

# **Citizen Seismology and Risk Reduction: The LastQuake Experience**

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European-Mediterranean Seismological Centre



# A Revolution!



Roma, April 2005

Election of Pope Benedict XVI



Roma, March 2013

Election of Pope Francis



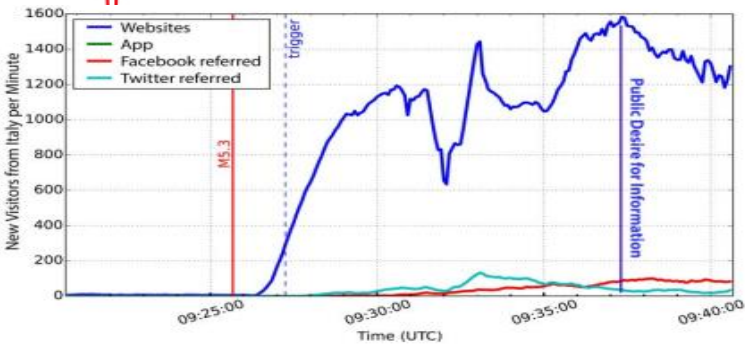
# Selfie as a new Stuff? NY 1920!



# Public Interest in Disasters: San Francisco 1906



# Internet as the Digital Nervous System of our Planet

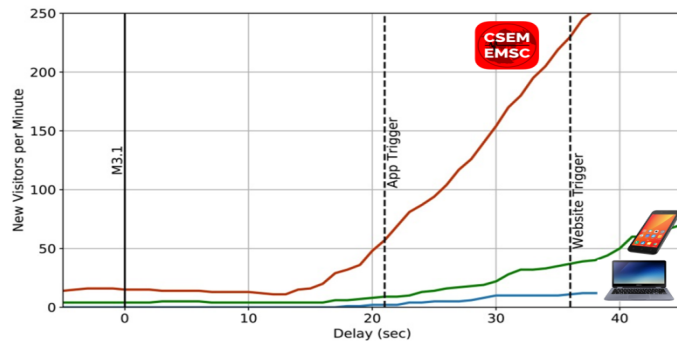
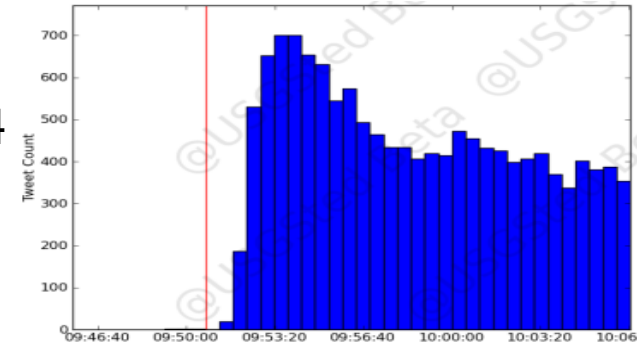


EMSC Website Traffic Monitoring since 2006

IP location at city level

Twitter EQ Detection (USGS) since 2014

Poor geographical Info



LastQuake App EQ Detection since 2016

Fastest and most accurate

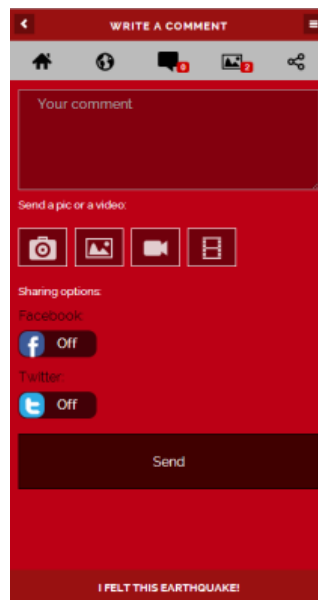
# Users as Real Time Seismic Sensors

M4.5 Los Angeles  
Sept. 18 2020



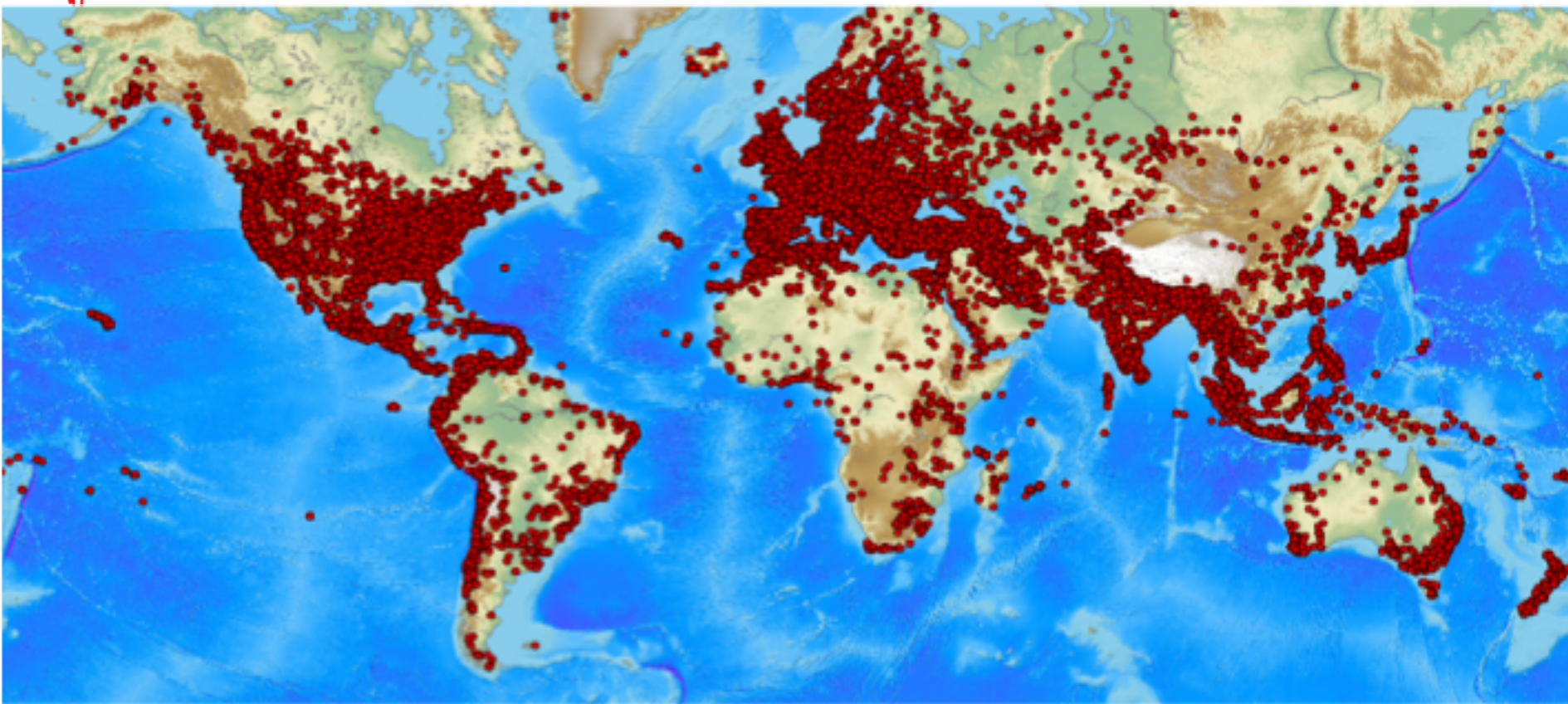


# LastQuake App: Felt Earthquakes!



- Questionnaires replaced by cartoons
- Best way to collect geolocated pics & videos
- Comments shared on Facebook, Twitter

# 1.4M LastQuake App Users



# LastQuake: A Multi Channels Info System



Accueil

Explorer

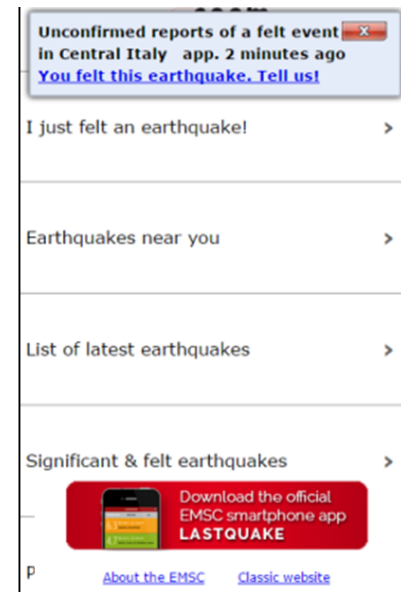
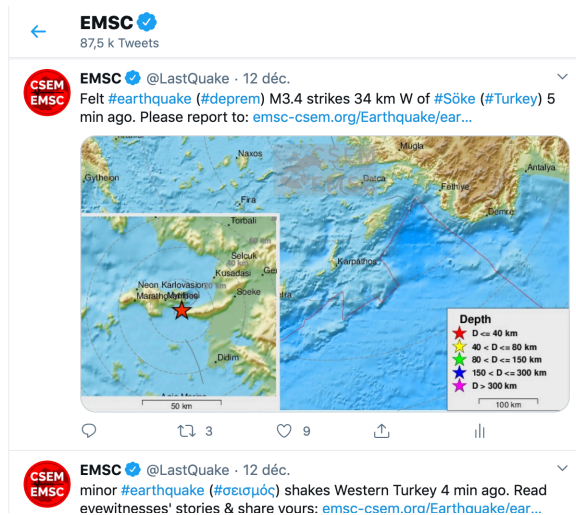
Notifications

Messages

Profil

Plus

Tweeter



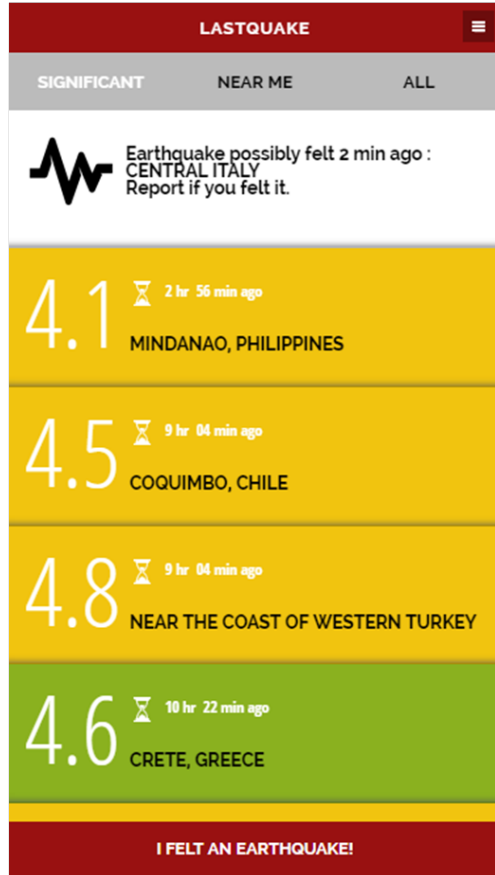
@LastQuake Twitter quakebot  
160k followers

LastQuake app  
1.4M users

EMSC websites  
1.5M visits/month

# Channels Interactions

APP



WEBSITES



# Complementary Crowdsourced Detections

M 4.4 LA, Aug. 29<sup>th</sup> 2018

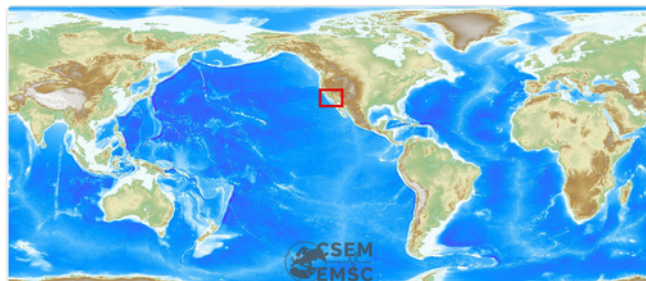


EMSC

@LastQuake

#Earthquake (#sismo) possibly felt 2 min ago in #California #United States. Felt it? See [emsc-csem.org](https://emsc-csem.org)

Traduire le Tweet



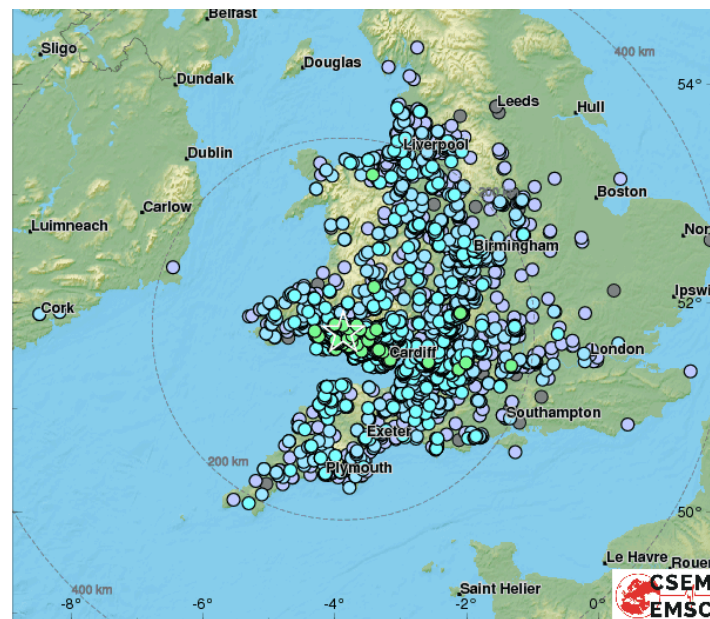
04:34 - 29 août 2018

388 Retweets 720 J'aime



**App Detection: 37s**  
**350 000 views**

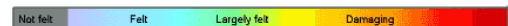
M4.4 UK, Feb. 17<sup>th</sup> 2018



5381 testimonies on this map

★ Epicentre location

Reported as:

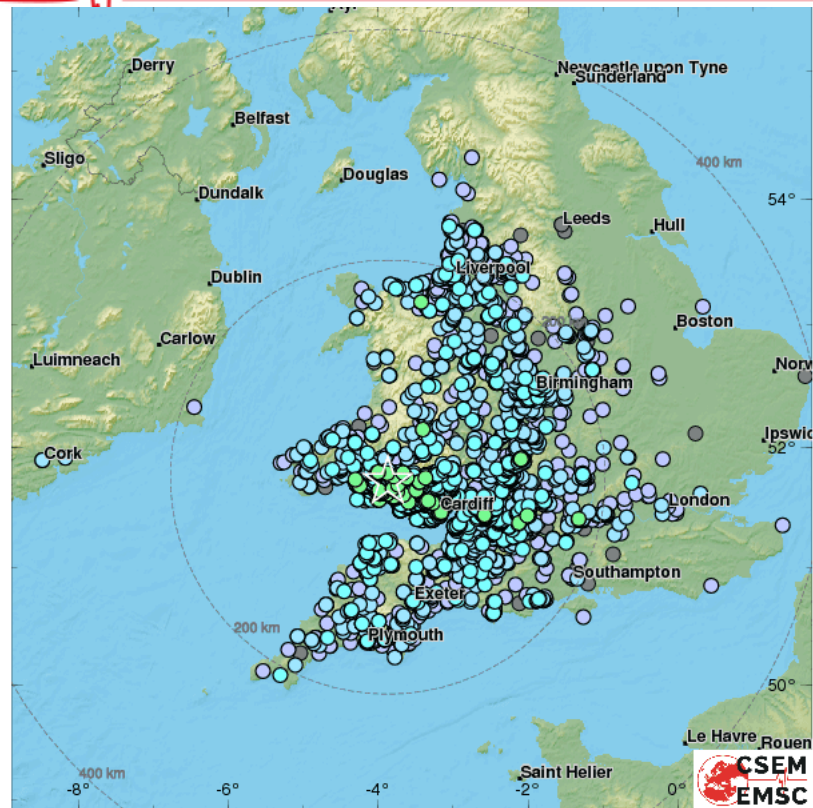


Updated on 22/02/2018 at 11:01 UTC

**Website detection: 74 sec**

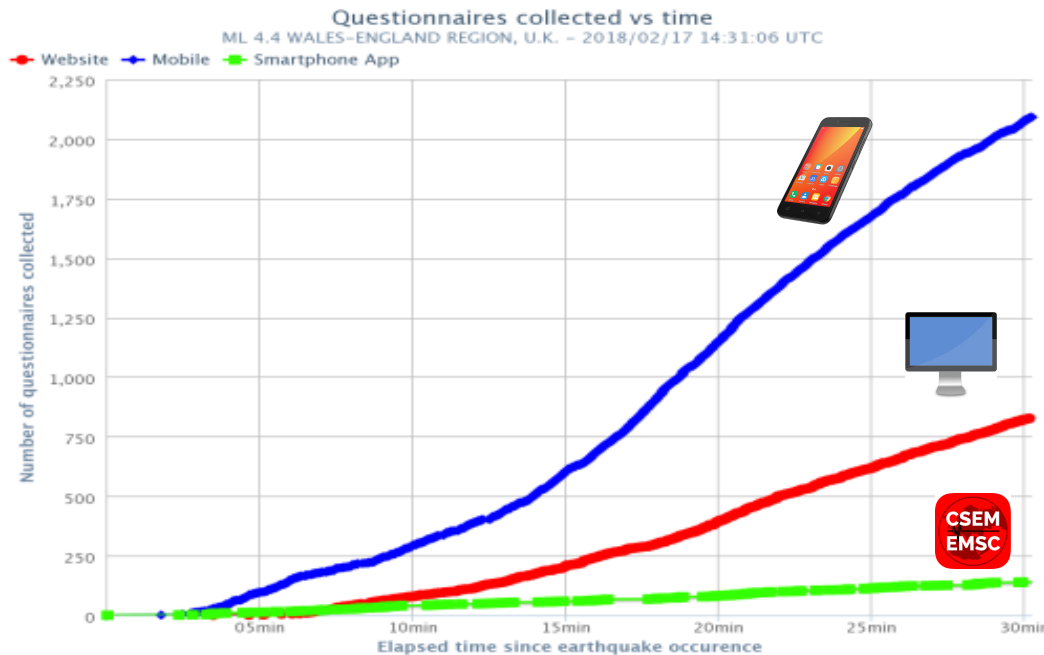
# The Power of Viral Spread

3 000 felt reports in 30 min  
>90% collected through websites!



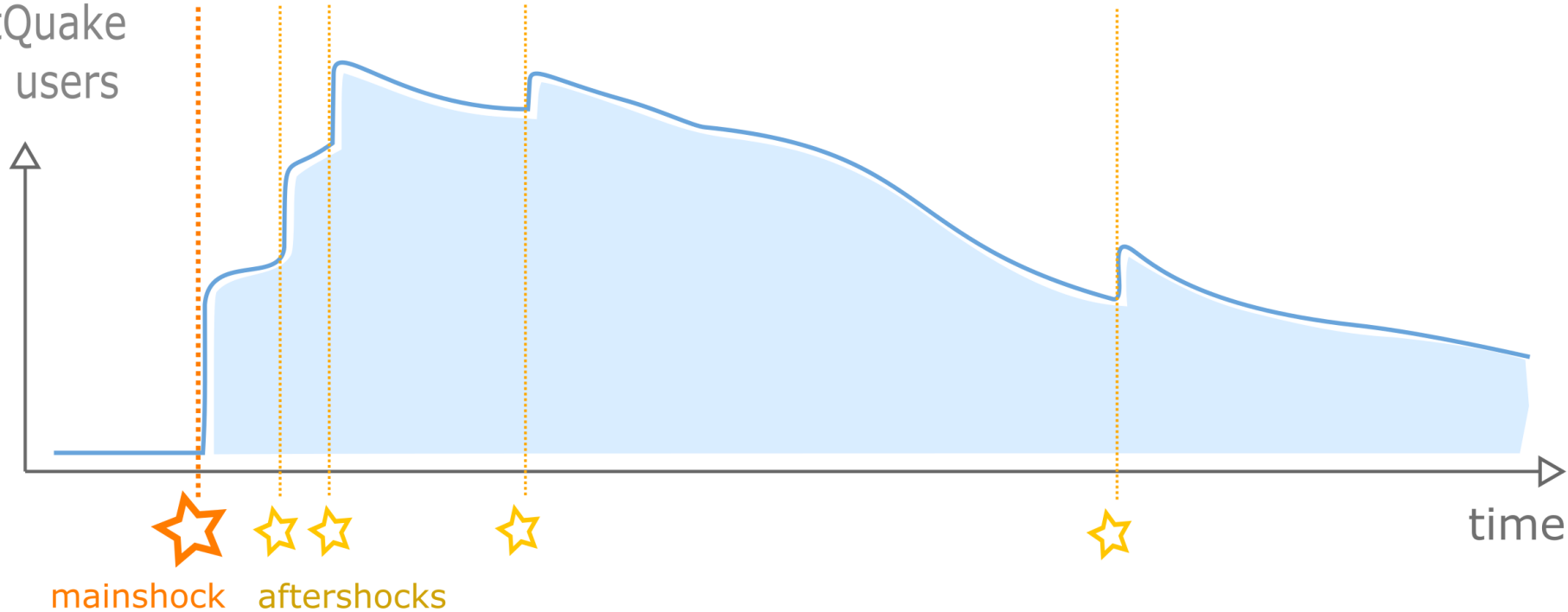
5381 testimonies on this map  
★ Epicentre location  
Reported as:

Not felt Felt Largely felt Damaging



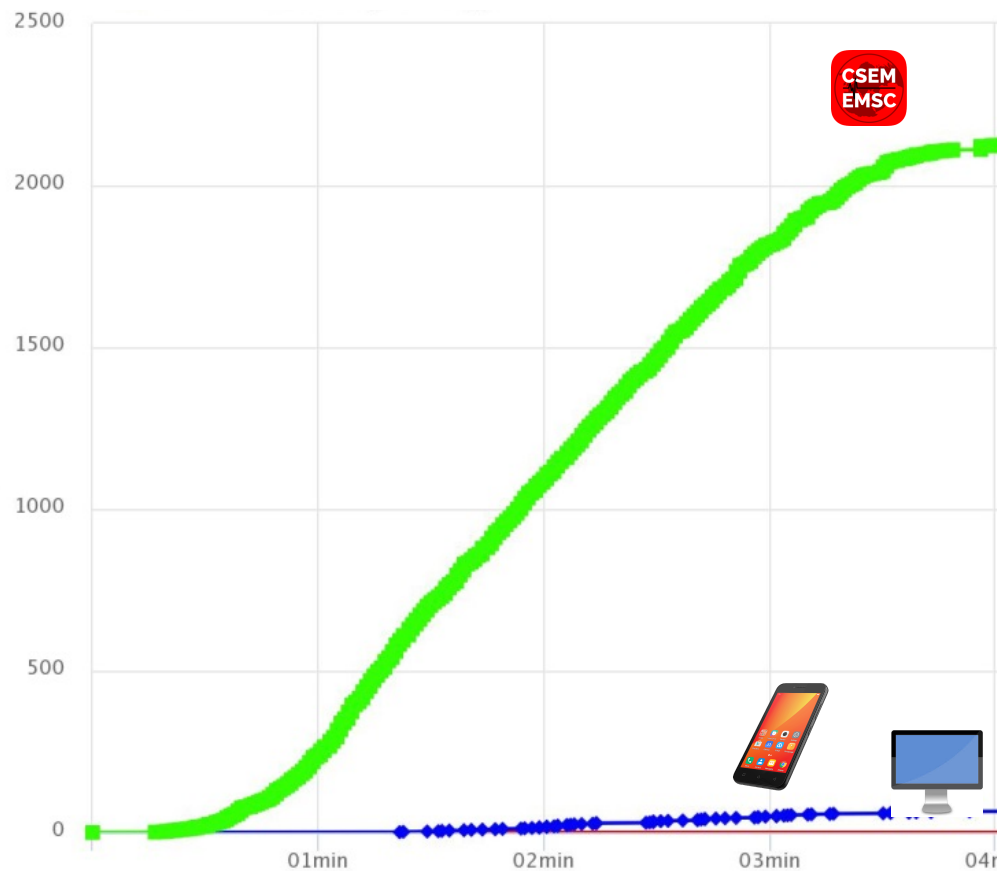
# LastQuake App Better for Aftershocks!

LastQuake  
app users



# App: Incredibly Fast Crowdsourcing!

M1.7 Zagreb aftershock:  
2 000 felt reports in 4 min





# Southernmost EQ EVER Documented!

M 5.6 - SOUTH SHETLAND ISLANDS - 2018-08-27 20:09:23 UTC



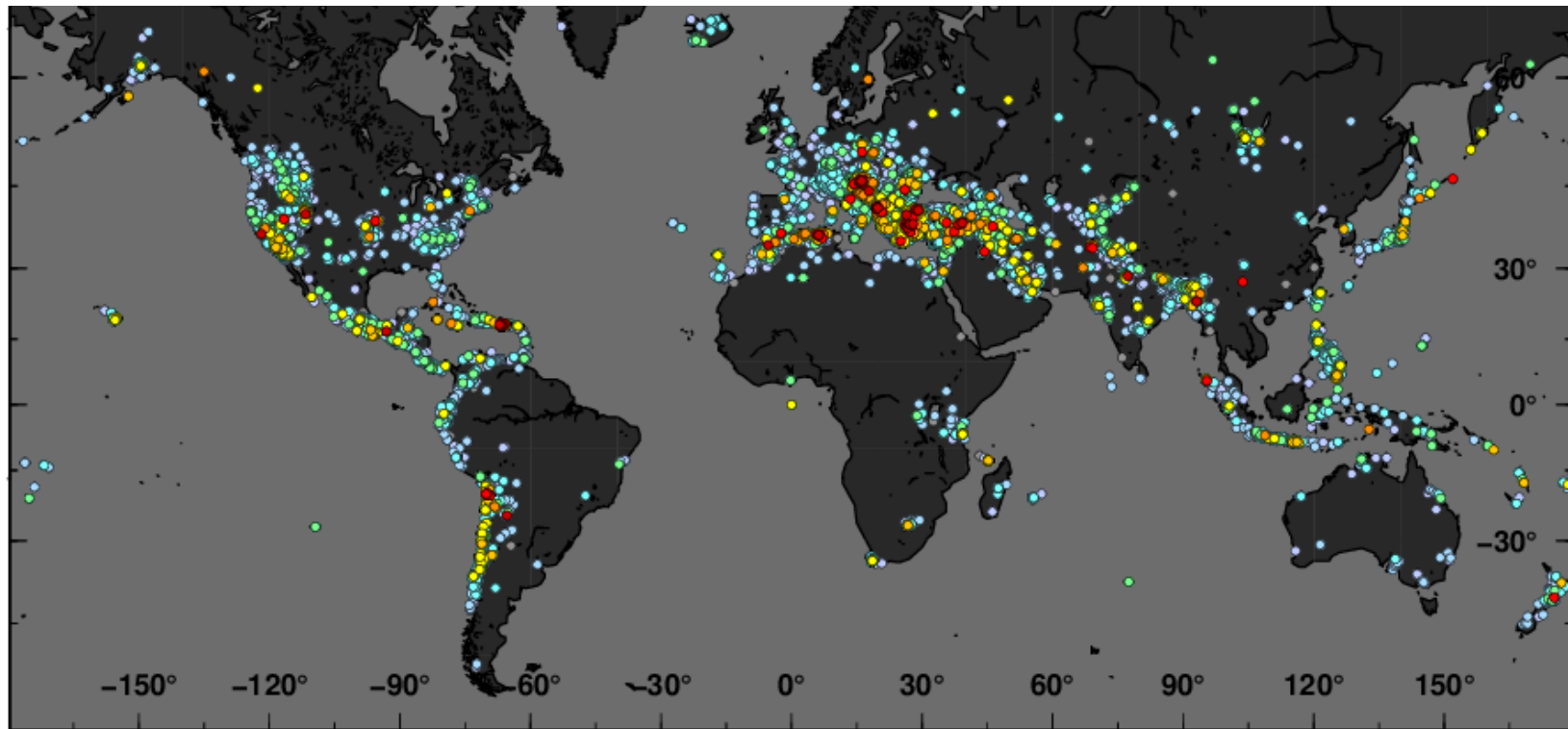
Villa Las Estrellas. Antarctica, 1 000 km SE of Ushuaia  
Population: 80



*First earthquake that I feel in the Chilean Antarctic, I had felt one in Chile, but not here*

*Felt strong in Chilean Antarctic Territory.*

# A Global and Rapid Service



2018: 125k felt reports

2020: 380k felt reports

50% of them collected within <10 min

# M4.3 Jan. 15 2018 T0 + 000s



# M4.3 Jan. 15 2018 T0 + 024s

9 LastQuake app launches





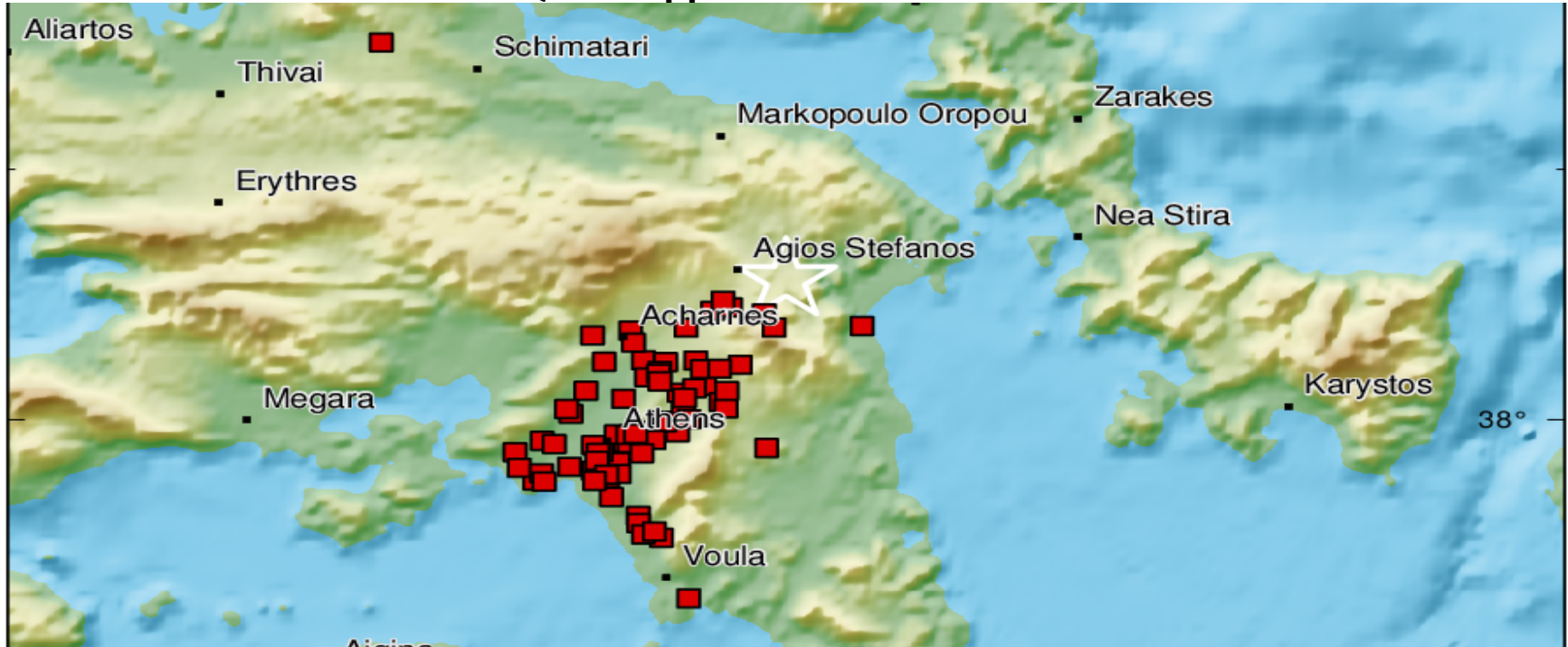
# M4.3 Jan. 15 2018 T0 + 030s

22 LastQuake app launches



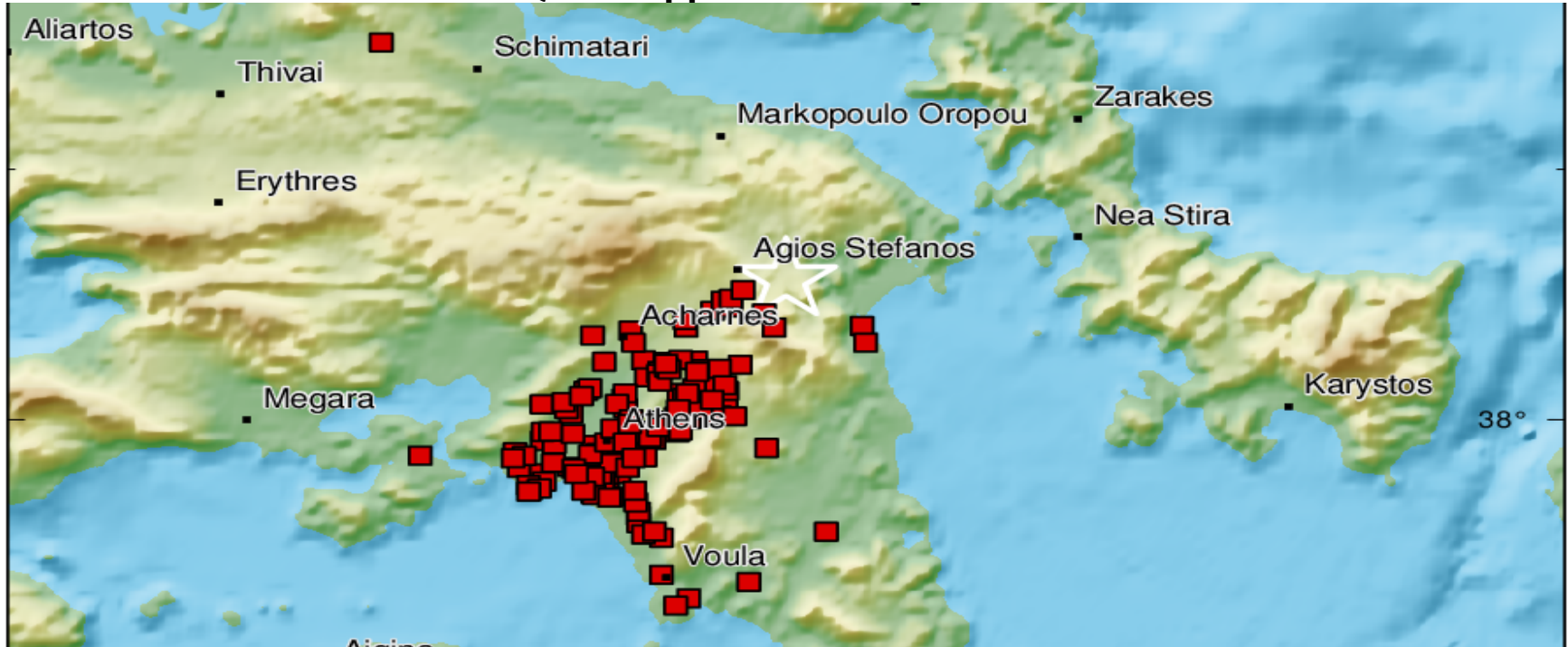
# M4.3 Jan. 15 2018 T0 + 040s

77 LastQuake app launches



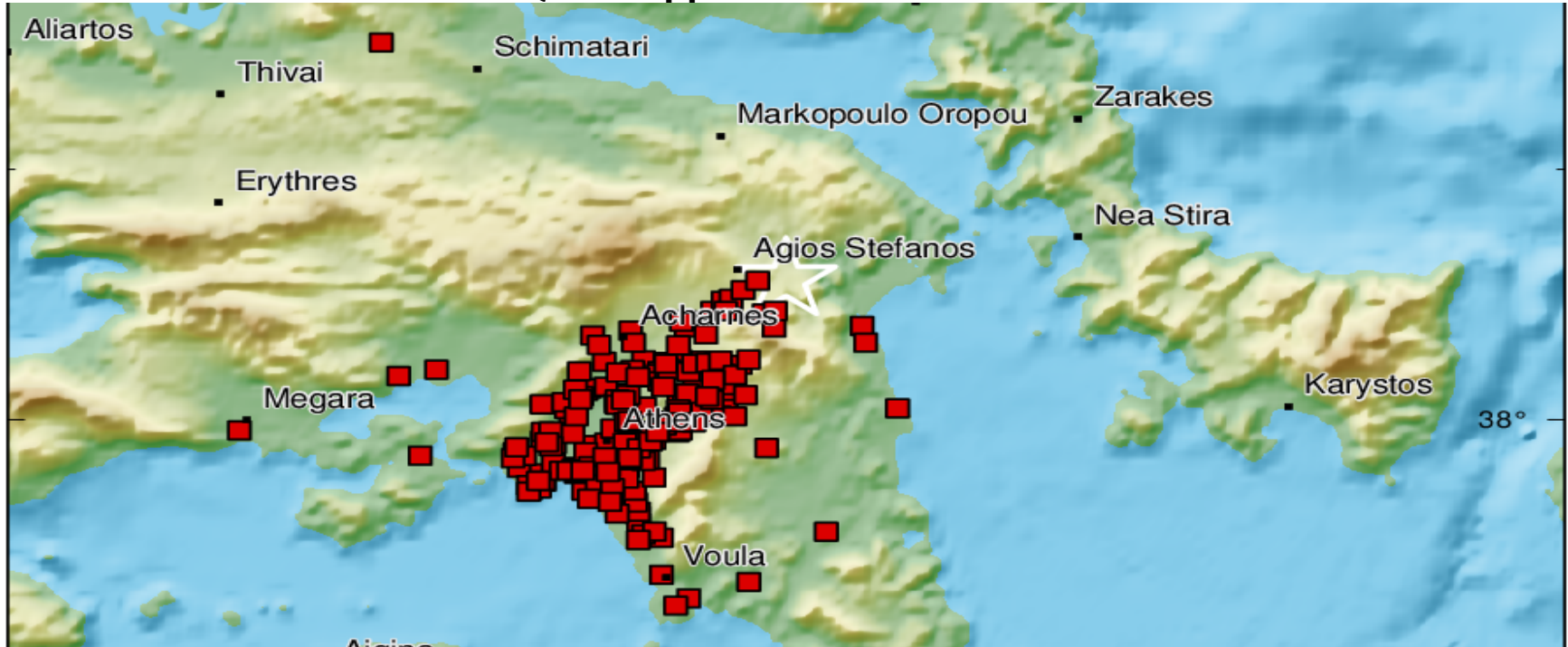
# M4.3 Jan. 15 2018 T0 + 050s

145 LastQuake app launches



# M4.3 Jan. 15 2018 T0 + 060s

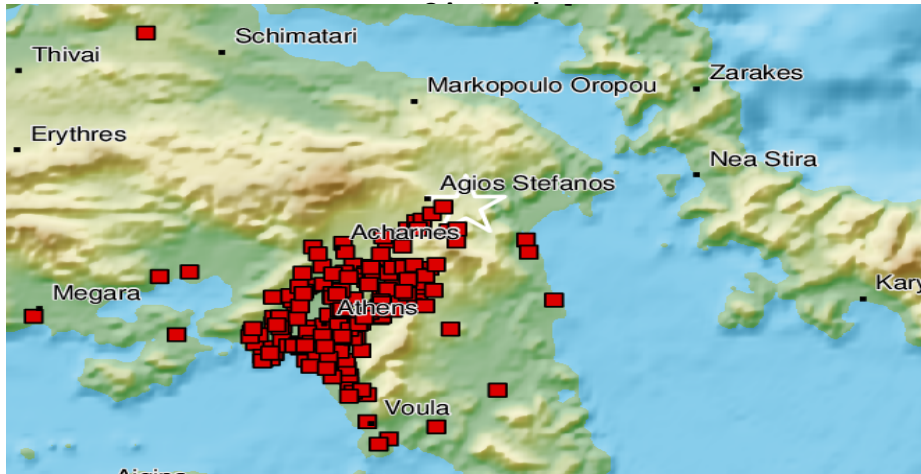
241 LastQuake app launches





# Felt Area & Macroseismic BEFORE Seismic Info

App Launches within 60s  
241 LastQuake launches

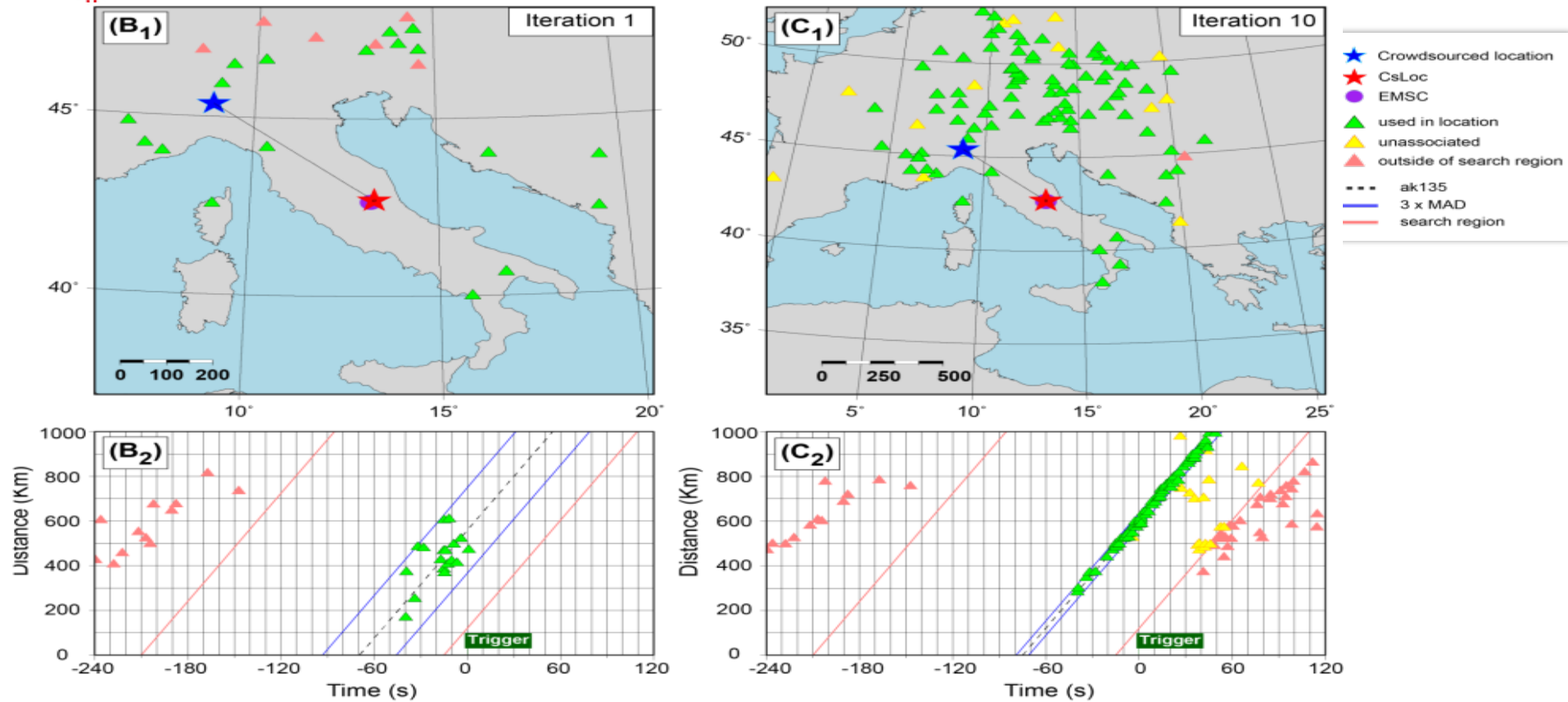


Macroseismic map at 292s  
544 felt reports

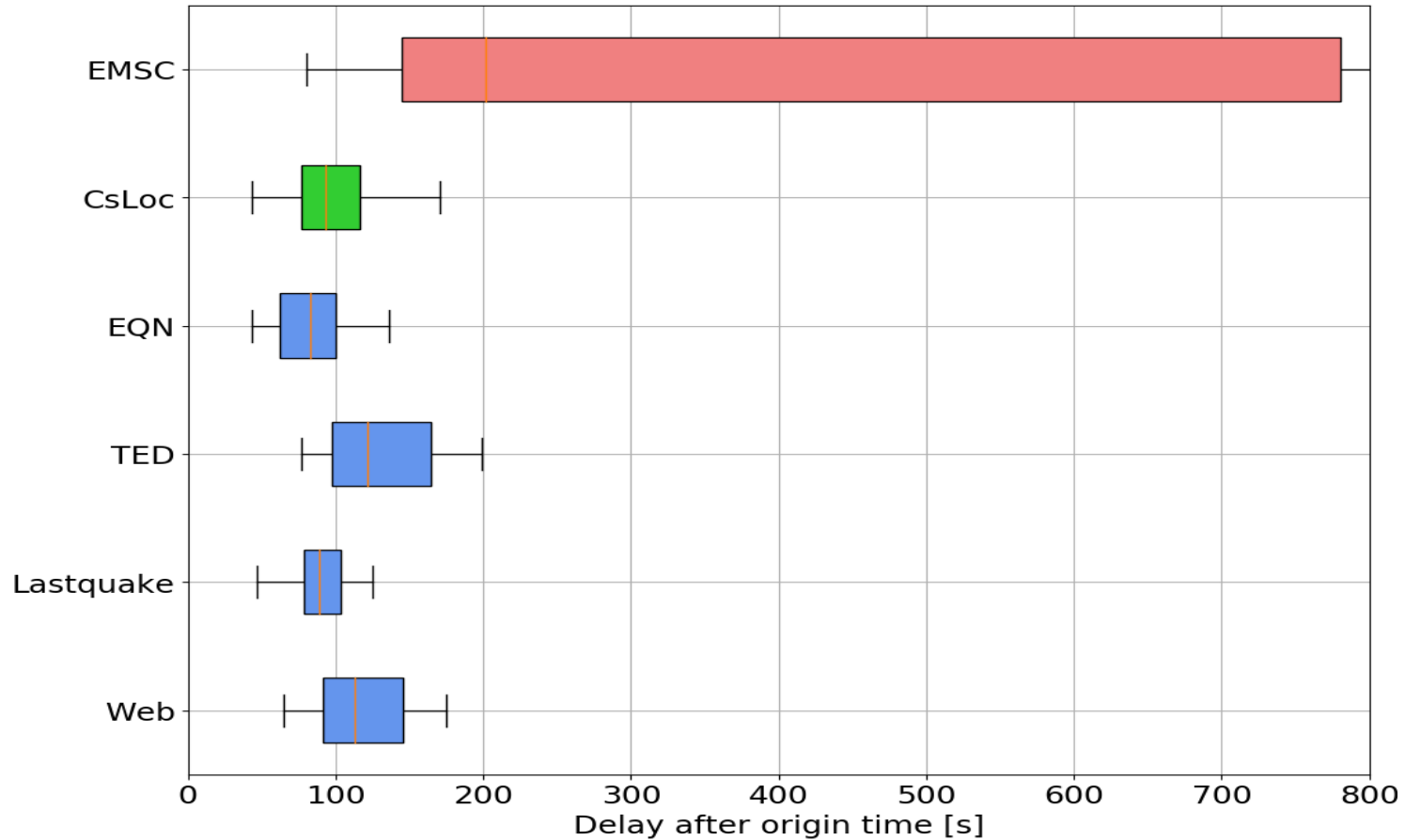




# Combined analysis of crowdsourced & seismic data



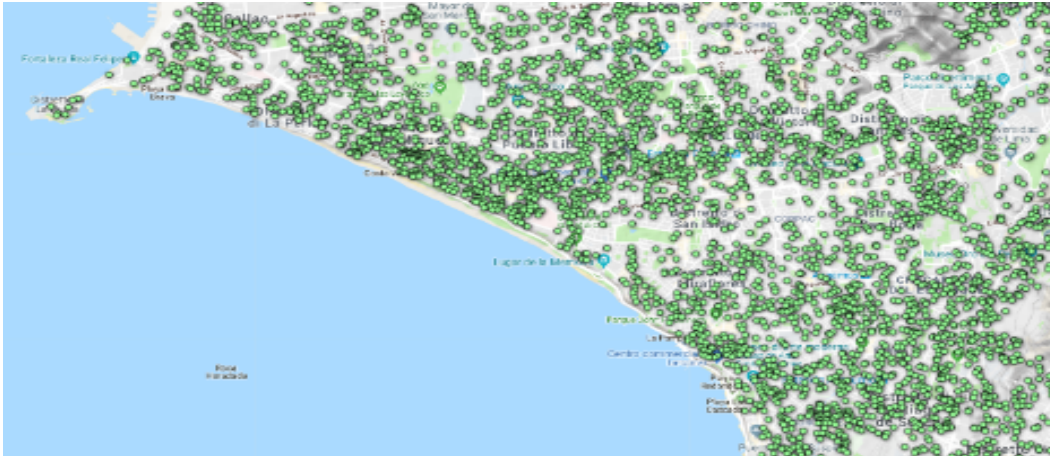
# First Seismic Location within 1 min!



# Citizen-Based Earthquake Early Warning!



## Earthquake Network Project High-density network



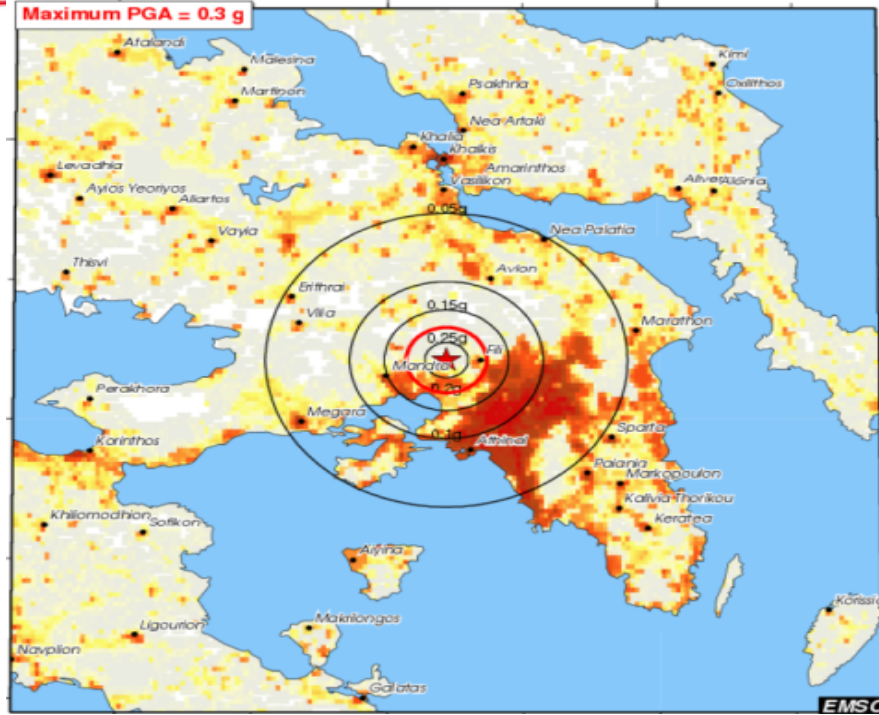
Lima region, Peru – 10k smartphones



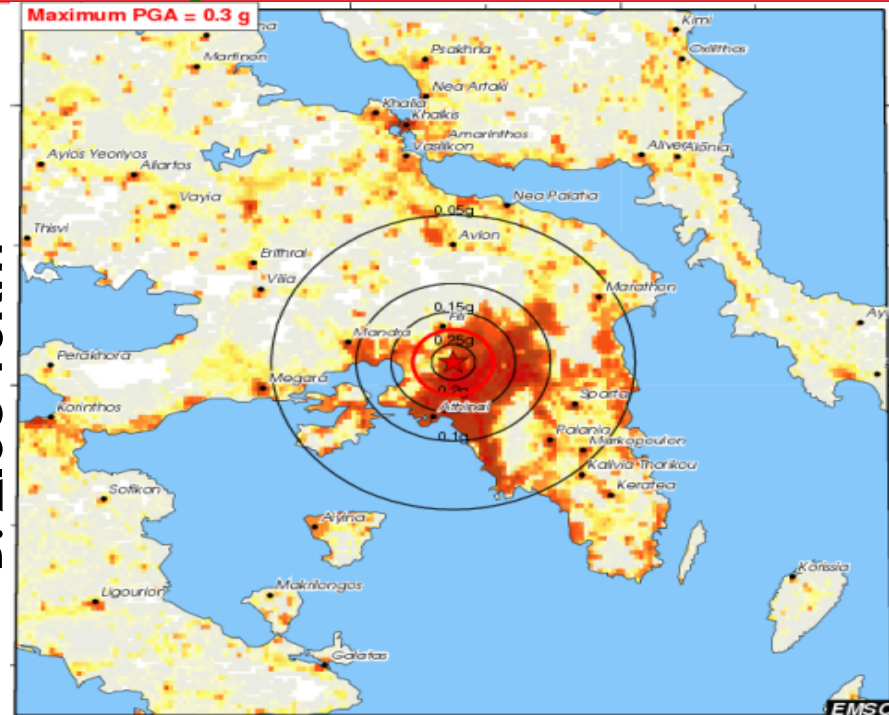
M8.0 quake – May 26th - Peru

# Location accuracy and Impact Assessment

A: Final Loc



B: Δloc 10km

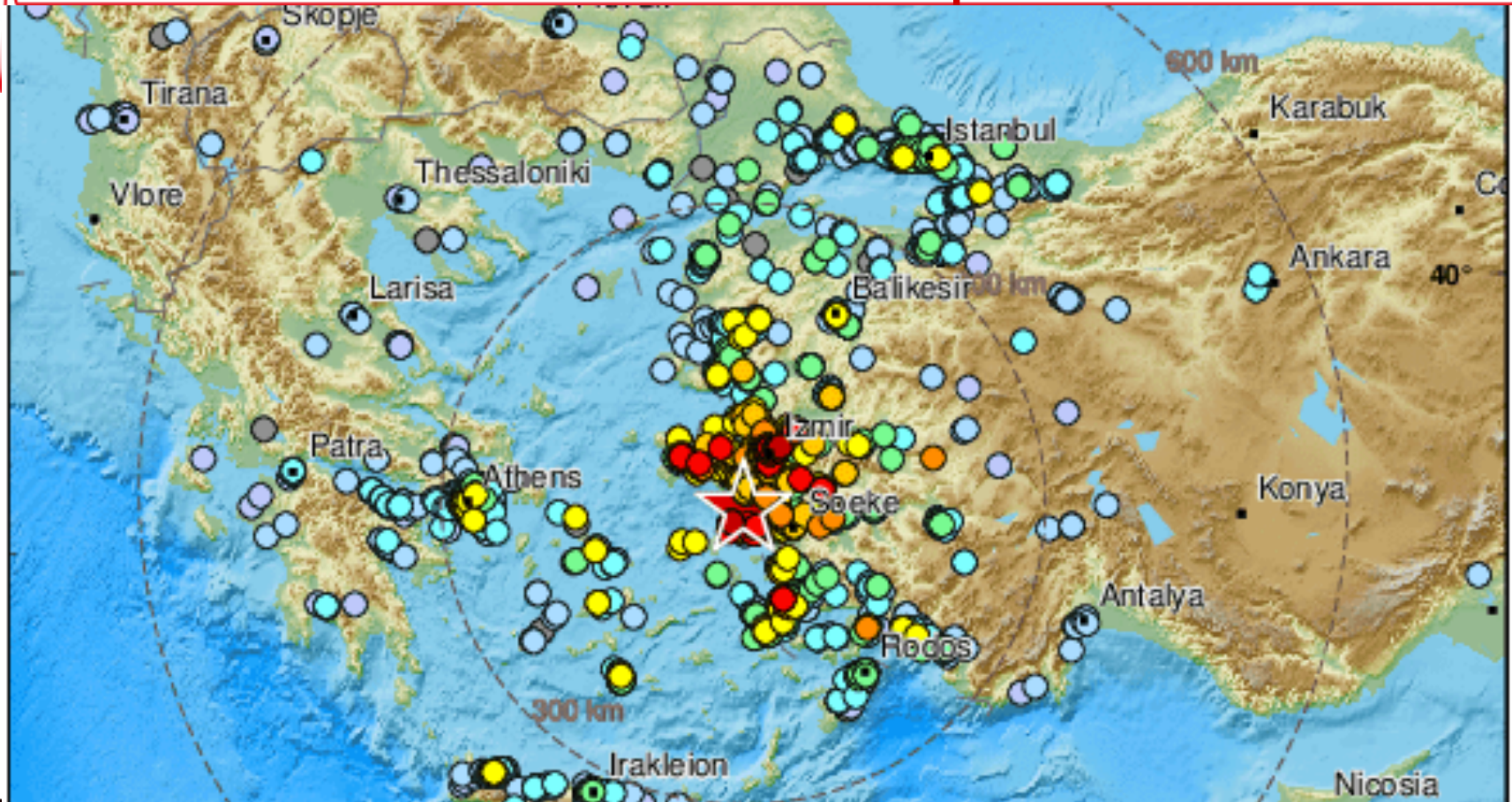


PGA (g)	0.25	0.20	0.15	0.10
# (A/B)	1.3k/326k	30k/1.1M	0,13/2.1M	1.7/3.2 M

Exposed Persons (M5.9 Athens 1999)

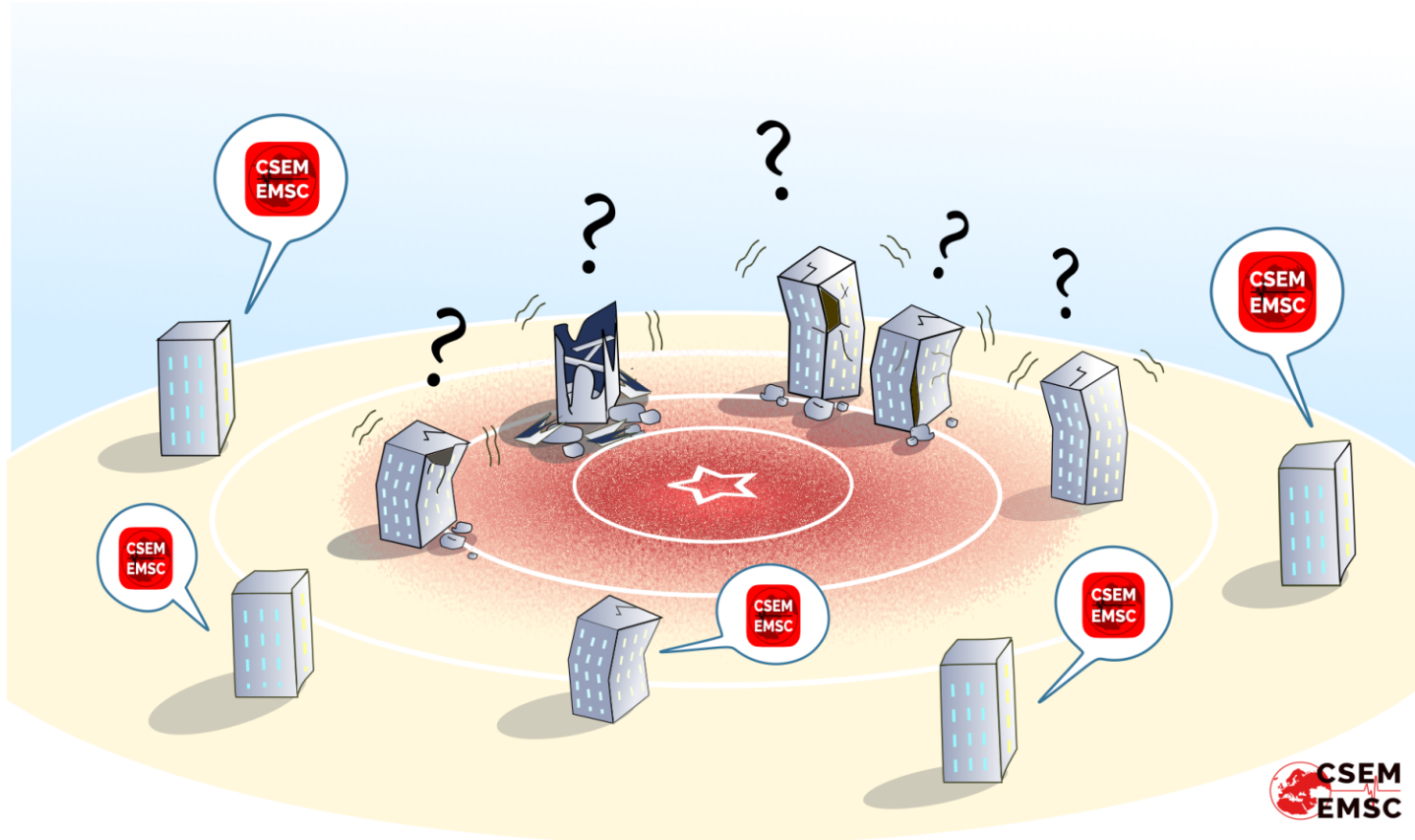


# M7 2020 Samos-Izmir earthquake



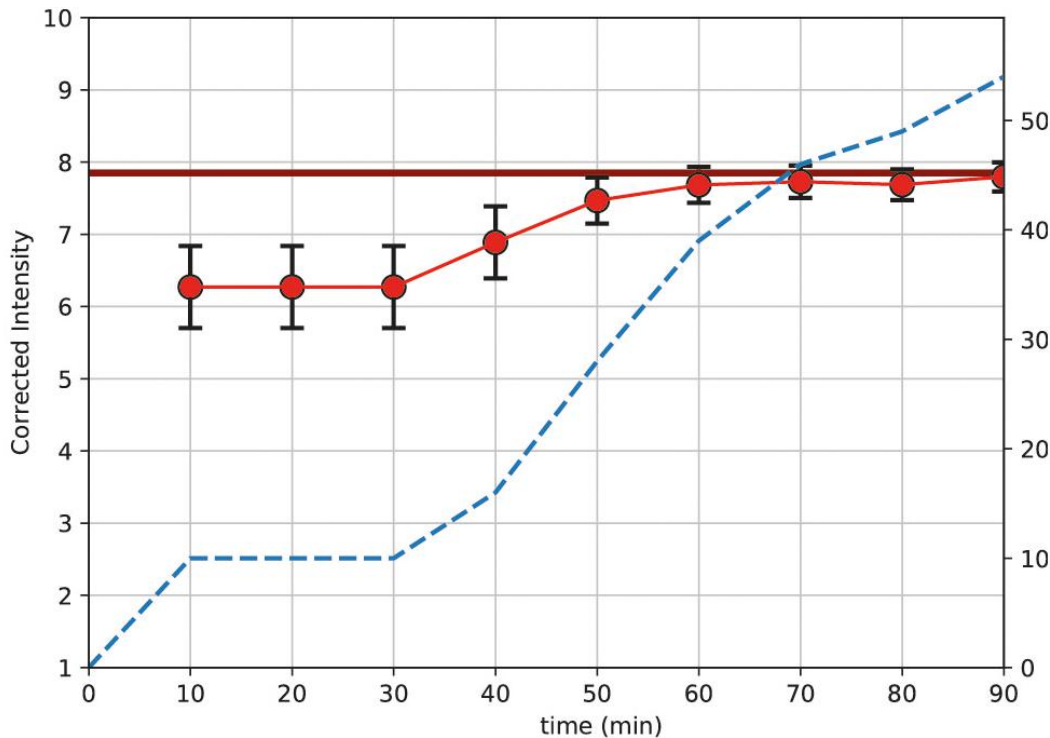


# The *Doughnut* Effect



# M6.4 Albania 2019 earthquake

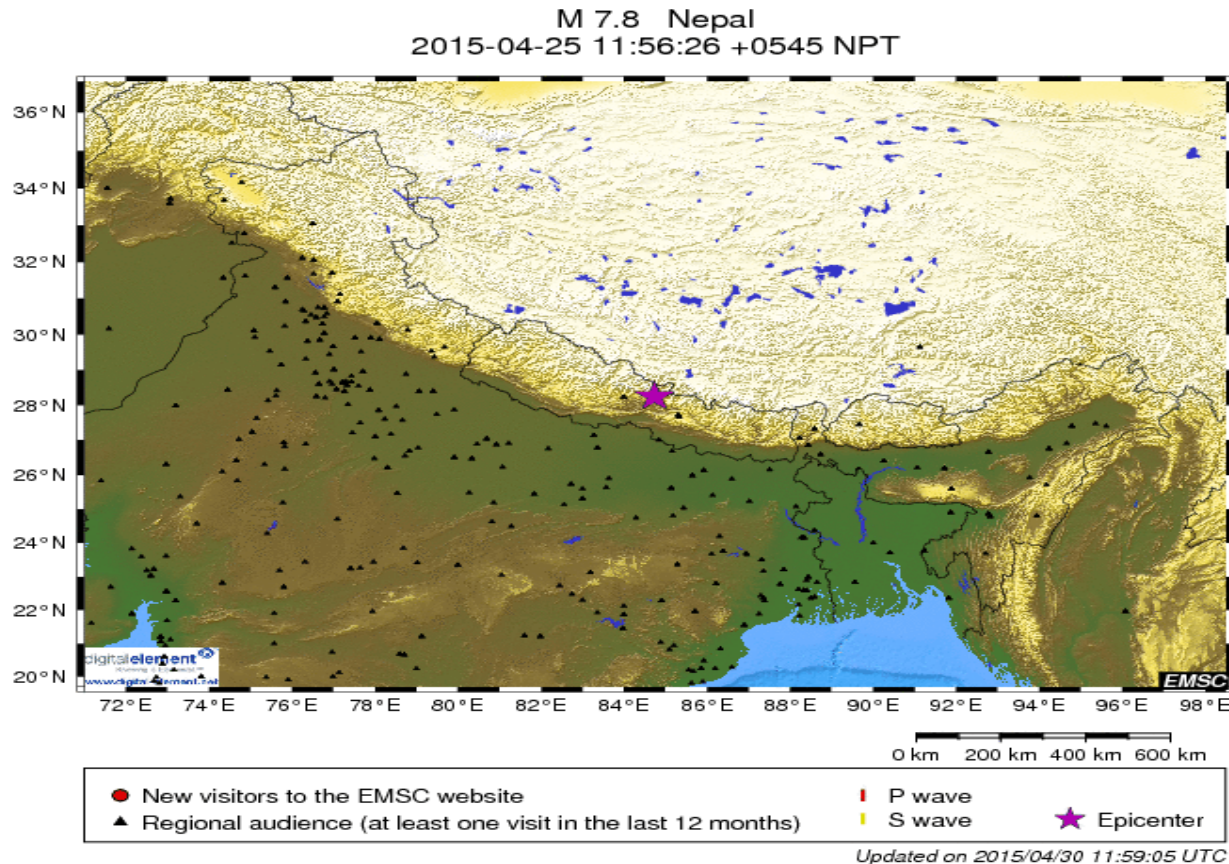
Time evolution of epicentral intensity



Crowdsourced geo-located pictures



# Nepal 2015: Kathmandu not Flatten!

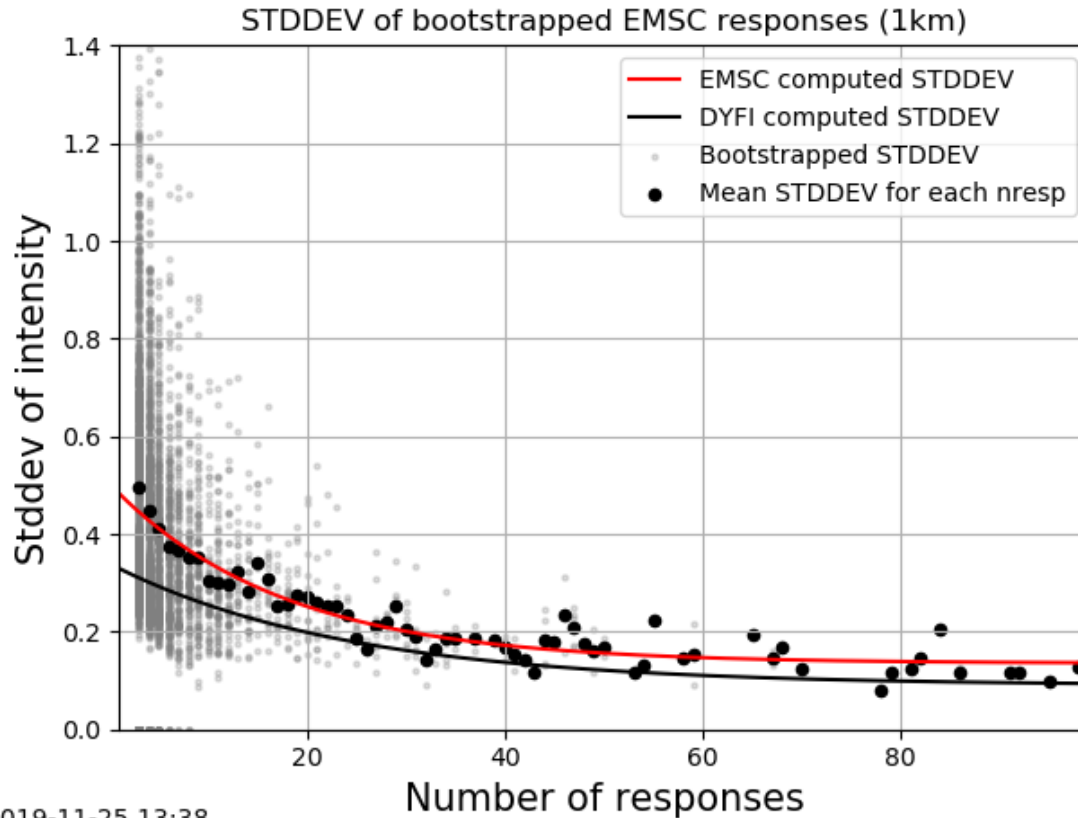




# 100+ Validated Geo-Located Pics



# Felt Reports & ShakeMaps



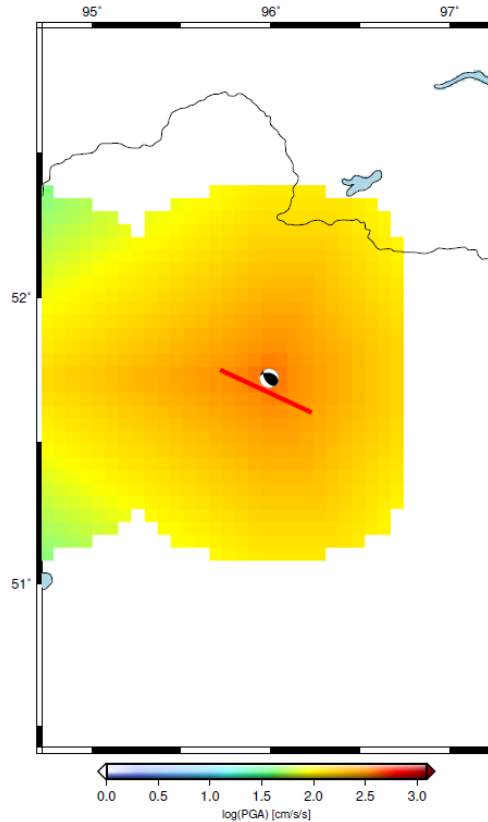
2019-11-25 13:38

Courtesy Quitoriano & Wald)

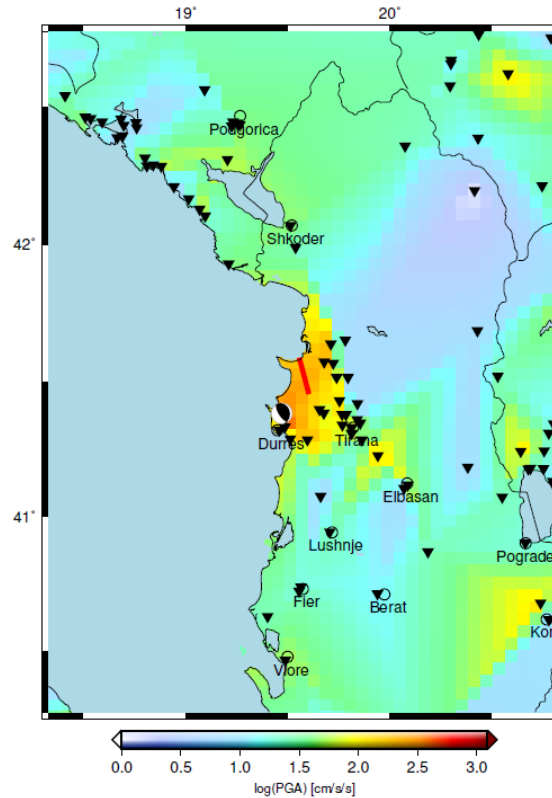


# Felt Reports and Rupture Geometry

SOUTHWESTERN SIBERIA–RUSSIA (256522): 2012–02–26T06:17:19, M6.6, Z=10°



ALBANIA (807751): 2019–11–26T02:54:11, M6.4, Z=10km

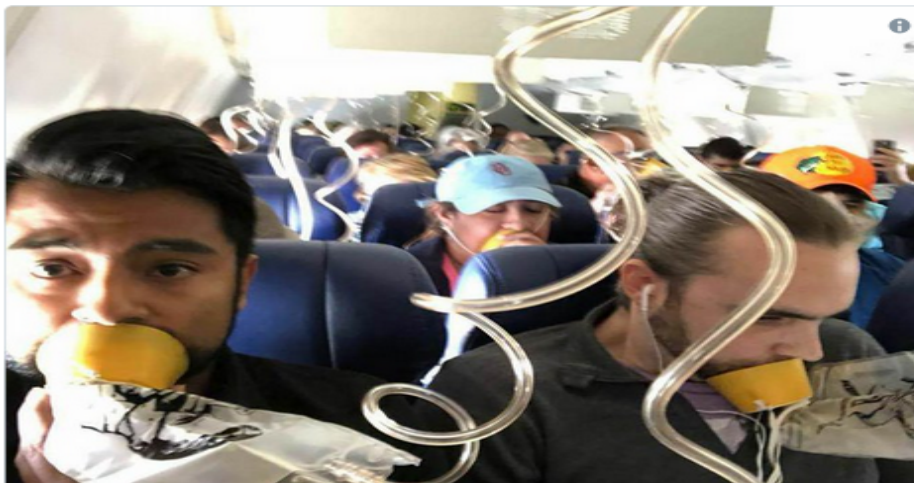


(Böse et al, SRL accepted)

# Right Info at the Right Time at the Right Person!

## Safety Tips: Timely Geo-targeted Information

TIMELY



**Bobby Laurie**  
@BobbyLaurie

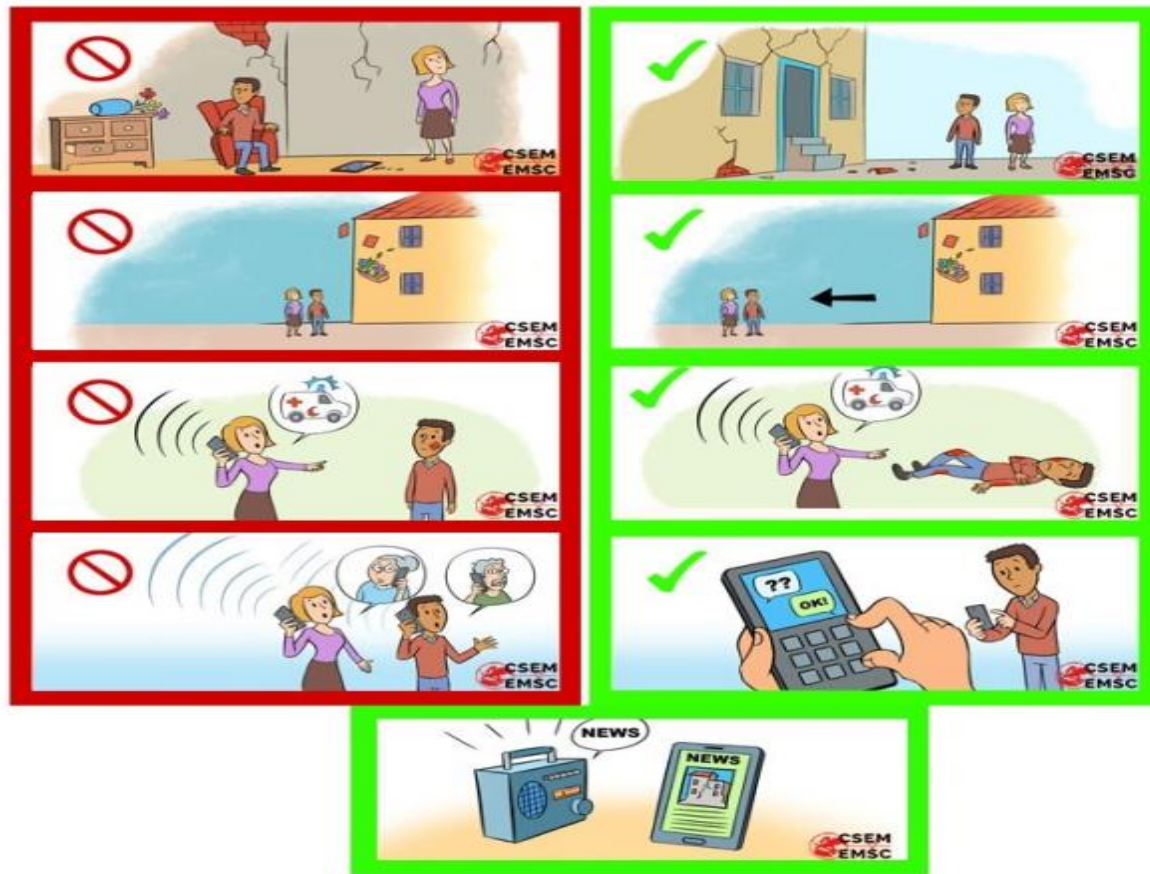


PEOPLE: Listen to your flight attendants! ALMOST EVERYONE in this photo from @SouthwestAir #SWA1380 today is wearing their mask WRONG. Put down the phone, stop with the selfies.. and LISTEN. \*\*Cover your NOSE & MOUTH. #crewlife #psa #listen #travel #news #wn1380

# Safety Tips Guatemala 2019



# Safety Tips & Safety Checks



# Timeline of LastQuake Evolutions

July 2014  
App Launch

April 2015  
Nepal EQ

May 2018  
Mayotte sequence

July 2018  
Lombok sequence

Sept. 2018  
Palu tsunami

## LastQuake Multichannel System Evolutions

EQ Safety Tips &  
Safety Checks

Access to map of  
felt reports

RT exchange  
on Twitter

Tsunami Safety Tips



# Palu, Indonesia: Shaking is the Alert!



# Tsunami Safety Tips

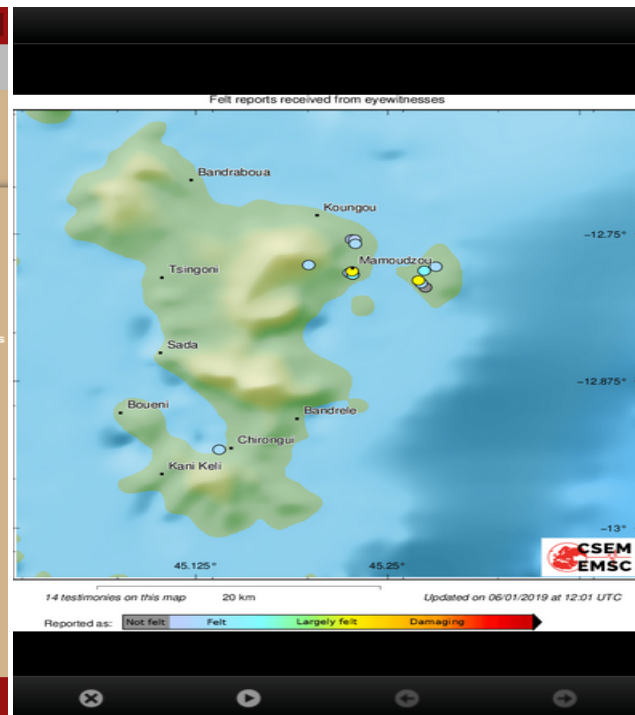
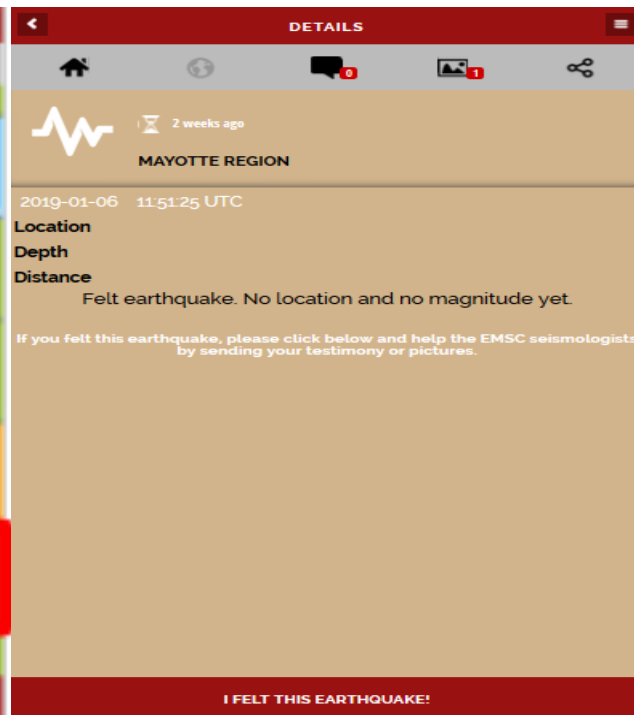


# Mayotte: A Sequence in a Poorly Monitored Area

- Many felt earthquakes that cannot be located
- Rumours, fake news and conspiracy theories

***Explain Why Information Is Missing!***

# Earthquake Without Mag nor Loc!





# Anxiety & Public Needs for Direct Interactions



**Alba**  
@EmarraAge

En réponse à [@LastQuake](#)

Thank you for the amazing work you do. It has been somewhat comforting to turn to you as a reliable source during this week of fear and panick. Also a lot of regards to our seismologists here in Albania, whose work we often fail to acknowledge and appreciate.



**Lisa**  
@lisjedad1

Even when there isn't an earthquake it feels like there is; when we finally manage to calm down another one strikes. We are living in a state of constant anxiety. Praying that God will have mercy and this will be over soon!! [#AlbaniaEarthquake](#)



**soni**  
@kingoftvseries

En réponse à [@LastQuake](#)

thanks for all the coverage you are getting for us, we have all downloaded your app and constantly check on it. It's happening every 1-2 hours, we are north in Shkoder and still feel each shaking. A nightmare



**inky boi**  
@InkyBoi0

En réponse à [@LastQuake](#) et [@blooisbabie](#)

Oh no i live in albania so like that is really bad beacuse when the aftershocks happen it feels like another big earthquakes is starting again and i have bad panick attacks

# Albania: Panic following EQ Prediction



EMSC @LastQuake · 22 sept.

To our friends in #Albania, you are likely to have heard or to hear in the coming days people claiming to have predicted yesterday's earthquake or future ones. Do not listen to them: Earthquake prediction DOES NOT exist as today. Stay safe

# EQ Prediction vs EQ Forecast vs EEW?



EMSC   
@LastQuake

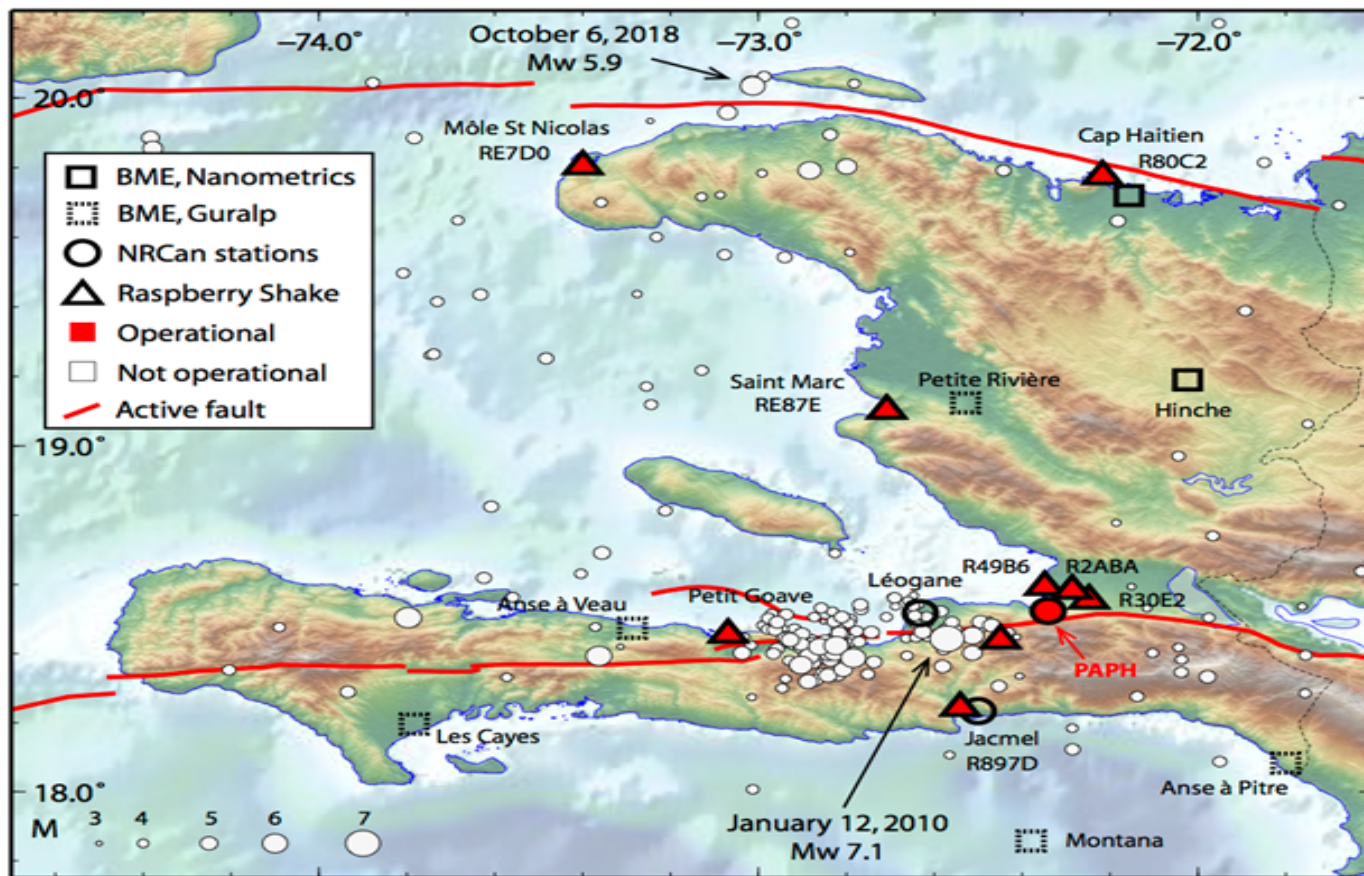
As systematically observed after a damaging earthquake, we start to hear people making prediction.

**EARTHQUAKE PREDICTION DOES NOT EXIST!**

These people are just exploiting the understable anxiety of the population.

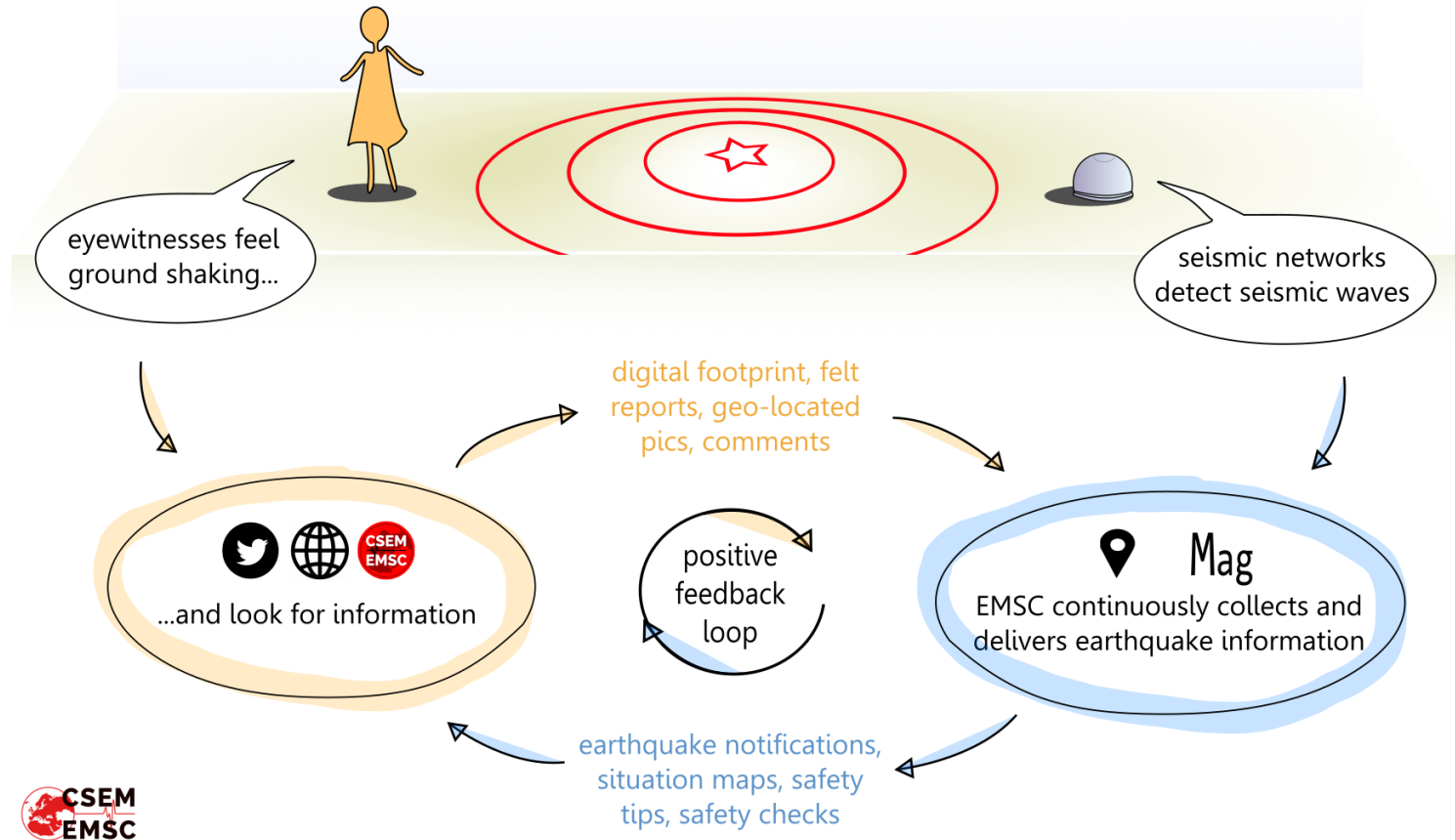
Nobody can predict earthquakes. Please RT

# Haiti: Citizen Operated Network





# LastQuake: A Win Win Participative Project



# Concluding remarks

- Benefit observational seismology
- Contribute to risk reduction:
  - Heightened situational awareness (crowdsourcing)
  - Limiting inappropriate behaviours (timely geo-targeted tips)
  - Enabled friend and family communication (safety checks)
- Improve dialogue between science and society
  - From info broadcasting to info on demand
  - Improved understanding of public expectations & understanding
- Studying the psychological cost of earthquakes & risk perception



# Thank you for your attention



## 24M LastQuake Launches

UniEarthS Thematic School:

Opening Sciences