

Project Result 3

SEISMO-Lab online platform and space for teachers

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Abstract	The SEISMO-Lab online platform has a two-fold aim: a) To install additional devices in schools all over the participating countries in order to expand the integrated network of school seismometers b) To provide a common space for educators and teachers to design new projects for their labs and to exchange knowledge and ideas with teachers from other schools. Since 2015, NOA supported by EA, IDIS, UCY has been creating an extended school seismometer network over the South-Eastern Mediterranean Basin. So far, the network output and scientific data has been pooled and was made available to teachers and students of the participating schools. The work led by NOA was a groundbreaking in the area of providing teachers with scientific real-time data that could enrich and enhance teaching techniques in natural sciences, as it managed to establish a South Eastern European/Mediterranean School Network of digital seismographs for the monitoring of the seismic waves across different regions and countries. In SEISMO-Lab the existing network of seismic instruments was extended to 100 SEISMO-Lab Schools. The schools are equipped with low-cost seismometers: TC1 and RaspberryShakes. Some of the TC1 seismometers have been constructed by schools, based on the project contribution from the Romanian partners.

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	During the in have been co utilizes this s learning hub Romanian se seismometer existing and the globe. c) SEISMO-Lab Teachers to i advice on th activities init and reports of Furthermore connection o local commu and awarene projects desi successful it students are collect with t semi-automa dedicated so web platform (of the order stored in a ce standard sei freely availab	mplementation, vast data o ollected. The extended version cientific material and transfer, a tool that allows a) The index coordinated by NOA. b) new seismometers to all teach partners and teachers of interact and exchange pract the students' projects. e) The iated - such as contest, etc of the students' project access , SEISMO-Lab facilitates the of participating schools, teach nity by allowing them to act ess about earthquakes, throug ned in the school labs. For is essential that participa able to easily share and visue their installed devices. To access their installed devices and visue their installed devices and visue their installed devices and visue their and user-friendly way the of the students of the school so of acted and user-friendly way the of the state of the schools of acted and user friendly way the of the school into a school so of acted and user friendly way the of the school into a school so of acted and user friendly way the of the school into a school so of acted and user friendly way the of the school into a school so of acted and scientists world acted and scientists world acted and scientists world acted and scientists world acted and scientists world	f seismographic activities on of the existing platform orm it into an educational ntegration of the existing the existing network of Access to all data of all others and schools around ching resources shared by participating schools. d) ices, resources, ideas and e presentation of various and upload the outcomes isible to a broad audience. cooperation with and hers and students to their has hubs of education ugh the activities and this to be feasible and int schools, teachers and ualize the data they hieve this in an effective, he project applies a the school data with the the installed instruments loaded and data are available in a miniseed files) and are of the network but also to wide.					
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SEISMO-Lab online platform and space for teachers

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1. Introduction

The Seimo-Lab online platform features a unique collection of free seismological services aimed to educate and promote seismology in schools. It is an upgrade of the earlier SNAC platform, enriched with more stations and data, with new map application programming interfaces (APIs) and with extensive educational material and examples.

2. Project Network

(https://seismolab.gein.noa.gr/project-network/)

5	EISMO-LAB		Home	Project Network	Automatic Alerts	Seismograms Database	Stations Status	Software ▼ C	Data Pr Download Re	oject Educ sults Ma	cational Activities - aterial
Pr	oject Network	τ.									
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20	10 mi	State and	Leaflet Tiles © Esri - Source: E	sri, i-cubed, USDA,	USGS, AEX, GeoEye, G	Setmapping, Aerogrid, IGN, IG	SP, UPR-EGP, and the G	SIS User Community	- 63 C	Kribi	
Stati	ons equipped with	Raspberry Shake	S								
Мар	Station	Code		Location	n		Latitude (N)	Longitude (E)) Elevation (m)		Daily Seismogram
<u> </u>	R0D9F	АМ	Porto Santo, Portugal				33.05405405	-16.33907092	50		
<u> </u>	R1388	AM	3o Dhmotiko Sxoleio Ioanninwn, Mar	outseio			39.66645	20.85758	35		8. e
	R1784	АМ	Lycée Français Anna de Noailles, Bu	icharest, Roman	iia		44.52142	26.07656	90		and the second
	R1822	AM	Musical School Chaniwn				35.52346	24.052092	30		Real and the second
	R1A12	AM	Funchal, Portugal				32.66666667	-16.92015265	318		
	R1A15	AM	Sibiu, Romania				45.79279279	24.1503919	415		
	R1C6C	AM	Fioliths, Zakynthos				37.776293	20.801645	35		
	R2F0C	AM	Polo Liceale Salvatore Di Giacomo, S	San Sebastiano	al Vesuvio, Italy		40.839	14.366	153		
	R32F0	AM	Nicolae Balcescu Highschool, Oltenit	ta, Romania			44.0772	26.6382	22		傳統
<u> </u>	R3BC5	AM	Seismo Labotory, NIEP, Romania				44.342342	26.027672	73		-
<u> </u>	R3CE7	AM	Oradea, Romania				47.05405405	21.9267659	60		Table 1
	R3DA0	AM	Escola Basica e Secundaria Goncalv	ves Zarco, Portu	gal		32.64864865	-16.92843013	161		
	DIALA		D.17 D 1				15 1505	22.2004	660 6		

Image 1. Seismo-Lab Project Network consisting of 89 stations that by the end of the project will be 100.

The whole website has been redesigned anew and the new elaborate map API offers a clearer display of the project network. The project network includes stations from Greece,

Romania, Italy, Turkey and Cyprus. Most stations are Raspberry Shake 1D and some are TC1 seismometer with Raspberry PI. More home-made seismometers, developed by schools and students are expected to be added as well. All the school stations data are available real-time through the platform.

SARGARAN SAR	LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL							
SMES	HL 01	BHZ	09:20:00 2023-10-30	09:25:00	09:30:00	09:35:00	09:40:00	09:45:00

Image 2. Seismo-Lab Project Network Real-Time Data

3. Seismograms Database

(https://seismolab.gein.noa.gr/seismograms-database/)

A comprehensive Seismograms Database allows filtered search for all available stations and time periods.





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4. Automatic Alerts System

(https://seismolab.gein.noa.gr/snac-automatic-alerts-all/)

A new Automatic Alert System API has been redesigned that shows the automatic located events by the Seismo-Lab school network, for last 30, 60, 90, 120 days and also all available events.





Image 4. Seismo-Lab Project Automatic Alerts

Each event can be clicked on the map and the available data can be downloaded from the contributing stations in a zipped file with the data streams in sac format.

Also, a search tool is available for more advances queries, using the International Federation of Digital Seismograph Networks Web Services (FDSNWS) standard.

SeisComP3 FDSNWS Event - URL Builder

Geographic constraints	S	_
O None		
O Bounding Box		
○ Circle		
Service specific constra	nints	_ _
Minimum Depth (km)	0.0	
Maximum Depth (km)	300.0	
Minimum Magnitude	2.0	
Maximum Magnitude	5.0	
Magnitude Type	M	
All Origins		
All Magnitudes		
Arrivals		
Exclude Picks		
Focal Mechanism		
All Focal Mechanisms		
MT Station Contribution	15 🗆	
Include Comments		
Event ID		
Limit	20	
Offset	1	
Order By	Time descending (default) 🗸	
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Contributor	agency	
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Output control		7
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Formatted 🗌		
No Data 404 🗹		

Image 5. Seismo-Lab Project Advanced Event Search using FDSNWS.

5. Data Download

(https://seismolab.gein.noa.gr/data-search/)

An advanced search tool is available for data queries and download using the International Federation of Digital Seismograph Networks Web Services (FDSNWS) standard.

SeisComP3 FDSNWS DataSelect - URL Builder

Time constraints
Start Time
End Time
Channel constraints
Network AB,C?
Station ABC,D*
Location 00
Channel BH?
Service specific constraints
Service specific constraints
Quality B 🗸
Minimum Length (s) 0.0
Longest Only
Authentication
Output control
Format miniseed V
No Data 404 🗹
URL
http://seismolab.gein.noa.gr:8080/fdsnws/dataselect/1/query?nodata=404

Image 6. Seismo-Lab Project Advanced Data Search using FDSNWS.

6. Software

A selection or seismological software tools are available along with video tutorial and examples (SWARM, JAmaSeis, SeisGram2K)

7. Educational Material Space for Schools and Students

(https://seismolab.gein.noa.gr/educational-material/)

All the educational material along with good practices is available for schools and students to use.



Image 7. Seismo-Lab Project Educational Material

8. Extended Deliverables - Parametric information for the Automatic Event Alerts of the SEISMO-LAB platform.

The SEISMO-Lab online platform features a fully automatic earthquake detection system (<u>https://seismolab.gein.noa.gr/seismolab-automatic-alerts-all/</u>). The system was providing the basic information of an event (location, magnitude and depth) along with the data for each station participated in the event.

Parametric data were added for each event stored in the SEISMO-Lab database, that show additional information for each station, participated in the event, like the station P phase pick time, it's residual, its azimuth information, it's distance from the event and its separate magnitude value.

A separate page was created for each earthquake event, that include a GMT map (<u>https://www.generic-mapping-tools.org/</u>) of the event, an OpenStreet Map of the event (https://www.openstreetmap.org/) and the additional parametric information in text and xml format.

Also in the same page, additional information is shown for each event, like the RMS, the location error, the number of stations used for picking and for magnitude calculation and the azimuthal gap.

This additional detailed event information allows the teachers and the students to explore and understand easier and more efficiently earthquake events and the parameters that characterizes them.



Image 8: Additional option was added to view the event's detailed information

	Automatic solution for SEISMO-LAB event 2024hgkp					
	Magnitude:	4.7 ML				
	Origin Time:	2024-04-13 02:23:15.5 +/- 0.3 s (GMT)				
	Latitude:	38.89 deg +/- 3 km N				
	Longitude:	23.41 deg +/- 3 km E				
	Focal Depth:	10 km				
	Туре:	Automatic				
2EI2MO-LAB	Location:	4 Km NNE from Agia Anna				
	<u>Download Event Data (sac format)</u>					
	Event solution in XML format (QUAKEML)					

Map:





Solution Details:

Event ID:	noa_SEISMOLAB_2024hgkpj
Origin Date:	2024-04-13
Origin Time:	02:23:15.5 +/- 0.3 s
Latitude:	38.89 deg +/- 3 km
Longitude:	23.41 deg +/- 3 km
Depth:	10 km
Mode:	automatic
Status:	NOT SET
Residual:	1.17 s
Gap:	102 deg
1 Network ma	gnitudes:

MLv 4.69 +/- 0.23 15 preferred

21 Phase arrivals:								
sta	net	dist	azi	phase	time	res	wt sta	
R58B0	AM	0.8	272	Р	02:23:27.8	-2.7 A	1.0 R58B0	
R4F38	AM	0.9	158	Р	02:23:33.0	-0.2 A	1.0 R4F38	
R4EB6	AM	0.9	165	Р	02:23:33.3	-0.4 A	1.0 R4EB6	
SNOA	HL	0.9	165	Р	02:23:33.4	-0.4 A	1.0 SNOA	
RG7FF	AM	1.0	169	Р	02:23:33.9	-0.1 A	1.0 RG7FF	
SSEA	HL	1.0	157	Р	02:23:33.9	-0.2 A	1.0 SSEA	
SNSM	HL	1.0	166	Р	02:23:34.8	0.4 A	1.0 SNSM	
SKAR	HL	1.3	293	Р	02:23:37.8	-0.8 A	1.0 SKAR	
RF25A	AM	1.4	248	Р	02:23:39.1	-1.0 A	1.0 RF25A	
RAC91	AM	1.4	298	Р	02:23:42.4	1.4 A	1.0 RAC91	
RC574	AM	1.9	350	Р	02:23:47.1	-0.3 A	1.0 RC574	
R1388	AM	2.1	292	Р	02:23:53.5	2.4 A	1.0 R1388	

Image 9: Example of a detailed event solution – information that features a detailed event solution, maps (both openstreet map and GMT) and the possibility to download the event data in sac format and to view the event solution in XML (QuakeML) format

(https://seismolab.gein.noa.gr/event.php?year=2024&month=06&id=snac2024mmzdq)

9. Extended Deliverables - Event Database for Parametric Event Information Retrieval and Web Graphical Unit Interface (GUI)

An additional Web Graphical Unit Interface (GUI) was added to the SEISMO-LAB platform that allow the users to easily and efficiently explore the events stored in the database and view download their parametric data.

Application URL: https://seismolab.gein.noa.gr/automatic-alerts-database-search/



Automatic Alerts Database Search



Image 10: Automatic Alerts Database Search Application

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