SERA
Seismology and Earthquake Engineering
Research Infrastructure Alliance for Europe

DELIVERABLE

D3.4 Science with seismo@school: results and targets

Work package	WP3 - Networking Seismo@school outreach programs
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Summary

Task 3.4 will review the results which have been obtained in past seismo@school initiatives at national and local level, as well as in the NERA and SERA projects, with the goal to review past scientific achievement; assess the potential of these programs to deliver useful scientific results, interfacing the dedicated school instrumentation with other monitoring networks; and identify specific scientific goals to be attained by federating all the seismo@school initiatives.

However, it was agreed at the meeting that the Task 3.4 did not map directly to D3.4. As such an interpretation of the approach was discussed at the meeting that centred around the draft approach shown below:

SERA's Seismo@school workshops and educational resources introduced ideas and teaching strategies for the use of real seismic data within schools to give students a better understanding of how science works and to enhance and improve students' scientific background. In addition, one of the key goals of the project was to use teaching strategies that also increased students' awareness of seismic hazard, risk and earthquake preparedness.

Seismo@school activities have enhanced educational sensor networks across project partner countries and in very exceptional circumstances the data that was acquired by schools could be used by researchers. However, Seismo@school did not specifically aim to integrate education networks into the professional networks, but such educational data could be used in circumstances where there are gaps in the professional network.

This report will use a number of case studies to demonstrate how SERA workshops and subsequent education or research projects have **linked** researchers with schools.

Case studies may include a combination of:

1. Research data that has been used in teaching by schools :
   Case1 : *Presentation of the InSight Mission realised during the 3 years of the SERA program*
2. Data acquired by educational networks or low-cost sensor networks that has been used in research projects : Case2 : *Presentation of the Nepal Mission carried out during the 3 years of the SERA programme*
3. Seismic hazard and earthquake preparedness information :
   Case3 : *Presentation of the PPS: an Earthquake prevention training centre*

In each case study the role of SERA is by a combination of the approaches shown below:

1. Use in education of SERA-derived education materials
2. Use in education of SERA-derived teaching methods/strategies
3. SERA workshops

1. Chapter 1 : Research data that has been used in teaching by schools

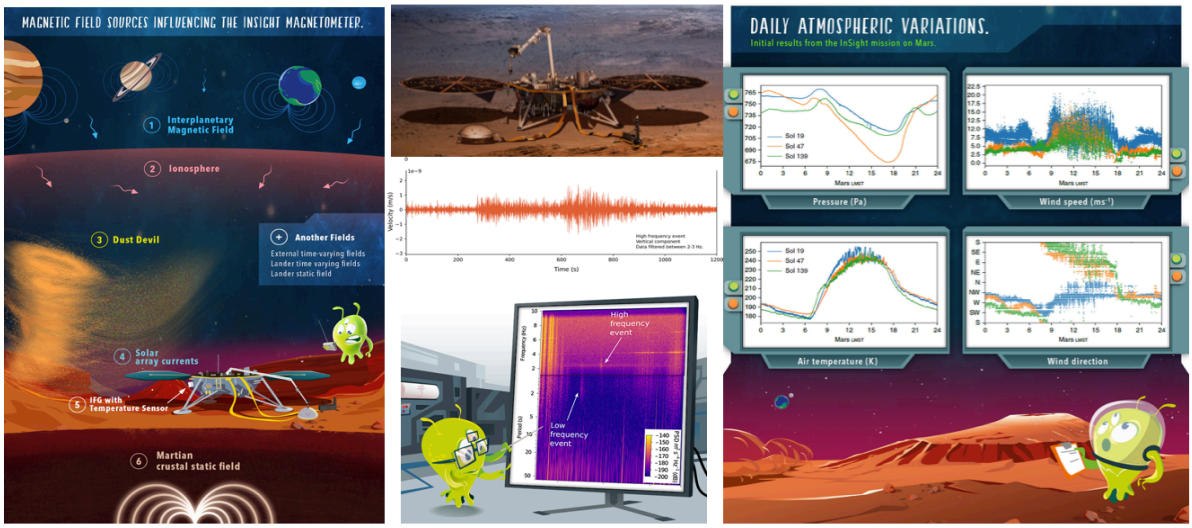

Figure 1: Research Data used by schools in collaboration with researchers

1. InSight space mission on Mars

The InSight space mission (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) studies the internal structure of Mars, via the deployment on its surface of a geophysics station, embarked on a fixed lander.
The mission objective ?
Clarify the mechanisms which preside over the formation of rocky planets of the solar system. Thanks to the seismometer SEIS (Seismic Experiment for Interior Structures), the sensor will measure the tectonic activity of Mars, what will allow to deduct informations on Mars structure (size of the core, thickness of the crust ...). The impacts of meteorites will be also analysed, via the generated seismic waves. Finally, the sensor RISE (Rotation and Interior Structure Experiment) will quantify the variations of the axis of rotation of the red planet.

I. Real data that comes to us from SEIS on Mars.

As part of the InSight mission's educational program, high school students are preparing to access real data that comes to us from SEIS on Mars.
Today, the dissemination of data through this network of about a hundred schools is a unique opportunity to develop a specific scientific programme for schools and general public. These first data will allow us to follow, live, the seismic activity of another terrestrial planet from the classroom!

The "InSight Education" network will be able to intensify with this data around an educational project shared by many schools in many countries... a project focused on discovery, investigation and knowledge.
By providing data to the educational community today, the InSight mission reaffirms the importance of maintaining strong links between scientific research and secondary education, in order to help

students better understand the university world, and to strengthen the link between science and citizenship.

The first data from the SEIS seismometer, part of NASA's InSight mission, are now available to the scientific community and the public through the IPGP, CNES and CNRS. The raw data recorded by the SEIS instrument will be made public three months after their acquisition on the Elysium plain, near the Martian equator. Thus, the first public data will cover a period up to the end of February 2019.

II. Example of collaboration with researchers: the Blind Test in InSight Mission

Before InSight was launched, a team of seismologists in Zurich generated a year of seismicity (terrestrial year 2019) on Mars with synthetic events, as they could be recorded on the "SEIS" instrument and as they would be transmitted on Earth. The challenge was to examine this signal over a year, and to identify the seismic events that are hidden within it. A total of 204 Marsquakes and 36 meteorite impacts were simulated. Here are the maps showing the locations of these events.

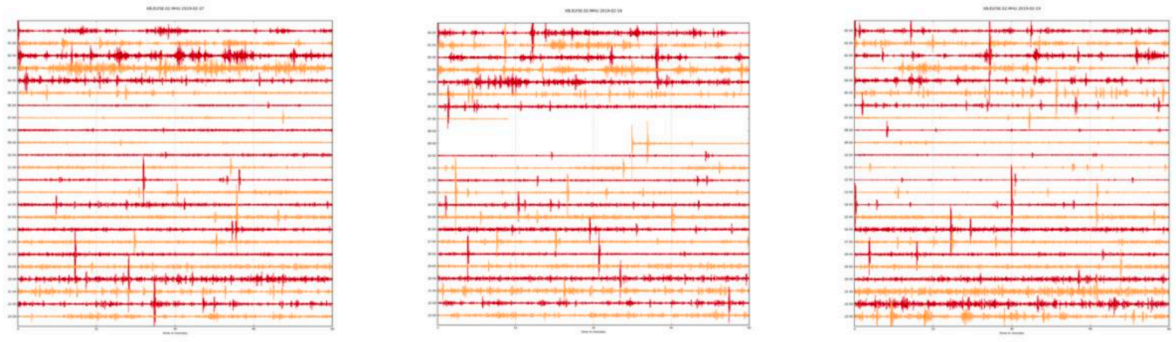

Figure 2:SEIS Data on Line

III. Data and references

The data available today will now allow us to monitor daily the seismic activity of another telluric planet from the classrooms, but with a little delay.

On Line informations to work with scientific approaches:

Discover Mars-SEIS data online : https://insight.oca.eu/fr/data-insight

Discover Mars-SEIS scientific analyse online : http://marsatschool.ethz.ch/en/mission/6/

IRIS Education website : www.iris.edu

ETH Zürich website : http://marsatschool.ethz.ch

GeoAzur Website website : insight.oca.eu

SEIS Public Website : www.seis-insight.eu

InSight Home tests for schools and public : http://insight-home.eu

IV. Publications

Seismological Research letters-(2020) 91 (2A): 1064-1073 :The InSight Blind Test . An opportunity to bring a research data-test into teaching programs:

V. role of SERA in this projet

Use in education of SERA-derived education materials

Use in education of SERA-derived teaching methods/strategies

SERA workshops

2. Chapter 2: Data acquired by educational networks or low-cost sensor networks that has been used in research projects

Figure 3:Earthquakes in Nepal

1. Seismology at School in Nepal: A Program for Educational and Citizen Seismology Through a Low-Cost Seismic Network

I. Localisation

Nepal is located above the convergent plate boundary between the Indian and Eurasian plates, and has repeatedly experienced devastating earthquakes. During the 2015 M7.8 Gorkha earthquake, an often-reported experience was that people are not aware of the threatening seismic hazard and have insufficient level of preparedness. A source of the problem is that earthquake-related topics are not part of the school curriculum. Earthquake education reaching a broad group of the population early in their lives is therefore strongly needed.

II. Focus on education and citizen seismology.

We established an initiative in Nepal, starting in a region extending from the 2015 epicenter towards the West where seismologists expect a great earthquake. The goal is to introduce seismology in Nepali schools, with focus on education and citizen seismology. We have prepared educational materials adapted to the Nepali school system, which we distributed to schools and also share on our website. In selected schools, we also installed a low-cost seismometer to record local and global seismicity and to allow “learning-by-doing” classroom activities.

III. Network of low-cost sensor (40 schools)

The low-cost sensor was selected following laboratory tests on several types of instruments. After comparison of their performance and adequacy to field conditions, the Raspberry Shake 1D (RS1D) instrument was found best for our purposes. At a test site in Switzerland we were able to record M1.0 events at 36 km distance. In Nepal, RS1D seismometers have been installed in schools, creating the Nepal School Seismic Network with 22 stations providing online data openly. The seismometer in each

school allows students to be informed of earthquakes, visualize the respective waveforms, and estimate distance and magnitude of the event. For significant local and regional events, we provide record sections and network shake maps on our website.

IV. Recording of earthquakes, location of events and determination of magnitude

In 4 months of network operation, a total of more than 40 local and teleseismic earthquakes of M34 have been recorded. From an STA/LTA-based catalogue, complemented with visual identifications, we provide a detectability graph in distance—magnitude space. We also calibrate a new magnitude equation for Nepal, related to epicentral distance and observed ground velocity.

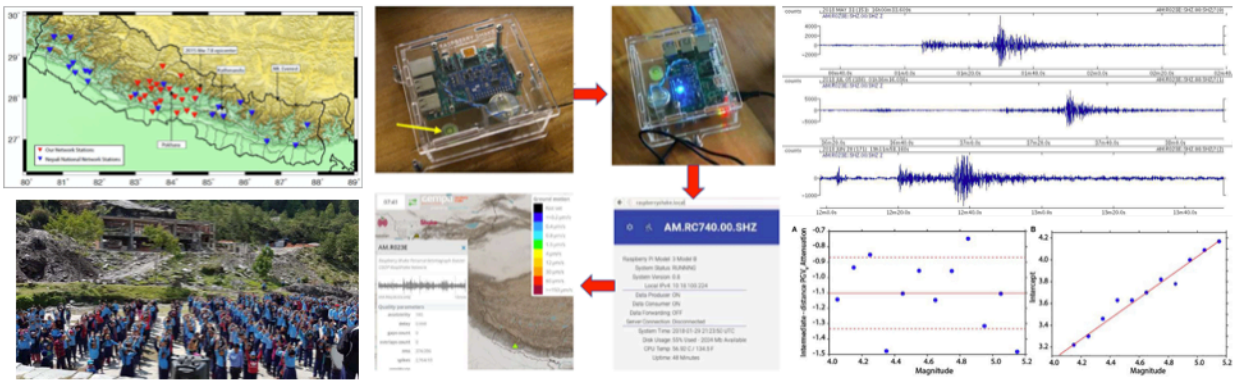

Figure 4: Network of low-cost sensor and recording of earthquakes, location of events and determination of magnitude

V. Data and references and the program of preparation of the population

The website Seismology at School in Nepal presents the Nepal mission and program in all its aspects

http://seismoschoolnp.org

VI. Publications

Front. Earth Sci., 09 April 2020 | https://doi.org/10.3389/feart.2020.00073
Seismology at School in Nepal: A Program for Educational and Citizen Seismology Through a Low-Cost Seismic Network
Shiba Subedi, György Hetényi, Paul Denton, Anne Sauron

V. role of SERA in this projet

Use in education of SERA-derived education materials
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SERA workshops

3. Chapter 3: Seismic hazard and earthquake preparedness information for school and population

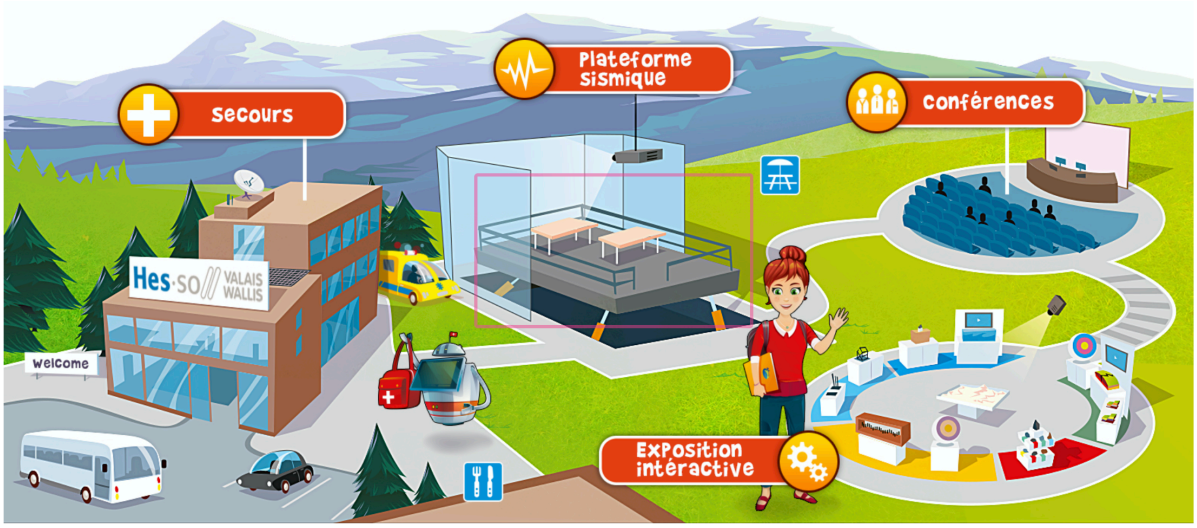

Figure 1:CPPS

CPPS
Centre pédagogique prévention séismes
Bildungszentrum für erdbebenprävention
Earthquake prevention training centre

1. Earthquake prevention training centre

This research project combining sociology, cognitive sciences and scientific development around the construction of manipulation and games has made it possible to develop an approach adapted to schools and natural risk professionals.

Faced with the seismic risk and the seriousness of its consequences, prevention is an absolute duty.Compliance with earthquake-proofing standards at the time of building construction is essential. But this is not enough: when an earthquake occurs, the protection of populations depends mainly on the behaviour of each individual facing the disastrous consequences of the earthquake.

Adapted behaviour is not innate; it must be acquired, and this acquisition cannot be limited to information or simple teaching. Adapted behaviour can only result from practical and concrete training.

This training requires an adapted framework, equipped with the necessary equipment to enable everyone to experience the effects of an earthquake on their own body and to be able to use models whose handling will facilitate operational understanding of the essential principles of safe driving.

The CPPS is an acronym for the French phrase “centre pédagogique pour la prévention en cas de séismes” – the Earthquake Education Centre.
It is a complete educational concept covering aspects that range from understanding the occurrence of earthquakes, learning how to protect yourself and giving you the basic skills to help on site.

The CPPS accueille tout public (scolaire et adulte) il est équipé du matériel nécessaire (simulateur, maquettes manipulables, logiciels interactifs, etc.) permettant aux visiteurs (classes, groupes, individuels…) Il permet de ressentir, d'éprouver, d'expérimenter les différents paramètres caractéristiques d'un séisme, mais aussi de s'entraîner aux réactions les plus efficaces pour la protection et la sécurité de chacun, sans oublier l'apprentissage indispensable pour la maîtrise individuelle et collective d'une « check list »
The activities offered by the CPPS are divided into three optional modules. These cover different themes to help young people and the general public familiarise themselves with earthquakes.

I. Interactive exhibition : Get ready BEFORE , understanding Earthquakes

From tectonic plates through the mechanisms at work in faults, the propagation of seismic waves and the liquefaction of sedimentary soils, landslides, avalanches to giant waves and tsunamis, the fundamental aspects of geophysics are taught using hands-on, fun activities, films and explanatory posters.

II. Seismic platform : Protect YOU DURING an earthquake

Learn to feel and compare different types of earthquakes and different intensities. Visitors become aware of the impact of an earthquake on their immediate environment and acquire good reflexes.

III. How to react AFTER

Inculquer les gestes à accomplir pour sauver des vies, premiers soins à prodiguer ou encore les différentes précautions à prendre pour se sécuriser soi-même, ainsi que les autres personnes. Ce module devra se faire sous la direction des pompiers, ambulanciers, samaritains, protection civile, armée, etc.

IV. Education and outreach

Training of school security officers and teachers appointed by the ES on how to behave in the event of a major seismic event.

Training of students, teachers at school, civil protection, nurses, doctors, fireman, brigade of police,

Informing the population so that they can have adequate preparedness measures in the event of a major seismic event….

V. Data and references

The website CPPS cpps-vs.ch

https://www.youtube.com/watch?v=AMJr6V0nZBg

Nb of specific visitors/ years : 22.000 pers.

Currently the CPPS is not open to the public . It is open to schools, teachers and state bodies involved in the protection of the population. Its opening to the public is planned for June 2021.

V. role of SERA in this projet

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Use in education of SERA-derived teaching methods/strategies
SERA workshops

VI. Publications

Engaging the public with cascading hazards using reasoned imagination
Arnaud Mignan, Anna Scolobig and Anne Sauron

Arnaud Mignan, Anna Scolobig, Anne Sauron, (2016) "Using reasoned imagination to learn about cascading hazards: a pilot study Disaster Prevention and Management, Vol. 25 Issue: 3, pp.329-344, https://doi.org/10.1108/DPM-06-2015-0137

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