9th EGU

Alexander von Humboldt International Conference

High Impact Natural Hazards Related to the Euro-Mediterranean Regions

Istanbul 1894 Earthquake: the Bazar

Geosciences Information For Teachers Workshop

Istanbul, Turkey, 27-28 March 2014

Dear Teachers,

Welcome to the GIFT (Geosciences Information for Teachers) workshop jointly organized by the European Geosciences Union (EGU) and the Kandilli Observatory and Earthquake Research Institute (KOERI).

This workshop is associated with the 9th Alexander von Humboldt Topical Conference « High Impact Natural Hazards Related to the Euro-Mediterranean Region ». The aim of this AvH conference is to open a forum on natural hazard events that are characterized by high impact and large destructive potential, particularly related to the Euro-Mediterranean Region including Turkey (e.g., Marmara Region).

High impact natural events may profoundly affect, or even destroy, the socio-economic fabric over different spatial and temporal scales. These events often have a low probability of occurrence, with society often unprepared for the resultant impact. Earth Scientists are foremost in studying and understanding the geo-processes and uncertainties surrounding these hazards.

The GIFT workshop will take advantage of the scientists already present in Istanbul to whom we have asked to address you on a vaiety of subjects, including...*earthquakes*, *tsunamis*, *volcanoes*, *hydro-meteorological* and *other hazards*.

The GIFT-2014 workshop will also include hands-on activities led by a science educator specialist of classroom experiments who we have invited to come and to show you a set of small experiments on seismic problems, all contained in the « EGU-Seismic Box – Do it Yourself ». You will be shown how to construct yourself simple and clear experiments on different aspects of seismic phenomena. Small material to construct these experiments will be provided to you.

We would like to continue to offer teachers the opportunity to attend GIFT and similar workshops, but this depends upon us being able to show our sponsors that teachers have used what they have learnt at the GIFT workshops in their daily teaching, or as inspiration for new ways to teach science in their schools.

Therefore, **we would ask you**:

1. To fill out the evaluation form as soon as possible and send it back to us.

2. To make presentations of your experiences at GIFT to a group of your teaching colleagues soon after you return.

3. To send us reports and photographs about how you have used the GIFT information in your classrooms.

We also encourage you to write reports on the GIFT workshop in publications specifically intended for geoscience teachers. Very soon, a « Teachers' Corner » will be uploaded on our web page, where all teachers will be able to post their opinions.

Information on past and future GIFT workshops are available on the EGU homepage (http://www.egu.eu/education/gift/workshops/) : At this link it is possible to download brochures (.pdf) of the workshops, presentations given at the GIFT workshops for the last 8 years (.pdf). Since 2009, web-TV presentations were also included, which may be freely used in your classrooms.
We hope you enjoy the GIFT workshop in Istanbul!

Seyhun Puskulcu and Carlo Laj

Acknowledgements

The GIFT-2014 workshop has been organized by the Committee on Education of the European Geosciences Union. EGU has supported the major share of the expenses, but the workshop has also benefited from the generous help of:

The European Space Agency

Istituto Nazionale di Geofisica e Vulcanologia

Westermann Verlag, Braunschweig, Germany

And we thank all the speakers who have contributed to this educational workshop and their institutions

Organizing Committee

Carlo Laj
Ecole Normale Supérieure
Département de Géologie
24 Rue Lohmond
75231 Paris Cedex 5
France
carlo.laj@ens.fr
&
Committee on Education
European Geosciences Union
education@egu.eu

Seyhun Püskülcü
Bogazici University, Kandilli Observatory
&Earthquake research Institute Unit
34684, Çengelköy, Istanbul,
Turkey
puskul@boun.edu.tr

Ali Özgün Konca
Bogazici University, Kandilli Observatory
&Earthquake research Institute
34684, Çengelköy, Istanbul,
Turkey
ozgun.konca@boun.edu.tr

Bruce Malamud
Department of Geophysics
King's College London
Great Britain
bruce.malamud@kcl.ac.uk

Carlo Laj

Ali Özgün Konca

Seyhun Püskülcü

Bruce Malamud

Program

European Geosciences Union - Kandilli Observatory

GEOSCIENCE INFORMATION FOR TEACHERS (GIFT) WORKSHOP

High Impact Natural Hazards Related to the Euro- Mediterranean Regions

Istanbul, March 27-28, 2014

Thursday March 27, 2014

8:30 – 9:00	Registration
9:00 – 9:10	**WELCOME !** Seyhun Puskulcu and Carlo Laj
9:10- 9:55	Disasters and environmental effects caused by natural forces as exemplified from Anatolia Prof. Yücel Ylmaz Faculty of Mines, Istanbul Technical University
10:05 – 10.50	Triggered Landslide Events: Statistics, Implications and Road Network interactions. Bruce D. Malamud Department of Geography, King's College London, UK
11:00 – 11: 30	Coffee break
11:30 – 12:30	Examples of Earth Observation applications to Natural Hazards in the Euro-Mediterranean Region Francesco Sarti ESA-ESRIN 00044 Frascati (RM) Italy
12:30 – 13:30	**LUNCH**
13:30 – 14:15	Global Warming and associated Hazard Risk. Mikdat Kadioglu, Istanbul Technical University

14:15 – 15:00 Magnitude 9 Earthquake Risk in the Eastern Mediterranean and the 365AD Catastrophe
Robert Muir-Wood
Chief Research Officer
Peninsular House, London, UK

15:00 – 15:30 Coffee Break

15:30 – 17:30 Hands-on Activities: the Seismic Box (Do it yourself)!Part 1
François Tilquin
Lycée Marie Curie
Echirolle, France

17:30 END OF THE DAY

Friday March 28, 2014

09:00 – 09:45 Coping with natural risk in the XXI century: new challenges for scientists and decision makers
Warner Marzocchi
Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy

9:45 – 10:30 Earthquakes: Understanding the Physical Process and How We Analyze Them
Ozgun Konca
Bogazici University
Kandilli Observatory and Earthquake Research Institute.
Department of Geophysics, İstanbul

10:30 – 11:00 Coffee Break

11:00– 11:45 Eruptions from calderas: the most devastating, the least understood
Paolo Papale
Istituto Nazionale di Geofisica e Vulcanologia, Pisa, Italy

12:20 – 13:30 LUNCH

13:30–15:30 Hands-on Activities: the Seismic Box (Do it yourself)! PART 2
François Tilquin
Lycée Marie Curie
Echirolle, France

15:30 – 16:30	The educational activities of the European Geosciences Union Carlo Laj Ecole Normale Supérieure Chair, Committee on Education of EGU Filling Evaluation form Distribution of videos
16:30	**End of the Workshop**

Speakers

Emeritus Professor of Geology Dr.Yücel YILMAZ

Address: Kadir Has University
Cibali Merkez Kampüsü 34083 Cibali/Istanbul
Istanbul Technical University,Mining Faculty,Maslak-Istanbul

e-mail: yyilmaz@khas.edu.tr

EDUCATION

B.Sc; İstanbul University, Faculty of Science (Geology-Geophysics) 1960-1964
M.Sc&Ph.D; University College, University of London 1967-1972.

PROFESSIONAL EXPERIENCE

· *Acta Volcanologica* Editorial Board Member since 1995.
· Joint research with Japanese Prize winner Prof. Dr. D. Mc Kenzie (1989-93) (Cambridge Univ.)
· Professor (İTÜ, Fac. Mines), 1987.
· Nato – Collab. research project with: Prof. Dr. Dan Karig (Cornell University USA) 1986-1988.
· Visiting scholar (Maitre de Conférence; Dept. Géologie, Paris Univ. Sud d'Orsay), 1981.
· Visiting research assistant, (Leicester University, England), 1975.
Research assistant (University of London, Geology), 1975.
· Member of The Monitoring committee of the Intern. Engineering Education Assoc. 2000-2004
· Convener of International project of the Black Sea -Mediterranean connection (IGIP) 2002-2009
· Visiting Professor, University of Washington 2011

PROFESSIONAL MEMBERSHIPS & DUTİES

· TÜBİTAK (Turkish Research Council) Board Member, 1981-1985.
· NATO Advanced Study Institute Panel Member, 1980-1985.
· Ocean Drilling Project EMCO (Executive Council member), 1989-2002
· TÜBİTAK Geology Research Group, 1992-2006
· Monitoring committee member of the Intern. Engineering Education association 2005-2009
· Member of the Turkish Academy of Sciences, 1996-2011
· Member of Academy of Sciences 2011-
· Rector of the Kadir Has University, 2002-2010

AWARDS

· TÜBİTAK, (Scientific and Research Council of Turkey) Young Scientist Award 1979.
· TÜBİTAK, Science Award, 1999.
· İhsan Ketin Awards, 2009.

SELECTED ACTIVITIES

· Supervised 12Ph. D thesis. 25 M.Sc. thesis
· Author and co-author of more than 130 research papers. 150 abstracts and extended abstracts
· Co-editing and editing a number of International scientific books and papers
· Over 100 International Conferences
· Conveners and co-conveners of a number of sessions in International geological meetings
· Consultant, TPAO (Turkish Petroleum Co.) (1996-2001, 2010-2013) and Exxon Mobil Petroleum Corporation 2001-2003,
· Areas of Expertise and interest; Igneous petrology, tectonics, geomorphology

Disasters and environmental effects caused by natural forces as exemplified from Anatolia

Yücel Yılmaz
Faculty of Mines -Istanbul Technical University

Anatolian geology displays great variations. Eastern Anatolia suffers a severe north south shortening. Such shortening is pushing the two peripheral mountain ranges (namely the Black Sea mountains :Pontides and the SE Anatolian mountains or the Eastern Taurus mountains) upward. The western Anatolia in contrast undergoes north –south extension.
As consequence of the north- south compression the continental crust in the East Anatolia, has been shortened, thickened and consequently elevated to form the present high plateau with average elevation of 2000m. Above this flat plateau there are significant peaks. They correspond to the volcanic cones. Volcanologists regard some of the volcanoes still active since they expel volcanic gases .Monitoring these volcanoes are needed, incase they suddenly explode and cause disasters.
The shortening deformation triggers widespread earthquakes in the whole eastern Anatolia. Almost every year some earthquakes of big magnitudes occur and cause severe damages and death toll.
In recent geological past the north-south compression began to be accommodated by the two big cracks in the earth crust. We geologists call them faults. The northerly located of these two faults is the bigger one , ,and cut across the entire length of Anatolia, running in east-westerly direction from the East Anatolia to the Aegean Sea extending more than 1000 km. It is a one of the well known faults of the world, because it generates big earthquakes all along the fault zone. The more recent one occurred in the Marmara region about 13 years ago, and caused in addition to very severe damages in the settlements, a death toll of about 30 000 .This event alone, still vivid in our memory, tells us that we should not forget it and take necessary precautions before an approaching earthquake hits the region again!
The on-going elevations in the peripheral mountains of Anatolia and particularly in the northern range; the Black Sea mountains the uplifting disturbs stabilities of the rocks along the slopes of the mountains ,and triggers enormous land slides every year causing severe damages and environmental effects .
İn contrast to the eastern Anatolia, the western Anatolia enlarges north –south. This extension thins the earth crust and allows hot interior of the earth ascent approaching to the shallow levels. So high heat flow generates geothermal energy resources but brings along some important environmental problems to be solved with care
The extension of the earth crust causes different features on the surface; have formed fault bounded depressions intervened by thin and long hills . Along these East-West trending low lands are located the major rivers of the western Anatolia such as the Buyuk Menderes and Gediz rivers.The fertile lands around these river valleys have long been preferred by the early dwellers as places of settlements .Previously some of these ancient cities located by the sea shore were closely connected to the sea trade .However most of these ancient famous cities such as Ephesus ,Miletus or Troy have been abandoned due either to the earthquakes or in fillings of the sea by the increasing amounts of the alluvial materials carried by the rivers or both, Therefore they lost their main sea port identity. The geological events played significant roles in their birth and decline
İn this presentation different geological characters of the east and west Anatolian will be outlined together with the disasters and environmental effects that geological factors cause

Bruce D. Malamud
Department of Geography
King's College
London, Great Britain

Bruce D. Malamud (PhD) is a Professor of Natural & Environmental Hazards. His main research and publication areas include wildfires, floods, earthquakes, landslides & heavy-metal contamination of water, crops and soil. Underlying subthemes of his research include time-series analyses, risk, and the comparison of models with data in the broad environmental sciences. He has over 50 peer-review journal articles, conference proceedings and chapters in books, including 1st author publications in *Earth and Planetary Science Letters*, *Earth Surface Processes and Landforms*, *Journal of Geophysical Research*, *Proceedings of National Academy of Sciences*, and *Science*.

Currently there are >3,000 citations to his publications. He has been PI on ESA, NERC, EPSRC, and EC grants, served as chief editor of Nonlinear Processes in Geophysics, President of the Natural Hazards Division of the European Geosciences Union (EGU), Chair of the EGU General Assembly 2010 and 2011 Programme Committee, and member of the NERC peer-review college.

TRIGGERED LANDSLIDE EVENTS: STATISTICS, IMPLICATIONS AND ROAD NETWORK INTERACTIONS

Bruce D. Malamud
Department of Geography, King's College London, UK

Landslides are the movement downslope of material, such as soil, rocks and debris. The area of landslides range from m^2 to km^2 and the velocity they travel from slow (mm/year) to very fast (e.g., as fast as 80 km/hr for debris flows). Landslides are generally associated with a trigger, such as an earthquake, a rapid snowmelt or a large storm. In the hours to days following the trigger, anywhere from a single landslide up to many thousands can be generated. We call this a triggered landslide event, which is what will be examined in this talk. Four examples of landslides triggered by a snow-melt event (rapid temperature increase) that occurred in central Italy during January 1997 are given in **Figure 1**.

Figure 1. *Four examples of landslides triggered by the January 1997 rapid snow-melting in Umbria. (A) To the right of the buildings can be seen a deep-seated slide (slump earth flow) of about 50 m × 180 m. (B) In the foreground, cutting across the paved road, can be seen part of a deep-seated slide (rotational) of about 30 m × 100 m. (C) On the slope can be seen a shallow slide (soil slip) of about 40 m × 40 m. (D) In the middle can be seen deep-seated slides (complex), with the largest (on the left) extending about 100 m × 250 m. Figure from Guzzetti et al. (2002).*

Triggered landslide event inventories are the compilation, through air photos, remote sensing, and/or ground work, of the location and area of landslides that have occurred as a result of a trigger. An example of a landslide event inventory for the Umbria Snowmelt event in 1997 (over 4,000 landslides) is given in **Figure 2**.

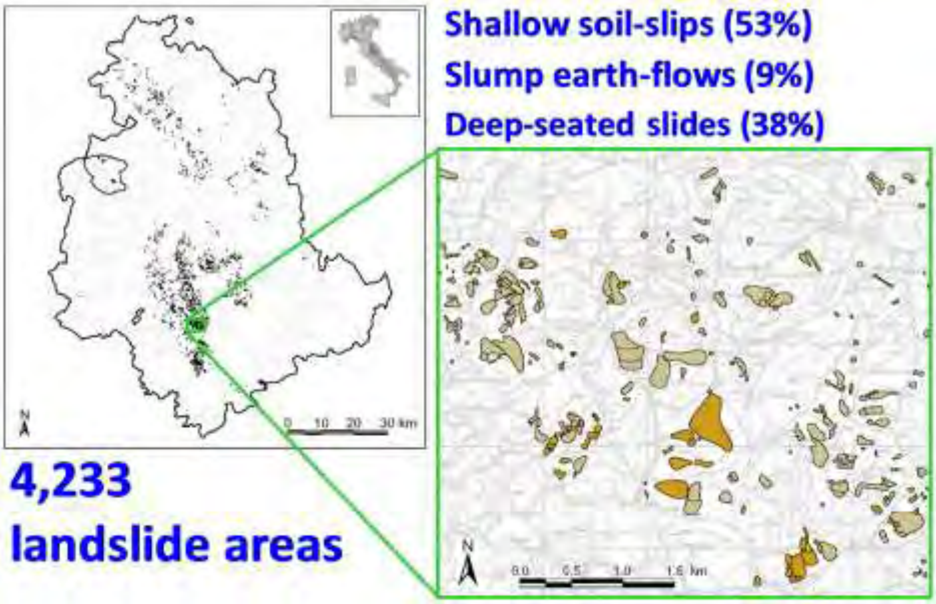


Figure 2. *Spatial distribution of Umbria landslides triggered by rapid snow-melt in January 1997. (Left) Shown is the spatial location of 4233 landslides identified through the interpretation of 1:20 000 aerial photographs fown 3 months after the event. These aerial photographs, supplemented by field surveys, resulted in mapping being carried out at a scale of 1:10 000. (Right) An example of the results of detailed mapping of landslides. Figure from Guzzetti et al. (2002).*

In addition to the Umbria Snowmelt event, we will examine two other triggered event inventories here (see **Figure 3**): (i) over 11,000 landslides areas triggered by a 1994 earthquake in California, and (ii) about 9,500 landslides triggered by heavy rainfall in Guatemala as the result of Hurricane Mitch in 1998.

Figure 3. *Two other triggered event landslide inventories considered in this paper: (Left) Northridge earthquake (California) triggered landslides in 1994. (Right) Hurricane Mitch (Guatemala) triggered landslides in 1998.*

There are many ways to study natural hazard processes (in this case, landslides), including examining them spatially, what happens to them temporally, the physical processes involved, the policy actors surrounding them, and issues such as communications. Here we examine what we can learn by examining the ***statistical population*** of the landslide areas or volumes in a triggered landslide event, i.e. what is the relative numbers of small, medium, large, and very large landslides that occur in the event. The probability of the distributions for these three triggered event inventories is given in **Figure 4**.

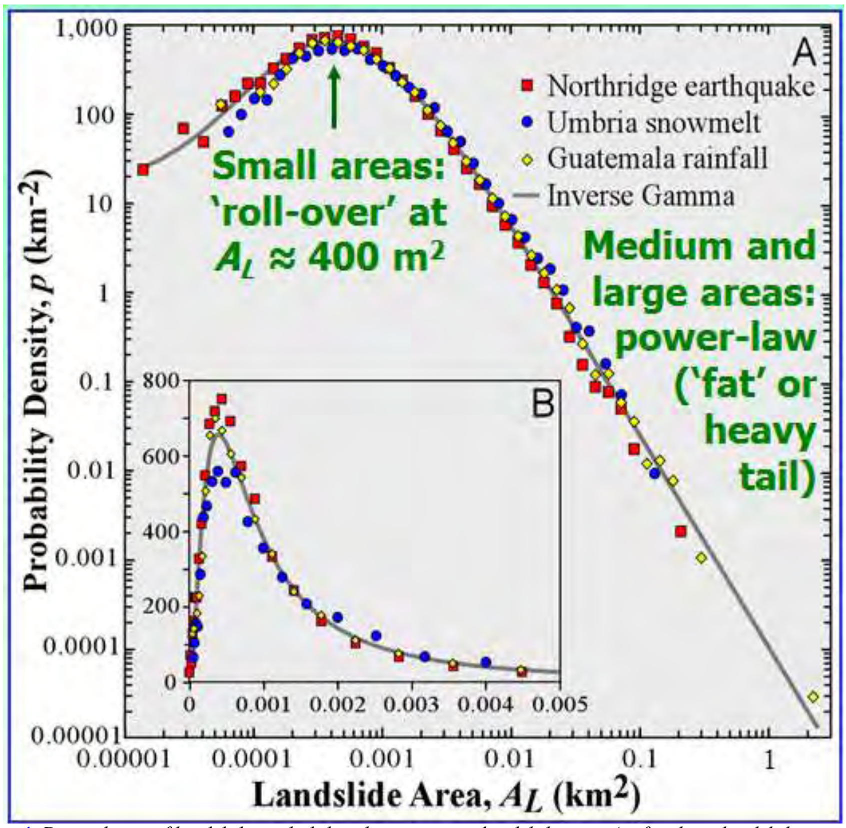


Figure 4. *Dependence of landslide probability densities p on landslide area A_L, for three landslide inventories discussed in this talk: January 1994 Northridge earthquake in California, USA; January 1997 snowmelt event in the Umbria region of Italy; heavy rainfall from Hurricane Mitch in Guatemala in late October and early November 1998. Probability densities are given on logarithmic axes (A) and linear axes (B). Also included is the proposed landslide probability distribution. This is the best fit to the three landslide inventories of the three-parameter inverse-gamma distribution, which is an exponential distribution for small landslide areas and a power-law for medium and large areas. Figure from Malamud et al. (2004).*

There are a number of implications of having the 'same' general probability distribution for triggered landslide event areas, including:

- Average landslide area in a triggered event will be the same.
- We can determine the total area of landslides in a triggered event from total number of landslides.
- We can make estimates of erosion due to triggered event.
- A quick 'Assessment' of triggered landslide numbers can be made by using largest areas.
- One can use this statistical distribution to explore, via a computer grid-based model, the probability of landslides interacting with road networks (see **Figure 5**).

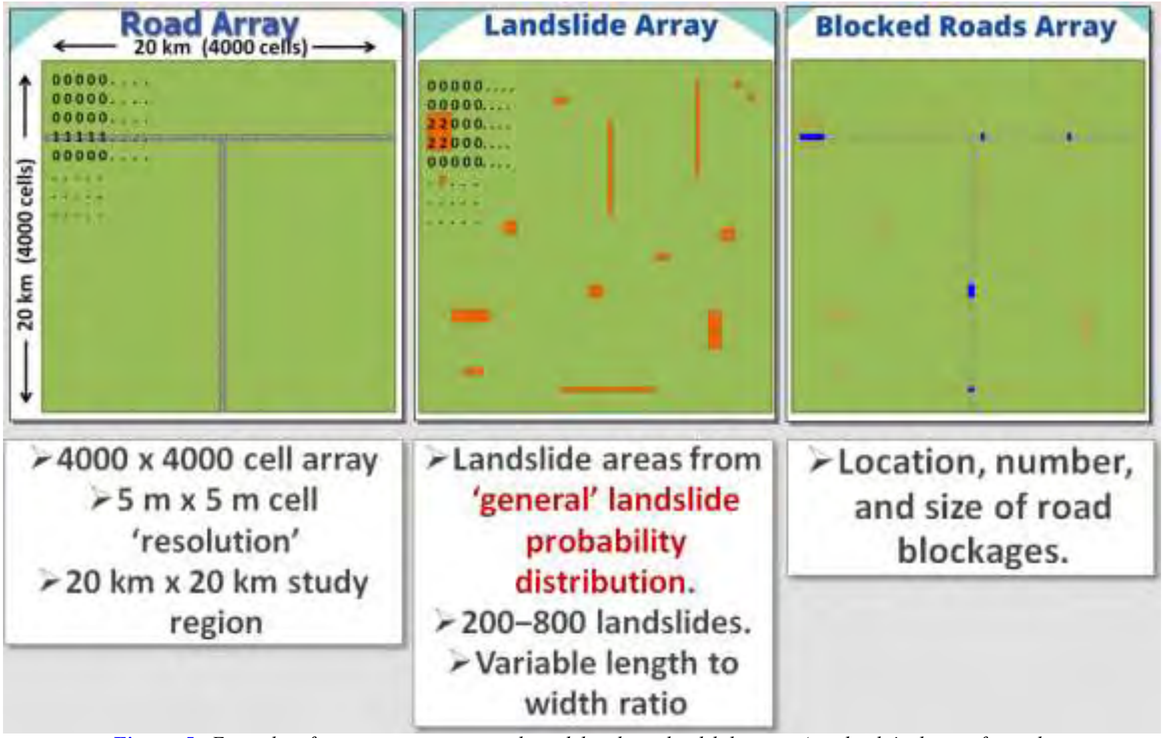


Figure 5. *Example of a computer generated model, where landslides are 'randomly' chosen from the statistical probability distribution shown in Figure 4, and 'randomly' dropped on a grid that includes roads. The number of 'road blocks' are then calculated, and the model run thousands of times. Knowing the average number of road blocks will help Civil Protection Agencies have an idea of the potential impact of future landslide invents on road network infrastructures. Figure courtesy of Faith Taylor, King's College London.*

Ultimately, through these implications and models, it is hoped that a better understanding of the landslide frequency-areas involved in past triggered landslide events can help hazard managers in their risk assessments for the future.

References Cited

Guzzetti F, Malamud BD, Turcotte DL and Reichenbach P (2002) Power-law correlations of landslide areas in central Italy: *Earth and Planetary Science Letters*, **195(3–4)**:169–183, 10.1016/S0012-821X(01)00589-1.

Malamud BD, Turcotte DL, Guzzetti F and Reichenbach P (2004) Landslide inventories and their statistical properties: *Earth Surface Processes and Landforms*, **29(6)**:687–711, doi: 10.1002/esp.1064.

Francesco Sarti
PhD, Scientific Coordinator of the Education
and Training Activities
Directorate of Earth Observation Programmes
ESA/ESRIN
V.Galileo Galilei, C.P. 64
00044 Frascati (Italy)

After his Master Degree in Electrical Engineering at the University of Rome *La Sapienza*, he was hired in 1990 at the Operation Center of the European Space Agency in Germany (ESA/ESOC) in the area of mission analysis and orbit control manoeuvre optimization. He then moved to precise orbit determination and to orbit and attitude control and continued his career at ESA/ESTEC in The Netherlands.

He moved to Toulouse, France, in 1997, where he got a Post-graduate Master in Applied Remote Sensing and Image Processing followed by a PhD on the subject of optical-radar remote sensing for the monitoring of surface deformation (University of Toulouse *Paul Sabatier*). In France, he was first employed by CESBIO (1998) and later by CNES (1999-2001), working as a Project Manager for the *International Charter on Space and Major Disasters*, conducting R&D activities for remote sensing applications to disaster management and natural risk monitoring, interferometric monitoring of several seismic areas and providing training courses in Earth Observation.

After a short period at Italian Space Agency (2001) as a technical interface ASI-CNES for the cooperation COSMO-SkyMed / Pléiades, he joined ESA/ESRIN, in Italy, working in Earth Observation applications; since 2007, he coordinates the Education and Training Activities in Earth Observation.

In his spare time (unfortunately not much) he enjoys painting, playing piano and open-air sport like swimming and kayaking.

Examples of Earth Observation applications to Natural Hazards in the Euro-Mediterranean Region

Francesco Sarti
ESA-ESRIN
Via Galileo Galilei C.P. 64
00044 Frascati (RM) Italy

Abstract:

Through its Earth Observation (EO) Programme, ESA undertakes a wide variety of projects related to the application of EO for the monitoring of natural hazards. These include operational services for rapid mapping and post disaster relief, as well as research and demonstration projects on the use of EO techniques for natural hazard monitoring.

Since the creation, in 1999, of the ***International Charter "Space and Major Disasters"*** , initiated by ESA and the French Space Agency CNES (plus many other space agencies who became members afterwards), a variety of different disasters have been mapped and analysed from space, including many that took place in the Euro-Mediterranean Region. These include earthquakes, volcanoes, floods, landslides. Just in Turkey, the Charter provided satellite-based products of three earthquakes (in 2003, 2010, 2011), one flood (2009) and one landslide (2011).

Some of these examples of catastrophic events (such as the Izmit/Turkey earthquake of 1999 or the Thessaloniki/Greece floods of 2006), mapped and analysed using satellite data, have been used in order to create computer exercises for secondary schools, using a free educational software developed and distributed by ESA in the frame of its multilingual web project Eduspace (http://www.esa.int/SPECIALS/Eduspace_EN/).

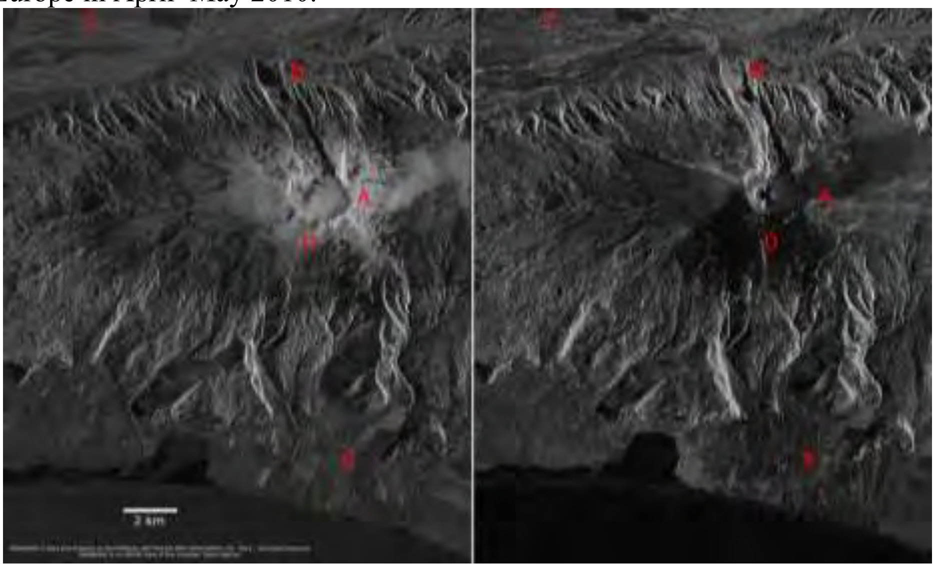
October 2006 floods in Thessaloniki (Greece). Left: False colour composite image for the multi-temporal analysis (change detection). Right: photos of the damages caused by the same floods. Taken from ESA Eduspace (http://www.esa.int/SPECIALS/Eduspace_Disasters_EN/SEMVPG826KH_0.html)

1999 Earthquake in Turkey. Left: Landsat 7 panchromatic multitemporal image, obtained by superimposing the acquisition of 10 August 1999 (before the earthquake) onto the one of 17 August. The large area in blue, to the left of the image, is the smoke plume. In the lower right corner of the image, along the coastline, changes are indicated by two other areas in blue, probably due to a bradyseism phenomenon. Right: Earthquake damage, 18 August 1999. Derince West. Taken from ESA Eduspace (http://www.esa.int/SPECIALS/Eduspace_Disasters_EN/SEMVPG826KH_0.html)

The International Charter aims to provide a unified system of space data acquisition and delivery to those affected by natural or man-made disasters worldwide. To date, 15 organisations are Charter members. The member agencies put at the disposal of the Charter their satellite resources. The Charter therefore benefits from a growing number of satellites that increase the revisit frequency and the choice of sensor for spectral and spatial resolution. Data from these sensors are processed, merged and interpreted in a variety of ways to extract the best possible information on the effects of a given disaster. One of the advantages of using Earth Observation satellites for disaster mapping is that ground-based information in the region affected is often difficult to generate otherwise because the infrastructure on ground, needed to generate the information might be destroyed or damaged by the disaster. Furthermore, satellites are the most effective means for synoptic viewing for disaster response on an emergency and priority basis. The Charter products are delivered to users on the ground with fast turnaround and at no cost. Value-adding and extraction of information from satellite data is generously sponsored by the individual Charter members. However, the Charter covers only the response phase of a disaster, on a best effort basis, whereas the later recovery and rehabilitation efforts are excluded by this mechanism.

Floods have been the most commonly covered disaster, representing roughly 50% of the Charter requests received. Typically, the main feature of the products is based on deriving flooded surfaces, either from the nature of the spectral response of these surfaces, and/or by comparison with the reference imagery predating the disaster. Typically, the flood vectors are presented as final products in GIS layers. More recently, with the advent of high-resolution SARs (metric resolution), new products showing changing water depths of inundated areas have been created.

In the case of volcanic eruptions, volcanic plumes and ash clouds can easily be detected using optical sensors from space. However, the volcanic cloud often hampers observation of the crater and the surface topography during the eruption - therefore radar backscattering properties of the ground features can be exploited to delineate the different types of volcanic deposits. A good example of the use of SAR imagery for this disaster type comes from the Charter coverage of the Iceland volcanic eruption that halted air traffic over much of Europe in April–May 2010.



Important changes connected with the eruption of the Eyjafjallajökull volcano in Iceland can be detected using radar images acquired before (April 9, left) and after the eruption (April 20, right). RADARSAT-2 Data and Products© MacDONALD, DETTWILER AND ASSOCIATES LTD (2010)

For fires, thermal and optical sensors from space constitute the core Charter capability for monitoring this disaster type. Large scale burnt area mapping of the 2009 Greek fires was carried out with satellite sensors.

Very similar to the Charter is ***the Emergency Management Service***, one of the services of Copernicus (former GMES: Global Monitoring for Environment and Security). Copernicus develops services dedicated to a systematic monitoring and forecasting of the state of the Earth's subsystems. It collects data from multiple sources (earth observation satellites and in situ sensors such as ground stations, airborne and sea-borne sensors), processes these data and provides users (mainly policymakers and public authorities) with reliable and up-to-date information through services. Six thematic areas are developed: marine, land, atmosphere, emergency, security and climate change. The pre-operational Copernicus emergency management service reinforces the European capacity to respond to emergency situations such as fires, floods, earthquakes, volcanic eruptions, landslides or humanitarian crisis. It functions very much like the Charter, in that EO data is processed to produce disaster mapping products, which are delivered to users.

While the Charter and Copernicus Emergency Management Service are predominantly for immediate disaster mapping, the Copernicus "***Respond***" service provides EO data in support to recovery, rehabilitation and reconstruction activities. The objective of Respond is to reinforce Europe's capacity to respond to emergency situations caused by the weather such as storms, fire and floods, geophysical hazards such as earthquakes, tsunamis, volcanic eruptions, landslides and subsidence, and environmental disasters resulting from human activity such as oil spills, and humanitarian disasters.

Another activity of ESA in the application of EO for natural hazards is in the development of a service for landslide monitoring. Ground Instabilities are among the most widespread geological hazards on Earth. Thousands of deaths and injuries, and enormous economic loss are regrettable evidences of worldwide slope instabilities. The necessity to identify and monitor slope movement is of paramount importance to reduce the socio-economic toll that every year is paid in developing as well as in developed countries. Several projects funded by ESA have investigated the feasibility and the operational applicability of spaceborne imagery to respond to the needs of governmental institutions that have a mandate in landslide prevention. These include the ***SLAM*** projects (Service for Landslide Monitoring), which are aimed at developing an end-to-end service chain for the provision of Slope Instability products.

The 1997 Kyoto Convention revealed to the general public that industrial and agricultural emissions of carbon dioxide, methane and other Greenhouse gases threaten to change the climate rapidly. The Baveno Manifesto reflected the European concerns for Global Environment Monitoring by space as a component of the Kyoto Convention implementation. In response to these, ESA developed the first ever multi-year ***Global Fire Atlas***. Remote sensing data from the ERS-2 ATSR-2 (Along Track Scanning Radiometer) allows to monitor agricultural fires and wildfires distribution at global scale and in Near Real Time. All Hot Spots (including gas flares) with a temperature higher than 312 k at night are precisely localised (better that 1km).

Through its activities in Earth Observation, ESA contributes to the monitoring of a wide range of disasters worldwide at all phases of the event cycle, including risk analysis and forecasting (e.g. in the case of SLAM), immediate disaster mapping (in the case of the International Charter and Copernicus Emergency Management Service), and post disaster recovery, rehabilitation and reconstruction (in the case of Respond). Continued availability of Earth Observation data is a prerequisite for the continuity of crisis mapping and disaster mitigation services in the long term. The upcoming Sentinel missions will provide essential rapid multisensor coverage over potential disaster-stricken areas.

MİKDAT KADIOĞLU
Professor
Faculty of Aeronautics and Astronautics
İstanbul Technical University
34469 Maslak – İSTANBUL, TURKEY
Tel: (0212) 285 31 33, E-mail : kadioglu@itu.edu.tr

Education
Ph.D., Department of Atmospheric Sciences, University of Missouri-Columbia, USA, 1991.
M.S., Department of Atmospheric Sciences, University of Missouri-Columbia, USA, 1987.
B.Sc., Department of Meteorological Eng., Faculty of Aeronautics and Astronautics, ITU, 1984.

Service on Faculty of Aeronautics and Astronautics
Total Years of Service: 19; 1991-Present
Original Appointment, Assistant Professor, 1991

Experience
Professor, Department of Meteorological Eng., Istanbul Technical University, 2002 – Present
Associate Professor, Department of Meteorological Engineering, İ.T.Ü, 1994 – 2002.
Assistant Professor, Department of Meteorological Engineering, İ.T.Ü, 1991 – 1994

Research Interests
Numerical Analysis and Modeling, Hydro-Climatology, Disaster Management.

Institutional and Professional Service in the Last 5 Years
Member of Faculty Executive Board, İ.T.Ü.
Member of Faculty Board, İ.T.Ü.
Chairman of Meteorological Engineering Department, İ.T.Ü.
Director of Disaster Management Center, İ.T.Ü.
Member of Executive Board, Disaster Management Center, İ.T.Ü.

Professional Development Activities in the Last 5 Years
UK Bournemouth Univ., Disaster and Emergency Manag.Training Certificate, 26/06-12/07 2005.
UK Bournemouth Univ., Disaster and Emer. Manag.Train-The-Trainer Certificate, 12-16/09/05.
Japan International Cooperation Agency (JICA) & Hyogo Int. Center-Kobe/Japan, Disaster Mitigation, Train-The-Trainer Certificate, 1-11/01/06.

Membership in Scientific and Professional Societies
Red Crescent Voluntary for Education/Training, 2005-Present.
The Chamber of Meteorological Engineers of Turkey, Member, 1985 – Present.
Turkish Marine Research Foundation (TÜDAV), Member of Executive Board, 1997 – Present.
The Chamber of Meteorological Engineers, Honorary Member, 1994 – Present.
American Meteorology Society Boston – USA, Student Member. 1985-1991.
US National Weather Association Maryland – USA, Student Member.1985-1991.
Turkish Students' Association University of Missouri-Columbia, President, 1987-1990.

Honors & Awards
Official Scholarship Student to USA by Turkish Ministry of Education, 1985-1991.
Superior Graduate Achievement Award, Graduate School of Uni. of Missouri-Columbia, USA 1990-1991.

Consultancies & Patents
National Consultant of Turkey, UNDP, Mitigation of Hydro-Met. Disaster, 2010-cont.
Consultant Istanbul Governor Disaster Management, 2004-cont.
Consultant Istanbul Municipality Disaster Coordination Center, Disaster Manag, 2004-2009.
Consultant Republic Of Turkey Prime Ministry Disaster & Emergency Management Presidency, May-August 2012.

Climate Change and Associated Hazard Risk

Prof. Dr. Mikdat Kadıoğlu
Istanbul Technical University
Department of Meteorological Engineering
kadioglu@itu.edu.tr

Summary

Rising global temperatures will bring changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather events. Climate change impacts will range from affecting agriculture-further endangering food security-, sea-level rise and the accelerated erosion of coastal zones, increasing intensity of natural disasters, species extinction and the spread of vector-borne diseases. Climate change is therefore the greatest environmental challenge facing the world today. The effects will be felt here in the Turkey and internationally there may be severe problems for people in regions that are particularly vulnerable to change. For Turkey, climate change means hotter, drier summers (more droughts, heat waves, wild fires, etc.), milder and drier winters, higher sea levels and an increased flood risk to coastal areas. Across the globe, there will be more intense heat waves, droughts and more flooding. There may be severe problems for regions where people are particularly vulnerable to changes in the weather. Food shortages and the spread of disease are commonly predicted. The social, environmental and economic costs of climate change could be huge. There are also enormous opportunities if we are willing to take action. Government, business and individuals all have a part to play, and all of us can benefit from rising to the challenge of climate change and living in a better environments.

Key Words: Climatic Change, Impacts of Climate Change, Natural Disasters

Robert Muir-Wood PhD

Chief Research Officer
Peninsular House
30 Monument Street London

robertm@rms.com

After a first degree in Natural Sciences and a PhD in Earth Sciences from the University of Cambridge, since 1992 Robert has twenty years experience of the development of catastrophe loss models of earthquake, tropical cyclone, windstorm and flood perils in Europe, Japan, North America, Caribbean and Australia.

He has been head of research at RMS since 2003 with a mission to explore enhanced methodologies for natural catastrophe modelling and develop models for new areas of risk.

He has been technical lead on a number of Catastrophe risk securitizations, was Lead Author on Insurance, Finance and Climate Change for the 2007 4th IPCC Assessment Report and Lead Author for the 2011 IPCC 'Special Report on Managing the Risk of Extreme Events and Disasters to Advance Climate Change Adaptation'.

He is Vice-Chair of the OECD High Level Advisory Board of the International Network on Financial Management of Large Catastrophes and has worked with the Geneva Association in the development of their policies and actions around climate change and insurance.

He has published six books (three for children on prehistory), written scientific papers on earthquake, flood and windstorm perils and published more than 200 articles.

Magnitude 9 Earthquake Risk in the Eastern Mediterranean and the 365AD Catastrophe

Robert Muir-Wood

Chief Research Officer
Peninsular House
30 Monument Street London

Following the Magnitude 9 Tohoku, Japan earthquake and tsunami of March 2011, attention has focused on all subduction zone plate boundaries worldwide to see whether they have the potential for comparable catastrophes.

One such candidate is the Hellenic Arc subduction zone that runs E-W through the eastern Mediterranean where the African plate dips down to the north under the Aegean Sea and Turkey.

The question as to whether this subduction zone is capable of generating a Magnitude 9 earthquake may already have been answered by the July 21st 365AD catastrophe. Piecing together all the evidence from documentary records, as well as geological and archaeological discoveries, we have indications that this was indeed a giant Magnitude 9 sized earthquake, accompanied by a tsunami that in some locations exceeded 30m elevation.

This talk will consider how all this forensic evidence can be evaluated and re-assembled. A recurrence of the 365AD event would have catastrophic impacts on coastal communities throughout the eastern Mediterranean, including in Greece, Turkey, Cyprus, Egypt, Libya and Italy.

EARTHQUAKES STUDIES in CLASSROOM

TILQUIN François
Lycée Marie CURIE
ECHIROLLES
FRANCE
francois.tilquin@ac-grenoble.fr

I am an ex- biology and geology teacher in a high school near Grenoble. My students were 15 -18 years old.

I am the author of various teaching softwares and pedagogical applications: data acquisition with interface, simulations, numerical and analogical modeling in biology and geology.

Even if more difficult, I prefer when the pupil have to do the manipulations by themselves, and test the hypothesis, rather than when the professor makes the demonstration himself.

In France, we are lucky to have practical classes with reduced number of students, and we dispose enough experimental material for individual manipulations.

Whenever it is possible, I try to adapt scientific experiments to the class, with some simplifications, and with the advice of research scientists who are always very interested in this transfer of their knowledge.

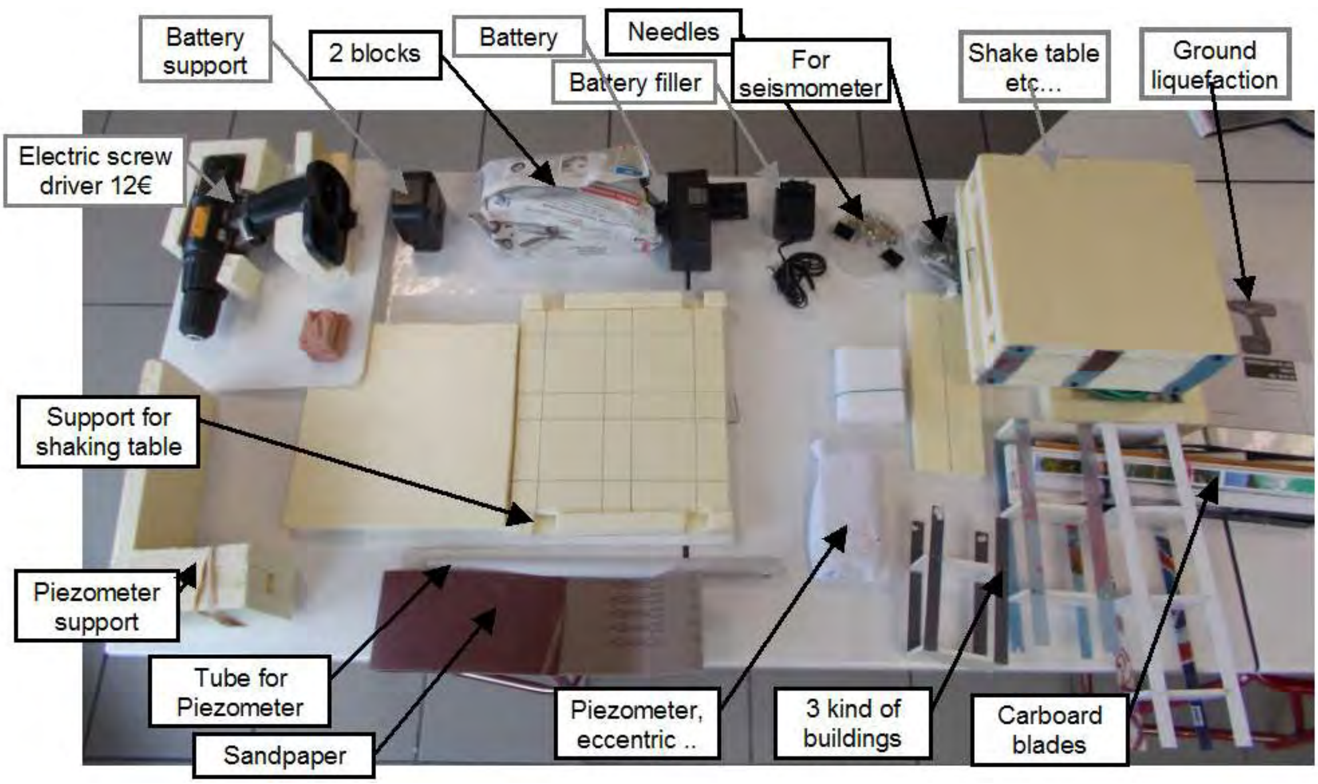
It was and it is still for me the most important goal of the earth sciences teaching.

EARTHQUAKES STUDIES in CLASSROOM with "SISMO-BOX": pedagogical SHAKE TABLES, STICK SLIP experiment, AZIMUT software.

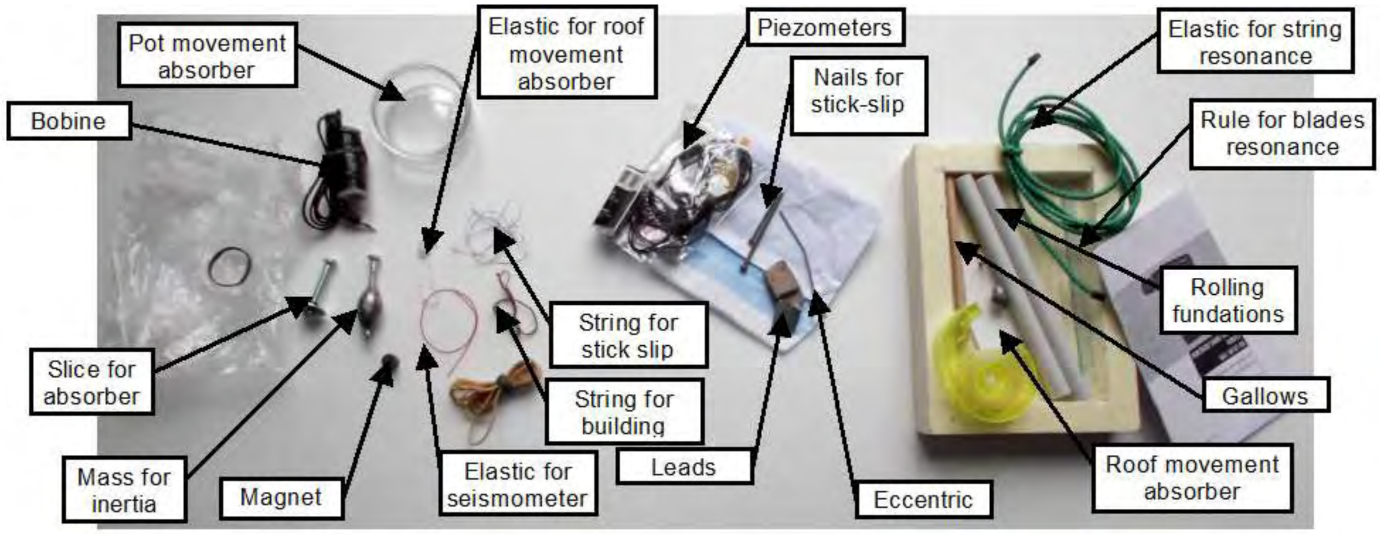
Istanbul, Turkey 24-28 March 2014

(francois.tilquin@ac-grenoble.fr ex-teacher of the French Education)

To prevent population against seismic risk, man must know **where** eathquakes take places, **when** earthquakes appear and with **which** magnitude.
These experiments made with very cheap equipment, allow to understand what is the origin of an earthquake, how to record and locate it, the impossibility to predict it, and what are its consequences on buildings. Then it is possible to understand better the difference between seism hasard (that we do not master) and risk (that we can minimize).
These goals are satisfied by very simple experiments of recording micro-earthquakes, simulation of vibrations on small buildings, and with the stick-slip experiment. The free software **AZIMUT**© FT 12/2011 allows to show which are the characteristics of the various waves which arise from an earthquake, and what is the first movement of the ground.

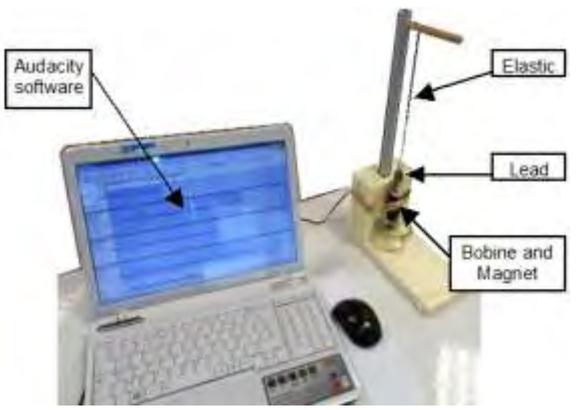


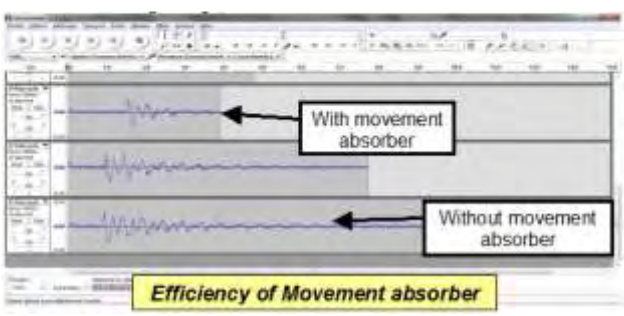
Contents of the home-made "Sismo-box" do-it-yourself



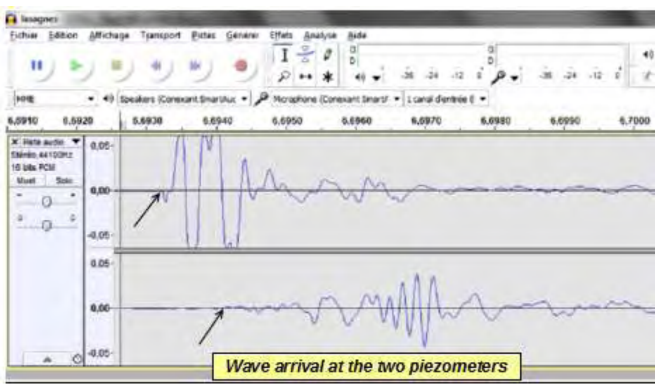
Détails of the small pieces to build seismometer or record table-eathquakes.

This “Sismo-box” do-it-yourself is made with very simple, recycled material and allows making a lot of experiments to show what is an earthquake and how to protect against it.

<table>
<tr><th>Table seismometer</th><th>Recording a lasagne micro-earthquake</th></tr>
<tr><td>




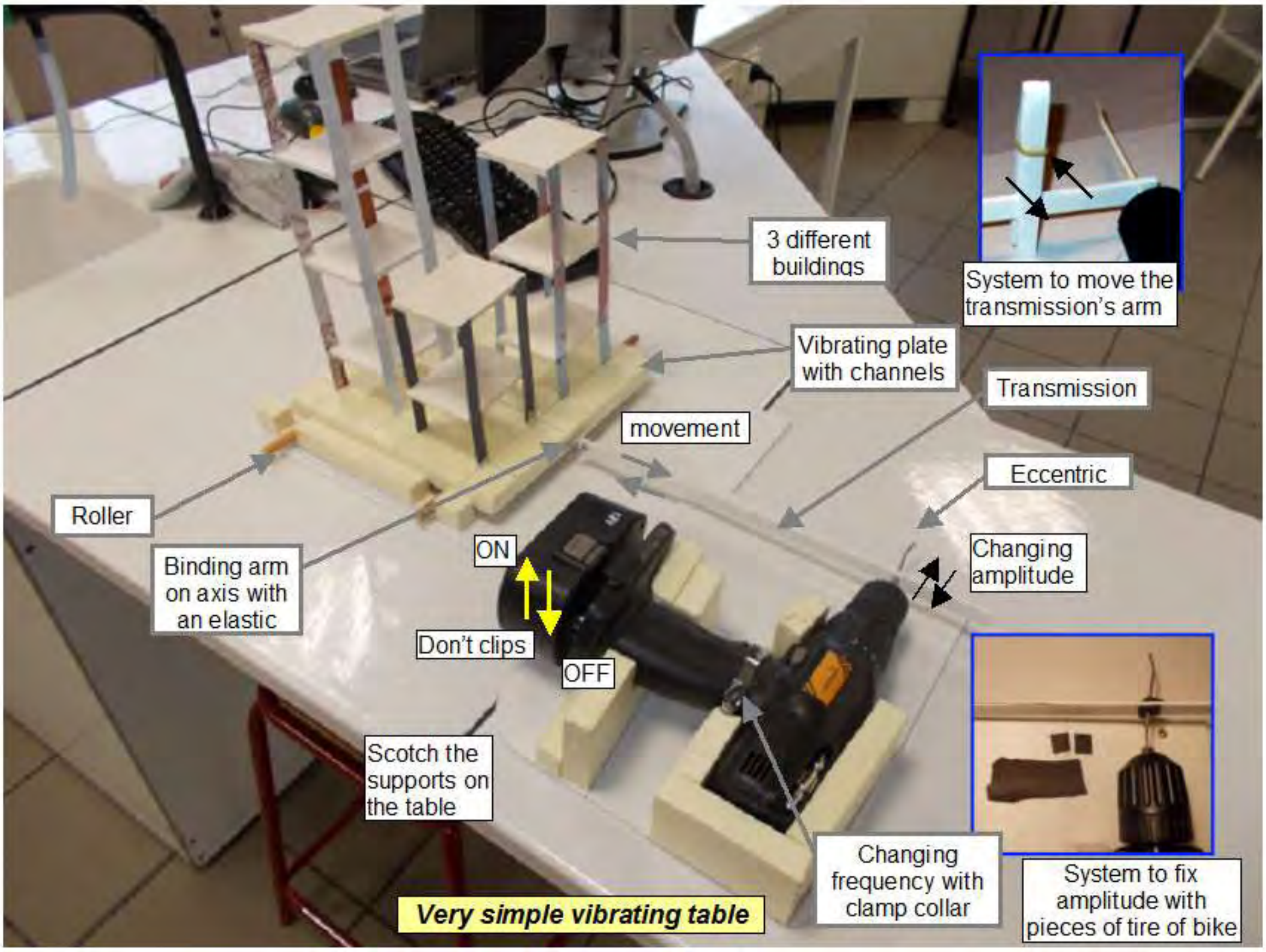
In case of earthquake everything moves but not the lead. The movement of the magnet in the
</td><td>

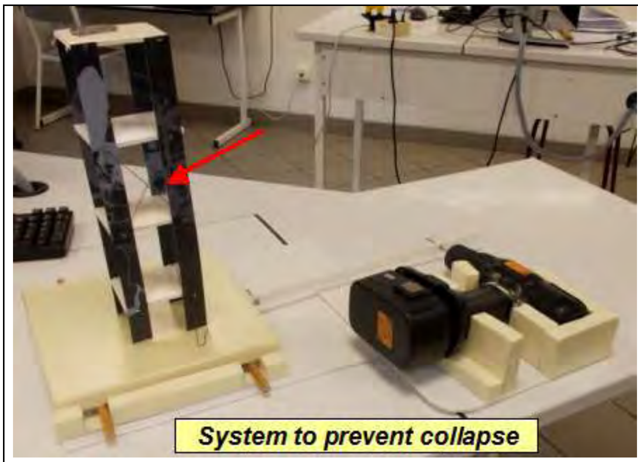
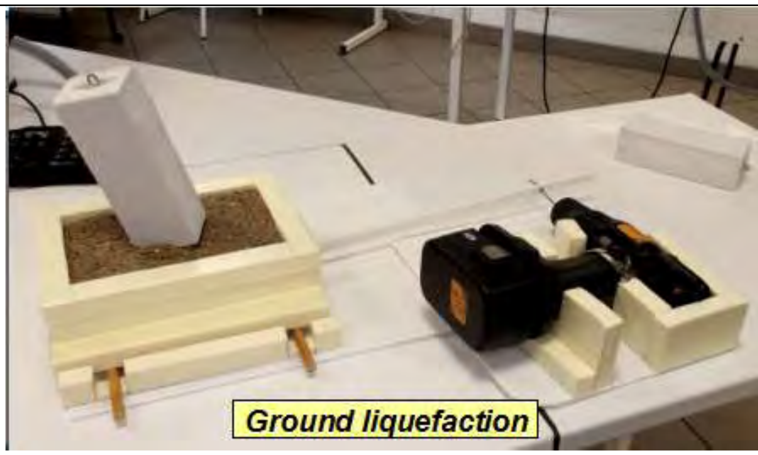



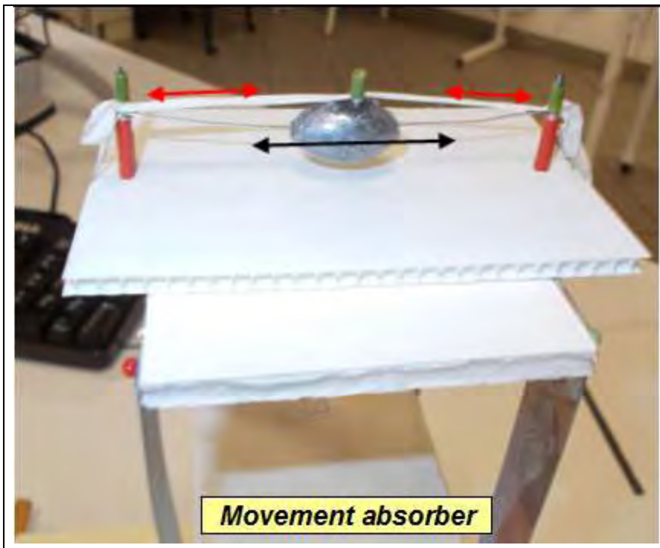
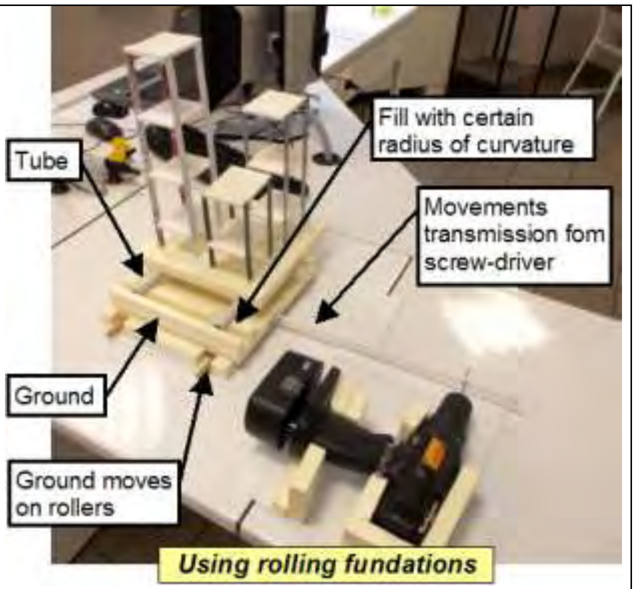
Waves are recorded by the 2 piezometers. With
</td></tr>
</table>

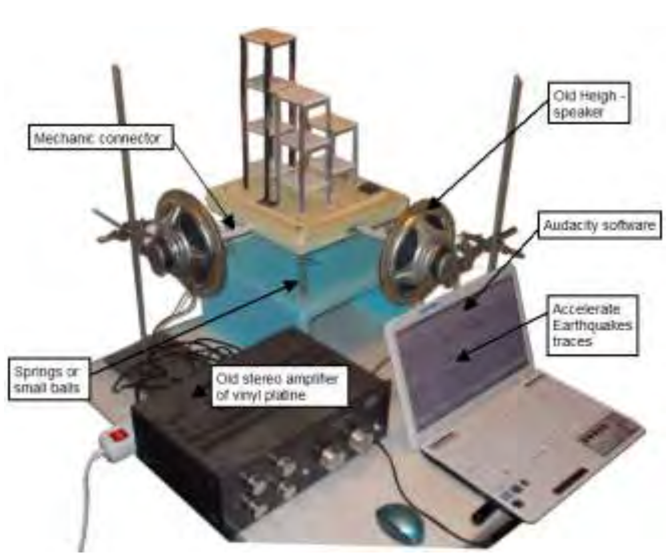
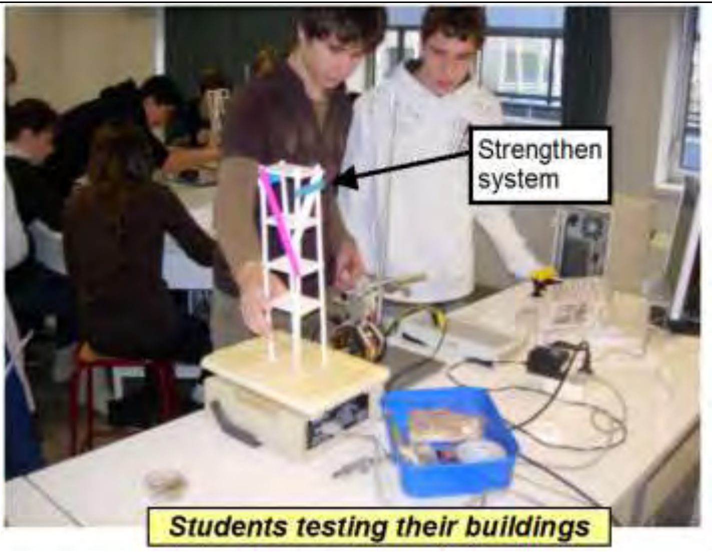
bobine is recorded by the sound card and Audacity software	certain laptop, we need a external soundcard.

Shaking table: the very cheap electric screw-driver rotates an eccentric wich converts rotations in longitudinal movements. They are transmitted to a tray with different height buildings and systems. We can change frequency and amplitude of the vibrations and see the resonance problem, and many other scientific facts.



 Preservation of building shape with 2 crossed threads.	 Vibration causes the ground liquefaction, and it's hétérogenousness makes the building falling down.

 In case of earthquake the big mass tends to remain motionless and the elastic which stretched fires push the building and puts it back in place.	 Rolling fundations allows the building to remain in place in certain frequencies.

 **The shake table built with an old stereo equipment** (sinusoïde and earthquakes 2D traces).	 Students have to make a building with 4 bearing walls and 4 floors, with only 4 pins by floor.

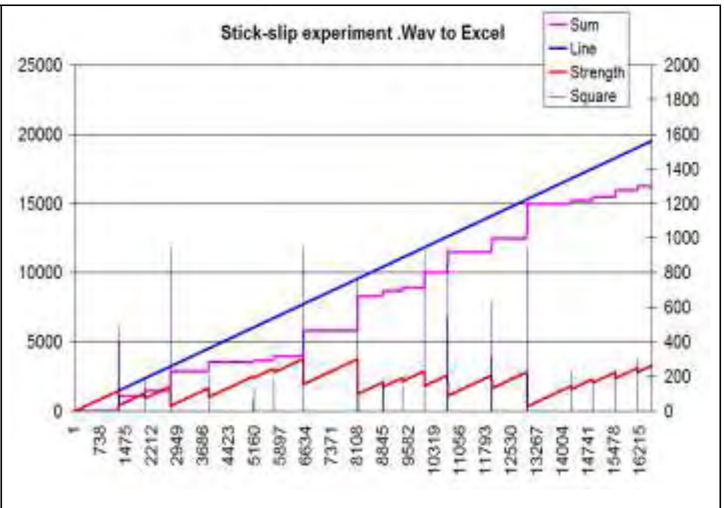
http://www.ac-grenoble.fr/webcurie/sismo/web_patin

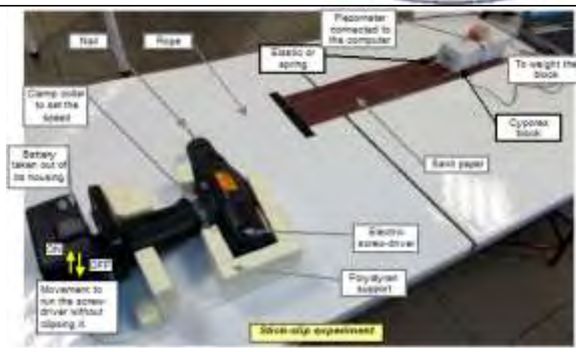
Scientists which help us: François Thouvenot (LGIT Grenoble), Julien Frechet (CNRS Strasbourg), Françoise Courboulex (CNRS Nice)

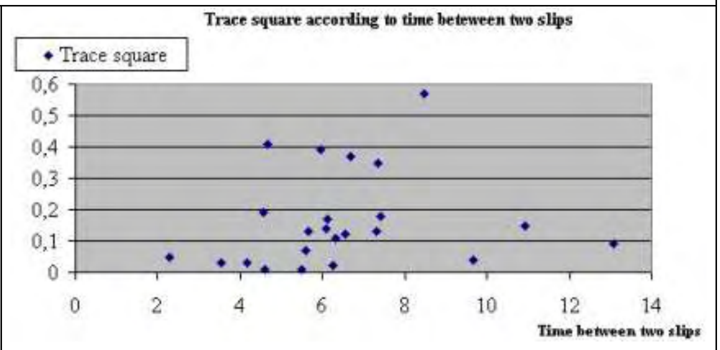
SPRING-SLIDER BLOCK MODEL experiment in classroom

Is it possible to predict earthquakes ?

This classical experiment in earth science is possible in classroom after simplification: only one block, and one spring. The material consist in a block of cellular concrete, a very low cost electric perforator-screw-driver (12 €), or manual crank, a computer with sound card to record signal from the piezometer and the Audacity software to record or read sounds. You need also Excel or Openoffice and the free software **Sismo-logic**© FT 2012 wich set Audacity correct parameters automatically, and converts .wav files into excel file, with following calculations: square of signal (Energy), sum of it, regression line to have the energy spent by the engine, and evaluate strength.
It is also possible to use two piezometric sensors, one for the block, and the other for the sudent, who hits it when he supposes the block is going to slip.
This experiment can be simplified at most by locating, with a pencil, the various positions of the block.







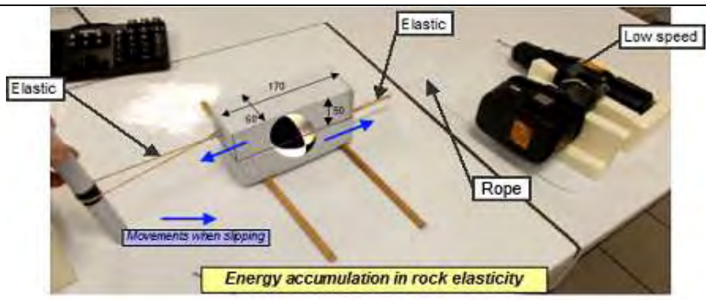
Differents other Excel treatements shows that there is no visible correlations between the magnitude and the time between 2 slippings, or no real visible regularity of sliping.

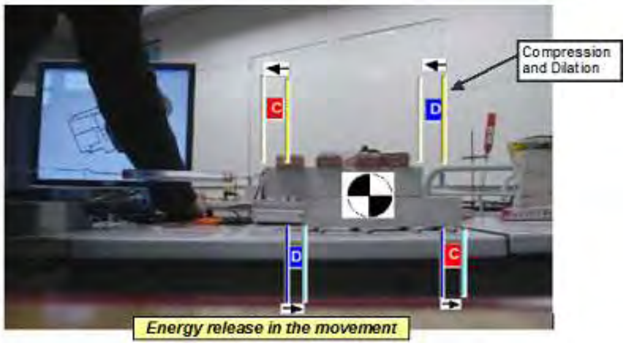
Movements on both sides of a fault

We also do a very similar experiment with 2 springs and 2 blocks, one upon the other to understand a little better, fault mechanism.

The upper block is pulled by the step to step engine until the rupture: the 2 blocks move in an opposite way (pull by the 2 springs) and make a compression in front of the movement and a depression behind it. It helps to understand the constraints ellipsoïd representation. A little freeware allows to understand that it exists 2 hypothesis about the fault direction when the ellipsoïd constraints representation is done.

http://www.ac-grenoble.fr/webcurie/sismo/web_patin

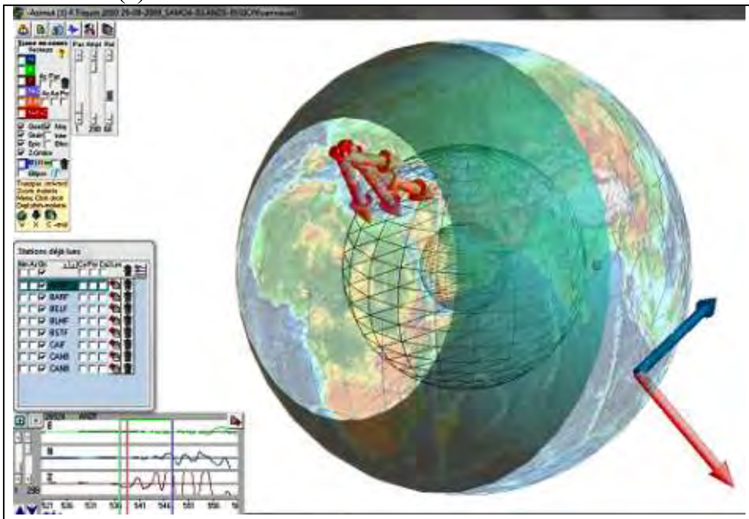




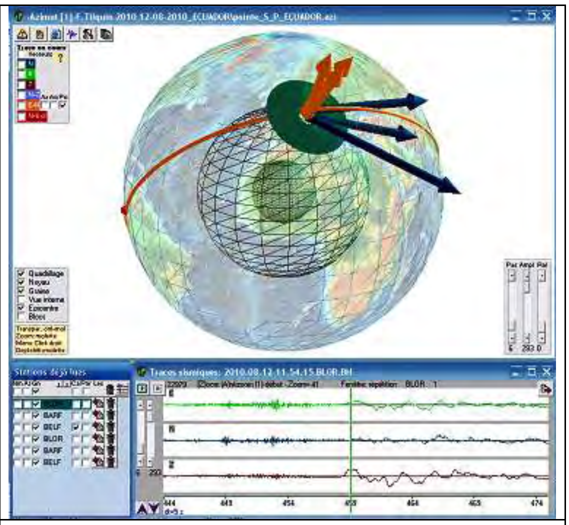
AZIMUT© FT 12/2011 free software

(Lycée Marie Curie- Echirolles Académie de GRENOBLE)

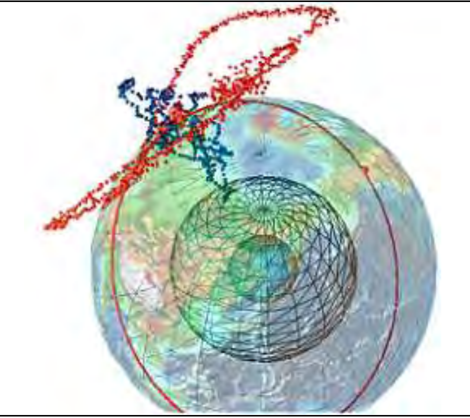
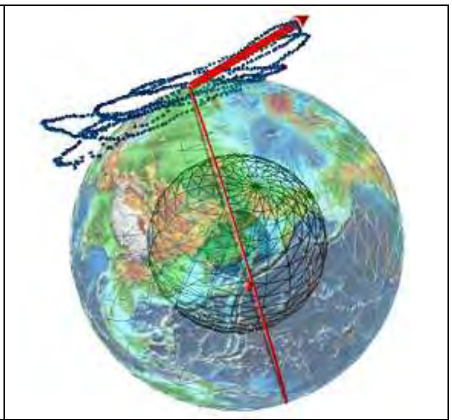
Goals: The software shows the 3D ground movments from the 3 components earthquake stations. The software shows ground speed vector, P, S and L waves, and the vector extremity with small balls. Epicenter can be found also with tools wich uses the vector extremity and the user decides the best direction.
Why do japan earthquake pushed us, althow japan went on the pacific ocean for few meters?
Samoa eathquake pull us: why?
This software is also able to record movements of USB accelerometer and is able to drive 1-3 Cassy interface(s) for a shake table.

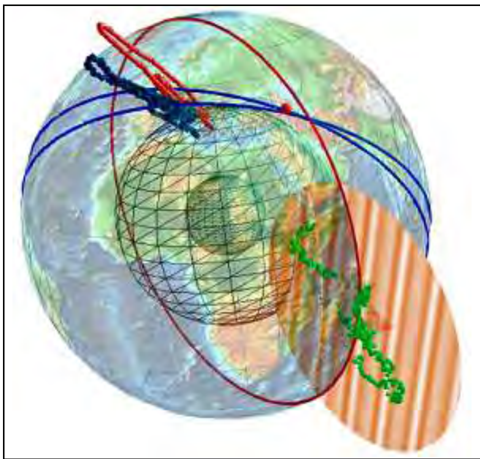
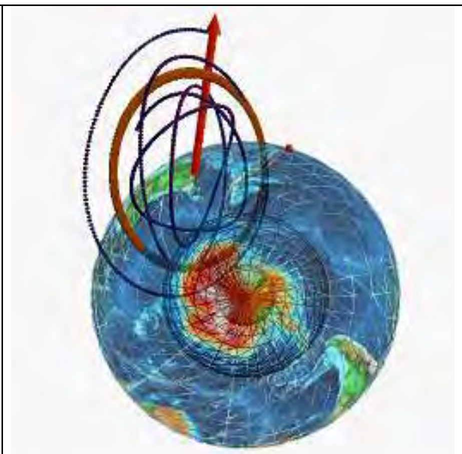
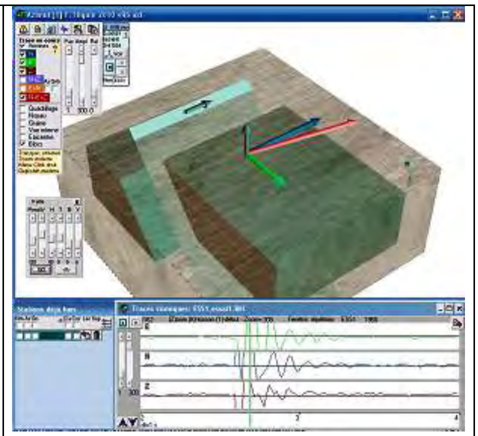


First ground movement: temporary depression (Samoa)



Perpendicularity of P-wave and S-wave. 1st arc pointed.

		
Azimut and ground compression movement : Japon (1st arc)	Perpendicularity of P-S waves (Vector extremity during few sec)	Love wave :S-wave horizontal and perpendiculary to azimut.

		
Epicenter determination with 3 azimuts of P-wave during 10 s.	Ellipticity of Rayleigh wave (P-wave perpendic with surface and azimutal)	Acquisition of trace from a USB accelerometer.

Scientists Pierre-Yves BARD (*Searcher IFSTTAR*), Michel CARA (*CNRS BCSF Strasbourg*), Françoise COURBOULEX (*CNRS UMR Geoazur, Valbonne*), François THOUVENOT (*CNRS LGIT Grenoble*).
Download software : http://www.ac-grenoble.fr/webcurie/sismo/web_patin

Warner Marzocchi

Senior researcher

Istituto Nazionale di Geofisica e Vulcanoligia

Education

PhD in Physics, at the *Alma Mater Studiorum* University of Bologna, July 1992.

Graduated in Geological Sciences *cum laude* at the *Alma Mater Studiorum* University of Bologna, December 1987.

Position held

Visiting professor at the Institute of Statistical Mathematics, Tokyo, Japan (2013).

Chief scientist at the Istituto Nazionale di Geofisica e Vulcanologia (INGV) of Rome (2003-present).

Associate Professor of Physics of Volcanism at the Osservatorio Vesuviano of Naples (1998-2002).

Post-doctoral Fellow in Physics at the Alma Mater Studiorum University of Bologna (1993-1995).

Professional service and committees

Co-chairman of the *Centro di Pericolosità Sismica* (*Seismic Hazard Center*) at the Istituto Nazionale di Geofisica e Vulcanologia (2013-present).

Member of the Board of Directors of *Analysis and Monitoring Environmental Risks* (AMRA) (2012-2014)

Member of the Advisory Board for UK ESRC-NERC IRNH STREVA "*Strengthening Resilience in Volcanic Areas*" project (2012-2017).

Member of the *Global Volcano Model* (GVM) Scientific Steering Committee (2012-present)

Member of the Scientific Review Panel for the *Uniform California Earthquake Rupture Forecast* (UCERF3) project (2010-2013).

Member of the Advisory Group for the NERC-ESRC programme '*Increasing Resilience to Natural Hazards*', funded by UK Natural Environment Research Council (NERC) (2010-2011).

Member of the *Commission for Seismic Risk mitigation* nominated by the chief of Dipartimento Protezione Civile, under the directive of the Italian Government (2010).

Responsible for the *Italian Testing Region of the Collaboratory for the Studies of Earthquake Predictability* (CSEP) and member of the *European Earthquake Forecast Testing Center* (CSEP-EU-TEC) board of directors (2009-2014).

Member of the *International Commission on Predictability of Earthquakes* nominated by the chief of Dipartimento Protezione Civile after L'Aquila earthquake on April 6, 2009, under the directive of the Italian Government (2009-2011).

Co-chairman of *World Organization of Volcano Observatories* (WOVO) (2005-2011).

Leader of the IAVCEI Commission on *Statistics in Volcanology* (COSIV) (2008-2011).

Member of the volcano hazards advisory committee to the *Institut de Physique du Globe de Paris* (IPGP) (2008-2010).

Scientific Consultant for *Analysis and Monitoring Environmental Risks* (AMRA) (2006-2012).

Project leader of volcanological and seismological INGV/DPC and Gruppo Nazionale di Vulcanologia (GNV) projects (2000-2013).

Member of the *Disasters Advisory Group* in support of GEO Task US-06-01 (2008-2010).

Joint steering committee member of UNESCO GARS-IGOS (2006-2008).

Reviewers for many international scientific journals: Science, Journal of Geophysical Research, Geophysical Research Letters, Bulletin of Seismological Society of America, Bulletin of Volcanology, Earth Planets and Space, Earth and Planetary Science Letters, Geology, Geochemistry Geophysics Geosystems, Geophysical Journal International, International Journal of Emerging Sciences, Journal of Seismology, Journal of Volcanology and Geothermal Research, Natural Hazards, Natural Hazards and Earth System Sciences, Nonlinear Geophysics, Pure and Applied Geophysics, Physics of the Earth and Planetary Interiors, Plos One, Seismological Research Letters, Tectonophysics, Terranova.

Reviewers for international projects in United States (National Science Foundation), Switzerland (Swiss National Science Foundation and ETH), New Zealand (earthquake commission), Singapore (Earth Observatory of Singapore).

Invited lectures and talks

Invited speaker at: Risk Management Solutions' symposium "Advances in earthquake forecasting", New York (Jan. 2008).

Invited speaker at: American Geophysical Union meeting (7), European Geosciences Union meeting (4), International Association of Volcanology and Chemistry of the Earth's Interior meeting (2), International Workshop on Applied Probability (1), Japan Geoscience Union meeting (1), Southern California Earthquake Center (SCEC) annual meeting (1), Seismological Society of America annual meeting (1), IUGG conference on Mathematical Geophysics (2), International Union of Geodesy and Geophysics meeting (1), International Conference on Applications of Statistics and Probability in Civil Engineering (1).

Invited seminar activity at: University of Potsdam, University College of London, ETH-Zurich, University of Hamburg, University of Auckland, University of Roma 1 "La Sapienza", University of Roma Tre, Earthquake Research Institute-University of Tokyo, University of Leeds, Karlsruhe University, Institute of Statistical Mathematics Tokyo, Institute of Industrial Science Tokyo.

Main Research interests

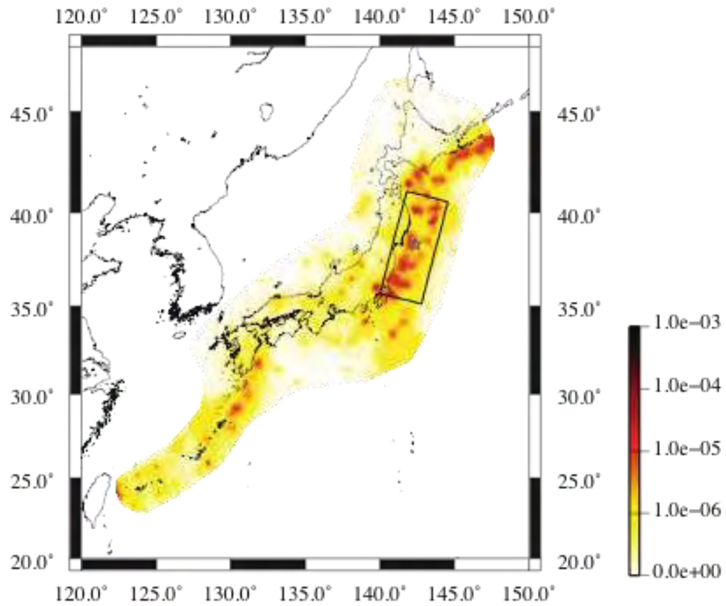
Author of more than 100 publications on ISI journals, the largest part on the following topics: 1- Earthquake forecasting models and probabilistic seismic hazard assessment. 2- Eruption Forecasting and probabilistic volcanic hazard assessment. 3- Development of probabilistic Bayesian tools for natural (multi)hazards assessment. 4- Study of the mechanism of volcanic and seismic events through the analysis of the spatio-temporal patterns of eruptive and seismic catalogs. 5- Analysis of interaction of seismic and volcanic events at regional and global scale. 6- Statistical evaluation of forecasting and probabilistic models.

Coping with natural risk in the XXI century: new challenges for scientists and decision makers

W. Marzocchi
Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma 1, Via di Vigna Murata 605, 00143 Roma, Italy

Despite an ever-increasing ability to understand the physics of natural events, like earthquakes, volcanic eruptions, hurricanes, etc, scientists can forecast these threatening events only in a probabilistic way. The use of probabilities poses great challenges to the decision makers who have to make decision under uncertainty, and represents an issue that is not easily understood by laymen.

In this lecture, I introduce the principles of the probabilistic approach to natural hazard and risks analysis. Natural systems are usually characterized by an extreme complexity, nonlinearities, limited knowledge, and large number of degrees of freedom that make deterministic predictions difficult if not impossible. Hence, the evolution of such systems is estimated only probabilistically. In particular, I show some examples of how scientists forecast the occurrence of natural events like the large earthquake occurrences, the onset and impact of volcanic eruptions and tsunamies, and the path of hurricanes and tornadoes.



Example of probabilistic earthquake forecast. Probability map for the period Jan.1-Dec.31 2011. The legend reports the annual probability map for a M≥ 8.5 earthquake in each cell of 0.1x0.1 degrees. The box is the fault of the Tohoku earthquake that occurred on March 11, 2011, and the star is the epicenter. (Woo & Marzocchi, 2013; Operational earthquake forecasting and decision-making. In: Early Warning for Geological Disasters - Scientific Methods and Current Practice, F. Wenzel and J. Zschau (eds.); ISBN: 978-3-642-12232-3, Springer Berlin Heidelberg New York, 2013)

After the scientific description of how scientists forecast natural threats, I discuss two other points that are of paramount importance to use at best this scientific information to reduce the impact on society of these events. In particular, I show how probabilistic forecast can be used for planning a rationale decision making at a societal level. Decision makers have to make decisions under uncertainty, so a decision cannot be judged as 'right' or 'wrong' depending on what is going to happen. Instead of 'right' and 'wrong', it is more appropriate to say that some decisions are rationale and justifiable (even a posteriori, regardless what happened), and others aren't. In particular, I show how decision makers can define probability thresholds for different mitigation actions in a rationale way; when a specific threshold is overcome, the mitigation action is worth being taken.

Finally, I briefly discuss the importance of education and communication. As a matter of fact any effective risk mitigation plan requires a correct understanding of the risk; in other words the population under threat has to be educated to understand correctly the meaning of probability. This is probably one of the biggest gap that scientists and public officials face now in planning sound risk mitigation strategies. I will show some examples of how the concept of probability and risk has been misinterpreted in past recent cases.

Ali Ozgun Konca

Address : Bogazici University
Kandilli Observatory and Earthquake Research Institute.
Department of Geophysics
34684, Çengelköy, İstanbul
Tel: +90(530) 510 40 31
e-mail : ozgun.konca@boun.edu.tr

Education

- PhD in Geophysics, California Institute of Technology, 2000-2008
- Koc University, Istanbul, BS with honor, Major in Physics, 2000

PROFESSIONAL EXPERIENCE

- Asst. Professor of Geophysics, Kandilli Observatory and Earthquake Research Institute, October 2011 -
- TUBITAK Postoctoral Scholar, Kandilli Observatory and Earthquake Research Institute, October 2010- October 2011
- Postdoctoral Scholar, CNRS- LGIT Universite Joseph Fourier, Grenoble, October 1 2009 – September 30, 2010
- Researcher, California Institute of Technology, June 2008 – September 2009

Distinctions

2006 scholarship International Workshop on the Comparative Studies of the North Anatolian Fault and the San Andreas Fault, August 2005, Istanbul Turkey

2005, recipient of the Outstanding Student Paper Award, Tectonophysics Section, American Geophysical Union Fall Meeting, December 2007, San Francisco, CA

1995-2000 Vehbi Koc Scholar, Koc University, Istanbul

Expertise and Interests

- Earthquake physics
- Finite-Fault earthquake Models
- Inverse theory
- Geodetic and Seismic Models of Earthquakes

Earthquakes: Understanding the Physical Process and How We Analyze Them

Ozgun Konca

Bogazici University
Kandilli Observatory and Earthquake Research Institute.
Department of Geophysics
34684, Çengelköy, İstanbul

In this talk, we will go over some questions related to earthquakes such as why earthquakes happen and how they happen. Most of the earthquakes happen at plate boundaries. This is due to the relative motion of the rather rigid blocks (plates) on the earth's uppermost layer. The earthquakes occur primarily due to friction between two plates. If there was no friction, the tectonic motion would happen without earthquakes. Due to the nonzero friction along the interface, the faults are locked in the interseismic period. This is called the interseismic locking. This leads to elastic stress build up. Once the stress builds up beyond a threshold, the slip occurs on the fault generating heat and releasing elastic waves. After a large earthquake, the stress drops to levels that do not create large earthquakes. However, as the plates move relative to each other, stress starts building up in time again to be ruptured once more in the next earthquake. This is called the seismic cycle.

Most of what we know about earthquakes comes from the motion that it creates. After an earthquake, the geologists do field work to obtain surface breaks and offsets from an earthquake. The GPS stations and satellite radar and image and geological work data helps constrain the slip from an earthquake. The seismometers that are close to the fault and much further can be used to obtain kinematic slip models of earthquakes. The models obtained from all these datasets give us a good idea about the ground motion due to an earthquake. We use these slip models to obtain peak ground motion maps to analyze where the damage would be the most.

Depremler: Fiziksel Süreci Anlamak ve Analiz Etmek

A. Ozgun Konca

Bu konuşmada depremlere dair bir takım temel sorulara yanıt arayacağız; örneğin depremler neden olurlar ve nasıl oluşurlar. Depremlerin büyük çoğnluğu levha sınırlarında meydana gelirler. Bunun nedeni dunyanın yüzeye yakın bölmünün göreli rijit bloklardan oluşması ve bu blokların birbirlerine göreli olarak hareket etmesidir. Depremlerin oluş nedeni ise levha sınırlarında belli bir sürtünme kuvvetinin bulunmasıdır. Eğer sürtünme kuvveti olmasaydı tektonik hareketler deprem olmadan oluşablecekti. Fakat plaka sınırlarında sürtünme katsayısı sıfır olmadığından, depremlerin olmadığı periyotlarda faylar kilitli kalırlar. Buna intersismik kilitlenme denmektedir. Bu kilitlenme elastic stresin fay çevresinde gelişmesine neden olur. Stres seviyesi belli bir miktari geçtiğinde fayda kayma oluşur ve buna deprem denir. Deprem oluşurken ısı açığa çıkar ve aynı zamanda elastik dalga yayar. Büyük bir depremden sonra ortamda birken elastik enerji azalır. Ancak zamanla plakalar birbirine göre hareket ettikçe tekrar stres artmaya başlar ve bir süre sonra bir başka byük depreme yol açar. Fayda stres birikmesi ve ardından fayda deprem olması döngüsüne sismik döngü adı verilir.

Depremler hakkındaki bilgilerimizin büyük bölümü yarattığı hareketlerden gelmektedir. Bir deprem olduğunda, jeologlar arazi çalışmalarıyla yüzey kırıklarını ve yüzey kayma miktarlarını elde ederler. GPS istasyonlari ve uydu radar ve imajlari kullanılarak depremden kaynaklanan kayma dağılımını elde edebiliriz. Faya yakın ve uzak kayıt yapan sismometreler de kullanılarak depremin zamana bağli olarak nasıl oluştuğunu anlayabiliriz. Bütün bu veriler kullanılarak depremin kayma dağilimini zamana ve mekana bağli olarak elde edebiliriz. Kayma dağılımı modelleri yer hareketini tahmin etmede kullanılabilir ve bize depremden oluşabilecek hasar dağılımı konusunda fikir verebilir.

Paolo Papale

Istituto Nazionale di Geofisica e Vulcanologia
Via Della Faggiola, 32
56126 Pisa, Italy
+39 050 83119-31
papale@pi.ingv.it

Education

- Degree in Geological Sciences 1989 Dept. of Earth Sciences, University of Pisa, with Full Honours

Position current

- Director of the Volcanoes Division at INGV

Positions past

- 2003-present Research Director, INGV
- 1999-2003 Researcher – ING/INGV
- 1996-1999 Contract Researcher, CNR
- 1990-1996 Contracts and Fellowships with ING, CNR, Univ. of Pisa

Appointments

- Director, Volcanoes Division of INGV, 2013 – to date
- Head of the Unit "Physico-mathematical Modelling and Numerical Simulation of Volcanic Processes", INGV, 2006 - 2013
- DPC Committee for the preparation of the Emergency Plan at Campi Flegrei volcano, 2009 – 2011
- Scientific Advisory Council, INGV, 2007-2008
- Presidential Advisory Board, EGU, in representation of the scientific theme "Solid Earth", 2007-2009
- Awarding Committee, EGU Robert Wilhelm Bunsen Medal, 2005 – to date, Chair since 2010
- Awarding Committee, EGU Arthur Holmes Medal and Honorary Membership, 2010 – to date
- Chair of Awarding Committee, EGU/GMPV YSOPP: "Young Student Outstanding Poster Presentation" award, 2009 – 2011
- Chief and Funding Editor, Solid Earth, published by EGU, 2009 – to date
- Editorial Board, Journal of Volcanology and Geothermal Research, 1998-2006
- Scientific Managing Committee, GNV, 2002-2004

Scientific Output

- > 50 refereed papers in international journals and books
- 1300+ ISI Citations (Papale P*)
- h-factor = 22

Advisory Roles

- Panel of NSF Merit Reviewers
- Panel of EU FP7 Reviewers, Programmes "People" and "Ideas"
- Panel of Reviewers, Belgian Government, Remote Sensing Research Programme
- Panel of Reviewers, French USAR – Gestion de Programmes de Recherches
- Panel of Reviewers, Italian Research Programme PRIN
- Reviewer for the main scientific journals in Geosciences (Nature, Nature Geosciences, Journal of Geophysical research, Geophysical Research Letters, Earth Planetary Science Letters, Bulletin of Volcanology, Journal of Volcanology and Geothermal Research, etc.)

- Chair of the GMPV Programme Committee, European Geosciences Union General Assemblies 2008-2009-2010 (about 100 scientific sessions organized)
- 20+ Graduating/Doctoral Students supervised
- 10+ Postdoctoral collaborators

Synergistic activities

- European Coordinator, FP7 Marie Curie Initial Training Network "NEMOH - Numerical, Experimental and stochastic Modelling of vOlcanic processes and Hazard: an Initial Training Network for the next generation of European volcanologists", 2012 – to date
- Principal Investigator, FP7 Cooperation "VUELCO - Volcanic Unrest in Europe and Latin America: Phenomenology, eruption precursors, hazard foreCast, and risk mitigation, 2011 – to date
- President, Geochemistry, Mineralogy, Petrology and Volcanology Division – European Geosciences Union, 2007- 2011
- National Coordinator of the INGV-DPC Projects in Volcanology, 2004-2006 and 2007-2009, and Head of Managing Committee
- Secretary, Volcanology Sub-Division – European Geosciences Union, 2005 – to date
- United Nations Commission for the Nyiragongo-Lake Kivu crisis 2002

Invited presentations (selected)

- 18th Symposium of the International School of Geophysics, Erice (Sicily), 2001: Physico-chemical magma properties and eruption dynamics.
- European Volcano Dynamics Research Training Network, 3rd Workshop, Azores, 16-26 May, 2003: Numerical modelling of volcanic processes.
- GIV Summer School of Volcanology, Catania (Sicily), June 2003: Numerical modelling of volcanic conduit processes.
- European Volcano Dynamics Research Training Network, 4th Workshop, Napoli, 12-16 January, 2004: Roles of volatiles in sub-surface volcanic processes.
- International School of Volcanology, Tenerife, Canary Islands, May-June 2004: Volatiles in magmas and their control on volcanic eruption dynamics.
- Seminars at Ludwig-Maximilian University, Munich, April 2005: Relationships between magma properties and volcanic eruption dynamics.
- An Introduction to Quantitative Physical Volcanology – Workshop, Geneva, April 2006: Conduit flow dynamics.
- University of Chieti, Italy, March 7th, 2006: Dynamics of explosive eruptions.
- Architectural Association School of Architecture, London, UK, May 2006: The January 2002 Nyiragongo eruption, DRC.
- ETH Zurich, January 12th, 2007: Magma properties and magmatic and volcanic processes: Complex relationships disclosed by numerical simulations.
- AIV School of Volcanology, Stromboli Island (Sicily), September 2008: Magma dynamics and pre-eruptive signals: the contribute of numerical simulations.
- IAVCEI Conference, Reykjavik, Iceland, August 2008: Linking geophysical observations and magma chamber dynamics at active volcanoes. Part I and Part II.
- Dept. of Earth Sciences, University of Leeds, UK, October 2009: Numerical simulation of magma dynamics and associated geophysical signals.
- American Geophysical Union Fall Meeting, December 2010: Current and future trends of volcanology in Italy and abroad.
- Fragile Earth International Conference, Munich September 2011: Towards a globally consistent dynamic picture of pre-eruptive eruption dynamics.
- AIECS – Academia Europea, Graz, 30-31 Agosto 2010: Volcano modelling: control of deep magma dynamics on geophysical network signals.
- 150° Anniversary of Geophysical Institute in Zagreb, December 2011: Recent achievements in volcanology.

Eruptions from calderas: the most devastating, the least understood

Paolo Papale

Istituto Nazionale di Geofisica e Vulcanologia, Italy
(papale@pi.ingv.it)

Large calderas are the site of the most devastating eruptions occurred on Earth; they often display substantial unrest dynamics that puzzle volcanologists, and in some cases like the Campi Flegrei case, trouble them as well as the society for the enormousrisks associated to their eruptions. Calderas display sequences of signals that would almost certainly prelude to an eruption if observed at central volcanoes; nonetheless, volcanic eruptions may not follow, while they may happen with definitely much weaker signals preceding them, as for the Rabaul eruption in 1994. Although largely debated, the origin of this controversial behaviour is still unclear. The caldera structure favours the development of large geothermal circulation, that is often invoked as an important controlling factor for the observed geophysical and geochemical changes. At Campi Flegrei, and possibly at other calderas like Krafla in Iceland, the structural setting appears to have repeatedly favoured emplacement of small magma bodies at very shallow (< 3 km) depth, creating a network of interconnected reservoirs capable to exchange mass and heat. The efficiency of interconnections likely controlled the scale of the eruptions, limiting the role of the shallow magmatic batch and complicating the forecasts. Although our knowledge of caldera systems has evolved substantially, their understanding is still limited, contributing to increase the associated risk.

Carlo Laj
Ecole Normale Supérieure
Département de Géologie
24 rue Lhomond
75231 Paris Cedex 5
France
carlo.laj@ens.fr
&
Committee on Education
European Geosciences Union
education@egu.eu

Education:

Secondary school in Italy and the USA (American Field Service Exchange Student.)
University studies at the University of Paris, PhD in Solid State Physics.

Career

I have done all my scientific career as an employee of the French Atomic Energy Commission, first as a researcher in the Physics Department than in the field of geophysics.

In 1985, I was appointed as Deputy Director of the Centre des Faibles Radioactivités and Head of the Department of Earth Sciences. I created and was first director of the Laboratoire de Modélisation du Climat et de l'Environnement, which was later united with the Centre des Faibles Radioactivités to form the present Laboratoire des Sciences du Climat et de l'Environnement (LSCE).

After 3 terms as Head of Department (12 years) I stepped down to a researcher position again, until I retired. I have been an "emeritus" researcher since then, and gradually reoriented my activities towards education.

I founded the Committee on Education of EGU, and have been its Chairman in the last 11 years.

Research Interests:

After my PhD I spent a few years working with critical phenomena (scattering of laser light by critical fluids) then moved into the field of geophysics.

My main interests in this new field has always been linked to the magnetic properties of sediments and igneous rocks (paleomagnetism), used with several objectives: geodynamical reconstructions (particularly in the Eastern Mediterranean and the Andean Cordillera), reconstruction of the history of the Earth's magnetic field (including the morphology of field reversals) and more recently reconstructions of environmental and climatic changes on a global scale.

I have published about 200 articles in international scientific journals and a few general popular articles in different journals.

Fellow of the American Geophysical Union (AGU).
F. Holweck prize of the French Academy of Science
Supervisor of 12 PhD students, and 8 Masters of Science

Educational activities:

Chairman, Education Committee of the European Geosciences Union
Participant to different National and International Education Committees
Union Service Award for creating the Committee on Education of EGU
Excellence in Geophysical Education Award of the American Geophysical Union

THE EDUCATIONAL ACTIVITIES OF THE EUROPEAN GEOSCIENCES UNION

Best practice for the science–teaching interface

C. Laj
European Geosciences Union, Committee on Education
education@egu.eu

Abstract

.

Introduction

In 2002 in Nice, France, EGU Executive Secretary Arne Richter announced a collaboration between scientists and schools all over Europe. The aim was to bring state-of-the-art science via high school teachers into tomorrow's classrooms.
Carlo Laj was appointed chair of the EGU Committee on Education (CoE) and, in 2003, the first GIFT workshop took place at the General Assembly, featuring 42 teachers from seven European countries. Since then, more than 1000 teachers have attended these workshops, which are a mixture of presentations by worldwide known scientists, hands-on experiences for the classroom and presentations by the teachers themselves to their fellow teachers

The Committee on Education of EGU has progressively developed programs and educational materials mainly aimed at secondary school teachers and pupils along 5 main axes:

1) Geosciences Information for Teachers (GIFT) workshops at EGU General Assemblies and more recently at Alexander von Humboldt topical Conferences
2) Educational sessions at EGU General Assemblies (teachers and scientists and science educators)
3) Gift Distinguished Lectures series
4) Teachers at sea
5) EGU-UNESCO-ESA Collaboration for GIFT workshops in Africa

These activities are briefly described below.

1) The GIFT workshops at the EGU General Assemblies

The program of each workshop is focused on a unique general theme, which changes every year, and which combines scientific presentations on current research in the Earth and Space Sciences, given by prominent scientists attending EGU General Assemblies, with hands-on, inquiry-based activities that can be used by the teachers in their classrooms to explain related scientific principles or topics. Also, teachers are welcomed to present to their colleagues some aspects of their own « out-of-the program » classroom activities.

The main objective of these workshops is to spread first-hand scientific information to science teachers of primary and secondary schools, significantly shortening the time between discovery and textbook, and to provide the teachers with material that can be directly transported into the classroom. In addition, the full immersion of science teachers in a truly scientific context (EGU General assemblies) and the direct contact with world leading geo-scientists are expected to stimulate curiosity towards scientific research that the teachers will transmit to their pupils.

The value of bringing teachers from several nations together includes the potential for networking and collaborations, the sharing of experiences, and an awareness of science education as it is presented outside their own countries. At all previous EGU GIFT workshops teachers mingled with teachers from outside their own country and had lunch together with the scientists, which provided rich dialogue for all those who participated since the dialogue included ideas about learning, presentation of science content, curriculum ideas… We, therefore, believe that, in addition to their scientific content, the GIFT workshops are of high societal value.

The workshop quickly became known amongst teachers all over the European continent and, in the following years, the number of participants doubled. Due to the importance of the valuable hands-on activities, which require an intimate setting, and the limited space at the conference venue, the maximum number of participants had to be limited to 85.

Today a GIFT workshop typically includes :

- Two and a half days of workshop
- 80 participants from 20 countries (selected from 250-300 applicants)
- 8-9 conferences by worldwide known scientists present at the General Assembly
- 1 half-day practical works with specialized educators
- 1 poster session “Science in tomorrow’s classroom” where teachers are encouraged to present their out-of-the-official-program school activities and which is open to non-teachers participants (in 2012 we have had about 50 posters from the teachers attending the GIFT workshop out of a total of about 65)

1 visit to local institutions in Vienna (UNOOSA, IAEA…)

And each GIFT workshops starts with a visit and an ice-breaker reception at the Vienna Museum of Natural History on the Sunday preceding the workshop.

In the last 5 years these different themes were addressed: Natural Hazards (2013), Water! (2012), Evolution and Biodiversity (2011), Energy and Sustainable Development (2010), The Earth from Space (2009) this last one in collaboration with the European Space Agency (ESA°.

All the expenses for the selected teachers (travel, lodging and registration at the GA) are met by the organization.

The year 2009 brought further additions to the GIFT concept. For the first time, recordings were made available as web streams and are openly accessible free of charge via the EGU website
(http://www.egu.eu/outreach/gift/workshops/).

Also, in 2010, the Committee on Education decided to hold a « local » GIFT workshop associated with EGU Alexander von Humboldt Topical Conferences. These are a series of meetings held outside of Europe, in particular in South America, Africa or Asia, on selected topics of geosciences with a socio-economic impact for regions on these continents, jointly organized with the scientists and their institutes/institutions of these regions.

The first GIFT-AvH took place in Merida (Yucatan), the second in Penang (Malay) the third in Cusco (Peru). Each time we have had a participation of 40-45 « local » teachers. Noticeably, in the three cases it was the first workshop of the kind organized ever.

2) Educational sessions at the EGU General Assembly.

We regularly organize 8-10 educational sessions during the General Assembly. One of these sessions, mentioned above, « Sciences in tomorrow's classroom » is open to both teachers attending the GIFT workshop and to scientists with an interest in education attending the General Assembly. A growing interest has been shown in Vienna, with over 60 posters presentations, 2/3 by teachers and 1/3 by scientists.

3) The **GIFT Distinguished Lecture Series**

In 2011, the EGU Committee on Education has inaugurated an annual series of Geosciences Information for Teachers (GIFT) Distinguished Lectures, to be given by top scientists who have previously participated as speakers in GIFT workshops during EGU General Assemblies. High school teachers, high school directors and educators for teachers from the European area are welcome to ask for a GIFT distinguished Lecture!
Distinguished lectures have been given in Spain, Poland and next (2013-2014) in France, Italy and Spain.

4) The « Teachers at Sea » Program

"Teachers at sea" is an Educational Program making it possible for high school teachers to participate to oceanographic cruises together with the scientists.
3 editions of this program have taken place on board the Marion Dufresne during cruises PACHIDERME in 2007 (along the Coast and in the fiords of Southern Chile), AMOCINT in 2008 (in the North Atlantic Ocean) and CIRCEA (in the South China Sea in 2012).
On board, teachers participate to the « watches » which is really absolutely necessary for them to be in direct contact with the scientists and students and to be totally immerged in the different activities taking place on board, not only for watching the different coring operations, but also to actively participate personally to the first steps of treatment of the cores: cutting, opening, archiving, measurements of some of their physical properties and of their sedimentological description.
Part of the sediments is saved for the schools, and can be mailed to the different teachers asking for them.

2014: GIFT goes to Africa! (An EGU-UNESCO-ESA Program)

2014 brings new and fascinating prospects for GIFT. The EGU has teamed up with UNESCO to take the GIFT workshop idea to Africa. ESA has more recently joined this program. The scope is to disseminate the latest findings in science to the teachers there, to support the development of the next generation of Earth scientists in Africa. The opportunities and challenges in the Earth sciences there are great, starting with traditional mineral extraction and extending into environmental management such as climate change adaptation, prevention of natural hazards, and ensuring access to drinking water.

(http://www.egu.eu/outreach/gift/)