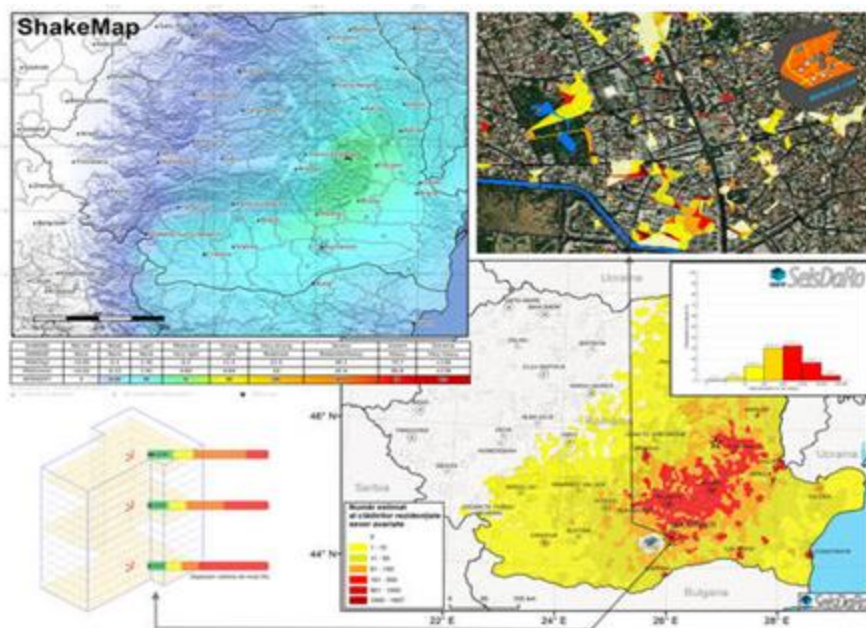
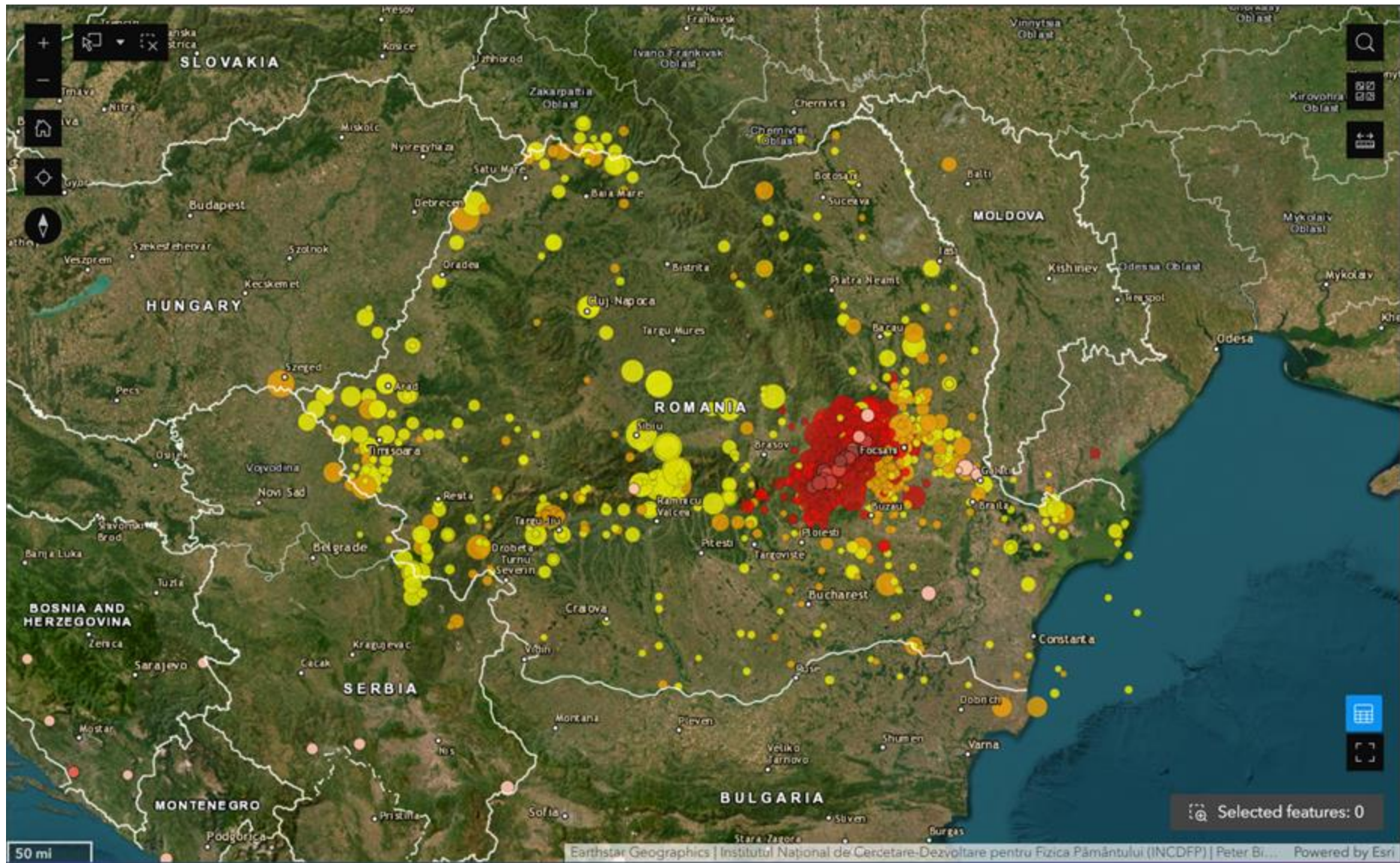


History and current status of Earthquake Early Warning System in Romania



National Institute for Earth Physics – Romania (NIEP)

Romania Seismicity



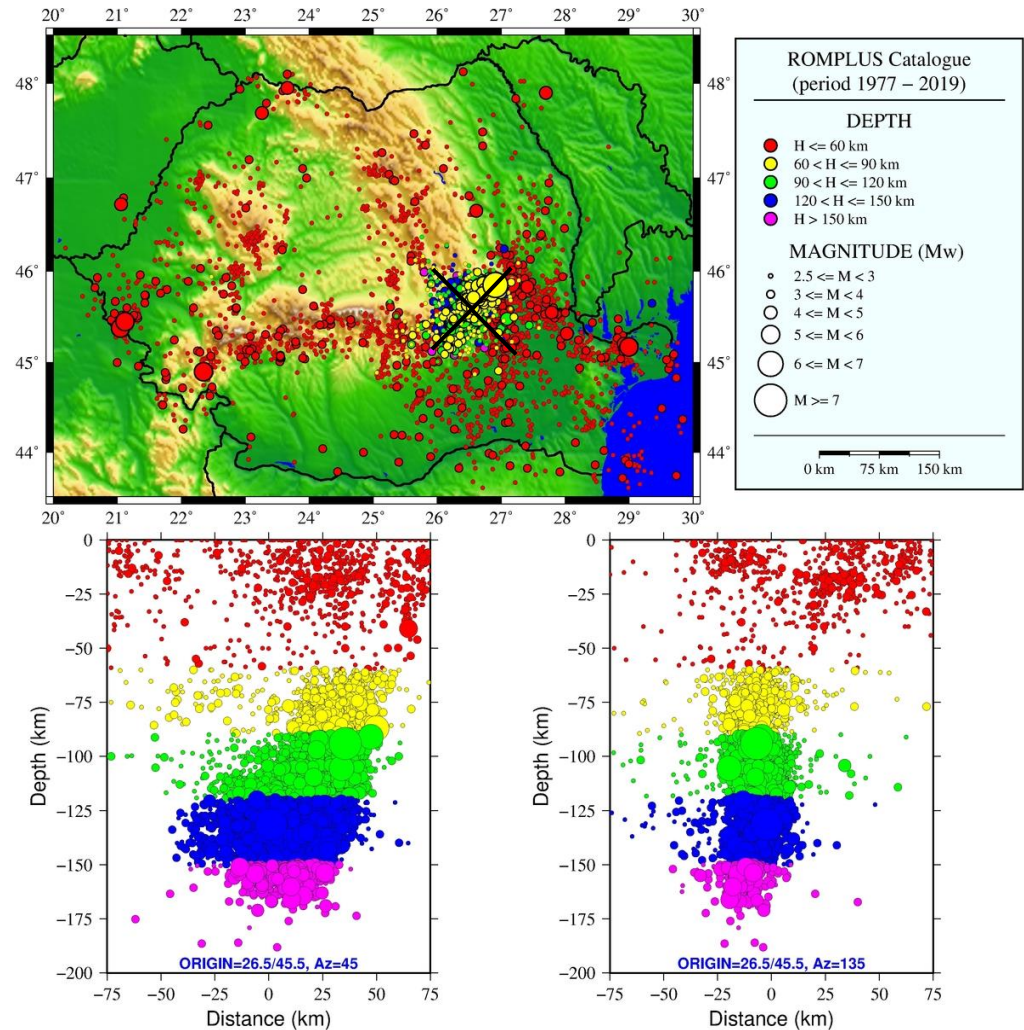
Seismicity of Romania

➤ Relatively high seismicity

➤ **Vrancea** seismic area

➤ 1977 – present

- 2 eqs. with $M_w > 7.0$
- 3 eqs. with $M_w \geq 6.0$ and $M_w < 7.0$
- 24 eqs. With $M_w \geq 5.0$ and $M_w < 6.0$
- thousands eqs. with $M_w < 5.0$



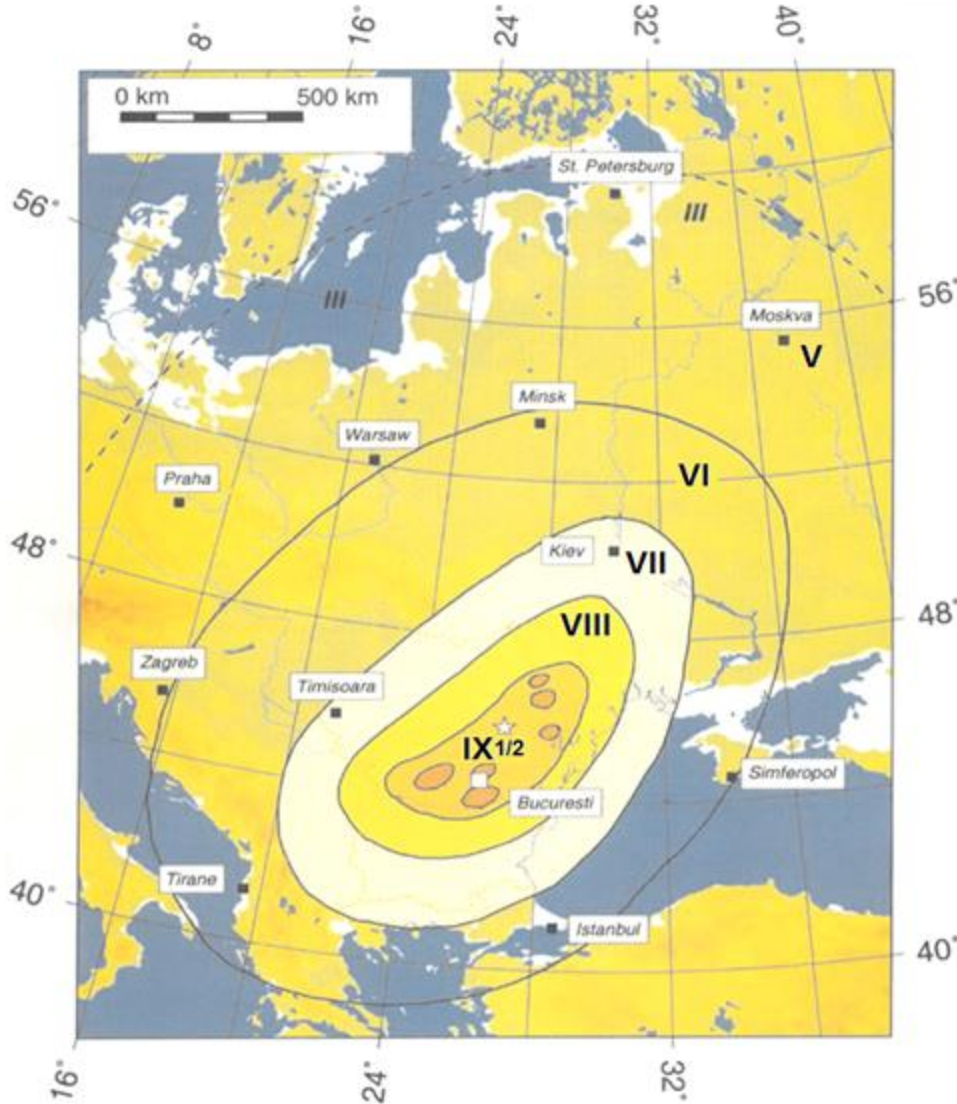
The 1977, Mw=7.5 Vrancea earthquake, h=95 km, Io=8-9 MSK

Bucharest is one of Europe's capital city most exposed to earthquakes.

32 tall buildings completely collapsed over 1500 deaths in Bucharest.
In Bulgaria - 8470 buildings partially destroyed and ruined.



Earthquake from 14 October 1802 (Mw-7.7). Intensity distribution from Bucharest to Moscow, Roma, Cairo and Istanbul



In 1802, at Lomonosov University in Moscow it was felt and statues in the courtyard collapsed. In the courtyard were Aleksandr Sergheevici Puşkin together with his nanny that described the effects of this Vrancea earthquake

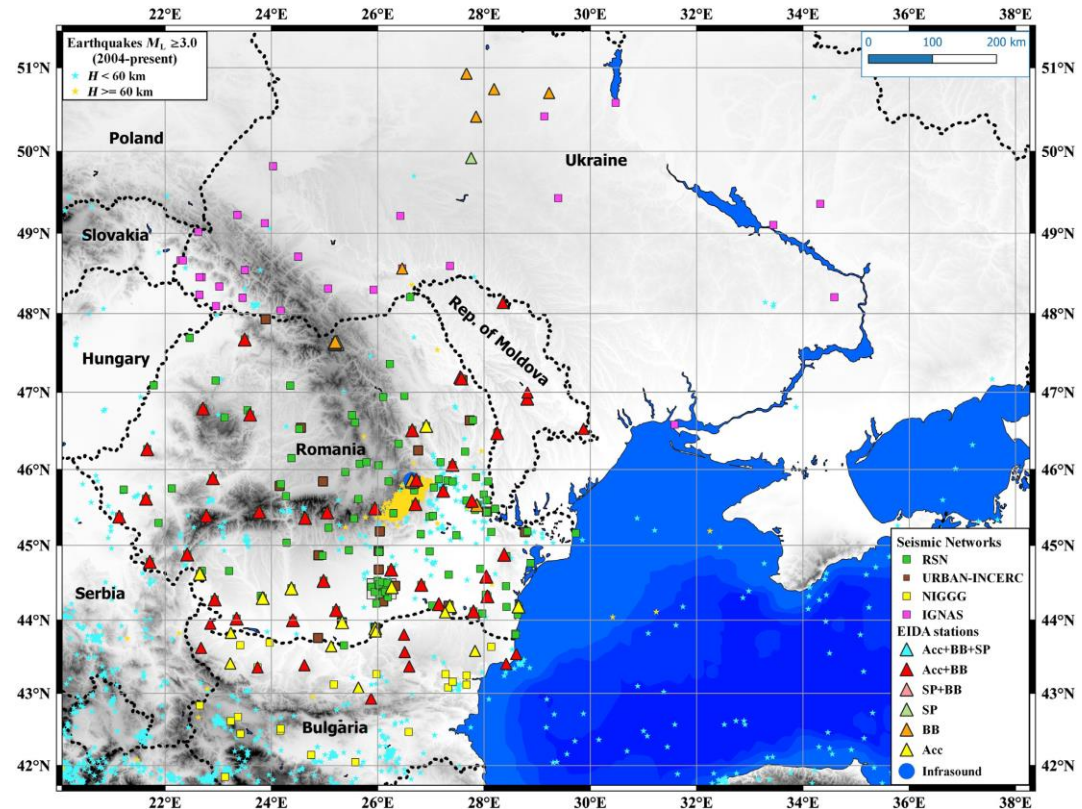
Romanian Seismic Network (RSN)

➤ Present day configuration

- 98 BB Stations
- 52 SP stations
- 188 Strong Motion stations
- 2 seismic arrays

➤ EIDA node

- ALL RONET (RO)
- 5 stations (MD)
- 18 stations (BS)
- 6 stations (UD – Ukraine)
- 7 stations Slovenia (KARST NFO)

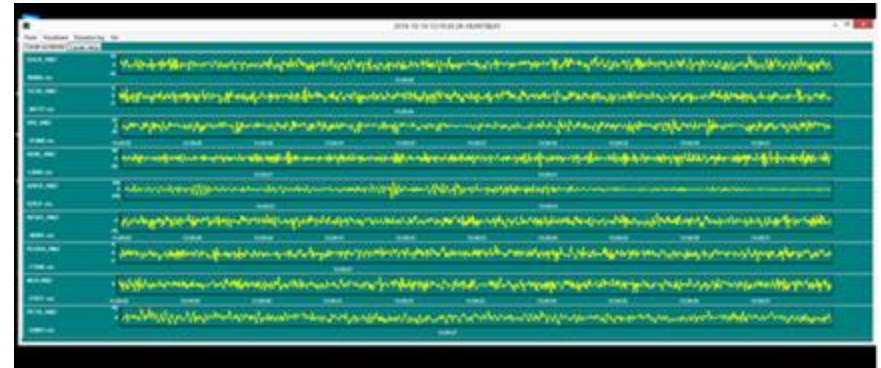
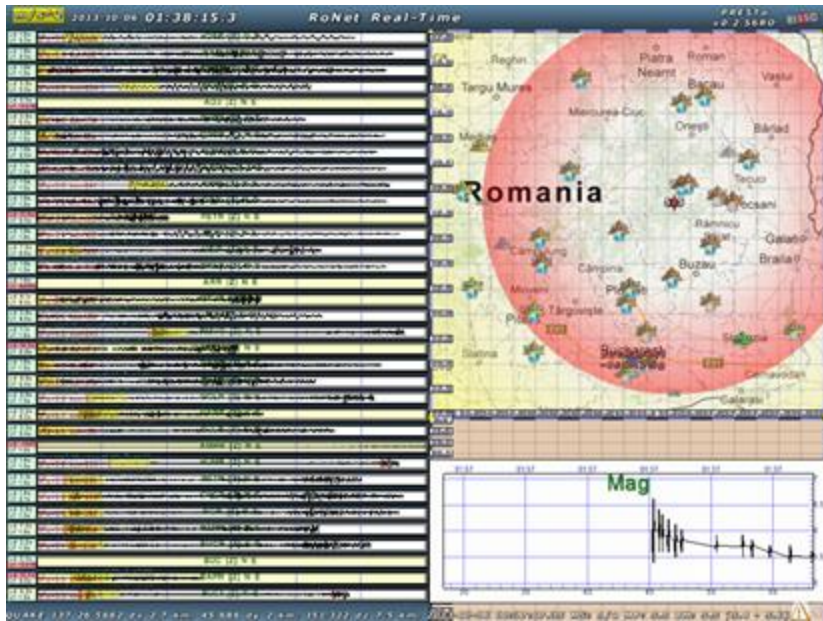


➤ Data exchange

- send data with: Bulgaria, CTBT, Czech Republic, GFZ, ISC, Montenegro, ORFEUS, Serbia, Turkey, USA, etc.
- receive data from: Bulgaria, China, Greece, Hungary, Italy, Poland, Russia, Serbia, Ukraine, USA, etc.

BB 113 / SP 55 / ACC – 208 (collocated with velocity). In EIDA 298 - RO, Y8,
UT, PL, S5, BS, RQ

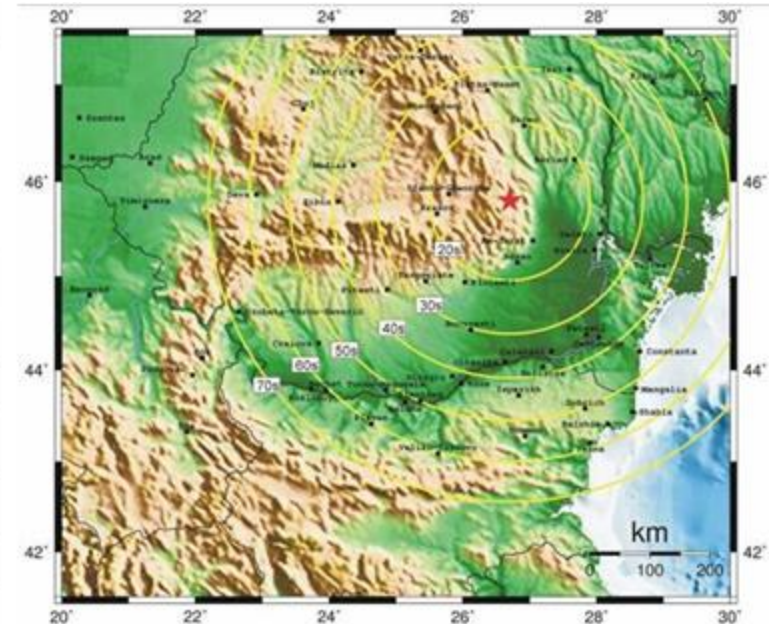
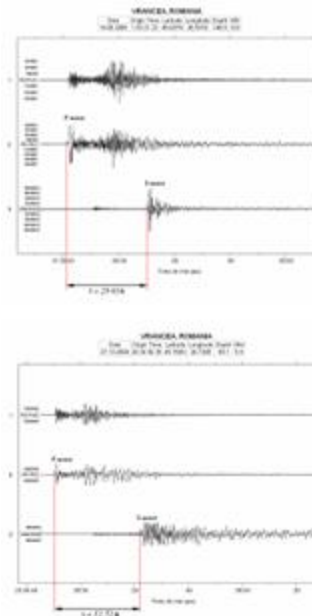
Vrancea EWS network

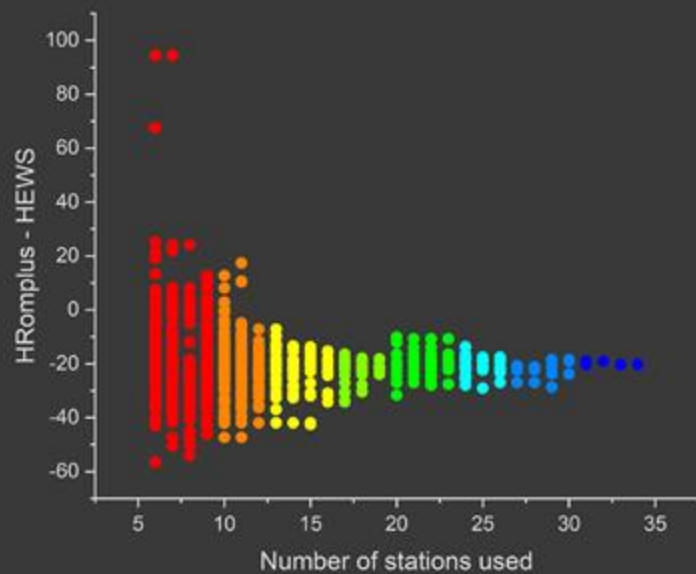
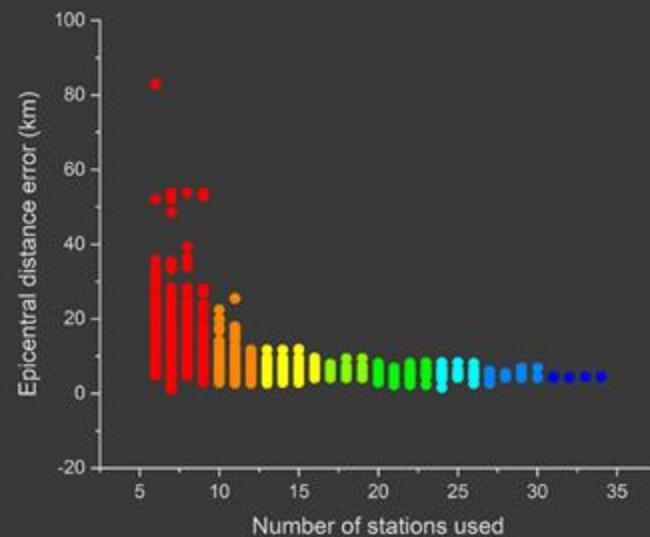
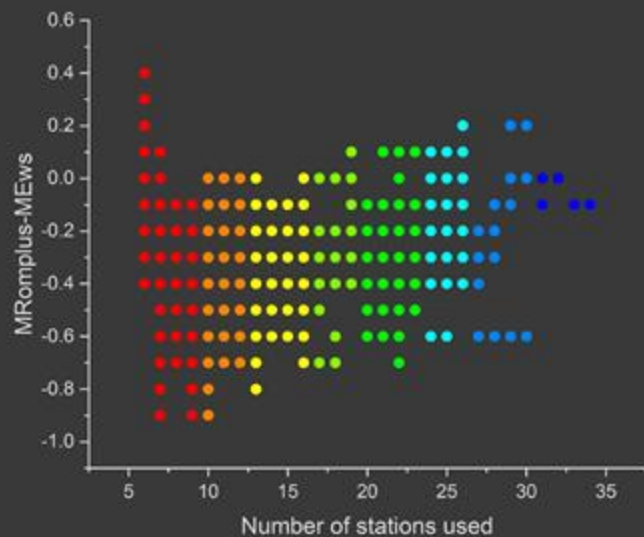


- Currently, PRESTo uses 35 real-time strong-motion stations, located in the Vrancea area, to compute magnitude and location, and the secondary system uses nine stations to compute magnitude and validate the event.
- The current system is able to provide between 25 and 31 s theoretical warning time for Bucharest, depending on the depth of the event. This system has issued 76 alerts since 2013,

EEW in Operation: Romania

- Seismic risk in Romania dominated by deep Vrancea earthquakes
- 4 events M6.9 – M7.7 from 1940 – 1990. M7.5 1977 >1500 casualties, mainly in Bucharest.
- Current Operational EEW System uses a network of 35 stations centred on Vrancea providing location and magnitude focusing only on these deep events
- 25 – 35 s warning for Bucharest 130km to South
- **Until now 83 alerts were sent to authorities !!!!**
- The Vrancea earthquake early warning system (EWS) is a free transnational service that covers Romania, Bulgaria, and Moldova.





Current End Users

Nuclear Research Institute, Bucharest

Nuclear source used for sterilization is **automatically secured** during an EEW alert

Vidraru Dam, Romania

Alert use to trigger data collection

Private company warehouse

Other End Users:

Nuclear Power Plants in Romania and Bulgaria

– just for information



Emergency response institutions in Romania and Bulgaria.
Currently, the alert is sent by SMS and email to ~ 450 official people from emergency response agencies in Romania through a SMS or e-mail governmental gateway.

The alert notification is also sent to 16 dedicated early warning receivers located at the governmental emergency response units located in Bulgaria and Romania.

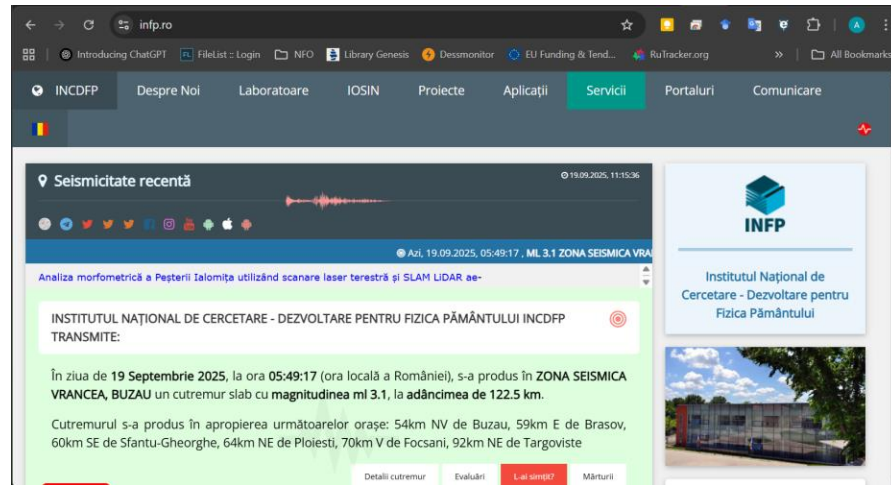


Governmental agencies involved in rapid intervention in case of a strong earthquake.

Current End Users

NIEP Webpage

Trigger a low version of website



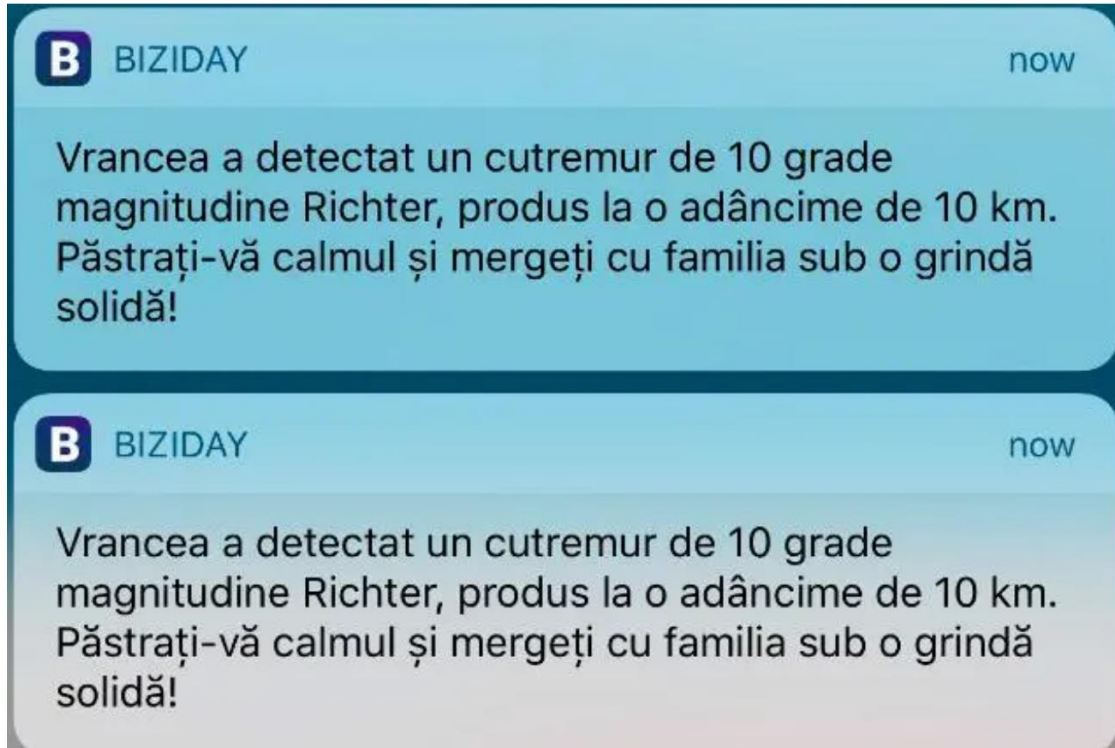
The screenshot shows the light version of the INFP website. It features a table of seismic events with columns for Date and time UTC, Region, Magnitude, Depth, Latitude, and Longitude. The table lists several events, including one in the Vrancea seismic zone and several off the east coast of Kamchatka.

Data si ora UTC	Regiune	Magnitudine	Adancime	Latitudine	Longitudine
2025/09/19, 02:49:17.24	Zona seismica Vrancea, judetul Buzau	ml 3.1	122.5 km	45.4827 °N	26.3303 °E
2025/09/19, 01:49:54.17	OFF EAST COAST OF KAMCHATKA	mb 5.4	10.0 km	52.7889 °N	159.6146 °E
2025/09/19, 00:48:35.99	OFF EAST COAST OF KAMCHATKA	mb 5.8	10.0 km	52.9820 °N	159.3224 °E
2025/09/19, 00:25:02.36	OFF EAST COAST OF KAMCHATKA	mb 5.4	10.0 km	51.4312 °N	161.1757 °E
2025/09/19, 00:22:35.79	OFF EAST COAST OF KAMCHATKA	mb 5.6	10.0 km	52.4568 °N	161.0439 °E
2025/09/19, 00:16:55.27	OFF EAST COAST OF KAMCHATKA	mb 5.1	10.0 km	52.4874 °N	160.1288 °E
2025/09/18, 23:27:49.48	NEAR EAST COAST OF KAMCHATKA	mb 5.4	10.0 km	53.2627 °N	160.4567 °E
2025/09/18, 23:14:58.66	OFF EAST COAST OF KAMCHATKA	mb 5.9	10.0 km	52.4010 °N	160.9492 °E

EEW in Operation: Romania – Current End Users

Public **free** alerts:

Biziday *NEWS application*



An earthquake of magnitude 10 on the Richter scale has been detected in Vrancea at a depth of 10 km. Stay calm and take shelter with your family under a sturdy beam or solid support!

Discontinued after Biziday servers were hacked. (150 000 people received a false alert. Mw 10) – March 3, 2017 (40 years after 1977 earthquake)

EEW in Operation: Romania – Current End Users

Telegram app(ioS/Android)



Educatie Seismica

3 705 subscribers

In acest canal se vor publica informatii referitoare la pregatirea in caz de seism precum si ce trebuie sa faceti / sa nu faceti in caz de seism.

June 24, 2017

Cum ne pregatim pentru un cutremur
<https://www.youtube.com/watch?v=UllpnoyfoXDE>

Programe pentru un cutremur
Campagna nationala "Nu Tremura la Cutremur"

Comportamentul din timpul unui cutremur - reguli generale
<https://www.youtube.com/watch?v=00Ud4X3tE>

Reguli generale de comportament in caz de cutremur
Campagna GISU - Nu tremura la cutremur



Alerta Cutremur - Actualizari

5 904 subscribers

Starea alerte 1: In alerta

Starea alerte 2: In alerta

June 25, 2017

Am adaugat materiale noi privind pregatirea in caz de cutremur, ce trebuie facut in timpul unui cutremur si dupa terminarea acestuia, pe care va recomandam sa le consultati pe canalul @educatieSeismica

June 26, 2017

Este posibil ca alerta seismica prin Telegram sa aiba intarzieri minore. Am luat la cunoscuta acest lucru si vom remedia problema in cel mai scurt timp. Revenim cu actualizari

June 27, 2017

In decursul zilei de azi vom efectua o simulare de alerta pentru testarea noilor imbunatatiri. Un nou anunt va fi postat aici inainte de inceperea testului.

Simularea de alerta seismica va fi amanata din motive tehnice. Revenim cu detalii.

June 28, 2017

Urmeaza cateva teste de alerta seismica. Nu intrati in panica, se verifica functionalitatea noilor imbunatatiri. Un nou anunt va fi postat cand testele vor lua sfarsit.

Acest test a luat sfarsit. Au fost transmise 2 semnale cu magnitudine 1.2 ce au sosit in canalul de alerta M=5.

December 5, 2017

Sistemul este suspendat temporar pentru mentenanta. Revenim in scurt timp.

Two info channels:
educational and updates
(maintenance).



Alerta Cutremur M< 5.0

13 504 subscribers

Cutremur Magnitudine: 4.7 21:24 10:29

Cutremur Magnitudine: 4.7 21:24 10:29

Cutremur Magnitudine: 4.7 21:24 10:29

Cutremur Magnitudine: 4.7 21:24 10:29

Cutremur Magnitudine: 4.6 21:24 10:29

Cutremur Magnitudine: 4.6 21:24 10:29

Cutremur Magnitudine: 4.6 21:24 10:29

Cutremur Magnitudine: 4.6 21:24 10:29

Cutremur Magnitudine: 4.6 21:24 10:29

August 6, 2024

Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.1 21:24 10:29

Cutremur Magnitudine: 4.1 21:24 10:29

Cutremur Magnitudine: 4.1 21:24 10:29

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Cutremur Magnitudine: 4.1 21:24 10:29

Cutremur Magnitudine: 4.1 21:24 10:29

Cutremur Magnitudine: 4.1 21:24 10:29

October 4, 2024

Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.3 21:24 10:29

Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.2 21:24 10:29

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Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.2 21:24 10:29

Cutremur Magnitudine: 4.2 21:24 10:29



Alerta Cutremur M 5.0 - 6.0

17 231 subscribers

Cutremur Magnitudine: 5.2 21:24 10:29

Cutremur Magnitudine: 5.2 21:24 10:29

Cutremur Magnitudine: 5.2 21:24 10:29

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Cutremur Magnitudine: 5.2 21:24 10:29

Cutremur Magnitudine: 5.2 21:24 10:29

Cutremur Magnitudine: 5.2 21:24 10:29

September 16, 2024

Cutremur Magnitudine: 5.5 21:24 10:29

Cutremur Magnitudine: 5.2 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29

Cutremur Magnitudine: 5.1 21:24 10:29



Alerta Cutremur M 6.0 - 7.0

10 992 subscribers



No events > 6 Mw

Alerta Cutremur M7+

10 768 subscribers

Four alerts channels: Integration of a new type of message (including date and time, latitude, longitude, depth, and magnitude range).

si LOV=26.7167, la adancimea H=133.584 km.

La data si ora: 2025-08-24 04:15:12.99 s-a produs un cutremur cu magnitudinea Mw=4.2, in intervalul de magnitudine Mmin=4.0 si Mmax=4.3. Coordonate eveniment: LAT=45.7554 si LON=26.7167, la adancimea H=134.391 km.

La data si ora: 2025-08-24 04:15:13.10 s-a produs un cutremur cu magnitudinea Mw=4.2, in intervalul de magnitudine Mmin=4.0 si Mmax=4.3. Coordonate eveniment: LAT=45.7554 si LON=26.7167, la adancimea H=133.316 km.

La data si ora: 2025-08-24 04:15:13.03 s-a produs un cutremur cu magnitudinea Mw=4.1, in intervalul de magnitudine Mmin=4.0 si Mmax=4.2. Coordonate eveniment: LAT=45.7576 si LON=26.7071, la adancimea H=133.988 km.

La data si ora: 2025-08-24 04:15:13.38 s-a produs un cutremur cu magnitudinea Mw=4.1, in intervalul de magnitudine Mmin=4.0 si Mmax=4.2. Coordonate eveniment: LAT=45.751 si LON=26.7167, la adancimea H=130.628 km.

La data si ora: 2025-08-24 04:15:13.38 s-a produs un cutremur cu magnitudinea Mw=4.1, in intervalul de magnitudine Mmin=4.0 si Mmax=4.2. Coordonate eveniment: LAT=45.751 si LON=26.7167, la adancimea H=130.628 km.

EEW in Operation: Romania – Current End Users

Public **free** alerts:

III) **Skype** app(IoS/Android)
discontinued

II) **Andoid app (discontinued)**

IV) **Webpage alerta.infp.ro**

V) **X (@[cutremurinfo](https://twitter.com/cutremurinfo))**

VI) **www.earthbot.ro - discontinued**

<http://ews.infp.ro/>



Main issues:

No control on time delivery of messages !

Communication issues with authoritative agencies!

ShakeMap - NEW integration with EWS

 VRANCEA EWS ROMANIA

Fri, 23 Sep 2016, 23:11:16 Mag 5.8 Depth 111.816 km Lat 45.747 °N Lon 26.6523 °E

Fri, 23 Sep 2016, 23:11:16 ➤ ML 5.8 EARTHQUAKE IN VRANCEA EWS ROMANIA, AT A DEPTH OF 111.816 km.



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)	<0.05	0.3	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.02	0.13	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)

△ Seismic Instrument

○ Macroseismic Observation

★ Epicenter

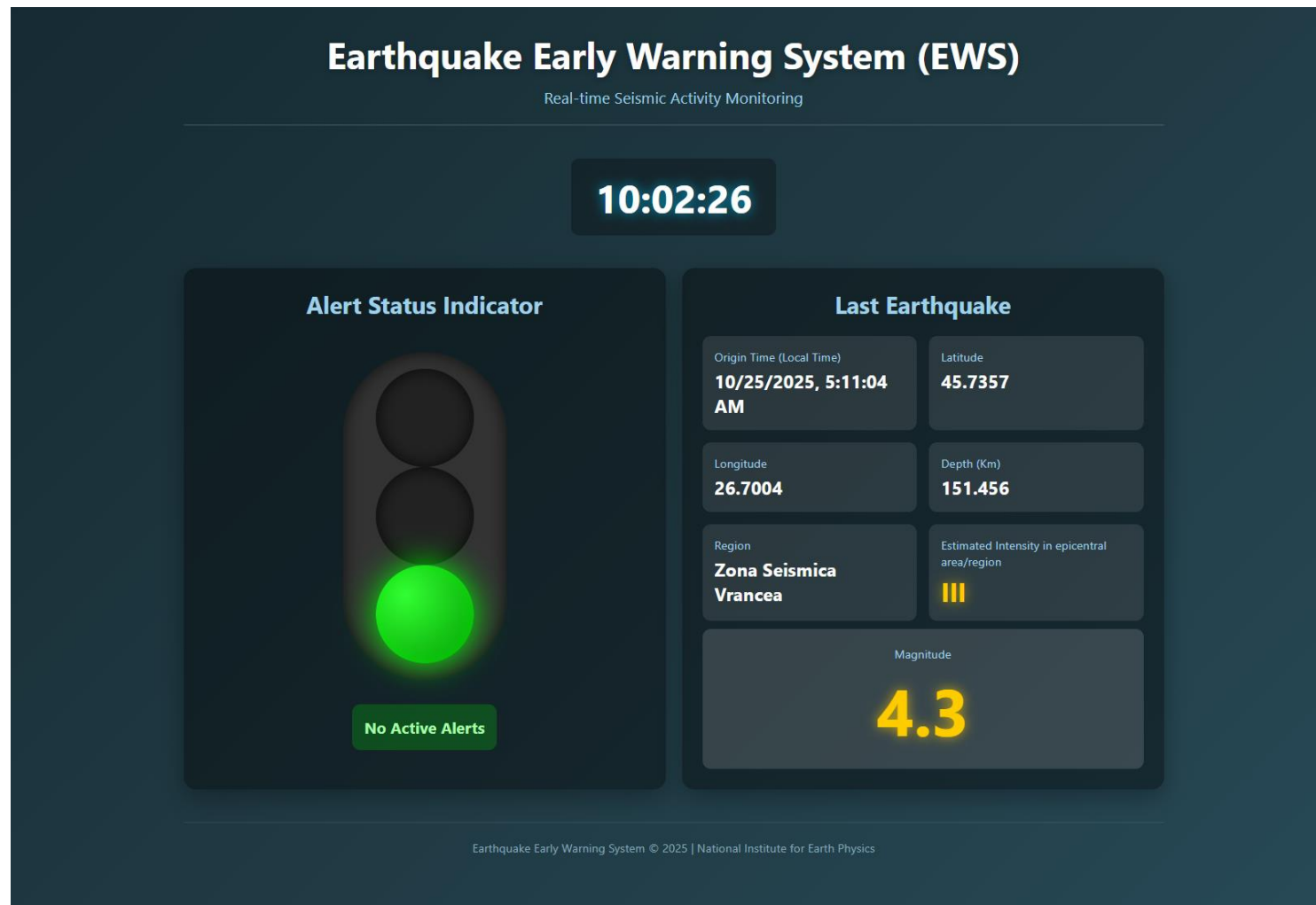
Version 1: Processed 2025-01-23T07:54:45Z

Free website: <https://eqtrack.infp.ro/ews/>

GREEN = earthquake alert $M < 4$

YELLOW = earthquake alert $M \geq 4$ and $M < 6$

RED = earthquake alert $M > 6$



New implementation
for entire country

Virtual Seismologist
in testing phase

Bulletin (UTC time): 2014/11/22 19:14:17.11 45.8683 27.1517 H= 40.9 ml 5.7

Tdiff	Type	Mag.	Lat.	Lon.	Depth	origin time (UTC)	Lik.	Or.	Ma.	Str.	Len.	Author	Creation t.	Tdiff(current o.)
11.16	MVS	5.82	45.36	26.87	5.00	2014-11-22T19:14:15.75Z	0.99	11	10			scvsmag@7	2014-11-22T19:14:28.77Z	
13.02														
12.16	MVS	5.61	45.36	26.87	5.00	2014-11-22T19:14:15.75Z	0.99	11	10			scvsmag@7	2014-11-22T19:14:29.77Z	
14.02														
13.16	MVS	5.48	45.38	26.88	5.00	2014-11-22T19:14:16.21Z	0.99	12	11			scvsmag@7	2014-11-22T19:14:30.77Z	
14.56														
14.16	MVS	5.60	45.38	26.88	5.00	2014-11-22T19:14:16.21Z	0.99	12	12			scvsmag@7	2014-11-22T19:14:31.77Z	
15.56														
15.16	MVS	5.53	45.38	26.88	5.00	2014-11-22T19:14:16.21Z	0.99	12	12			scvsmag@7	2014-11-22T19:14:32.77Z	
16.56														
16.16	MVS	5.45	45.44	26.90	11.27	2014-11-22T19:14:16.47Z	0.99	13	12			scvsmag@7	2014-11-22T19:14:33.77Z	
17.31														
17.16	MVS	5.42	45.44	26.90	11.27	2014-11-22T19:14:16.47Z	0.99	13	13			scvsmag@7	2014-11-22T19:14:34.78Z	
18.31														
18.17	MVS	5.33	45.89	27.15	20.94	2014-11-22T19:14:17.59Z	0.99	20	19			scvsmag@7	2014-11-22T19:14:35.78Z	
18.19														
19.17	MVS	5.38	45.89	27.15	20.94	2014-11-22T19:14:17.59Z	0.99	20	19			scvsmag@7	2014-11-22T19:14:36.78Z	
19.19														
20.17	MVS	5.44	45.89	27.15	20.94	2014-11-22T19:14:17.59Z	0.99	20	18			scvsmag@7	2014-11-22T19:14:37.78Z	
20.19														
21.17	MVS	5.43	45.90	27.15	19.63	2014-11-22T19:14:17.64Z	0.99	23	21			scvsmag@7	2014-11-22T19:14:38.78Z	
21.14														
33.18	MVS	5.37	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:50.80Z	
33.18														
34.18	MVS	5.36	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:51.80Z	
34.18														
35.18	MVS	5.36	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:52.80Z	
35.18														
36.18	MVS	5.39	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:53.80Z	
36.18														
37.19	MVS	5.39	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:54.80Z	
37.19														
38.19	MVS	5.39	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:55.80Z	
38.19														
39.19	MVS	5.39	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:56.80Z	
39.19														
40.18	MVS	5.39	45.88	27.16	20.24	2014-11-22T19:14:17.61Z	0.99	36	34			scvsmag@7	2014-11-22T19:14:57.80Z	
40.18														

Vs first alert – OT = ~11 seconds

First solution SCAUTOLOC
2014/11/22 19:14:28 [info/Autoloc]
Detailed info for Origin 1

9:55 2.58 KB/s 4G+ 93%

☰

NIEP Earthquake Alert

National Institute For Earth Physics

Last Rapid Notif.

Magnitude

4.2

Depth

122 km



26 km SSW of Tulnici, Romania

2025-09-26 18:15:31

34 days, 16 hours ago

EQs Notifications

Magnitude

Information

4.2

26 km SSW of Tulnici, Romania

2025-09-26 18:15:31

II. Not Felt (in home)

6.5

3 km NNE of Constanţa, Romania

2025-09-26 17:43:59

V. Moderate (in home)

6.6

2 km SSE of Constanţa, Romania

2025-09-25 15:28:59

+



SEISMIC CONTROL ROOM at NIEP HQ