Education and awareness regarding earthquakes and their consequences within the Cluj-Napoca SEISMOLAB, Romania

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Abstract

Education and awareness are efficient methods to mitigate the effects of natural disasters on communities. In this regard, the most receptive target group is the youth who have the potential to become vectors of information dissemination in their families and communities. In a country with significant seismic potential like Romania, the development of a Seismolab by means of an educational project is welcomed. The Seismolab operates within the Faculty of Environmental Science and Engineering at "Babes-Bolyai" University, Cluj-Napoca, and it hosts activities conducted with the students of the faculty and pupils from Cluj and other schools involved in the RoEduSeis project. The RoEduSeis Project is a research and education project meant to develop the practical skills of primary, secondary and high school students in the field of Earth Sciences. A major objective of the project pursues the development and validation of new practical training methods for both teachers and students in the field of Earth Sciences. In this context, the Seismolab serves this particular aim by activities such as: training of students and teachers on conducting analyses and processing seismological data obtained from the educational seismographs in the Romanian educational seismic network; hands-on activities for pupils using educational resources developed through the project; documentary 2D and 3D movies and round tables on the topic of earthquakes and other natural risks. The students of the faculty use the data bases within subject matters in the curricula such as: Management of natural risks and disasters, Natural hazards and risks, Management of emergency situations etc. The seismometer used within the Seismolab will be connected to the above-mentioned educational network and the interaction between all the schools involved in the project will be conducted by the means of an e-learning platform. The results of this cooperation will contribute to a better education and awareness regarding earthquakes as a natural risk.

I. ACTIVITIES

1. EARTHQUAKE LOCATION

a. Digital localization using the jAmaseis software and the waveforms recorded by means of the educational seismometers (Figure 1)

Scope	Steps
• acquaintance of pupils and students with the earthquake localization software installed on the computers in the Seismolab • visualization and use of in-house recorded data • stimulation of relation between students and pupils in the context of obtaining the waveforms from at least 3 educational seismometers	• recording of data by means of the seismometer in the Seismolab • accessing the data recorded by other educational seismometers • localization of the earthquake epicenter by means of the jAmaseis software

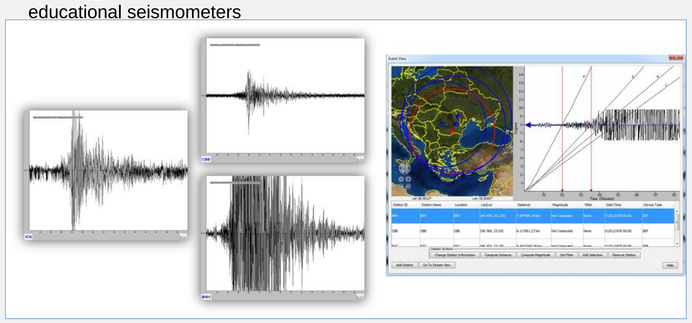
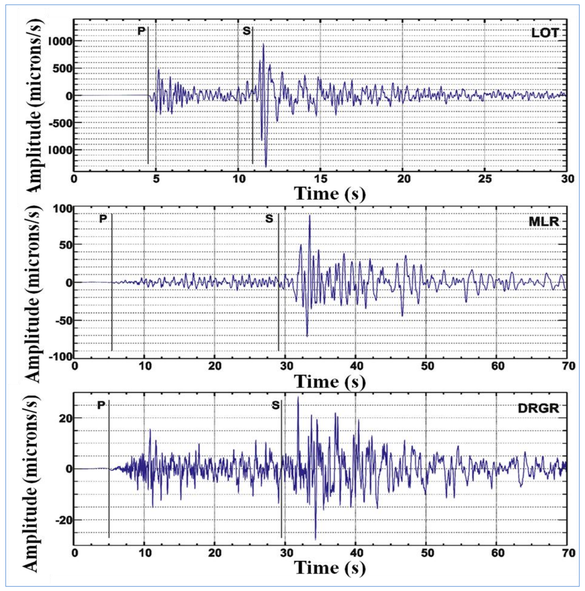


***Figure 1**.Locating an regional earthquake from Greece using jAmaseis. 2014-02-03 03:08:45.13, 8.26N 20.32E, 2 km depth, Mw=6.0,according to European Mediterranean Seismological Centre.*

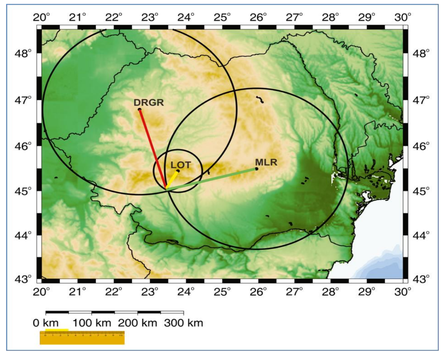
b. Manual localization using printed waveforms (Figure 2)

Scope	Steps
• developing the skill of using the physics formulas (d = v x t) and methods (triangulation method) for the localization of the earthquake and comprehension of these methods principle	• determining the time difference between the entry of the P and S waves in the recorder (ΔT) • using the formula to calculate the epicentral distance from the given stations • tracing the circles for the localization and positioning of the epicenter



Seismograms recorded at Lotru (LOT), Muntele Roșu (MLR) and Drăgan (DRGR) stations in Romania

	LOT	MLR	DRGR
Time lap between the arrival time of P ans S waves	~6,5 s	~23 s	~24,5 s
The epicenter – station distance	53 km	184 km	196 km



Map of Romania presenting the location of the epicenter and stations used for this purpose

***Figure 2.** Manual localization of an earthquake in Romania using printed waveforms*

2. EXPLORATION OF THE AREA INSIDE THE EARTH AND OF SEISMIC WAVES PROPAGATION

Scope	Steps
• comprehension by visualizing the internal structure of the Earth and the manner the waves propagate inside • appreciation of the epicentral distance, respectively of the type of earthquakes (local, regional, teleseisms) depending on the recorded waveform	• exploration of dedicated programs and animations (e.i. Seismic waves vers. 4.0, Earthquakes 3D a.o.) • debating on and assessment of seismic records

3. SIMULATION OF BUILDING BEHAVIOUR UNDER THE SEISMIC WAVE

Scope	Steps
• arguing fundamental aspects regarding buildings oscillations, behavior and damage • presenting realistic scenarios of buildings behavior during earthquakes • developing awareness regarding the seismic risk exposure level	• simulation of movements: *high frequency* = crustal earthquakes *low frequency* = sub-crustal earthquakes • exposure of the different types of building replicas (composed of a frame / structure with or without structural or infill walls, with or without a weak ground floor etc.) to these movements • examination of the oscillations induced to these replicas and the assessment of their behavior under these effects

4. DISCUSSION OF SOME ASPECTS REGARDING THE MANAGEMENT OF EARTHQUAKES AND EMERGENCY SITUATIONS GENERATED BY EARTHQUAKES IN THE CONTEXT OF RISK MANAGEMENT AND NATURAL DISASTERS

Scope	Steps
• understanding the seismic vulnerability function • raising awareness on the methods and tools used for the earthquakes effects mitigation • acquiring the adequate behavior in case of earthquake occurrence	• approach of relevant study cases from the perspective of hazard, vulnerability, seismic risk and disaster management • formulation of opinions on the population and authorities attitude regarding the above-mentioned aspects

SEISMOLAB : activities conducted by students using the available learning materials

5. VISUALIZATION OF DOCUMENTARY FILMS ABOUT EARTHQUAKES AND THEIR EFFECTS

Scope	Steps
• comprehension by visualizing the seismic phenomenon and its effects	• visualization of 2D and 3D movies regarding earthquakes

II. ACTIVITY, METHODS/FORMS

- Explanation
- Heuristic conversation
- Exercise
- Cooperative learning
- Discovery learning

III. MEANS OF TRAINING, LEARNING MATERIALS

- Seismometer
- Computer
- 3D Monitors
- Software products
- Seismograms from different seismic stations
- Waveforms recorded by means of the educational seismometers
- Data bases of the earthquakes recorded by means of the educational seismometers
- Building replicas with different height regimes and structures
- Mini earthquake simulator

IV. TARGET GROUP

- Students from various educational cycles.
- Students and master students from the Faculty of Environmental Science and Engineering and from other specializations in Earth sciences
- Other interested persons

CONCLUSIONS

- **The founding of the SEISMOLAB within the ROEDUSEIS-NET project represents an opportunity for the development of educational abilities and competencies in Earth Sciences**
- **The SEISMOLAB represents a demonstrative platform dedicated to the understanding of and awareness on the basic aspects regarding earthquakes and preparedness for the emergency situations generated by earthquakes**
- **Due to the existing learning means and materials, efficient and interactive hands-on learning methods can be used within the SEISMOLAB**
- **The activities are dedicated mainly to pupils and students and are carried out within thematic visits or university subject matters included in the school curricula**

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