Romanian Network for Seismic and Crustal Movement Monitoring

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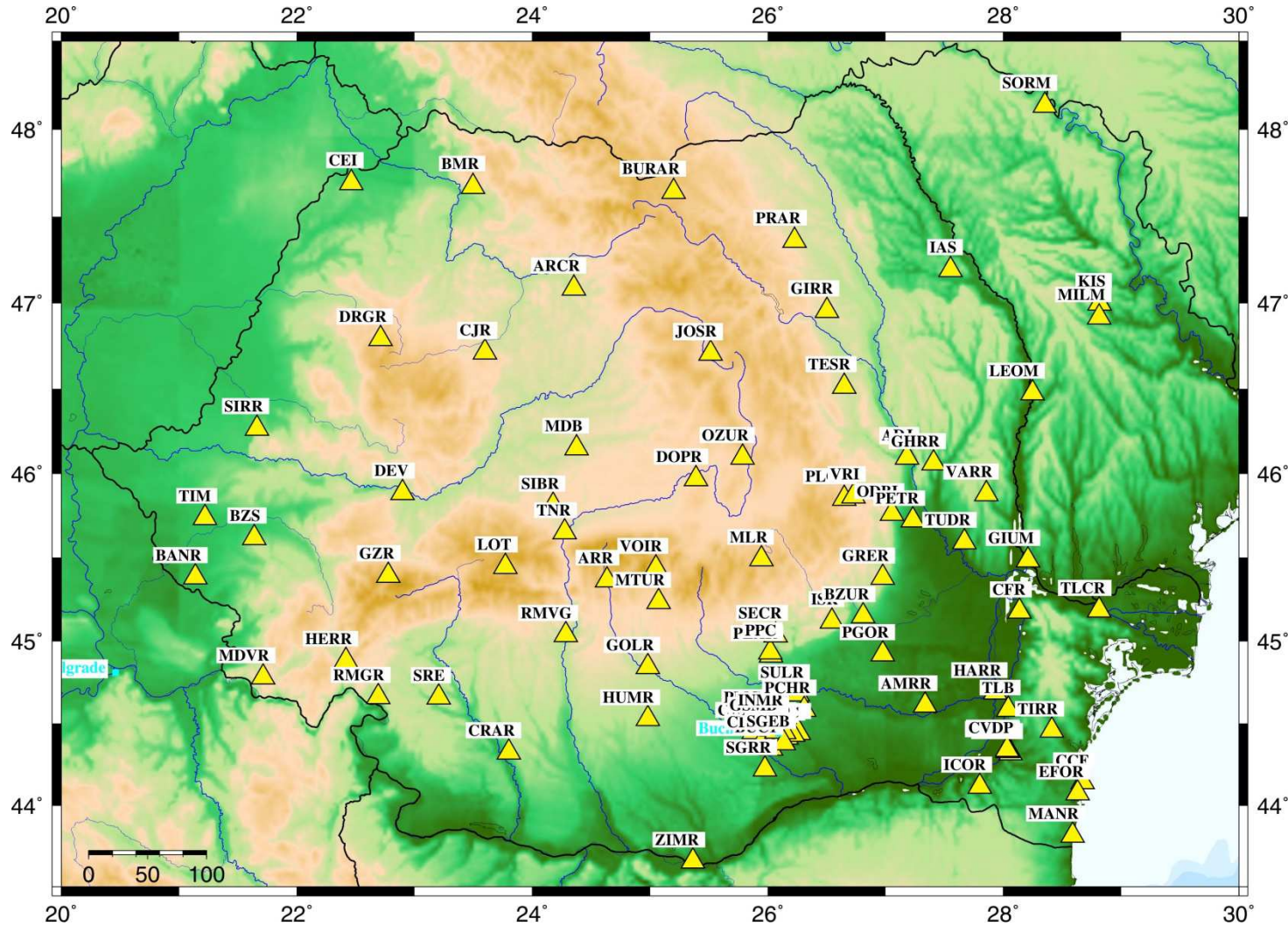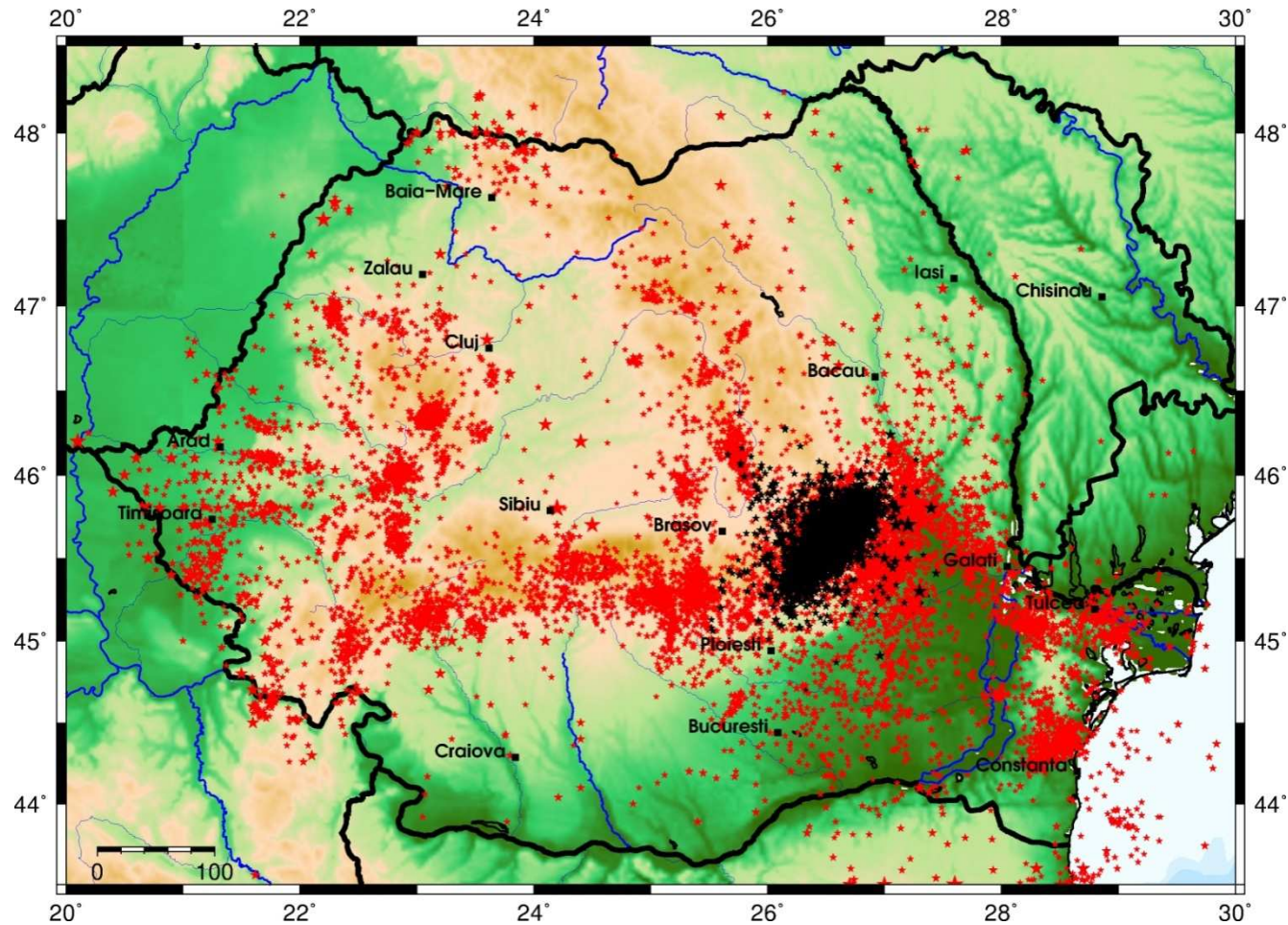
Real time Seismic Network
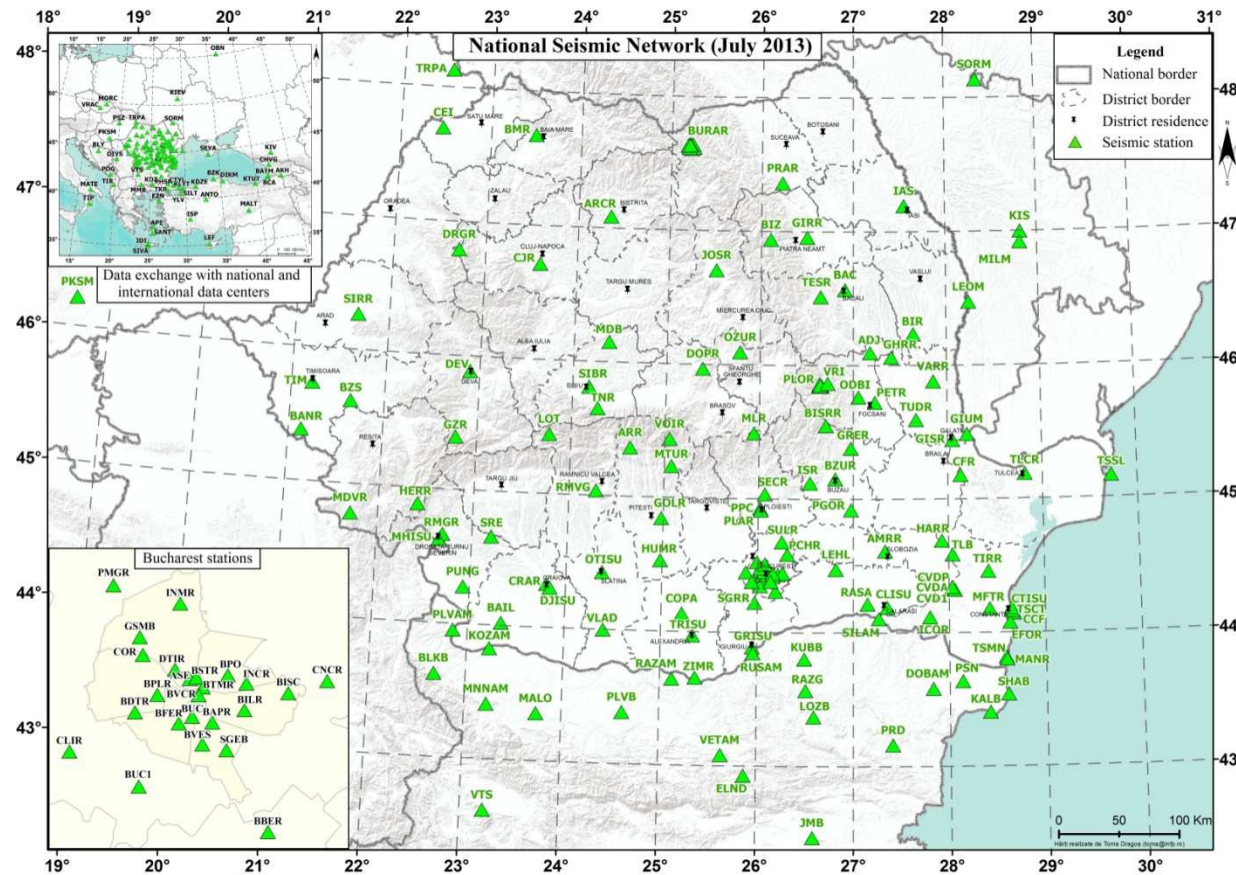
- 85 digital seismic stations

- Two arrays (BURAR and PLOR)

- 29 seismic stations installed in the framework of the DACEA cross-border project
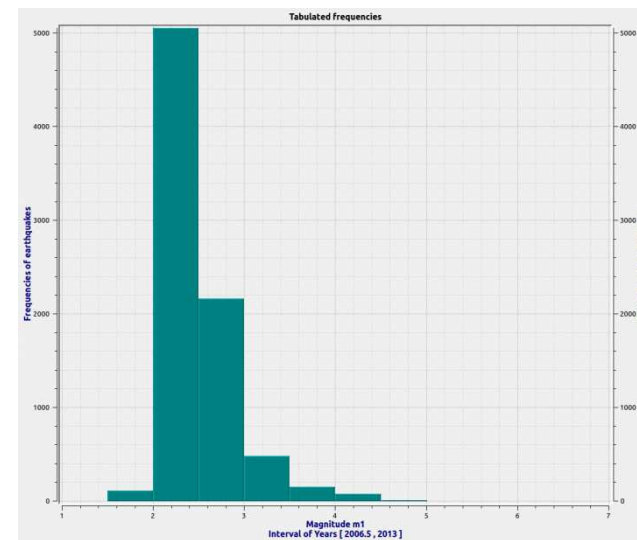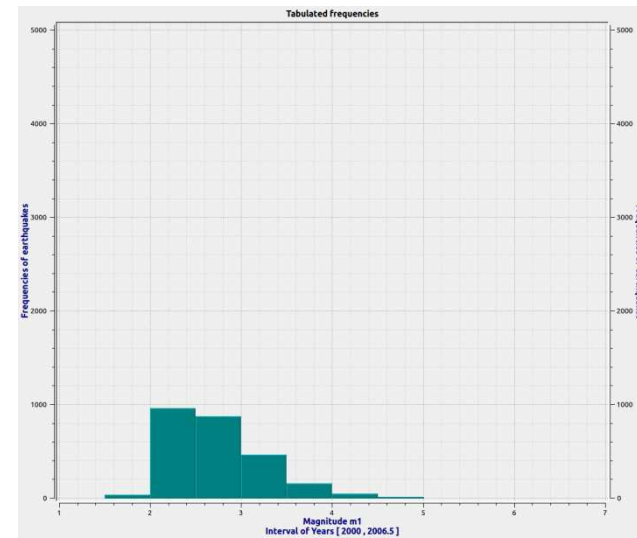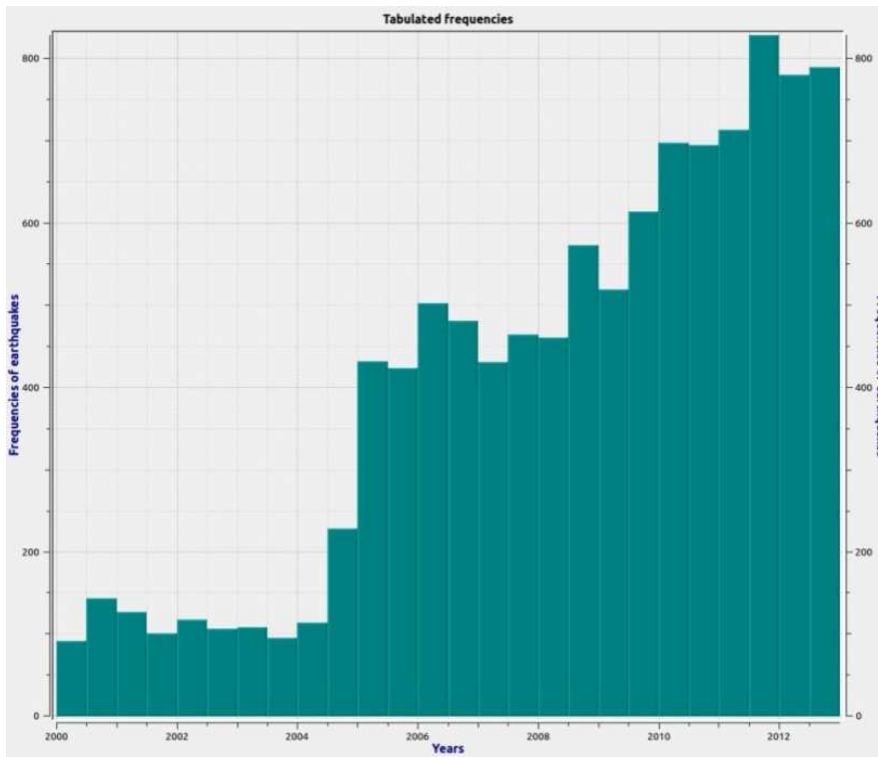
Strong motion Network

119 strong motion stations using accelerometers (Episensor) with different digitizers (Q330, Q4120, K2 and DM24)

Seismicity (984 – 30 Sep. 2013)

➢ increasing the number of stations has helped increasing the number of detected events and lowering threshold magnitude
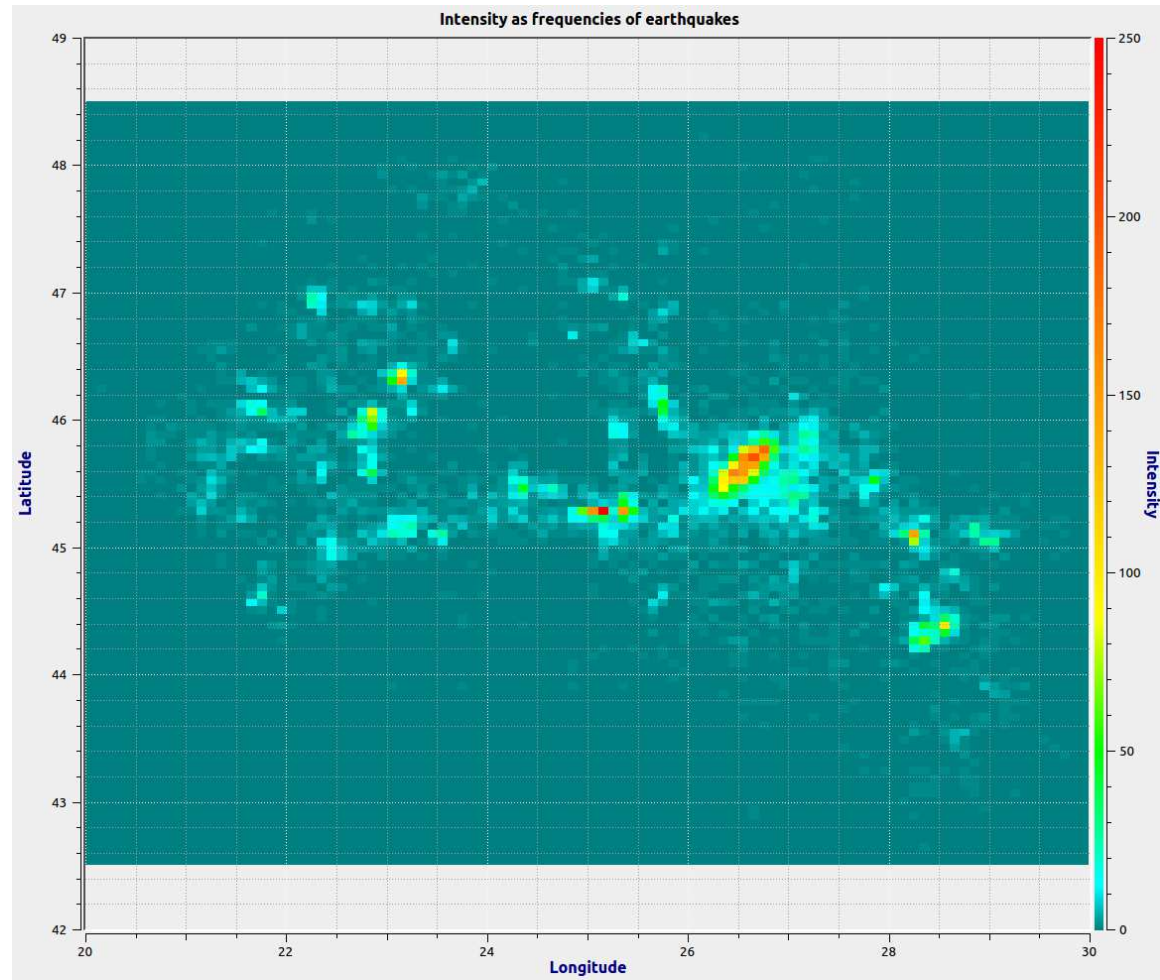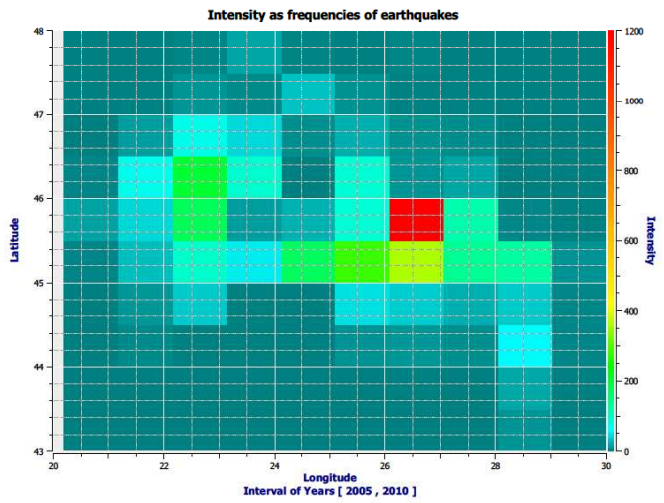
Intensity as frequencies of earthquakes

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Danube Cross-border System for Earthquake Alert (DACEA) Project

- **General objective :** *Prevention of the natural disasters generated by earthquakes in cross-border area Romania-Bulgaria developing the early warning integrated communication network and capacity building at local level based on results of research in this field.*

- 6 seismic stations installed on Romania territory and 8 in Bulgaria, along the Danube river

- 7 accelerometers and equipments installed at the Emergency Situations Inspectorates in Romania and 9 in Bulgaria

Main activity tasks
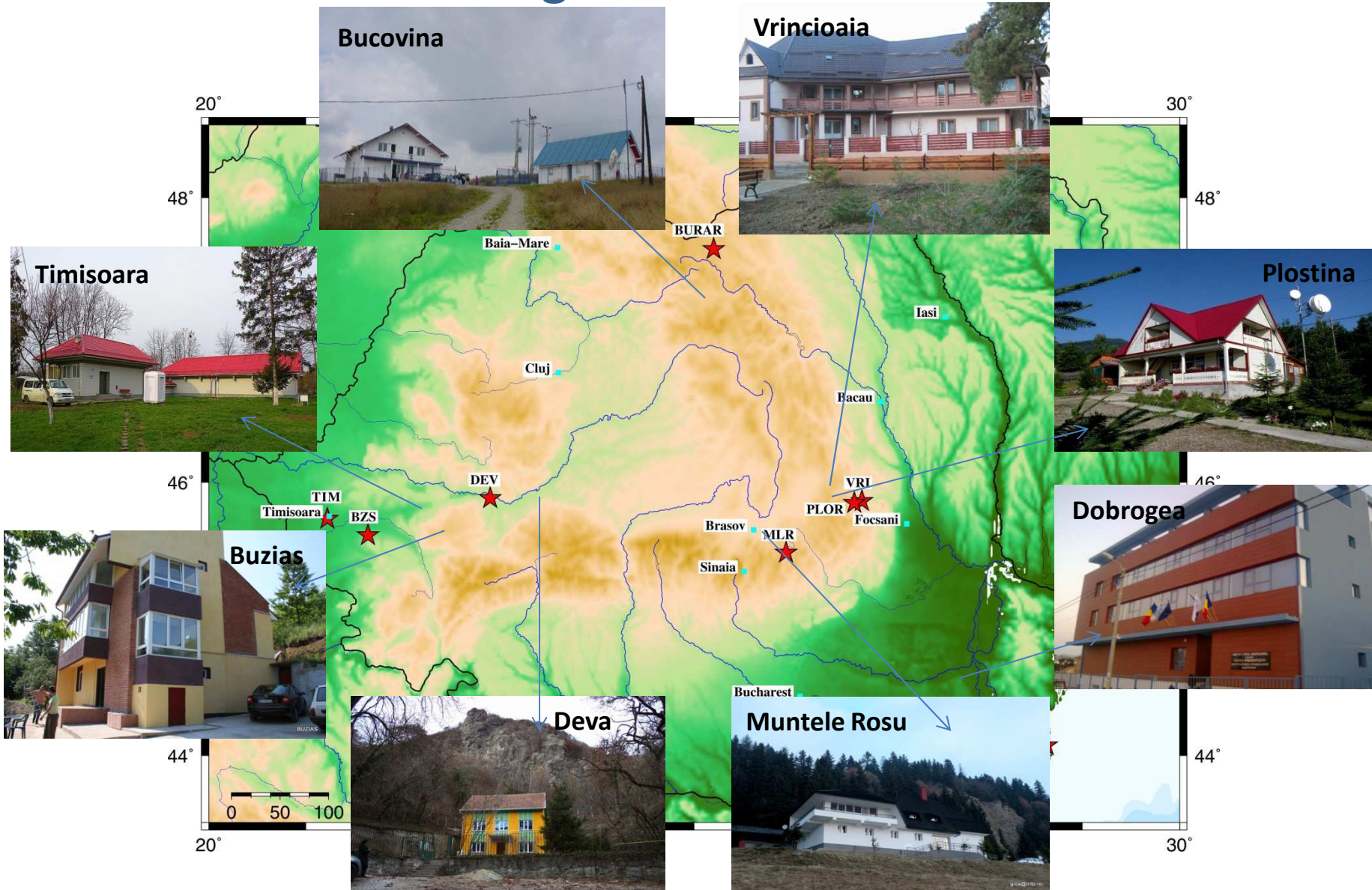
Continuous operation of the national network: Seismological Observatories (SO)

Participation in the regional seismic monitoring

SO

Maintenance of the Observatory building
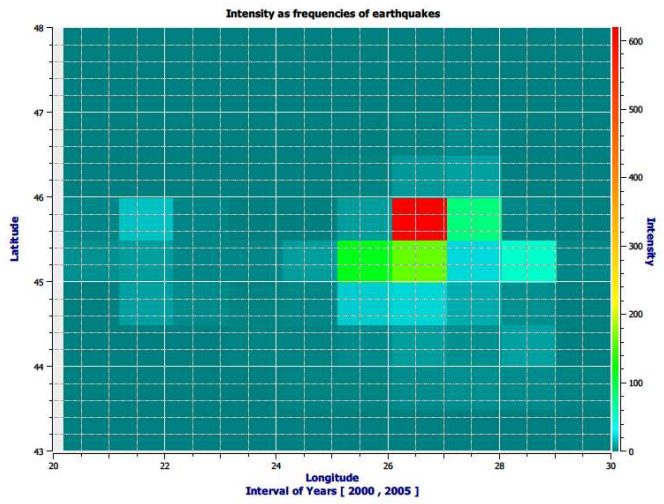
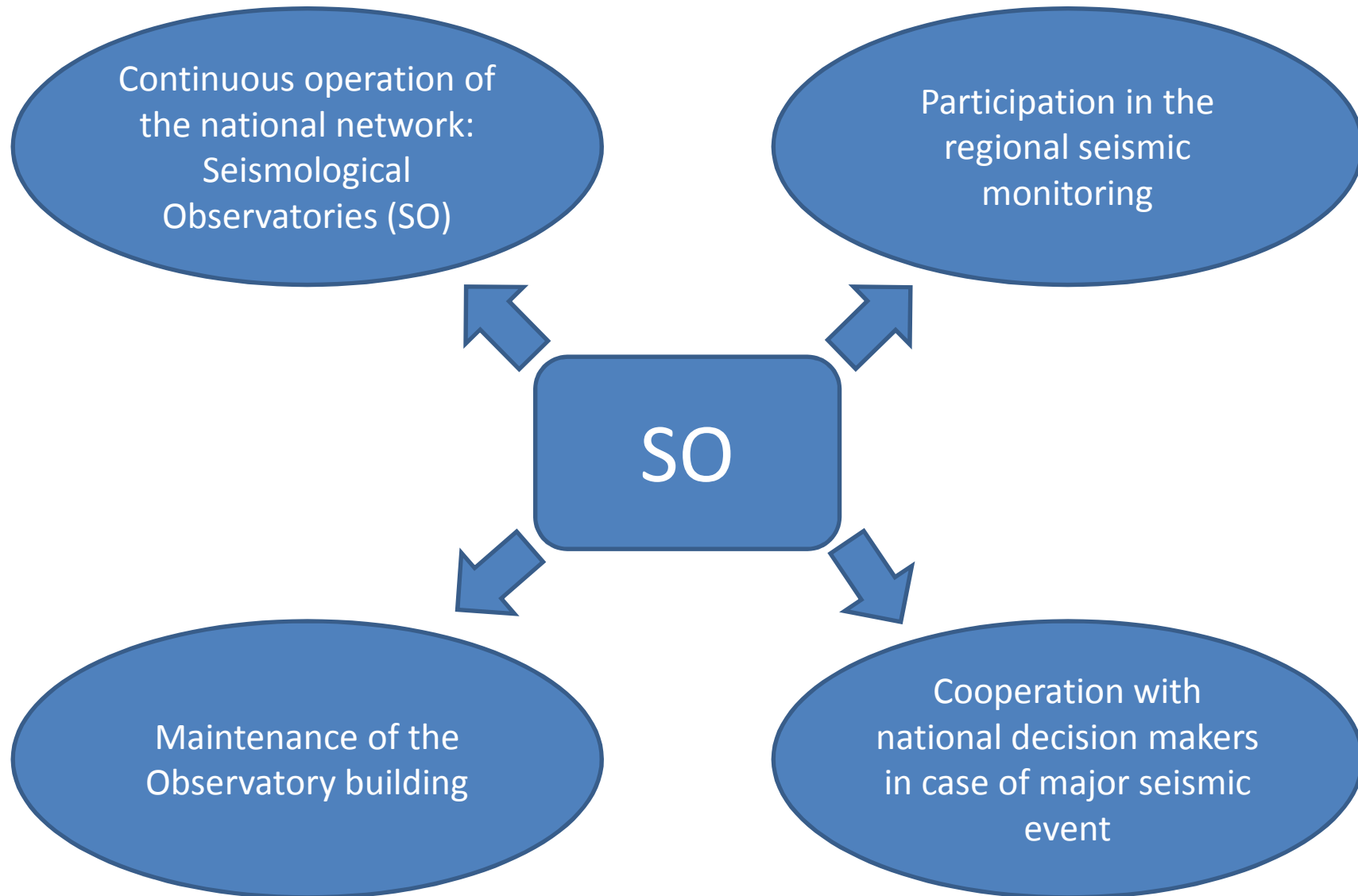Cooperation with national decision makers in case of major seismic event

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Seismological Observatories

Operation of the SO consists of:

→ permanent supervision of the equipment

→ upgrading the seismic and communication equipment

→ preliminary data processing (main event parameters, rapid maps etc.)
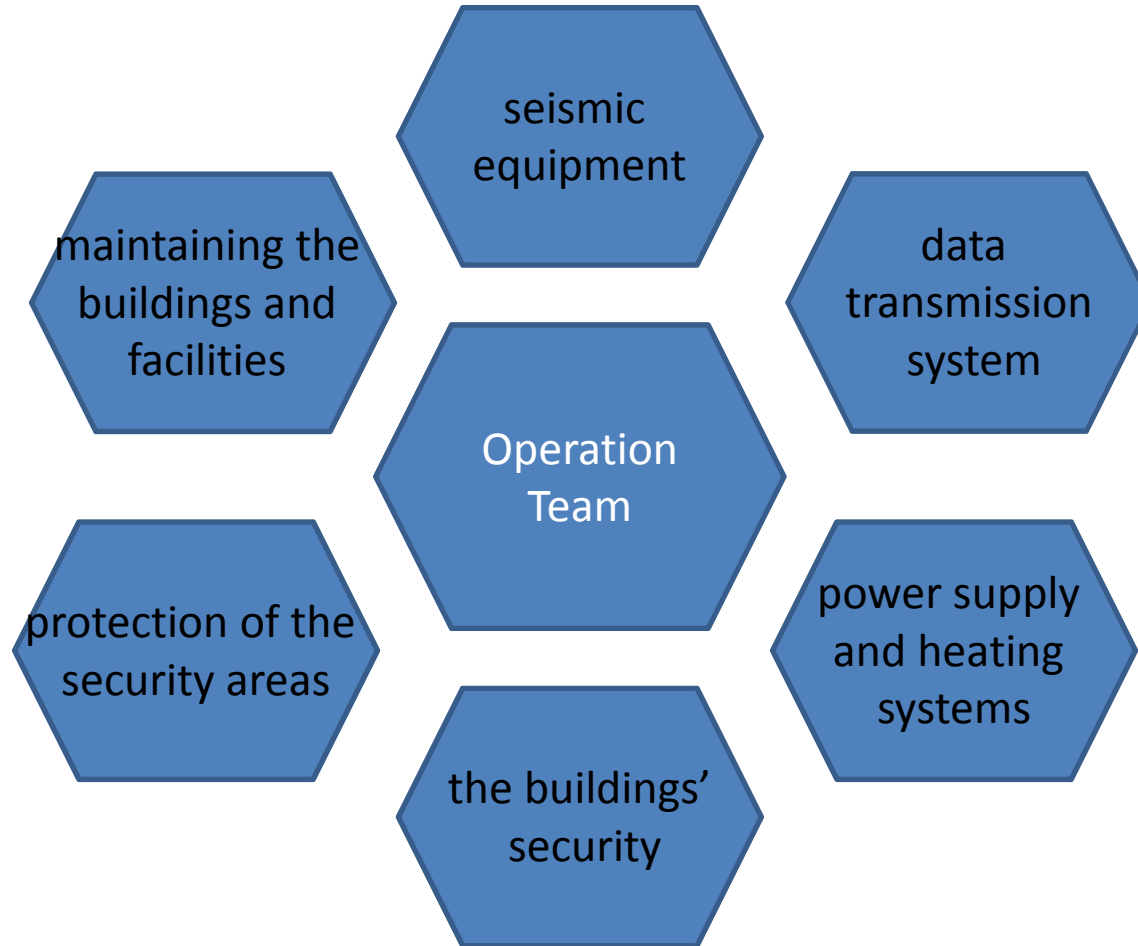
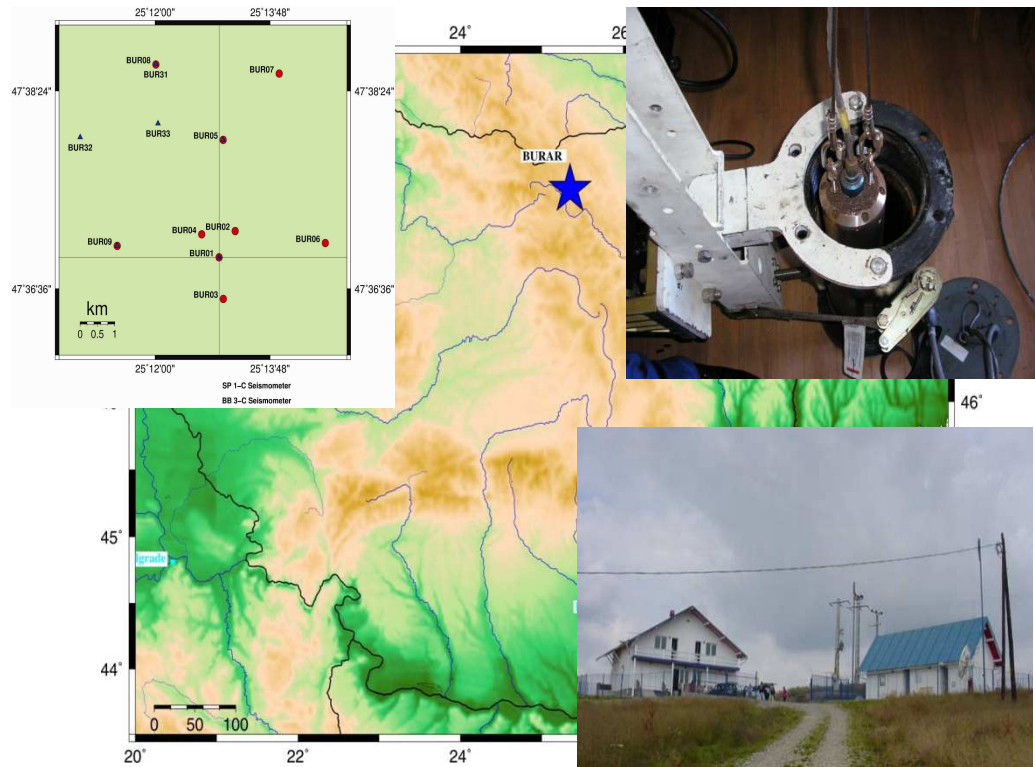→ participation to the elaboration of the reviewed event bulletins

→ In case of major seismic events provides information and cooperates with state authorities and decision makers

# Maintenance of the SS equipment and facilities

BURAR Observatory

Bucovina Observatory was built between 1999 and 2001 under cooperation with AFTAC – USA (Airforce Technical Application Center). The array elements are distributed on an area of 25 km square.

The BURAR Array has 6 broad band sensors, 9 short period sensors and one accelerometer. The data from this sensors are transmitted in real time to the National Data Center and from here to US.
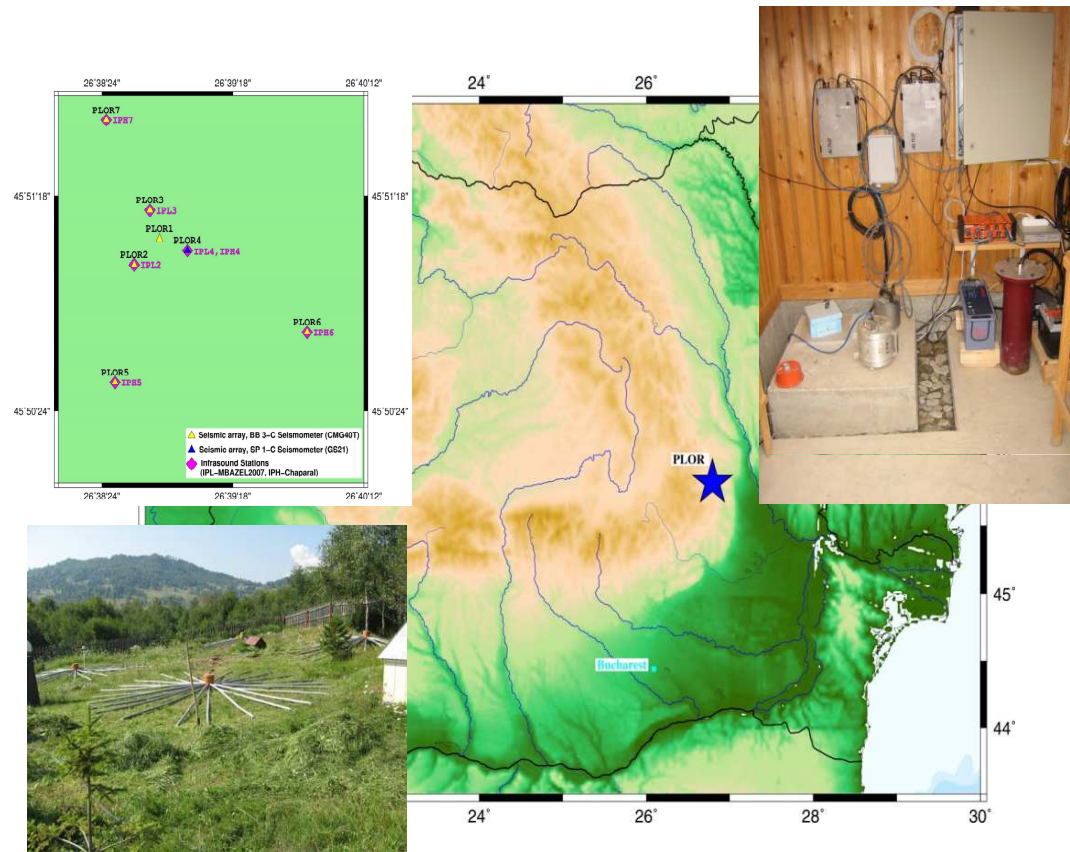
Vrincioaia Observatory
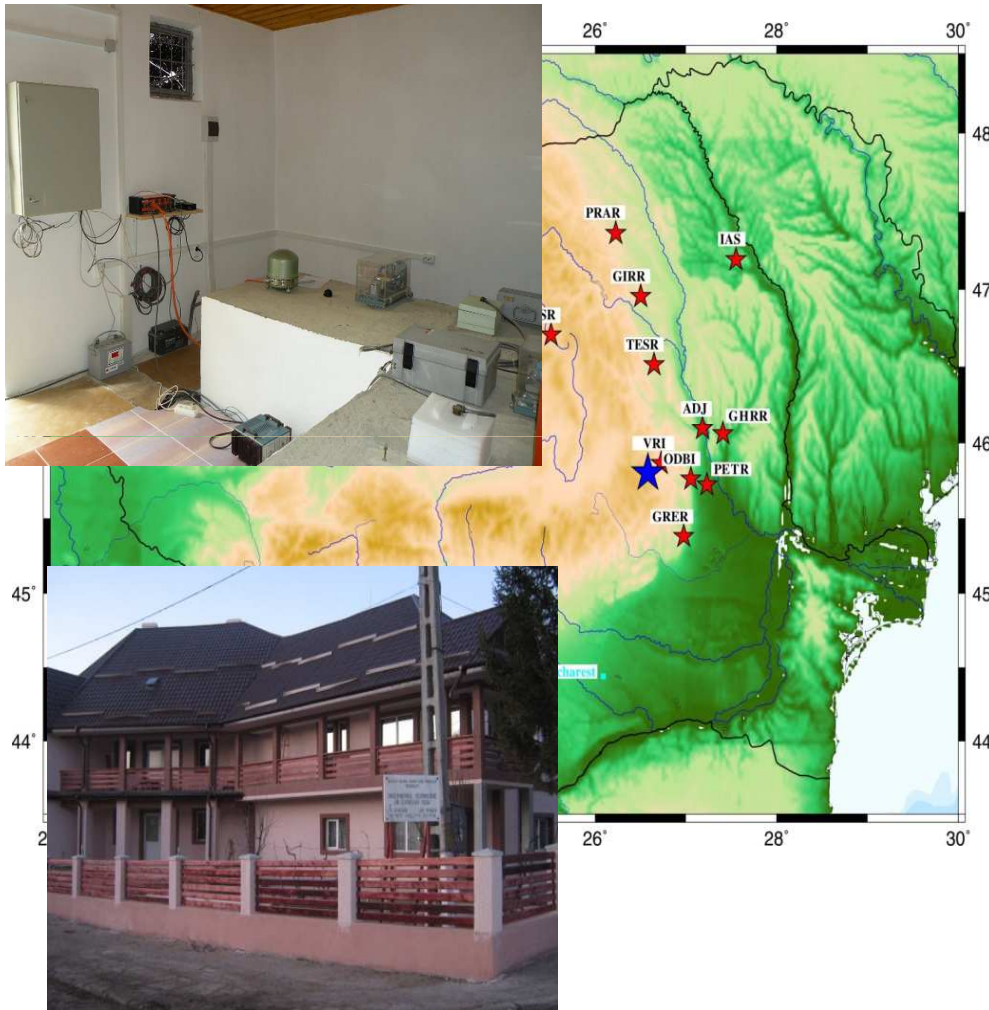
Vrincioaia Observatory was built in 1956. Maintenance and operation by 1 assistant researcher and 2 assistants. The personnel has in charge also maintenance of 10 seismic stations in the NE Romania.
Data transmitted in real time to the National Data Center.

Plostina Observatory

The Plostina Observatory (set in 2002) includes:

- A seismic array of 6 broad band sensors over an area of 2 km square
- A short period sensor
- An infrasound array of 7 elements
- A GPS station
- A proton processor magnetometer (since 2011)
- Data from the seismic array and infrasound stations are transmitted in real time to NDC.

Dobrogea Observatory

Seismological Observatory set up in 2008 in Eforie, as back-up for the data acquisition and processing and as monitoring center for Black Sea tsunamis.
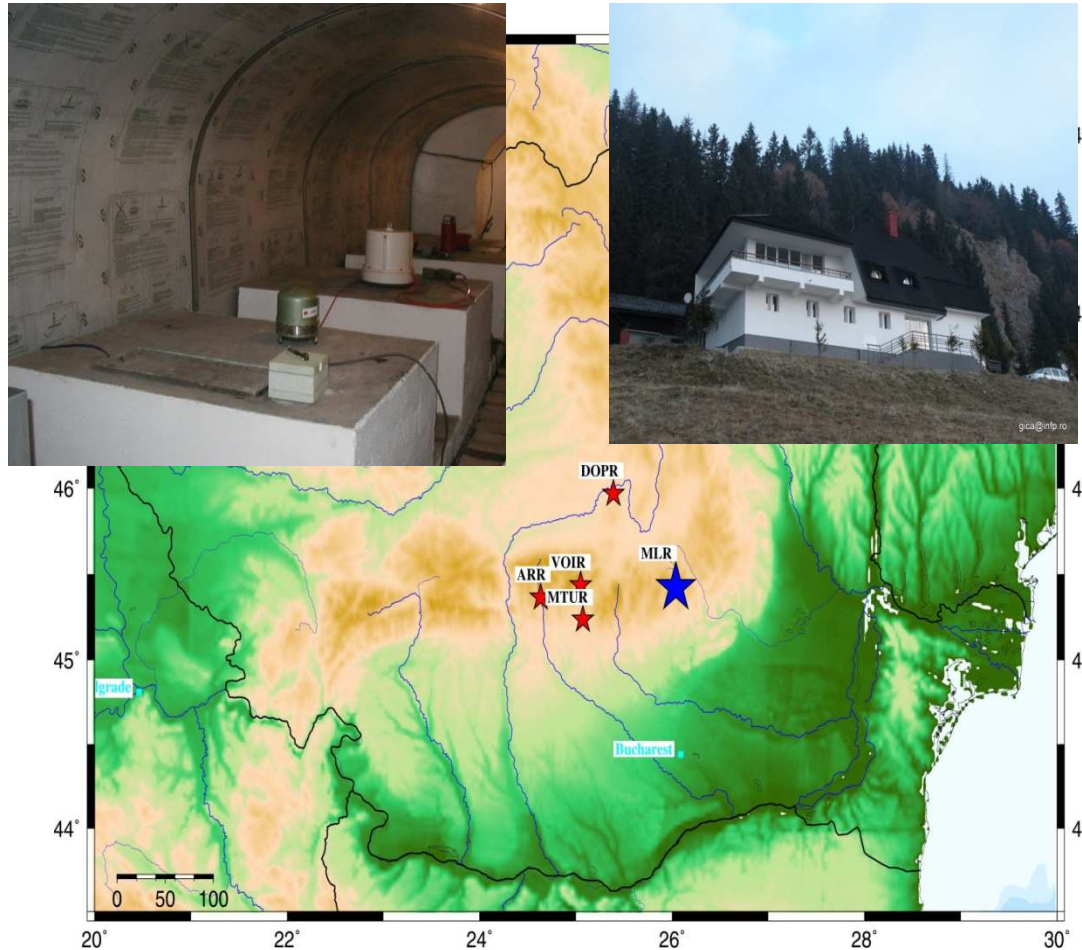
The observatory employers assure also the maintenance of other 10 seismic stations located around.

The observatory equipment:

- seismometers
- accelerometers
- electromagnetic field
- uv radiation

Real-time transmission to NDC.

Muntele Rosu Observatory

Muntele Rosu (MLR) station was built in 1970.
MLR station belongs to the international monitoring system of CTBTO.
Equipment for seismic and electromagnetic field monitoring.
The observatory personal has in charge maintenance of other 4 stations equipped with seismometers and accelerometers.
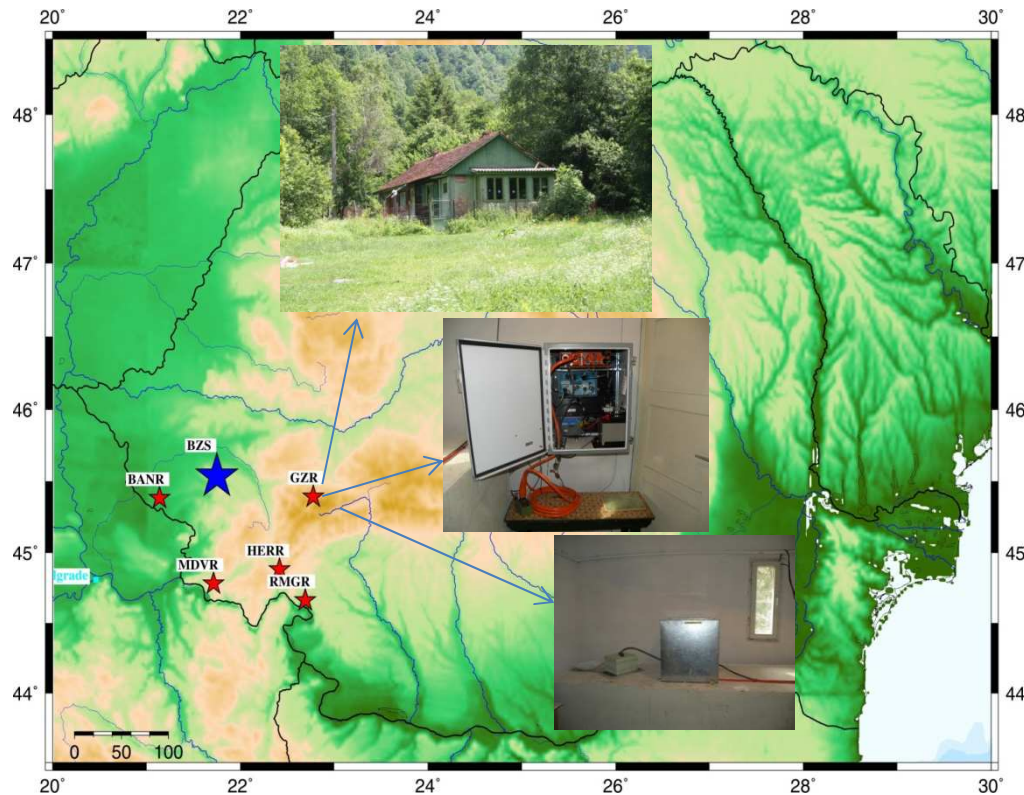The data are transmitted in real time at the National Data Center.
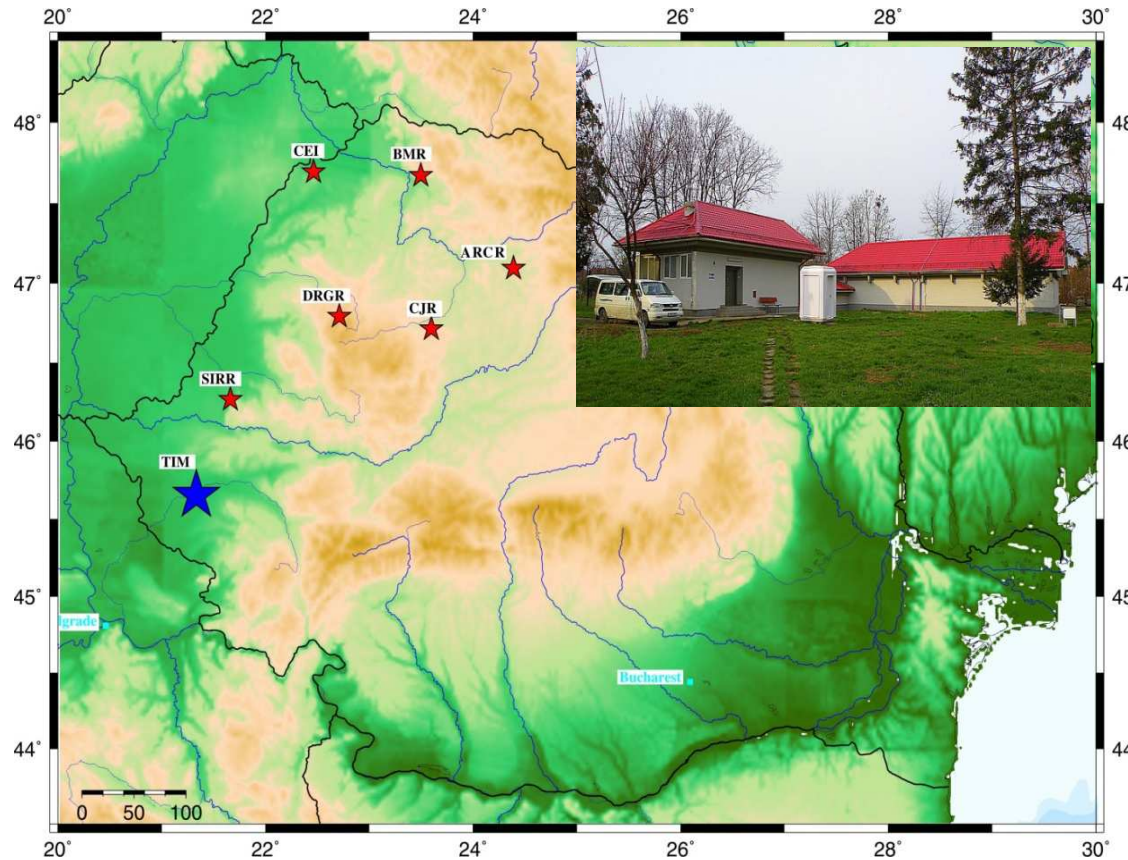
Deva Observatory
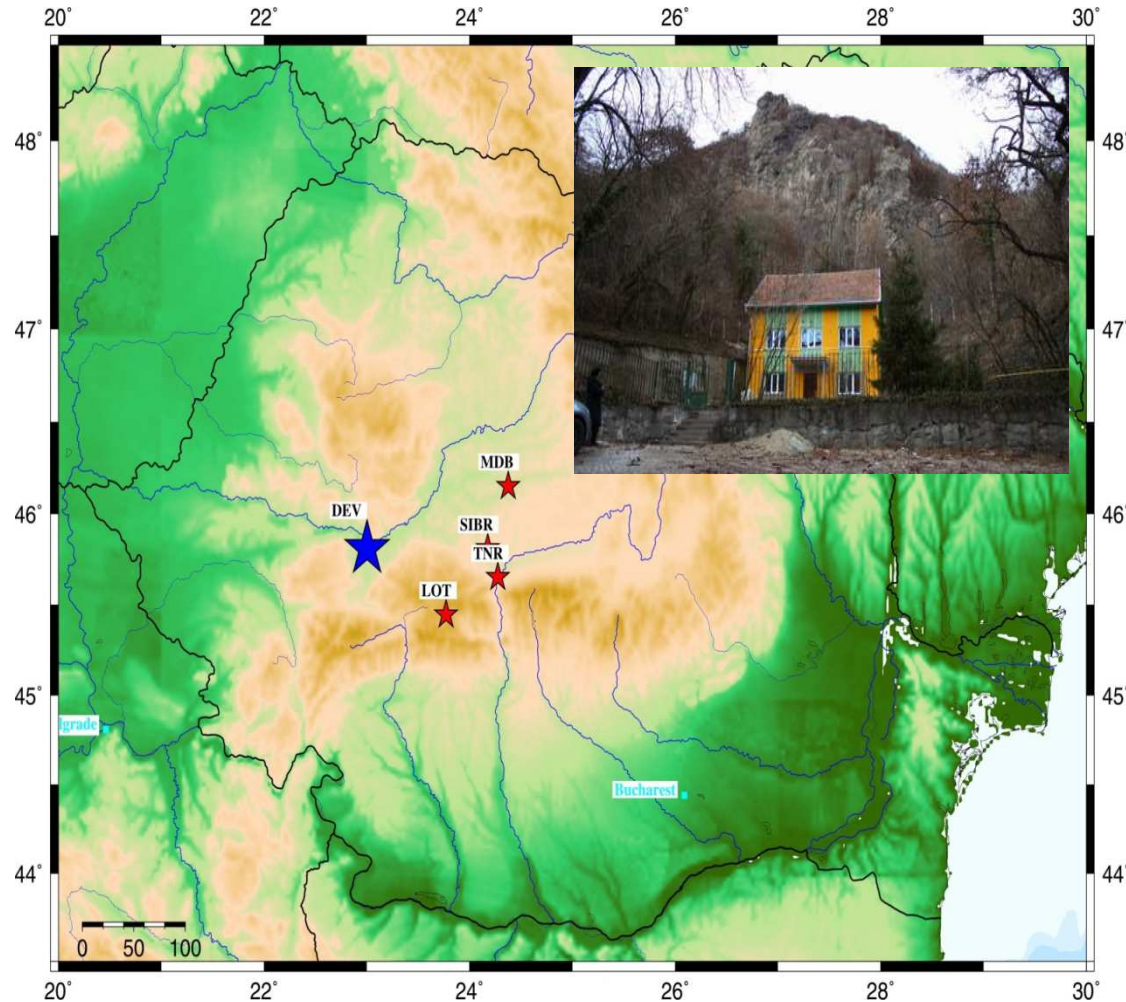
Deva Observatory was built in 1971. One assistant who takes care also of other 4 nearby stations.
The stations are equipped with seismometers and accelerometers and data are transmitted in real time to NDC.

Buzias Observatory

- Buzias Observatory was build between 1977-1978 in the SW part of Romania
- 2 assistants have in charge observatory + 6 seismic stations in the region, equipped with seismometers and accelerometers (see photos from Gura Zlata – GZR station).
- The data are transmitted in real-time to the National Data Center.

Timisoara Observatory

The Timisoara Observatory has been operating since 1962 in the western part of Romania.

1 engineer and 1 assistent researcher maintain into operation the Observatory and other 6 seismic stations equipped with seismometers and accelerometers sensors.

The data recorded by the RSN in real time are sent to the Timisoara Observatory to be analyzed independently using SEISCOMP software. The locations are compared with those obtained at NDC using Antelope software.

GPS network
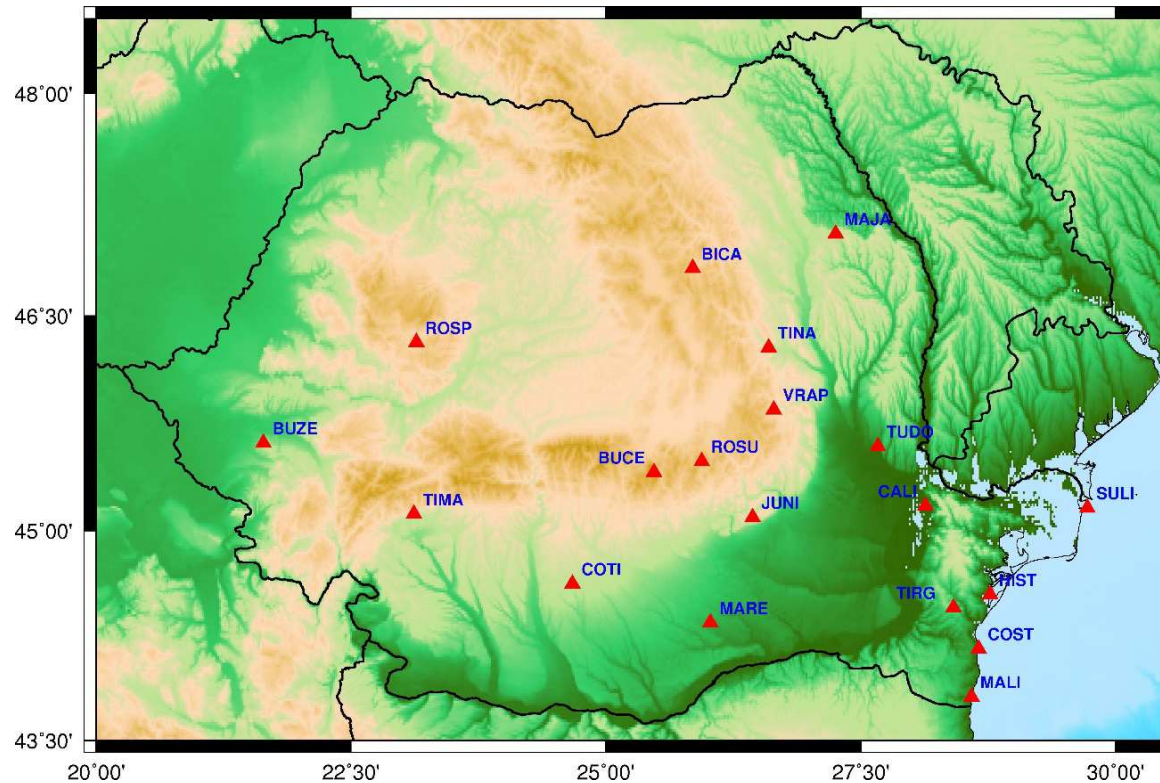
The first station was installed in 2001 and now the network consists of 19 stations.

The network was installed in cooperation with the Faculty of Geology and Geophysics – University of Bucharest (FGG), Delft University of Technology, the University of Utrecht and the Netherlands Research Center for Integrated Solid Earth Sciences (ISES)

GPS network

Objectives:

- Monitoring of crustal deformation in Romania in correlation with tectonic processes in South-East Europe (Africa-Europe plate interaction).

- Observation of crustal movements in order to investigate surface-to-depth coupling and geodynamics in the area of the Eastern Carpathians bend zone (Vrancea region).

- Improving the accuracy of the coordinates of the national seismic network stations.
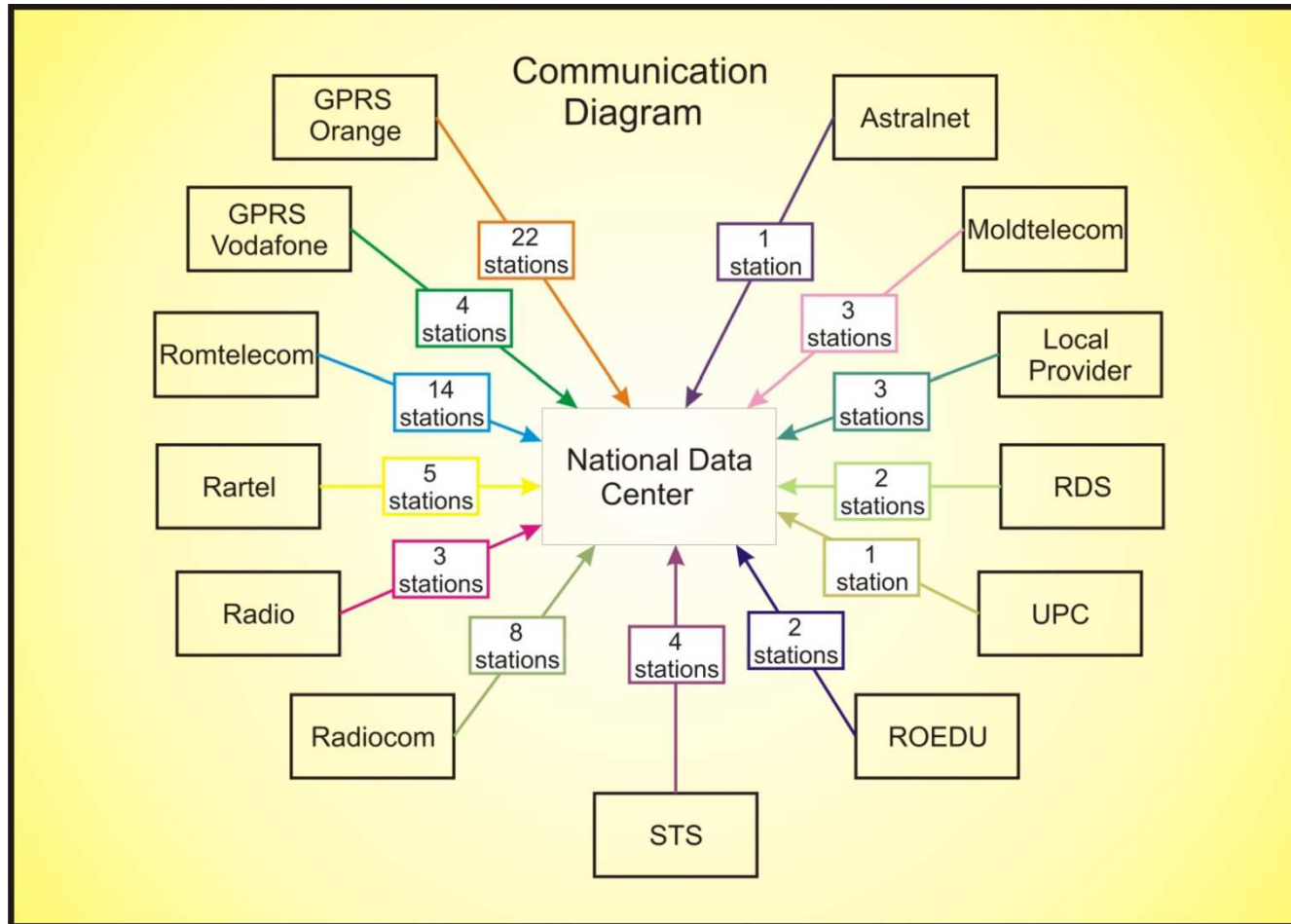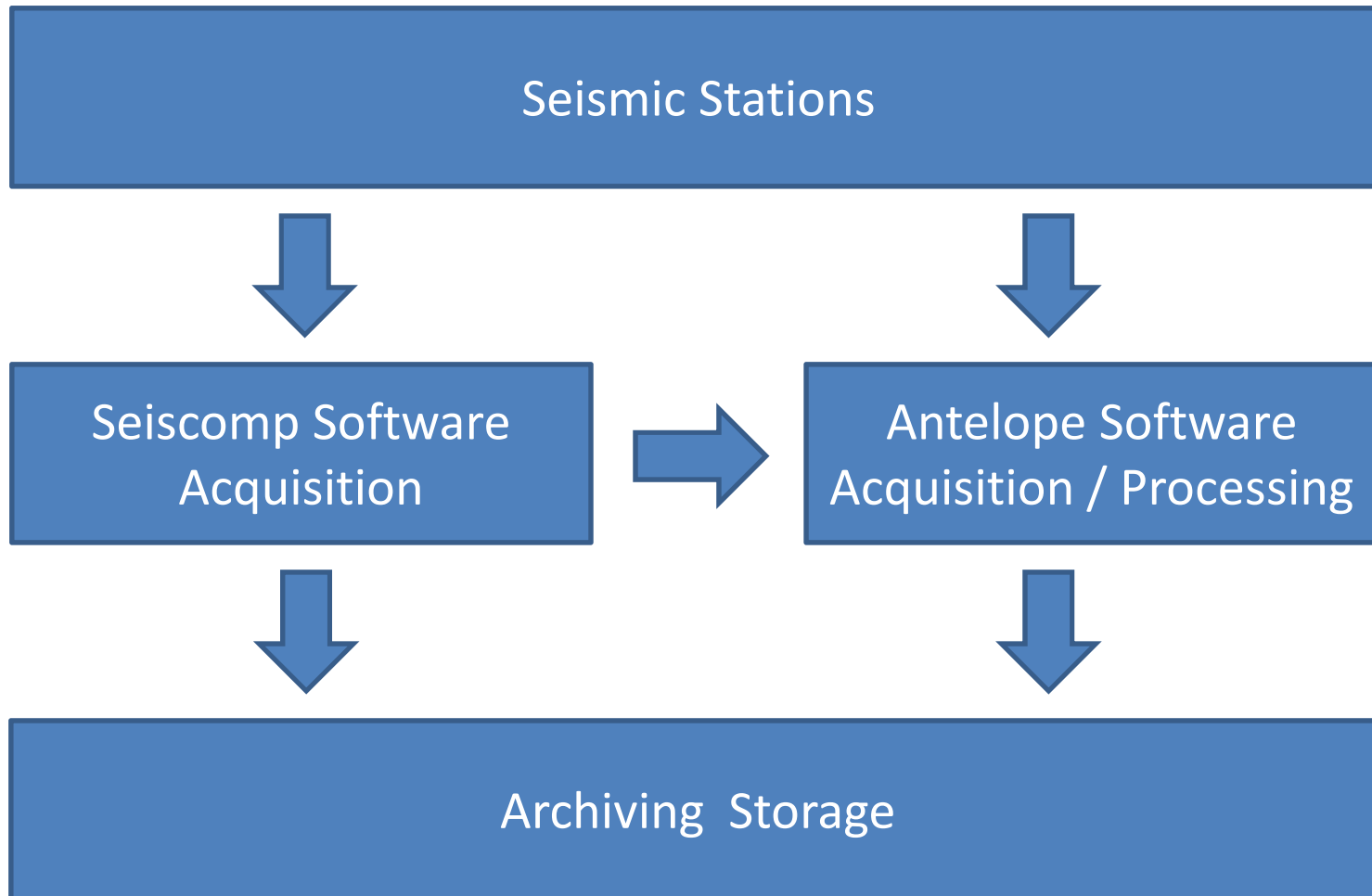
GPS network

Data acquisition is made in real time, in RAW and RINEX DATA format using the Leica GNSS Spider Software.

Communication links

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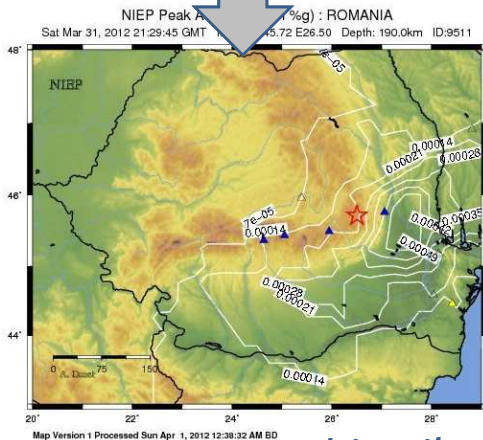*28 November – 02 December 2013, BAS-Sofia*

Data acquisition and archiving

Seismic Stations

Seiscomp Software Acquisition

Antelope Software Acquisition / Processing

Archiving Storage

Antelope support for

Shakemap

Alerting system

Website

Email

SMS

Twitter

Near realtime quake info

Collects user data

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Antelope products – Near Real Time Alert system

Quake parameters

Alert system

Depth?

Magnitude?

Is it local?

Email

SMS

Twitter
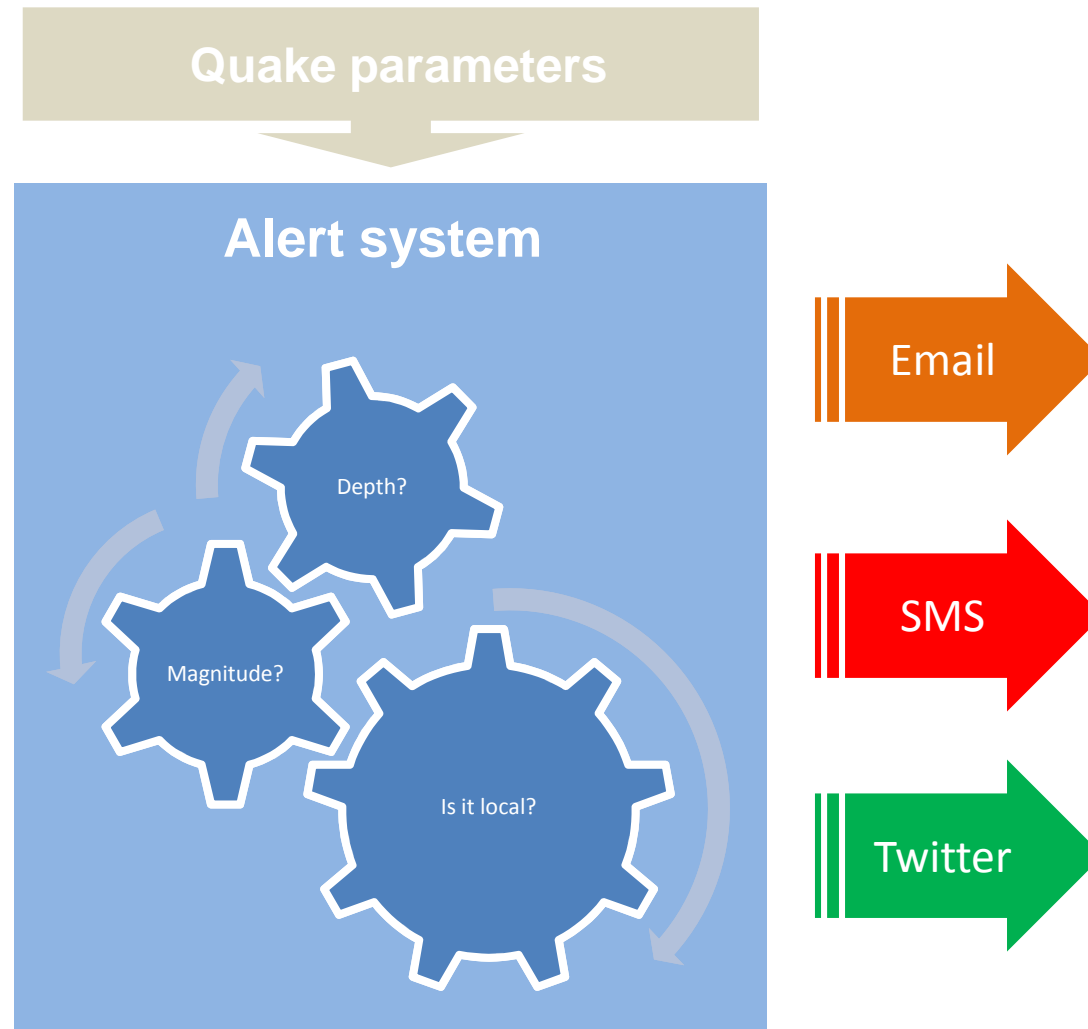
Antelope utility – Website (www.infp.ro)

- Real-time event catalogue
- Easily searchable and filterable
- Integrates Google Maps for displaying catalogue items
- Can associate other related information (e.g. youtube recordings of the seismic recorder)

Antelope utility – Did you feel it?

• Provides means to collect data from Internet users after a seismic event

• Computes user answers into estimated macroseismic values grouping answers by city and also computing intensity values per city.
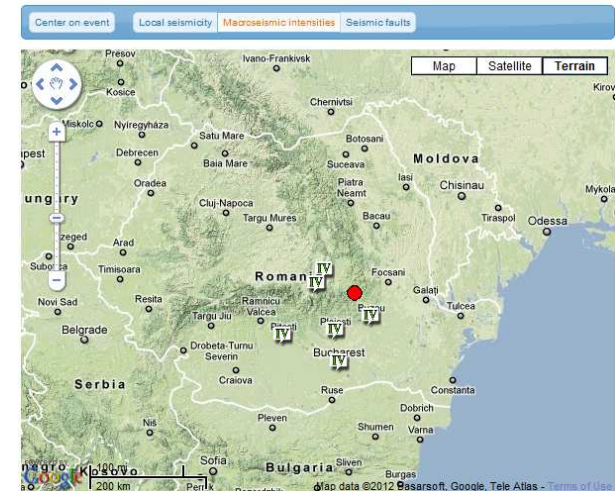
Global exchange of data and products

Romanian NDC ensures the global exchange of data and information between NIEP and international seismological organizations and other NDCs: *National Earthquake Information Center, USA; European Mediterranean Seismological Centre; IDC, International Seismological Centre, UK; NDCs from: Hungary, Serbia, Bulgaria, Republic of Moldova, Ukraine, Poland*
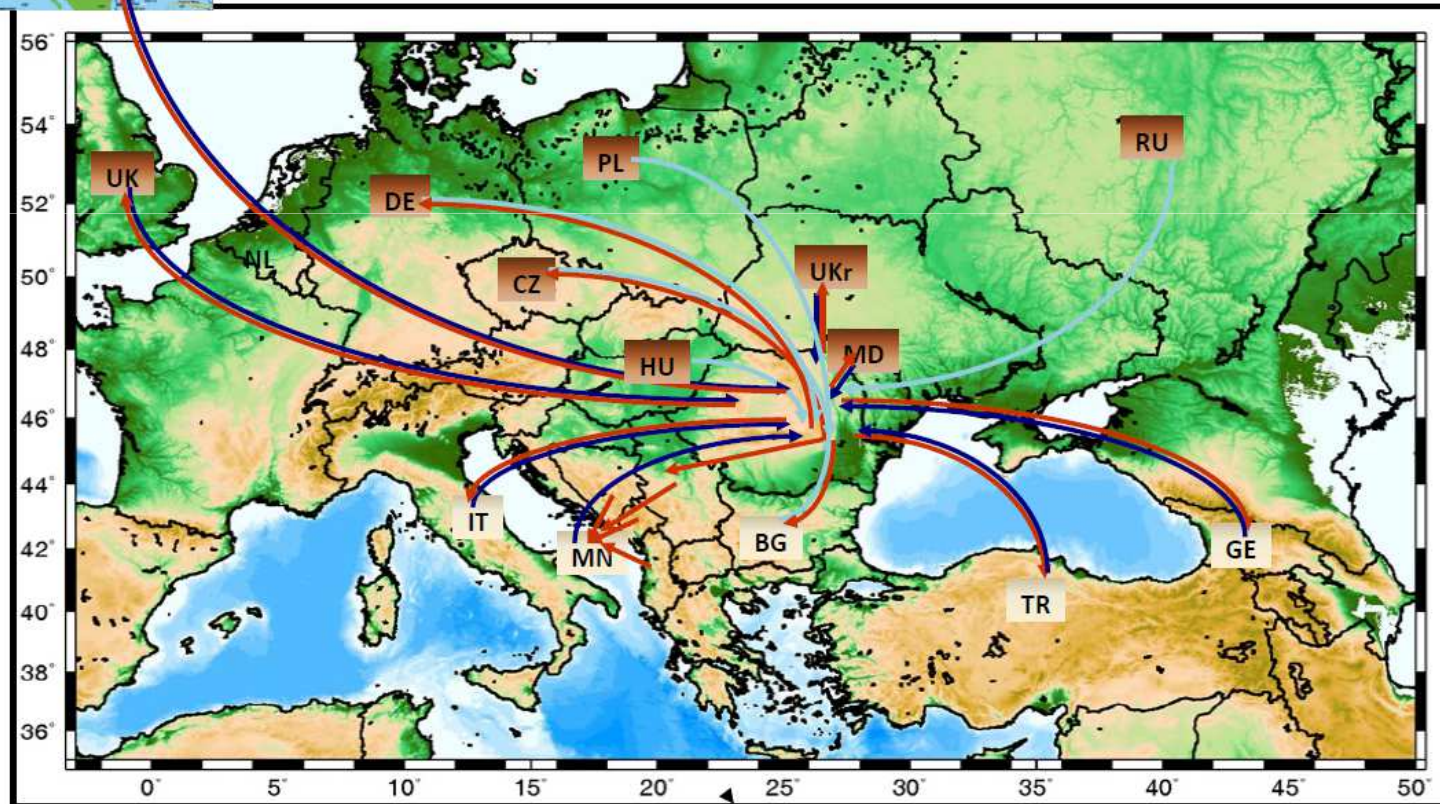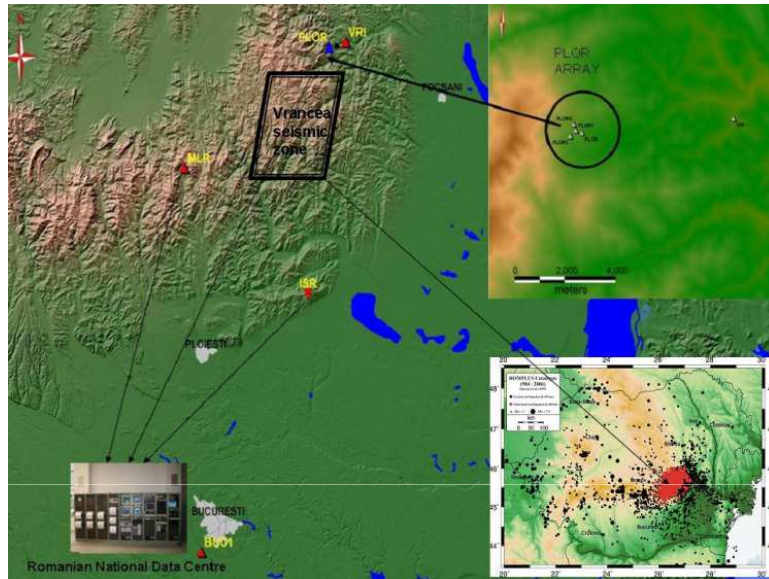

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Early Warning System

A seismic early warning alarm is triggered having the following details: P - wave peak acceleration value and level of triggering.
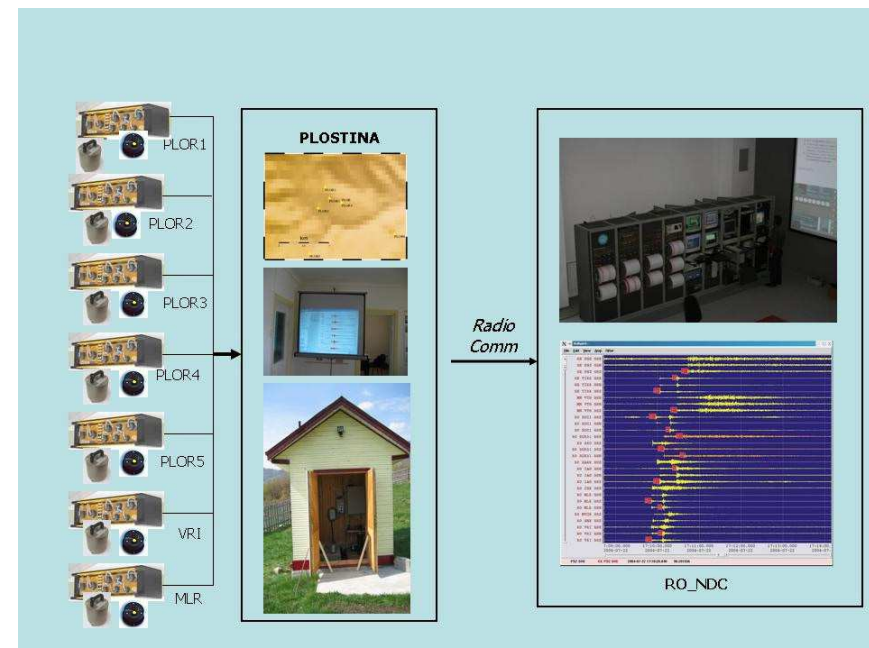
EWS' detection of the P waves works in the following steps:

1. Frequency analysis for the first 4 seconds of initial motion.
2. Acceleration threshold detection on accelerometers.
3. **Rapid magnitude computation using PGA**

Alarm is switched on when first condition is fulfilled and acceleration threshold is detected on more than one accelerometer of the detection network;
Then the alarm is sent to the user (including also SMS and email).

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Thank you!