CSEM EMSC

Euro-Mediterranean Seismological Centre

Centre Sismologique Euro-Méditerranéen

Find us on:

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SCOR FONDATION POUR LA SCIENCE

How Citizen Seismology Contributes to Risk Reduction: The LastQuake System

Rémy Bossu on behalf of EMSC and collaborators

Paris, Oct. 2023

Why Citizen Seismology
&
How does LastQuake Work?

Euro-Mediterranean Seismological Centre

And then a Revolution!

Roma, April 2005

Election of Pope Benedict XVI

Roma, March 2013

Election of Pope Francis

Euro-Mediterranean Seismological Centre

SF 1906: Iconic Picture!

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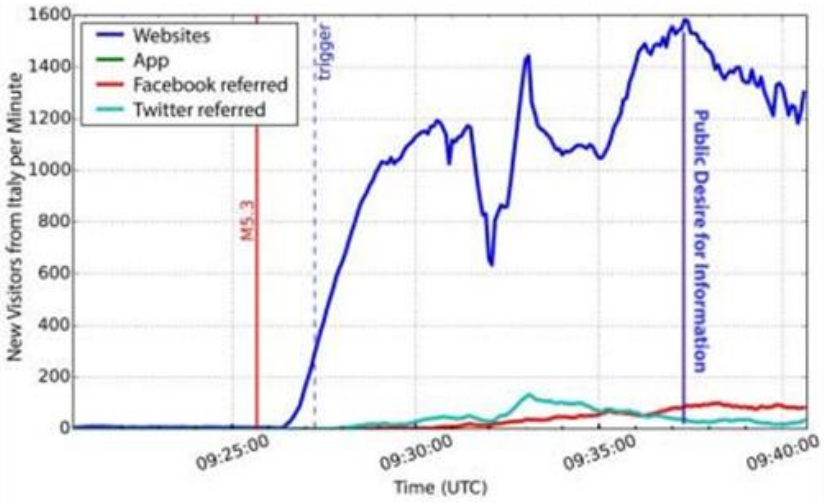
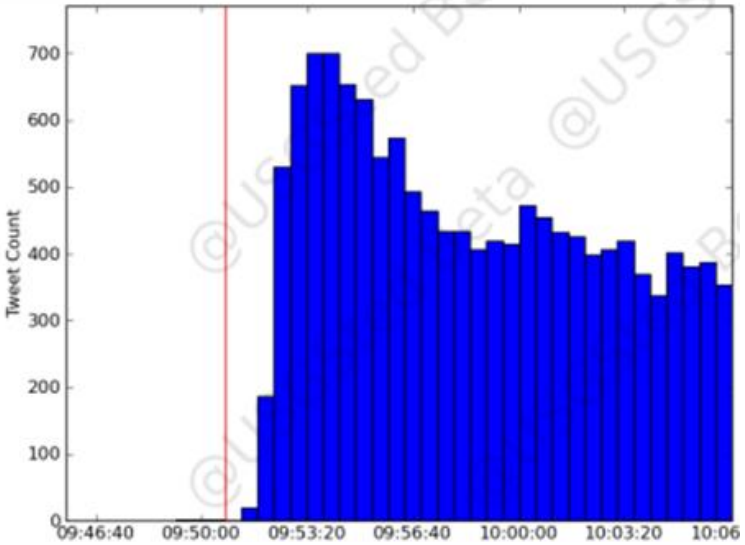
CrowdSourced Detections (15-90s)



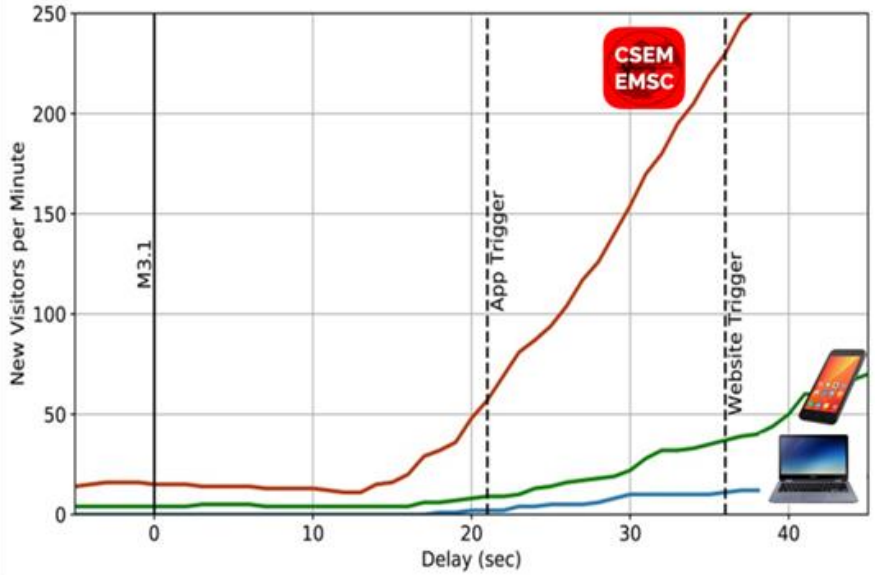
EMSC Website Traffic Monitoring:

- 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

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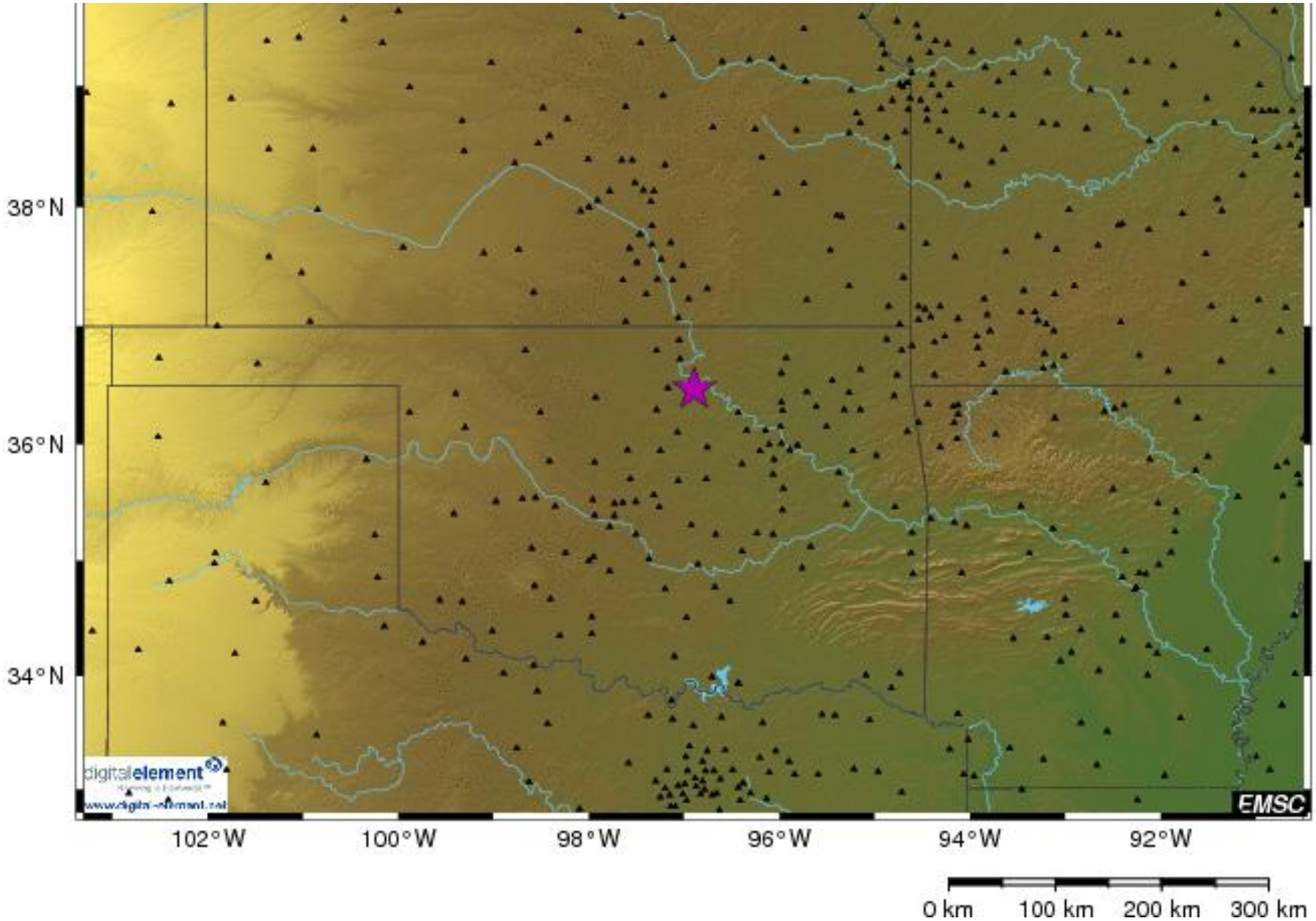
Internet as Digital Nervous System of our Planet!

OK M5.6 2016

Virginia EQ located in 2min with 30 km accuracy



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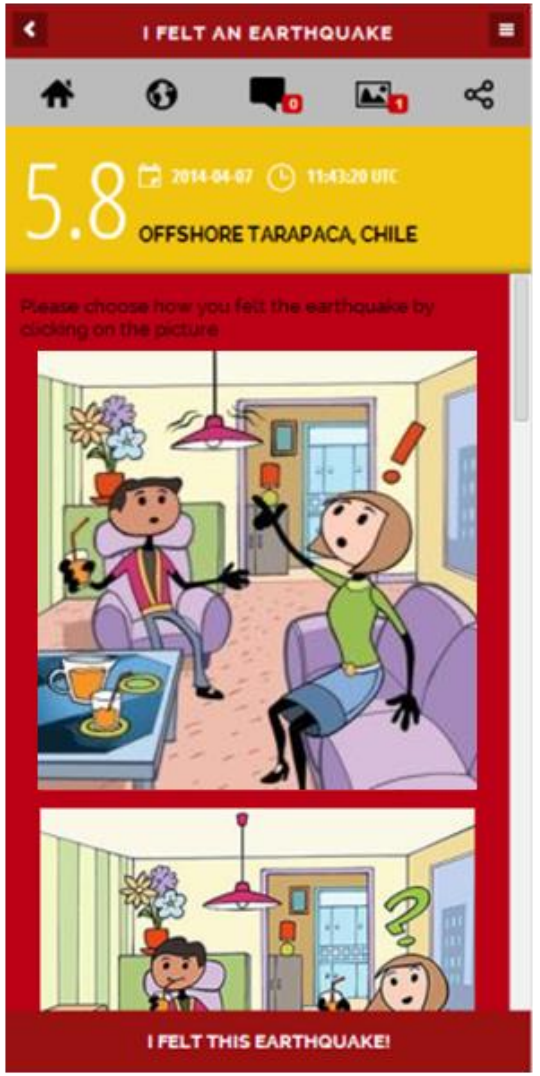
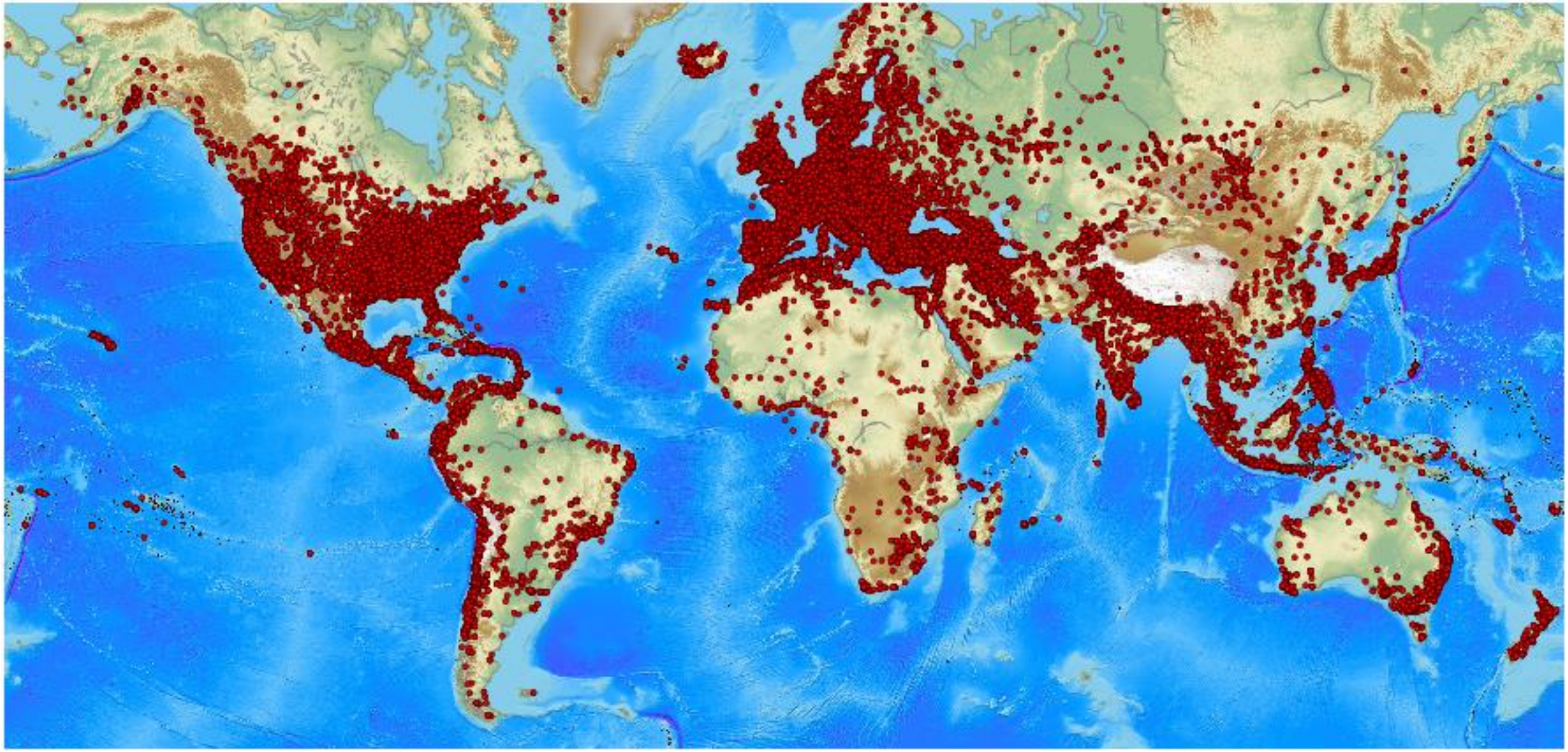
Earthquakes that Matter for the Public!

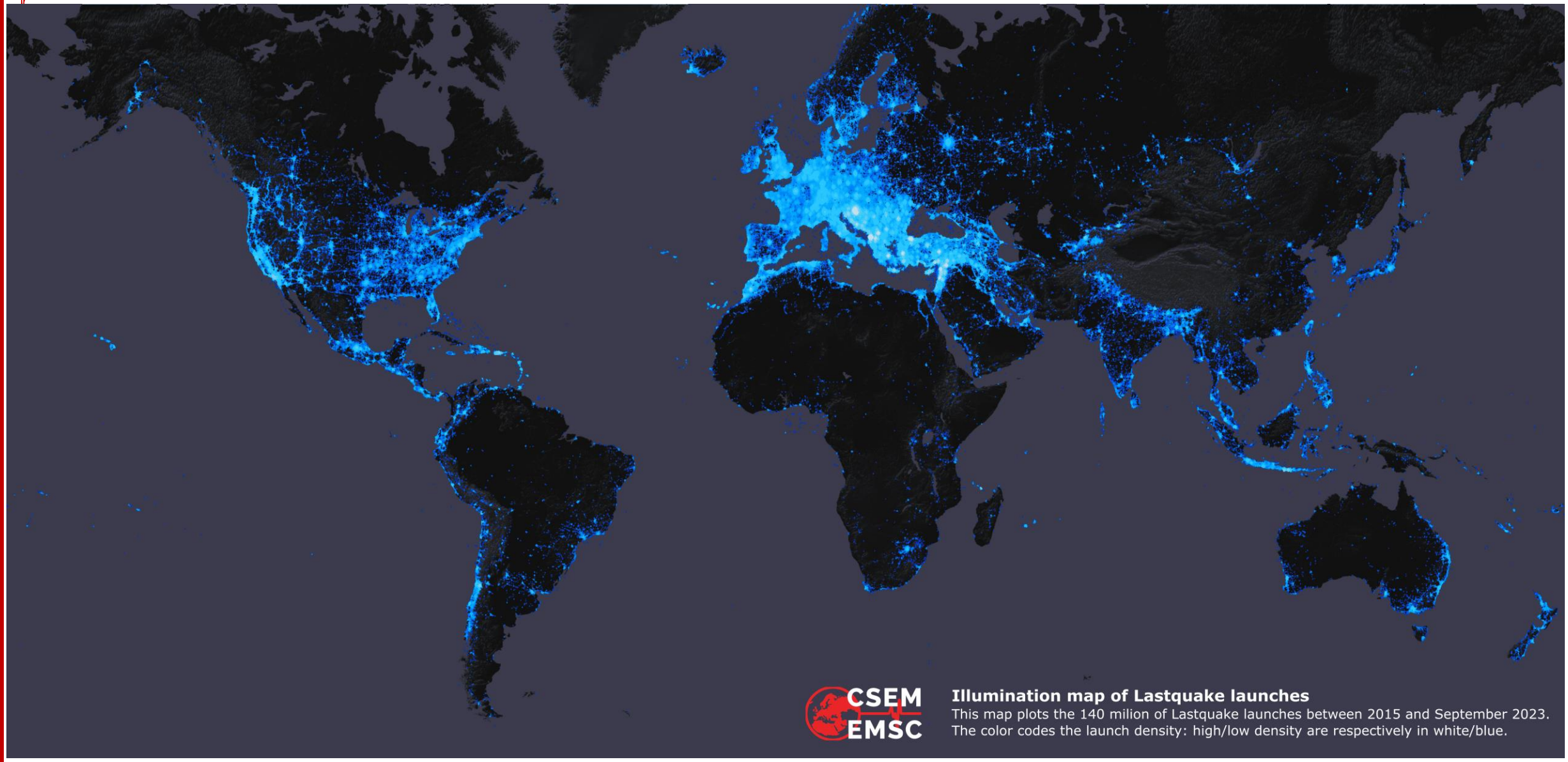


- Questionnaires replaced by cartoons
- Collect geolocated pics & videos
- Comments shared on Facebook, Twitter
- Available in 40+ languages

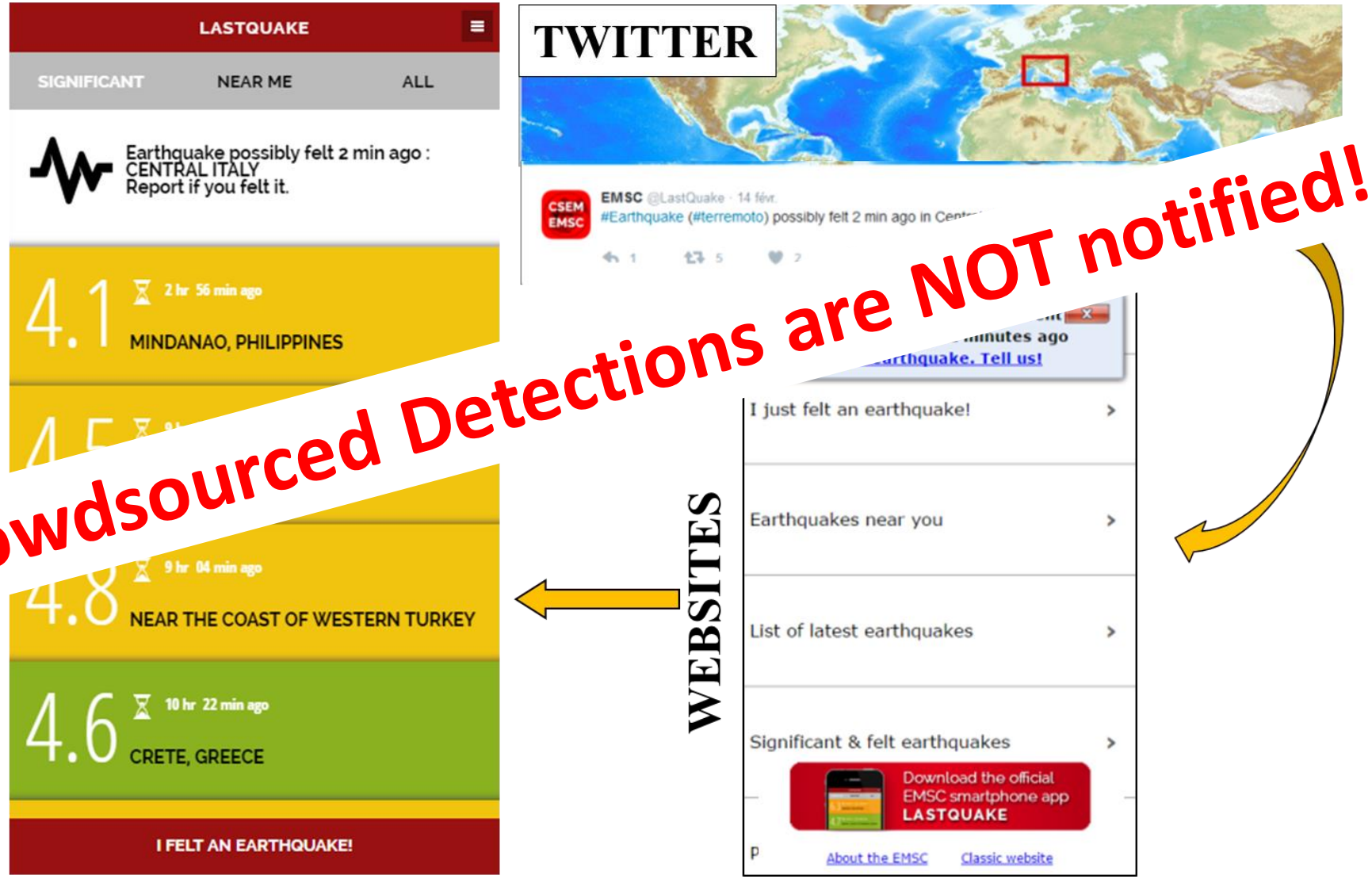
1M+ Users



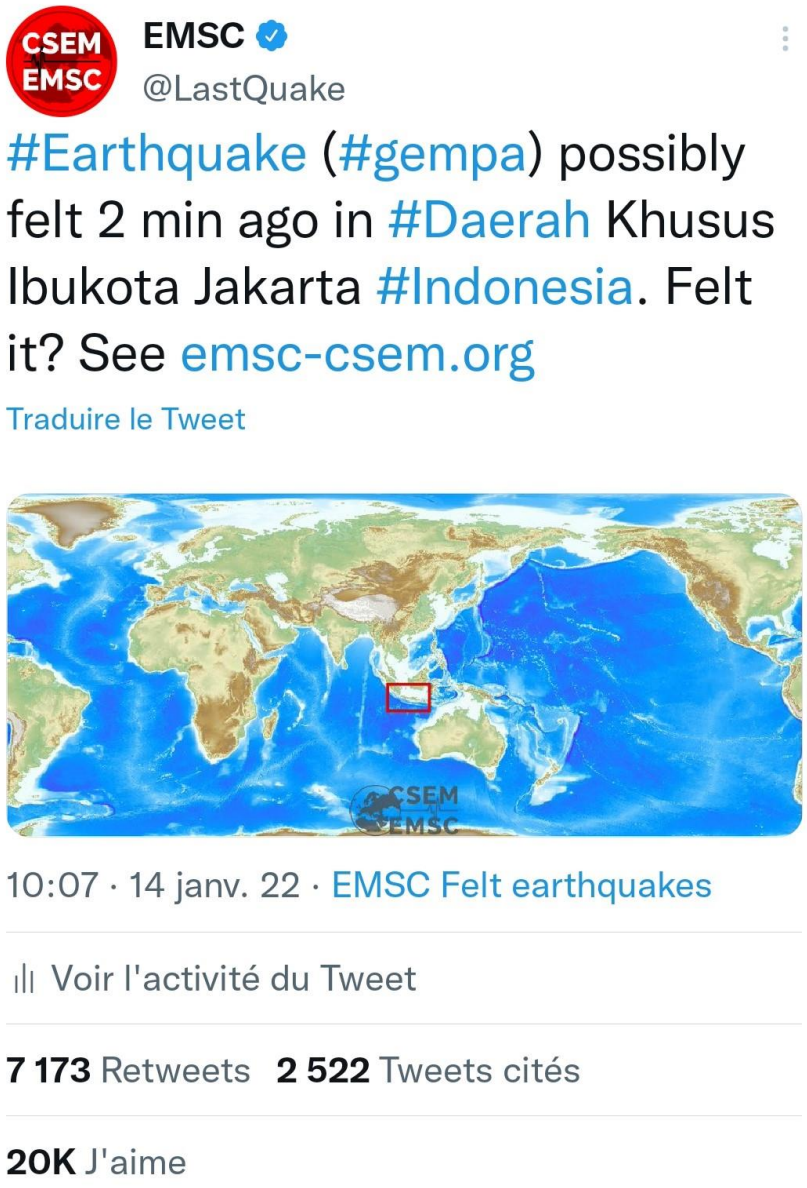
Cumulative LastQuake App Activity!



Crowdsourced Detections for Eyewitnesses' Engagement



Findability and Visibility: Jan. 2022 Sunda strait M6.6



- « #Earthquake » in local language
- Tweet geo-located at detection location
- 2M views (15k followers from Indonesia)
- 77% of the 4,873 Indonesian website visitors within 30 min from this Tweet!
- 2/3 of the 438 felt reports collected from websites

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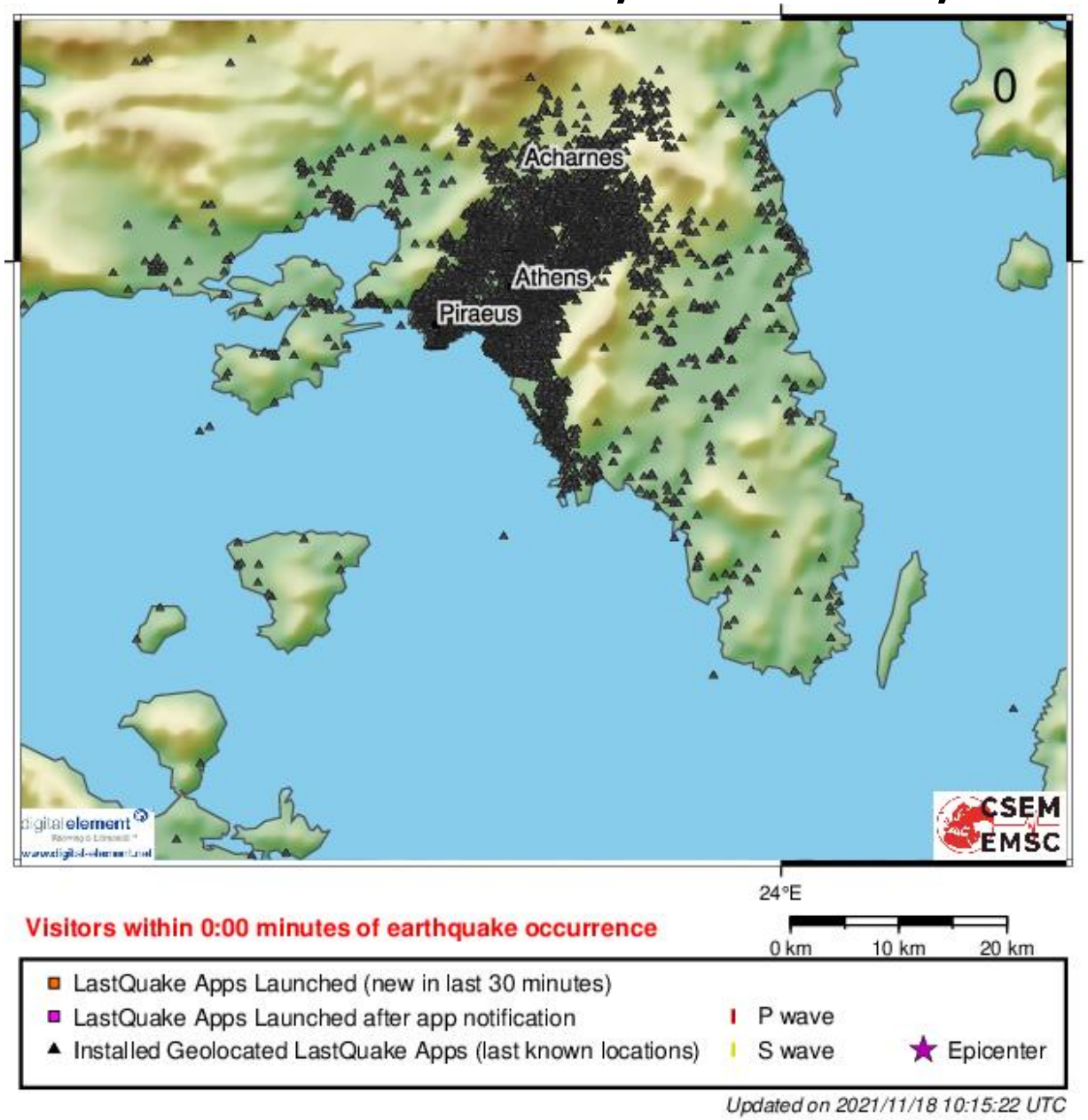
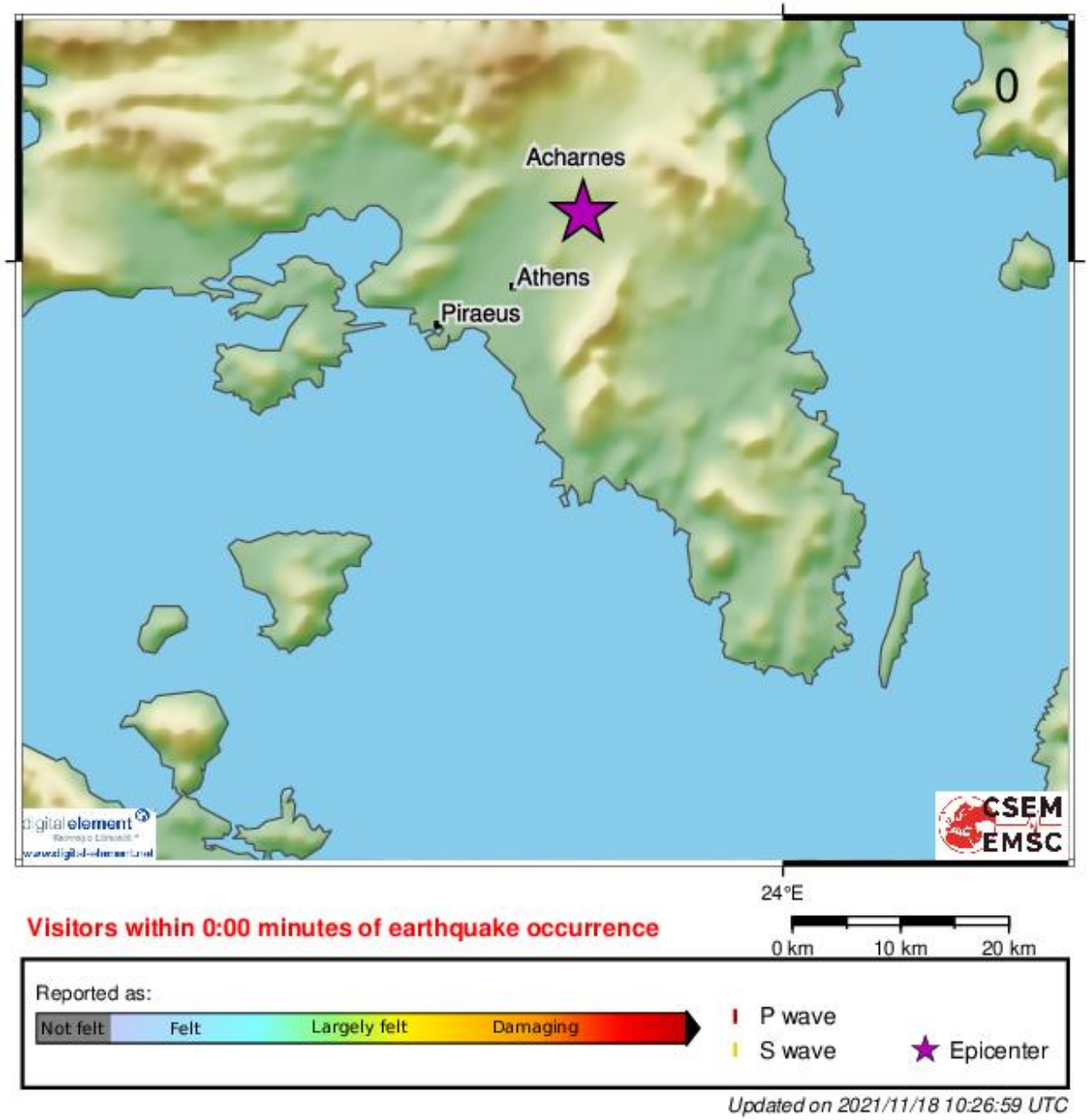
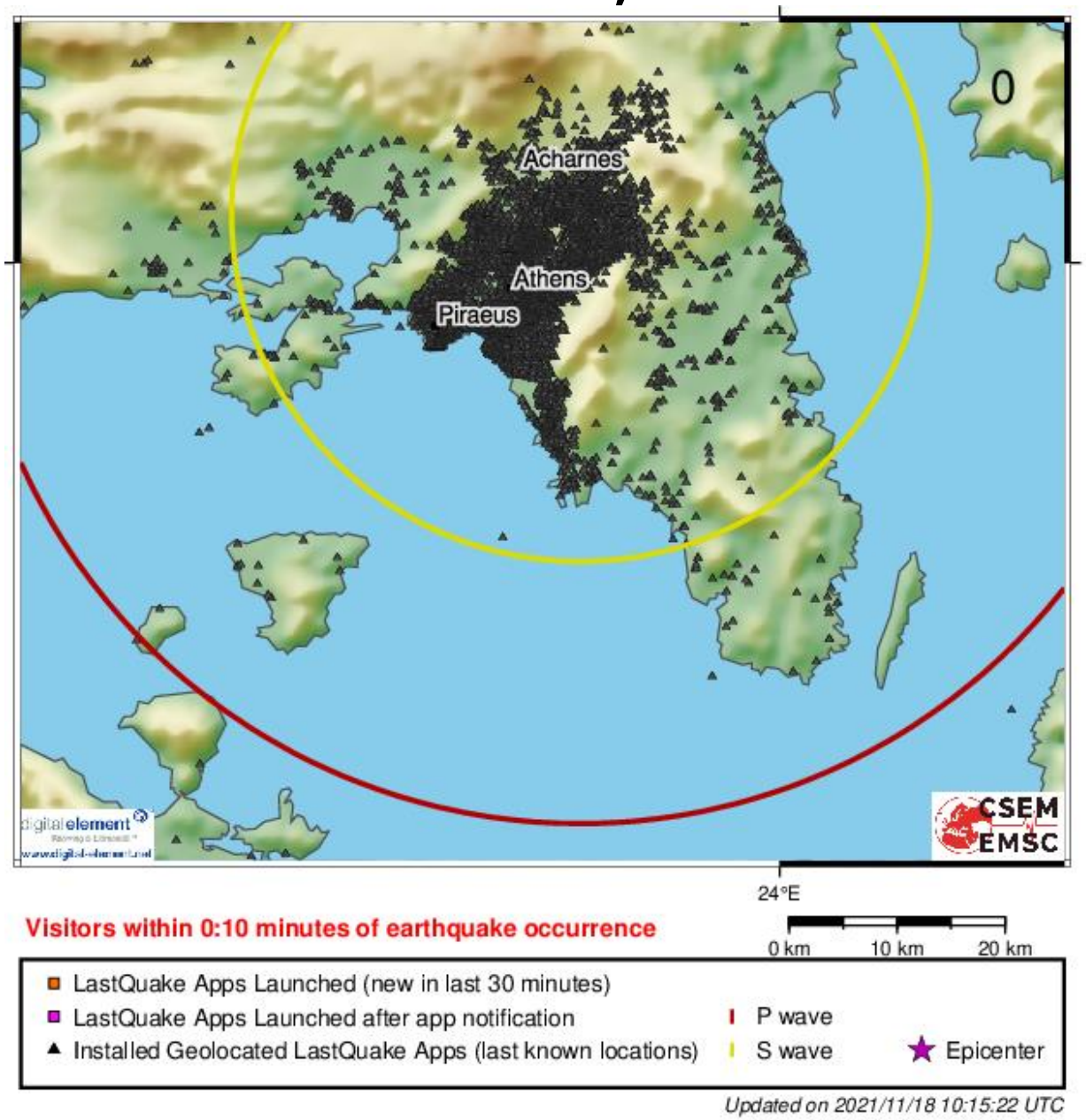
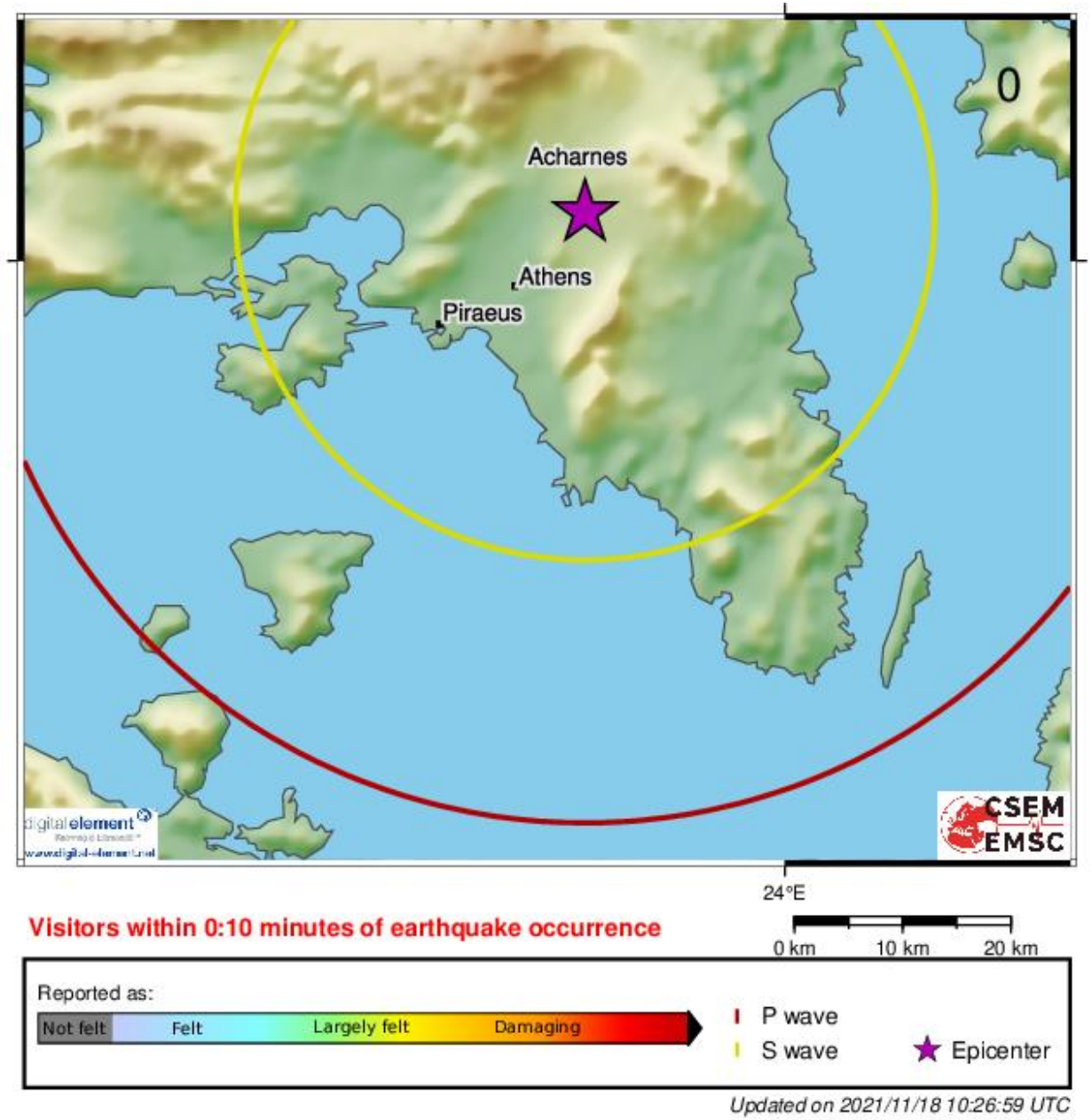
M2.9 Athens, Greece, Oct. 25th 2021 12:52 UTC



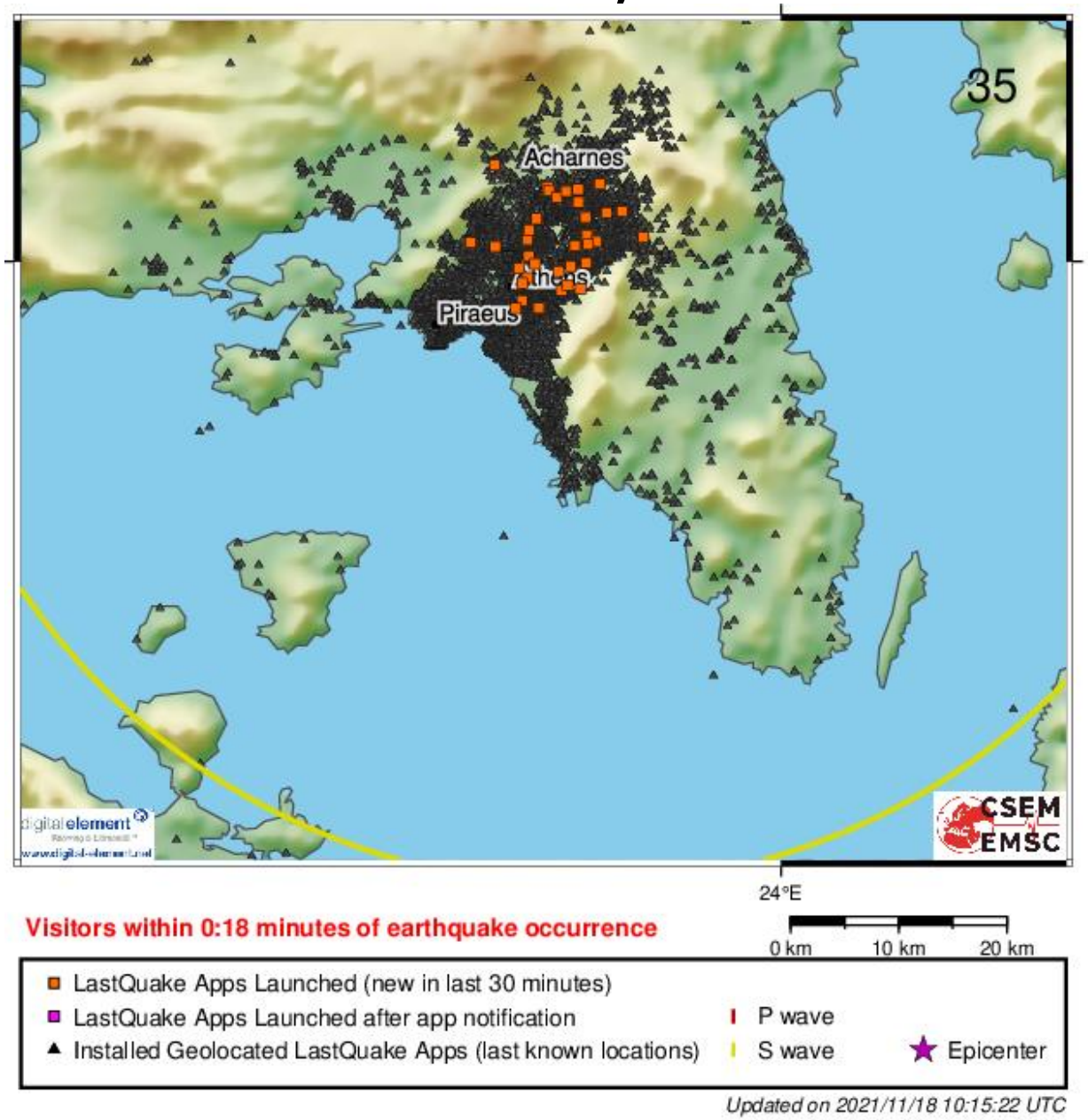


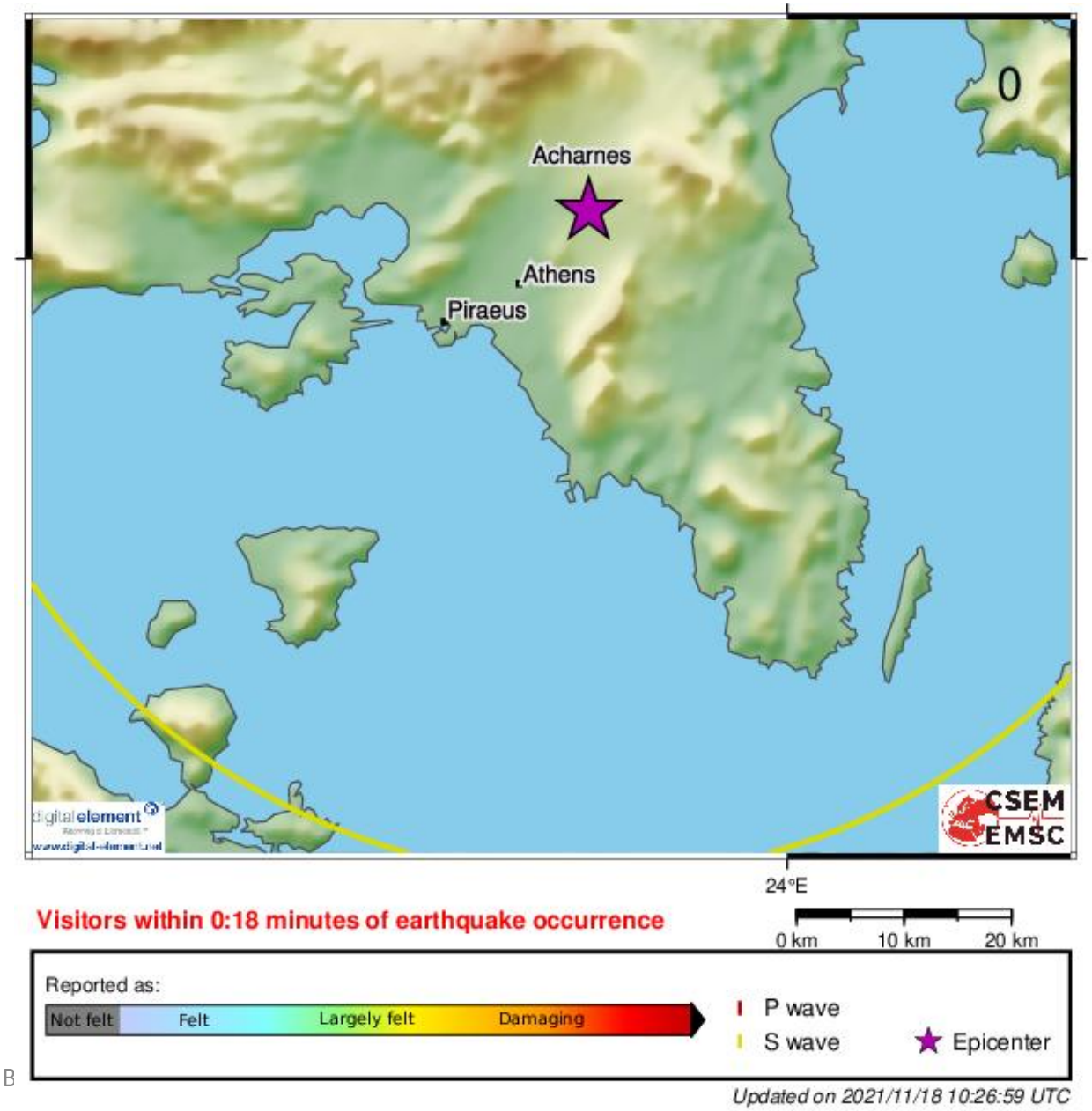
M2.9 Athens, Greece **T0 + 010s**



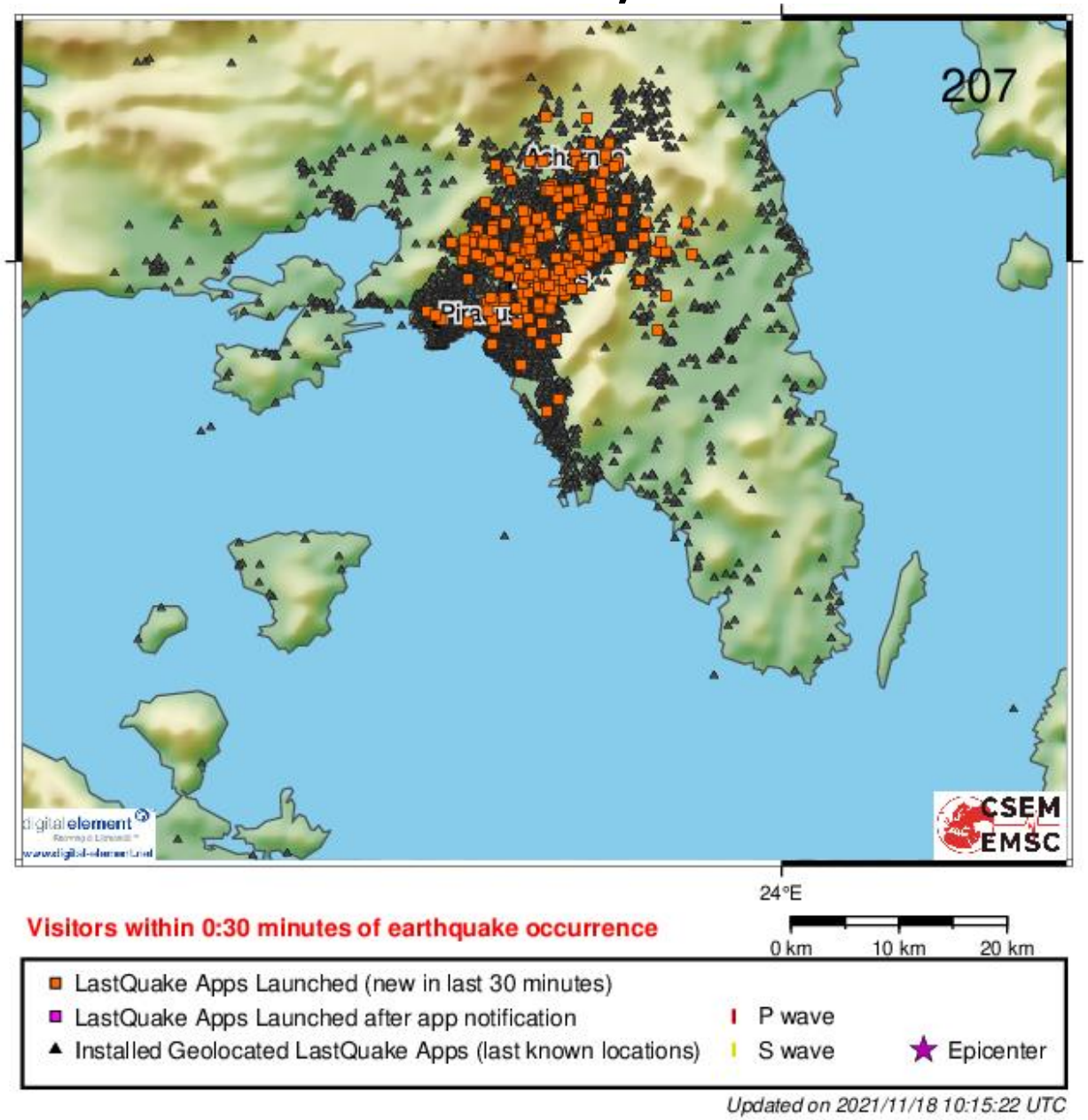


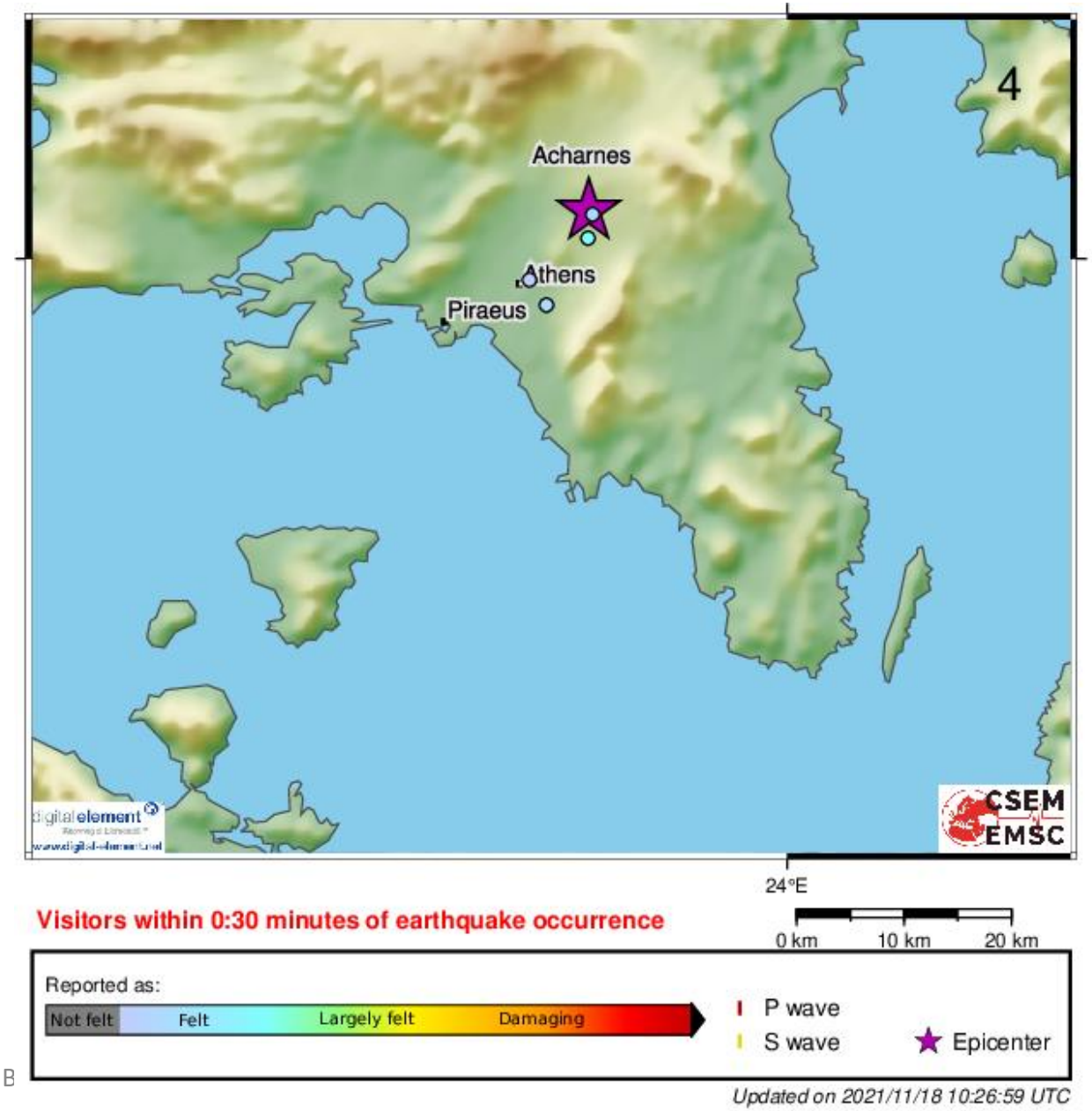
M2.9 Athens, Greece **T0 + 018s**



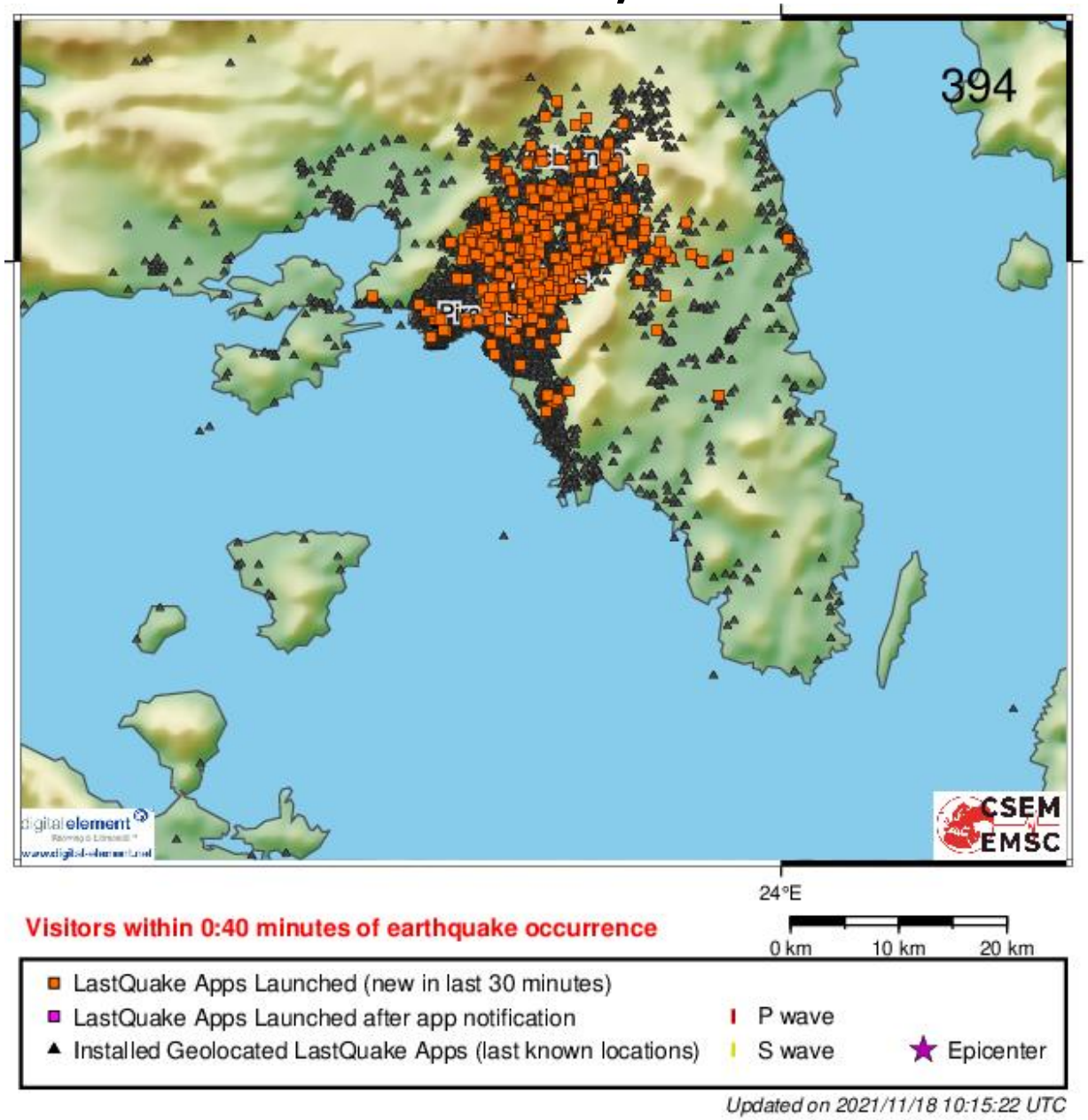


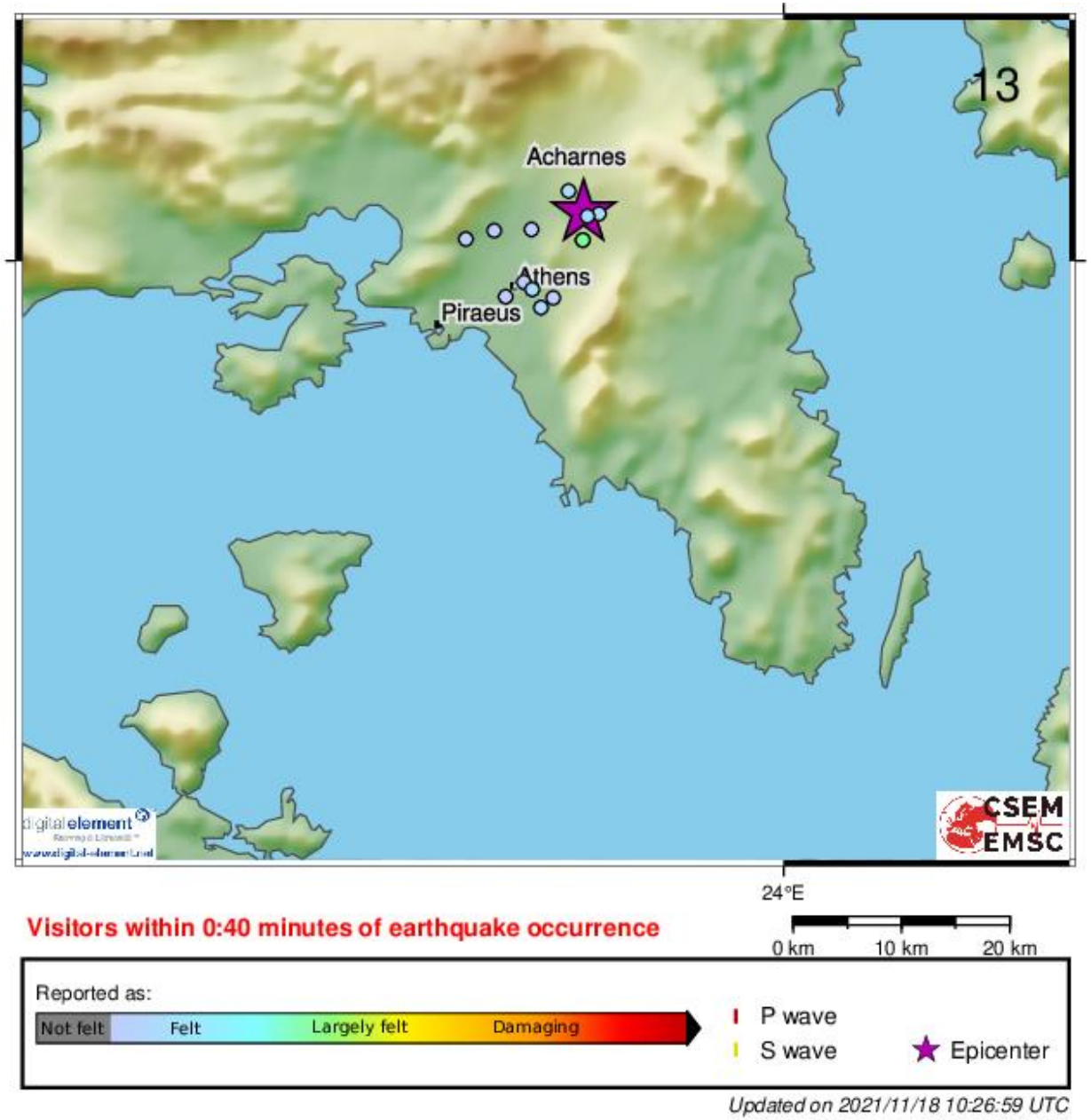
M2.9 Athens, Greece **T0 + 030s**



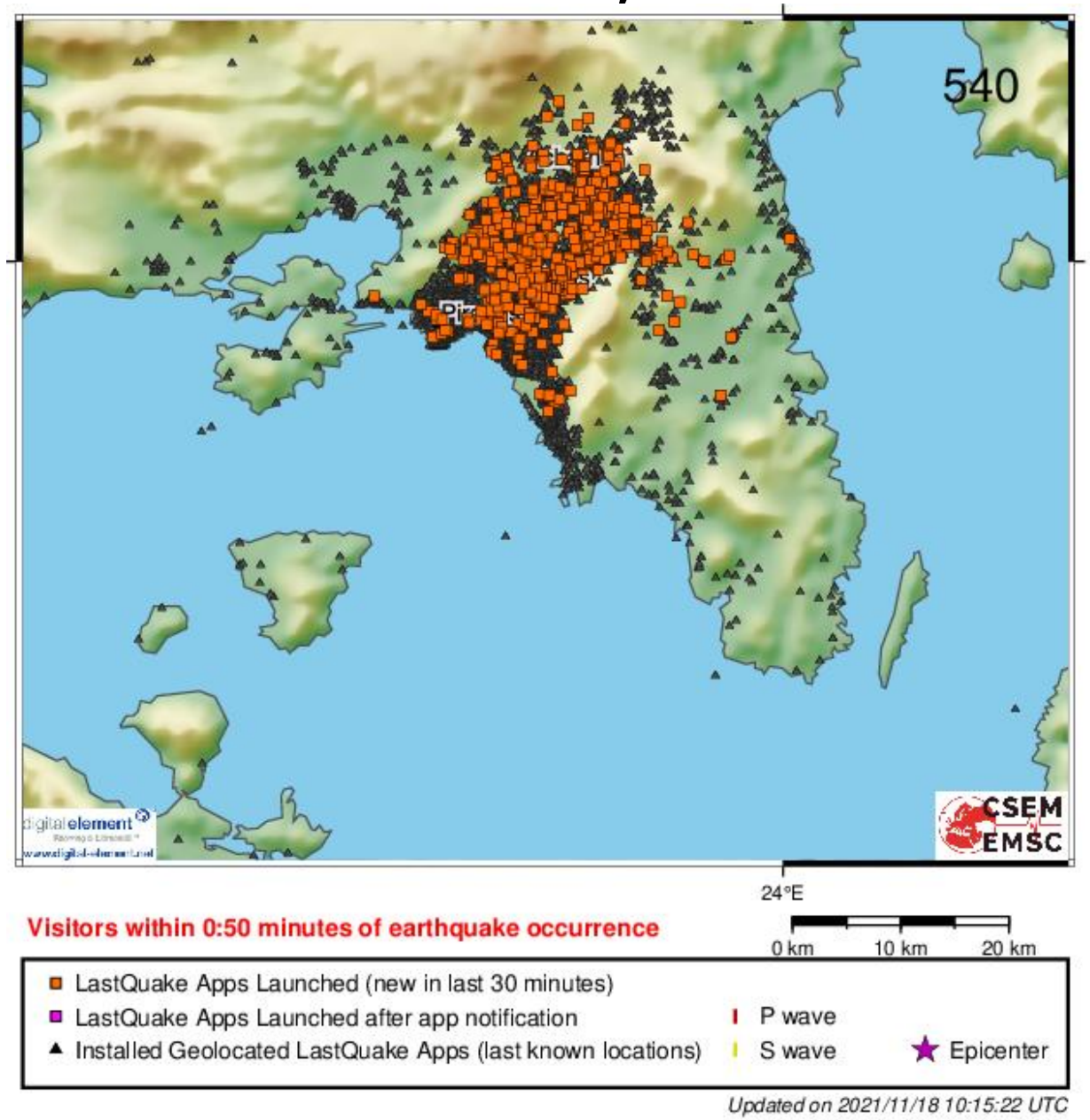


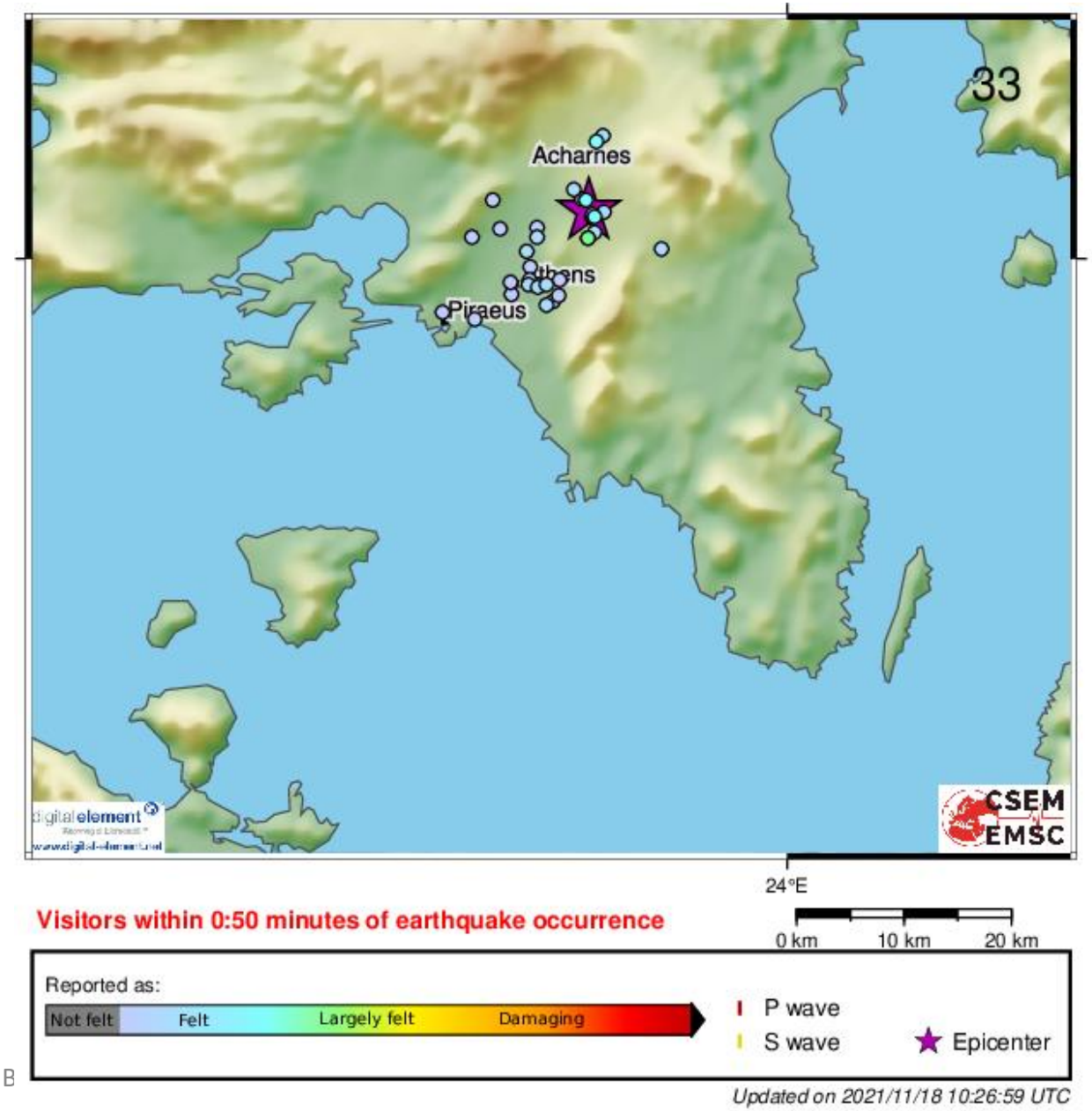
M2.9 Athens, Greece **T0 + 040s**



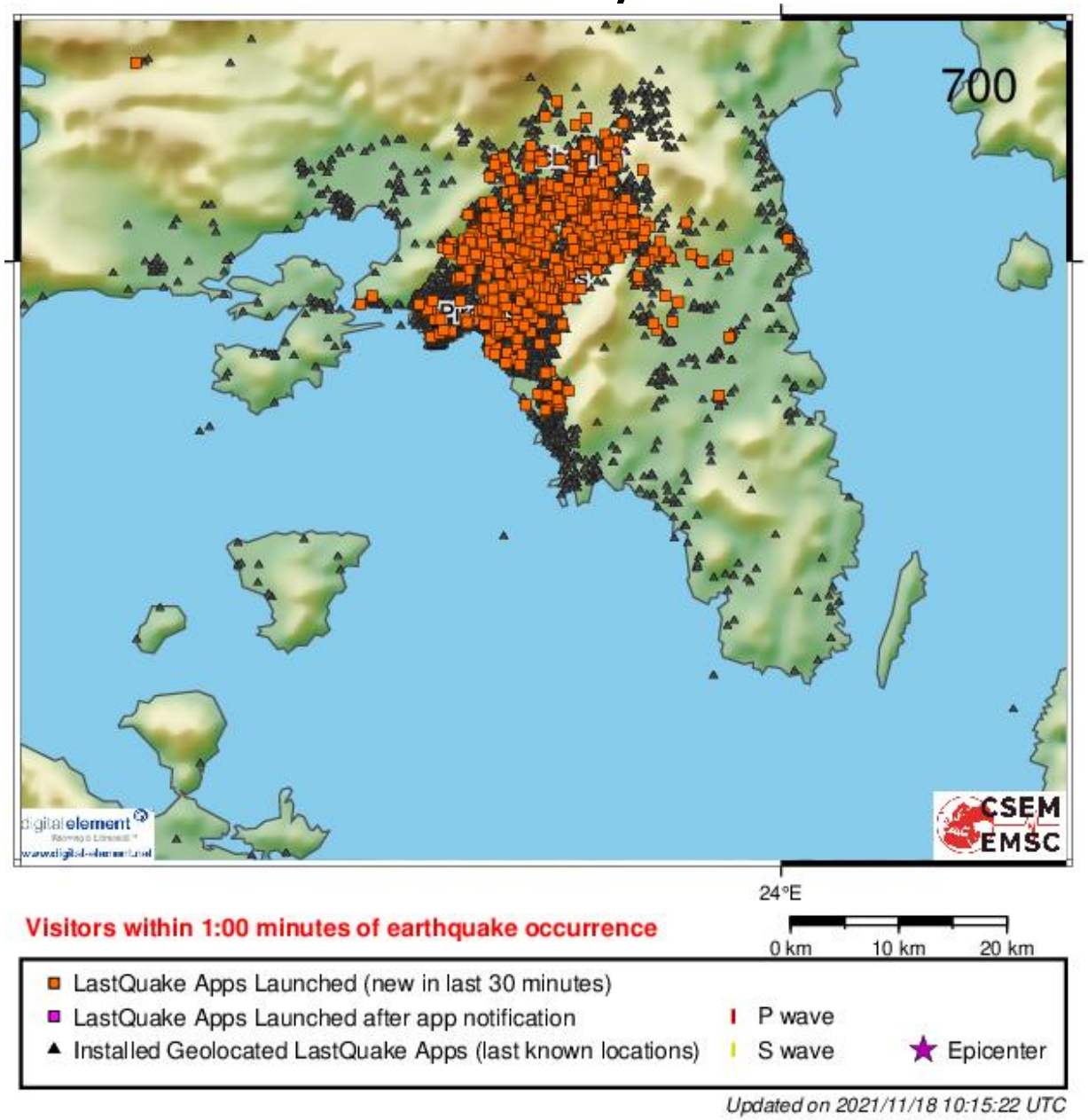


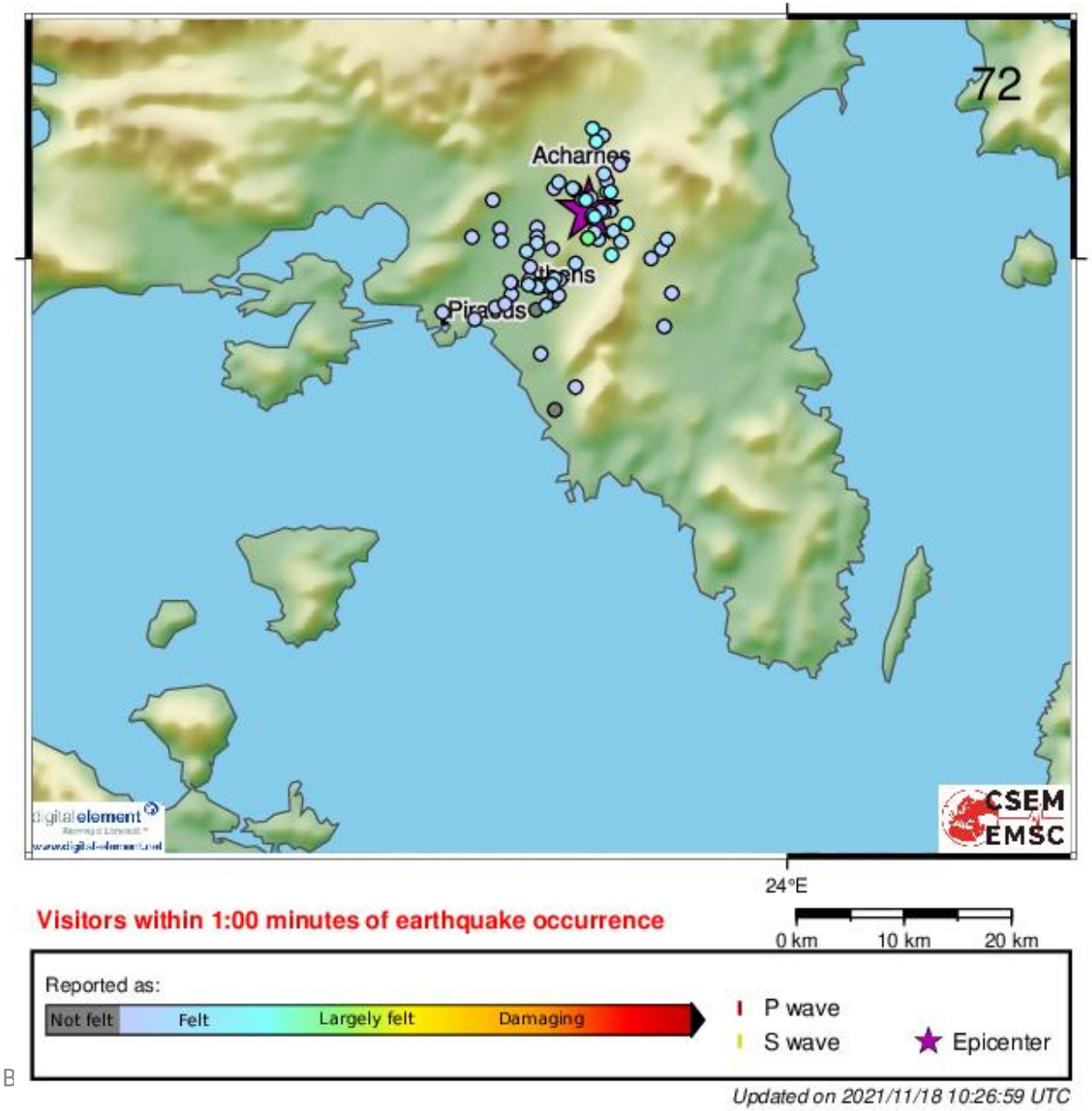
M2.9 Athens, Greece **T0 + 050s**



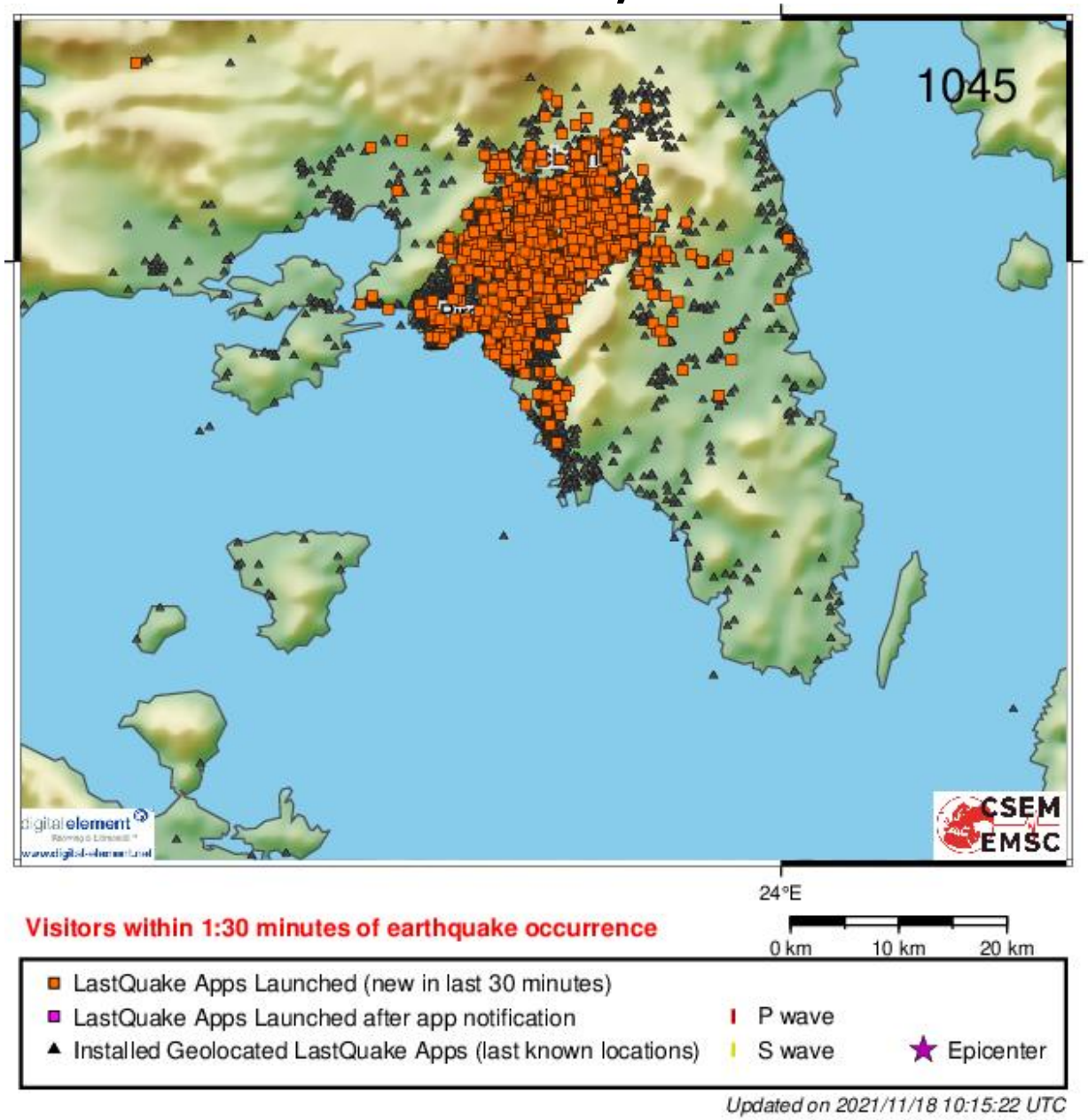


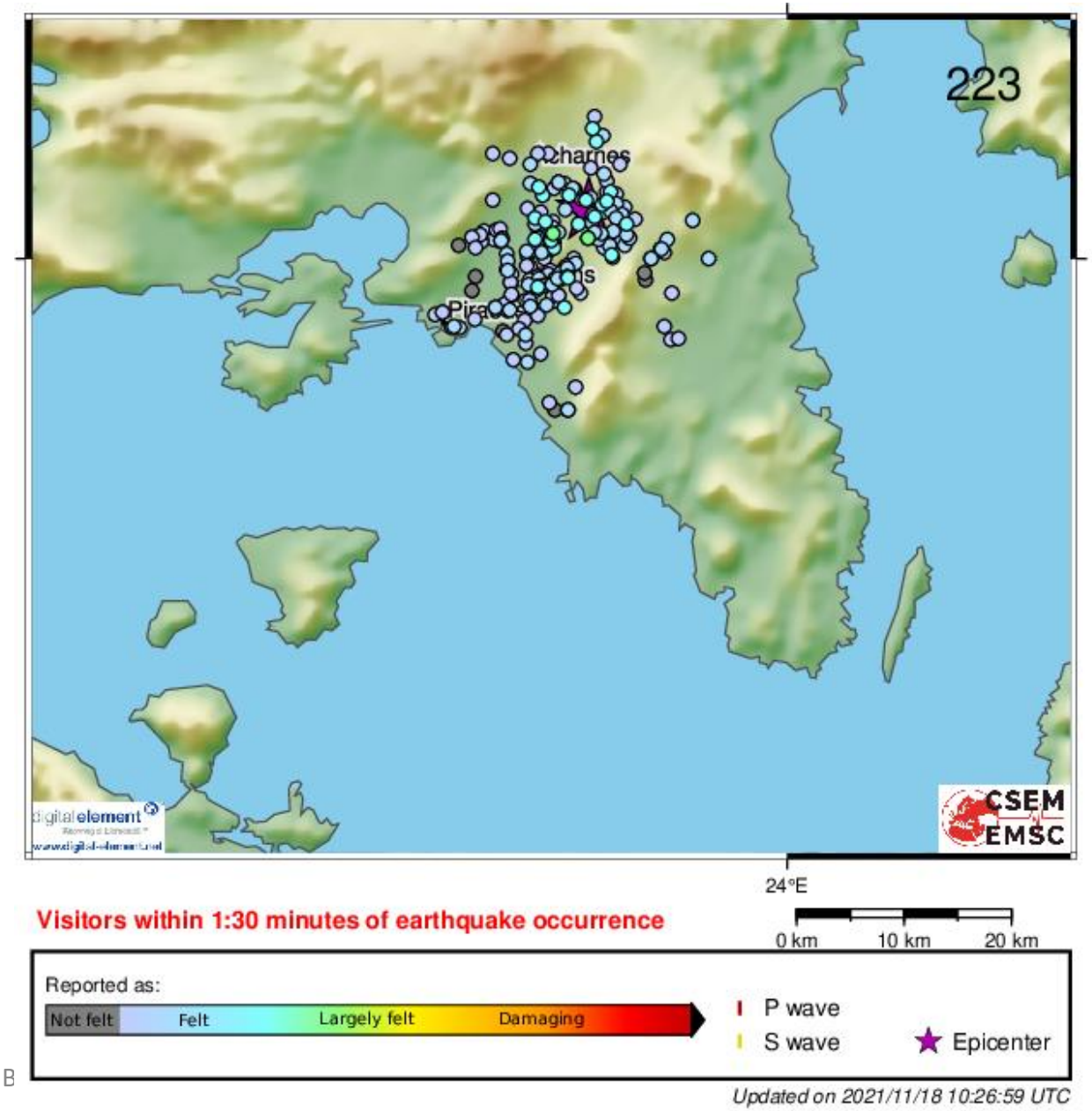
M2.9 Athens, Greece **T0 + 060s**



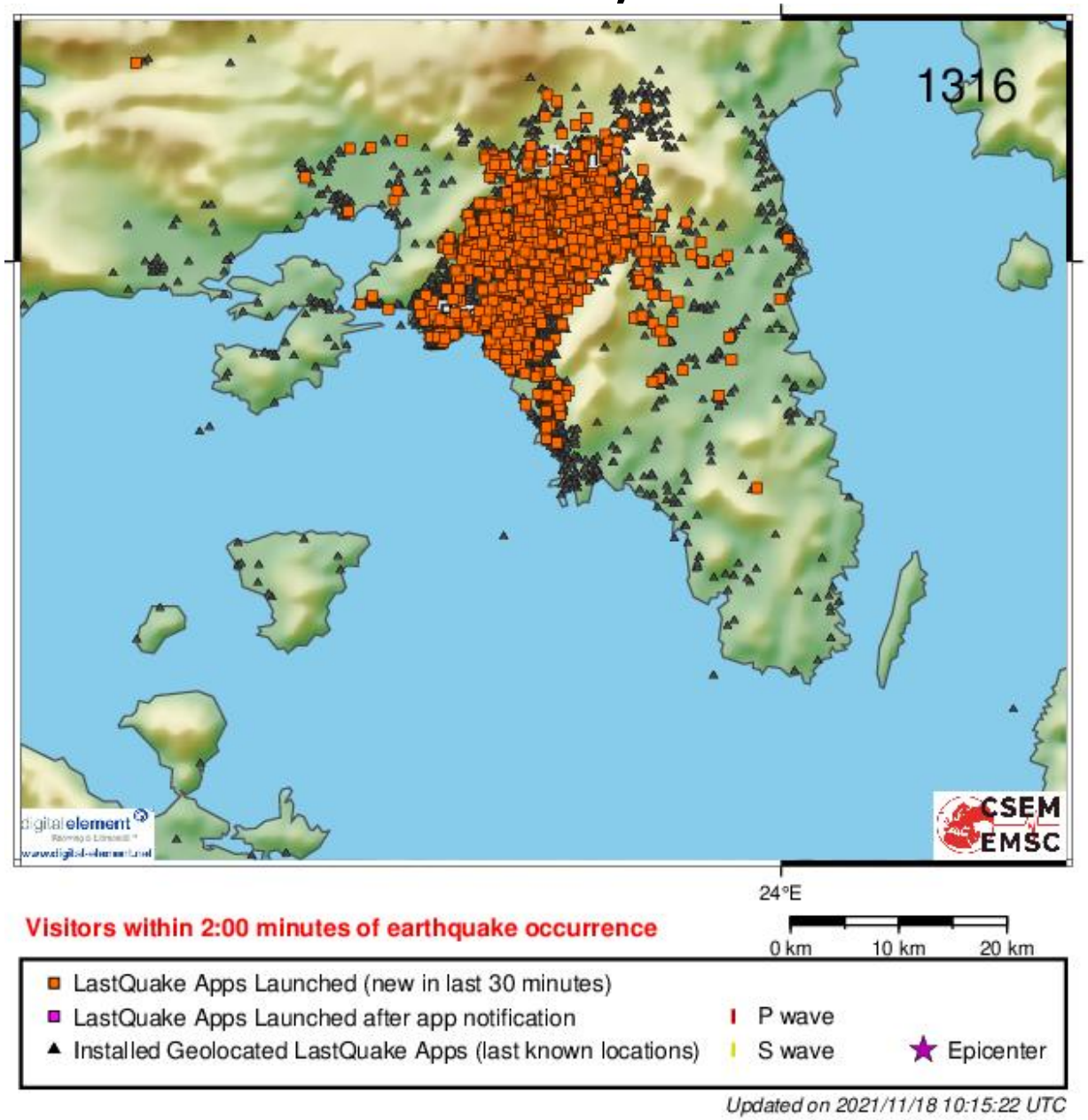


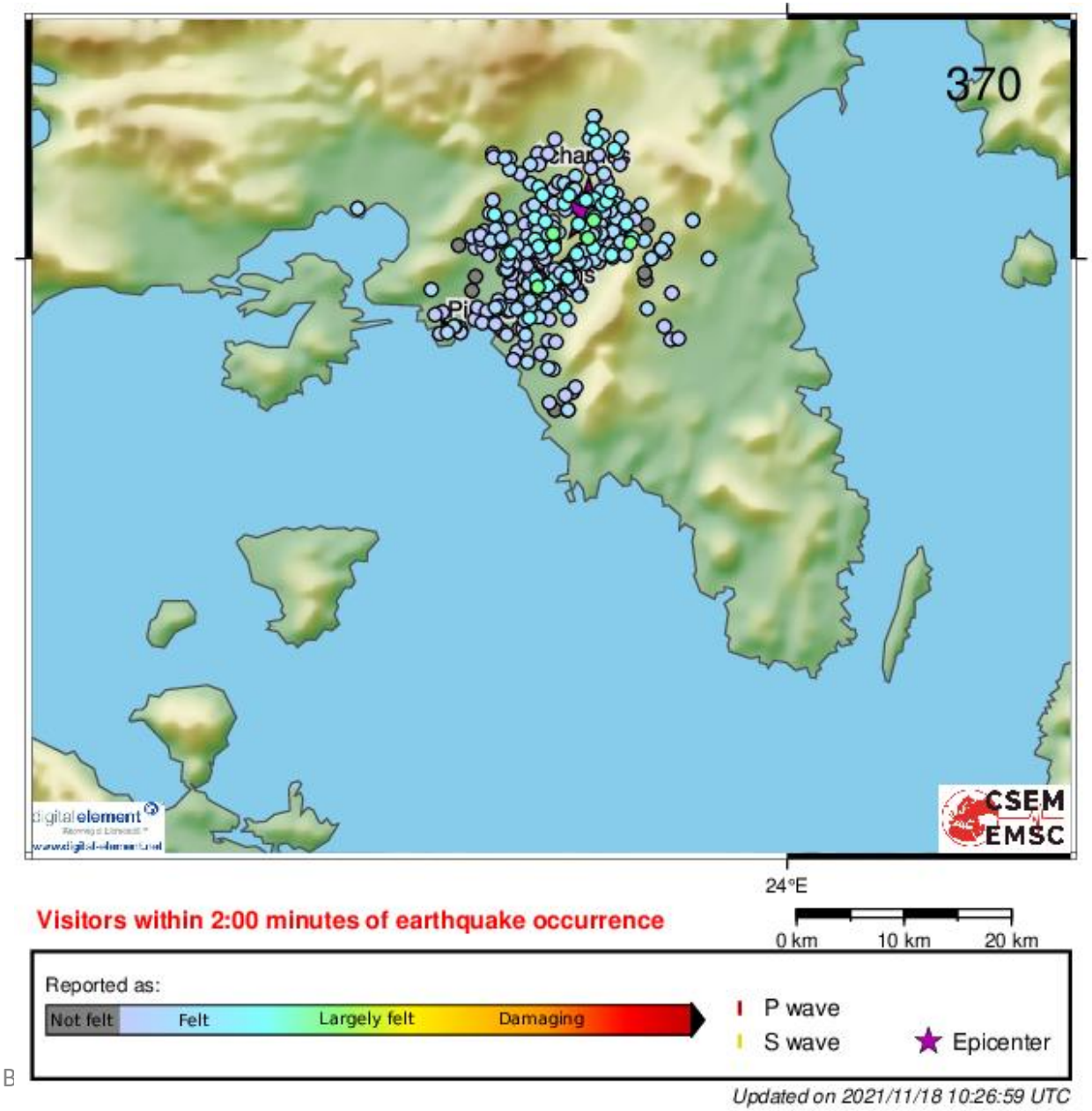
M2.9 Athens, Greece **T0 + 090s**



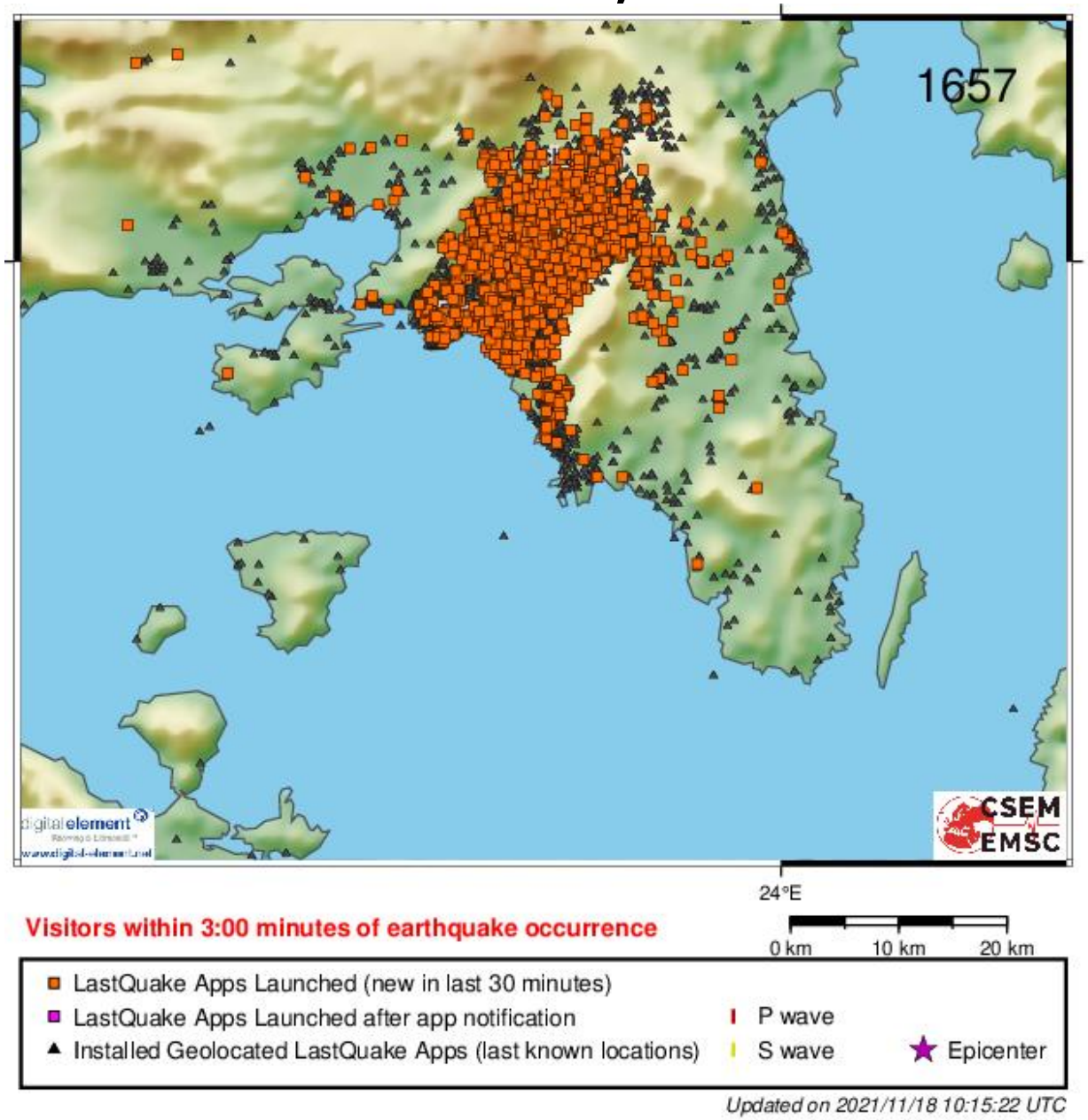


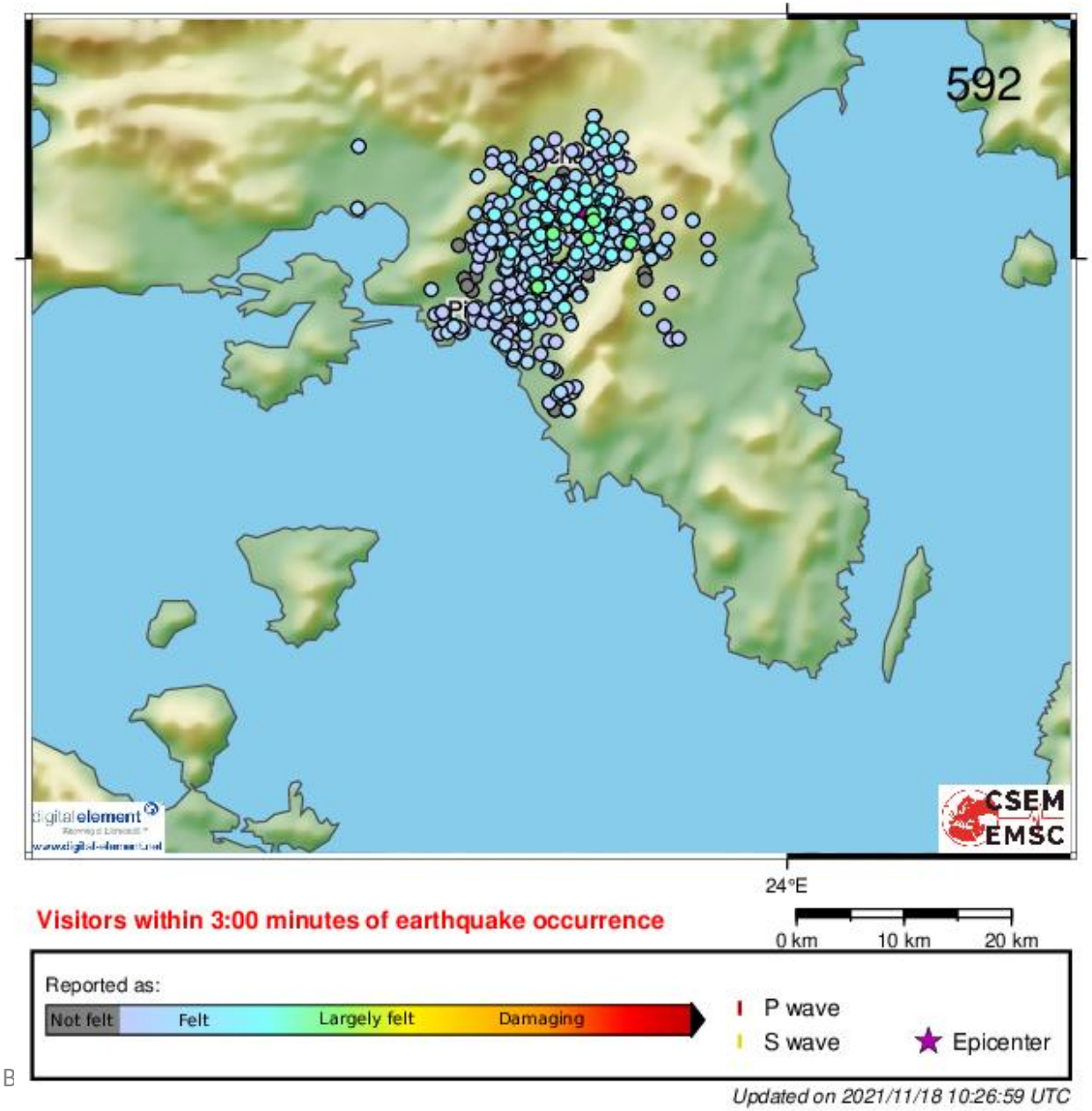
M2.9 Athens, Greece **T0 + 120s**



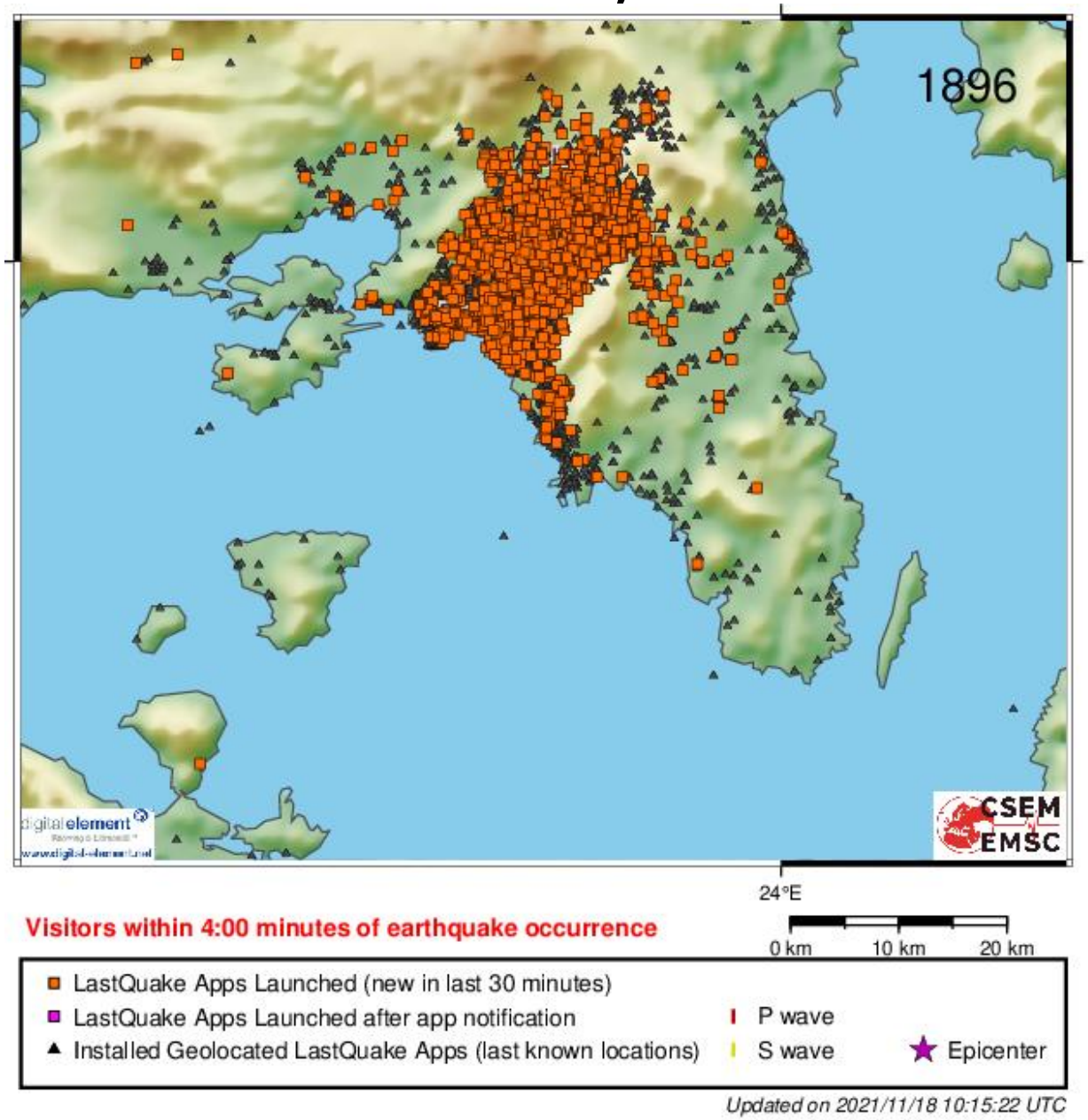


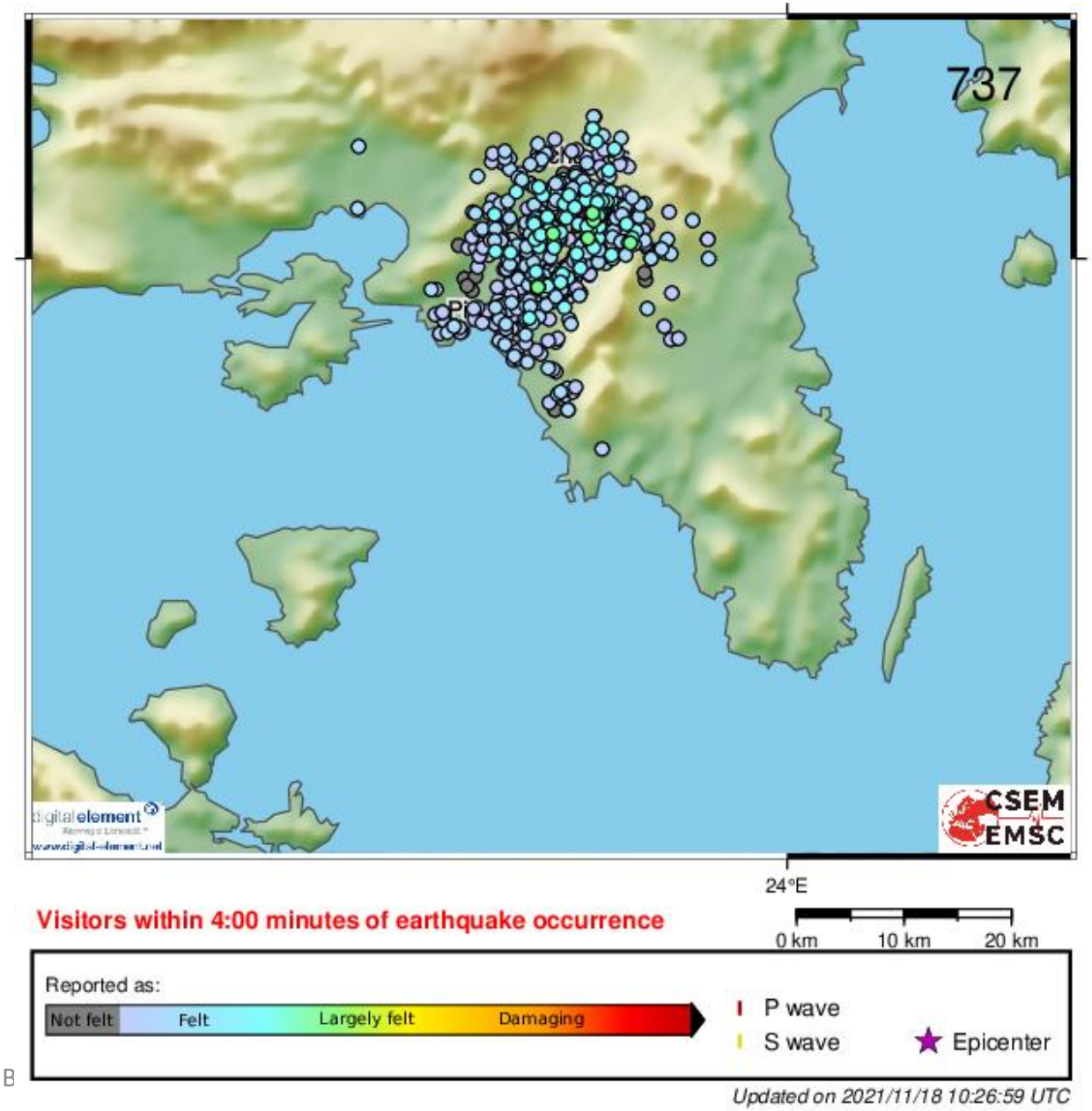
M2.9 Athens, Greece **T0 + 180s**



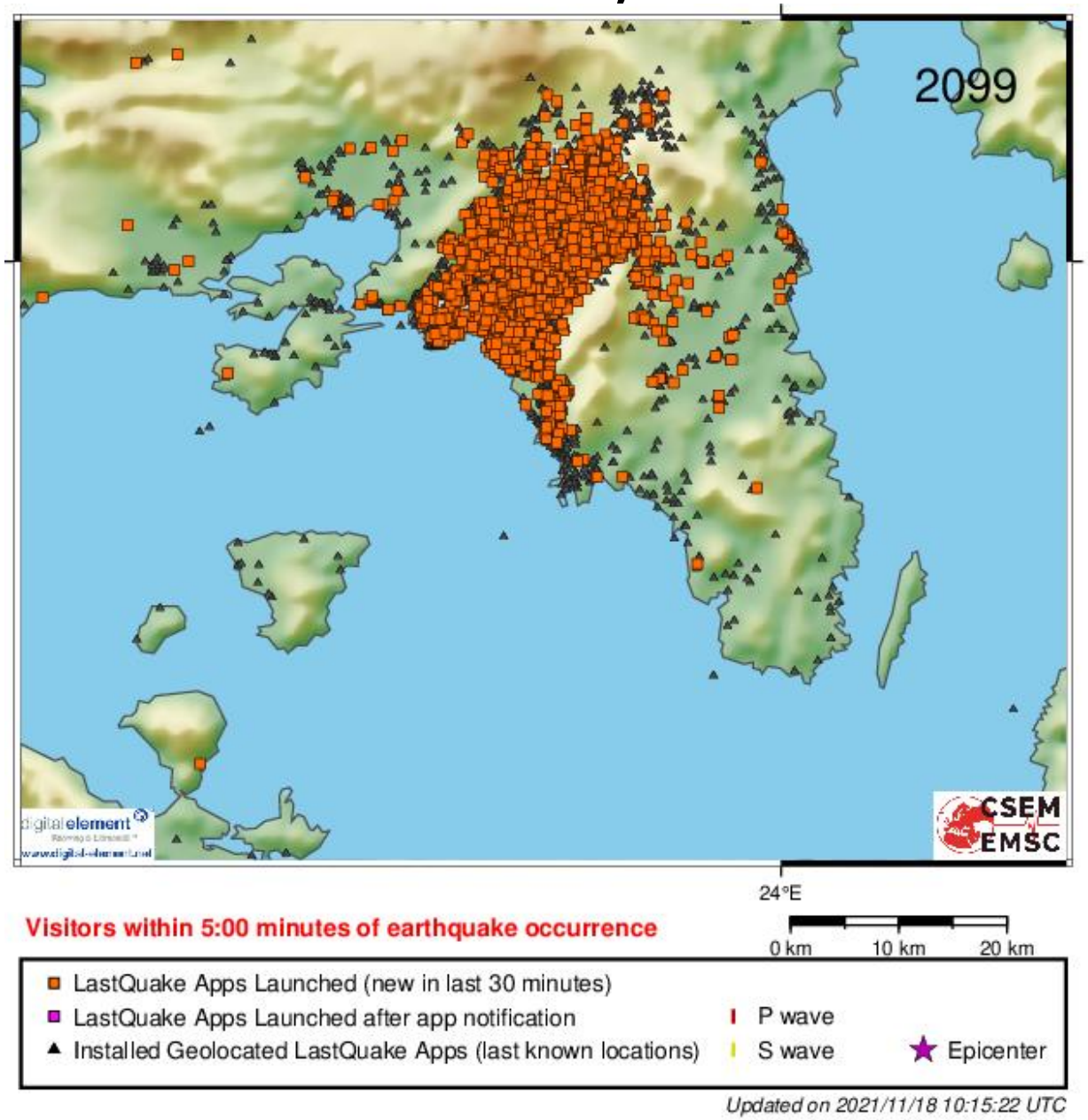


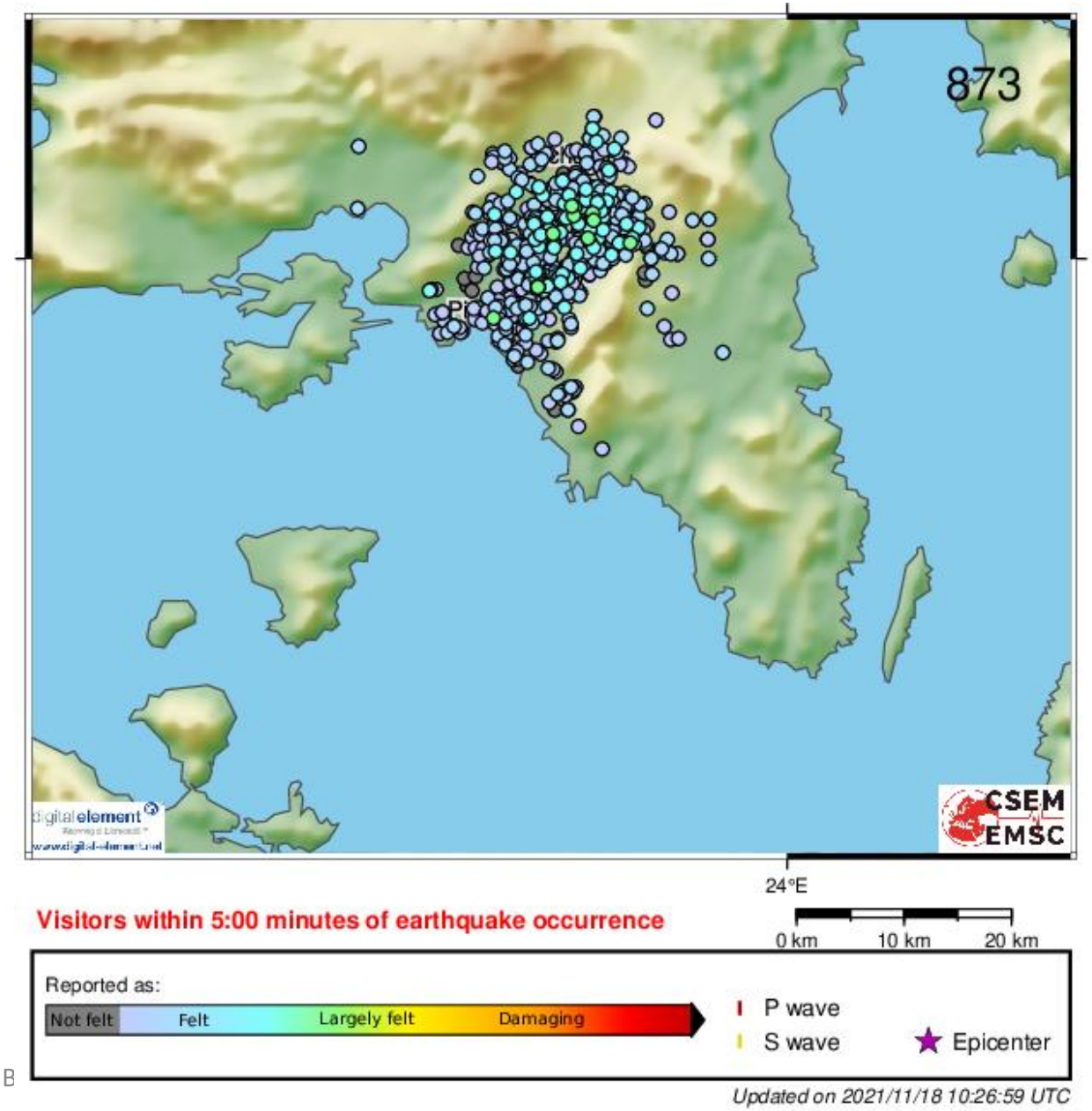
M2.9 Athens, Greece **T0 + 240s**



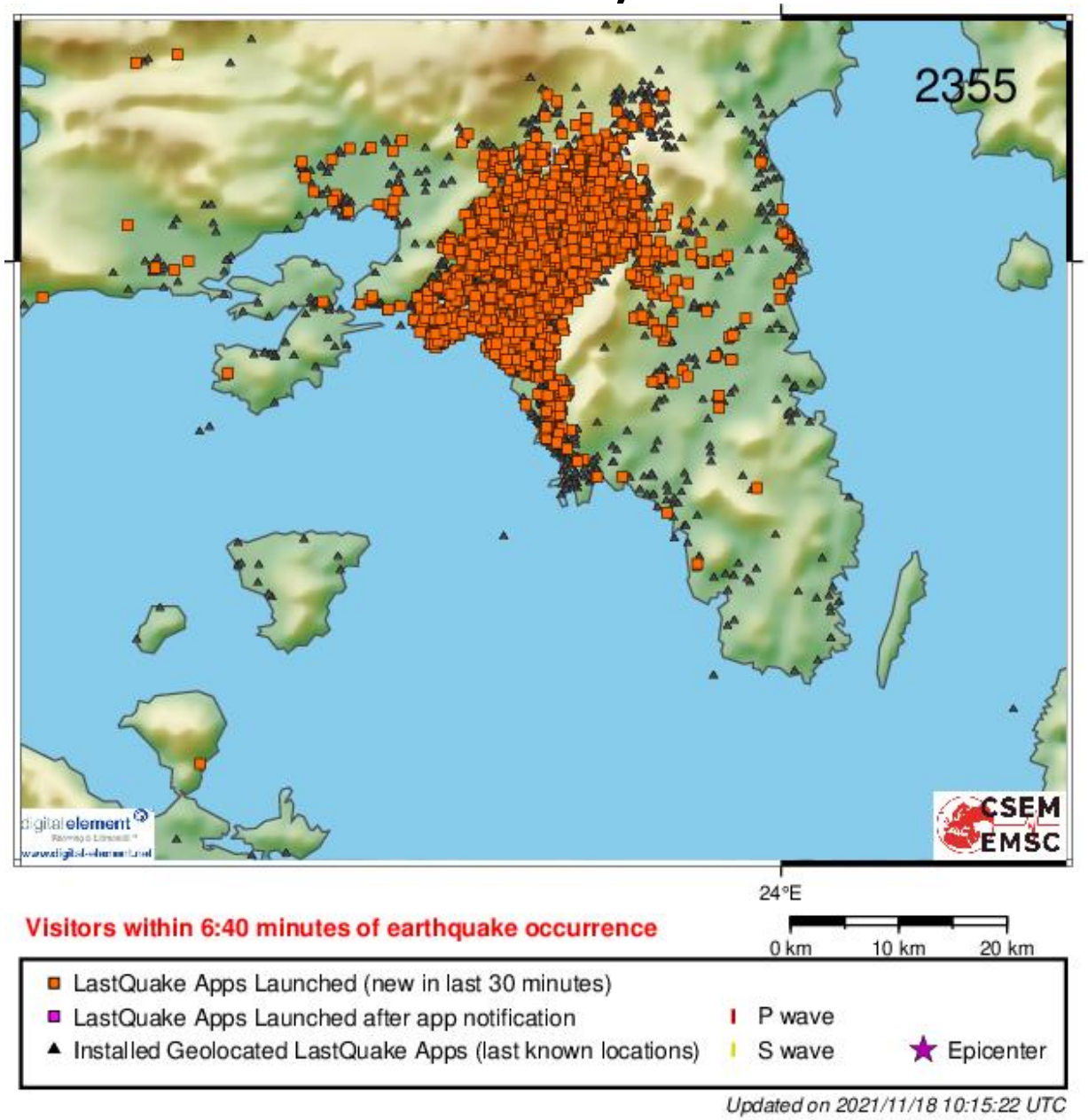


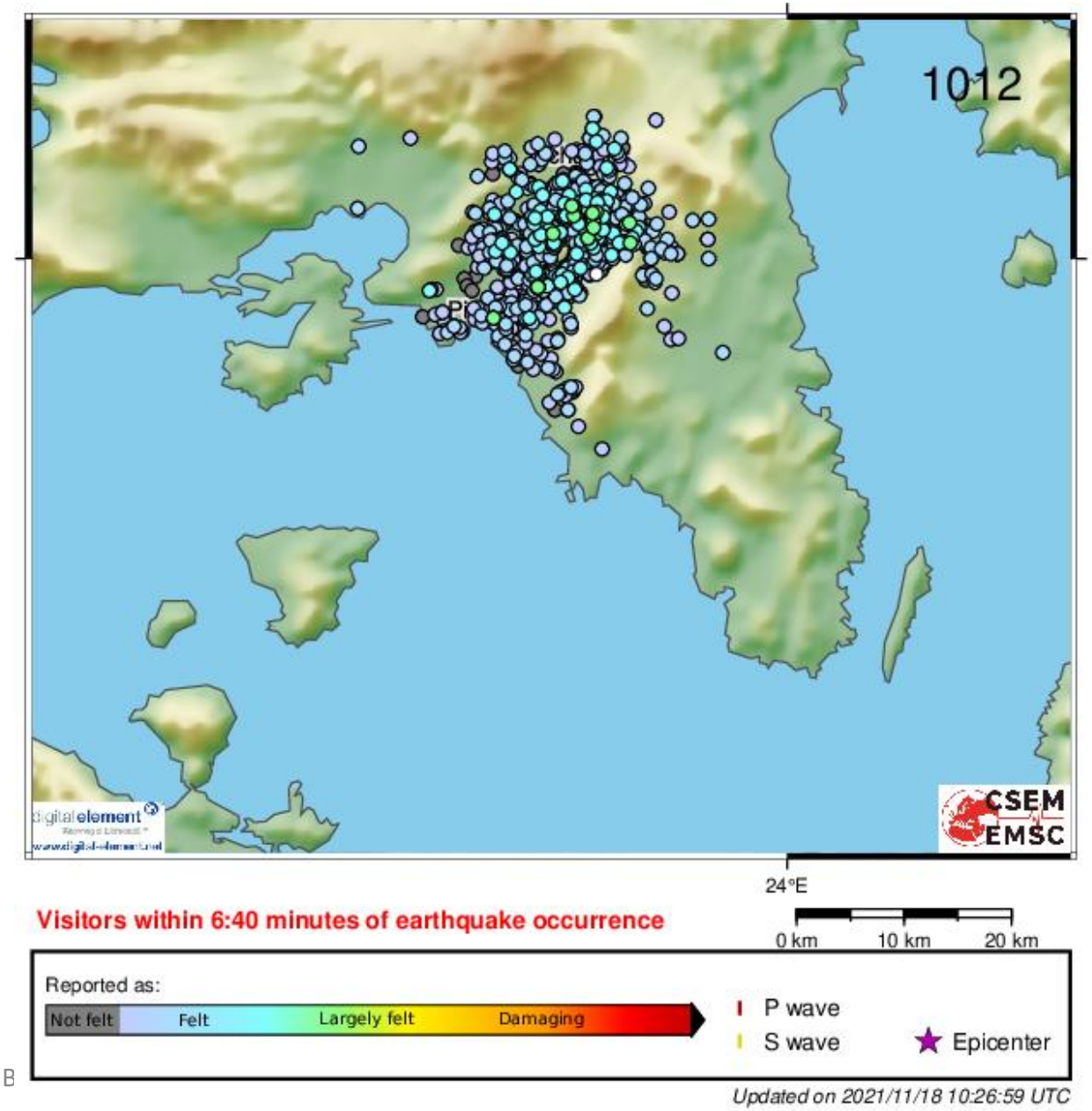
M2.9 Athens, Greece **T0 + 300s**



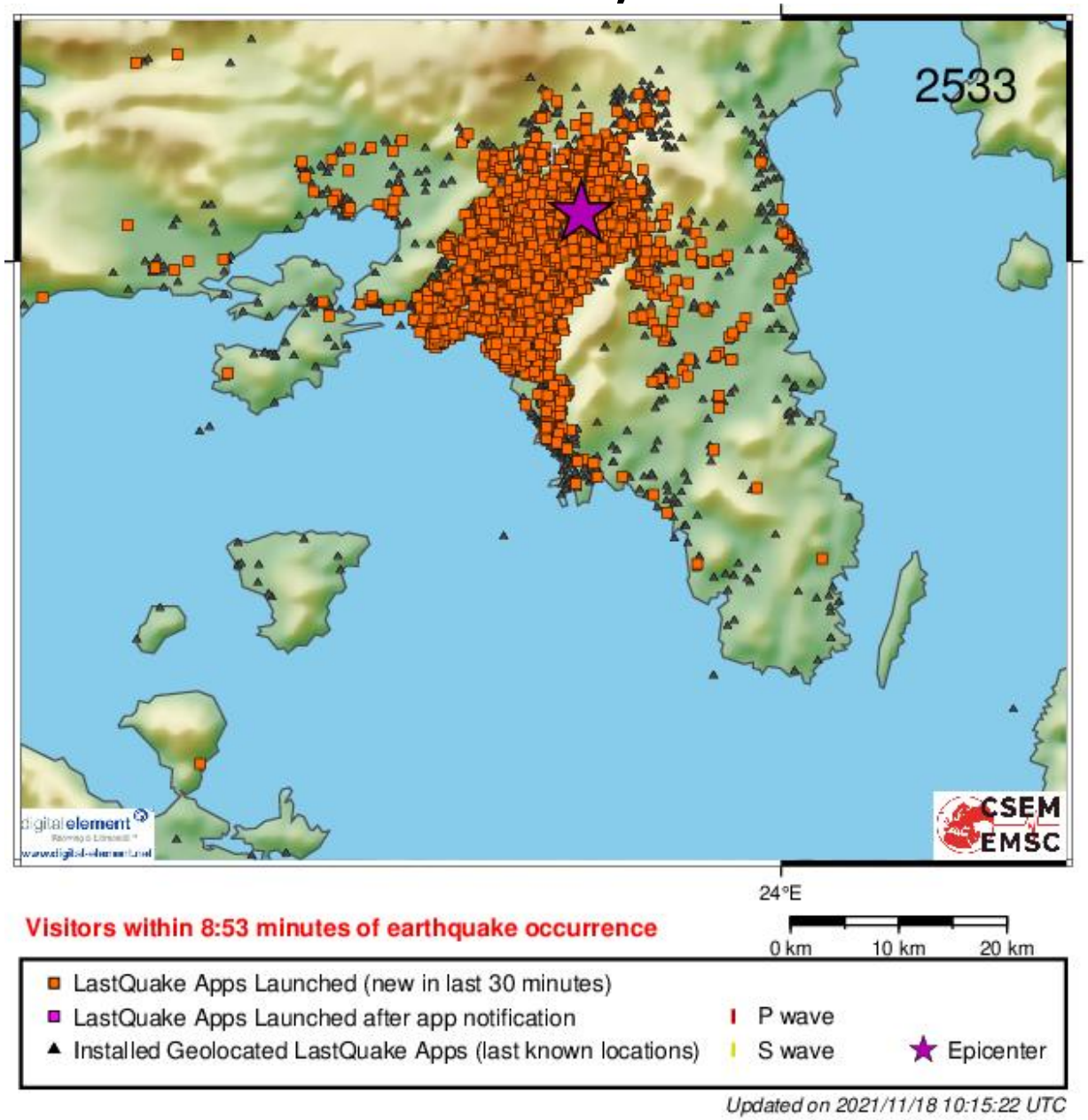


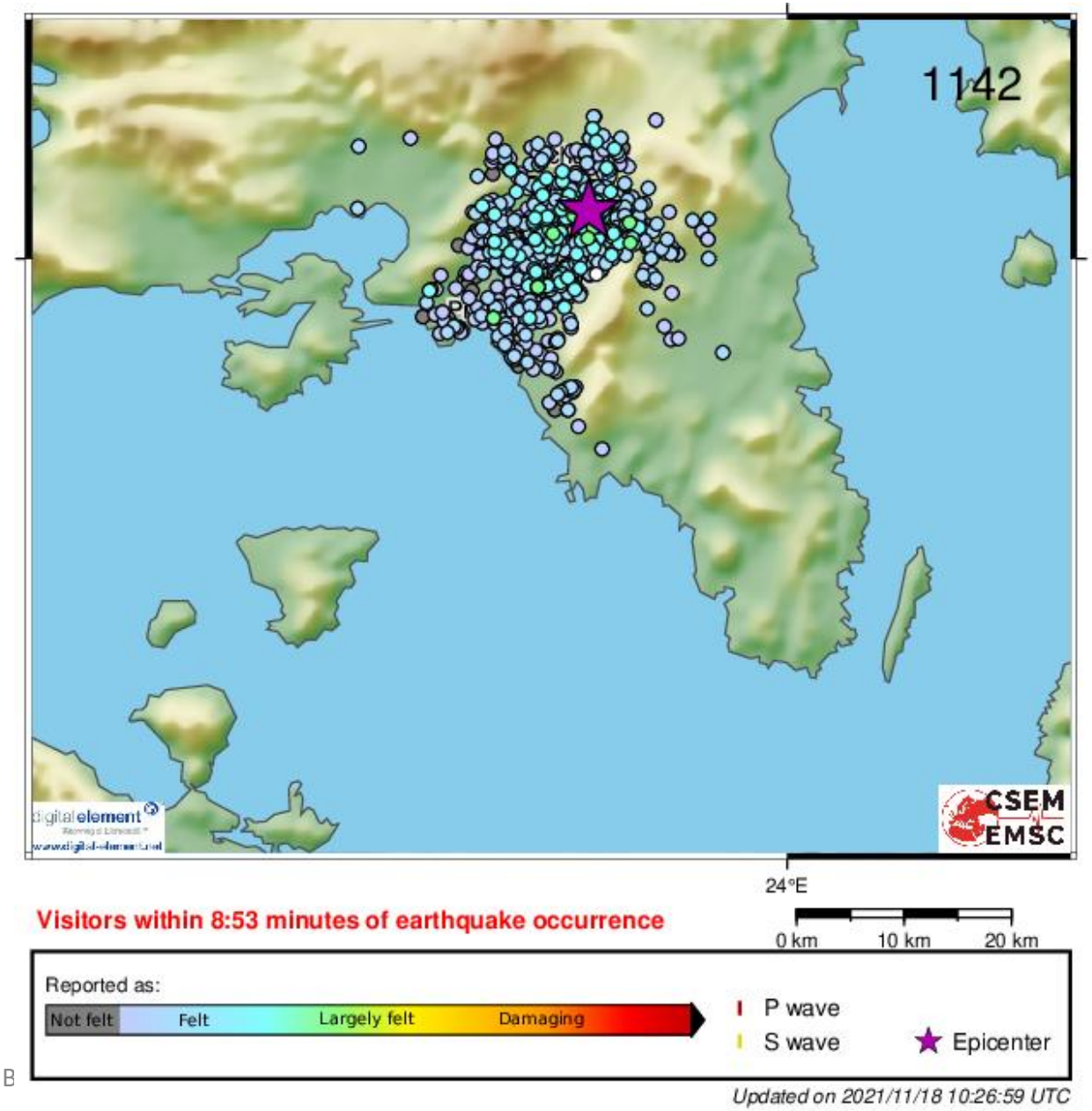
M2.9 Athens, Greece **T0 + 400s**





M2.9 Athens, Greece **T0 + 533s**

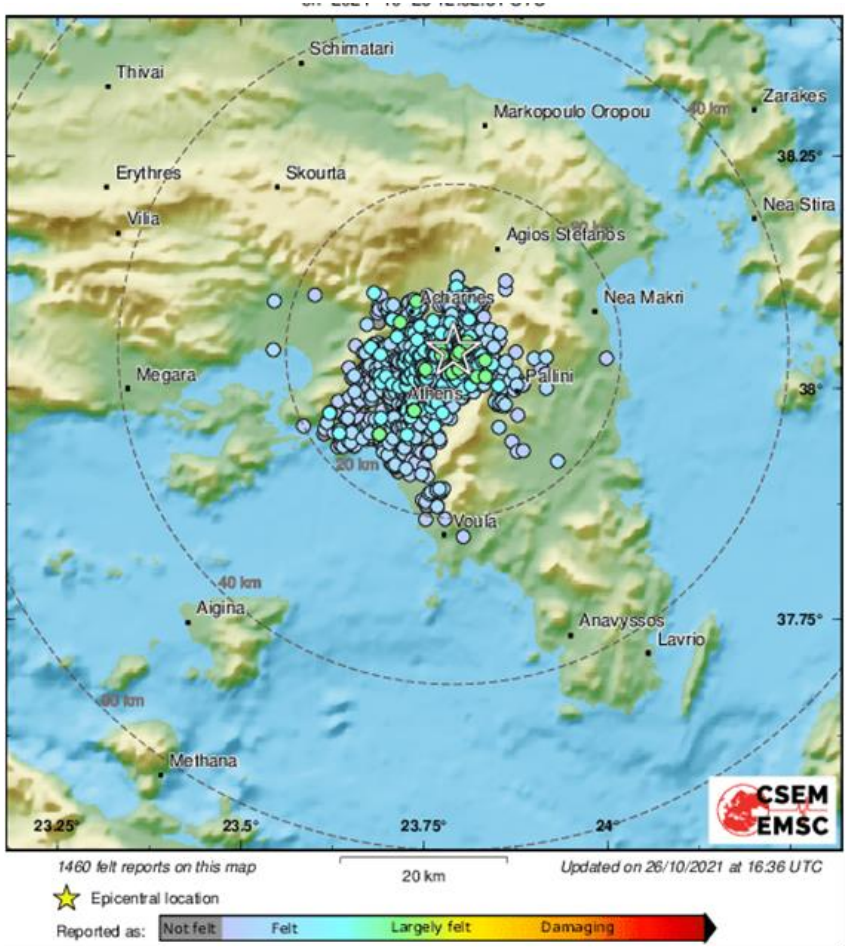




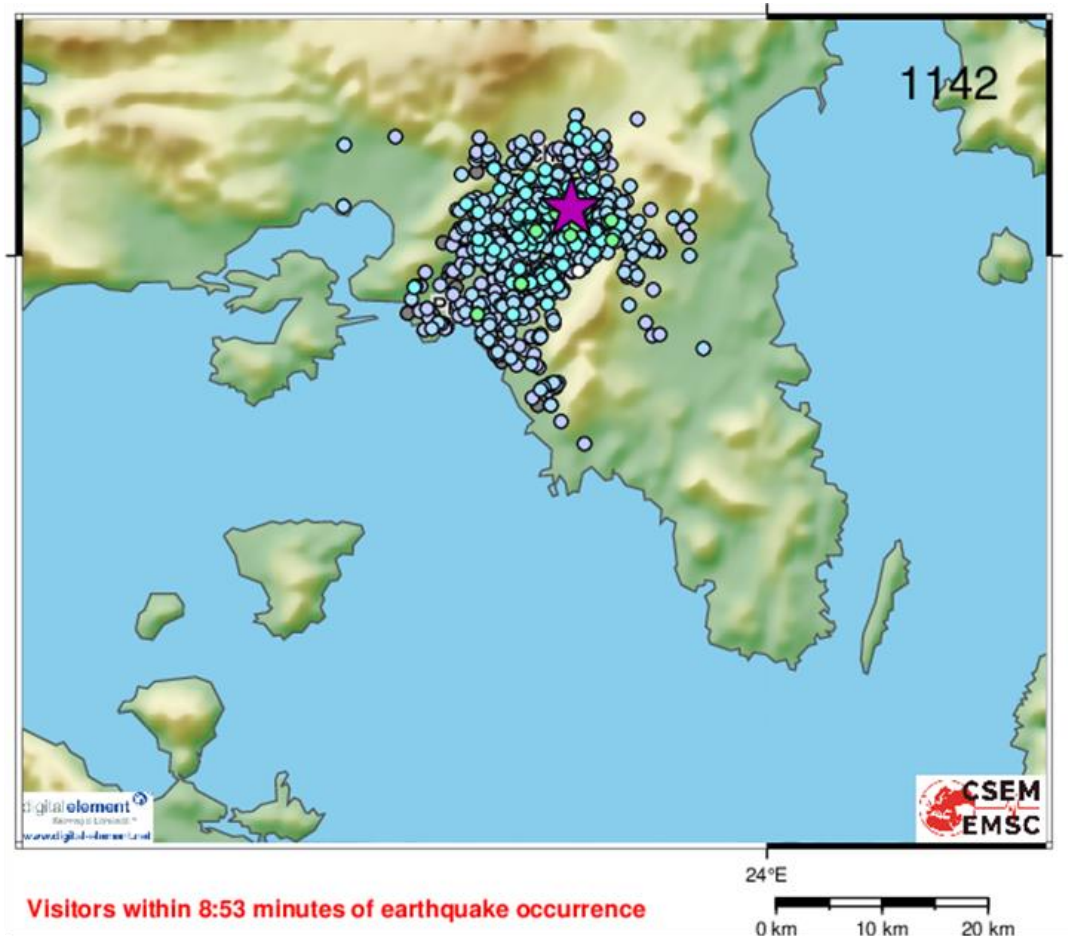
B

M2.9 Athens. Felt Reports: 80% BEFORE Notification!

2021: 37% of felt reports BEFORE preliminary loc (<5 min)



1 460



1 142

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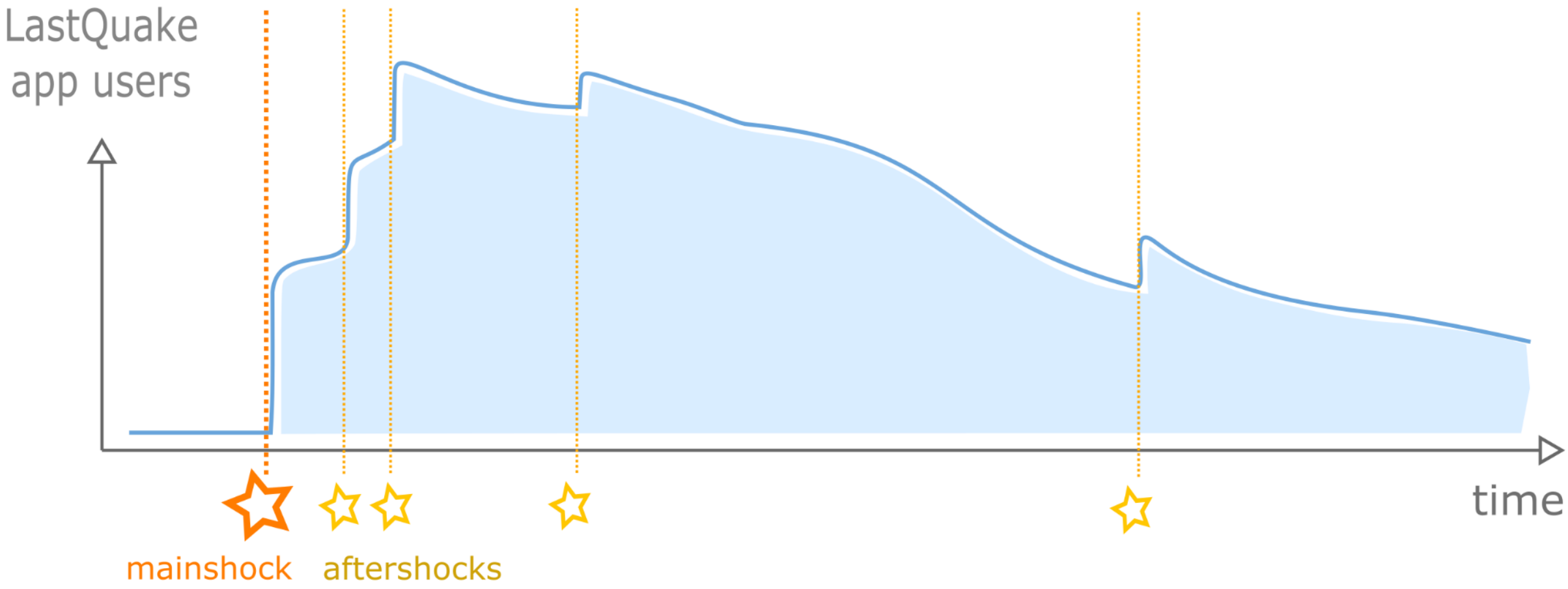
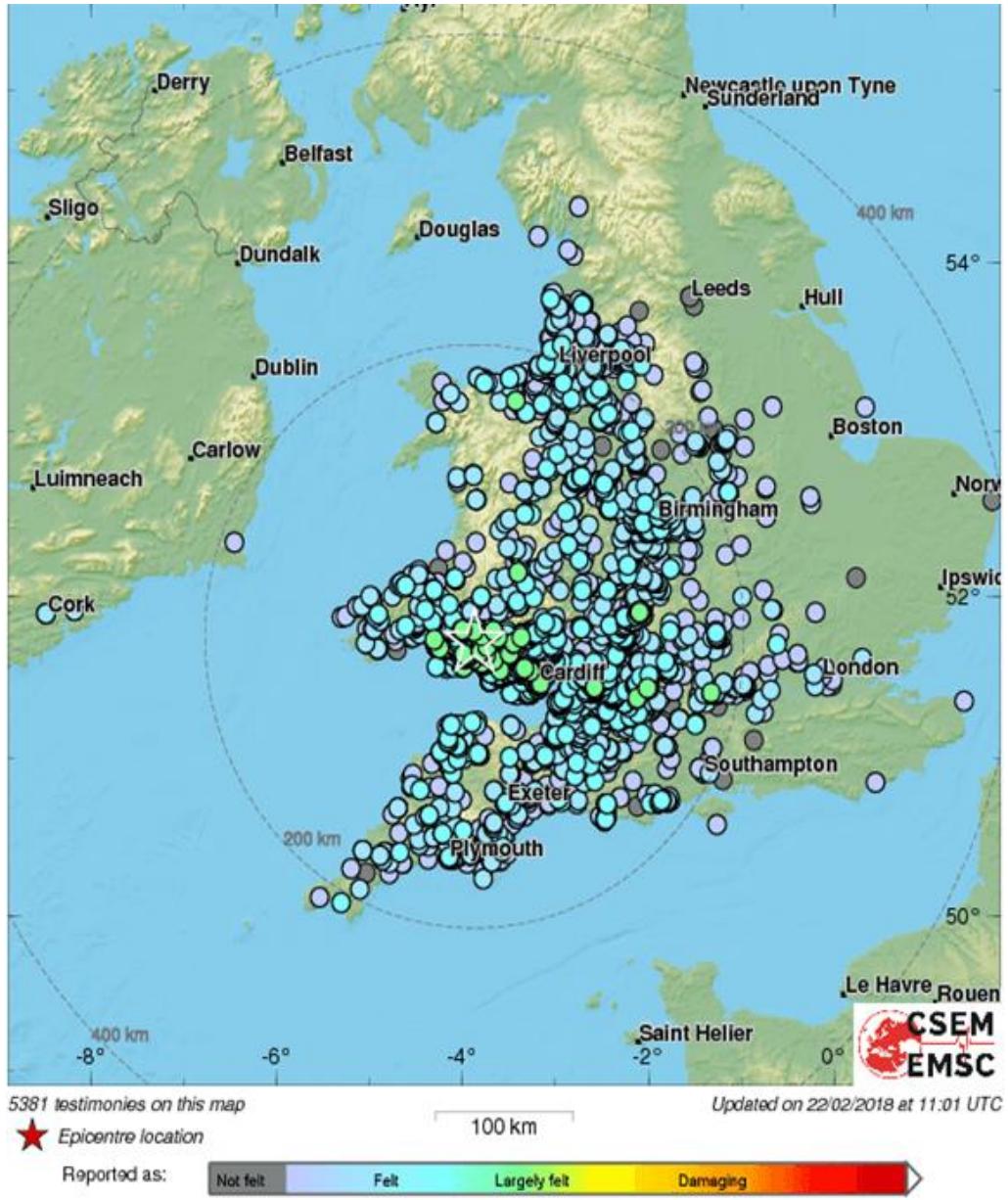
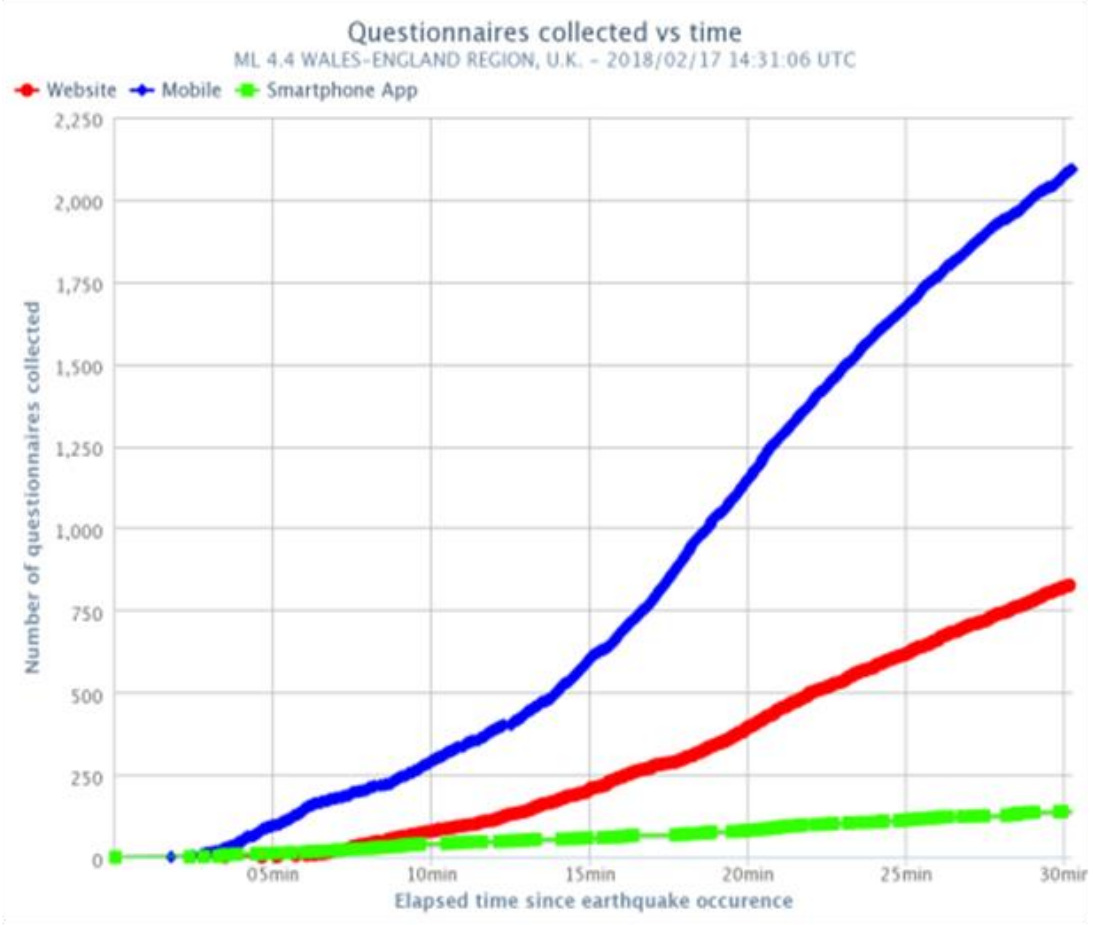
An App is NOT enough!



Wales-England Region Feb. 17 2018



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



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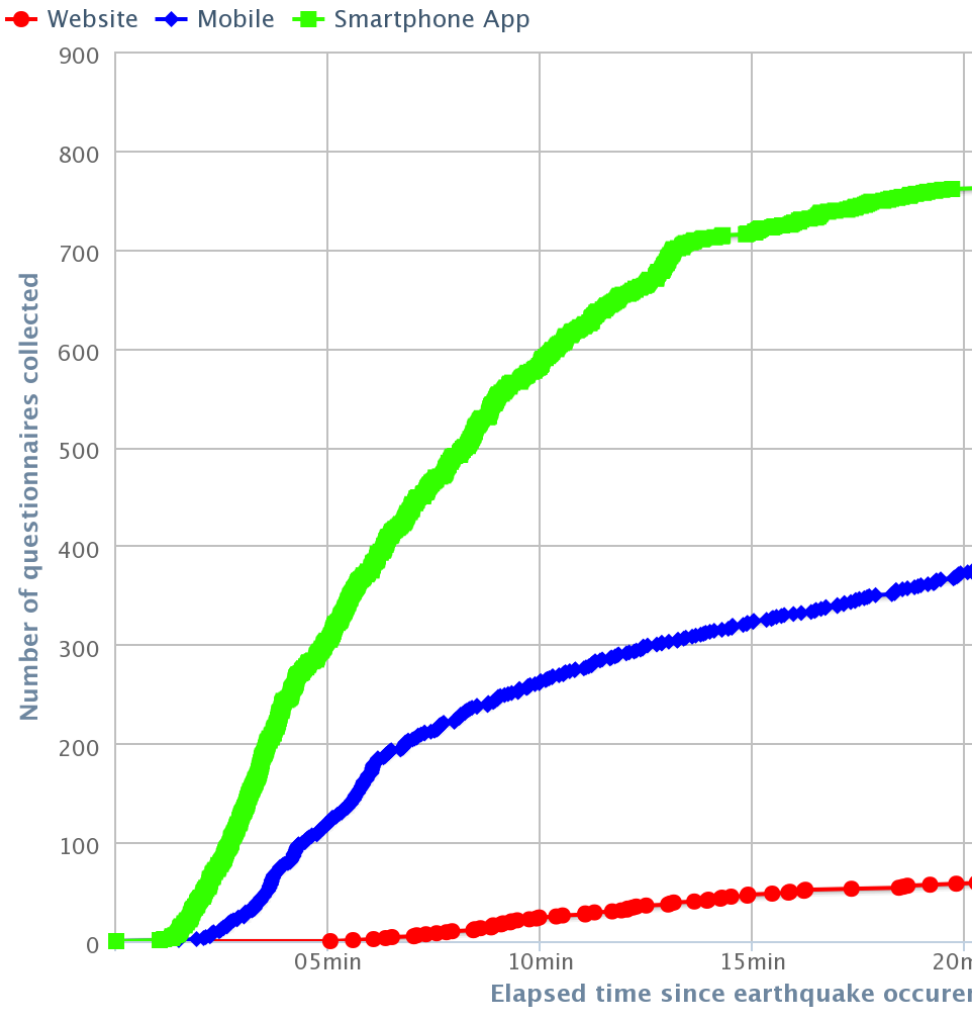
M5.6 Albania, Sept. 21, 2019 14:04

2 286 Felt reports

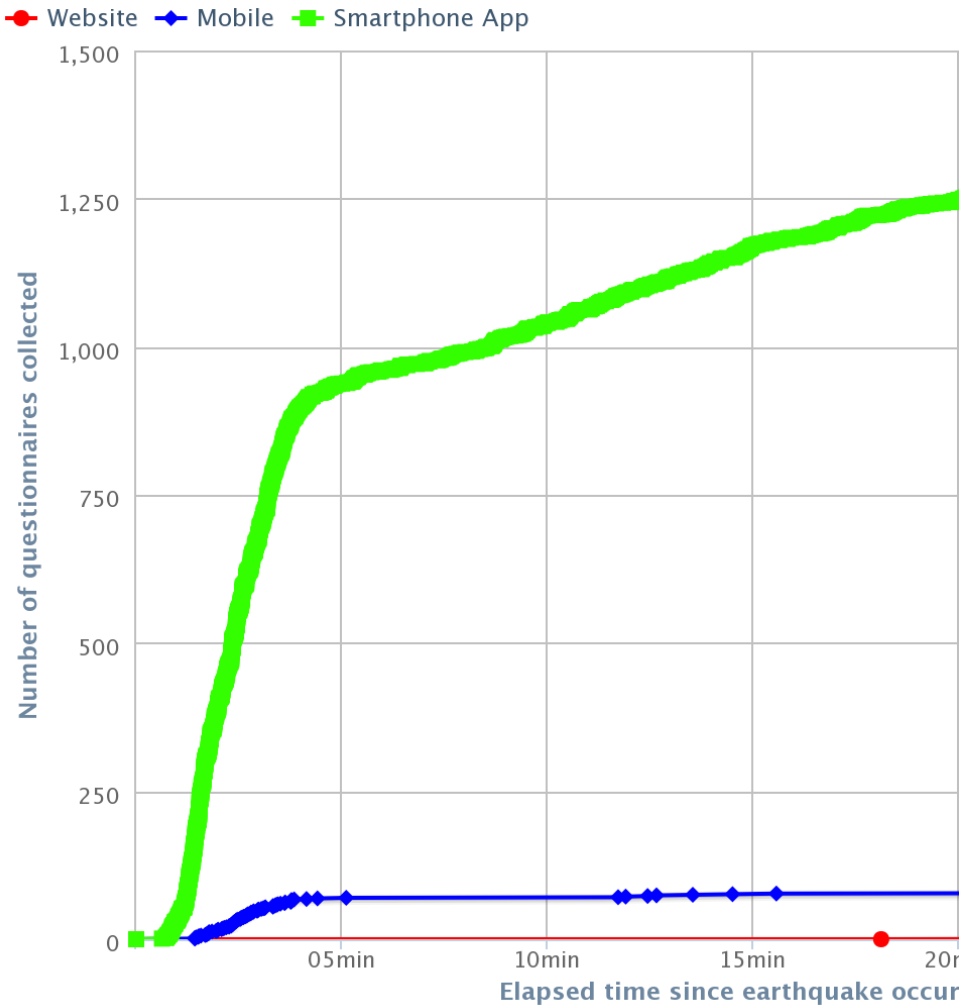
400 reports in 5 min (300 by the app)



M4.4 Albania, 30 hours Later

2 260 Felt reports

1 000 reports in 5 min (900 by the app)



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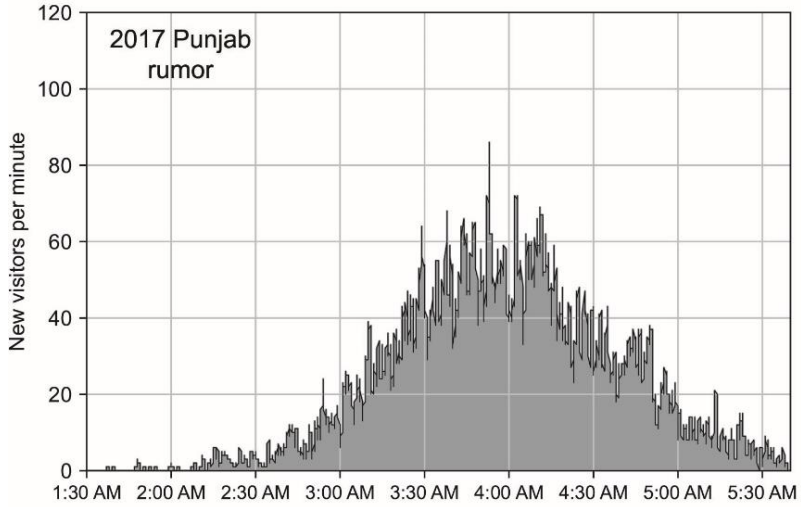
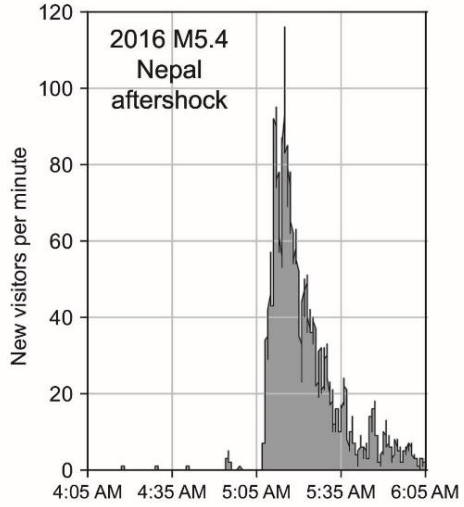
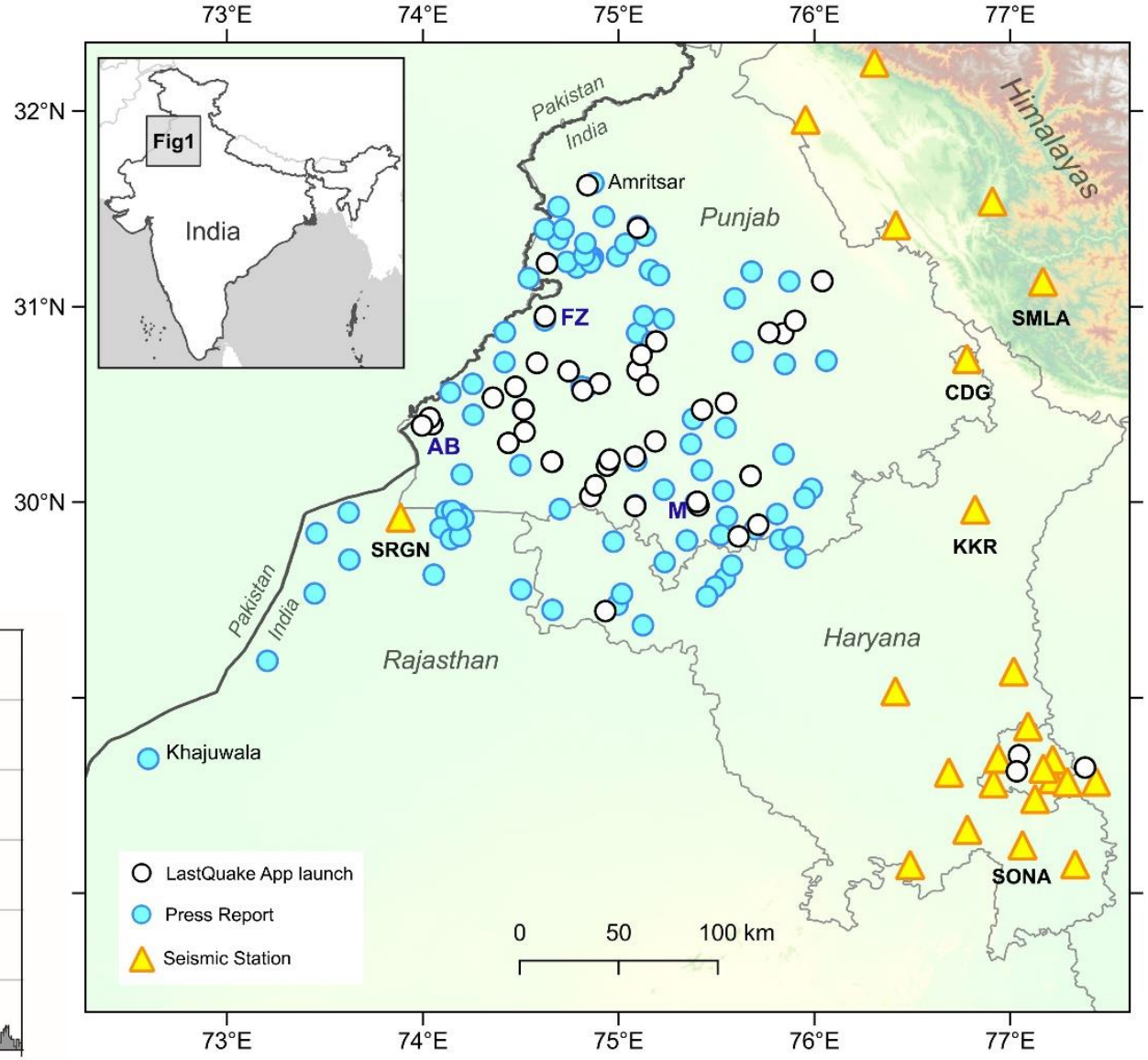
Not Only Earthquakes!

Decreasing Frequency

Sonic booms
Media coverage
Explosion (e.g., Beyrouth)
Meteor (Croatia)
Prediction…







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LastQuake: Risk and Crisis Communication

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Smartphones: Right Info at the Right Time at the Right Person!

Safety Tips: Timely Geo-targeted Information
Safety checks: Inform your loved ones

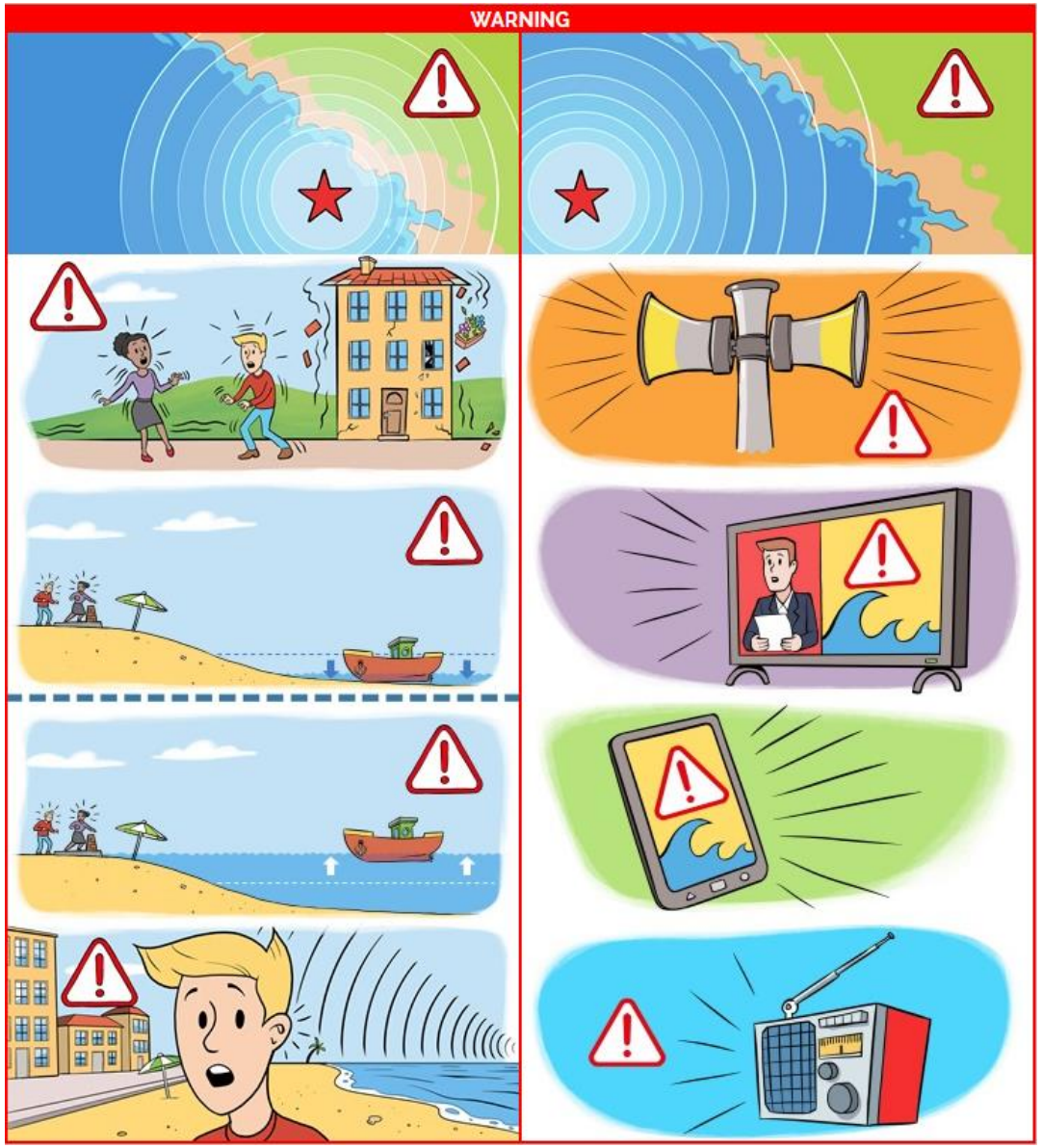
TIMELINESS

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

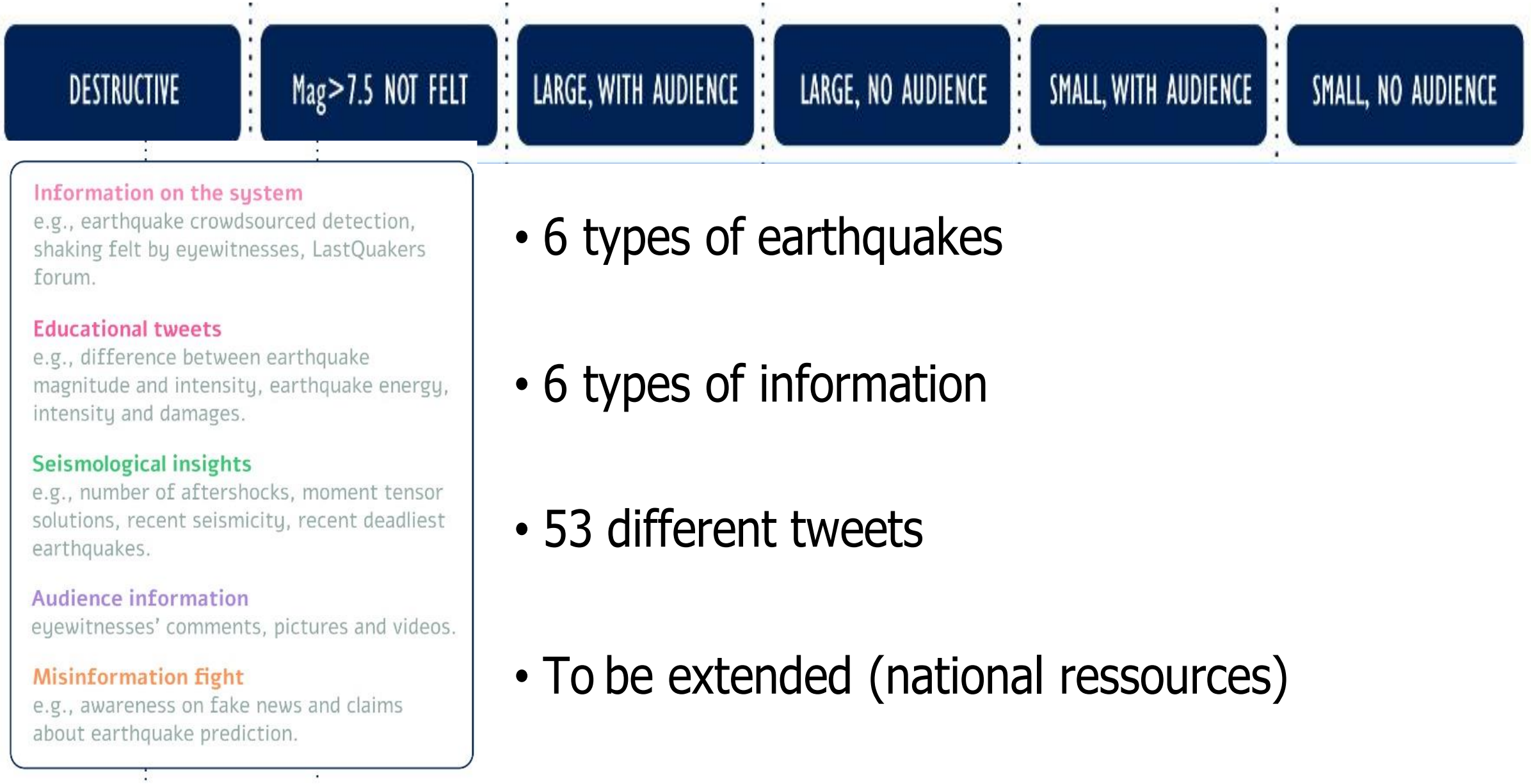
« *What Should I do After an Earthquake?* » Do's & Don'ts

Tsunami: Warnings and Safety Tips



Visual Communication

@LastQuake Twitter bot: 300+K followers



- 6 types of earthquakes
- 6 types of information
- 53 different tweets
- To be extended (national ressources)

Not Only a Bot: Answering Questions in Real Time

Echoing that. I'm really surprised there has been no authoritative real time info on earthquakes in English for tourists in Indonesia. @LastQuake has been it - keep up the good work!

Traduire le Tweet

16:46 - 7 août 2018

The lack of info after the 6.9 by the hotel staff. I had to dig for info by myself and found someone referring to your profile on tweeter. I then followed your advice by downloading your app. Thank you for the amazing work. I somehow feel more secure knowing whats happening.

Traduire le Tweet

17:53 - 9 août 2018

Your doing a great job by the way @LastQuake very nice for me to have updates as im away from home and can keep an eye on things and call home to Bali once i know there has been another aftershock, hope it calms down soon for the people in Lombok ❤

Traduire le Tweet

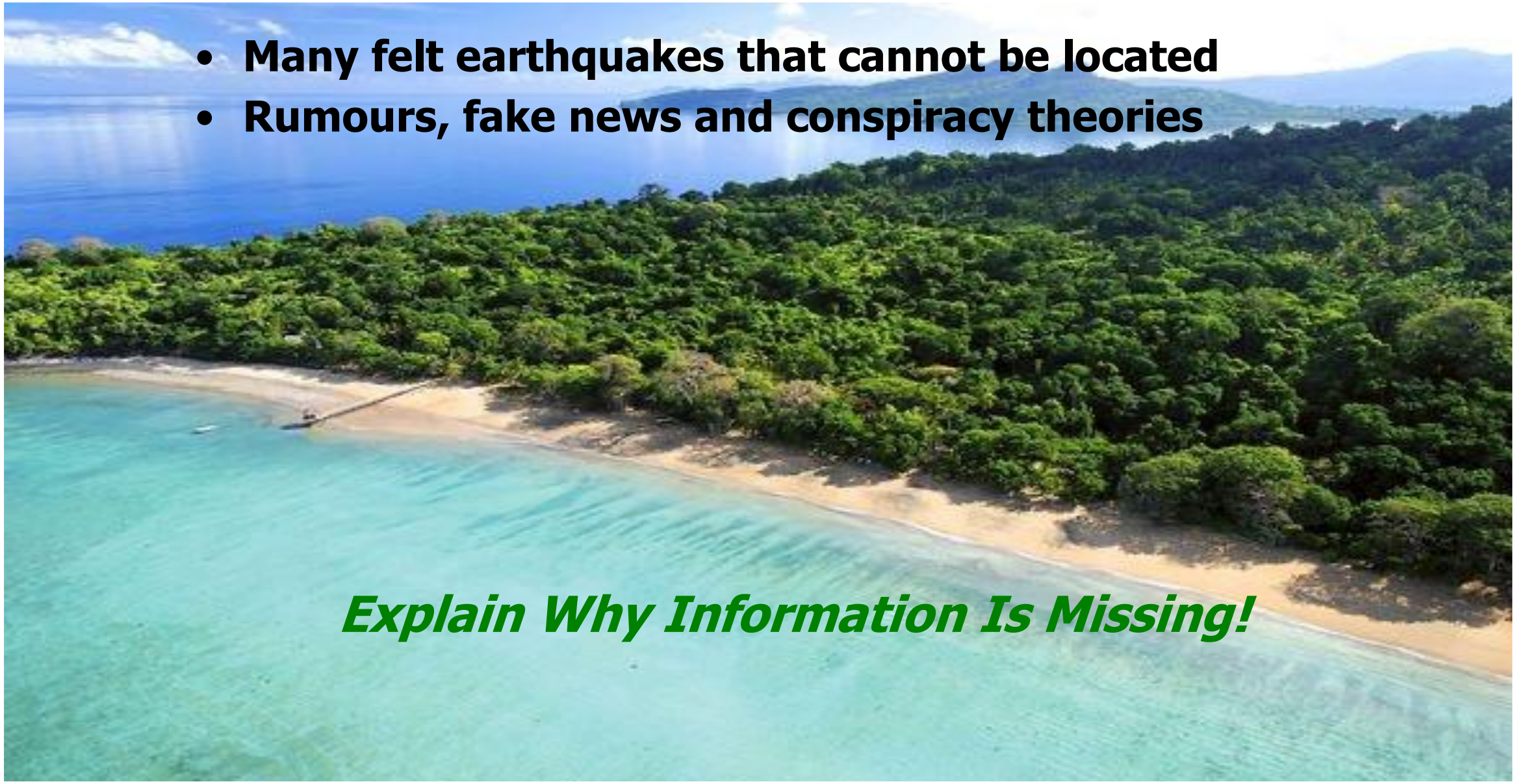
17:38 - 9 août 2018

I know it's crazy making to repeat it over & over, but I promise you are helping SOOOO much. I don't know what I'd do w/o you guys right now! We log onto Twitter in a panic and scroll to latest entry...no time to review previous entries when unsure what to do next. SO THANK YOU!

Traduire le Tweet

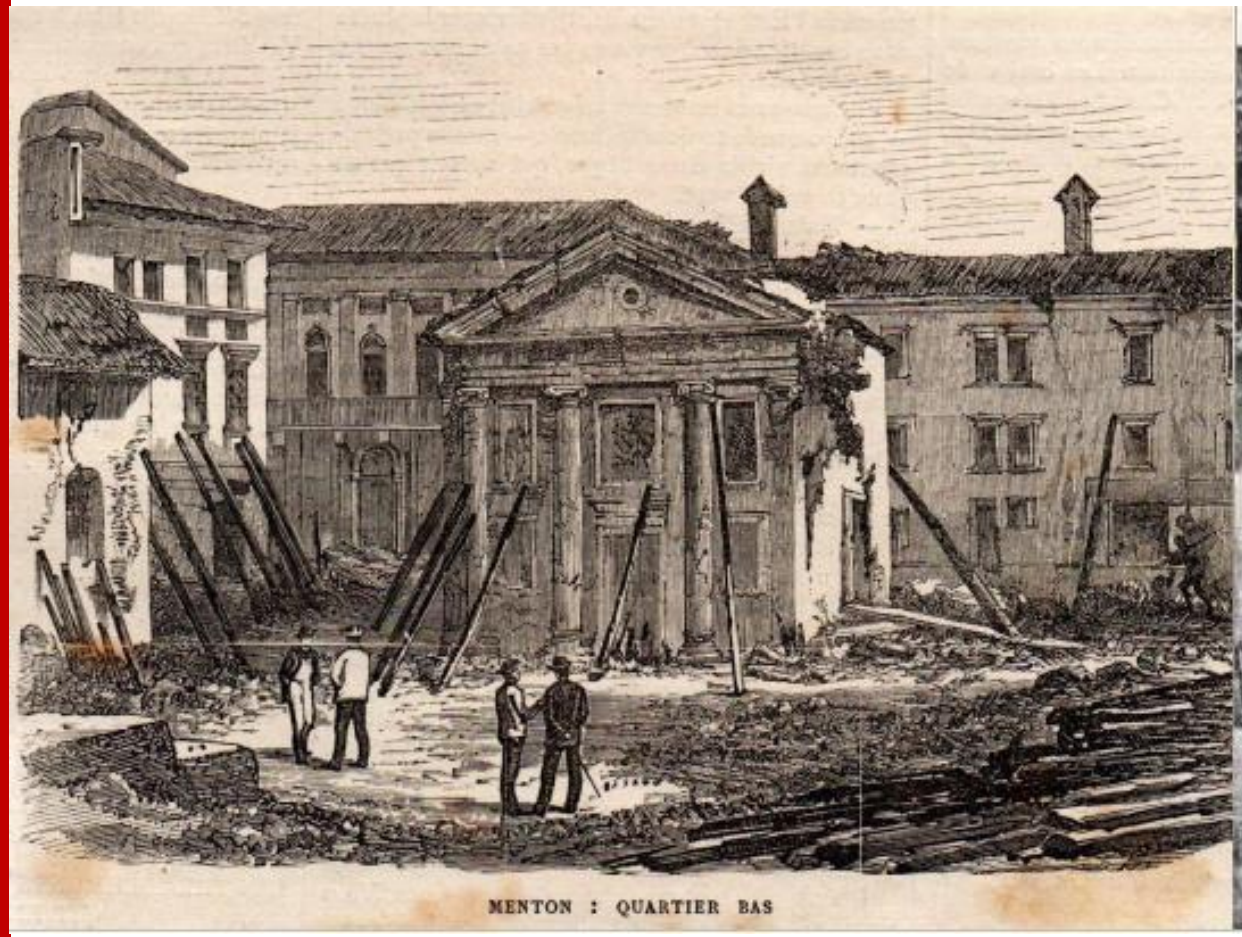
18:18 - 6 août 2018

Misinformation: 2018 Mayotte: An Earthquake Sequence in a Poorly Instrumented Region



Euro-Mediterranean Seismological Centre

Disinformation: Not New!



The 1887 quake in Menton? No! 1873 EQ, Belluno, Venetia, Italy

(courtesy A. Laurenti)

Earthquake Prediction: 2019 Albania, People Leaving Tirana!

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

Debunking, Pre-bunking Misinformation

EMSC
@LastQuake

"Earthquakes do their best to be as unpredictable as possible" - Watch this video from @geosociety where seismologist Ross Stein explains why #earthquakes cannot be predicted at present 👇

Traduire le Tweet

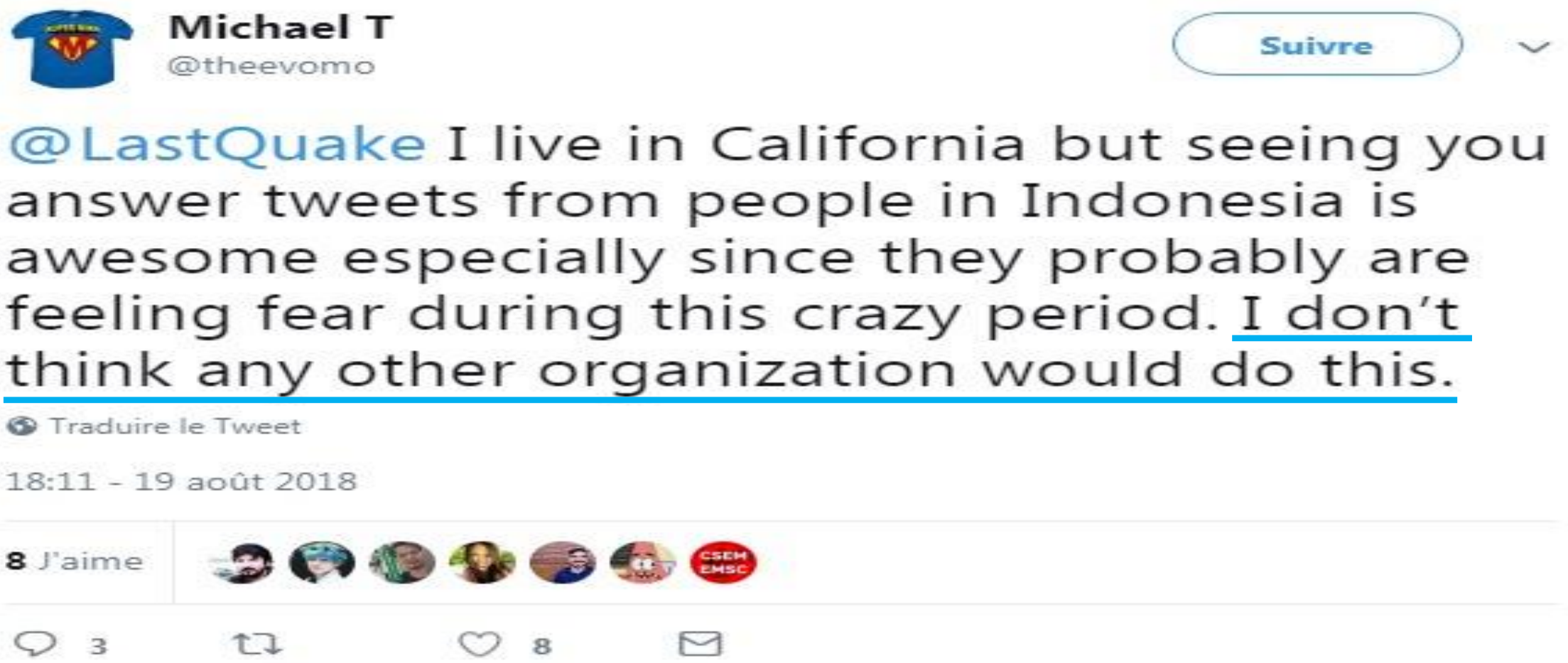
youtube.com
Quakecaster - Ross Stein, GSA Lecture
Earthquakes explained by GSA's 2017-2018 GSA James B. Thompson, Jr. Distinguished International Lecturer Ross ...

EMSC
@LastQuake

❓ Do you have an #earthquake prediction? The Collaboratory for the Study of #Earthquake Predictability(scec.org/research/proje...) accepts predictions & evaluates them. Careful though: saying you did predict after the #earthquake happens means nothing 😉

Traduire le Tweet

The Role of Seismologists!



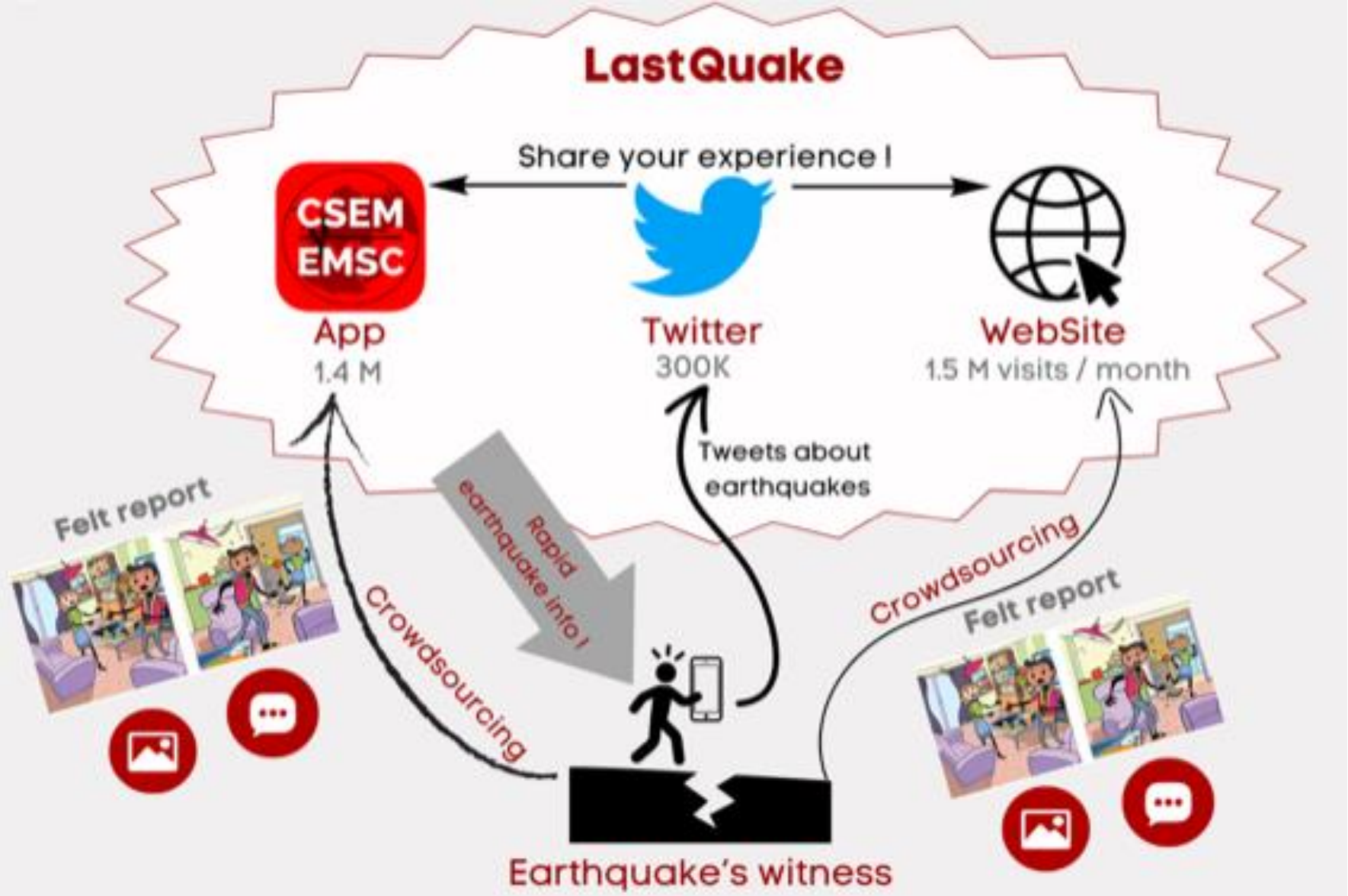
Euro-Mediterranean Seismological Centre

Main Media also Covering Misinformation (12/09/2023)

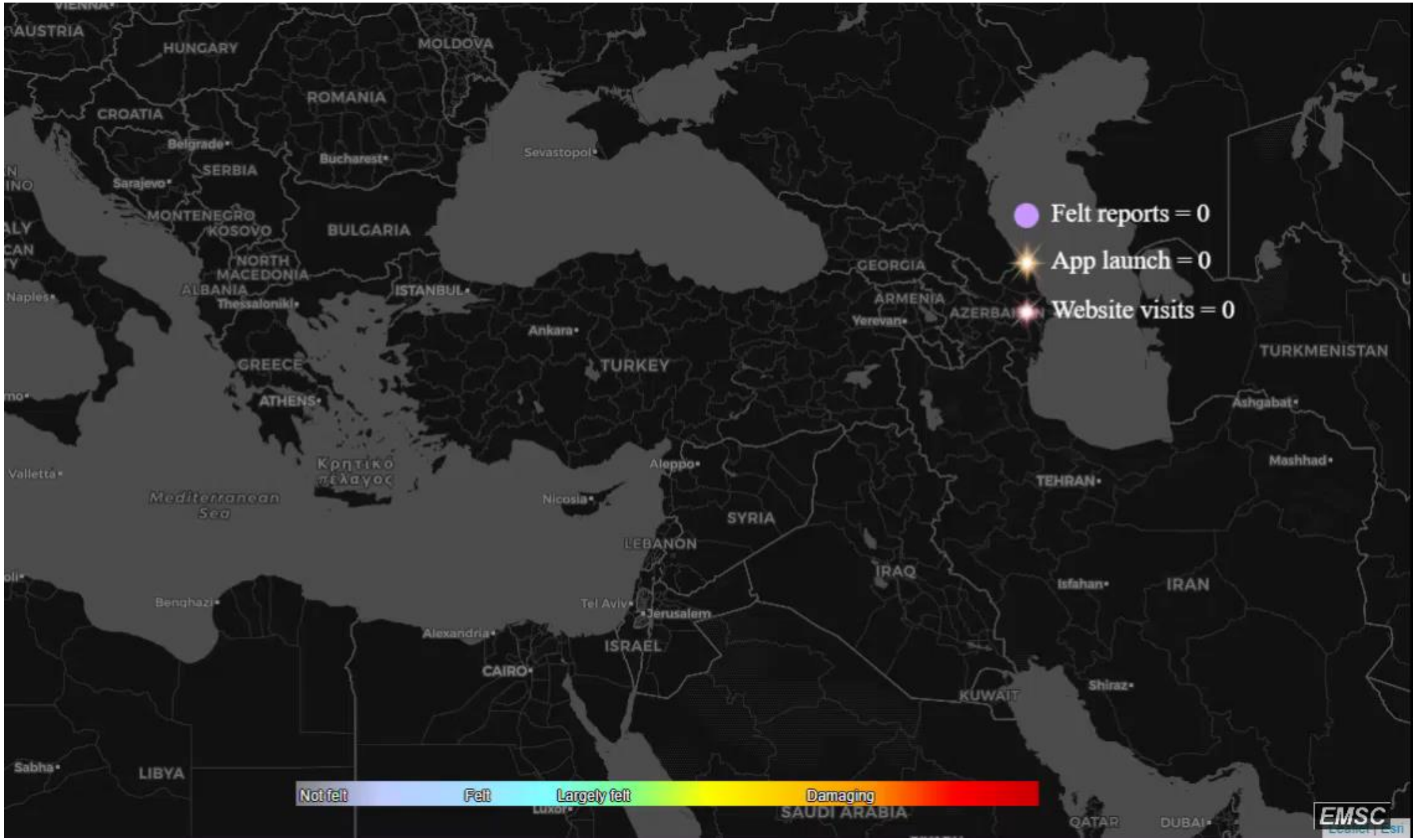
CrowdSourced Data for Rapid Impact Assessment

Euro-Mediterranean Seismological Centre

LastQuake: A Multi-component Information and Crowdsourcing System



The Use of LastQuake in the Aftermath of the M7.8 2023 Turkish Earthquake



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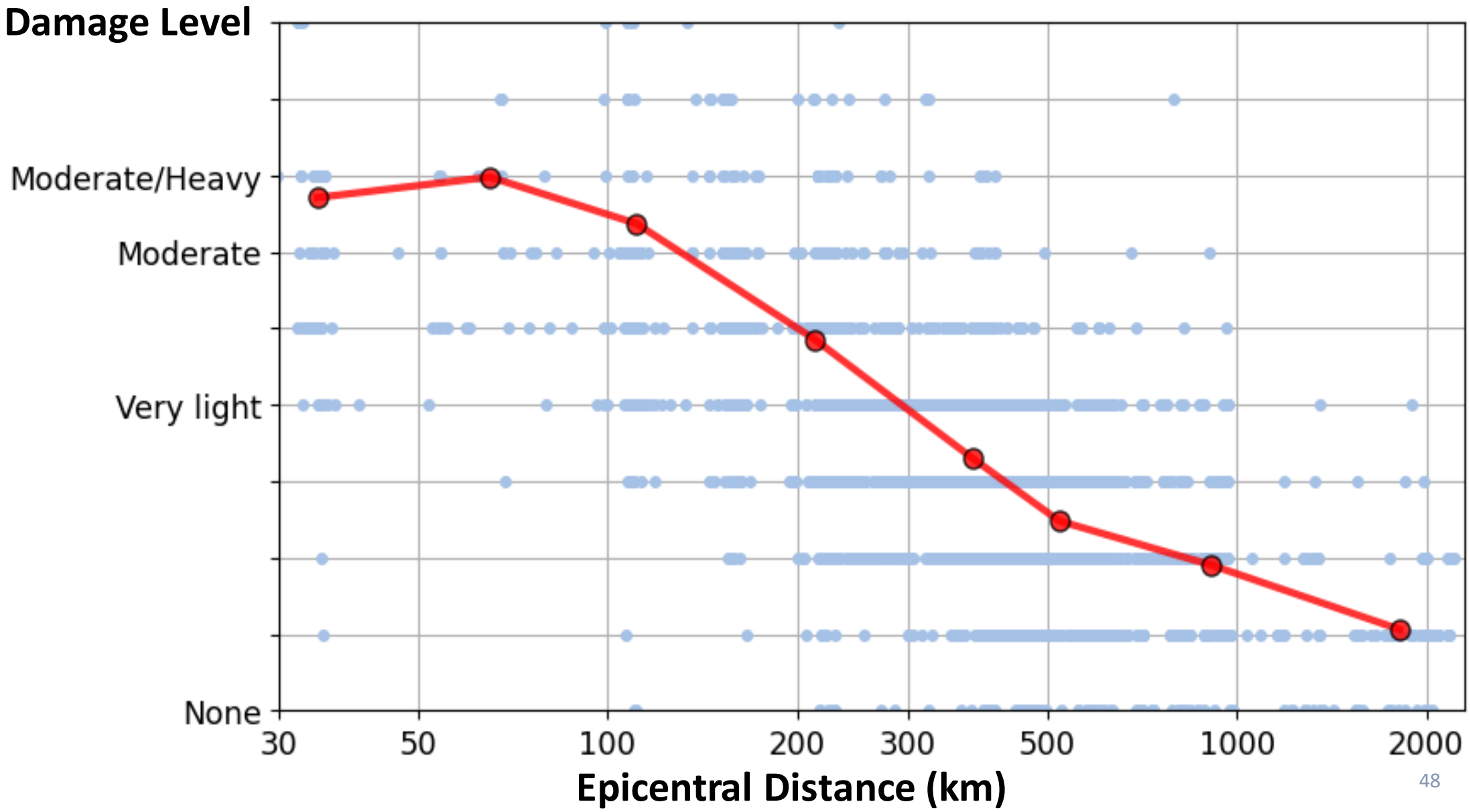
At least 3 M subjected to Moderate/Heavy Damage



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Ingestion in ShakeMaps, M6.4 Petrinja, Croatia

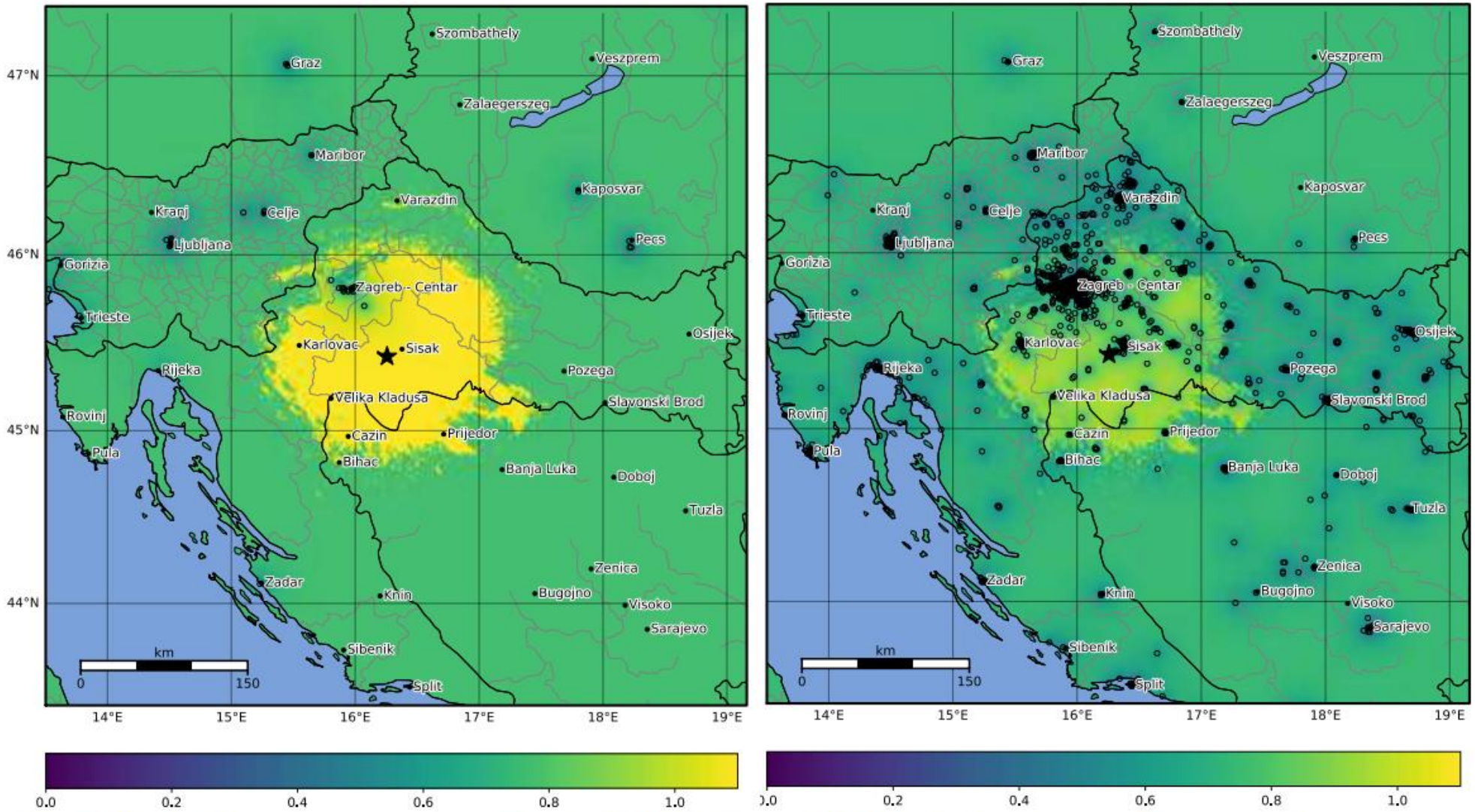


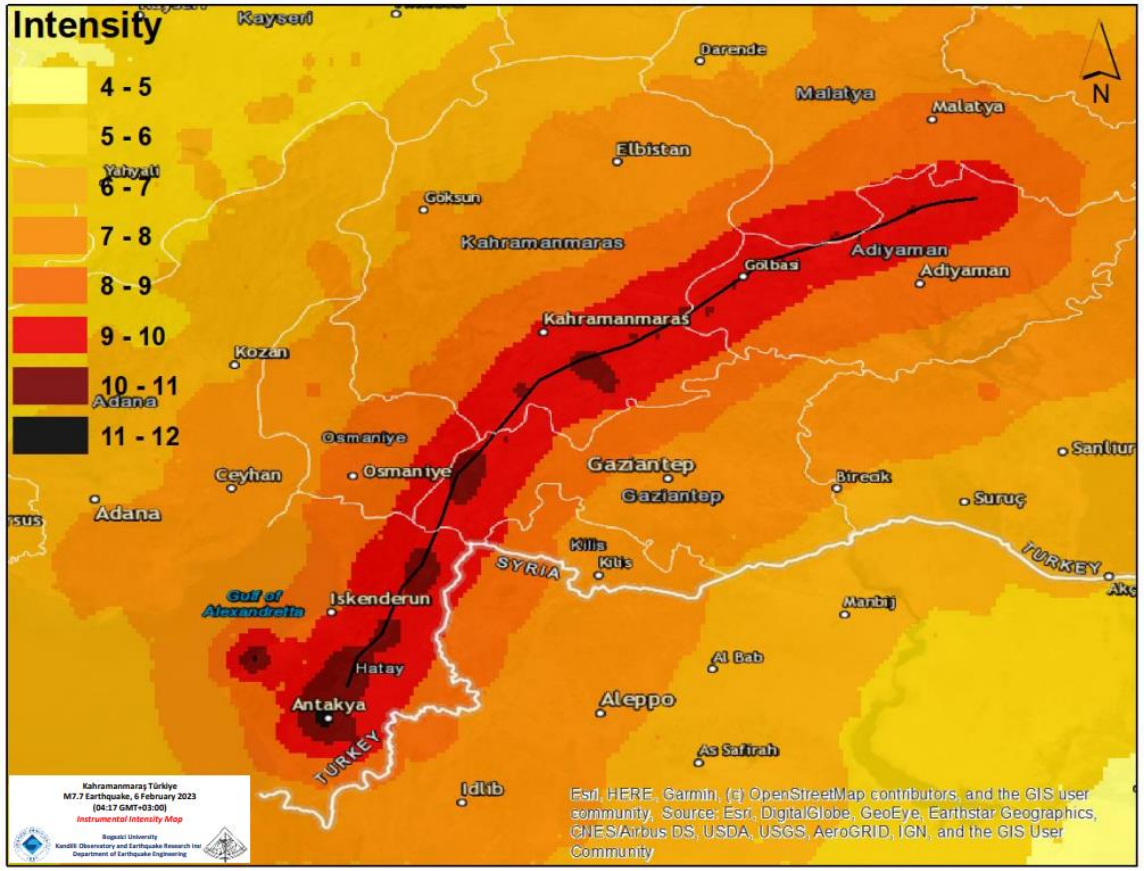
Fig. 7. ShakeMap uncertainty maps for the DYFI (left) and EMSC (right) datasets. Brighter colors indicate higher uncertainty.

Quitoriano and Wald, 2022

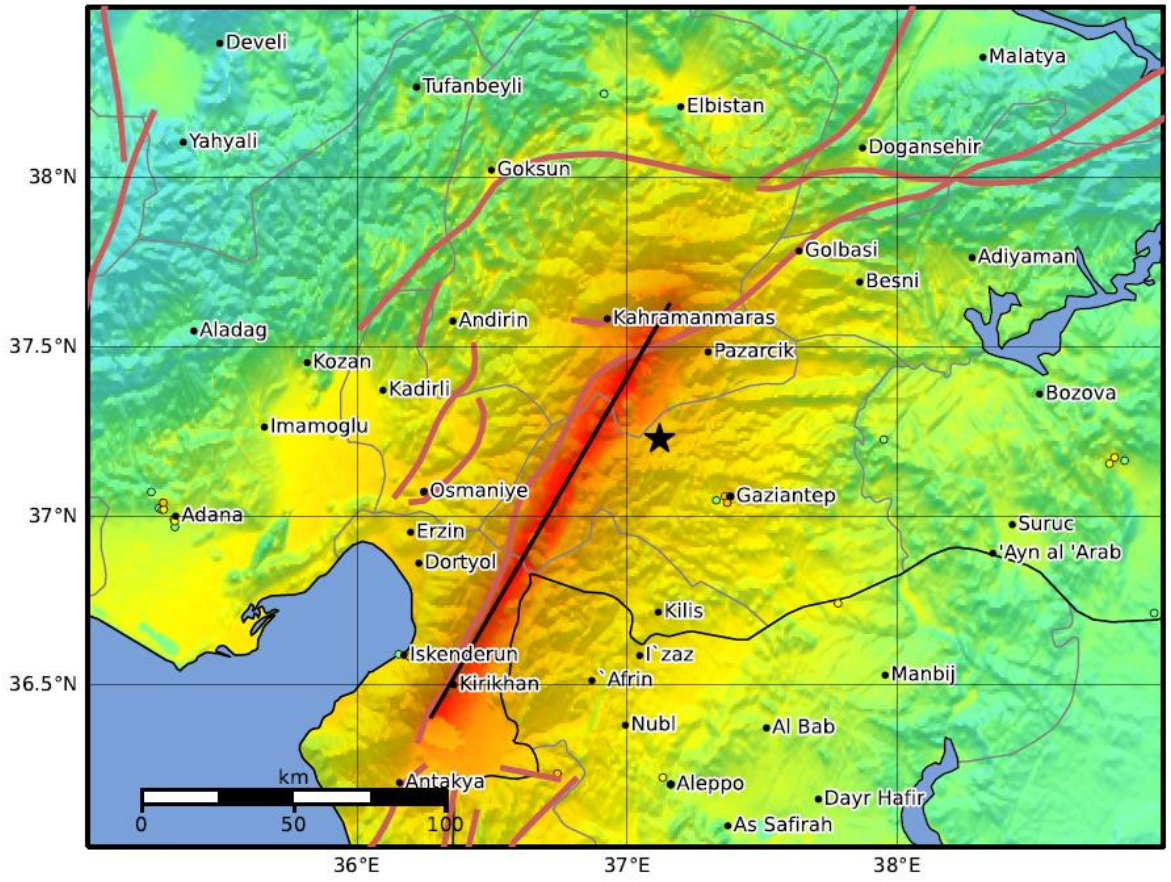
Euro-Mediterranean Seismological Centre

Mixing Data and Models

Field Survey



Rapid Determination of Rupture Geometry



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very heavy
PGA(%g)	<0.0464	0.297	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.0215	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Worden et al. (2012) Version 1: Processed 2023-03-16T13:45:03Z

△ Seismic Instrument ○ Reported Intensity ★ Epicenter ▭ Rupture

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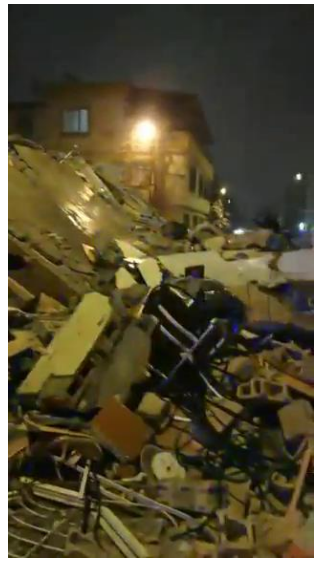
ETH zürich USGS

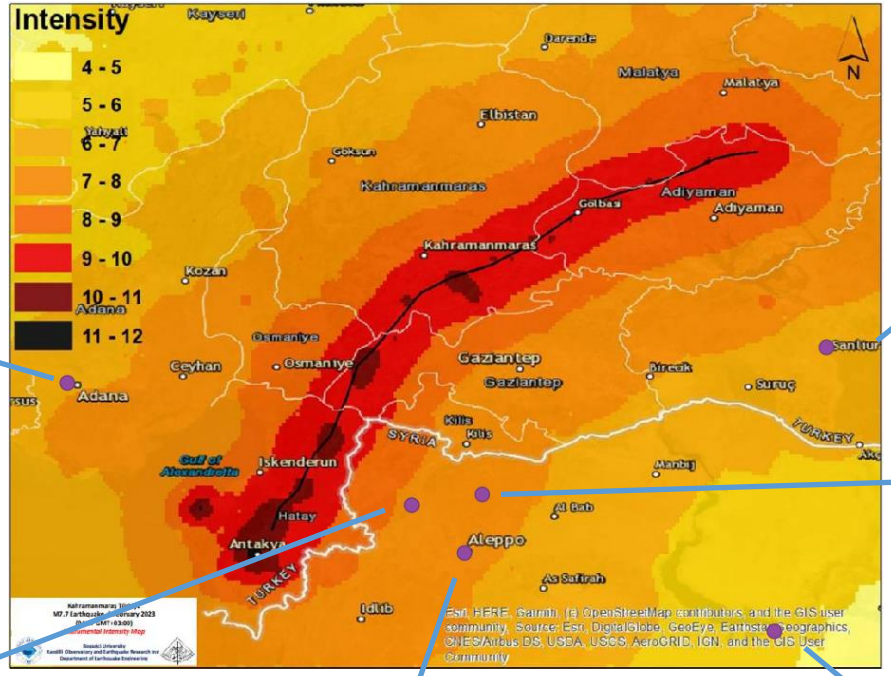
Images with Severe Damage

Euro-Mediterranean Seismological Centre

3hr 45min



3hr 30min



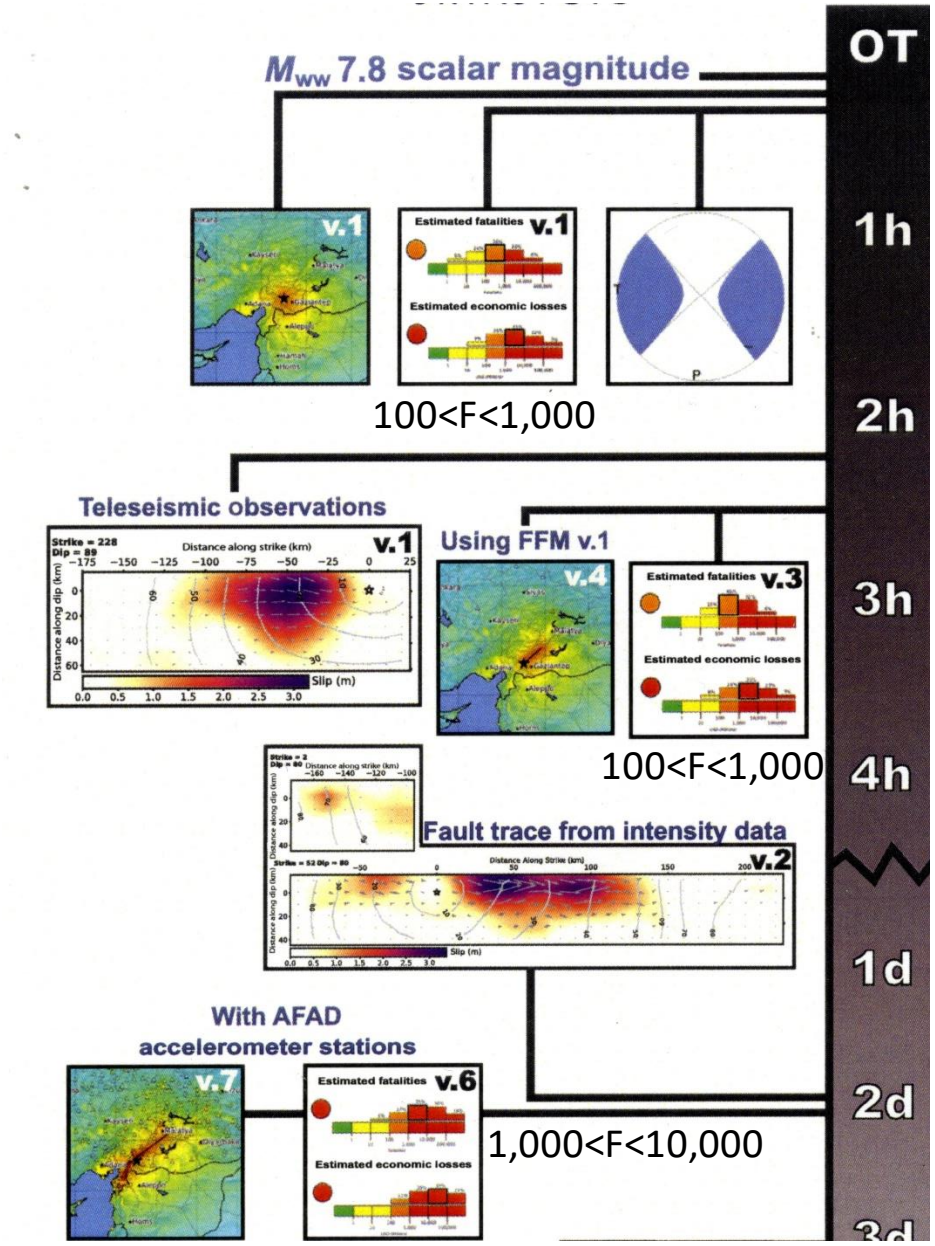
2hr 53 min

29min 200 km

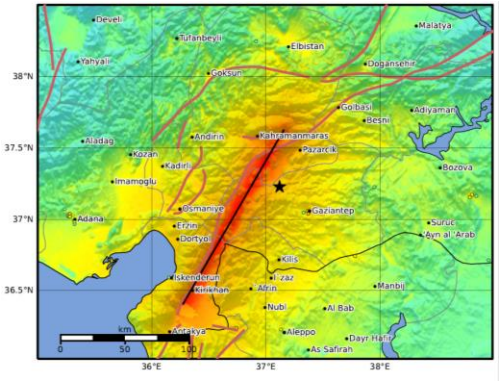
3hr
175 km

3hr
200 km

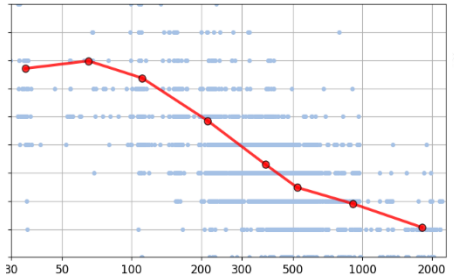
Added Value for Impact Assessment: the M7.8 earthquake



- 10 min: Prob.: 0,68+/-014



- F>> 3,000



- Intensity locally >> moderate-heavy
- 12 hr: Landslide

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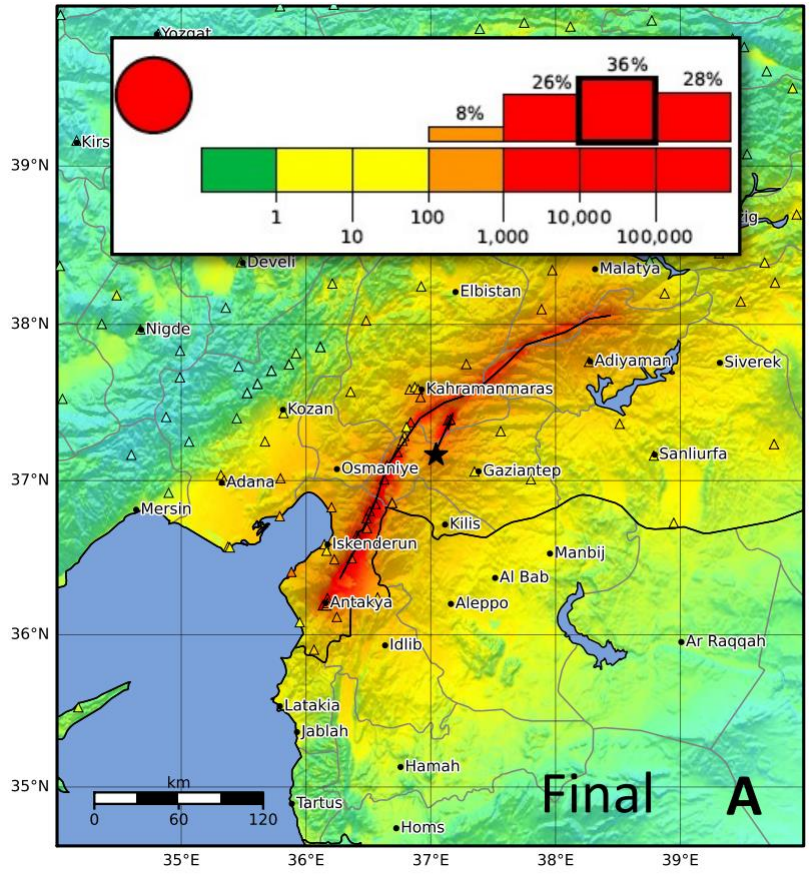
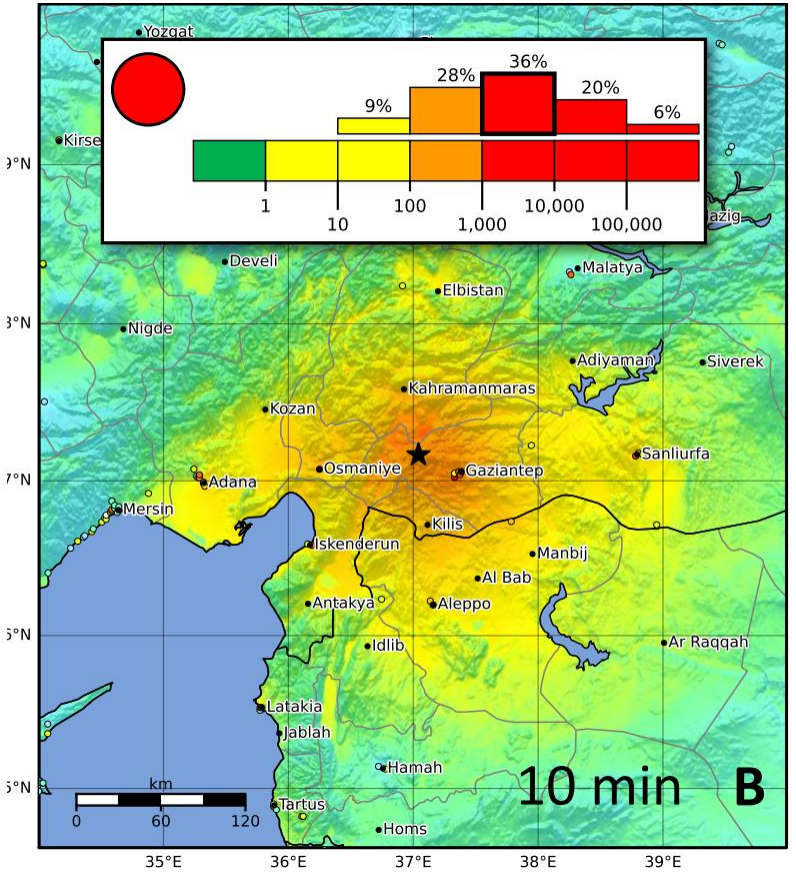
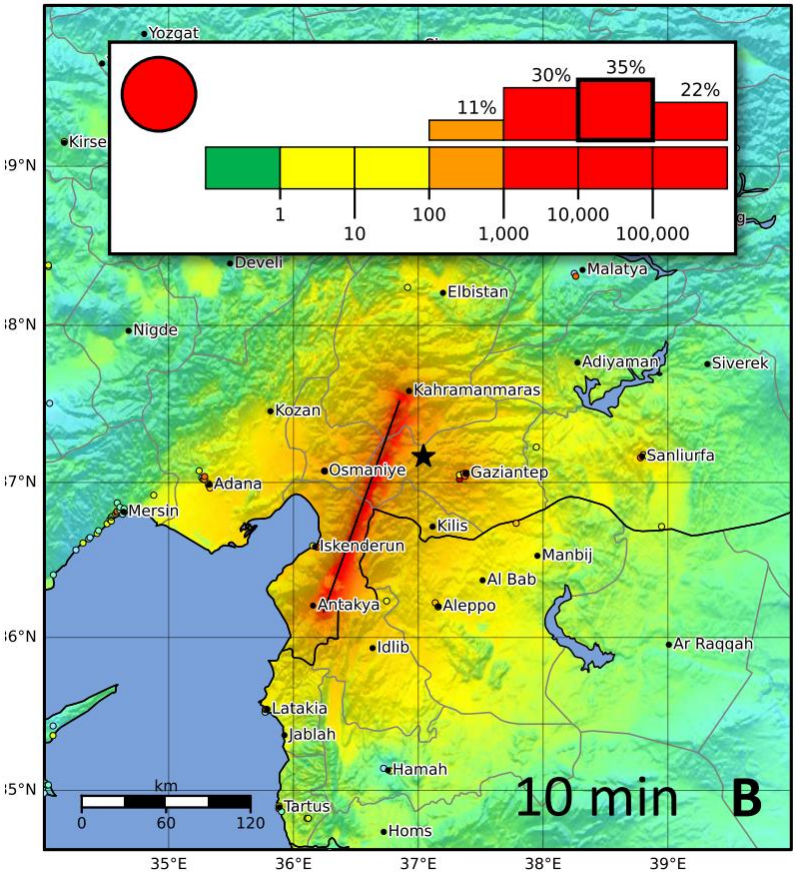
Fatalty estimates: Felt Reports and Finite Fault Model



T0 + 6 days



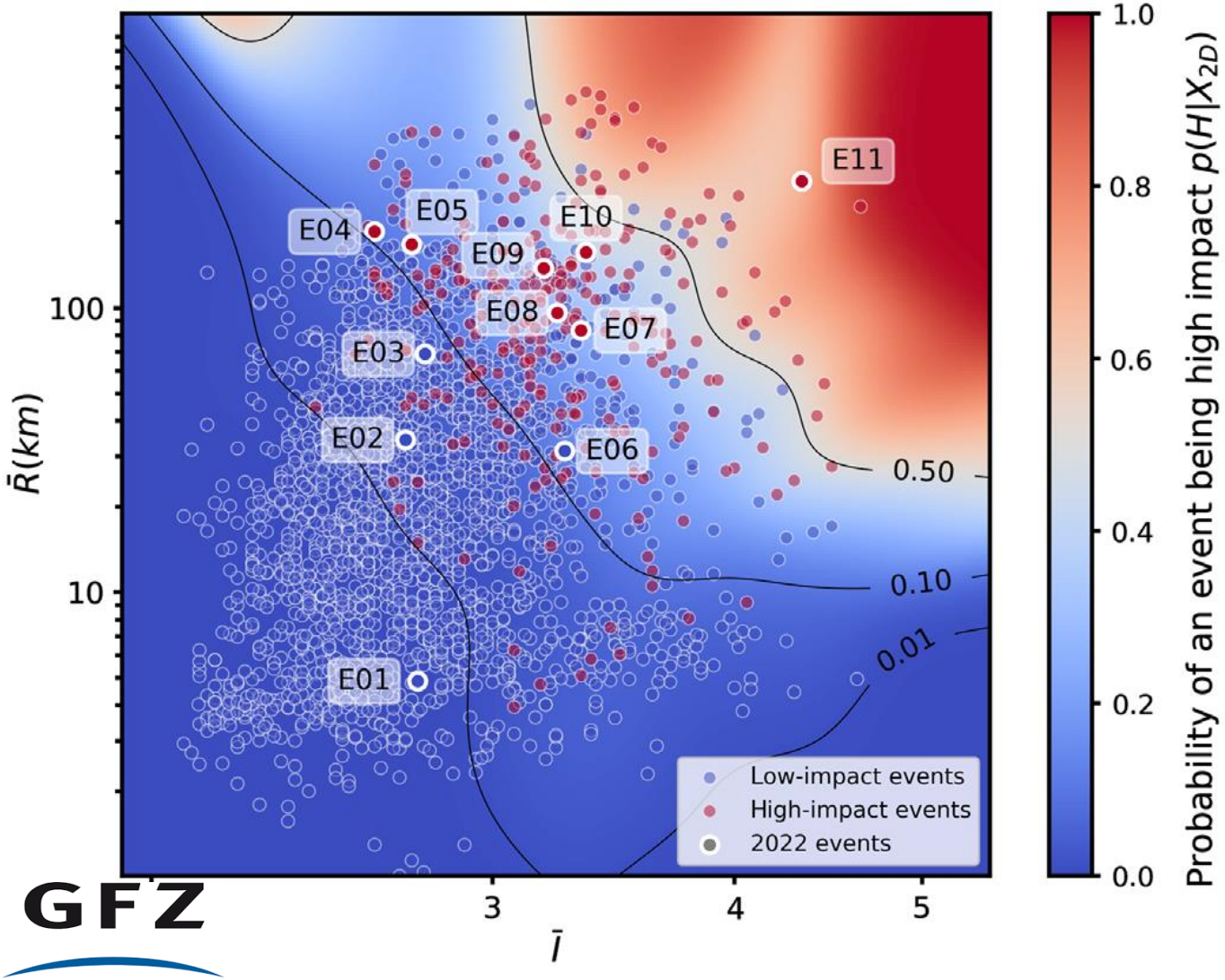
Felt Reports only



Felt Reports + Finite Fault

Felt Reports to Distinguish High-Impact from Low-Impact Earthquakes

First 10 min of Felt Reports only



Afghanistan M5.9 June 2022

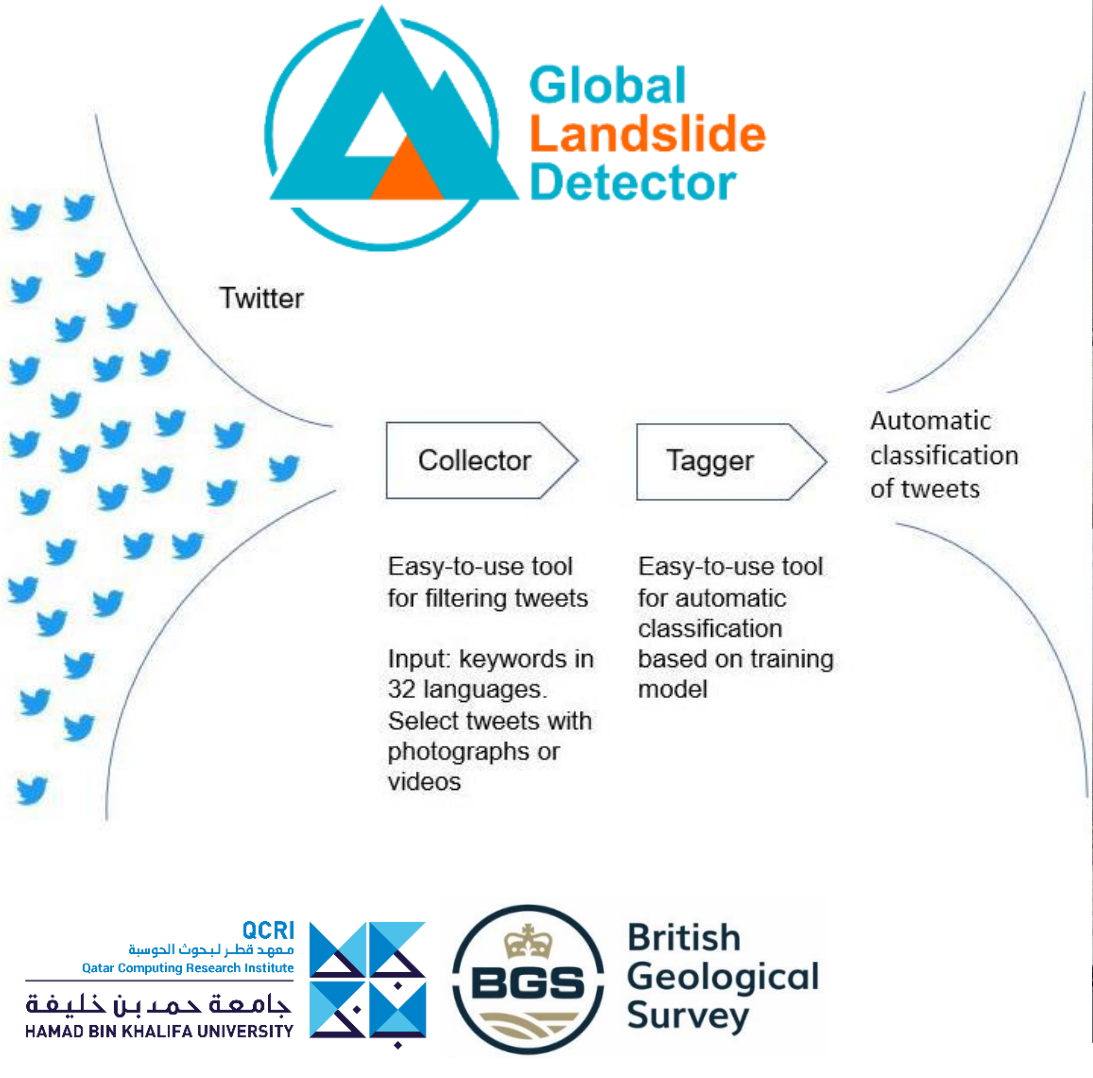
1 150 dead: E10

Japan M7.3 March 2022, 4 dead

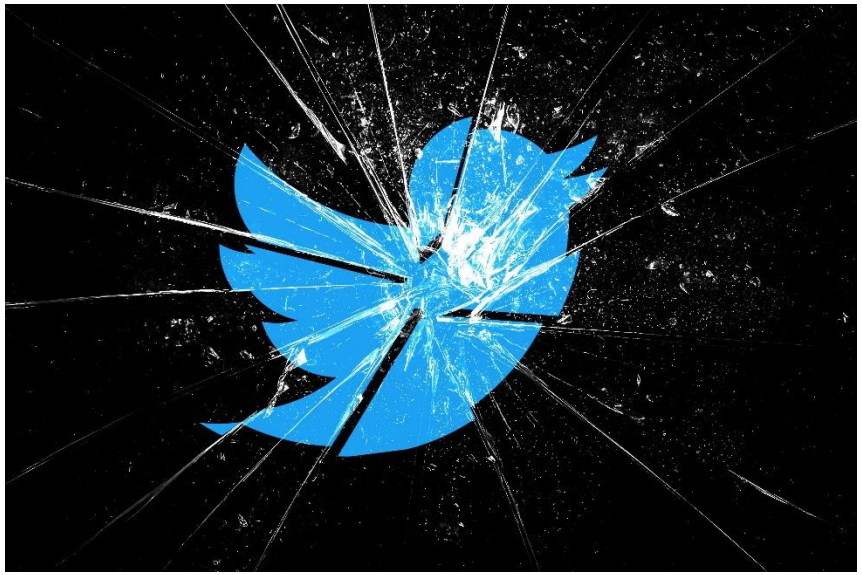
E11

Euro-Mediterranean Seismological Centre
GFZ
Helmholtz Centre Potsdam

Goodbye Twitter (?), Hello Telegram and WhatsApp!



T0+12h



Messaging Apps

Eyewitnesses hold the Key for Rapid Earthquake Impact Assessment

- Eyewitnesses hold the data and the tools exist to collect it (social media, websites, messaging apps…)
- Understand & satisfy their evolving needs and habits in return for this data
- No single tool can do it all: crowdsourcing, social media harvesting, AI, statistics…
- Beyond impact: engage with eyewitnesses to improve awareness and preparedness
- LastQuake data included in ARISTOTLE's impact assessments to the ERCC (ECPU)

Thank you for your attention!

- EMSC Team:
  - J.M. Cheny, L. Fallou, S. Issartel, M. Landès, J. Roch, F. Roussel, R. Steed, G. Ucciani

- External Collborators:
  - M. Böse & F. Massin (ETHZ), F. Cotton & L. Lilienkamp (GFZ), C. Pennington (BGS), V. Quitoriano & D Wald (USGS), M. Imran, F. Ofli & U. Qazi (QCRI)

- EMSC thanks its members, data contributors and users as well as its sponsor (and welcomes new ones!):

SCOR
FONDATION POUR LA SCIENCE

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