Information for schools interested in participating in the Australian Seismometers in Schools program

Introduction

The Australian Seismometers in Schools project (2011-2014) is an outreach program to put 40 earthquake-measuring seismometers in Australian Schools, and thereby raise awareness of geoscience through observing our dynamic earth in motion. Students are required to look after their very own seismometer and in doing so be a part of a national science experiment. The Australian Seismometers in Schools project aims to:

- Raise community awareness of regional earthquakes;
- Raise awareness of seismology and, more generally geoscience, as a field of study;
- Promote science as a possible career choice;
- Provide a tool to teachers to assist in teaching physics and earth science to high school students.

The Seismometers in Schools project is not a new concept. There are several similar projects already underway in the USA, Italy, Ireland, UK and France. The Australian Seismometers in Schools program is a four-year project (2011-2014) funded by the Geophysical Education Observatory component of AuScope Australian Geophysical Observing System (AGOS). The seismometer network will be complemented by an educational website allowing real time access by students to earthquake recordings from both local and global earthquakes. The portal will be designed to align with Australian educational syllabi at multiple teaching levels.

What the program will provide

- A seismometer (Figure 1)
    - Guralp CMG-6TD
    - Includes GPS antenna and cables

Figure 1: Seismometer with GPS antenna and cables

- Installation
    - We will come to your school and assist in finding a suitable site and install the instrument.
    - We will also install the software on your computer.
- Basic Training
    - Once installed we will teach you how to use the software to view data from your instrument
    - We will also direct you to information on classroom activities that use the instrument.

Other instrument options:

- At some sites we will provide a Quake-Catcher (Figure 2) instead of or as well as a seismometer. Quake-Catchers are accelerometers and are less sensitive to noise. At very noisy sites, such as schools close to the city, they are more suitable than a seismometer. Students will not see many earthquakes recorded by a Quake-Catcher besides local felt earthquakes, however; they can be used as a tool for classroom demonstrations. Quake-Catchers do not require any special installation, just plug them into the USB port on your computer, install some software and they are ready to go. If you have an Internet connection you can also send data back to a repository for others to use.

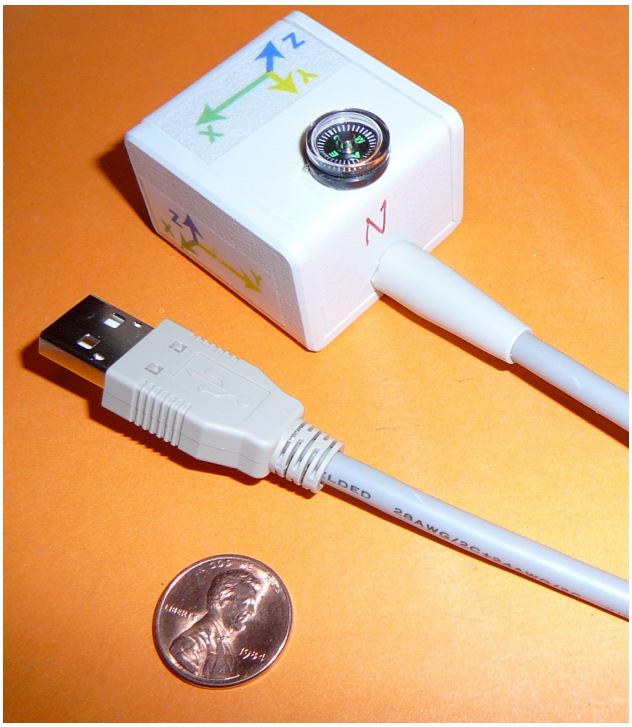

Figure 2: A Quake-Catcher instrument.

- Another option for schools who might miss out on a seismometer is to build their own slinky seismometer (http://cgiss.boisestate.edu/~kasper/geoph297wiki/index.php/BSU_Network). These instruments pick up large distant earthquakes and small to moderate local events. We are hoping to assist schools in providing guidance on how to set up these instruments.

What is required by the schools

Although the program covers the majority of the setup costs there are some requirements that the school will have to provide in order to participate:

- A secure location for the seismometer
- A dedicated computer connected to the internet
- Some enthusiasm!

Instrument location

One of the biggest challenges is to find a suitable location for the instrument. Seismometers are very sensitive that is why they can record earthquakes on the other side of the world that we cannot feel. Unfortunately, they can potentially pick up lots of noise too. To minimize noise, the seismometer should be located on the ground floor or preferably in the basement of a building and on a concrete floor or slab. There must also be a power outlet near the instrument and space for cables to be run from the seismometer to a computer located nearby (for display) and to a GPS antenna located outside.

Other things to consider when looking for a suitable location:

- Avoid areas with high foot traffic, such as classrooms or corridors.
- Avoid locations close to the road.
- Avoid locations close to noisy equipment, such as boilers or generators.

- Temperature fluctuations can also create a type of noise, so well insulated areas are best, although we can provide some insulation around the instrument with the installation.
- Somewhere dry as water can damage the instrument.
- Easily accessible
- Secure

Computer and Internet connection

The instrument requires a computer (laptop or desktop) to display the waveforms and connect to the Internet to transfer the data back to the central repository at ANU. If possible, the computer should run Windows and have either an Ethernet, 9-pin RS232 port or Wireless connection.

How the Seismometers in Schools program fits in the national curriculum

Although the national curriculum is yet to be finalized for science (at the time this document was written), we envisage the Seismometers in Schools program will provide teachers with a tool that can be used to address many elements of the curriculum.

The Seismometers in Schools program has the potential to address the overall aims of the science curriculum (see http://www.australiancurriculum.edu.au/Science/Aims) in the following ways:

- The program will spark student's curiosity in the world where we live by seeing waves recorded from earthquakes all over the world.
- Students will gain an understanding of the nature of scientific inquiry by using recordings from their seismometer and those in other schools to locate and measure the magnitude of large earthquakes. These exercises can lead to simple questions relating to why earthquakes occur where they do to more complex questions regarding the physics of waves and how they travel through the earth.
- SIS will promote careers in science, especially earth sciences: seismology, geophysics and geology.
- SIS can include historical lessons, such as, how the first earthquake was recorded, how we learn about historical earthquakes and how earthquakes effect daily decisions, such as, building codes and land use.
- Finally, seismology requires understanding of the basic topics that students learn in school, such as, physics, mathematics and earth sciences.

The national curriculum identifies a number of strands and sub-strands (see http://www.australiancurriculum.edu.au/Science/Content-structure). We see the Seismometers in Schools program being incorporated into the following:

- Science Understanding
    - Earth and Space Sciences
    - Physical Sciences
- Science as a human endeavor
    - Nature and development science – history and development of earthquake monitoring.

    - Use and influence of science – How seismology influences building design, land use and emergency planning.
- Science inquiry skills
    - All sub-strands but in particular processing and analyzing data and information.

Overarching ideas in the curriculum that Seismometers in Schools could support: (see http://www.australiancurriculum.edu.au/Science/The-overarching-ideas for a description)

- Patterns, order and organization
    - What do patterns of earthquakes tell us about the earth?
- Stability and change
    - How earthquakes change our landscape, e.g., mountain building.
    - Difference between relatively stable intraplate settings and unstable plate boundaries.
- Scale and Measurement
    - Amplitude of waves, magnitude and magnitude scales.
    - Intensity scale.
    - Wave speed and arrivals.
    - Earthquake location.
- Systems
    - The Theory of Plate Tectonics and the role earthquakes play.
    - What is the earthquake cycle for large earthquakes?
- Matter and Energy
    - How energy is released during an earthquake?
    - How different waves travel through different materials in the earth, e.g., liquid vs. solid, compressional vs. shear waves.

We intend to work with teachers to provide resources for activities in the classroom that help incorporate SIS into the curriculum. For this to work we will encourage the teachers to provide feedback on the activities and their success or difficulties. We are planning to hold a workshop at CONASTA 2012 to help teachers with classroom activities involving the seismometer and obtain feedback for future teaching aids.

Links

Similar programs elsewhere in the world.

The UK project
http://www.bgs.ac.uk/schoolseismology/schoolSeismology.cfc?method=viewLatestQuake
The USA program
http://www.iris.edu/hq/sis
The French program
http://www.edusismo.org/en/index.asp
The slinky seismometers in schools program
http://cgiss.boisestate.edu/~kasper/geoph297wiki/index.php/BSU_Network

Educational Resources

The Incorporated Research Institutions for Seismology (IRIS) website provides good animations and material about earthquakes for a range of learning levels. We would like to utilise this material as well as developing some Australia specific material.
http://www.iris.edu/hq/programs/education_and_outreach
PDF of earthquake related exercises published by Geoscience Australia.
http://www.ga.gov.au/image_cache/GA10101.pdf
Virtual courseware: interactive earthquake location and magnitude exercises. Requires Firefox.
http://www.sciencecourseware.com/eec/earthquake/

Instrumentation - Seismometers

Here are some links to websites about the instrument and software (warning it is fairly technical)
http://www.guralp.com/products/6TD/
http://www.guralp.com/support/software/scream/

Instrumentation – Quake Catchers

The quake catcher website for small demonstration instruments that we will use at schools that are subject to very high noisy, such as those in the cities.
http://qcn.stanford.edu/

Funding Provider

Here is a link about AuScope who are providing the funding for this project.
http://www.auscope.org/content.php/category/id/2

Contact

For more information contact:
Natalie Balfour – Seismometers in Schools Coordinator
Phone: +61-02-6197-0083
Email: sis@anu.edu.au