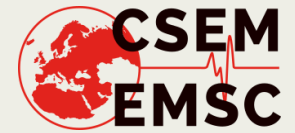


# Real-time monitoring of global seismicity, public response and detection of particular seismic events

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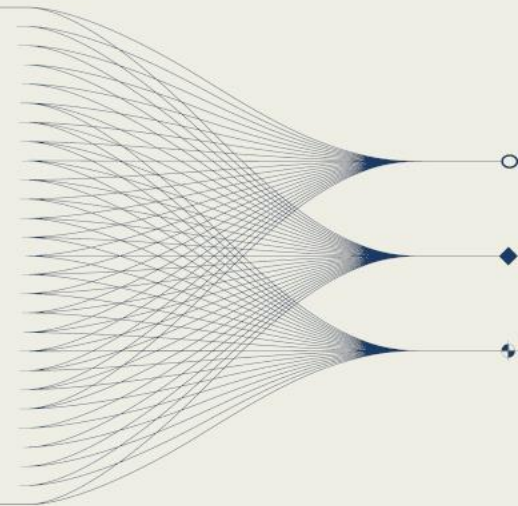
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## INTRODUCTION AND MAIN RESULTS

The EMSC provides real-time information on earthquakes and their effects by collating data from 116 seismic networks around the globe and crowdsourcing the felt experiences of witnesses. This creates the most comprehensive open real-time seismic and macroseismic catalogues available. Its web services attract 1.5M requests per day, while public visibility (i.e. websites, applications, and social networks) amounts to 10M views / month.

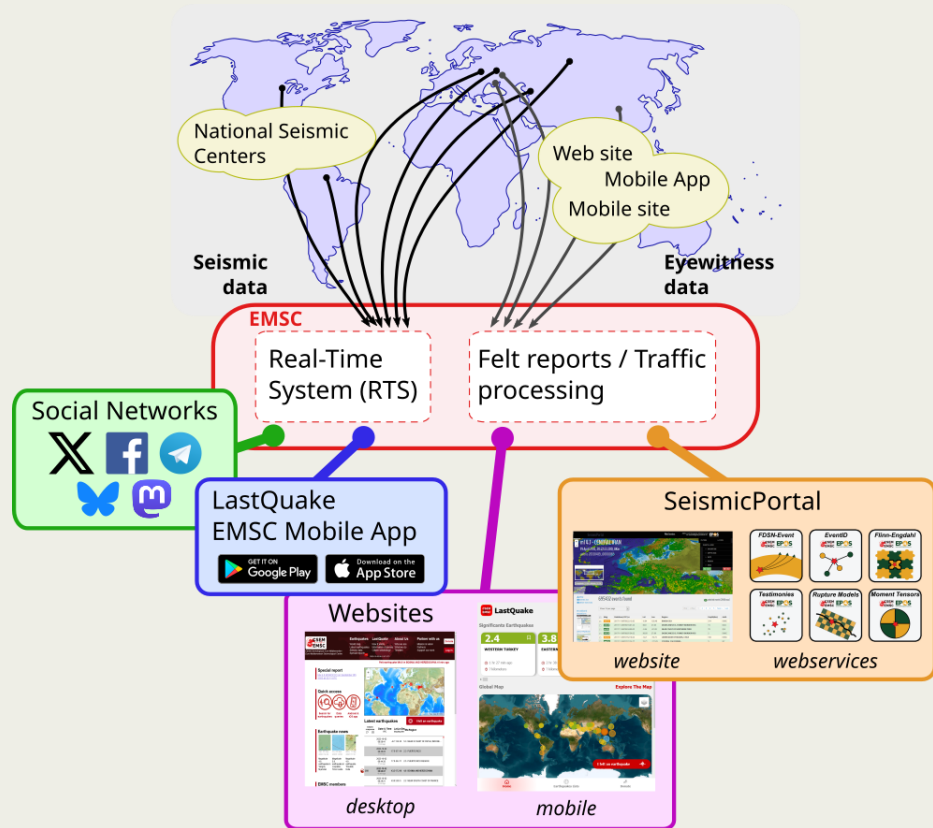


## How it works?

The EMSC is a not for profit NGO created in 1975 to provide rapid information on earthquakes and their effects. Its services are based on:

- Seismic data from 116 contributing networks (as of 2025);
- Crowdsourced observations to characterise earthquakes' effects.

The data can be accessed via webservices (with an open data policy).

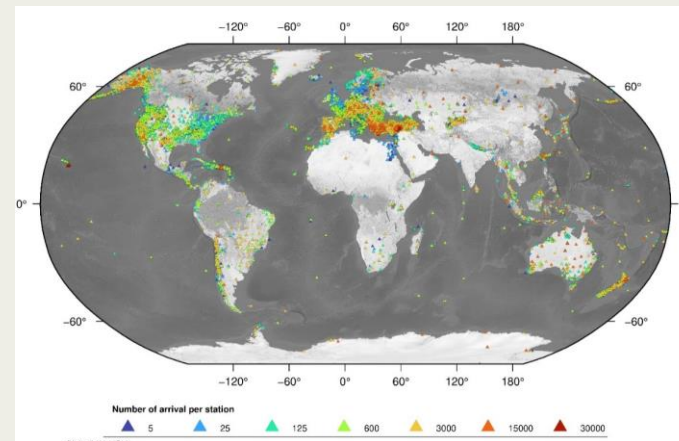


*Schematic representation of the collection and processing of data and the distribution of information and services. The EMSC does not operate any seismological stations; its services are based on seismic data provided by monitoring networks and crowdsourced data from witnesses*

## Real-time system for seismic data

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In 2024, there were 9 433 contributing stations, 5.1M arrival times and 4 559 moment tensors.



*Map of the 9 433 stations reporting data in 2024. The color indicates the number of arrival times reported. The maximum (20 500), is linked to the seismicity in Hawaii*

The preferred (published) location follows a “trust but verify” principle:

- Networks can be trusted in the area covered by their network (if a location is reproducible). Outside this area, locations must be independently confirmed;
- Relocations (obtained by merging data) are limited to cases where quality improvement is expected;
- 88% of earthquake locations are published without modification.

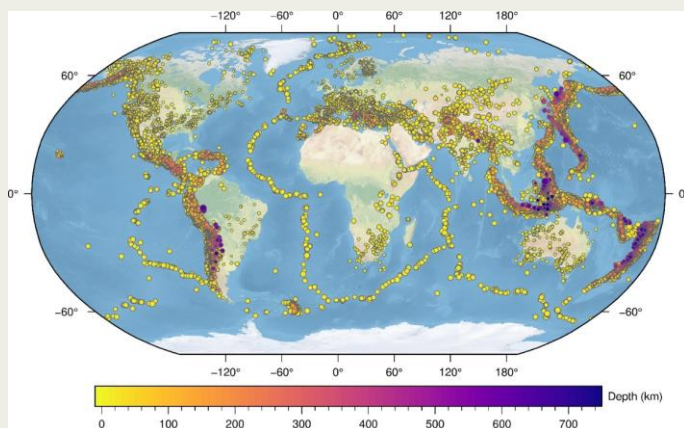
The system can handle both automatic and manual data. It is dynamic, with updates superseding previous source parameter estimates. Earthquakes measuring over M5 in Europe, over M5.5 in the Euro-Mediterranean region, or over M7 worldwide are manually analysed by a seismologist on call, who disseminates the information. Other locations are manually validated during working hours.

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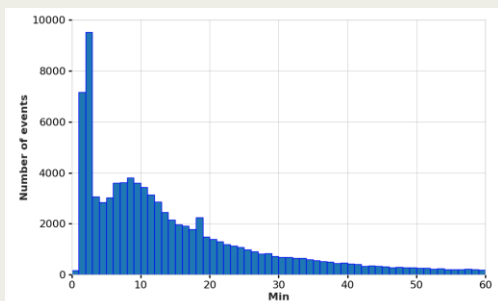
## Global seismicity

In 2024, 114,000 earthquakes were published, 47,500 of which were located in the Euro-Mediterranean region. The first locations were published after a median time of 16 min, with location and magnitude accuracy of a few km and 0.1, respectively.

The locations of earthquakes with a magnitude greater than 5 are generally published within one to a few min.



Map of the 114 231 earthquakes located in 2024. It includes 92 seismic events of anthropogenic origin.



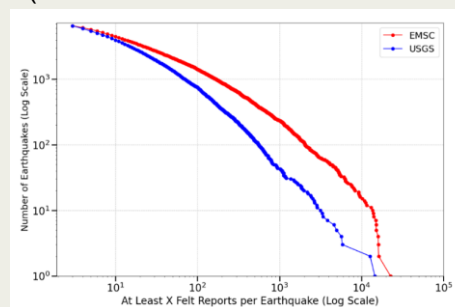
Distribution of publication delay in min (time difference between earthquake occurrence and first publication)

## Crowdsourced detections & felt reports

The EMSC detects felt earthquakes through the online information-seeking behaviour of witnesses immediately after the shaking, such as an increase in traffic to our website or LastQuake app.

These *crowdsourced detections* typically occur within 10-90 sec of an earthquake, usually preceding seismic detections. Their publication initiates the rapid collection of macroseismic data (felt reports).

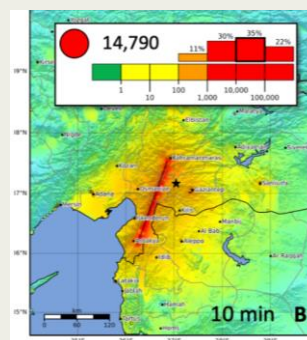
In 2024, 270 000 felt reports were collected for 2 736 earthquakes (median collection time of 7 min).



For earthquakes outside the USA, EMSC felt reports are more numerous than reports from USGS/DYFI, the other global online collection system.

Felt reports can be ingested into shakemaps, rapidly constraining the rupture geometry of  $M > 7$  earthquakes and improving rapid impact assessment.

Finite rupture and fatality estimates obtained for the 2023 M7.8 Turkey earthquake using felt reports collected in the first 10 min only (Bossu et al., 2024)

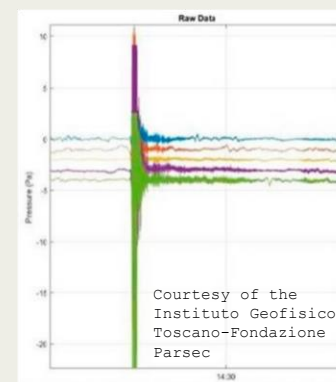
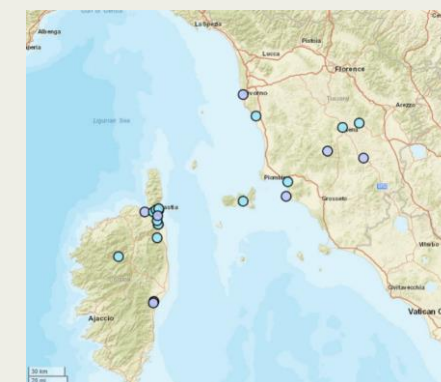


## Particular seismic events

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Earthquakes are not the only events that can be reported by witnesses. Explosions, sonic booms or meteorites entering the atmosphere can also be the cause of reports, when they rattle windows or shake the ground.

This was the case on 20<sup>th</sup> June 2024, when the EMSC collected felt reports from Corsica, Elbe Island, and the Italian coast. These are consistent with the infrasonic signal of a meteorite entering the atmosphere, recorded at the ELB array in Italy (right).



Courtesy of the  
Istituto Geofisico  
Toscana-Fondazione  
Parsec

## Conclusions

The EMSC offers the most extensive open real-time seismic and macroseismic catalogues available. These are valuable resources for benchmarking and comparing to similar near-real-time datasets.



Download our 2024 activity report