In 2014, Serbia suffered a massive flood (please find a video of the affected territories at this [link](#)), which led to the implementation of the Serbia National Disaster Risk Management Program aimed at increasing resilience and preparation to floods. A critical part of this program is the strengthening of the remote hydrometric network supplied to the Republic Hydrometeorological Service of Serbia (RHMS). In July 2019, CAE has won the tender for the implementation of the new system based on redundant (mobile and UHF) communication technology.

# RECENT INTERNATIONAL PROJECTS



## MALDIVES CHOOSE ITALIAN TECHNOLOGY AGAIN

*February 2020*

In the two years that followed the first important CAE contract in the archipelago, the Maldives Meteorological Service turned to the firm based in Bologna (Italy) for another 9 weather monitoring stations, a software system to integrate all the existing stations on the Maldivian territory, a public web portal to show real-time weather conditions and 2 PG4i stand-alone rain gauges.



## BELGRADE: THE FLOOD MONITORING AND WARNING SYSTEM IS "MADE IN ITALY"

*April 2020*

The City of Belgrade, together with the United Nations Development Program (UNPD), has planned a 3-year cooperation within which CAE has won the tender for the supply of PG4i stand-alone rain-gauge stations, stations equipped with PG2R heated rain gauges, hydrometric stations, UHF repeaters...

# RECENT INTERNATIONAL PROJECTS



## EARLY WARNING SYSTEM (EWS) IN CITY OF UŽICE, SERBIA

*December 2020*

CAE in Serbia has won the tender for the supply and installation of hydrological, meteorological, climatological and rainfall equipment for the early warning system in the City of Užice within the Municipal Disaster Risk Reduction Project (MDRRP)...



## KYRGYZSTAN: MODERNIZATION OF THE CENTRAL ASIAN HYDRO-METEOROLOGICAL MONITORING SYSTEM BEGINS

*September 2020*

CAE has signed the contract with the Hydro-Meteorological Agency of Kyrgyzstan for the execution of the works for the "Supply of hydrological monitoring networks, glaciers, roads and large cities equipped with automatic weather stations". The supply includes 23 fully equipped Automatic Weather Stations (AWS), 1 system for the determination of cloud altitude, 13 local data centres and 1 national data centre...

# RECENT INTERNATIONAL PROJECTS



## TAJIKISTAN: SAREZ LAKE MONITORING AND EARLY WARNING SYSTEMS (EWS)

*February 2021*

CAE has signed the contract "Supply, installation and commissioning of equipment for the monitoring and Early Warning Systems (EWS) of Sarez Lake, Tajikistan". The system will enable real time and reliable monitoring of Sarez Lake's right and left banks, as well as upstream and downstream rivers for data collection, Early Warning System activation and communications with control centers.



## REDUCING THE VULNERABILITY OF COMMUNITIES TO GLACIAL LAKE OUTBURST FLOOD (GLOF) IN PAKISTAN

*February 2022*

Pakistan Meteorological Department (PMD) relies on CAE's technology for the supply of an Early Warning Systems (EWS) to reduce the risk of Glacial Lake Outburst Flood - GLOF in the Hindukush-Karakorum-Himalaya (HKH) area. The project includes 244 hydro-meteorological monitoring stations and...

# RECENT INTERNATIONAL PROJECTS



## PAKISTAN CALLS CAE: 163 NEW STATIONS

*January 2023*

163 new monitoring stations for Pakistan, ordered less than 1 year from the first 293, to expand the early warning system to reduce vulnerability from GLOF (Glacial Lake Outburst Flood) in 24 valleys, in the Gilgit-Baltistan and Khyber-Pakhtunkhwa regions. The Pakistani Meteorological Department...



## KYRGYZSTAN: 8 MORE AGRO-METEOROLOGICAL STATIONS

*March 2023*

The Hydrometeorological Service of Kyrgyzstan continues to invest in the reliable technologies provided by CAE, suitable for installation in a very harsh environment. With this project, the Kyrgyz monitoring network expands to include 36 hydrometric and agro-meteorological monitoring stations...



# Our business



GEOLOGICAL AND HYDROGEOLOGICAL RISK



RISK DUE TO EXTREME WEATHER EVENTS



WATER AND HYDROLOGICAL RISK



RISK DUE TO POLLUTION OF WATER RESOURCES



RISK DUE TO WILDFIRES

The background is a dark blue gradient. In the corners, there are white line-art graphics resembling circuit boards or data paths, with lines connecting to small circles.

# Hydrological and Meteorological Monitoring

# AUTOMATIC WEATHER STATION



Typically 10 meters high, tilting mast for easier maintenance (possibility to use towers).

Wind Speed and Direction, Air Temperature and Humidity, Direct Solar Radiation, Pressure, Precipitation Sensor and soil moisture.

Solar powered and double communication system.

Installation in suitable place, for both accuracy of measurements and safety of the equipment.

# AUTOMATIC WEATHER STATION



**Standard solution**  
*10m flippable mast*



**Portable solution**  
*Portable mast with dead weight*

# PG4I – STAND ALONE RAIN GAUGE



Register your product



Power it up



Enjoy your data



# HYDROLOGICAL MONITORING STATION



**Ultrasuond**  
Range: 0 – 20 metri



**Radar**  
Range: 0 – 35 metri

# HYDROLOGICAL MONITORING STATION



**Pressure**

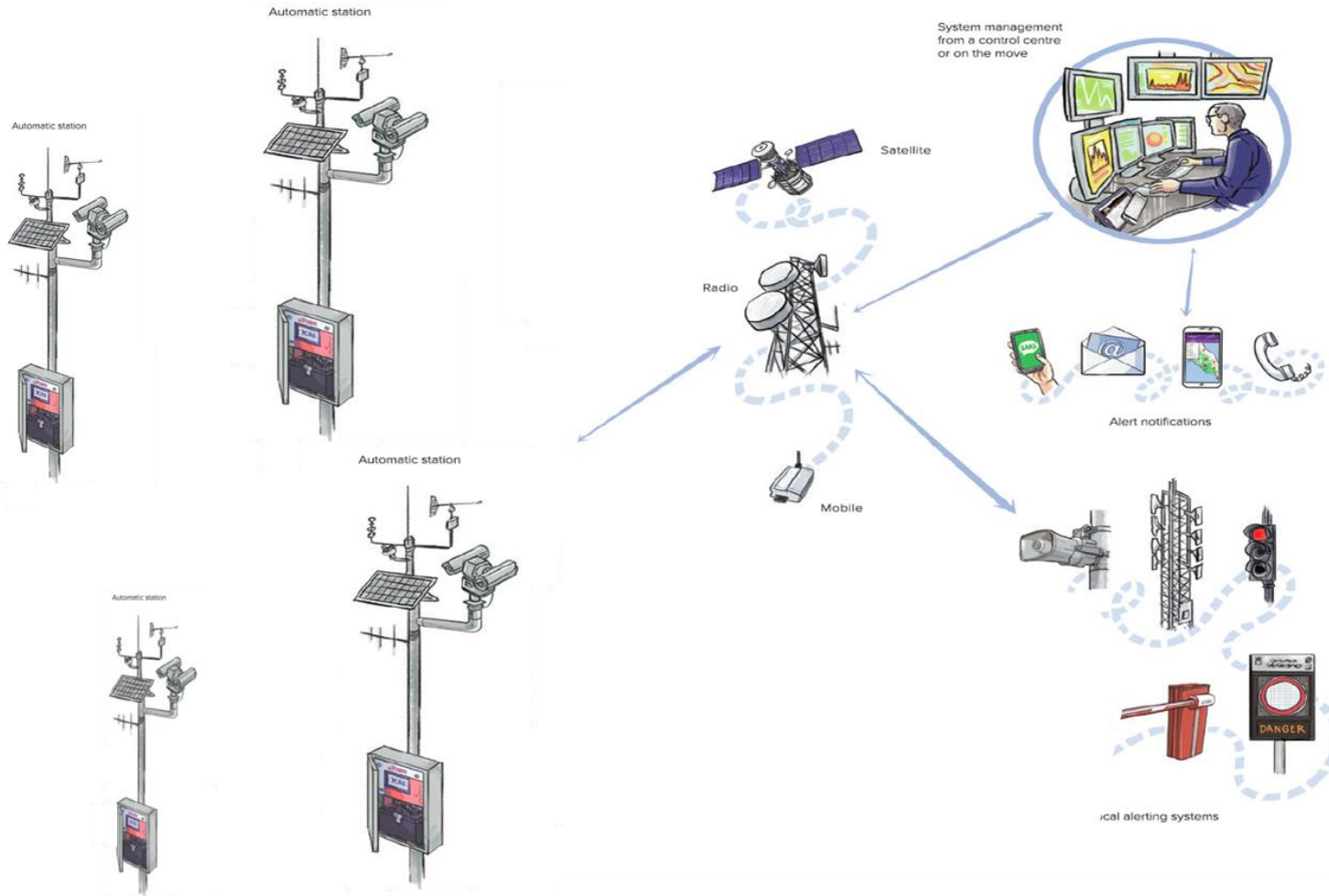
Range: 0 – 50 + metri



**Pneumatic**

Range: 0 – 15 metri

# TRADITIONAL SYSTEM ARCHITECTURE

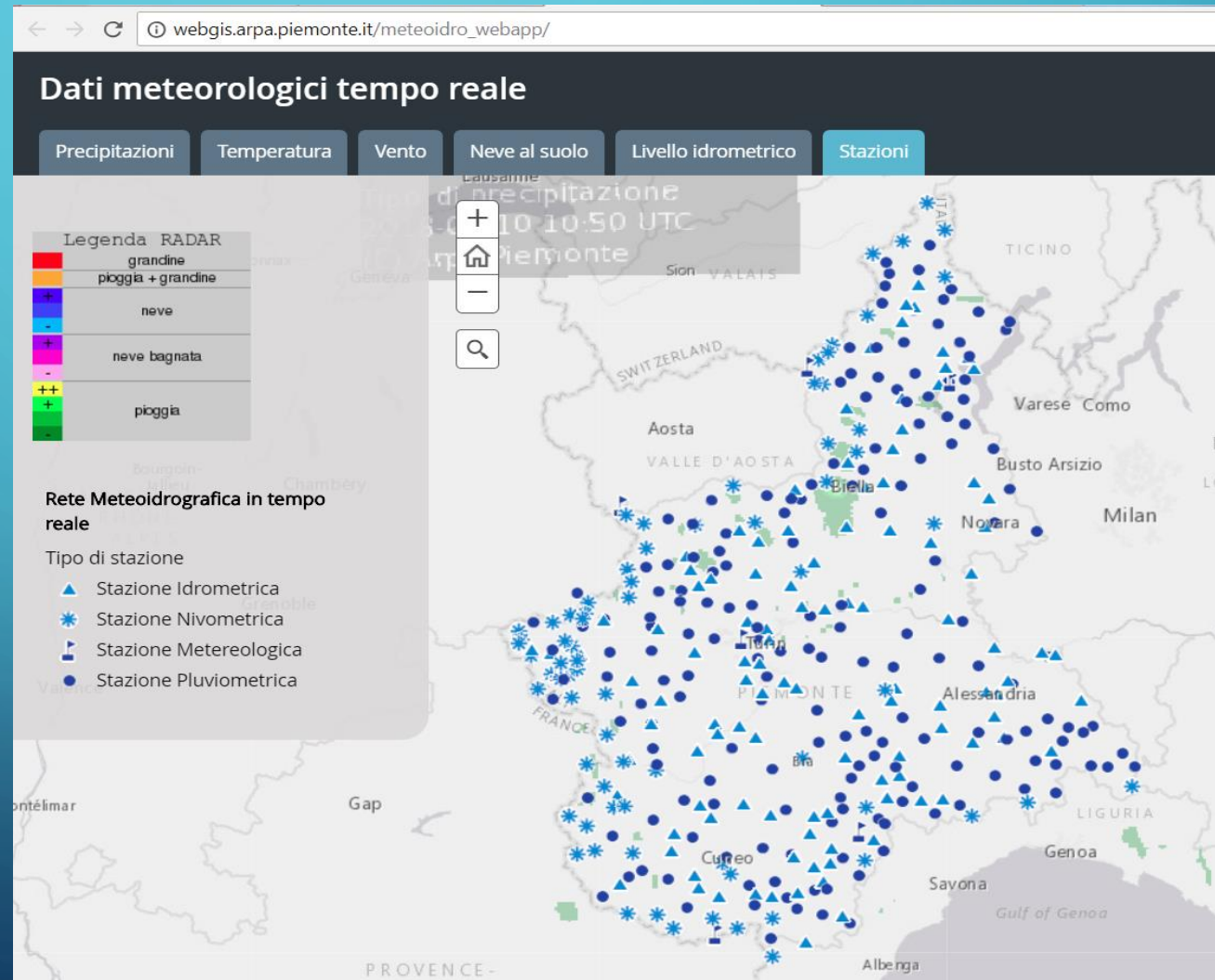




# EXAMPLE OF REGIONAL MONITORING NETWORK: OVER 400 AUTOMATIC STATIONS IN 30 YEARS

- Over 400 Automatic Stations
- Redundancy of transmission systems
- All stations connected by UHF radio, 70 radio repeaters, 100 with additional GPRS

## Piedmont Region



# Example of Regional Monitoring Network: over 400 automatic stations in 30 years



**SP200**

1987 - 2000



**SPM20**

2001 - 2013



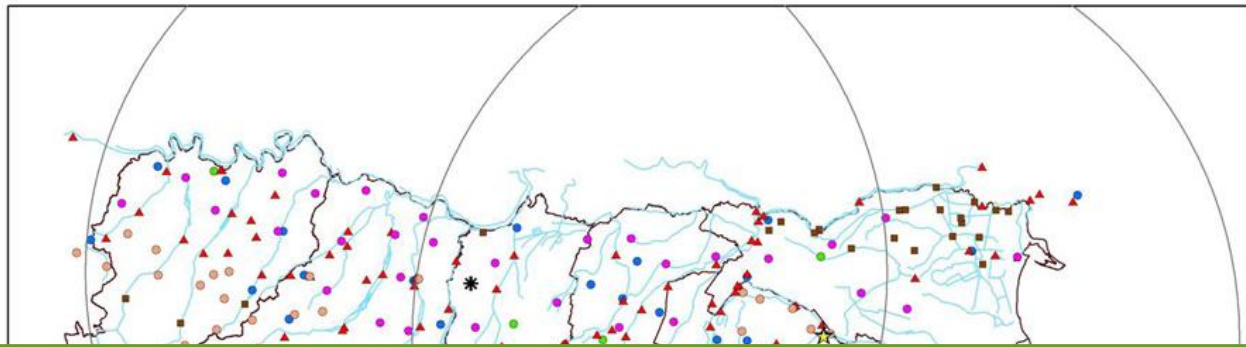
**Mhaster**

2013 - ...



# EXAMPLE OF REGIONAL MONITORING NETWORK: OVER 400 AUTOMATIC STATIONS IN 30 YEARS

Emilia Romagna Region



These monitoring networks are multi-purpose, as measured data support hydropower management, agriculture irrigation, drinking water production, etc. However, in countries like Italy, the leading design criteria depends on the needs of natural hazard mitigation activities.

Measured data are necessary inputs for **Alerts and Warning Bulletins**.

- Provincia
- Raggio di influenza del Radar (125 km)

OCTOBER 11<sup>TH</sup>, 2014. THE BAGANZA RIVER  
FLOODED THE SOUTH-WEST PART OF PARMA



# Real Time Monitoring Systems contribute to better Decision Making during emergencies, as part of «traditional» Early Warning Systems

**Arpa** **BOLLETTINO** 46875482

**ALLERTA REGIONE PIEMONTE**

Regione Piemonte  
Servizio Protezione Civile

BOLLETTINO N. numero/anno	DATA EMISSIONE data	VALIDITA' ore 13:00	AGGIORNAMENTO data	SERVIZIO A CURA DI Arpa Centro Funzionale	AMBITO TERRITORIALE Regione Piemonte																																																																																																																																												
<p><b>LIVELLI DI ALLERTA</b></p> <table border="1"> <thead> <tr> <th rowspan="2">ZONA DI ALLERTA</th> <th rowspan="2">MPP</th> <th colspan="2">IDROLOGICA</th> <th colspan="2">IDROGEOLOGICA</th> <th colspan="2">TEMPORALI</th> <th colspan="2">VALANGHE</th> <th rowspan="2">SINTESI dello SCENARIO ATTESO</th> </tr> <tr> <th>AVVANTICATA</th> <th>ATTIVA</th> <th>AVVANTICATA</th> <th>ATTIVA</th> <th>AVVANTICATA</th> <th>ATTIVA</th> <th>AVVANTICATA</th> <th>ATTIVA</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>ARANCIONE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>Limitata coesistenza dei corsi d'acqua e attivazione fenomeni di versante</td> </tr> <tr> <td>B</td> <td>ARANCIONE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>VERDE</td> <td>Limitata coesistenza dei corsi d'acqua e attivazione fenomeni di versante</td> </tr> <tr> <td>C</td> 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**Regione Emilia Romagna** **ALLERTA** **arpe**

**METE-IDROGEOLOGICA-IDRAULICA**

DOCUMENTO N.	DATA EMISSIONE	INIZIO VALIDITA'	FINE VALIDITA'
116/2019	28/11/2019 11:46	29/11/2019 00:00	30/11/2019 00:00

Criticità idraulica, idrogeologica, temporali

Criticità meteo e marino-costiera

		CRITICITA' IDRAULICA	CRITICITA' IDROGEOLOGICA	CRITICITA' PER TEMPORALI	VENTO	TEMPERATURE ESTIVE	NEVE	PIOGGIA CHE GELA	STATO DEL MARE	CRITICITA' COSTIERA
A	1	VERDE	VERDE	VERDE	GIALLO	VERDE	VERDE	VERDE		
	2	VERDE	VERDE	VERDE	GIALLO	VERDE	VERDE	VERDE		
B	1	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE		
	2	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE
C	1	VERDE	VERDE	VERDE	GIALLO	VERDE	VERDE	VERDE		
	2	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE		
D	1	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE
	2	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE
E	1	VERDE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		
	2	VERDE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		
F	1	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE		
	2	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE	VERDE		
G	1	VERDE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		
	2	VERDE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		
H	1	ARANCIONE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		
	2	ARANCIONE	GIALLO	VERDE	VERDE	VERDE	VERDE	VERDE		

Метео аларм - Прогнозиране метеоролошке појаве за датум: 02.03.2018.

\* Важи од: 09:56 28.02.2018, за: 02.03.2018.

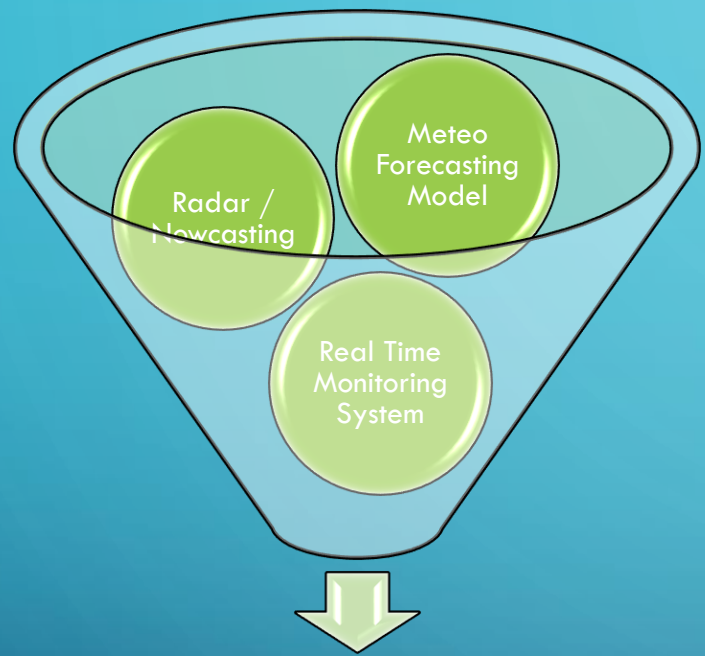
Изабери датум: 28.02.2018. ::: 01.03.2018. ::: 02.03.2018. :::

Бачка:	
Банат:	
Срем:	
Београд:	
Западна Србија:	
Шумадија:	
Поморавље:	
Источна Србија:	
Југоисточна Србија:	
Југозападна Србија:	
Косово и Метохија:	

Кликни регион на слици или назив региона за више детаља

- ❑ Bulletins describe the expected evolution of a natural phenomena over the following 6 to 48 hours, focussing on the effects of the phenomenon at the ground.
- ❑ Scenarios include large geographical areas, assuming homogeneous conditions within it. Local risk scenarios cannot be considered individually.

# The technical components of «traditional» Early Warning Systems



Input



Process

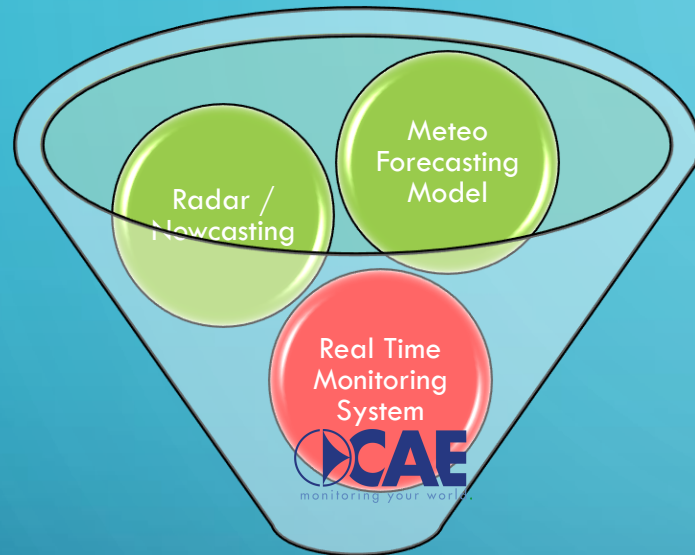


**Output: Warning Bulletin**

Region	Alert Level
Beograd	High
Baranja	High
Central Serbia	High
Eastern Serbia	High
Western Serbia	High
Southwestern Serbia	High
Northwestern Serbia	High
Vojvodina	High

Region	Alert Level	Start Time	End Time
Beograd	High	20:00	06:00
Baranja	High	20:00	06:00
Central Serbia	High	20:00	06:00
Eastern Serbia	High	20:00	06:00
Western Serbia	High	20:00	06:00
Southwestern Serbia	High	20:00	06:00
Northwestern Serbia	High	20:00	06:00
Vojvodina	High	20:00	06:00

# The technical components of «traditional» Early Warning Systems



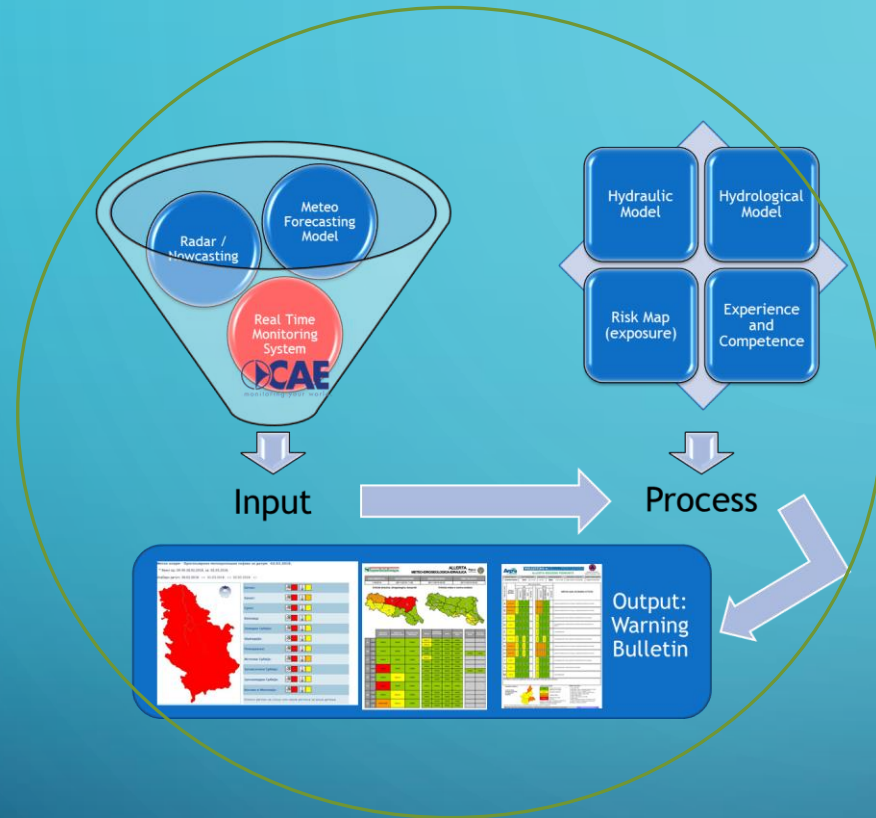
Input



Process

Output:  
Warning Bulletin

# Weaknesses of the «traditional» Early Warning Systems



- Institutional issues: this process works well if the Institutions have a clear responsibility over their duties. Institutional setting, therefore the definition of «who does what» is crucial.

**Each Country sets specific responsibilities on selected State departments and Agencies. In Italy the «Functional Center Network» plays a major role**



# In Italy, monitoring and risk evaluation activities are performed by Regional «Functional Centers»



21  
Centri  
Funzionali



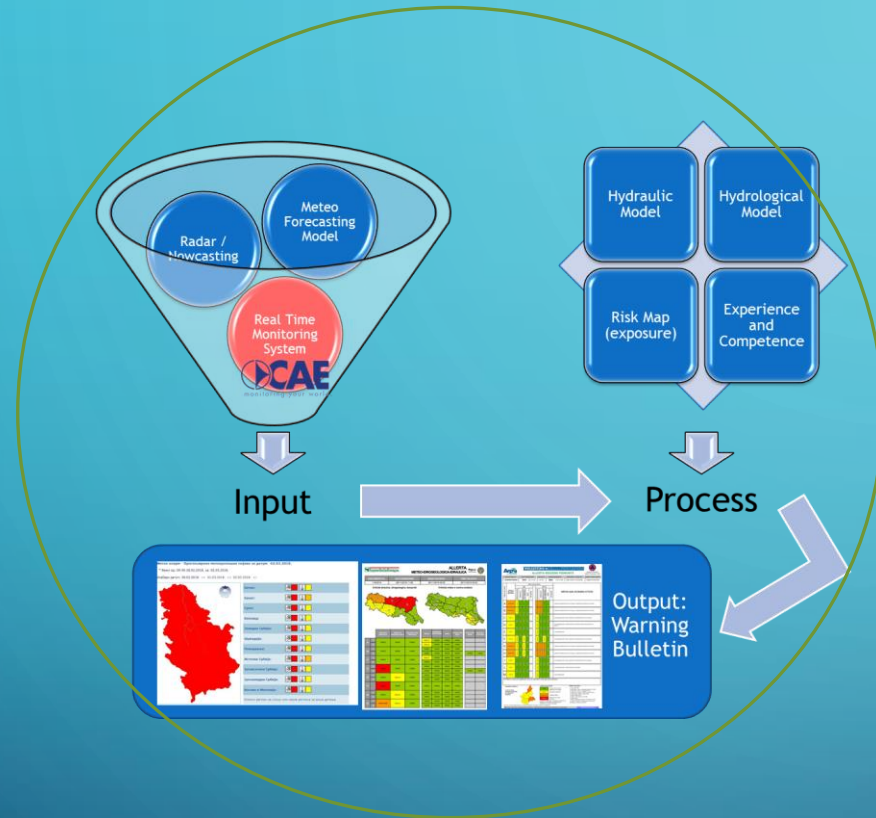
Depending on the type and size of the risk scenario, then the emergency will be «National», «Regional» or «Local».

The emergency response will be coordinated by the related level of the Government.

The ultimate responsible authority for the citizen safety, will be always on the Town/City Mayor.

Link to «Codice di Protezione Civile»

# Weaknesses of the «traditional» Early Warning Systems

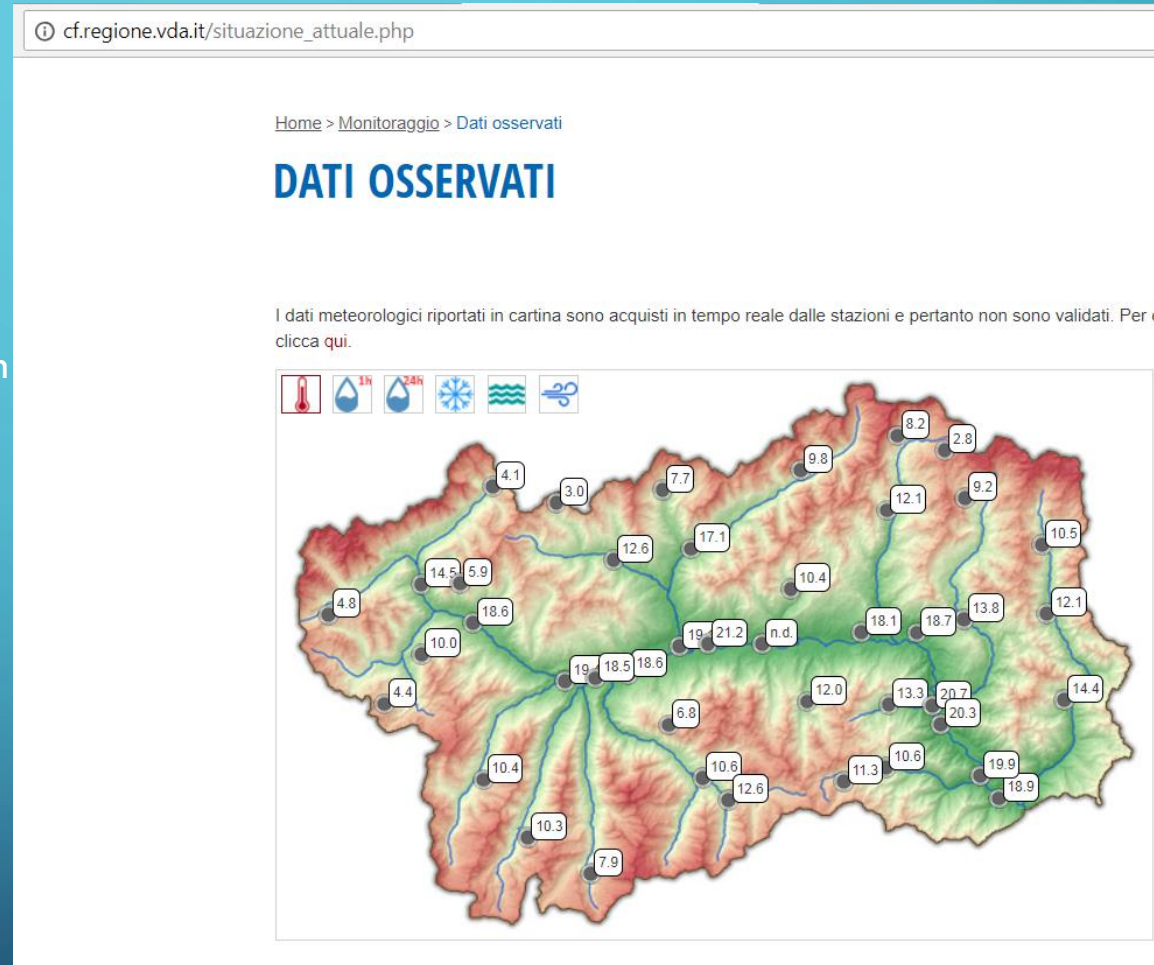


- ❑ Institutional issues: this process works well if the Institutions have a clear responsibility over their duties. Institutional setting, therefore the definition of «who does what» is crucial.
- ❑ Operational issues: Citizens, local authorities and organizations must understand the warning messages and know what to do.
- ❑ Technical limits: the whole process takes time and updates are likely to be every 12 or 6 hours at shortest. This fits the traditional flooding scenario for big and medium rivers.

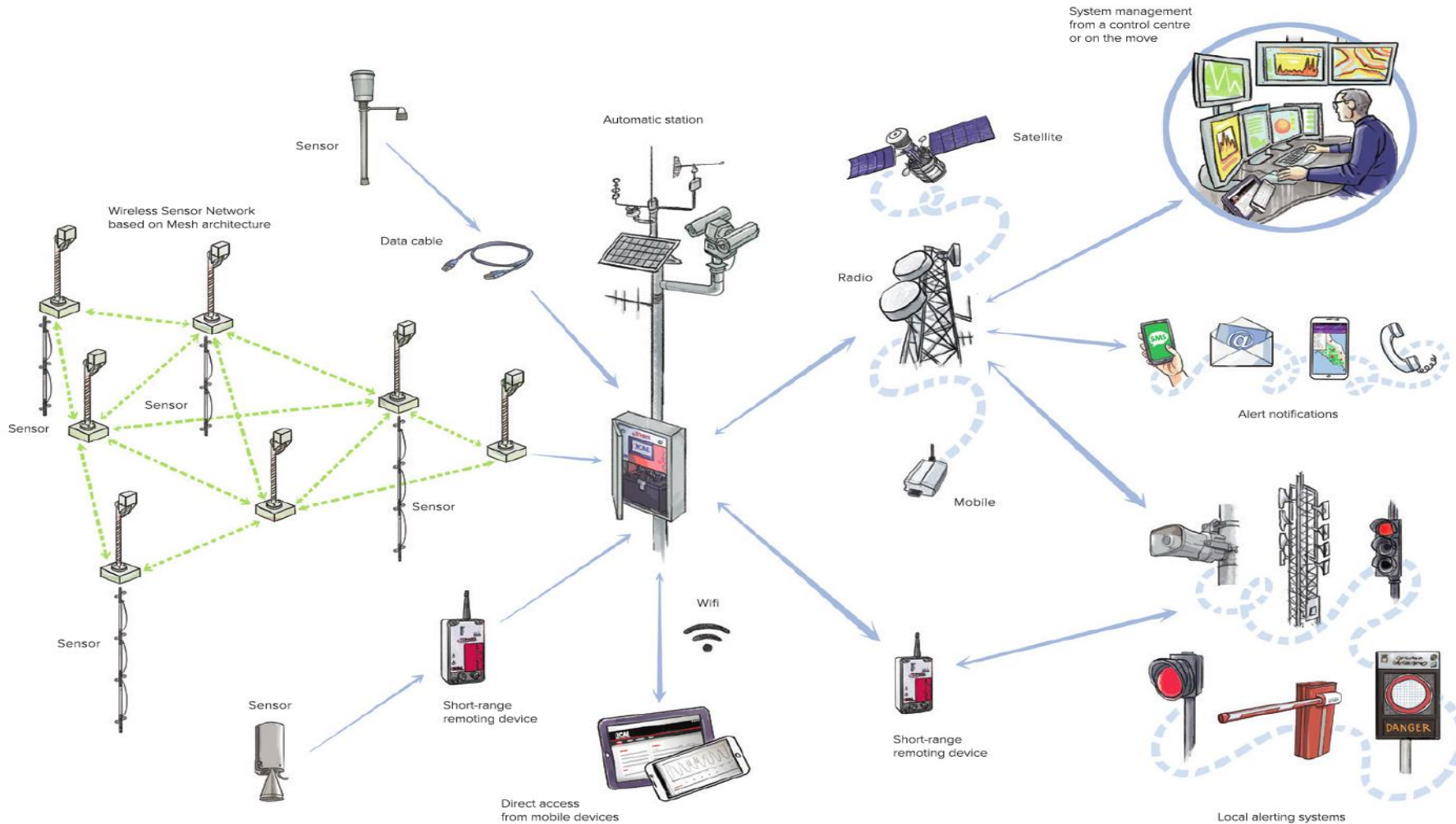
**Flash Floods and local phenomena, which usually happen in shortest time, may require something different and additional.**

# Regione Autonoma Valle d'Aosta: openness, interoperability and effectiveness

- All the stations implement redundant communication network: standard protocols over IP radio and mobile back-up;
- 100 automatic stations, equipped with Linux OS embedded into datalogger;
- Freedom to program new functionalities on the datalogger (Python interpreter on board)
- Webservice on board each datalogger, as a standard interface for configuration, databrowsing and download
- Dataservice at the control center, for data exchange with other systems
- Traditional reliability offered by CAE



# From «real time monitoring systems» to «Real Time and Local Early Warning Systems»



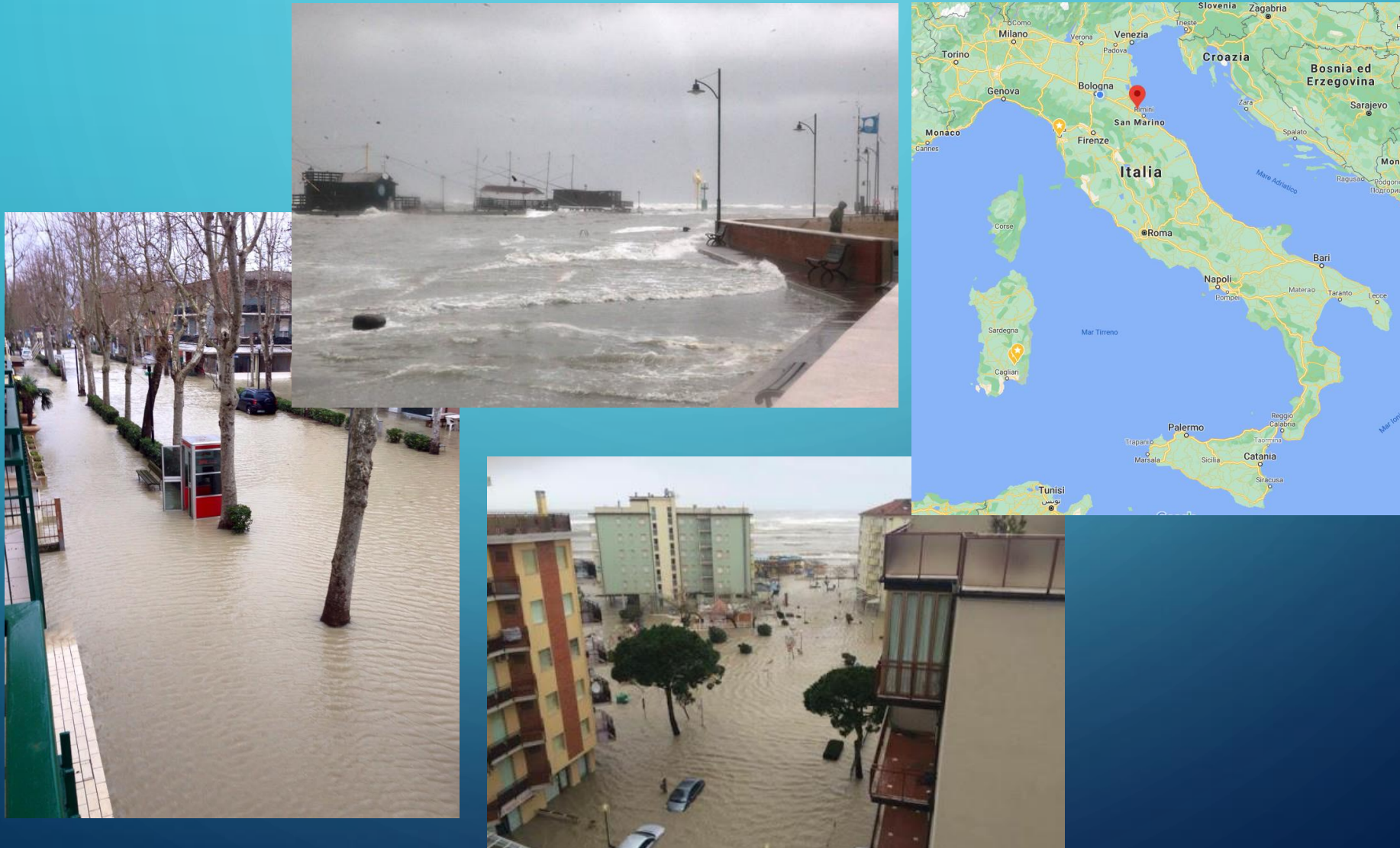


  
monitoring your world.

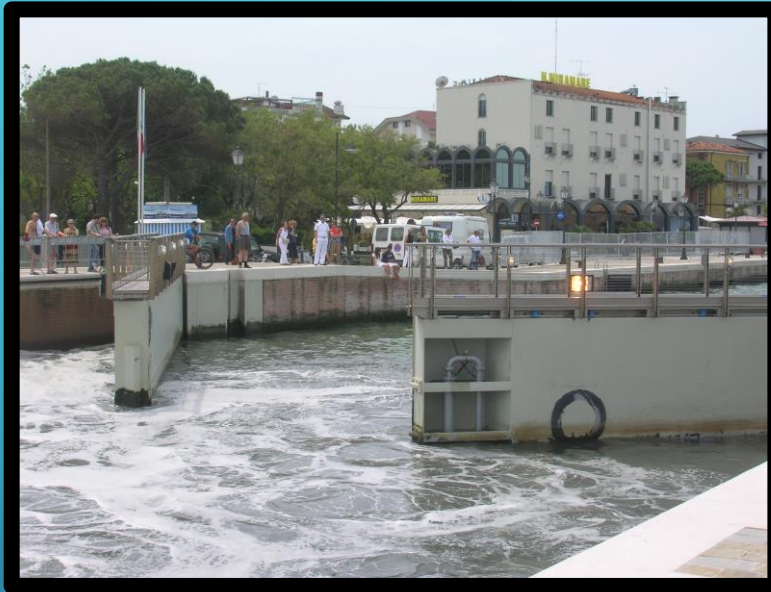


  
innovation for a safer world.

# In the year 2000, CAE was contracted to provide a local monitoring and early warning system for a periodical coastal flooding in the town of Cesenatico



# In 2001, CAE engineered and implemented a local early warning system, based on hydrometric thresholds



## Main targets:

- Optimal management of the gates to regulate the water in the channel, used as a local seaport
- Automatic alerts, also by mean of the local church bells

# In 2001, CAE engineered and implemented a local early warning system, based on hydrometric thresholds

One of the few automatic stations included into this local system





In 2001, CAE engineered and implemented a local early warning system, based on hydrometric thresholds

www.romagnauno.it/cesenatico/cesenatico-scatta-lallarme-acqua-alta-suonano-le-campane/



**Cesenatico, scatta l'allarme  
acqua alta: suonano le campane**

marzo 11, 2018 ◀ 1531

**11 march 2018**

In 2001, CAE engineered and implemented a local early warning system, based on hydrometric thresholds

www.corrierecesenate.it/Cesenatico/Allerta-in-centro-storico-e-suono-delle-campane-ma-la-situazione-pare-so

# CORRIERE CESENATE

SETTIMANALE DI INFORMAZIONE DELLA DIOCESI DI CESENA-SARSINA FONDATA NEL 1911

Martedì 19 Giugno 2018

Il settimanale Foto e Video Rubriche Community E-shop

Diocesi Cesena **Cesenatico** Valle Savio Rubicone Sport Dall'Italia Dal Mondo Dalla Chiesa Lettere

Home » Cesenatico » Allerta in centro storico e suono delle campane, ma la situazione pare sotto controllo

## CESENATICO

MALTEMPO

### Allerta in centro storico e suono delle campane, ma la situazione pare sotto controllo

Suona l'allarme a Cesenatico. Stato di massima allerta. Tanti uomini impegnati per sorvegliare la situazione



24/02/2018 di > Redazione

**24 February  
2018**

## Florence flooding in 1966



# Florence flooding in 1966

[https://it.wikipedia.org/wiki/Alluvione\\_di\\_Firenze\\_del\\_4\\_novembre\\_1966#La\\_notte\\_tra\\_il\\_4\\_e\\_il\\_5\\_novembre](https://it.wikipedia.org/wiki/Alluvione_di_Firenze_del_4_novembre_1966#La_notte_tra_il_4_e_il_5_novembre)

**Venerdì 4 novembre** [ modifica | modifica wikitesto ]

- **00.16:** in mezza **Toscana** si verificano smottamenti e frane a causa dell'acqua e straripano anche dei fiumi. **Casentino**; l'Arno è straripato a Ponte a **Poppi**, allagando tutto il paese: la situazione è tragica e le persone
- **01.00:** l'Arno straripa in località **La Lisca**, nel comune di **Lastra a Signa**. Vengono interrotte la **strada statale Firenze ed Empoli** (allora non era stata ancora costruita la **SGC FI-PI-LI**). A Firenze sui **lungarni** sono affacciata una situazione: sono presenti poliziotti, ingegneri del **Genio Civile**, giornalisti, il sindaco e il **prefetto**. Ci si domanda se suonare tutte le campane oppure evitare il panico sperando che non accada niente: si opta per la seconda opzione.
- **01.30:** la piena dell'Arno si fa notare attraverso le fogne: l'acqua affiora in **Piazza Mentana** e anche attraverso le fogne d'Arno.
- **02.00:** il torrente **Mugnone**, affluente dell'Arno in piena città, rompe gli argini e straripa presso il **Parco delle Cascine**; allagato; il custode **Cesare Nesi**, informato da una guardia campestre, chiama il personale e i proprietari dei giardini: i giardini sono terrorizzati; si tenta a fatica di portarli in salvo sui camion. Settanta cavalli di razza muoiono. Le carcasse vengono gettate in acqua. Anche lo **zoo** viene allagato: il **dromedario** Canapone, amato dai bambini, affoga.
- **02.30:** le fognature granducali esplodono una dopo l'altra: la pressione dell'Arno è troppo forte. Il fiume straripa in **San Salvi**. Nell'**Oltrarno** di Firenze, nel quartiere di **Gavinana**, inizia la paura per i cinquantamila fiorentini che vivono in case a gli scantinati e si rifugia nei piani più alti. Nella zona di **Santa Croce** l'acqua inizia a inondare **via de' Benci**.
- **03.00:** alla nuova sede de **La Nazione**, in via Paolieri, si cerca di fare un quadro della situazione. Nessuno in **redazione** si aspettava un evento di dimensioni così catastrofiche. Franco Nencini chiama per telefono Carlo Maggiorelli, addetto alla sorveglianza degli impianti idrici dell'Anconella, per avere qualche informazione. Maggiorelli muore in diretta telefonica; verrà ritrovato due giorni dopo in un **canale ricoperto di fango**. [1]
- **03.30:** un sottile **Palazzo Vecchio** viene allagato.
- **03.48:** arriva l'acqua in **provincia di Firenze**.
- **04.00:** le acque allagano **l'isolotto** e **San Bartolo a Cintola**, rimanendosi solo a **Sommario** ed alle porte di **Scandicci**. L'acqua inizia ad annuire nel quartiere di **Santa Croce** e salta la luce elettrica. A **San Piero a Ponti** il **Bisenzio** inonda la stazione del **Genio Civile**, posta sull'argine: la gente della zona inizia a tirare fuori le cateratte, credendo di avere a che fare con una delle solite tracimature del fiume, che al massimo portavano ad un allagamento di qualche decina di centimetri nella zone più prossime all'argine. A **San Donnino**, il priore Don Giovanni Mantellassi riceve la telefonata di un amico parroco che lo avverte del pericolo imminente e fa suonare le campane a distesa per avvertire i parrocchiani ma pochi prendono sul serio l'allarme, confidando nella robustezza dell'argine strada mediceo che ha sempre retto anche alle piú forti piene del passato.
- **04.30:** inizia il dramma nella periferia occidentale: Lastra a Signa e una parte del comune di Scandicci (San Colombano, **Badia a Settimo**) sono allagate dalle acque di alcuni torrenti (**Vingone**, **Rimaggio**, **Guardiana**).



## Maggiorelli

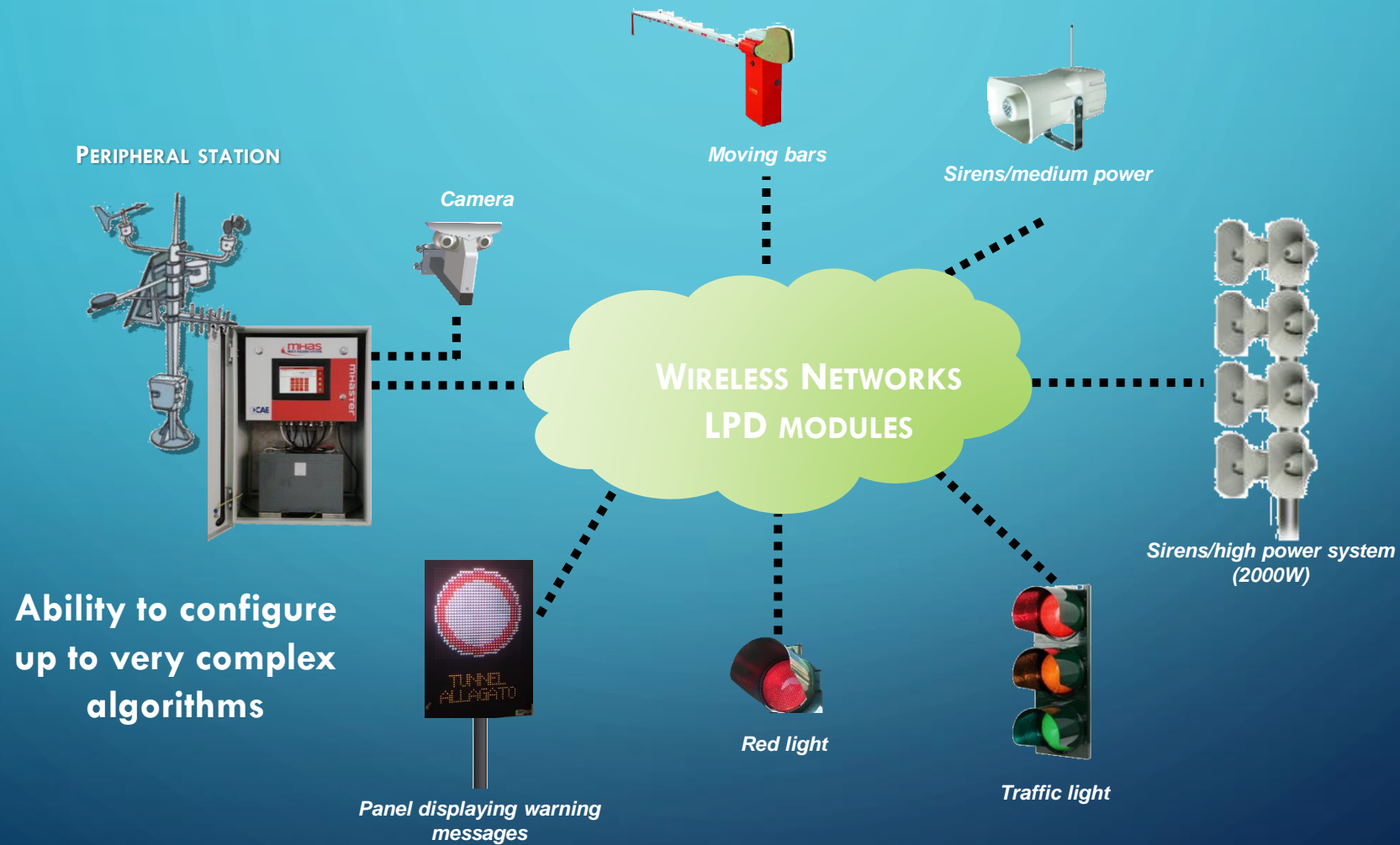
...bre la nuova sede de **La**  
...a in uno stato di totale  
...i telefona a Carlo  
...era addetto alla  
...ti idrici dell'Anconella.  
...turno di notte e sta  
...del 3 novembre. Nencini  
...suscettendo. Maggiorelli gli  
...e disastro, che stanno  
...00 avevano dovuto  
...i lo esorta ad andarsene e a  
...in tempo. Maggiorelli resiste  
...andonare la sua postazione,  
...può più fuggire. Nencini  
...viene interrotta dall'onda

**Back at that time, the priest of a local church rang the bells to warn the local community about the imminent flooding... but nobody understood or trusted the message!**

**Simple signals are necessary but not sufficient: citizens must be trained and prepared.**

# Local monitoring and early warning systems: potentiality of MHAS-based technology

## Local Early Warning Devices



# «Beyond bells»: one of the first challenges of the new technological era

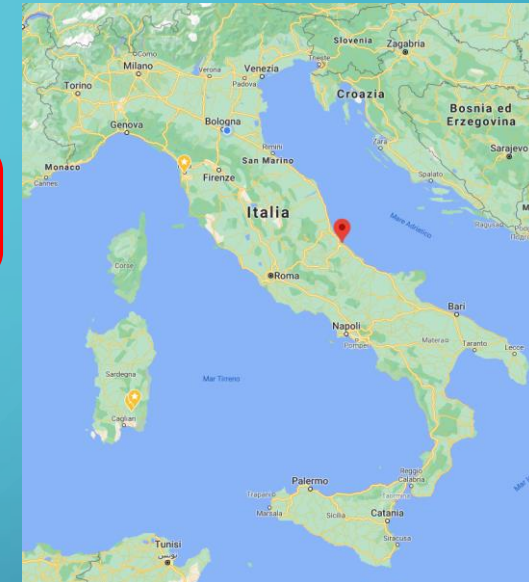
https://tg24.sky.it/cronaca/photogallery/2013/12/02/maltempo\_allagamenti\_centro\_sud\_pescara\_evacuazioni\_frane\_smottamenti.h

sky **TG24** HD HOME VIDEO CRONACA POLITICA COMUNALI 2018 ECONOMIA **2013** INTRAT

02 dicembre 2013

## Pescara allagata: una vittima e migliaia di sfollati. FOTO

Pioggia e vento si sono abbattuti sul capoluogo abruzzese costringendo l'amministrazione comunale a far evacuare centinaia di persone per il rischio esondazione. Il vicesindaco a Sky TG24: "Situazione critica".  
[AGGIORNAMENTI](#) - [VIDEO](#) - [PREVISIONI](#)



The background is a dark blue gradient. In the corners, there are white line-art graphics resembling circuit boards or data paths, with lines connecting to small circles.

**Real Time Monitoring and Local Alerts**  
**Flooded Underpasses**

# Examples of local monitoring and early warning systems

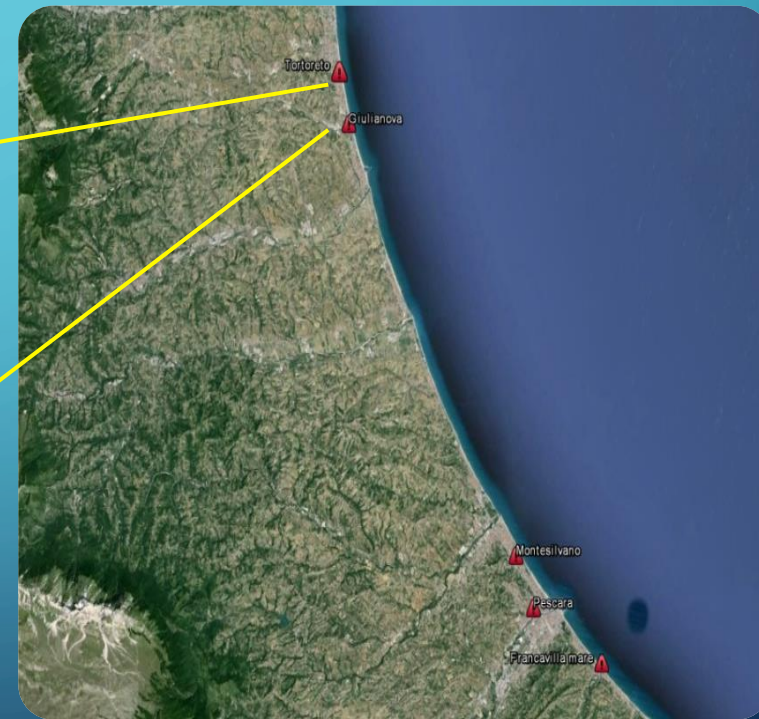
## Pictures from Region Abruzzo, underpasses monitoring system

Pilot Project for engineering and implementation of n. 5 local early warning systems for underpasses with purpose of civil protection in the Municipalities of the Abruzzo Region:

Contracting authority: Functional Center of the Abruzzo Region

Contract provision:

- n. 5 control panels;
- n. 5 peripheral monitoring and early warning systems for underpass crossing in the municipalities of **Tortoreto**, **Giulianova**, **Montesilvano**, **Pescara** and **Francavilla al Mare**;
- warranty service.





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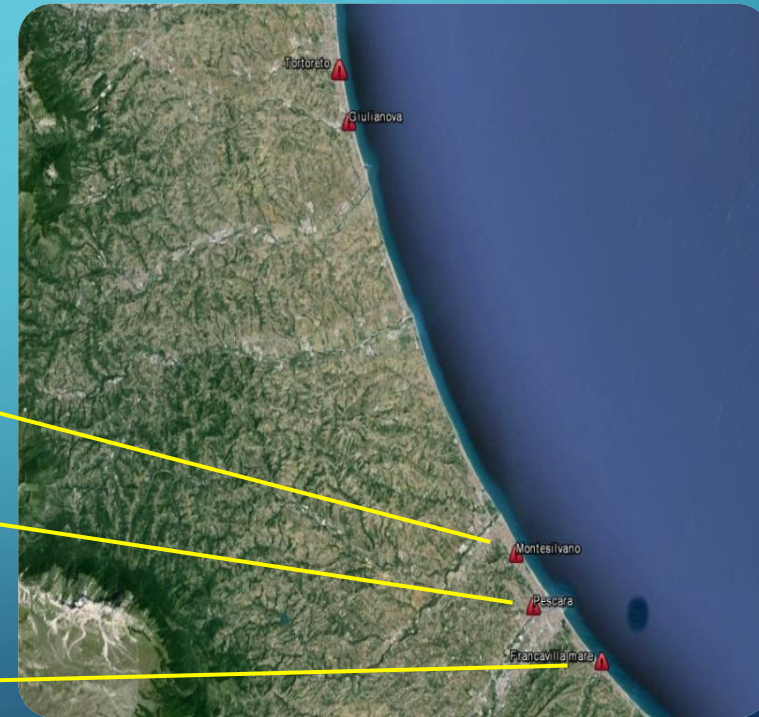
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- warranty service.

Pescara



Montesilvano



Francavilla mare



# Examples of local monitoring and early warning systems

## Underpasses monitoring system

Webcam Robotix



Sensori di livello CLS-23



Sensore di livello PLM10



Modulo di comunicazione UMTS/GPRS MCS



Data logger CAE Mhaster



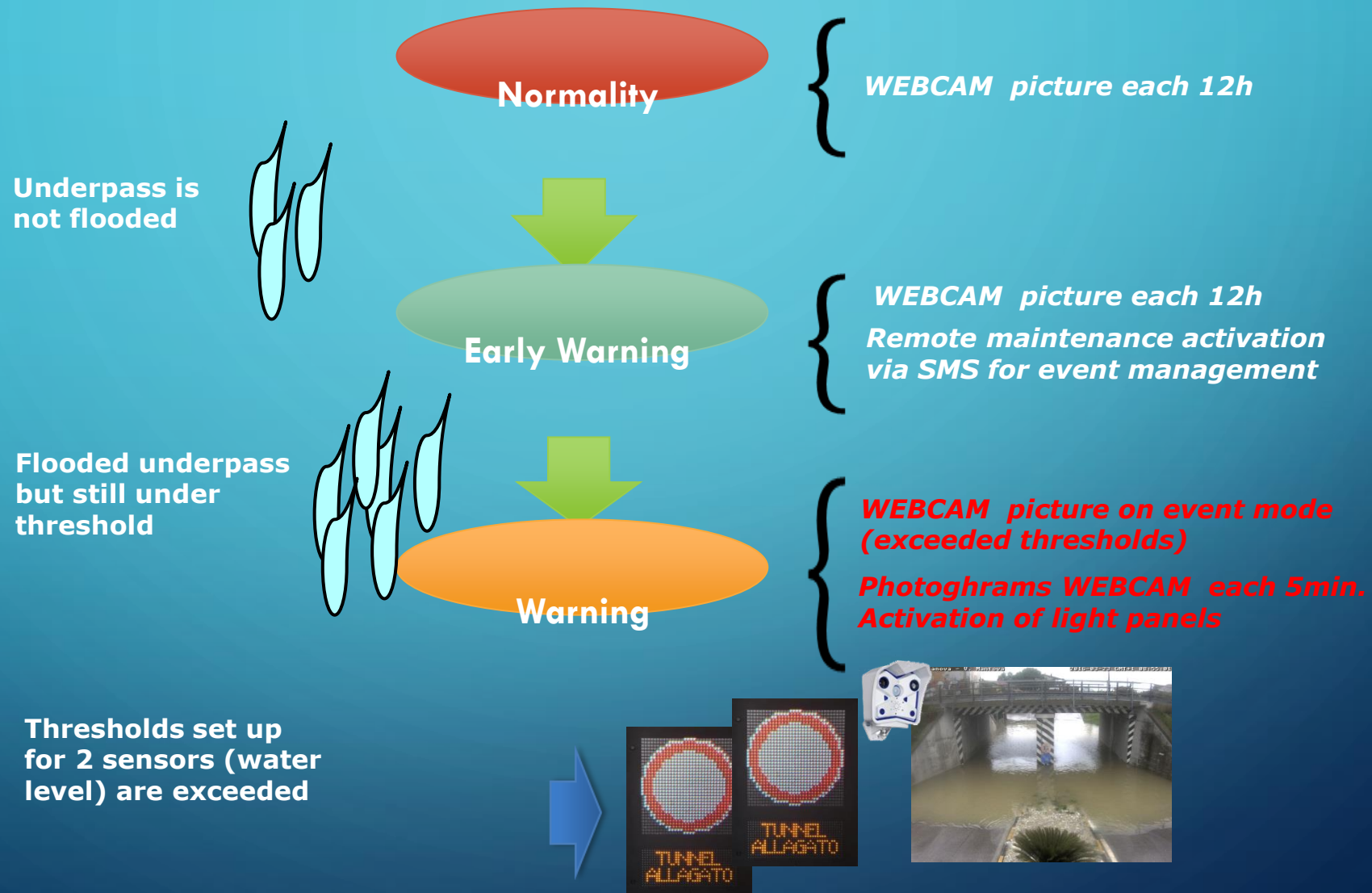
Modulo di alimentazione da rete GA220



Pannelli a messaggio variabile Safeway

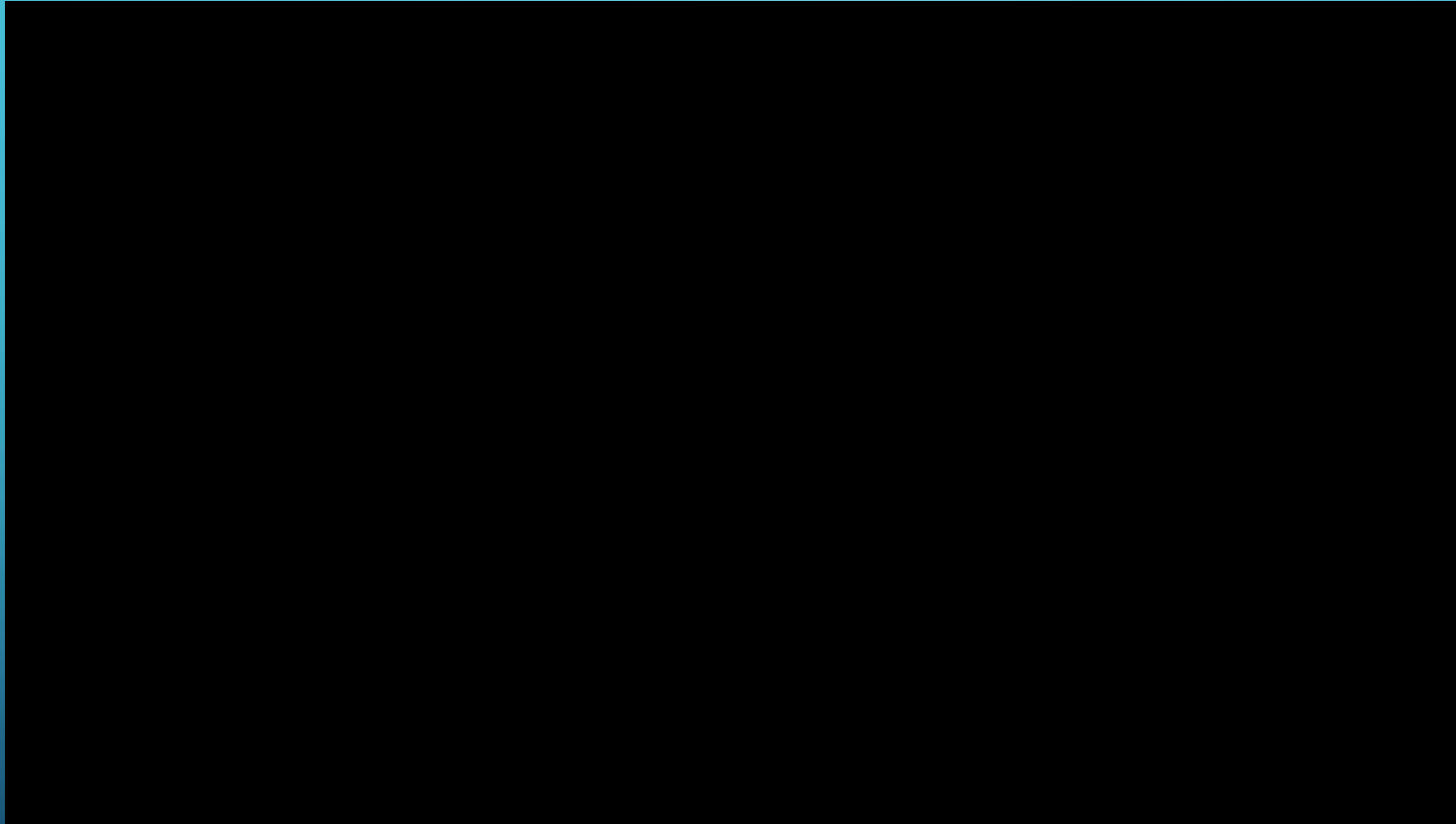
# Examples of local monitoring and early warning systems

## Underpasses monitoring system



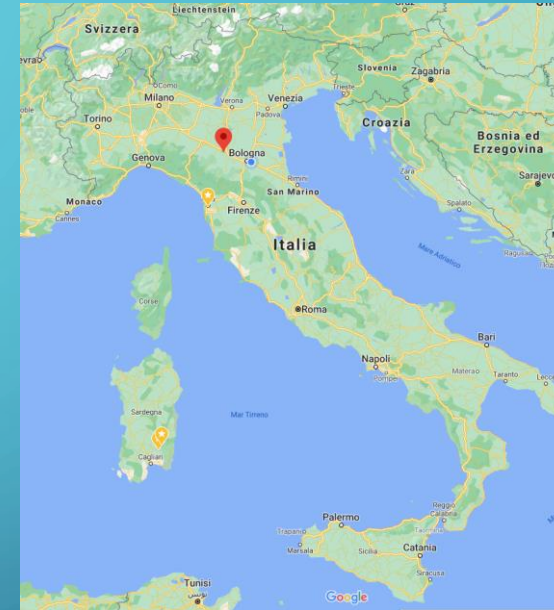
# Examples of local monitoring and early warning systems

## Underpasses monitoring system



# Province of Reggio Emilia

## Early Warning for **flooded underpasses** in the Municipality of Rubiera

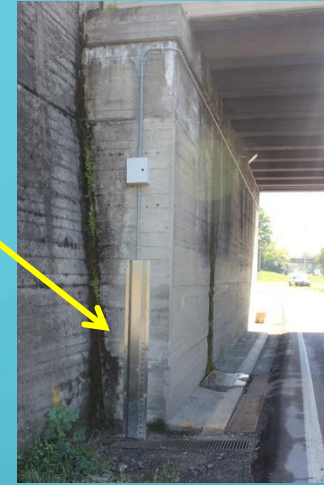


- Independent local early warning system
- It can be integrated into new or pre-existing networks
- It does not require any software

- Use the web service hosted directly on the station
- Connected with mobile devices
- Totally independent of the mains power
- Use of double check logic for alerting

# Examples of local monitoring and early warning systems

Underpass of Rubiera, province of Reggio Emilia



# Examples of local monitoring and early warning systems

Underpass of Rubiera, province of Reggio Emilia

North

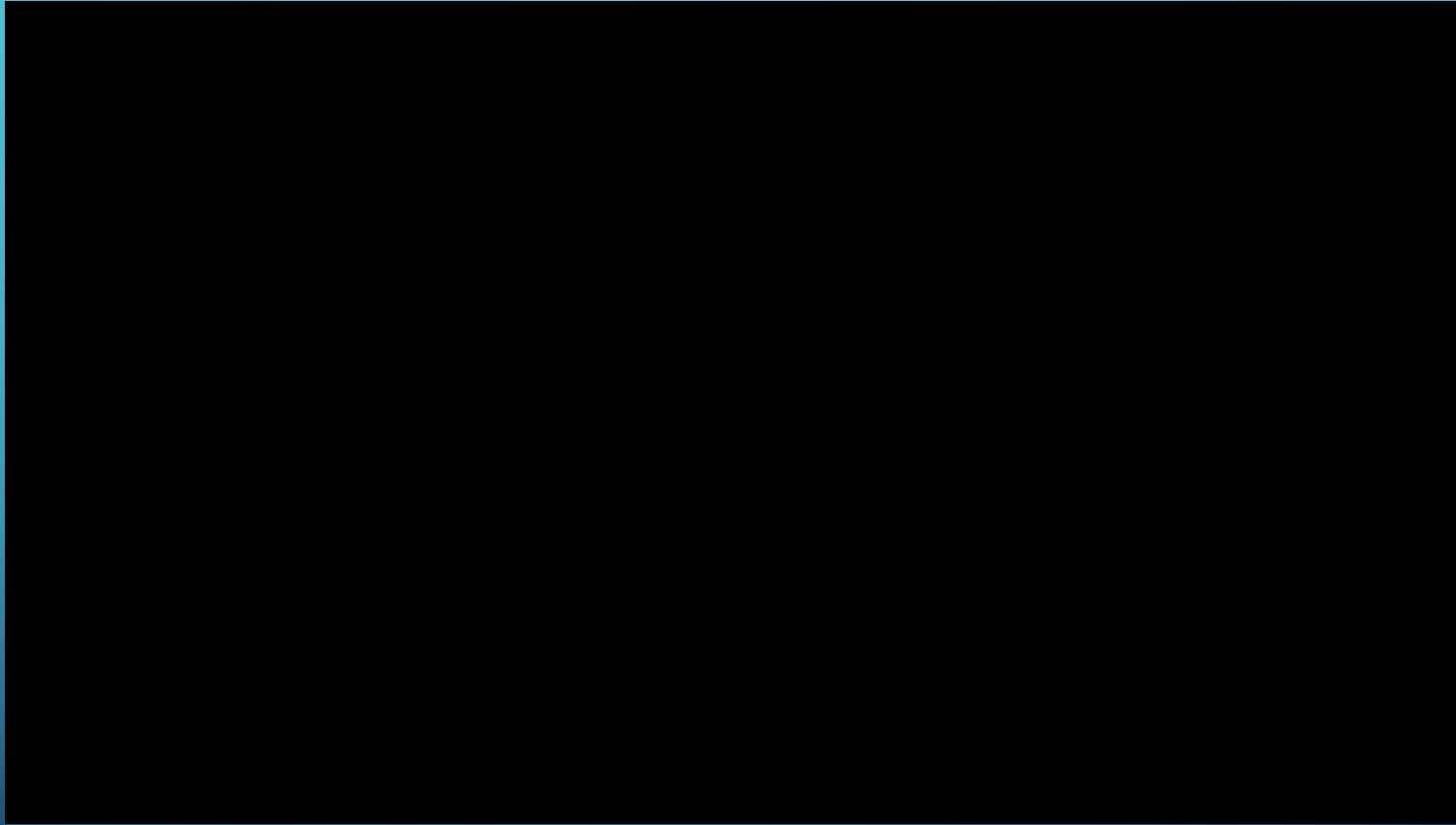


South



# Examples of local monitoring and early warning systems

Underpass of Rubiera, province of Reggio Emilia





# Examples of local monitoring and early warning systems

Easiness of data access and use

Data access on mobile devices - tablets

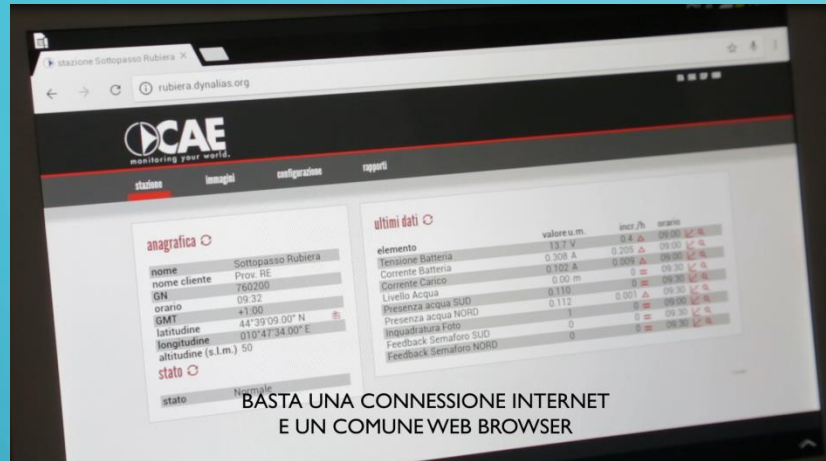
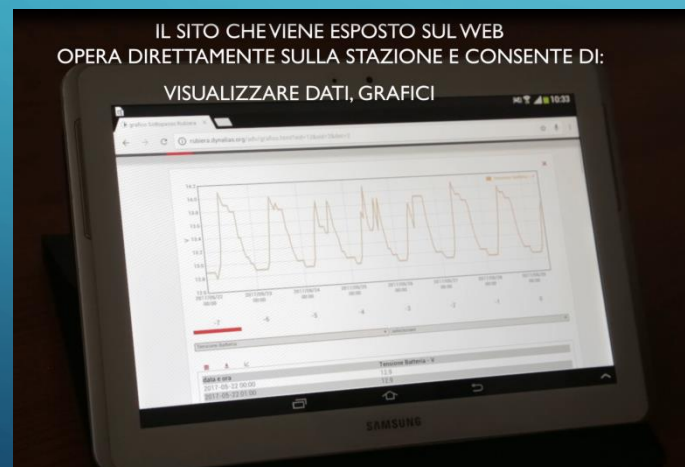


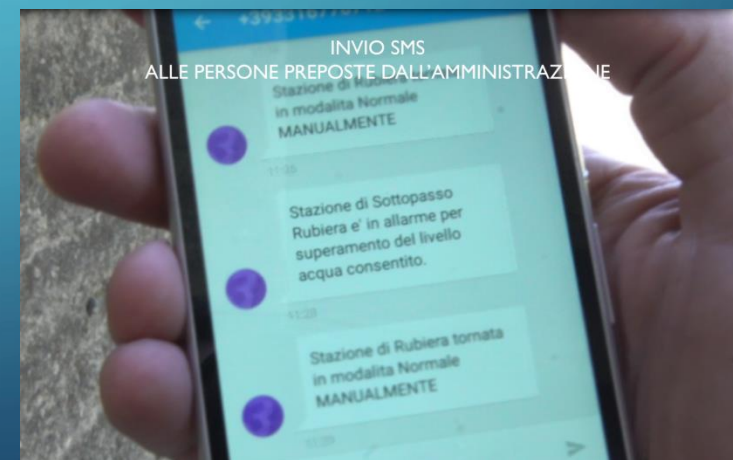
Photo access on mobile devices - tablets



Graphs access on mobile devices - tablets



Warning SMS on mobile devices - smartphones



The background is a dark blue gradient. In the corners, there are white line-art graphics resembling circuit boards or data paths, with lines connecting to small circles.

## Real Time Monitoring and Local Alerts

# Flash Floods

# Examples of local monitoring and early warning systems

## Flood Early Warning Systems in Region Emilia-Romagna

### Mitigating flood risk of Riccò Torrent in Emilia Romagna Region

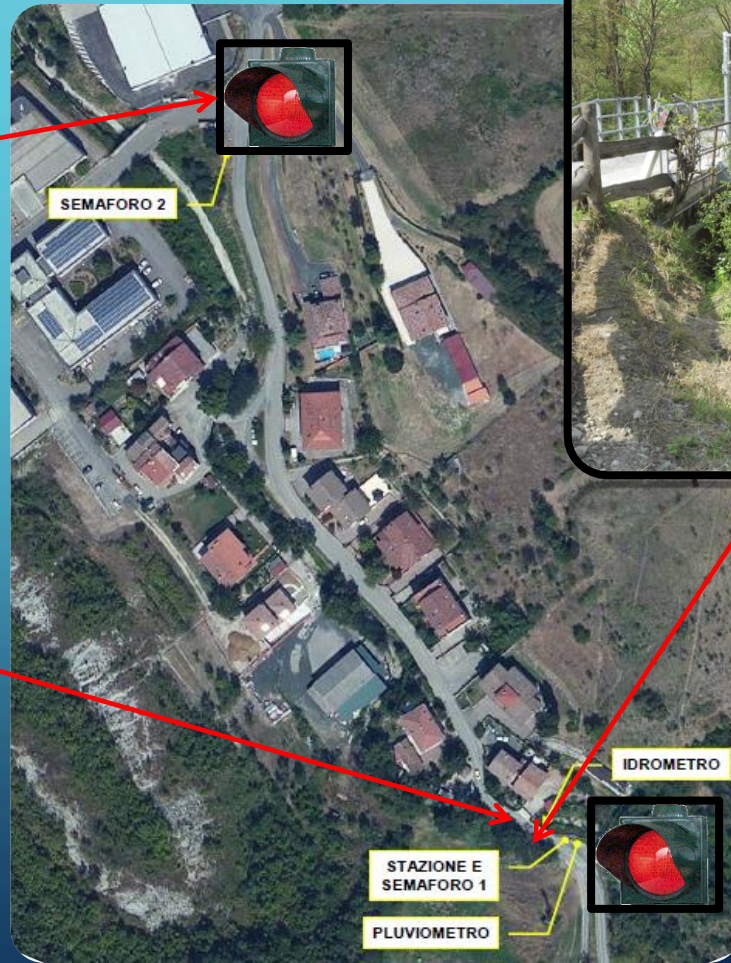


# Examples of local monitoring and early warning systems

## Flood Early Warning Systems in Region Emilia-Romagna

### Mitigating flood risk of Riccò Torrent in Emilia Romagna Region

Redundant warning system: the location is provided with one “water level + rain measurement station”. Traffic control system can be activated by water level thresholds, only after a double check with cumulative rainfall measurement. The station operates autonomously, on the basis of its local data acquisition.

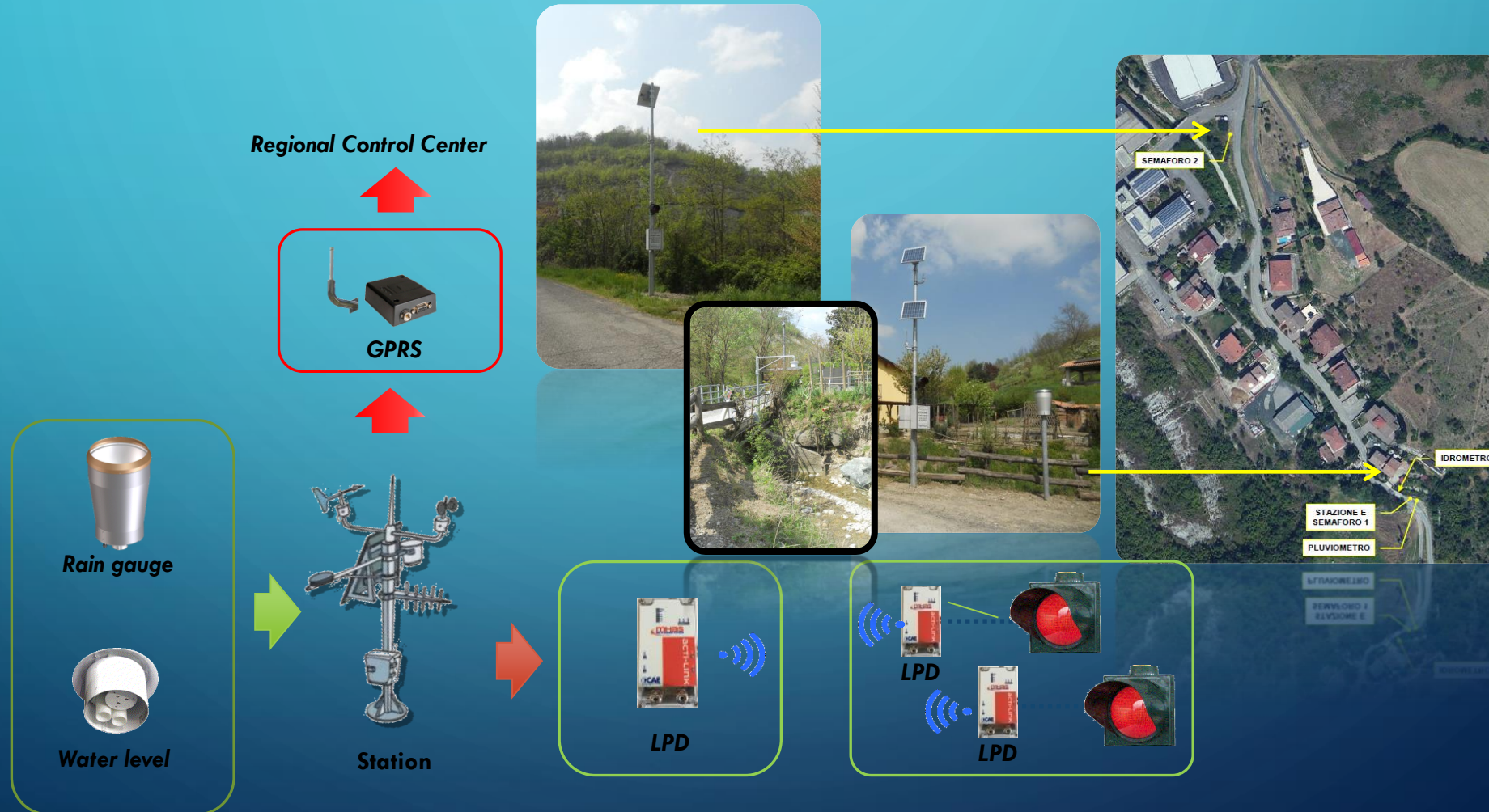


# Examples of local monitoring and early warning systems

## Flood Early Warning Systems in Region Emilia-Romagna

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# The small town «Ottone» hit by a flash flood in September 2015



# Monitoring and Early Warning System for the Municipality of Ottone



# Monitoring and Early Warning System for the Municipality of Ottone

Maltempo e disagi

## Cellulari muti da quattro giorni nelle Alte valli, sindaci esasperati

CONDIVIDI



INVI LA NOTIZIA

2 novembre 2018



C'è amarezza in tutti i sindaci delle alte valli piacentine per la lentezza con cui gli operatori di telefonia mobile stanno affrontando il problema della mancanza di segnale nei loro territori.

“La copertura non è mai efficiente, soprattutto quando piove”, è la voce corale dei primi cittadini, e dopo il flagello del maltempo di domenica notte i cellulari sono muti, creando pesanti difficoltà di comunicazione – soprattutto con gli anziani delle

Year 2018

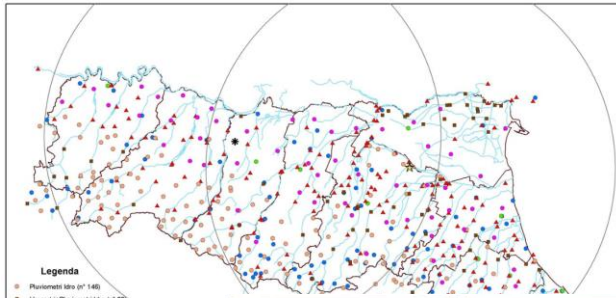
Vulnerable mobile communication network, especially during extreme meteorological events.

Mayors of the small town in the valley complains after 4 days without mobile network coverage:

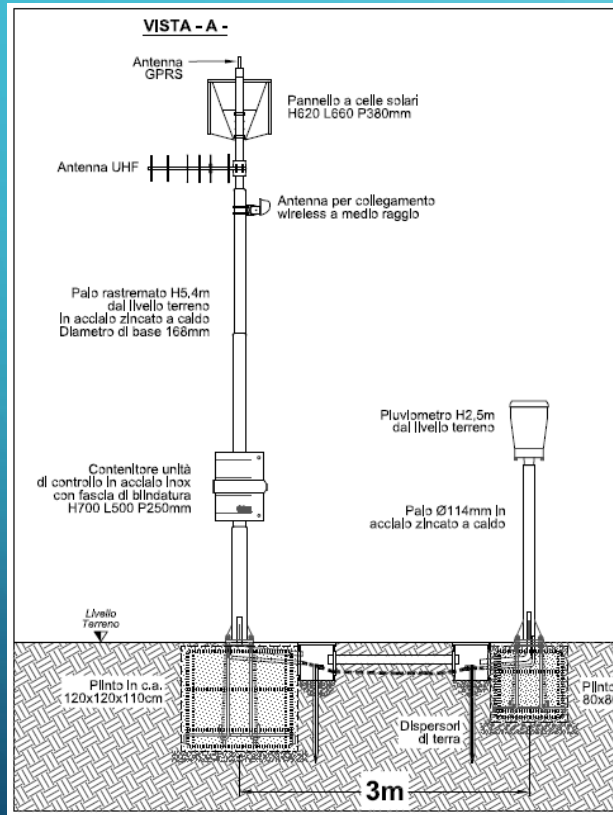
«It happens often, especially when it rains...»



# One automatic Mhaster station with an active role on the territory



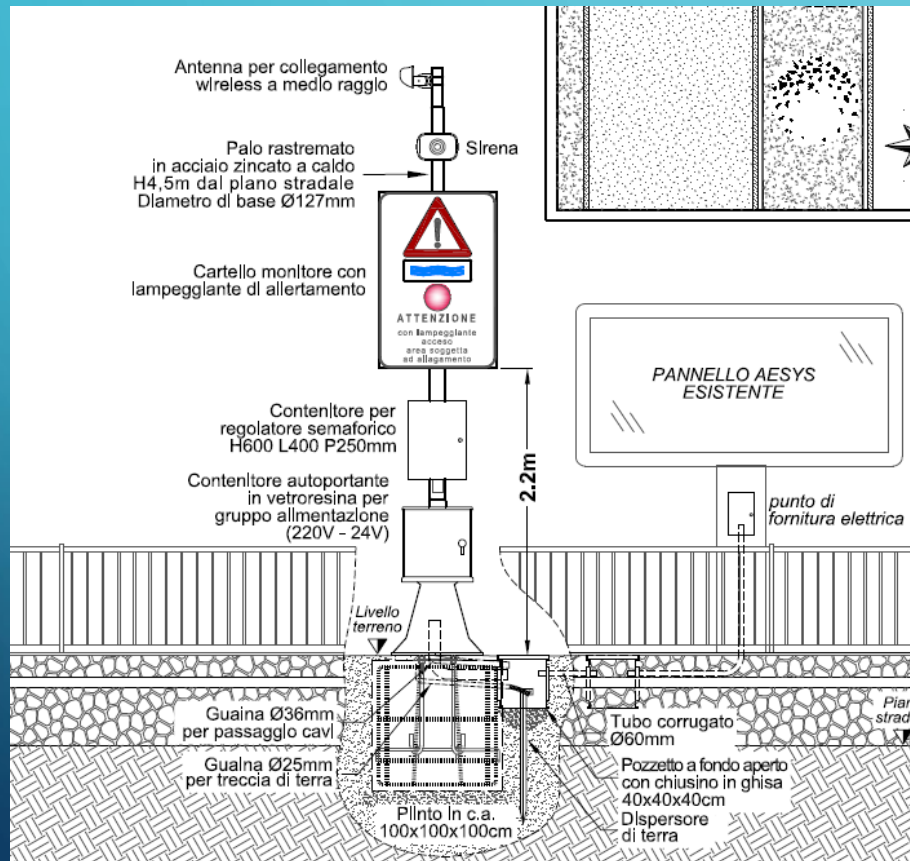
# The automatic station for rain measurement and alert management



# Warning point with siren and connection to the light panel/variable messages

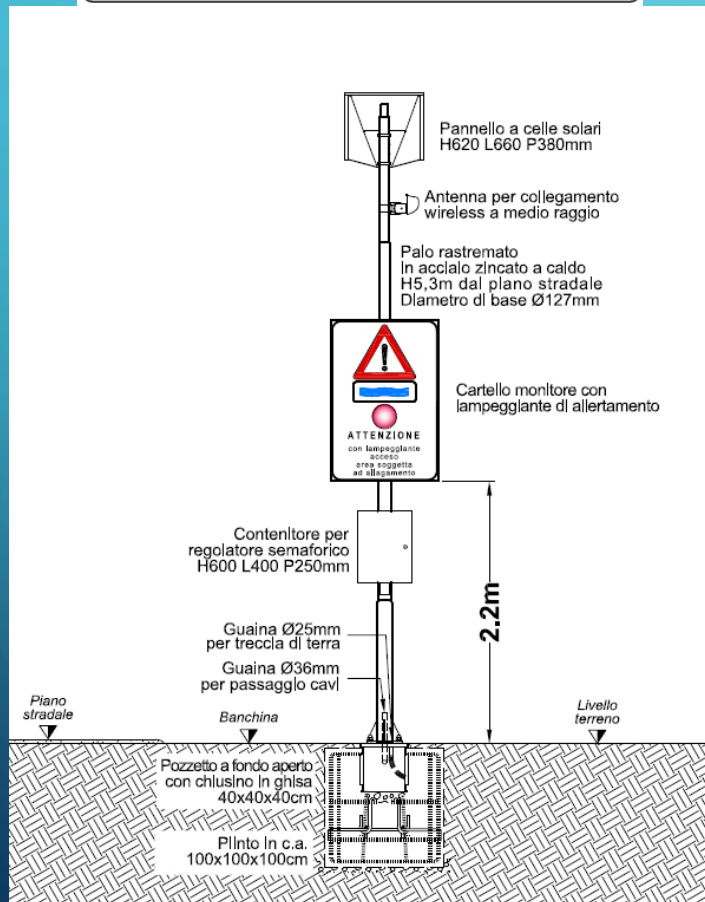
Lay-out di installazione di  
**IMPIANTO DI ALLERTAMENTO  
ACUSTICO E VISIVO**

**PA 1**



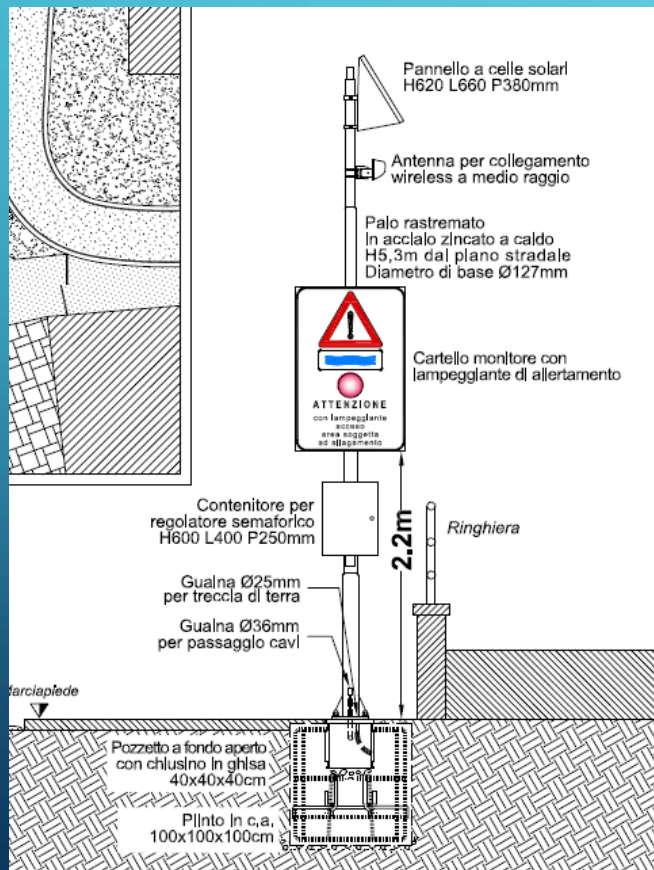
# Warning point with red light, independent from mains supply

## Lay-out di installazione di IMPIANTO DI ALLERTAMENTO VISIVO PA 2



# Warning point with red light, independent from mains supply

## Lay-out di installazione di IMPIANTO DI ALLERTAMENTO VISIVO PA 3



The background is a dark blue gradient. In the corners, there are white line-art graphics resembling circuit boards or data paths, with lines connecting to small circles.

## Real Time Monitoring and Local Alerts **Landslides**

# CASE HISTORY: CANCIA DEBRIS FLOW MONITORING AND EARLY WARNING SYSTEM

18 July 2009

**Corriere delle Alpi**

HOME CRONACA SPORT TEMPO LIBERO VENETO **NORDEST ECONOMIA** ITALIA MONDO FOTO

SI PARLA DI CASO CORAZZIN CORTINA 2021 MAGICHE DOLOMITI EROSTRATO

Sei in: BELLUNO > CRONACA > MALTEMPO, FRANA A BORCA DI CADORECASA...

## Maltempo, frana a Borca di Cadore Casa travolta, morti madre e figlio

*Madre e figlio sono le vittime di una frana avvenuta questa notte sulla statale all'altezza di Borca di Cadore, in provincia di Belluno. Lo smottamento è stato causato dal forte maltempo. La frana di acqua e fango, con un fronte di 60 metri, ha travolto la loro abitazione, facendo crollare il solaio. Altre case sono state lambite dal movimento franoso, evacuate trecento persone*

**FRANA**

18 luglio 2009

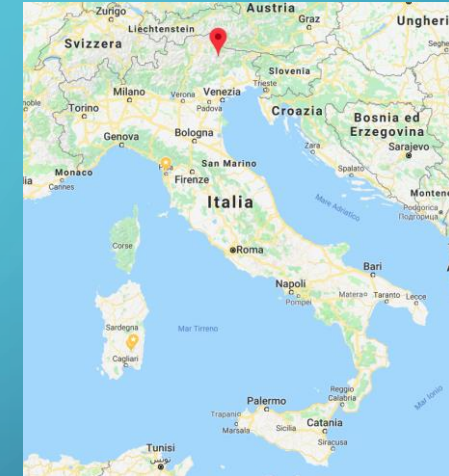
Condividi 0 Tweet G+



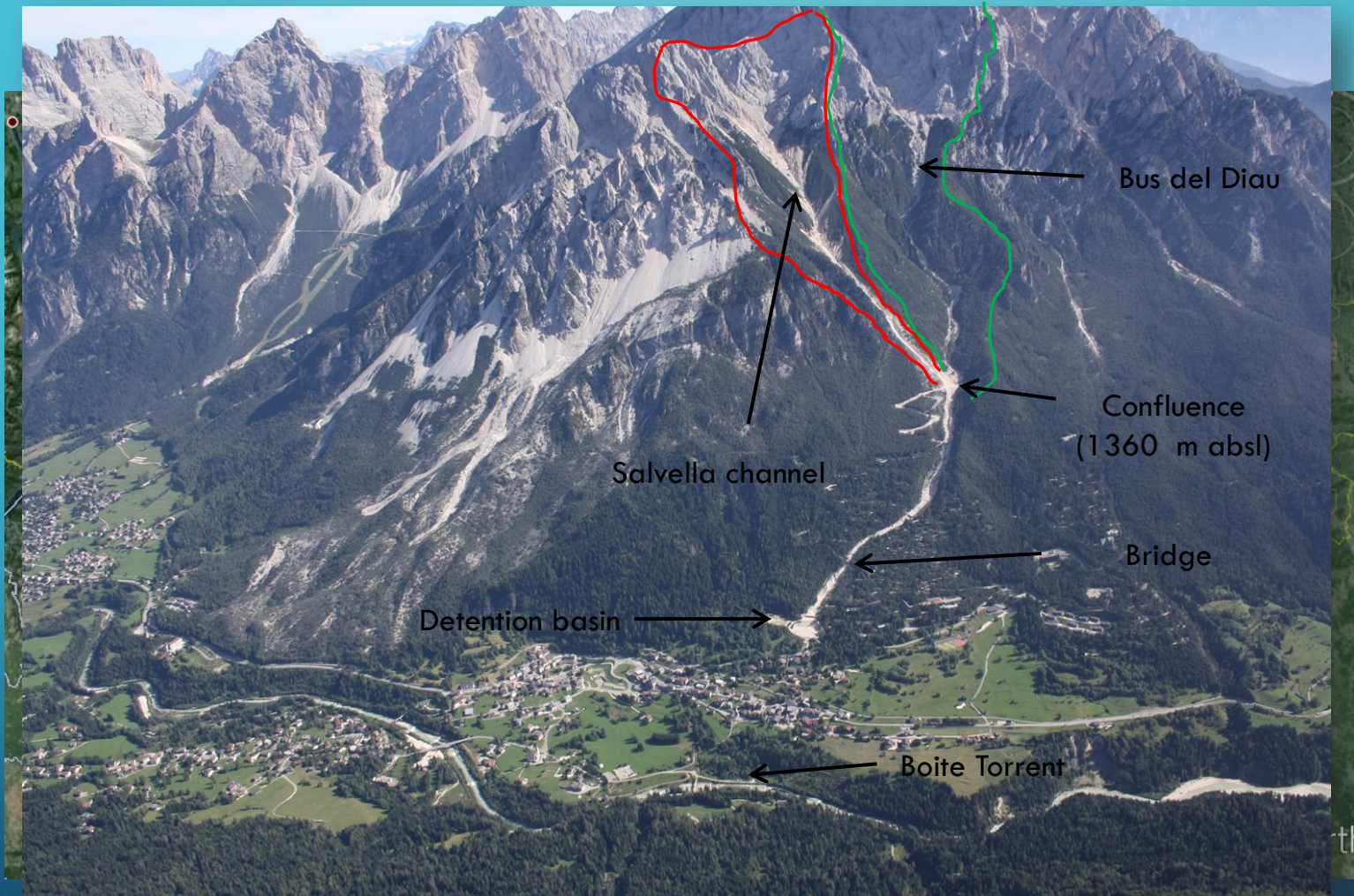
Due persone, madre e figlio, sono morte stamani a Cancia di Borca di Cadore nella loro casa travolta da una frana causata dal maltempo stamani, poco prima dell'alba. Ieri la zona, nella valle del Boite, ad una quindicina di chilometri da Cortina, era stata interessata da forti piogge e temporali.

Le vittime sono Adriano Zanetti, 63 anni, e la madre Giovanna Belfi (82). Entrambi erano in casa quando la frana di acqua e fango, con un fronte di 60 metri, ha travolto la loro abitazione, facendo crollare il solaio. Altre case sono state lambite dal

4



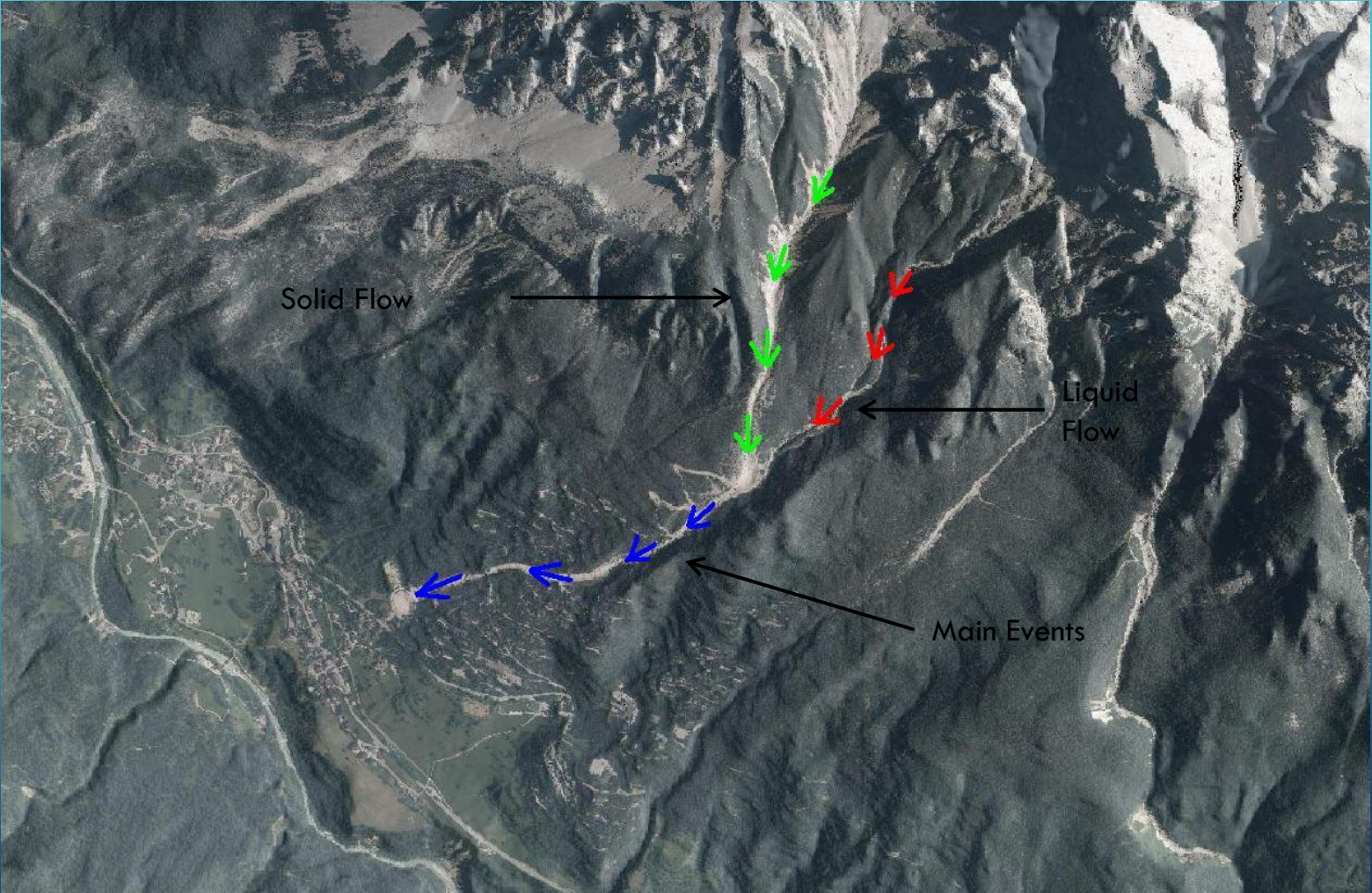
# Case History: Cancia debris flow monitoring and early warning system



The Study Area



# Cancia debris flow monitoring and early warning system



The Study Area

# Cancia debris flow monitoring and early warning system

## Targets

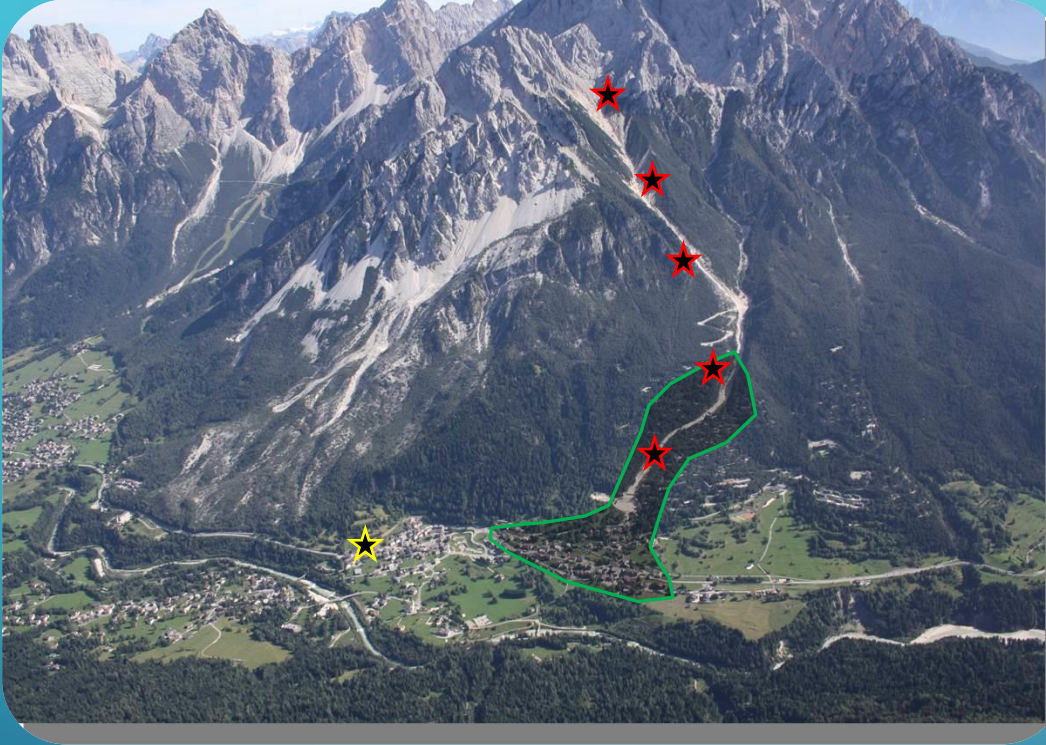
- Monitoring the triggering rainfalls
- Monitoring the flow transit
- Spreading alarms to stakeholders
- Studying the phenomenon

## Design Criteria

- Redundancy
- Robustness
- Independent power supply

# Cancia debris flow monitoring and early warning system

## Field Devices



### ★ n.5 weather and debris flow monitoring stations:

- 3 rain gauges
- 6 geophones
- 4 on/off sensors
- 8 level sensors
- 2 Camera



### ★ On field warning system:

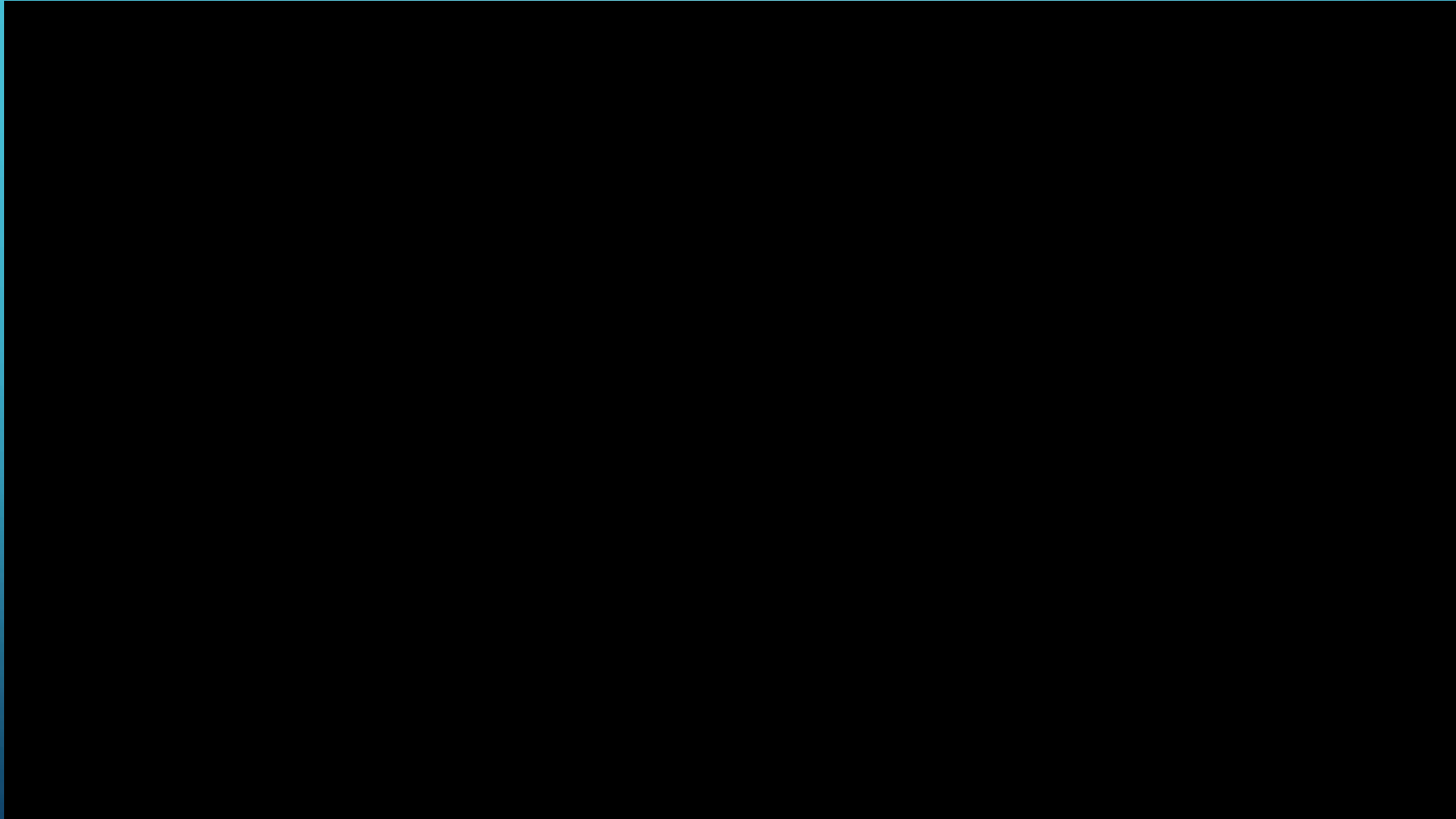
- 2 high power sirens
- 40 medium power sirens
- 10 traffic lights

### ★ Remote messaging warning system:

- Text message (3.600 sms/min)
- Voice messages
- fax
- email

# Cancia debris flow monitoring and early warning system

## Field Devices



# Cancia debris flow monitoring and early warning system

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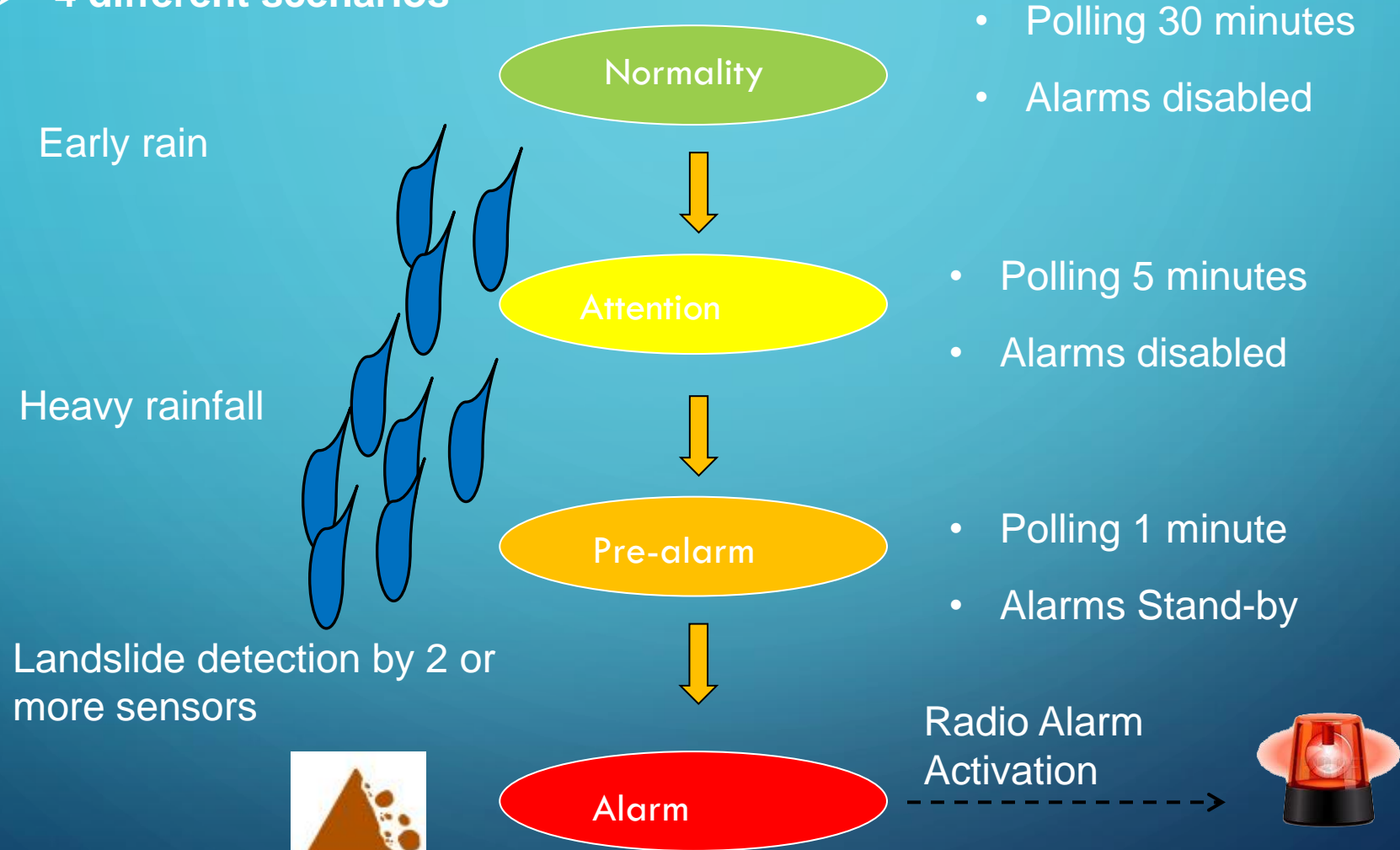
- Hot-Swap cluster server
- GPRS server
- 2 radio controllers
- 2 alarm activators
- UPS and emergency batteries



# Cancia debris flow monitoring and early warning system

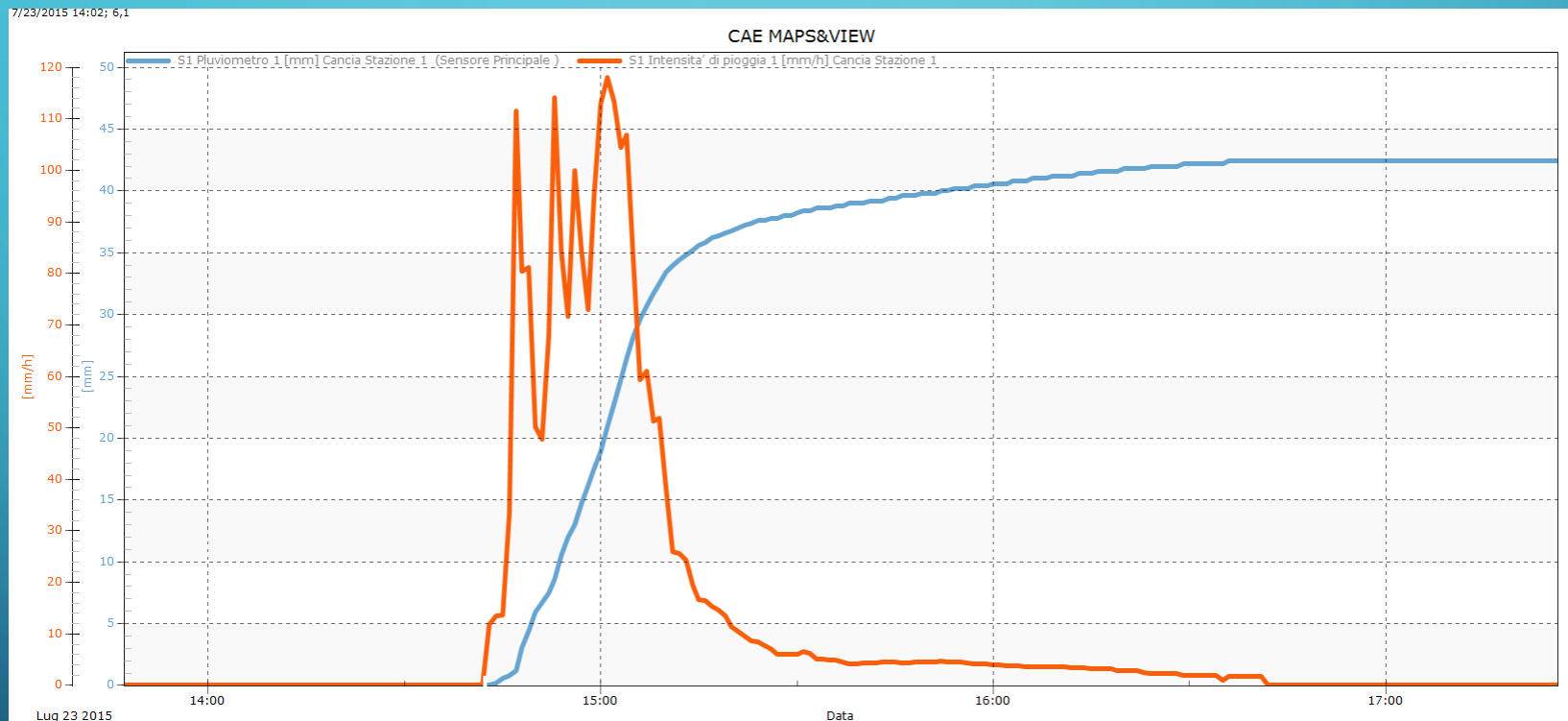
## Operating logic

### ➤ 4 different scenarios



# Cancia debris flow monitoring and early warning system - Case History

➤ July 23, 2015

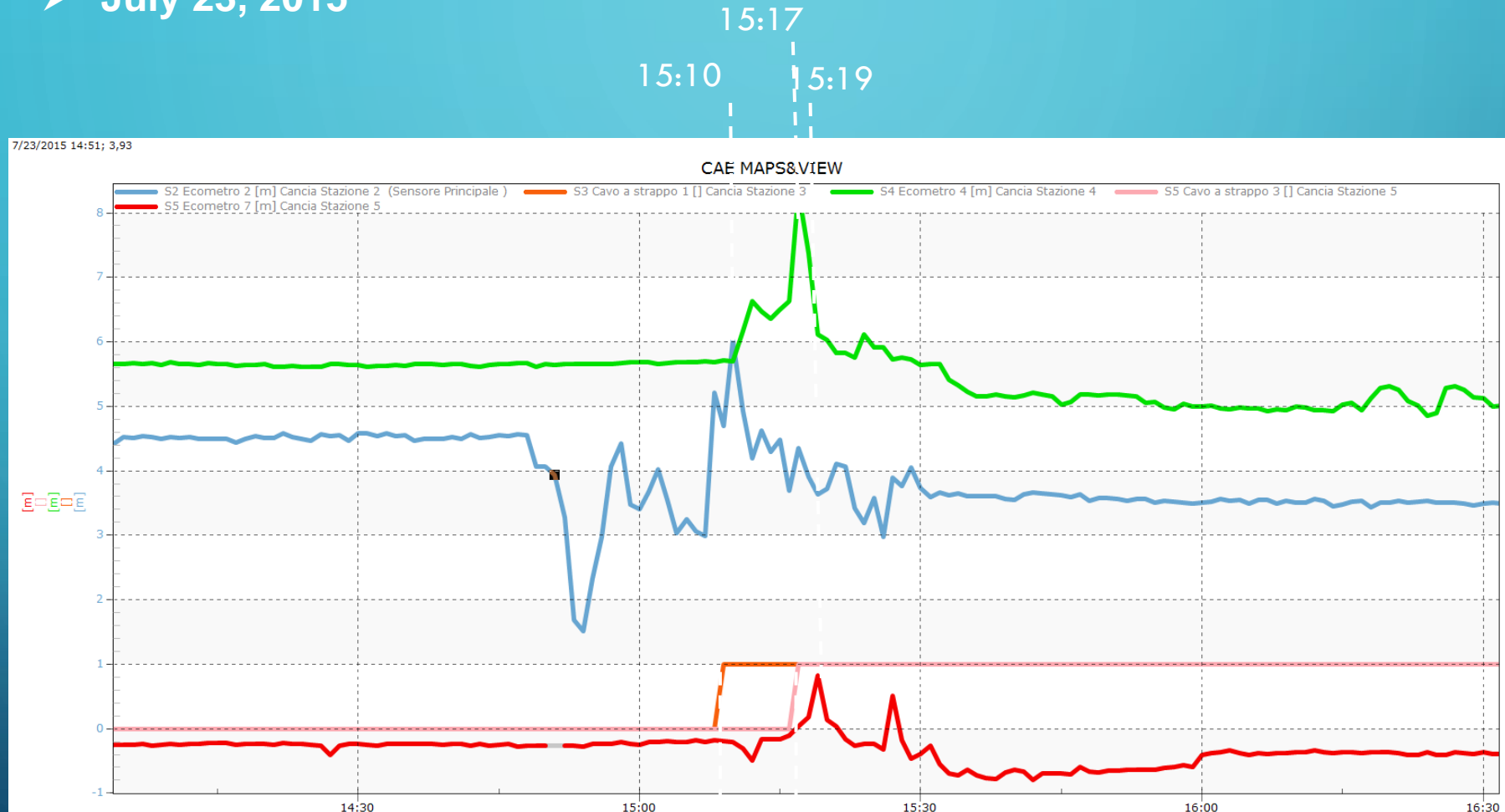


14:43

# Cancia debris flow monitoring and early warning system

## Case History

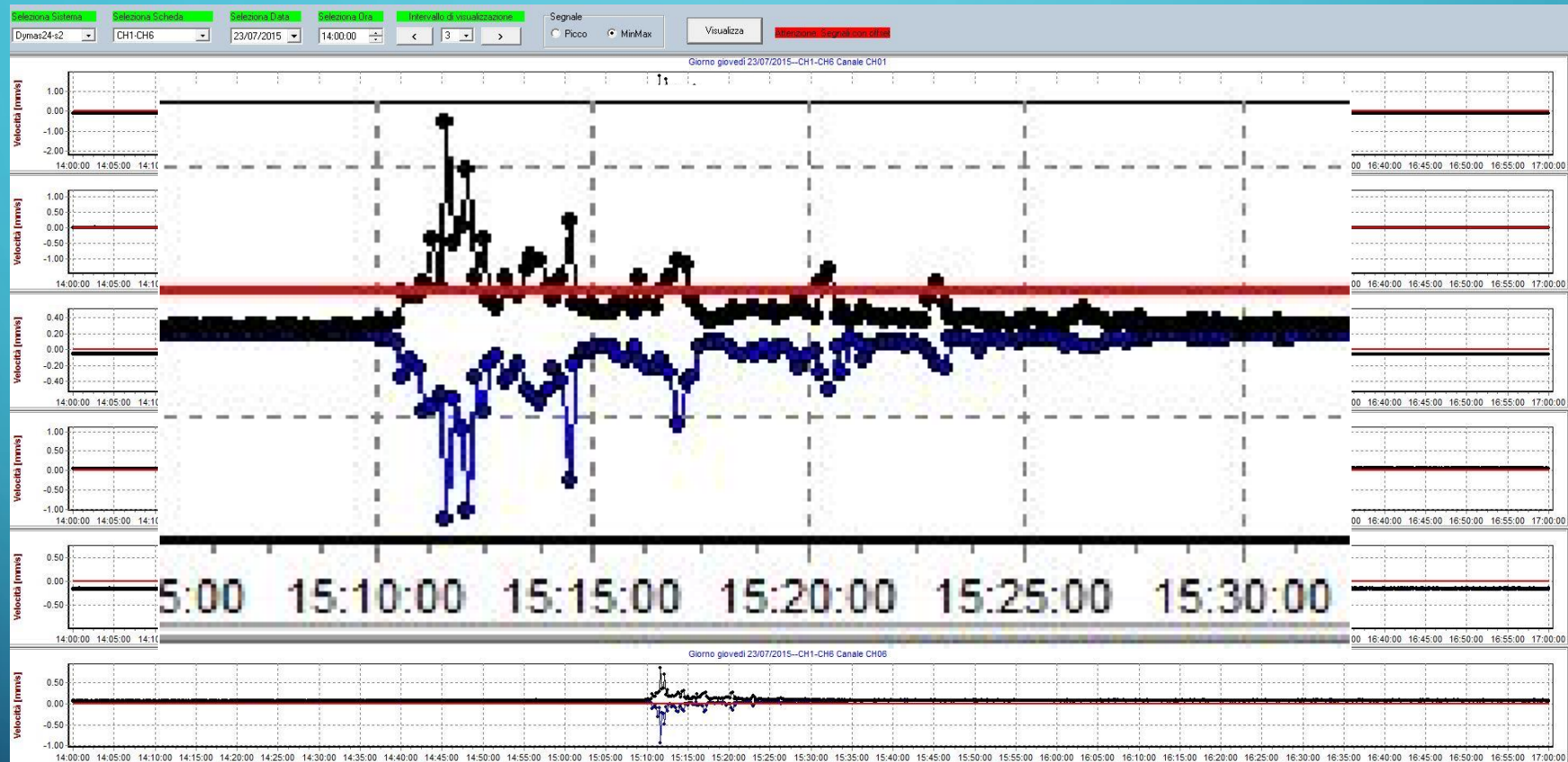
➤ July 23, 2015



# Cancia debris flow monitoring and early warning system

## Case History

➤ July 23, 2015



# Cancia debris flow monitoring and early warning system

## Case History

➤ July 23, 2015 - Station 3



# Cancia debris flow monitoring and early warning system

## Case History

➤ July 23, 2015 - Station 5



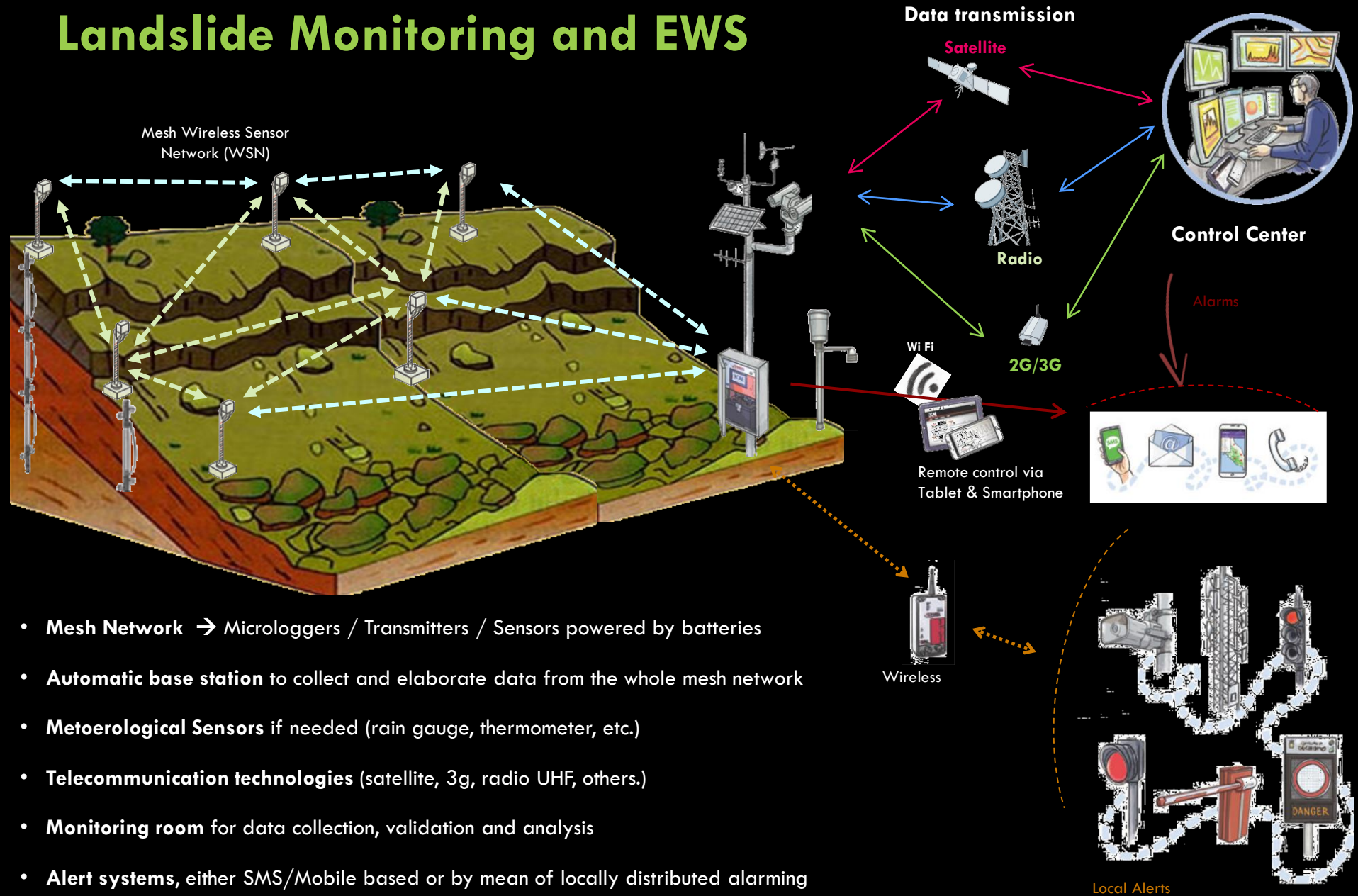
# Cancia debris flow monitoring and early warning system

## Conclusions

- A monitoring and warning system, to be reliable, must avoid false alarms as well false positives. That can be obtained through guaranteeing the system redundancy in the following features:
  - ✓ number and type of sensor
  - ✓ power supply
  - ✓ communication systems (at least 2)
  - ✓ warning criteria
- Triggering rainfall threshold can be used as pre-alarm tool and as filter for data collected by other sensors. Using a rainfall threshold as independent parameter for an alarm spreading may be risky and misleading, because it requires a deep comprehension of triggering mechanism;
- It is advisable to monitor the instantaneous intensity of rain for a complete comprehension of debris flows triggering mechanisms, since the average intensity may not be representative;
- Rainfall must be monitored in the debris flow triggering area, since precipitations are highly variable with altitude in alpine environment.



# Landslide Monitoring and EWS



- **Mesh Network** → Microloggers / Transmitters / Sensors powered by batteries
- **Automatic base station** to collect and elaborate data from the whole mesh network
- **Meteoerological Sensors** if needed (rain gauge, thermometer, etc.)
- **Telecommunication technologies** (satellite, 3g, radio UHF, others.)
- **Monitoring room** for data collection, validation and analysis
- **Alert systems**, either SMS/Mobile based or by mean of locally distributed alarming equipment (sirens, traffic lights, others)

# Supported sensors

Extensometers



Pressure cells



Load cells



# Supported sensors



Inclinometers



Tiltmeters



Accelerometers



Piezometers

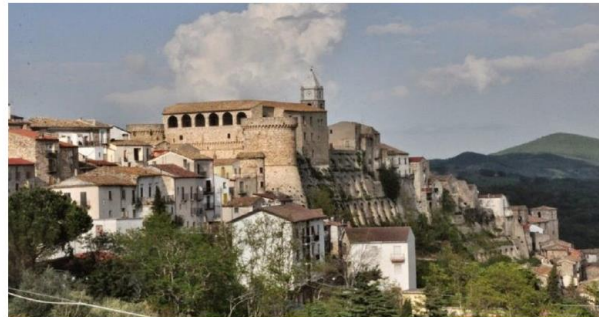
# Monitoring and Early Warning for Landslide at Civitacampomariano (CB)



molisenetwork.net/2017/03/14/frana-civitacampomariano-ritorna-la-paura-famiglie-sgomberate/

**March 2017**

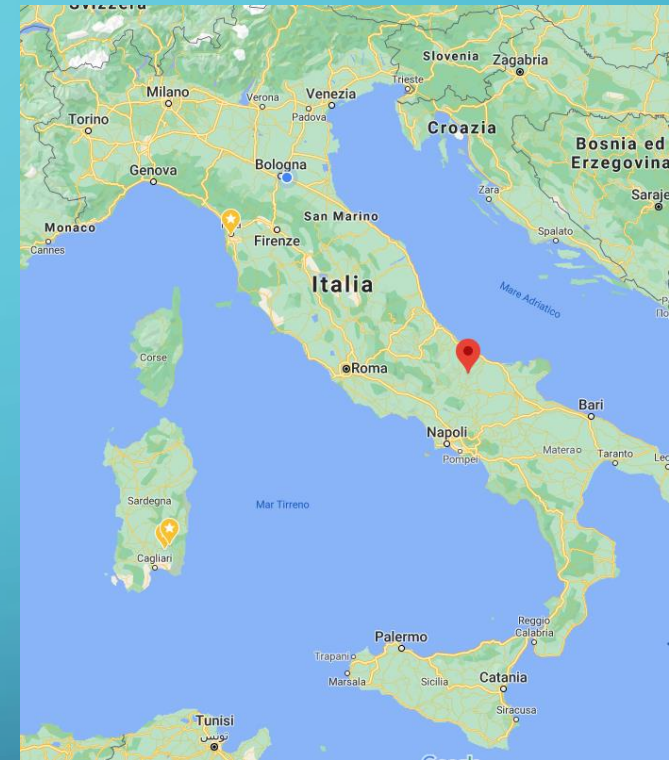
**FRANA – A Civitacampomariano ritorna la paura, sei famiglie sgomberate**



PUBBLICITA' >



CAMPOBASSO – Emergenza a Civitacampomariano. Frana dentro le viscere del paese già interessato negli anni passati da frane gigantesche con investimenti infrastrutturali straordinari sulla palificazione e sulla viabilità che all'epoca ne hanno interrotto anche i collegamenti verso la Bifernina e quindi Castelmauro Termoli e verso il capoluogo regionale.



# Monitoring and Early Warning for Landslide at Civitacampomarano (CB)

Landslide area – red evacuated zone



# Monitoring and Early Warning for Landslide at Civitacampomariano (CB) – System Components

Synoptic Panel



**n. 1 automatic station for building structural monitoring:**

- 1 rain gauge
- 1 air temperature sensor
- 1 radio in UHF band
- 1 GPRS/UMTS
- 15 W-POINT nodes connected to 2 piezometric sensors; 7 gap meters; 10 biaxial clinometric sensors



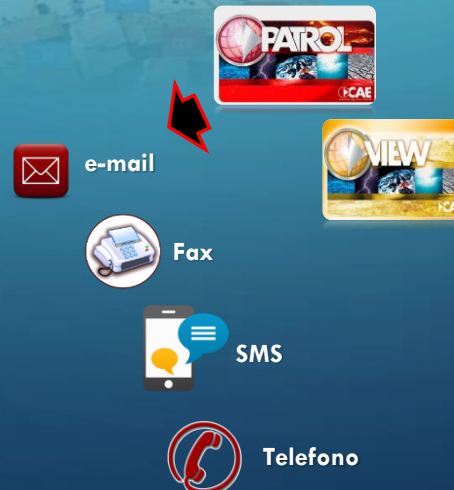
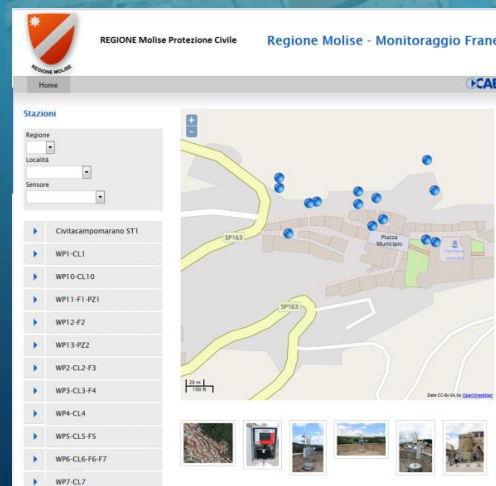
**Monitoring Center:**

- Workstation with software
- Router
- Ups
- Radio receiver

Alerting system with instant messaging:

- Sms
- Vocal messages
- Fax
- Mail

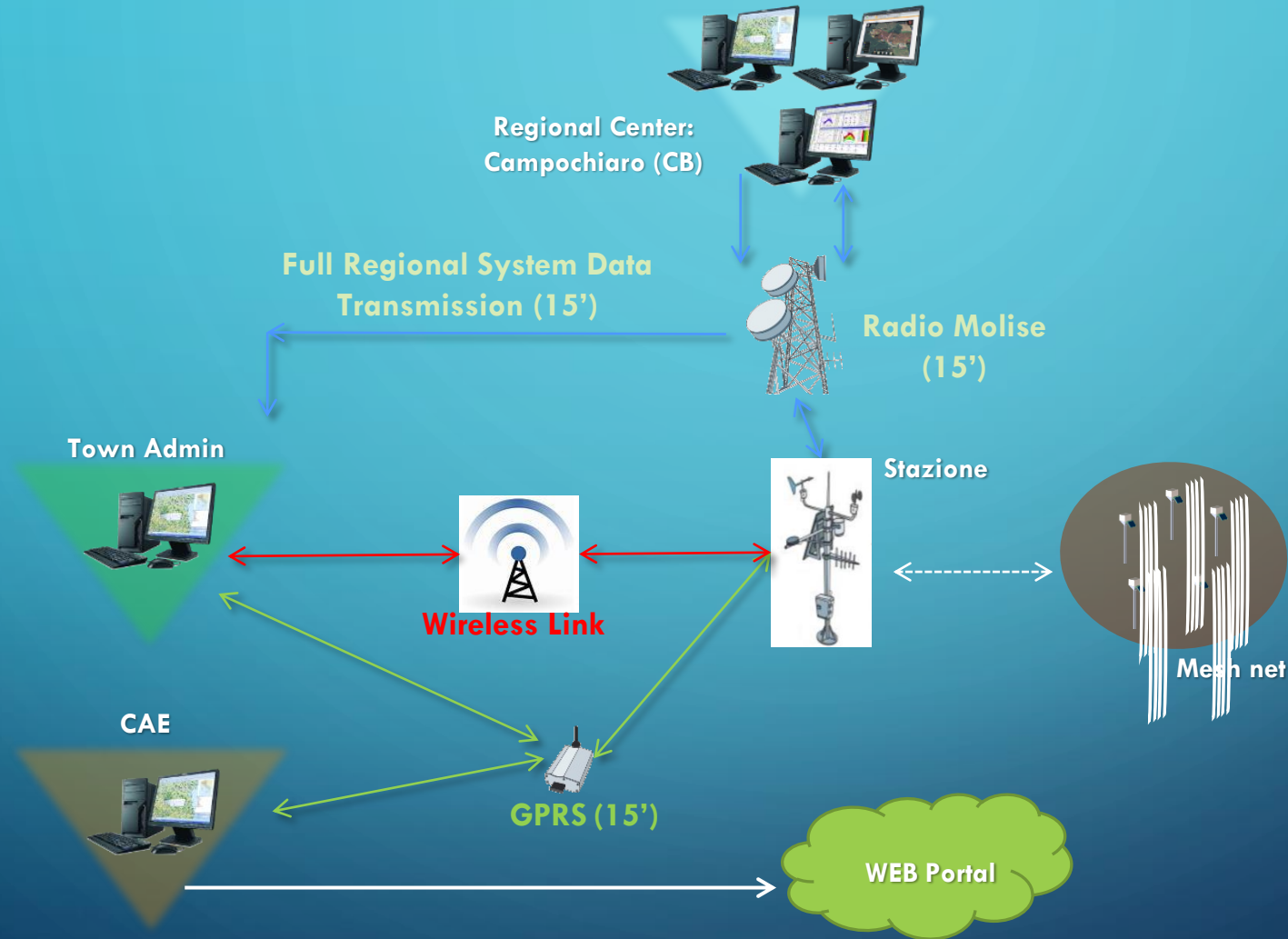
Sito Smartweb



# Sensors in field - Civitacampomariano (CB)



# Monitoring and Early Warning System Architecture – Civitacampomariano (CB)





# One day, should you be in charge of proposing a non structural solution for a local natural hazard, additionally to all the scientific factors, please consider that...

Automatic Stations included into the real time networks dedicated to hydrological and meteorological monitoring, are ready to become «active» tools to alert citizens when predetermined scenarios occur. Sirens, sms, mobile apps, traffic lights can be integrated as part of the local alerting systems.

Regardless of using existing automatic stations or designing a new local monitoring and early warning system, remember that these systems need to:

1. Have an owner administration, responsible for it
2. Be properly maintained; a budget must be allocated
3. Purchased as «systems» (best value for money awarding criteria, with quality and price evaluation) and not as «goods» (lowest price awarding criteria).
4. Be included into updated Local Civil Protection plans
5. Be explained to population

One day, should you be in charge of proposing a non structural solution for a local natural hazard, additionally to all the scientific factors, please consider that...

Local alerting systems should be designed to:

- Work properly during extreme weather
  - Independent power supply for all and each elements
  - Independent and redundant communication system, especially with regard to the main scope of the system
- Limitate «false positive» (double check, conditioned change of «status»)
- Limitate «missed positive» (redundant architecture)
- Activate simple alerting messages, easy to understand

The background is a solid teal color. In the four corners, there are decorative white line-art elements that resemble circuit traces or a stylized tree structure, with small circles at the end of the lines.

# And.... Call us!

THANK YOU  
GRAZIE  
谢谢你们  
GRAZIAS

GUIDO BERNARDI – [GUIDO.BERNARDI@CAE.IT](mailto:GUIDO.BERNARDI@CAE.IT)



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[guido.bernardi@cae.it](mailto:guido.bernardi@cae.it)

**Thanks**

*Todi, Italy, 25 August 2023*