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The Scientific Value of Crowdsourced Data in Seismology

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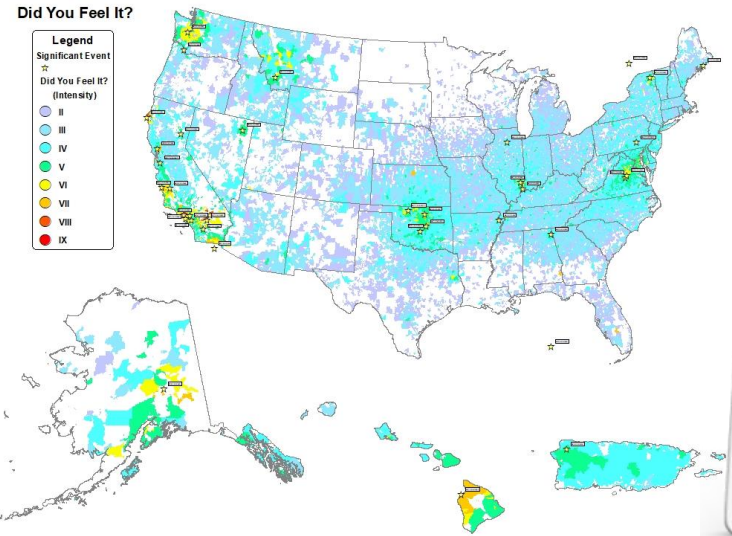
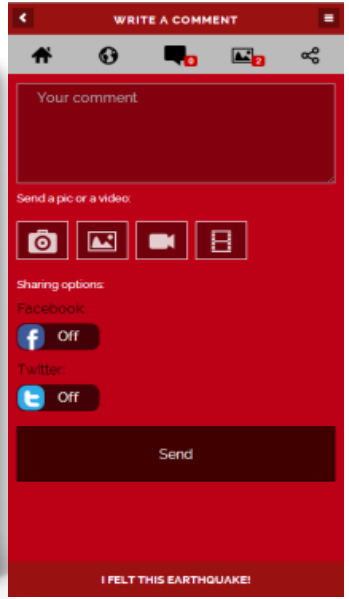
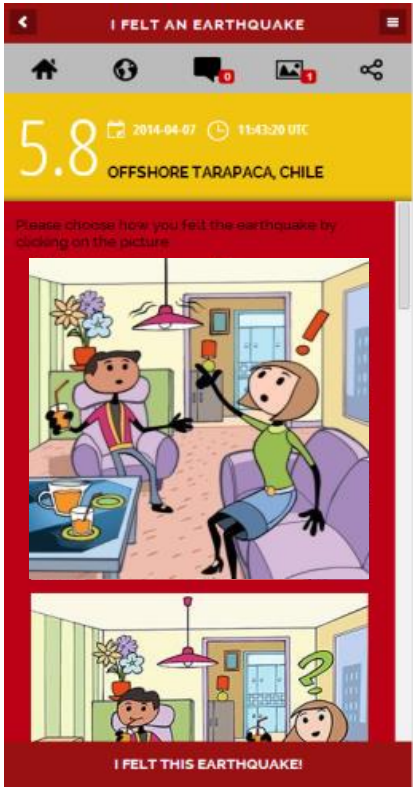
LastQuake:

From Internet to Mobile Internet

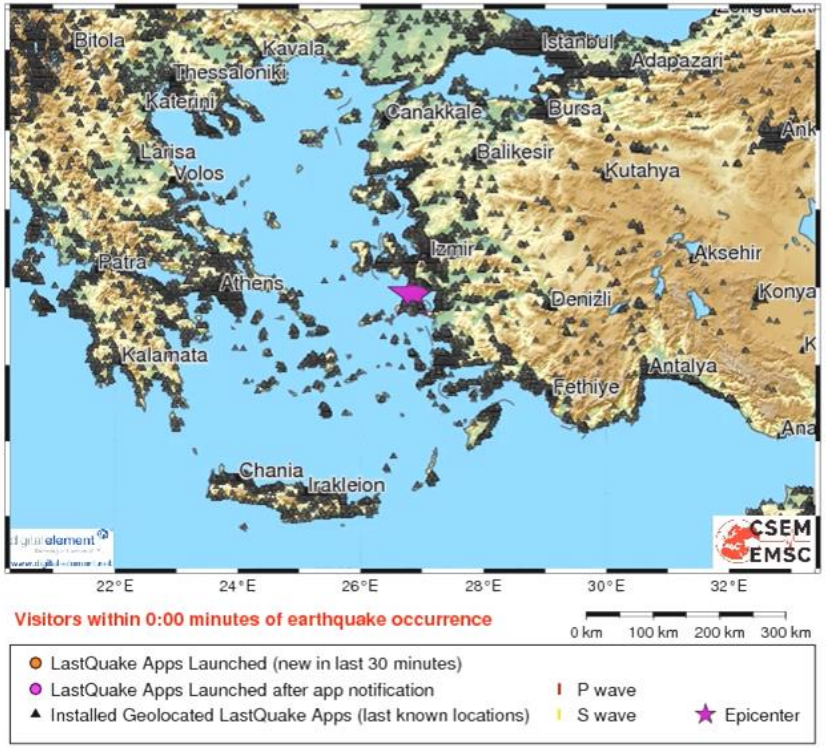


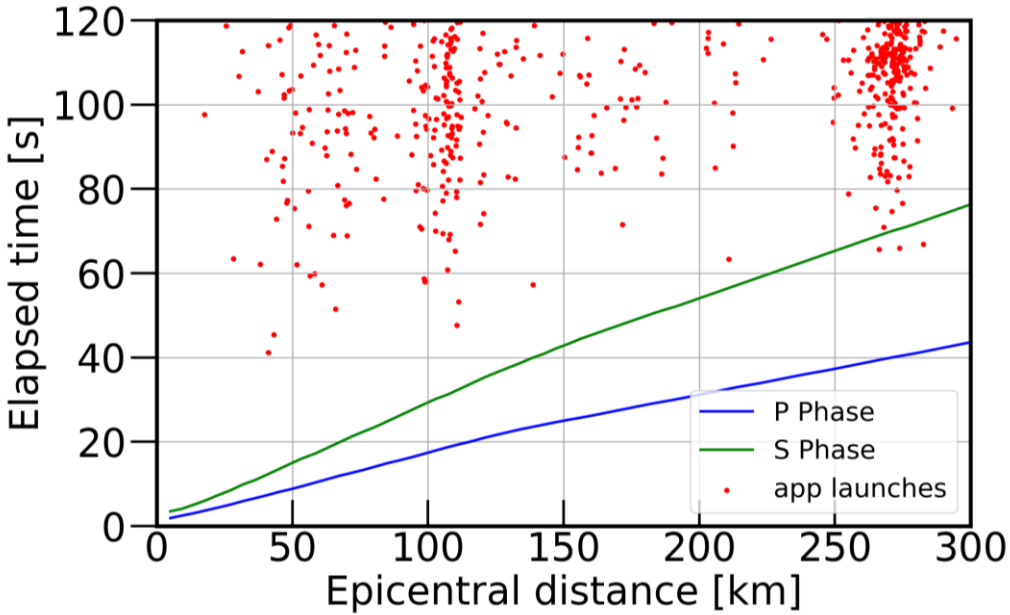




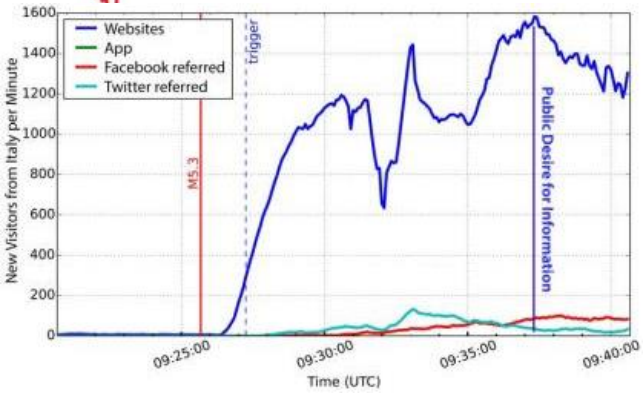
Anytime, Anywhere & Precise Location!

Eyewitnesses as real-time shaking sensors!



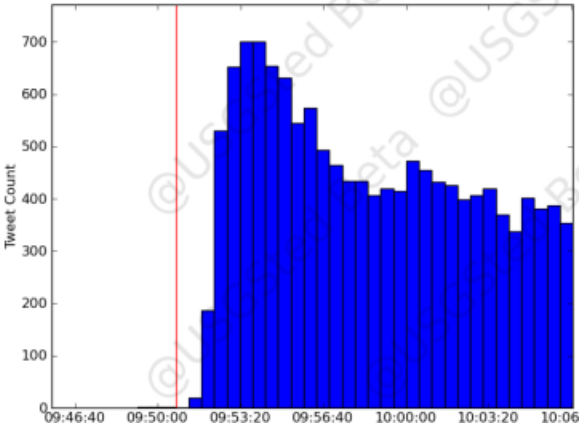


Crowdsourced Detections (15-90s)



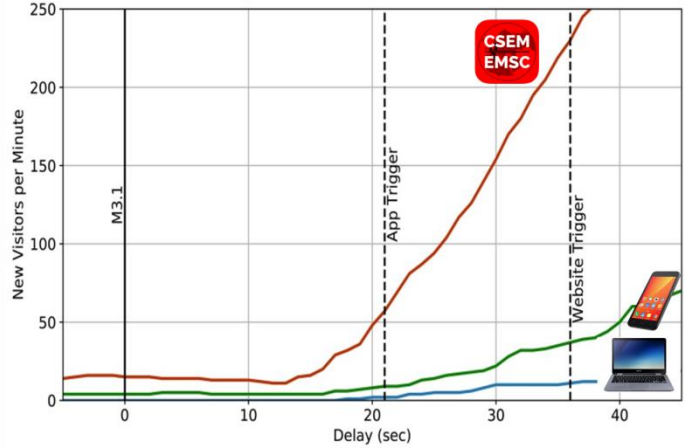
EMSC Website Traffic Monitoring:

- Since 2006
- Works at global scale
- IP location at city level



Twitter EQ Detection (USGS):

- Since 2014
- Where Twitter is popular
- Poor geographical Info



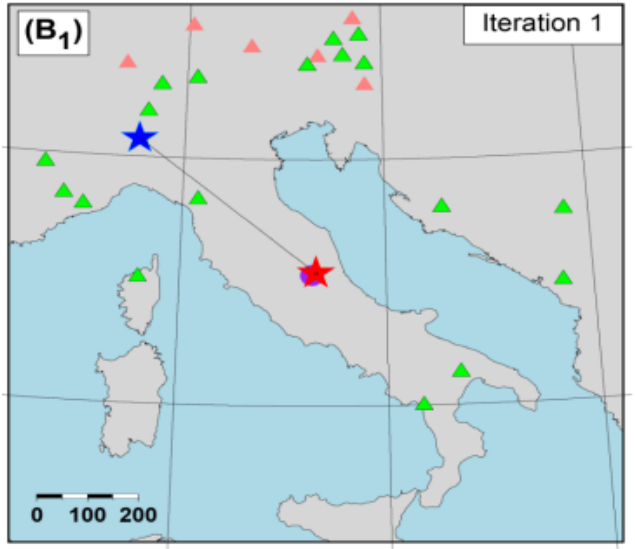
LastQuake App EQ Detection:

- Since 2016
- Where LastQuake app is popular
- Accurate locations

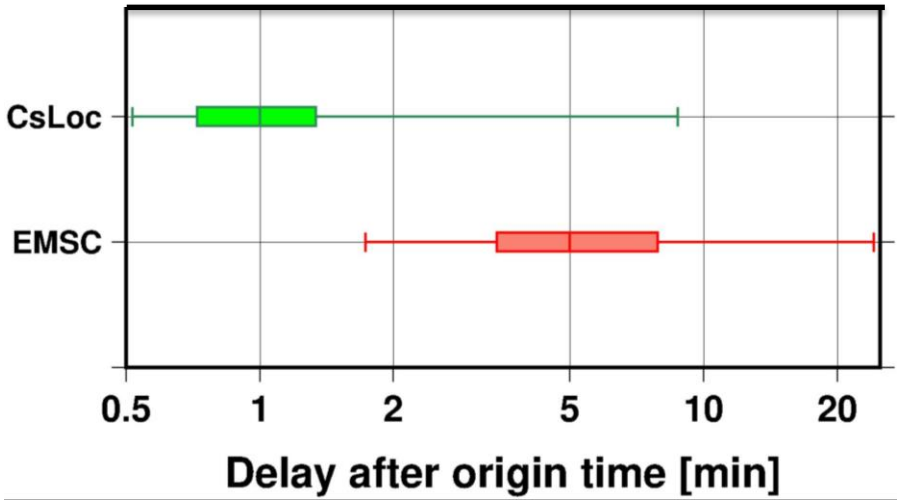
CsLoc: Global Service of Fast & Reliable Loc of Felt EQ

Combined analysis of crowdsourced & seismic data

In Progress

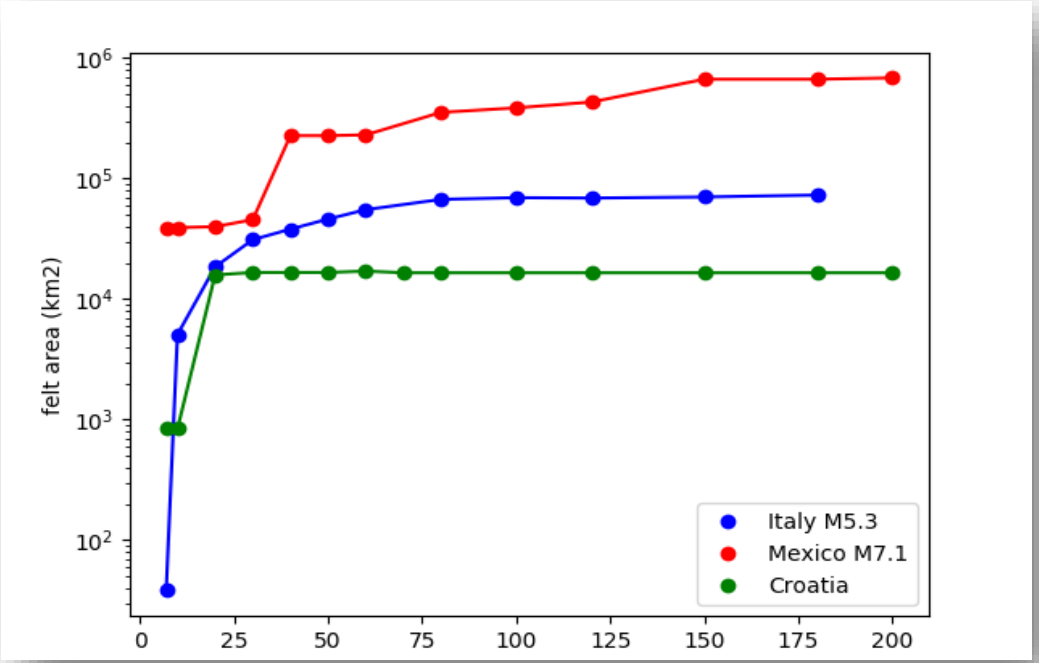


Reliable & accurate loc in 1 min

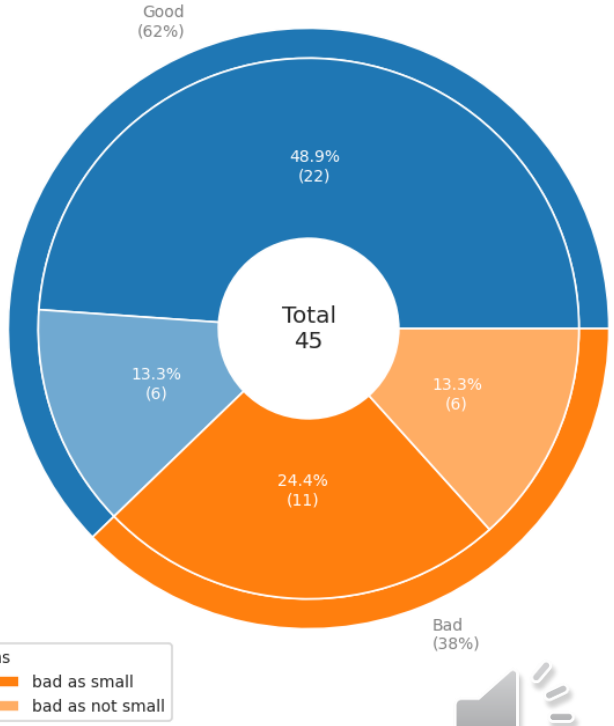


Felt Area Estimate for Rapid Identification of Small Quakes

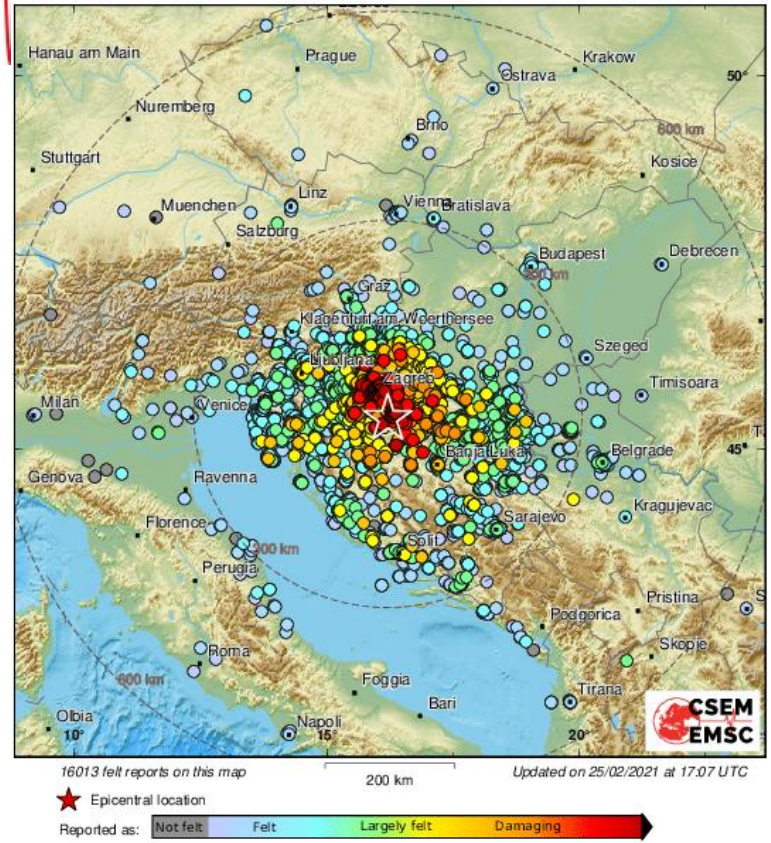
Median time: 2 min

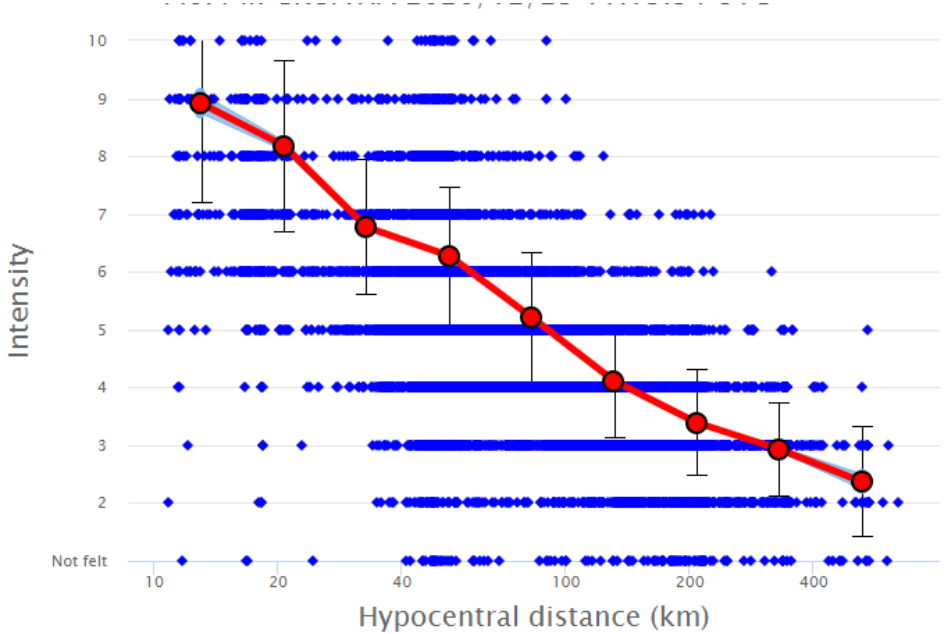


AI training in progress

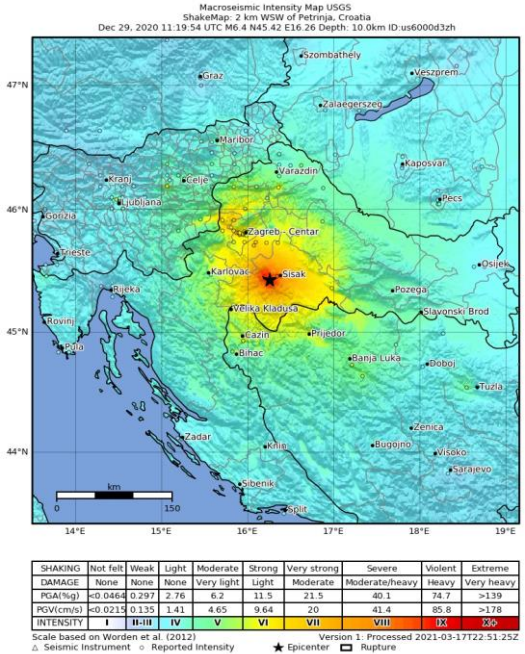


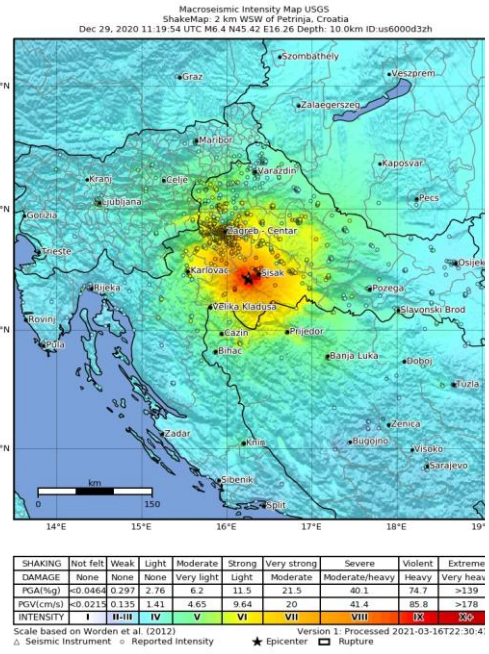
Felt reports M6.4 Petrinja Croatia earthquake

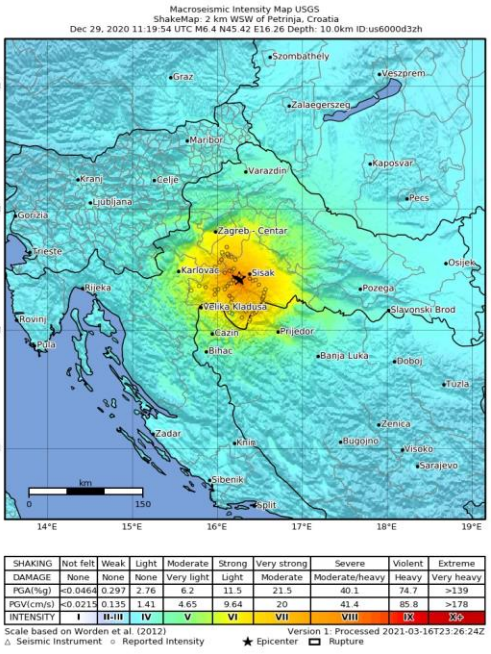




Towards Felt Report integration in ShakeMaps







DYFI only

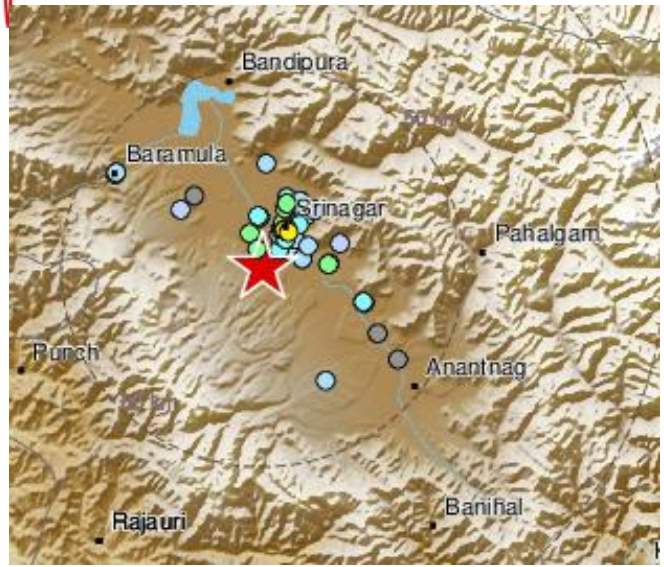
EMSC only

Survey

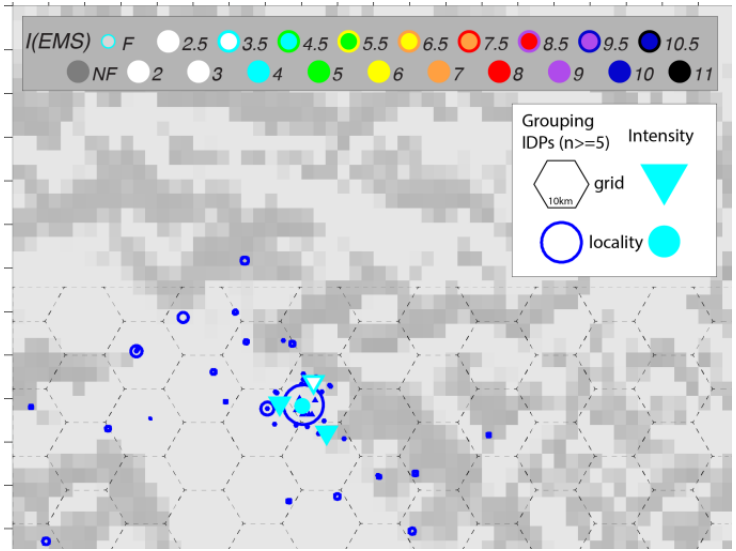
Courtesy V. Quitoriano and D. Wald

Boxer: From IDP to Earthquake Parameters

IDP: 106



MDP: 4

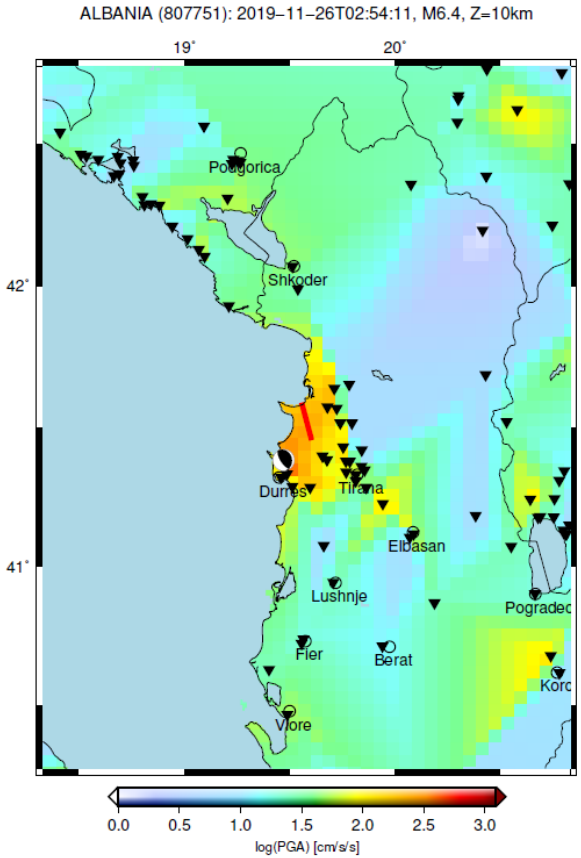


KASHMIR

Δloc: 12 km (6 min after To)

First seismic loc: 42 min after To

FINDER: Finite Rupture from Felt Reports

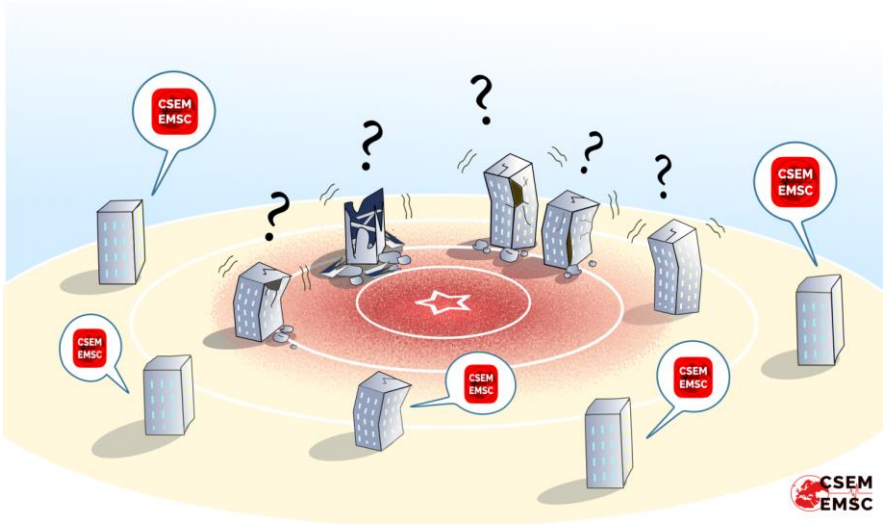


- Strike better constrained than rupture position (i.e. bilateral vs unilateral rupture)
- Works better for strike slip events
- Depends on felt reports geographical coverage
- Available within 10 to 30 min of the EQ
- On-going tests in operational conditions

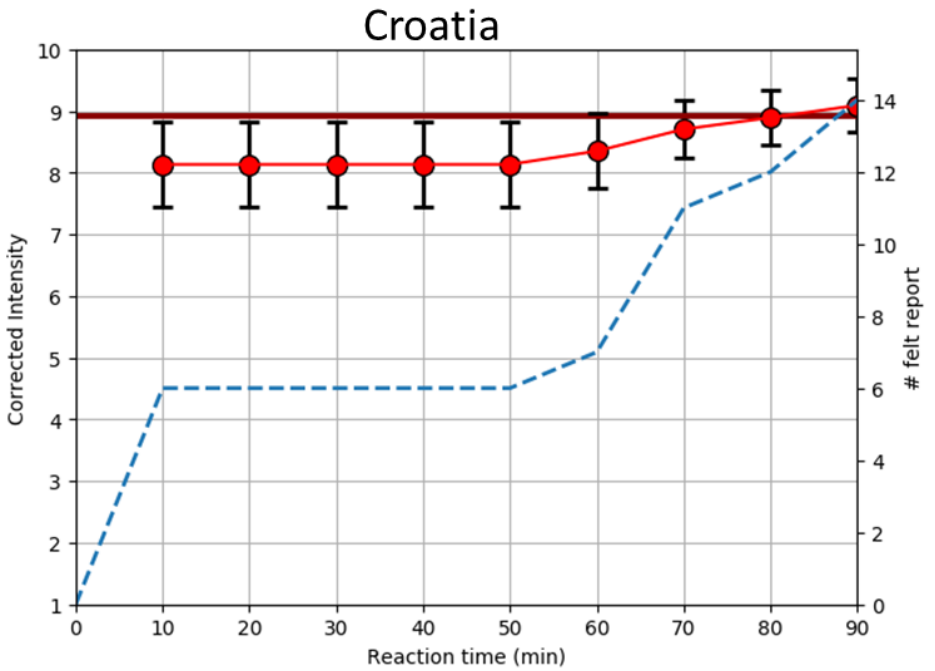
(Bose et al. 2021, SRL)

Crowdsourcing for Damage Detection

The Doughnut Effect

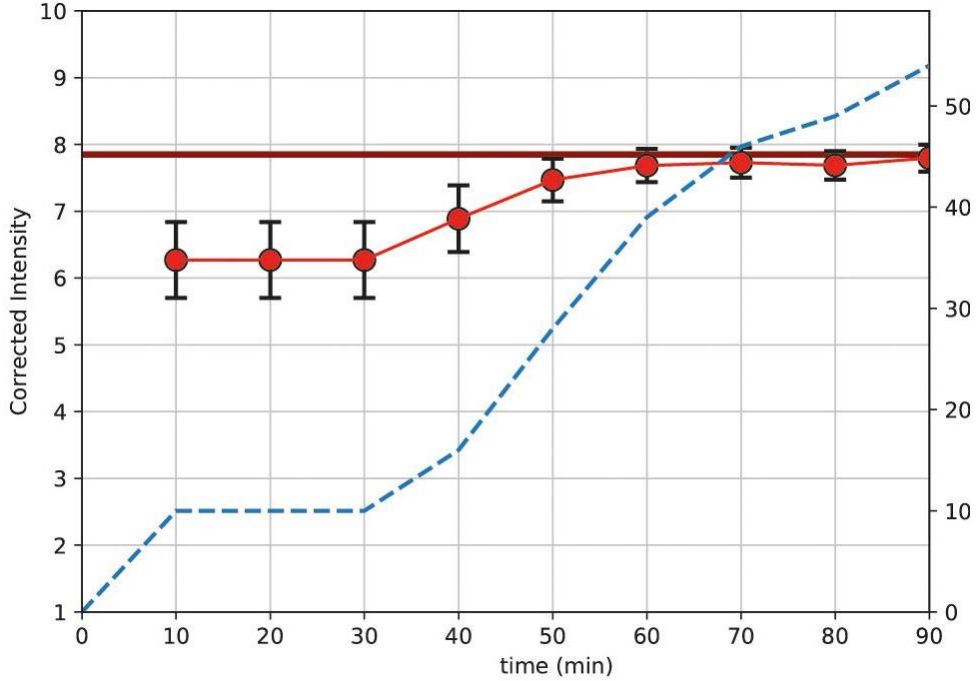


Time evolution of epicentral intensity



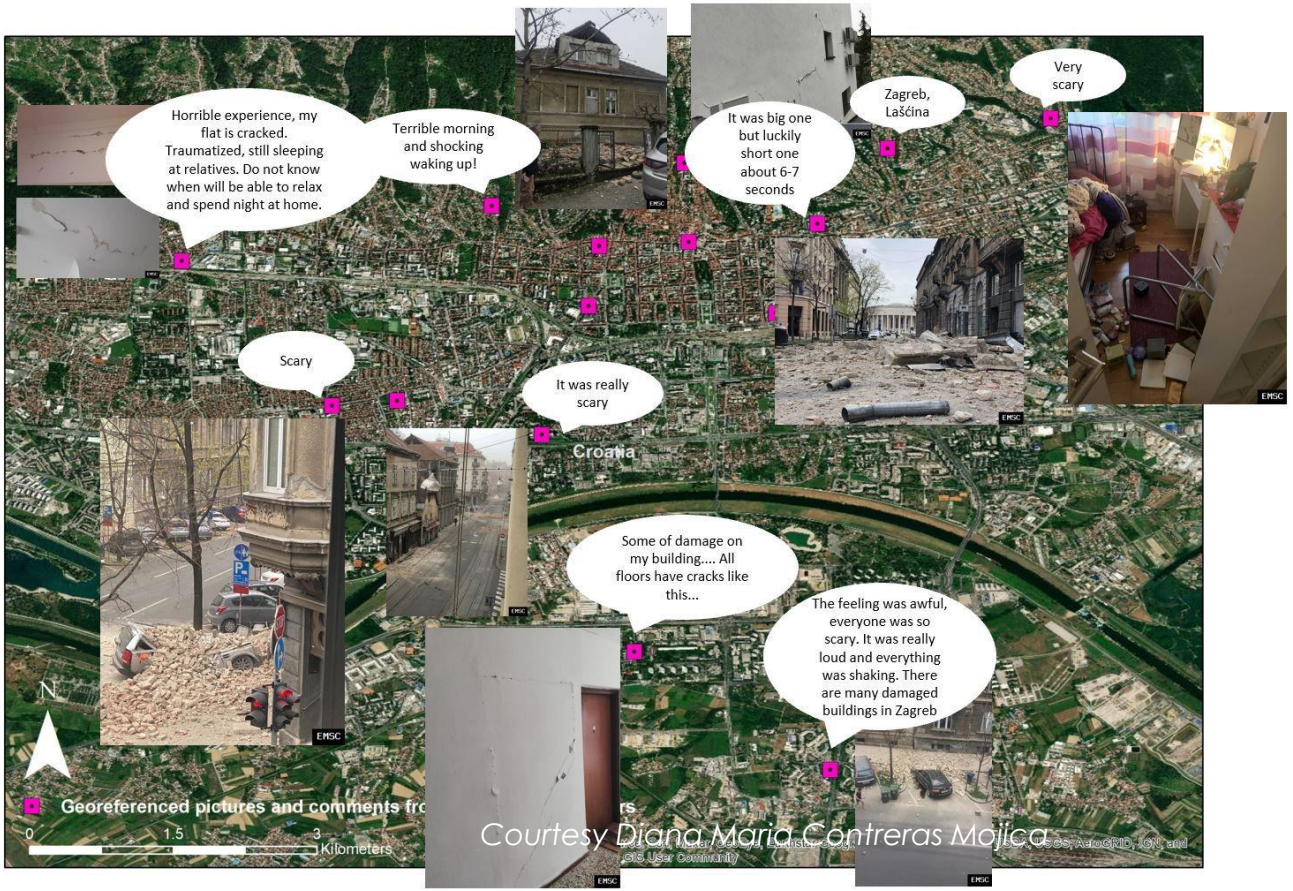
M6.4 Albania earthquake

Time evolution of epicentral intensity



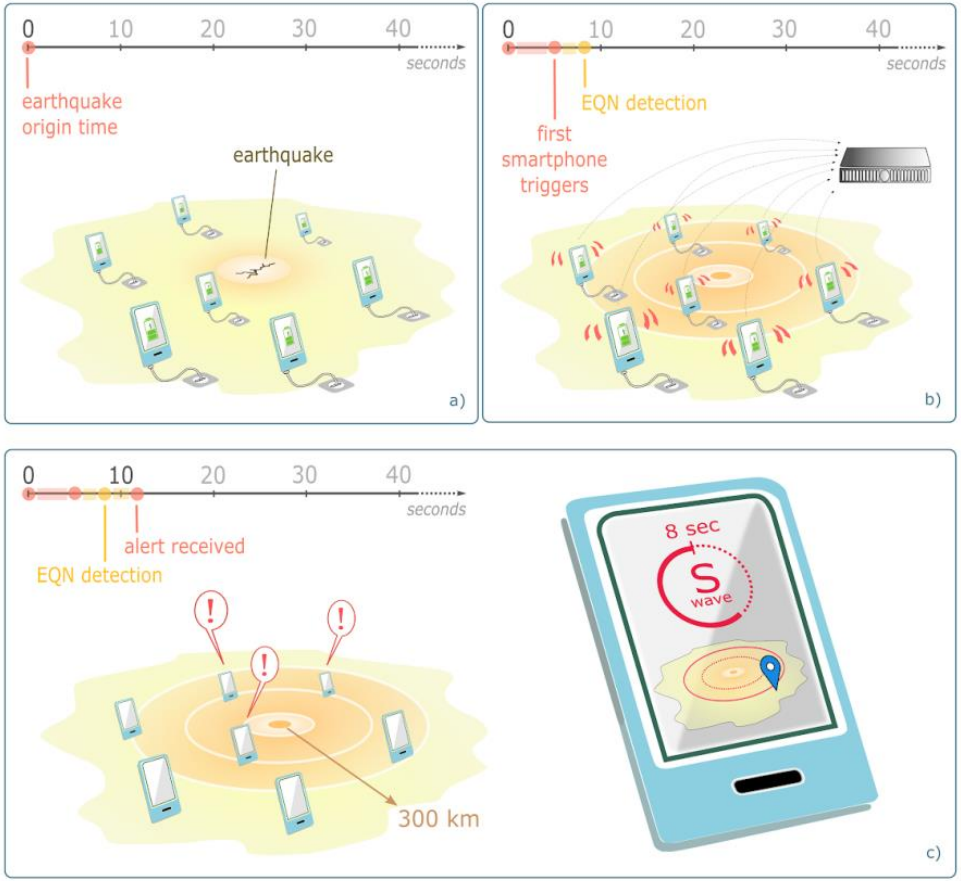
Crowdsourced geo-located picture

Remote field Survey (Univ. Newcastle)



Courtesy Diana Maria Contreras Mojica

EQN: Global Earthquake Early Warning



(Finazzi, Uni. Bergamo)

Scientific Value of Crowdsourced data

- Valuable for large section of operational seismology:
  - EEW, rapid public information, rapid parameters determination (loc, mag, rupture geometry), ground shaking distribution and damage assessment & surveys

- Volume of data to grow exponentially (IoT) making us of AI inevitable

- Link seismology and humanities (human behaviour from app usages, narrative & sentiment analysis from comments…)