

MARSEILLE  
DU 27 MAI  
AU 3 JUIN  
2022



ICOLD  
27<sup>TH</sup> CONGRESS  
90<sup>TH</sup> ANNUAL  
MEETING



CIGB  
27<sup>ÈME</sup> CONGRÈS  
90<sup>ÈME</sup> RÉUNION  
ANNUELLE



Q106 – Surveillance, Instrumentation, Monitoring and Data Acquisition and Processing/Surveillance, instrumentation, auscultation, acquisition et traitement des données

# PERFORMANCE OF LARGE DAMS UNDER THE 2016-2017 SEISMIC SEQUENCE IN CENTRAL ITALY

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ITALY

Rosella Caruana

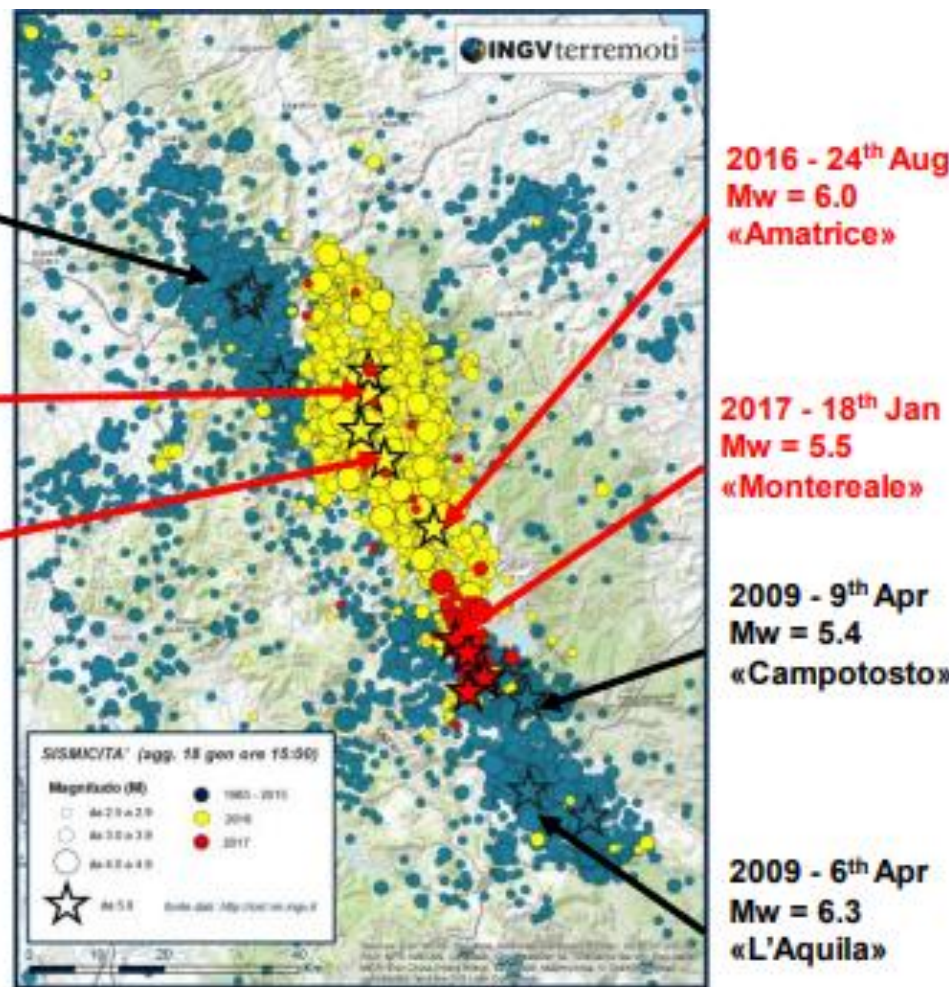
## THE 2016-2017 SEISMIC SEQUENCE IN CENTRAL ITALY

Seismic main events in the last 20 years in the interested area.

1997 – 26<sup>th</sup> Sep Mw = 6.0 «Colfiorito»

2016 - 30<sup>th</sup> Oct Mw = 6.5 «Norcia»

2016 - 26<sup>th</sup> Oct Mw = 5.9 «Norcia»



2016 - 24<sup>th</sup> Aug Mw = 6.0 «Amatrice»

2017 - 18<sup>th</sup> Jan Mw = 5.5 «Montereale»

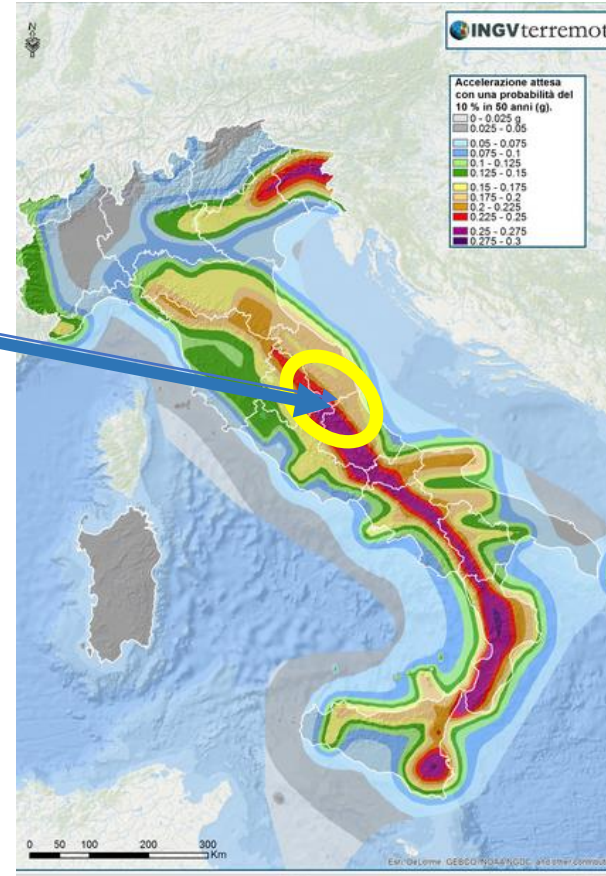
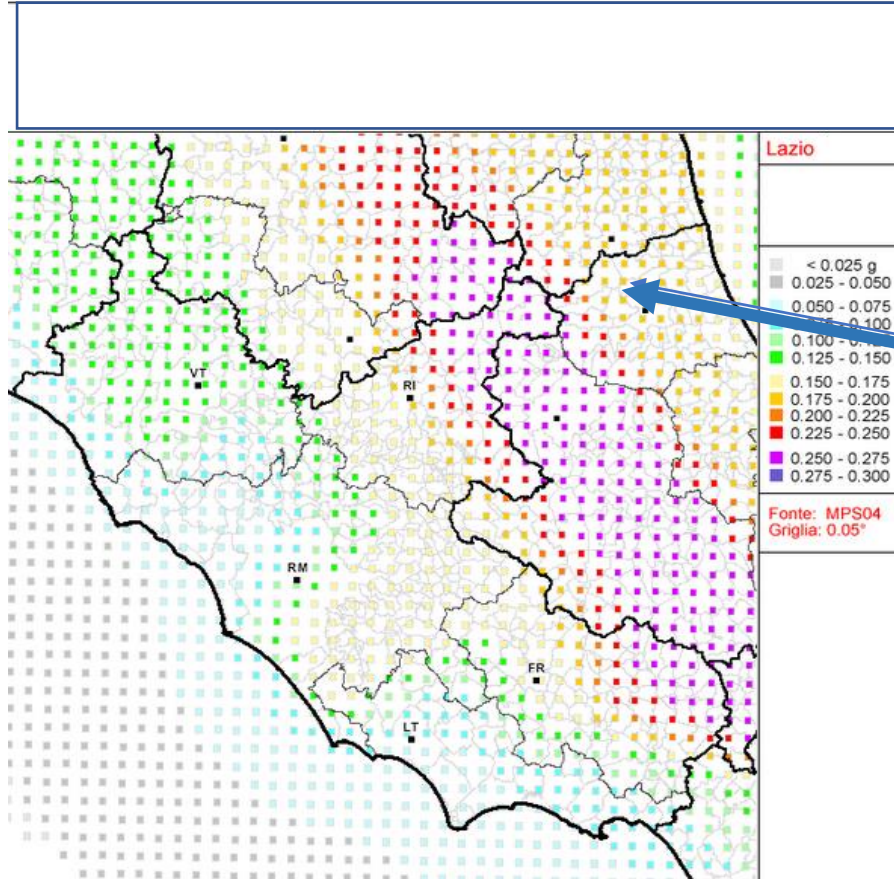
2009 - 9<sup>th</sup> Apr Mw = 5.4 «Campotosto»

2009 - 6<sup>th</sup> Apr Mw = 6.3 «L'Aquila»

# Central Italy Seismic Sequence

## Seismic Hazard Contest

ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

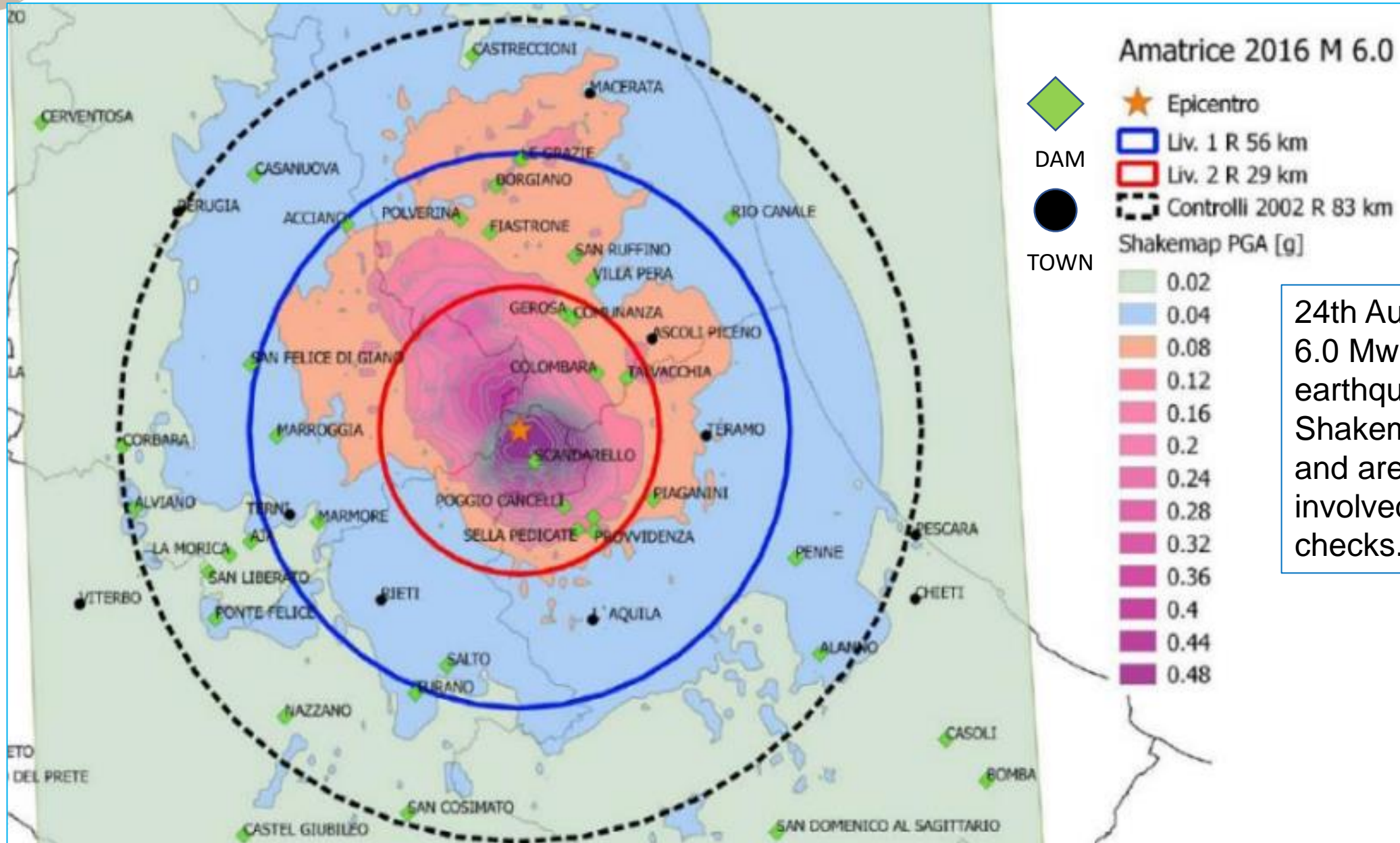


Central Italy Seismic Sequence is located in an High Hazard Seismic Area referred to the official Italian Seismic Hazard Map

## EFFECTS ON TERRITORY

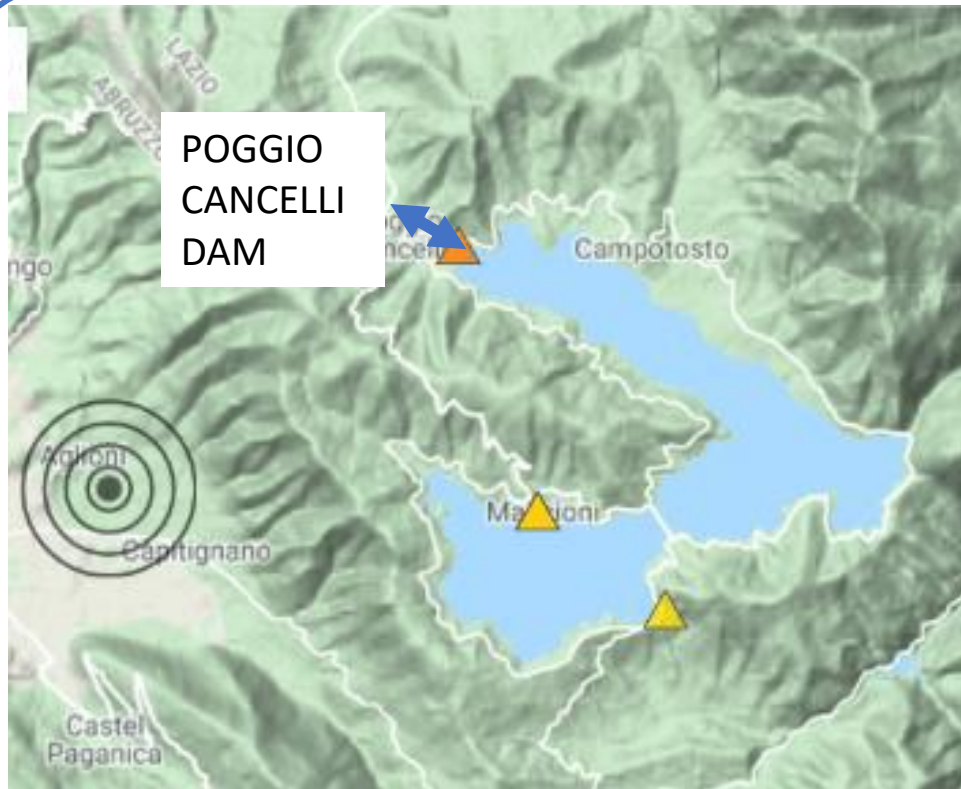


Amatrice town before and after the 24th August Mw 6.0 earthquake.



24th August 2016  
6.0 Mw "Amatrice"  
earthquake.  
Shakemap (PGA)  
and areas with dams  
involved in safety  
checks.

## PROCEDURES AND EXTRAORDINARY INSPECTIONS



18th January 5.5 Mw “Rieti” earthquake. Poggio Cancelli embankment dam, only 6 km far from the epicenter.

## PERFORMANCE OF THE DAMS

### ACCELEROMETRIC RECORDINGS DYNAMIC RESPONSE

| Date       | Station RAN Name | PGA (g) Nord/Sud | PGA (g) East/West | Dams Name       | Distance (km) Dam-Station |
|------------|------------------|------------------|-------------------|-----------------|---------------------------|
| 24/08/2016 | AMT              | 0.44             | <b>0.91</b>       | Scandarello     | 1.7km                     |
| 30/10/2016 | AMT              | 0.44             | 0.61              | Scandarello     | 1.7km                     |
| 26/10/2016 | MNF              | 0.09             | 0.13              | Fiastrone       | 0 km                      |
| 30/10/2016 | MNF              | 0.11             | 0.12              | Fiastrone       | 0 km                      |
| 18/01/2017 | PCB              | <b>0.57</b>      | 0.44              | Poggio Cancelli | 0 km                      |
| 18/01/2017 | SPD              | 0.13             | 0.21              | Sella Pedicate  | 0 km                      |

Recorded Peak Ground Accelerations and dam distance.

## EVIDENCES FROM INSPECTIONS



Scandarello Dam. Slight damages on the parapet and crack pattern on the crest.

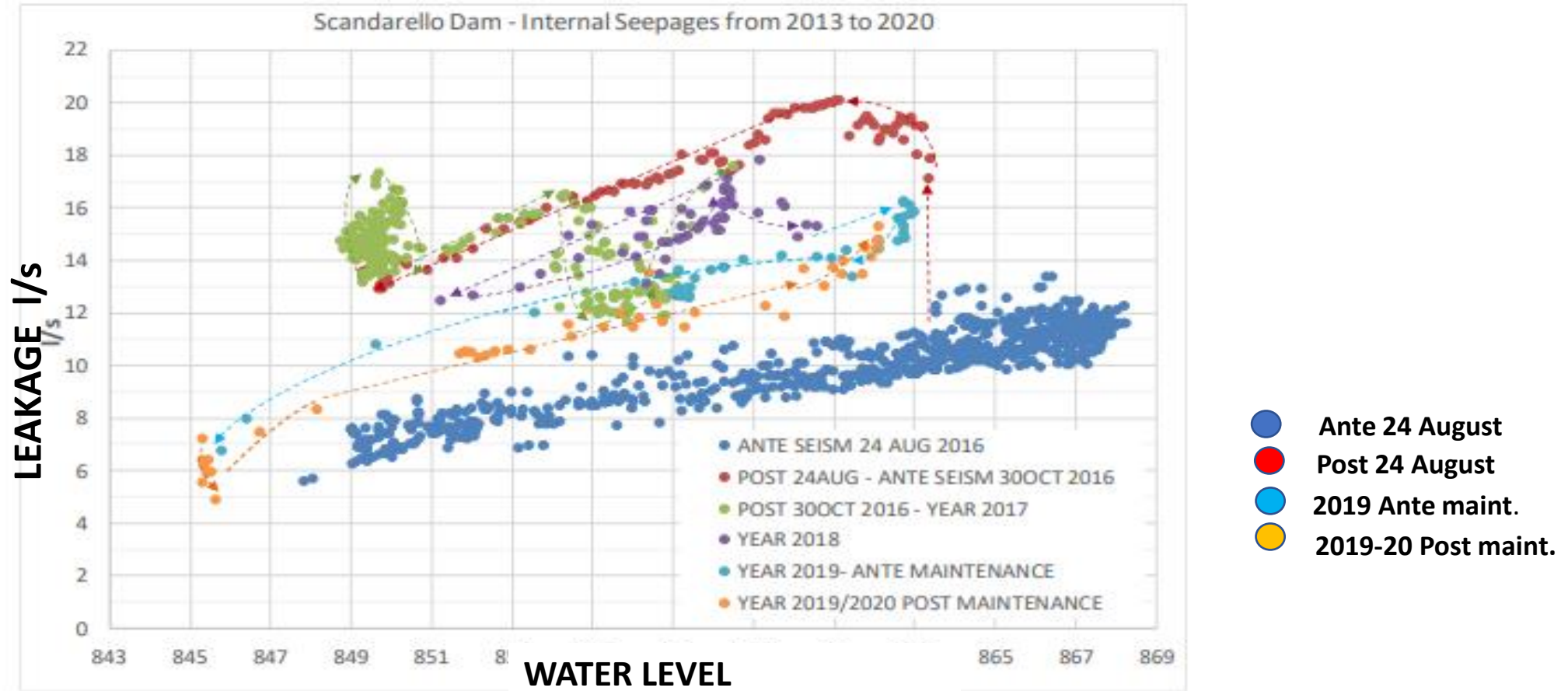


## EVIDENCES FROM INSPECTIONS



Fiastrone Dam. Increased seepages on the downstream face after 30th Oct 6.5 Mw earthquake.

INSTRUMENTAL EVIDENCES



**Scandarello Dam.** Correlation diagram between reservoir water level and internal seepages before and after the major earthquakes, until nowadays.

## APPURTENANT WORKS

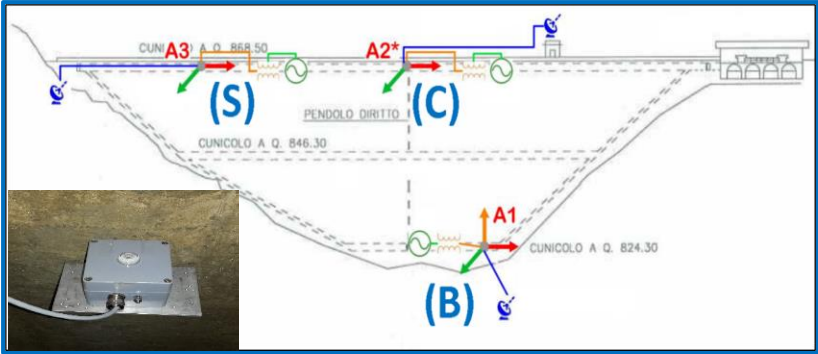


Fiastrone Dam warden’s house with the evidence of the damages due to 24th August 6.0 Mw earthquake (important crack patterns on all the walls).

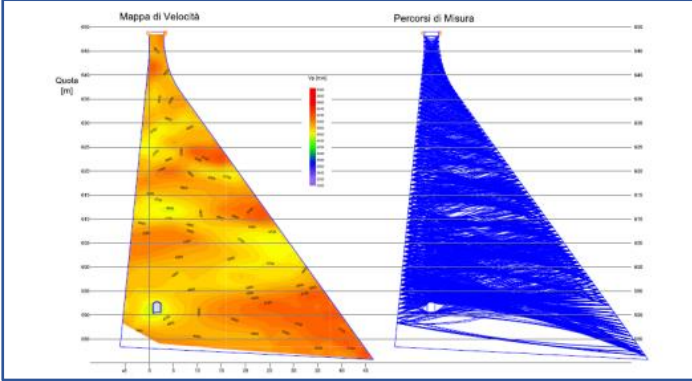
Scandarella hydroelectric power plant – Damages (short columns failed in shear and out of plane mechanisms).

# ACTIONS AFTER SEISMIC SEQUENCE

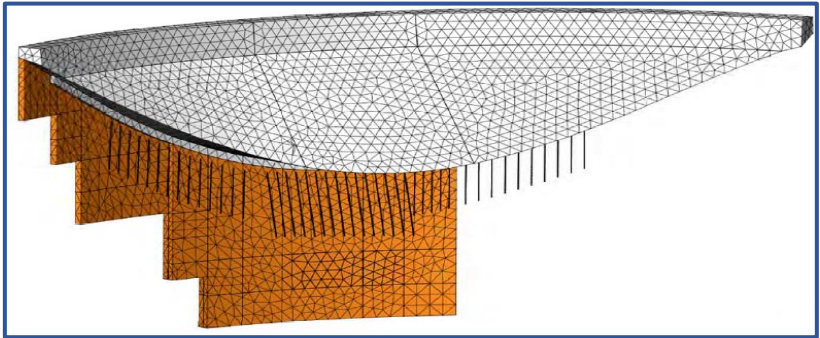
**MONITORING SYSTEM**



**IN-DEPTH ANALYSIS AND SEISMIC RE-ASSESSMENT**



**INVESTIGATION AND WORKS**

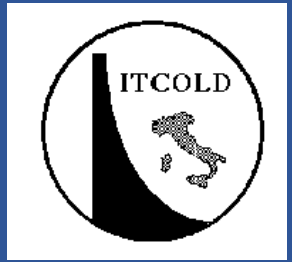


**SEISMIC REASSESSMENT OF THE APPURTENANT WORKS**





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**THANKS FOR YOUR ATTENTION**

# Conclusions

***Hard seismic sequence in 2016-2017 undergone by Scandarello Dam***

***Small damages for the appurtenant structures***

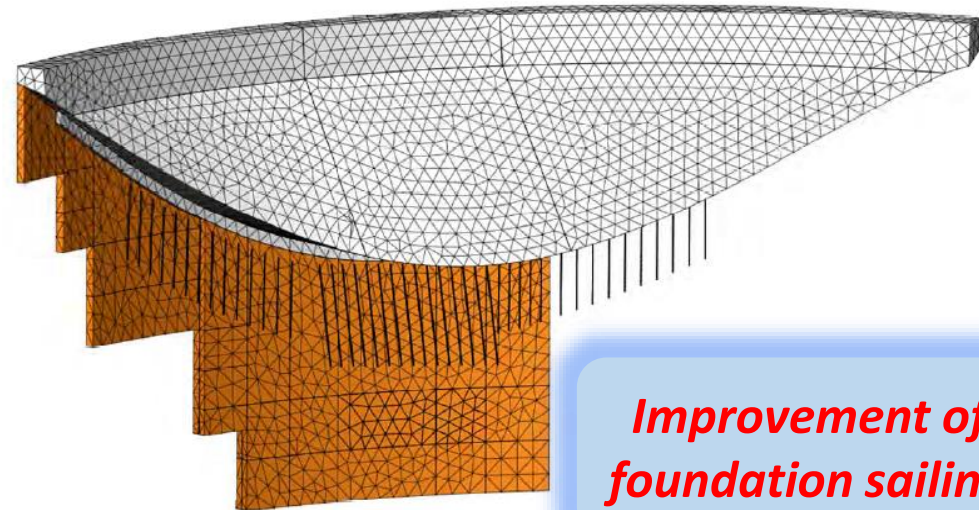
***No significant evidences on the Dam Body***

***No significant anomalies in the Dam Behaviour.***

***Significant increase in the seepages, partially recovered.***



***Reduction of the Water Level by Dam Authority***



***Improvement of foundation sailing***