PROBABILISTIC SEISMIC HAZARD ANALYSIS FOR THE PERTUSILLO DAM IN THE AGRI VALLEY

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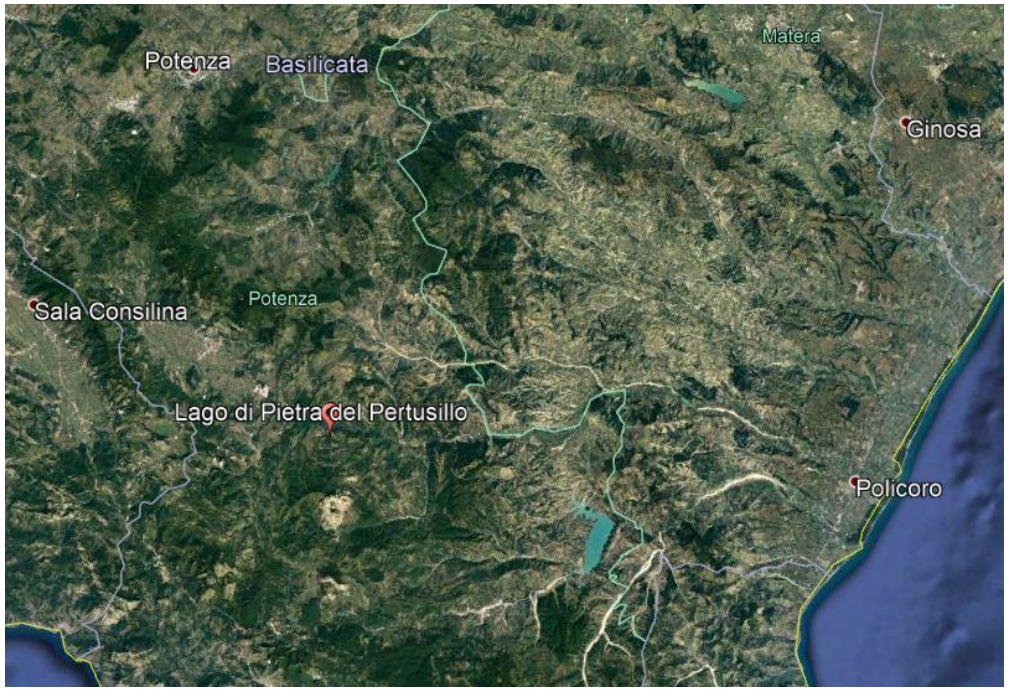
Pertusillo dam

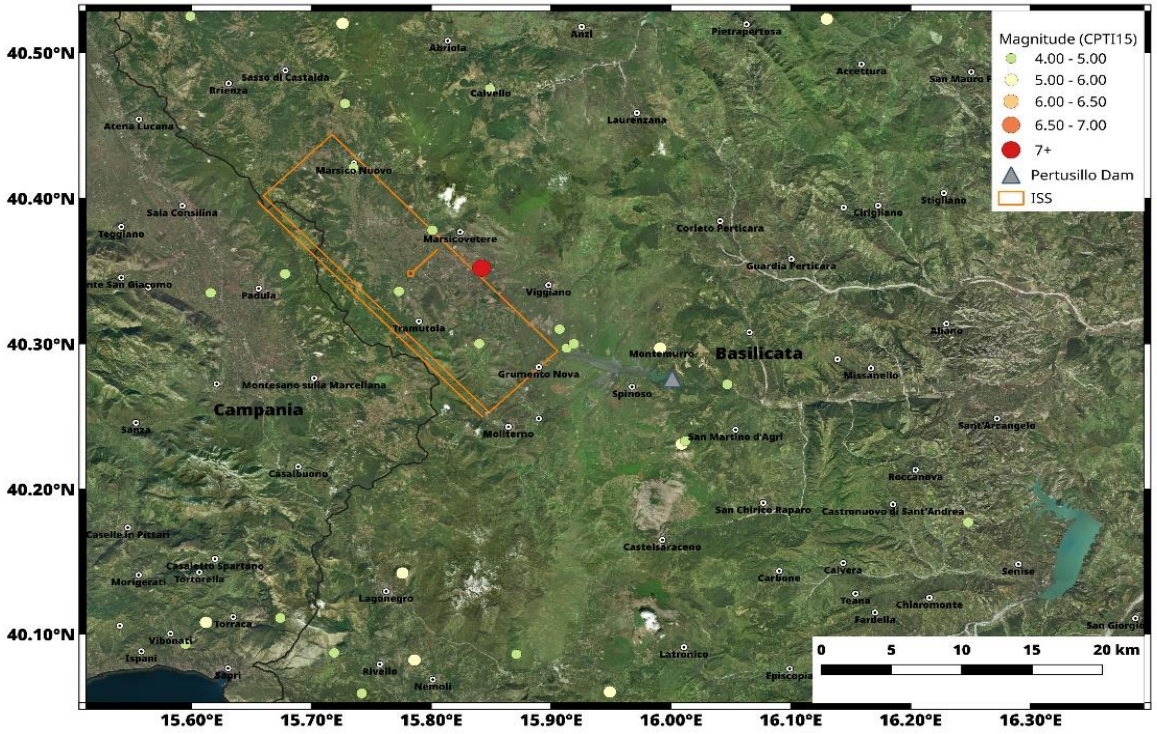


- Water volume 155 million m^3, surface 7.5 km^2

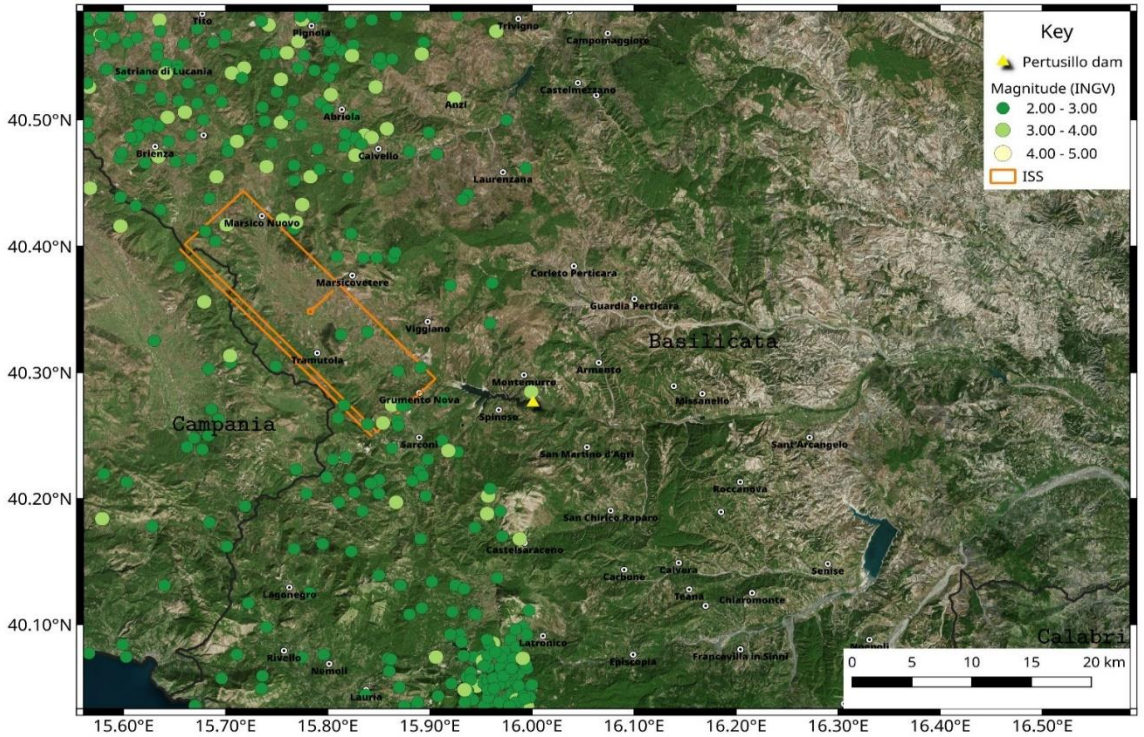
- D.L. n. 79/2004: seismic hazard assessment for every Italian dam

Seismicity in the area

Historical seismicity (1000 – 2014)



Recent seismicity (1985 – 2019)

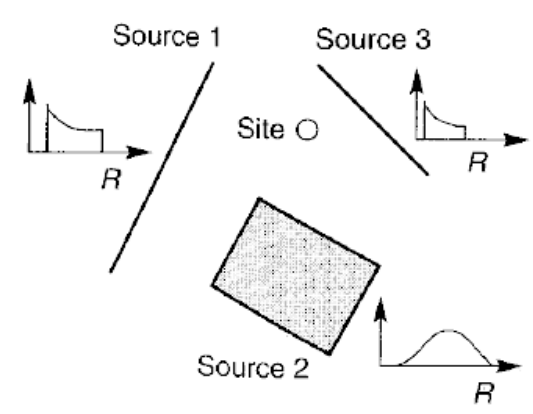


Induced seismicity in the Agri Valley

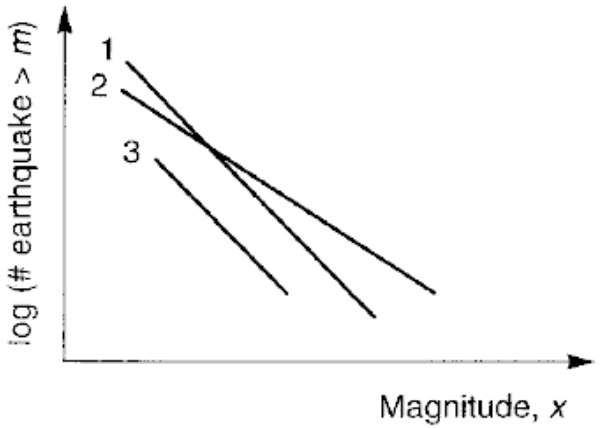
Pertusillo dam

Hydrocarbon extraction

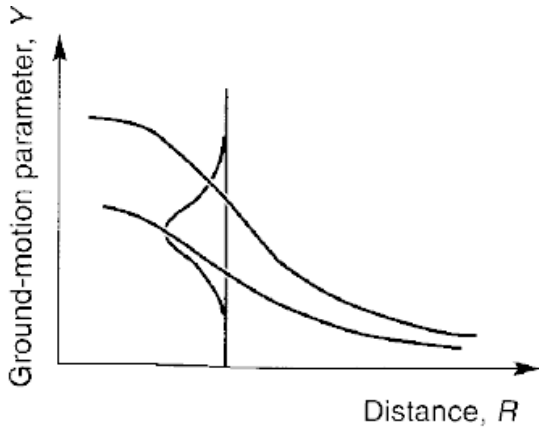
Probabilistic Seismic Hazard Analysis (PSHA)



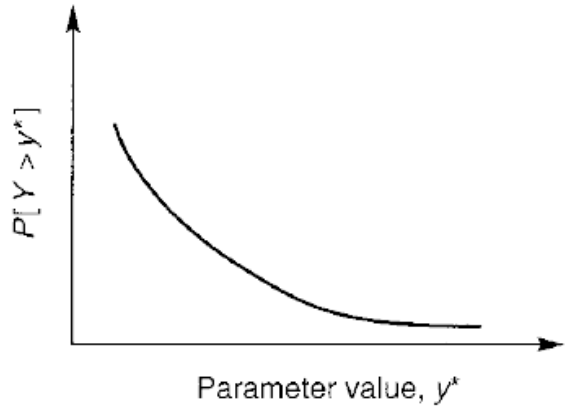
STEP 1



STEP 2



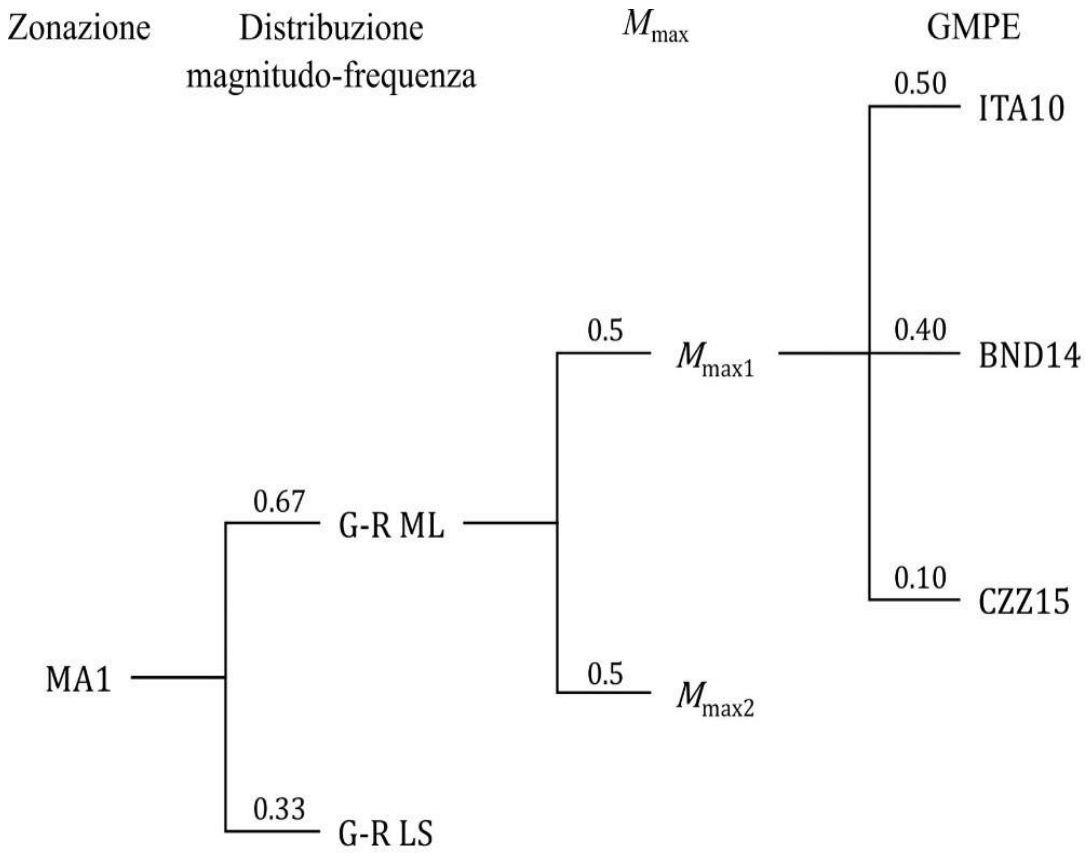
STEP 3



STEP 4

1) Definition of all the seismogenic sources capable of producing a relevant ground shaking at the site of interest
2) Definition of the frequency of occurrence of earthquakes of different magnitude for each source
3) Calculation of the ground shaking at the site of interest for every possible magnitude-distance pair
4) Calculation of the probability (or frequency) of exceedance of fixed ground motion parameter values in a given time period

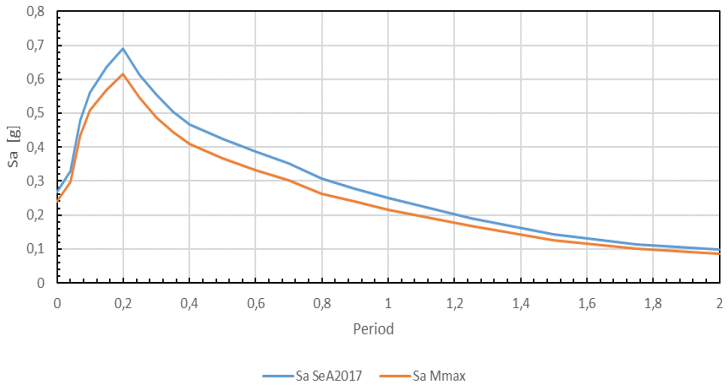
PSHA: logic tree



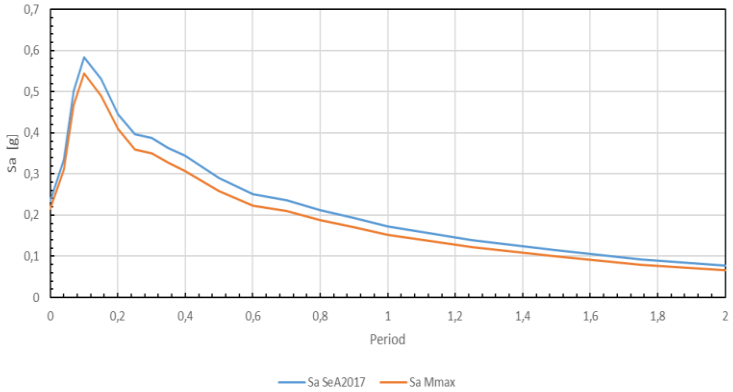
Sensitivity analysis

Sensitivity to M_{max}

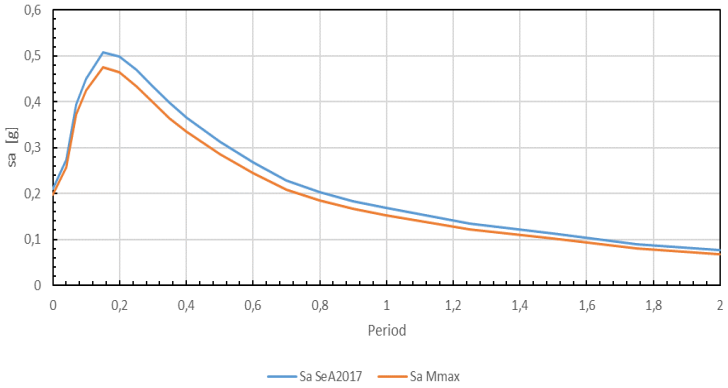
ITA10



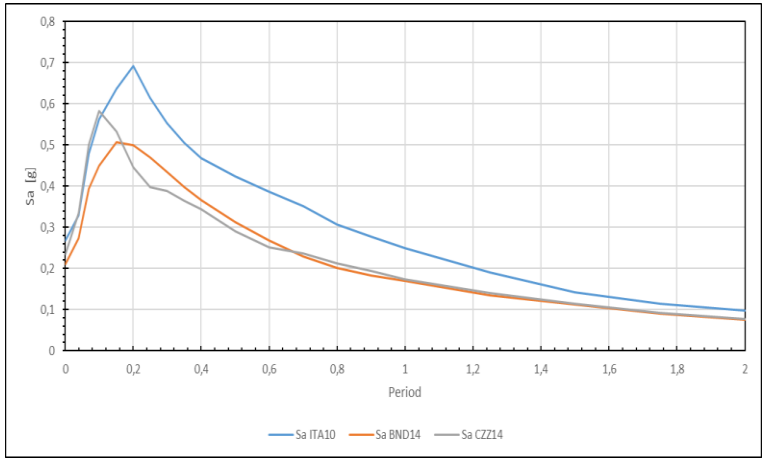
CZZ14



BND14



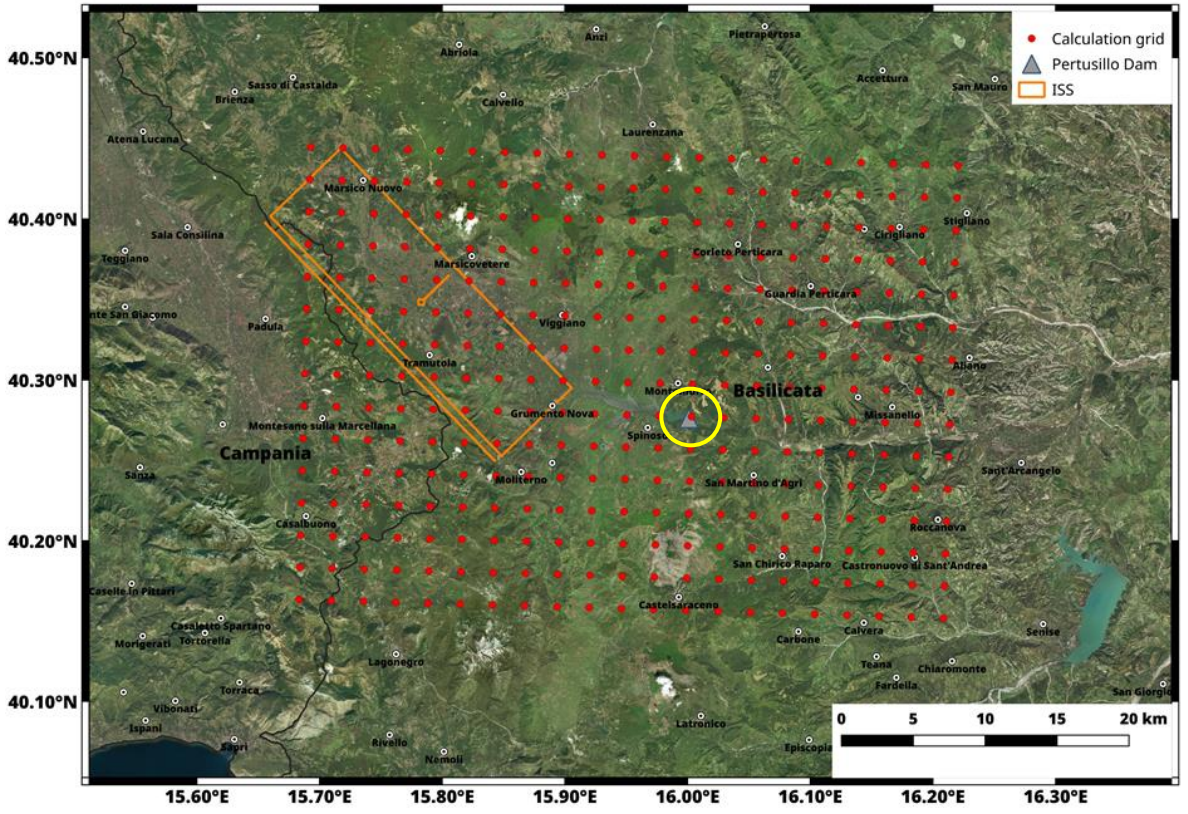
Sensitivity to GMPEs



RESULTS

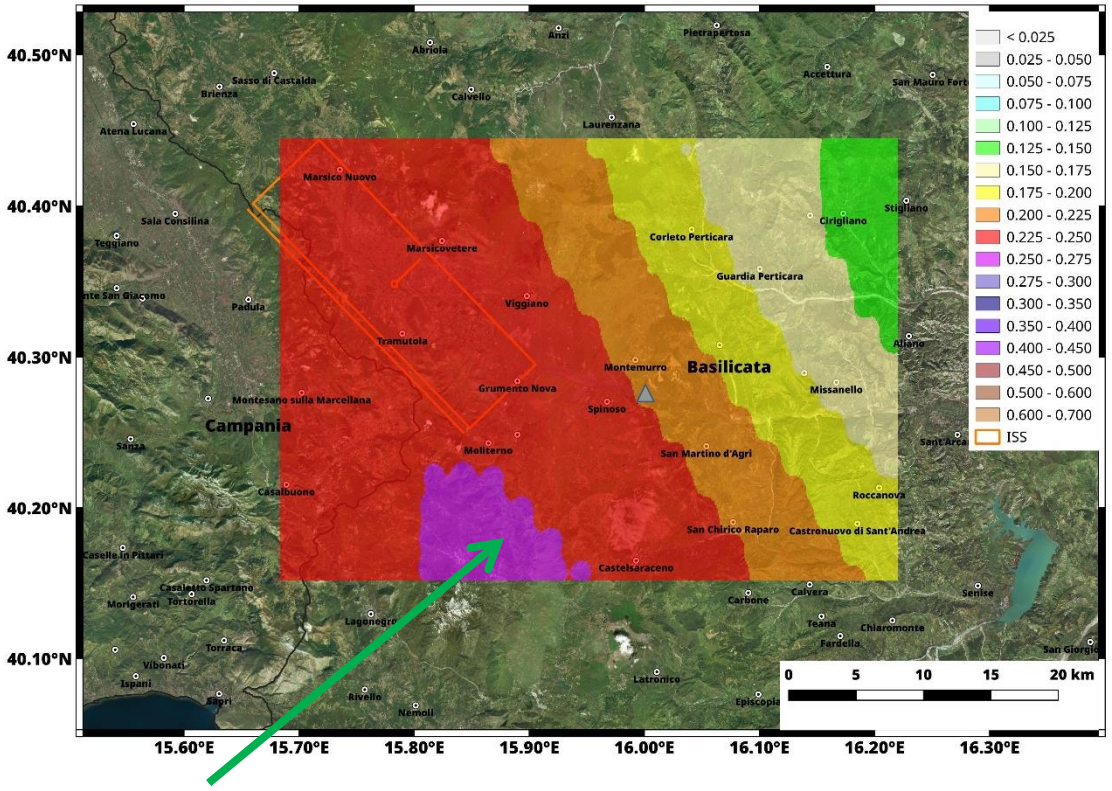
Computation grid

- 315 nodes
- Node spacing: ≈2km
- Covered area of 1463 km^2



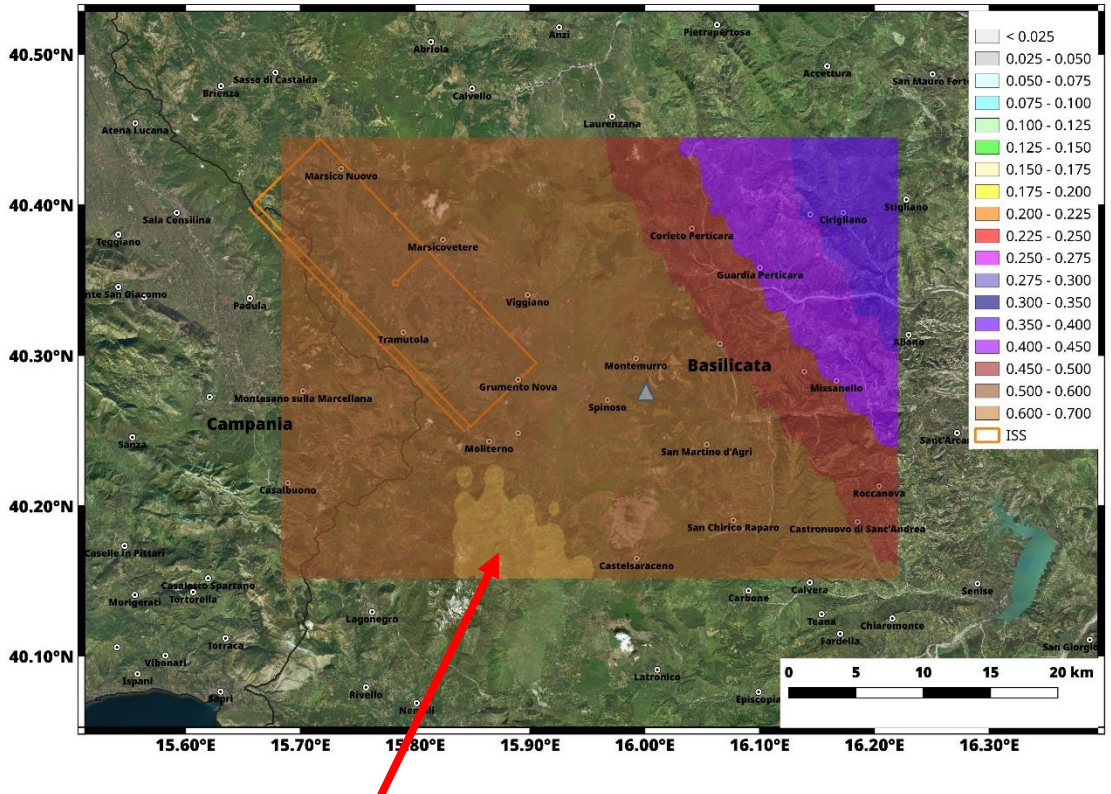
Ground shaking hazard maps (PGA)

475-year return period



(max PGA = 0.25g)

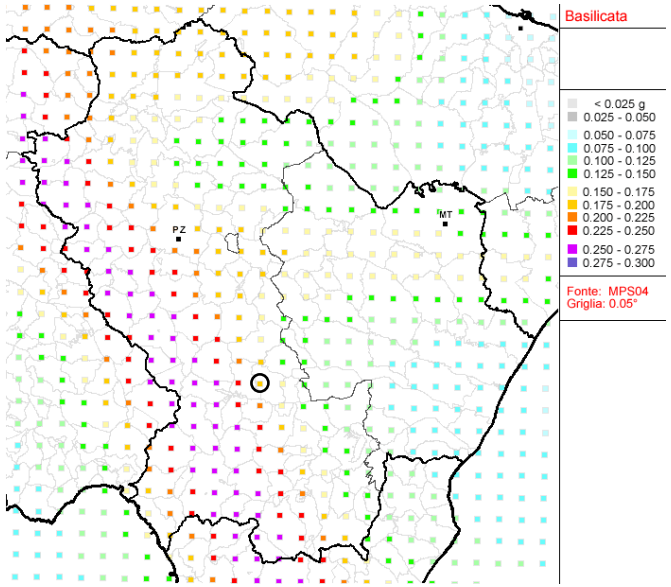
2475-year return period

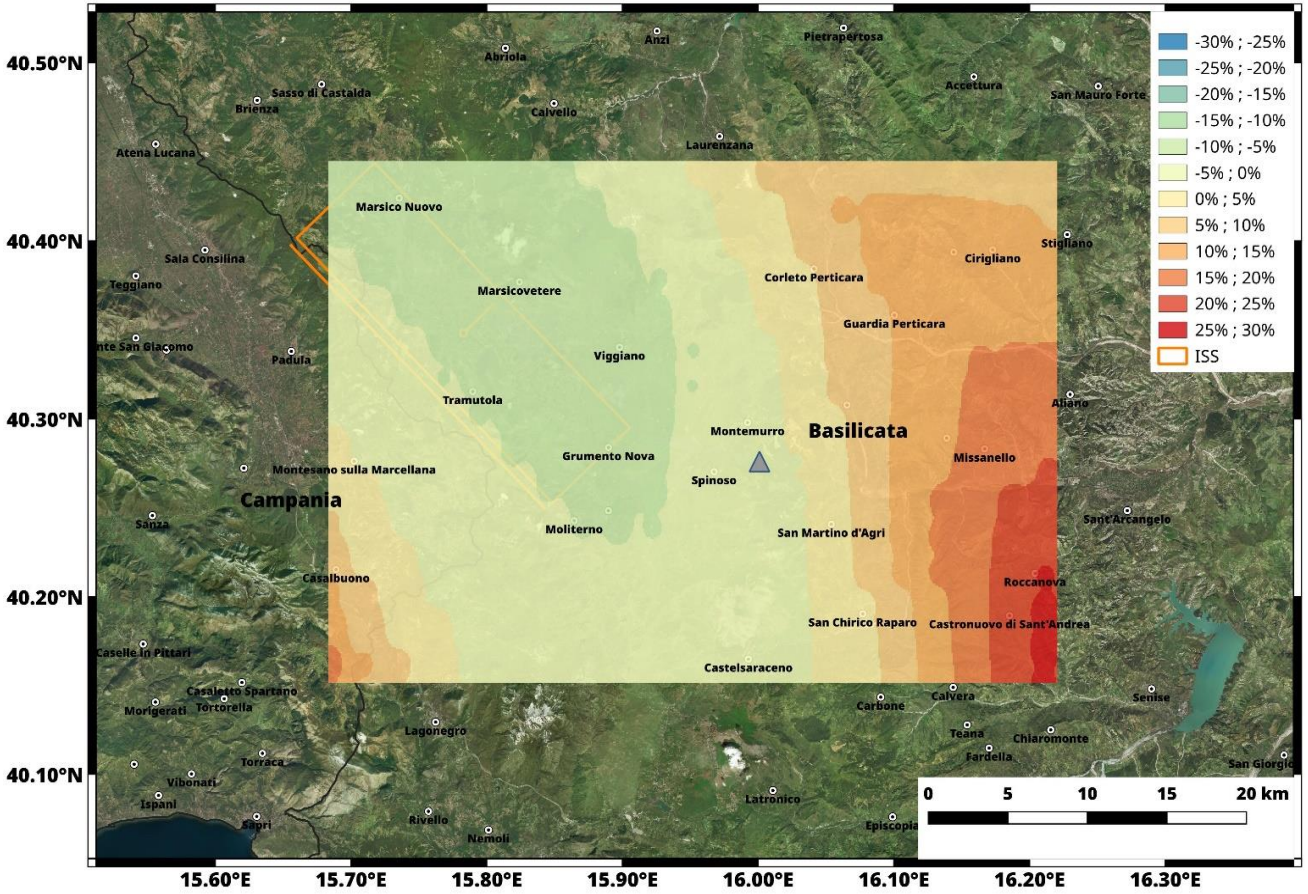


(max PGA = 0.6g)

This study VS reference NTC18 – PGA (475-yr RP)

- This study is up to 30% more conservative
- This study is less than 10% unconservative



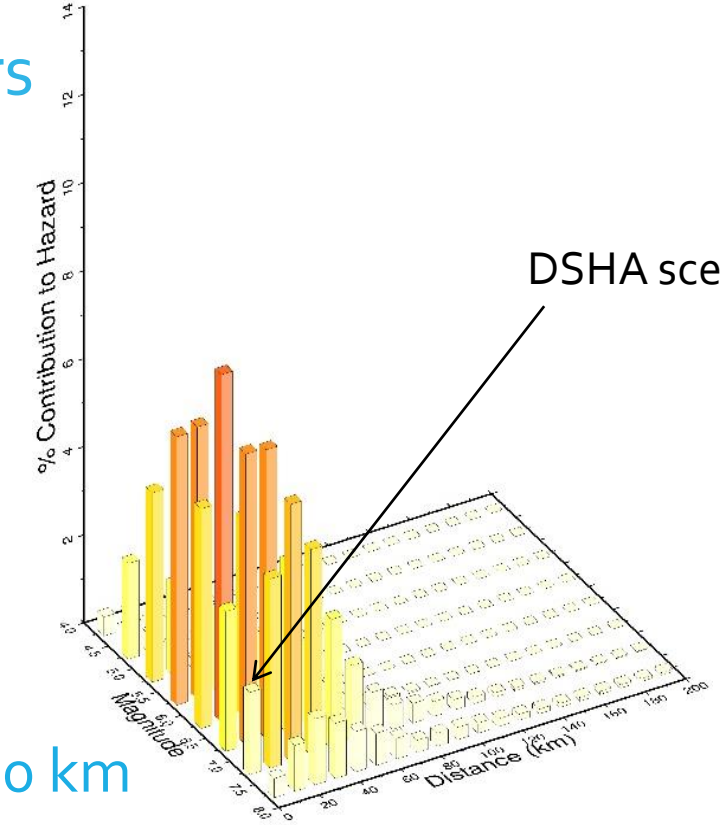


Deterministic Seismic Hazard Analysis (DSHA)

- Focus on the worst-case ground motion scenario
- Selection and characterization of the nearest source to the site of interest
  - Selection of the minimum distance between the source and the site of interest
  - Selection of the highest magnitude earthquake associated with the source
- Calculation of the ground shaking at the site of interest assuming that the highest magnitude earthquake occurs at the shortest distance to the site

Hazard disaggregation (Pertusillo node)

PGA 475 years



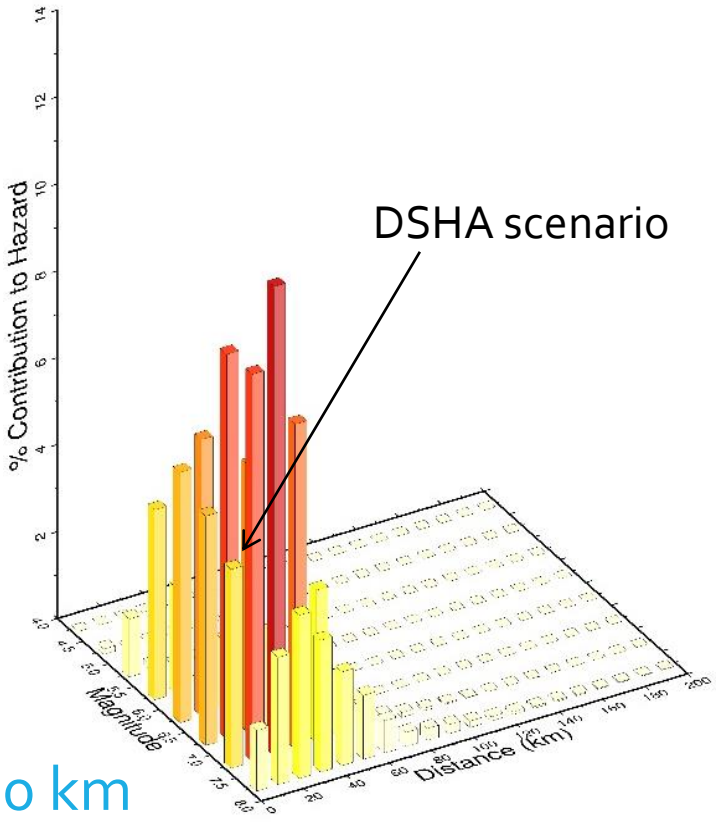
Mean

6.5 ; 26 km

Mode

6.0 – 6.5; 10 – 20 km

PGA 2475 years



Mean

6.9 ; 24 km

Mode

7.0 – 7.5; 20 – 30 km

Conclusions

- The Pertusillo dam is in an area characterized by an intense seismicity
  - Max PGA (475-year return period) 0.25g; Max PGA (2475-year return period) 0.6g
  - Max $S_a(2s)$ (475-year return period) 0.08g; Max $S_a(2s)$ (2475-year return period) 0.23g
- The hazard calculated in this study is similar to the reference NTC18 hazard for a 475-year return period
- For a 2475-year return period, NTC18 is significantly unconservative
- The DSHA yields more conservative results than the PSHA for a 475-year RP
- The DSHA yields more conservative results than the PSHA for a 2475-year RP
- The disaggregation showed that the maximum contributions to the hazard comes from scenarios with magnitude between 6.0 and 7.5 and distance between 10 and 50 km

THANK YOU FOR YOUR ATTENTION