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**Seminar on Public Communication on Nuclear Emergencies:
Example & experience from non-nuclear emergencies**

Case study

"Seismic risk communication: the emergency phase in Romagna in 2000"

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- identification institutional & social decisions → to decrease risks ($R = H * V * E * C$) of anthropic communities exposed at risk during Italian seismic events in last decades

→ decreasing Vulnerability (= spatial-geographic proneness to hazards)

→ increasing Coping Capacity/resilience (= human ability of taking measures)

(Hazard = loss probability/Exposure = # and value at risk → *kostant* in this case)

↗ Research on marginal and minor hazardous events = unprecedented kind of analysis

- Typically, attention only to major crisis/catastrophes
→ examined case studies = not high magnitude event nor causing physical destruction of anthropic world → substantially ignored

BUT

→ several practical effects on daily life habits
(outdoor shelters, tent sites, commuting, etc.)

→ several repercussions on health, socio-cultural spheres,
urban/territorial infrastructures and emergency/response authorities

→ useful to understand vulnerability roots and anthropic system flaws before occurrence of major events

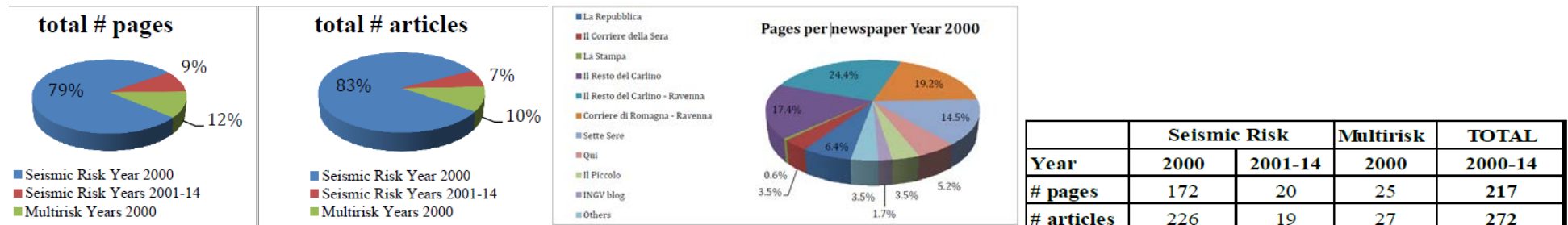
UME-INGV Ph.D. research framework: fields, tools, methodologies

- The emergency management holistically observed

1/ scientific data, 2/ institutional entities' actions, 3/ civil protection's response system, 4/ building codes, infrastructures and urban networks, 5/ public communication and population reactions

➔ macro-seismology (effect intensity & historical seismology)
+ disaster epidemiology (survey on roots, development and distribution of effects)

➔ Extensive surveys to rebuild entire seismic phase with local/national documentation collected by scientific/authority entities & media/press review database ➔ Romagna: circa 350 documents

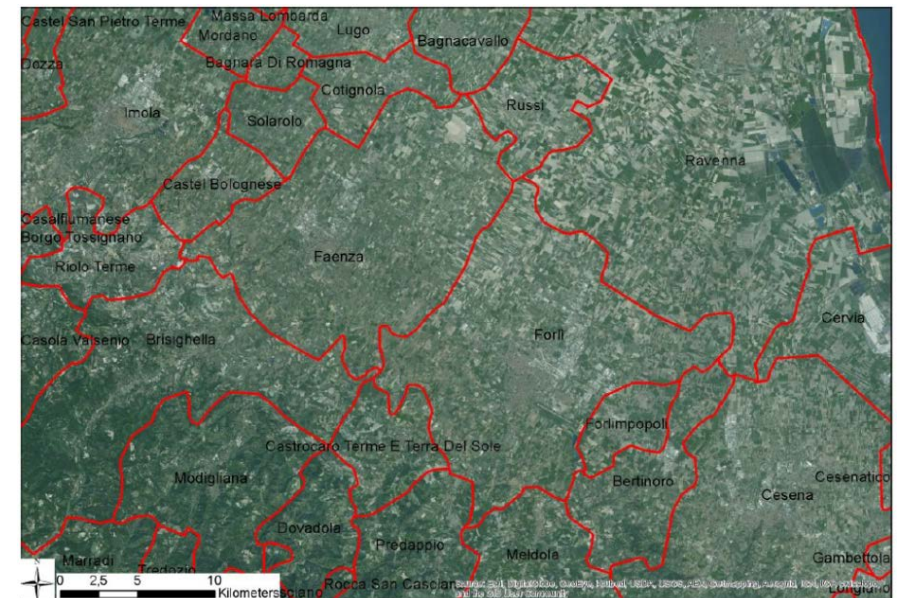
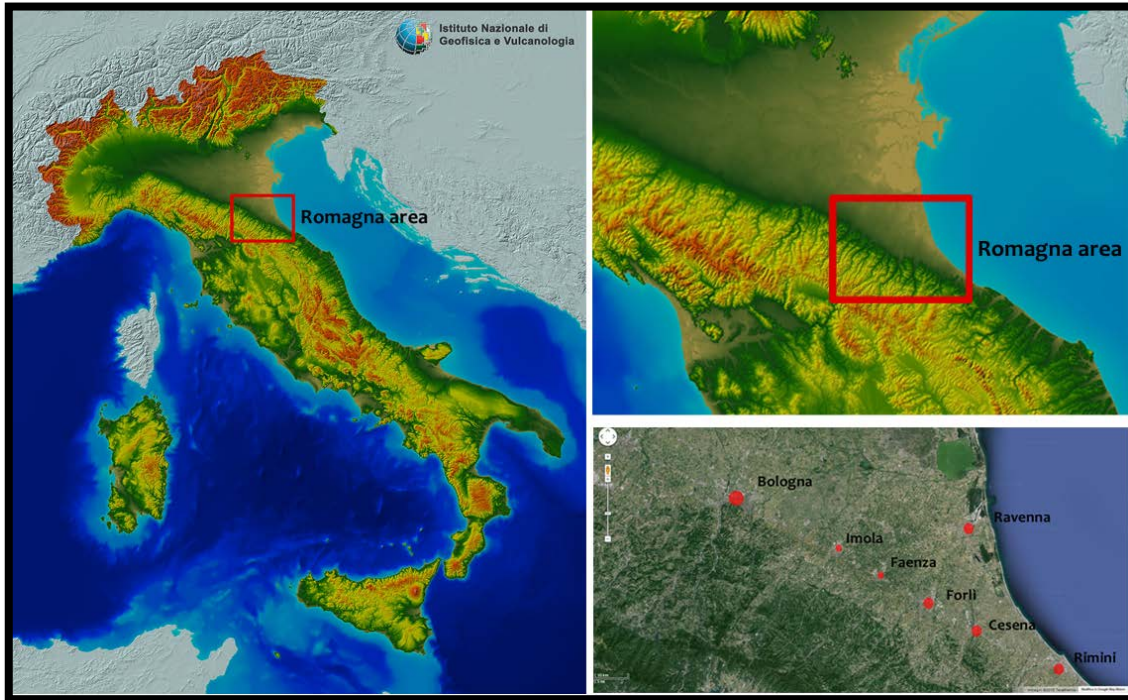


- Nature/consistency of information

➔ verified through institutional reports/decisions

implemented by Civil Protection + local authorities at different levels
(municipality, province, region)

Case study April-May 2000 seismic swarm in Faenza-Forlì districts



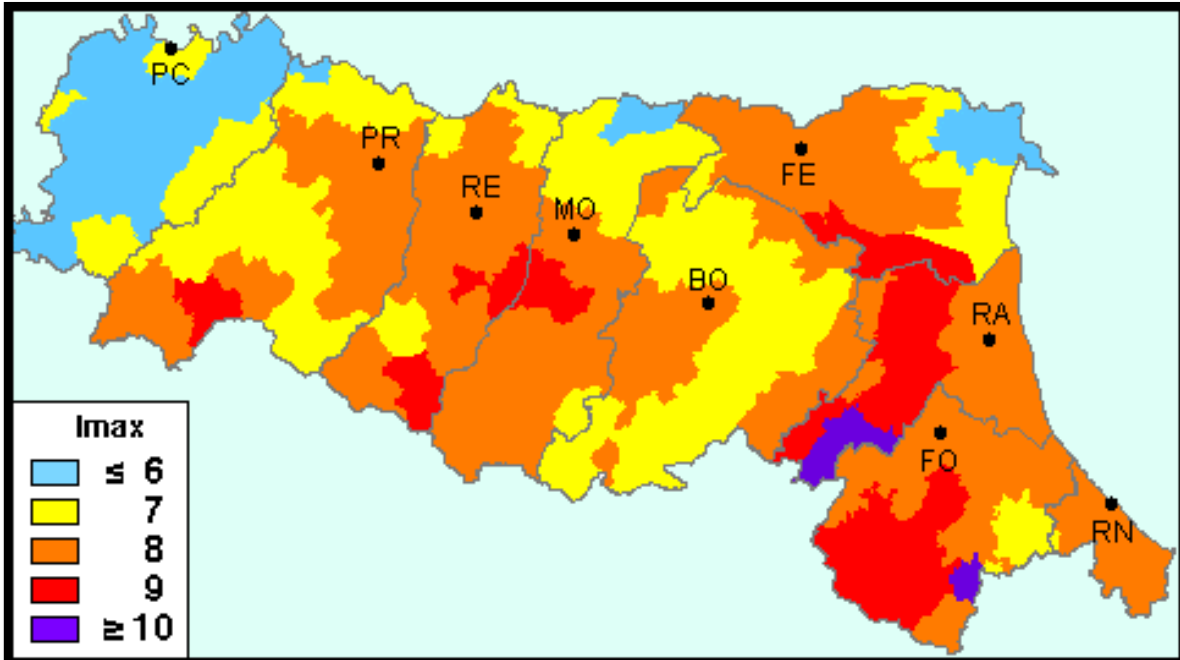
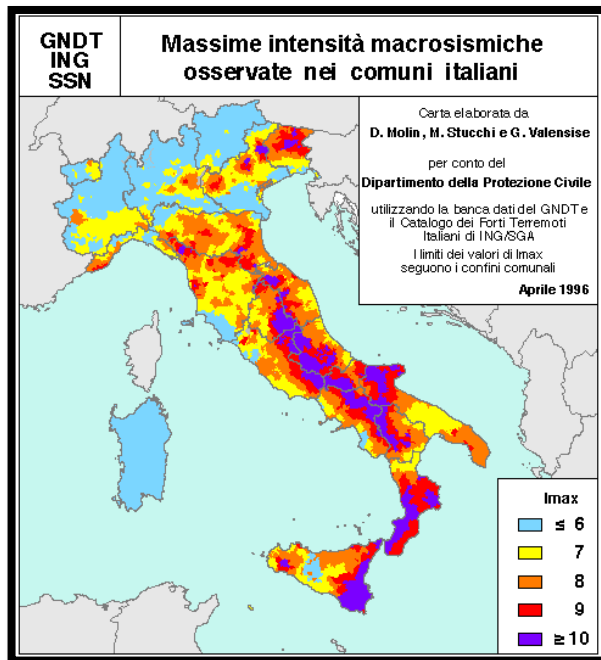
Faenza: 53 549 inhabitants

Territorial area: 215,76 km² Demographic Density: 272,59 inh./km²

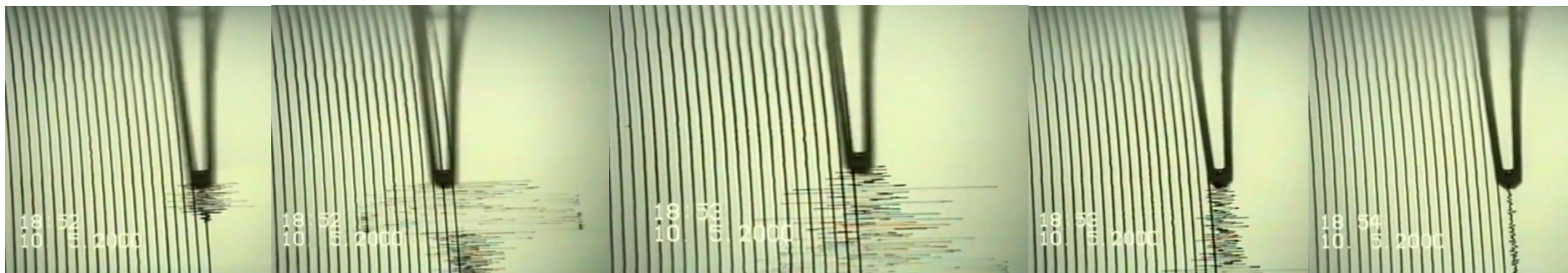
Forlì: 107 745 inhabitants

Territorial area: 228,2 km² Demographic Density: 518,57 inh./km²

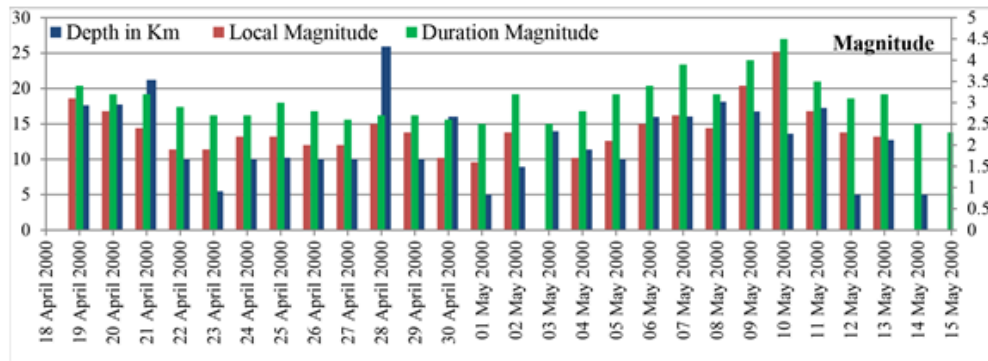
2000 SEISMIC SEQUENCE: SEISMOLOGY ASPECTS (INGV database)



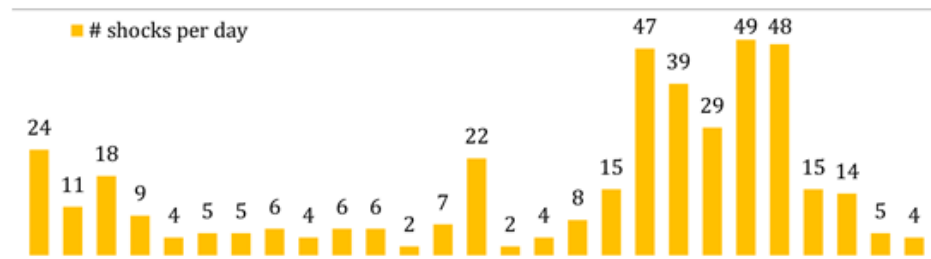
- **What?** An intense seismic sequence of moderate Magnitude (Max M_L 4.2) [L'Aquila=6/Tohoku=9]
- **Where?** Italy, Northern-East Apennine region, so-called Romagna
- **When?** April 19 – May 15, 2000/ Max M_L Peak occurrence: Saturday May 10, 18:53 local time



Geophysical KEY FACTS: 2000 seismic sequence characteristics (INGV database)



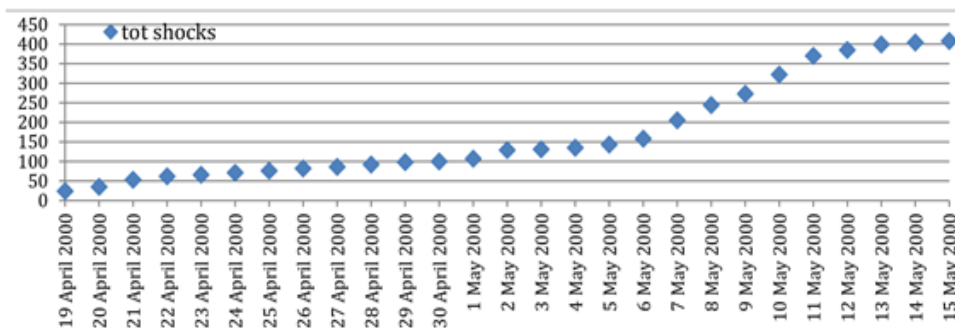
Max MAG trend → soft increase of fickle seismic activity



shocks per day → correlated with MAG reached?



perceived seismic thuds → low MAG? high # shocks?



cumulative trend of # shocks

→ total shocks = 408 instrumental values

↗ Dramatic peak between May 6-7 night and May 15 = “Seismic Acme Phase”

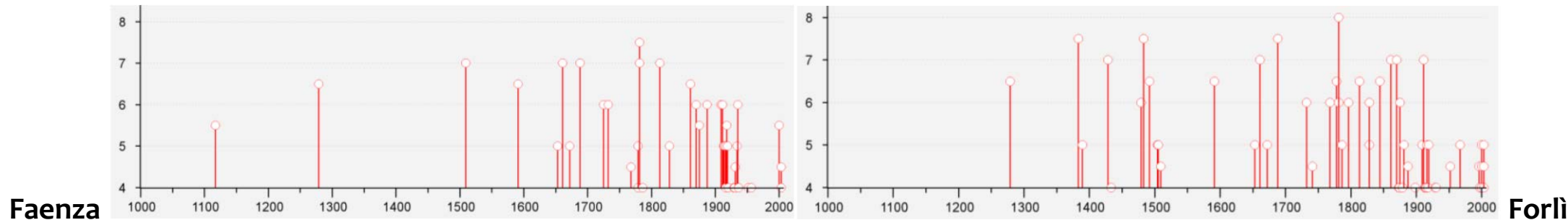
Historical seismic activity KEY FACTS: what we did know in 2000 (INGV database)



➔ Italy ➔ **persistent combination of 2 factors**

= among most seismic Mediterranean countries + some of most ancient civilizations =
many chronicles describing/interpreting macro-seismic effects and impacts

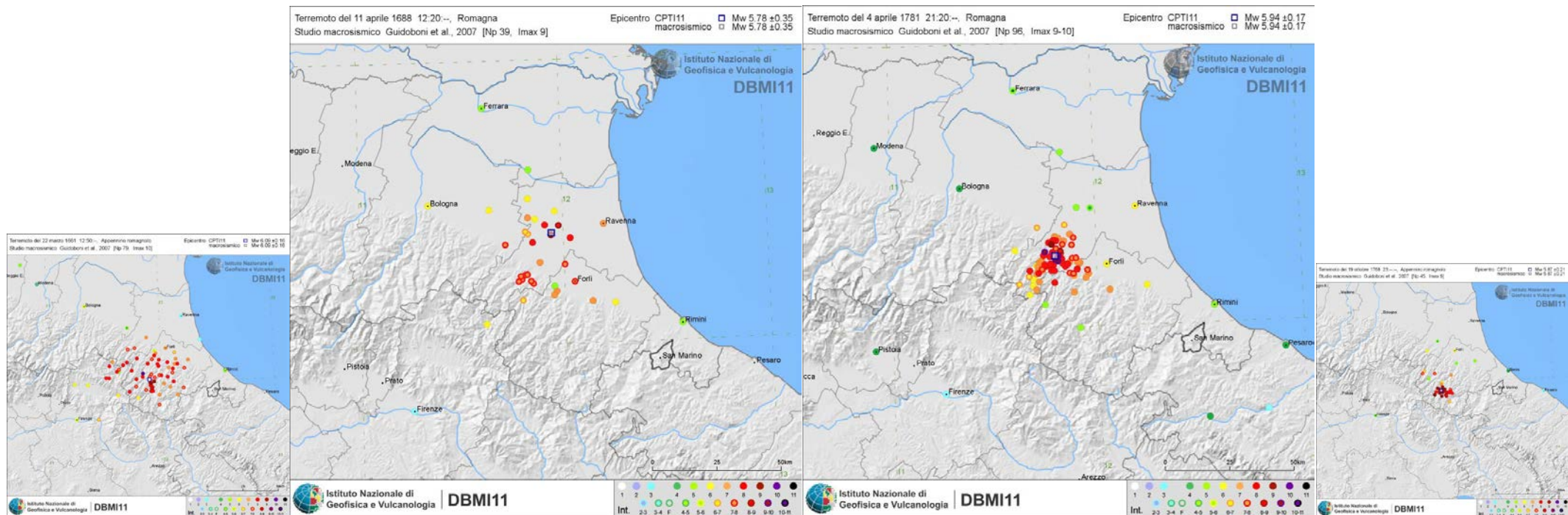
➔ registration of several reliable news/info on even very antique quakes = since first centuries of II millennium



Observed seismic history in Romagna: features of local seismic activity

- **Known earthquakes in Romagna ➔ form of seismic sequences** = several shocks spread over + or - long span of time. Usually only one or a few are "strong" enough to cause damage = defined as "major shock" or "main events" of the sequence

Historical seismic activity features KEY FACTS: what we precisely know (INGV database)



- By written records / in this area 2 largest known earthquakes:
April 1688 and April 1781 → long seismic sequences

➔ **begun with main event**, harmful enough to cause destruction. At least, no of earlier shocks
→ this means that if some previous telluric events had occurred, might have been of too low strength to be felt by people
➔ **continued with a number of aftershocks**, some of which were themselves strong enough to produce new damage.

- **However, also some other seismic sequences with a different trend.** For example, October - November 1725 earthquake begun with some mild shocks and culminated in October 29 with a main shock, which caused some damage.

Known and unknown: geophysical knowledge, emergency mechanisms and communication



Romagna → important seismic history → “Here, the Earth trembles”

- typically energies involved = medium-low ($M_w < 6$) / Probability of a strong earthquake = low but not excluded
- observed seismic history in this area → earthquake occurrence = frequent
 - damage effects in urban areas = not serious but recurrent
 - greatest destructions = in Apennine mountains/hills
- Trend of past earthquakes → quite similar but not identical modalities

→ UNCERTAINTY: impossible to state evolution of sequence in progress, among those known

➔ promptness of municipal authorities + emergency and security officials

= readiness in case of a major event / sort of “state of alarm”

Un'altra scossa ieri mattina, è la trentesima oltre il 3° grado negli ultimi quindici giorni

Faenza trema, cresce la paura

Ieri alle 10,48
la scossa più forte
tra 5° e 6° grado

FAENZA — Centotrenta scosse telluriche in quindici giorni (di cui trenta oltre il 3° grado Mercalli) sono sicuramente abbastanza per mettere a dura prova i nervi di qualsiasi persona. E' quanto sta accadendo a Faenza, dove uno sciame sismico sta fornendo molto lavoro ai sismografi dell'Istituto nazionale di geofisica, alla Protezione civile, ai vigili del fuoco ed ai tecnici comunali, impegnati in riunioni per mettere a punto strategie per un'eventuale emergenza. La scossa più violenta dal 19 aprile è stata registrata ieri



I sismologi
rassicurano: non ci
sono grossi rischi

lento di ieri mattina. «Sono comunque fluttuazioni modeste — spiega il professor Giambattista Vai, docente di geologia stratigrafica all'ateneo di Bologna — Non è molto probabile che ci siano scosse più forti. Nella zona di Faenza ci sono numerose faglie attive, ed ogni tanto si libera l'energia accumulata, e se questo accade gradualmente è sicuramente un bene». Può inoltre risultare confortante anche un altro elemento, sottolineato dal geologo Stefano Marabini: «Il centro manfredo poggia su alcune centinaia di metri di depositi alluvionali, materia-

Ieri notte un'altra violenta scossa di terremoto ha creato il panico in città. In molti scelgono di dormire in auto

Faenza, l'incubo diventa terrore

➤ FOCUS: epistemic and stochastic UNCERTAINTY and collateral events

→ from Plato: “Episteme = exact science” → still not possible on earthquakes

“A seismic storm... likewise many others. The probability of a strong earthquake is low”

“But... who knows what’d happened before we could record the earthquakes?”

“Statistics are made of paper while fear is tangible”

→ difficult to communicate to common people this aspect without proper previous education

no certain science + risk of confusion & interferences =

→ exogenous to seism → pretty endogenous to human spheres

- information by press/newspaper not always precise and accurate
- local legends + religious + “planet cosmic alignment-NASA” events and self-educated local people



➤ FOCUS: UNCERTAINTY collateral events and domino emulation

Cascading effects < Uncertainty ➔ practical and physical consequences on human behaviour

Involvement /sensitivity of individual /collective education/knowledge, faith and beliefs

Factors apparently feeble/intangible unexpectedly erupted, entailing day-by-day **notable aftermath**

Several noise factors for people

- Uncertainty of seismic information
- day and/or night time occurrences
vibrations/seismic roars-dull thuds
- day-after-day “rapid-fire” of shocks
- mild but certain raise of magnitude
- epicentres shifting “here and there”

Human individual reactions and mass behaviours

- ➔ individual education/cultural beliefs
- ➔ fear, stress, pouring outdoor, downer
weakening of communication networks
- ➔ commuting, car/tent sites, lack of sleep
- ➔ displacement, weakening of mobility/safety netw.
- ➔ different sites, similar reactions, shelters, looting

**Cascading effects < Uncertainty ➔ Social and public disorder
(TIME, SHELTERING, SHIELDING, DISTANCE)**

Some sort of further “contamination” effect BUT it lasts well after seismic sequence stop

Uncertainty communication & best practices / Seismic activity and emergency mechanisms

- NEED OF (REDUCING DETERMINISTIC EFFECTS + PREVENTING ALEATORY EFFECTS) * JOL principles
deterministic = over threshold → effects are certain / aleatory = casual/unconditioned → effects are uncertain
 - Justification of practices
 - Optimization of protection and resources
 - Limitation of individual dose/exposure
- No “state of emergency” *stricto sensu* requested nor declared = quickly solution of ordinary or extra-ordinary matters arisen BUT this expression remained a topic in media press → risk of domino reactions
- ↗ FOCUS / seismic sequences may be dangerous = may entail and increase fatigue on building structures
- soft increase of seismic activity + emerging social/collective effects in certain areas = safe and security bodies
→ gradually beyond the ordinary competences = different emergency tools deployed

↗ FOCUS: Best smart actions and practices

→ Sunday May 7, Faenza's Municipality + DPC + CRI → unprecedented ON-SITE “ASSISTANCE POINTS”, 7/24 + special tents for sheltering-recovering / Closure of schools + intensive monitoring of buildings and Critical Infrastructures CI

→ Monday May 8, Faenza's Municipality → “special” council “Comitato Operativo Comunale COC” (i.e. the municipality operational committee) = gathering the whole municipality/security/emergency authorities + in few hours, extension to overall seismically concerned municipalities → Before the “main shock” of May 10, all the interested provinces and municipalities, formerly in close contacts, were coordinated both at local and major scale level.

Uncertainty communication / newspapers-mass media and human aspects



- ➔ Panic attack? Or resilient actions?
- ➔ Risk tolerability: negligible, fair, unacceptable?
- ➔ Prolonged anxiety and psycho-physiological effects
- ➔ Need of clear-cut information and risk education
- ➔ Spatial and temporal distance: outdoor sheltering / shielding issues / looting attempts
- ➔ Individual and collective behaviours
- ➔ Need of safety/emergency body on-site assistance
- ➔ Lack of equipment (tents, sleeping bags, soft downers, etc.)
- ➔ Thrust in safety and response authority

➤ FOCUS: Uncertainty and prolonged anxiety / psychologist & sociologist opinions

- hazard is real, not paranoia + prolonged anxiety ➔ may chemically work on our mind and health status
 - 2 tangible behavioural reactions: push to escape or completely paralyze a person
- In both cases, body alarmed ➔ release of hormones (**Cortisol, Adrenaline & Noradrenaline**)
➔ increase physical performance in order to escape



- If hormones unloaded ➔ everything comes back to normality BUT if stimulus causing these reactions not prolonged
 - if hormones remain in blood circuit too many days ➔ out-and-out prolonged neurotic reactions (anxiety status, nightmares, stress, irritability, asthenia, etc.)
- ➔ difficult suggestions to skip anxiety (individual behaviours/beliefs) ➔ risk of collective and mass domino reactions
➔ hazard changes daily habits and some habits stay for a long time ➔ 2 kind of human behaviour
1. Risk of psycho-somatic trauma

2. Risk of memory repression and suppression

Since ever, Romagna = seismic zone → forgotten by several people (many seismic swarms in recent years)

Information acquired on this earthquake swarm → precious for future → avoid repetition of uncorrected behaviours

Also positive effects → solidarity, collective sharing, cordiality and empathy/sympathy

**→ we must learn to cohabit with earthquakes and hazards
also reducing the human vulnerability**

Your questions are welcome

Thank you

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