



**International
Projects**

February 2011

International Projects

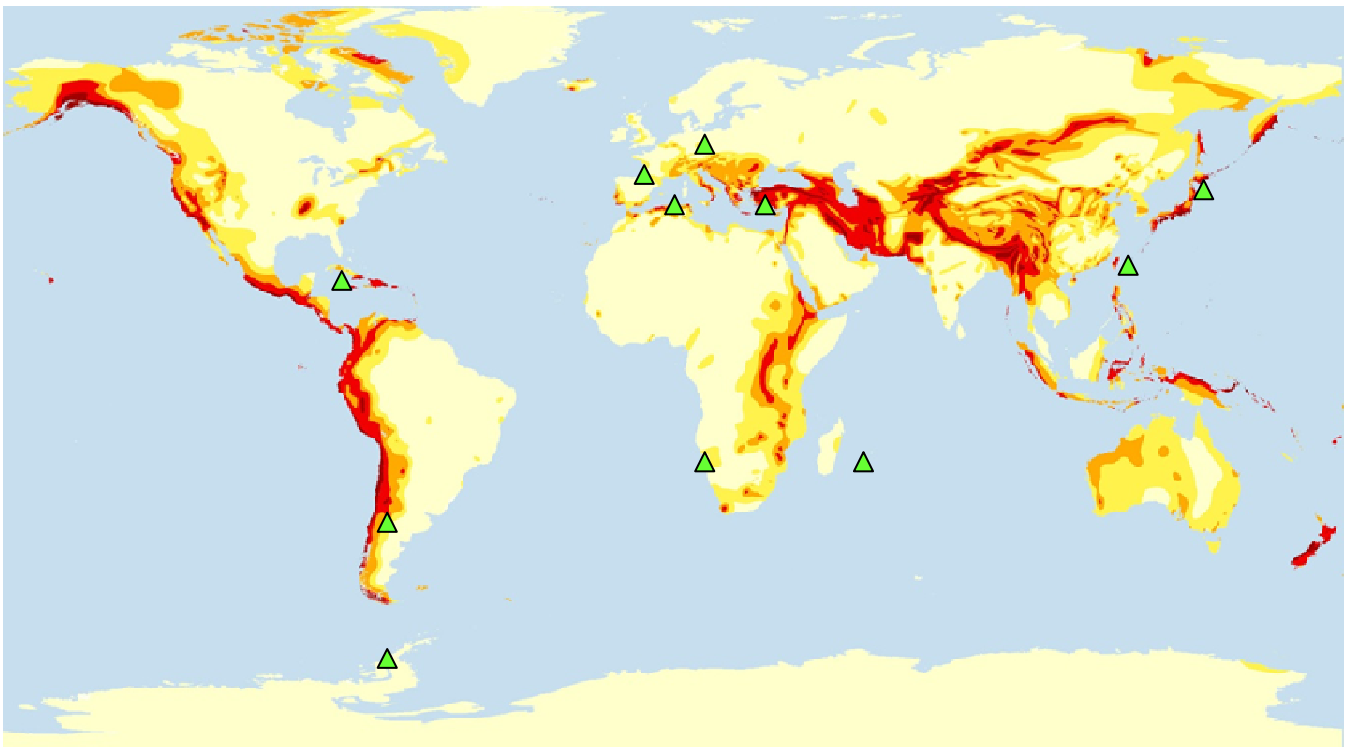
The Geological Institute of Catalonia was created by Law 19/2005 of 27 December, in order to become, in the field of geotechnical geology, ground and Geo-thematics, an excellence centre of knowledge for soil and subsoil, as well as to work to implement public policies in planning, risk assessment and geological thematic mapping.

According to the functions conferred at the time of its creation, the Geological Institute of Catalonia is called upon to perform a thorough assessment and to provide technical support and information to the competent authorities in different areas such as planning, territorial planning, and execution of public works and management of natural hazards.

Its international background (first as Geological Survey of Catalonia, and after as Geological Institute of Catalonia) has been acquired through numerous projects in natural hazard management around the world.

The main working areas of the IGC are: Geology and Geological Cartography, Geological Engineering, Seismology, Applied Geophysics, Snow Avalanche forecasting, Geothematic Cartography and the study of other Natural Hazards.

International projects are presented below, ordered by hazard. The above map shows the situation of projects around the world (▲).



Cartography

Geological map of Paraje Castaño Nuevo 1:100 000, Argentina	5
Agroecological zoning in Namibia	5
Technical assistance for the Republic of Namibia	5
Pianure alluvionali and Che cosa è una carta geologica?	6

Geology and Hydrogeology

Exchange of matter and fluid motion in karstic media	7
Integrated Basin Studies	7
A global multidisciplinary approach to groundwater flows in karstic areas and its consequences on water resources and environment studies	7
ResPyr. Réseau GPS des Pyrénées	8
AWARE. A Tool for Monitoring and Forecasting Available Water Resource in Mountain Environment	8

Geophysics

Experience exchange on seismic microzoning on urban areas. Salta, Argentina	9
---	---

Earthquake

Determination of earthquake parameters from records obtained in the SMART-1 strong motion accelerometer array in Taiwan	10
Research of Historical Seismicity in Europe	10
Observation and analysis of seismicity in the Pyrenees	10
Seismicity study methods – instrumental network	11
PotSis: Seismic Potentiality of Eastern Pyrennes	11
Implementation of methods for calculating strong motion earthquakes. Application to the Ashigara Valley experiment in Japan	11
Study of the 1373 earthquake in the central Pyrenees	12
EUROSEISTEST. Volvi-Thessalonik: A European test site for Engineering Seismology and Seismology	12
Comparative testing of strong ground motion accelerographs in Veletri, Italy	12
Installation of a digital seismic network to observe the seismicity of the Salta region, Argentina	13
A basic European earthquake catalogue and a database for the evaluation of long-term seismicity and seismic hazard	13
EUROSEISMOD. Development and experimental validation of Advanced modelisation techniques in seismology and seismic engineering	13
Research with seismic refraction in the area of Aínsa	14
PALEOSIS. New approaches and recent methodologies in Paleoseismology	14
Seismic network of the Dominican Republic	14
RISK-UE. Advanced methodology for seismic risk scenarios with applications in European cities	15
Seismic risk in the Principality of Andorra	15
Study of the local seismic effects in Andorra	15

European-Mediterranean Seismic Hazard Map 1:5 000 000	15
EUROSEISRISK. Evaluation of seismic hazard, soil effects and soil-structure interaction in an instrumental basin	16
ISARD. Automatic information of seismic damage	16
NERIES. Network of Research Infrastructures for European Seismology	16
SISPYR. Seismic Information System of Pyrenees	17
IMERNET. Ibero-Maghrebian earthquake risk reduction network	17

Tsunamis

CASABLANCA. Exchange of submarine seismographs experiences (OBS) between Mediterranean tsunami observers	18
--	----

Snow Avalanches

Hazard maps of snow avalanches. Training in modelling in the field of natural phenomena	19
Work on the avalanche zones map in the north of Andorra	19
SAME. Snow Avalanche Modelling and Warning in Europe	19
Avalanche prediction in the Pyrenees	20
PARAMOUNT. Public Safety & Commercial Info-Mobility. Applications & Services in the Mountains	20
Avalanche risk evaluation and technical defence proposal in Mina Veladero, Chile	20
Alternative protections against avalanches on the exploitation of Rajo Sur mine, in El Teniente, Chile	21

Volcanology

Seismicity instrumentation techniques applied to volcanology. Experimentation in Antarctica	22
Compilation of seismic reflection profiles on the Reunion Island as part of a project to study volcanic risk	22

Subsidence

Radar Interferometers	23
RISCMASS. Methodology for the risk management of ground movement in the scenario of insurance policy	23

Geological map of Paraje Castaño Nuevo 1:100 000, Argentina



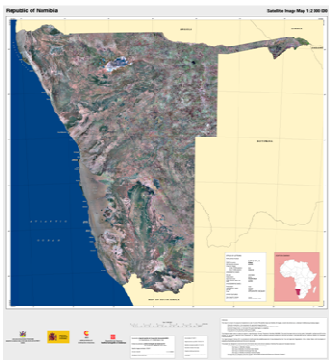
Partners: Servei Geològic de Catalunya, Spain; AURENSA, Spain.

Period: 1995-1998

Funded by: Subsecretaría de Minería de la Nación of the Secretaría de Industria, Comercio y Minería of the Government of Argentina, Argentina.

Complete geological cartography of Argentina on one sheet at scale 1:100 000. The first step to be able to produce the necessary basic cartography was to prepare an orthoimage of the study area at scale 1:100 000 from a SPOT satellite image. Thereby, some field points were confirmed, the parameters defining the geometry of the sensor were adjusted and the initial image was constructed. At the same time, the necessary field work was completed. A geological synthesis at scale 1: 100 000 was extracted from both sources of data.

Agroecological zoning of Namibia



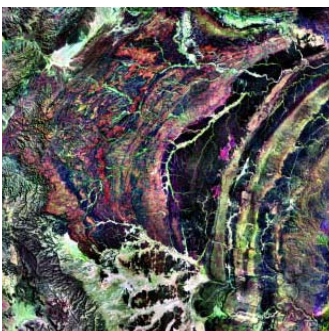
Partners: Servei Geològic de Catalunya, Spain; Ministry of Agriculture, Water and Rural Development, Namibia; The National Planning Commission, Namibia.

Period: 1998-2000

Funded by: Agencia Española de Cooperación Internacional para el Desarrollo (AECID).

Soil cartography and land use of Namibia at scale 1: 1 000 000 (615.000 km²), the NE part of the country at scale 1:250 000 (190.000 km²) and three areas of special interest at 1:100 000 (20.000 km²), as well as introducing the data obtained into a GIS data base. Cartography produced through Landsat-TM image interpretation and aerial orthophotos. In order to locate control points for the adjustment of the image correction model cartography 1:50 000 was needed.

Technical assistance for the Republic of Namibia



Partners: Servei Geològic de Catalunya, Spain; Central Bureau of Statistics of the National Planning Commission, Republic of Namibia.

Period: 2004-2005

Funded by: Agencia Española de Cooperación Internacional al Desarrollo (AECID).

Technical approach and support to implement a GIS application in the Central Bureau of Statistics, as well as the training of end users in the use of GIS information for land-use planning, water resources protection, and urban/rural agro-ecological economic development.

Pianure alluvionali and Che cosa è una carta geologica?



Partners: Servei Geològic de Catalunya, Spain; Servizio Cartografico e Geologico of the Regione Emilia-Romagna, Italy.

Period: 1999-2000

Funded by: Servizio Cartografico e Geologico of the Regione Emilia-Romagna, Bologna, Italy.

Preparation and publication in Italian of the English booklet "Alluvial Plains", produced by the Geological Survey of Catalonia, Servizio Cartografico e Geologico of the Regione Emilia-Romagna, Bologna, Italy and Rijks Geologische Dienst of Holland and the Magyar Geológiai Szolgálat of Hungary, as well as "què és un mapa geològic?" published in Catalan.

Exchange of matter and fluid motion in karstic media

Partners: Servei Geològic de Catalunya, Spain; Laboratoire Geofluides-Bassins-Eau del Centre National de la Recherche Scientifique (CNRS), France.

Period: 1993-1995

Funded by: Directorate General XII for Science, Research and Development (Human Capital and Mobility) European Union.

The objective of this project was to demonstrate the potential use of radon and natural radioactivity as characteristic parameters of movement of water in aquifers of different kinds. Development in 11 water pilot systems.

Integrated Basin Studies

Partners: Servei Geològic de Catalunya, Spain; Institut Français du Pétrole, France; Elf Aquitaine Production, France; Vrije Universiteit, The Netherlands; Universitat de Barcelona, Spain; Consejo Superior de Investigaciones Científicas (CSIC), Spain; Centre National de la Recherche Scientifique (CNRS), France; École National Supérieure de Géologie, France; Universität Tübingen, Germany; University of Newcastle, United Kingdom; Groupement pour l'Étude des Structures Souterraines de Stockage, France; Universität Friedericiana Karlsruhe, Germany; Norsk Hydro, Norway.

Period: 1993-1998

Funded by: Directorate General XII for Science, Research and Development (Joule II) of the European Union.

This project was conceived to make an integrated study of some previously selected sedimentary basins in Europe and to carry out dynamic modelling. The study included basins in both expansion and compression regimes. The sedimentary response in the tectonic regime was modelled and the compaction and flow fluids in the sediment were studied.

A global multidisciplinary approach to groundwater flows in karstic areas and its consequences on water resources and environment studies

Partners: Servei Geològic de Catalunya, Spain; Geofluides-Bassins-Eau del Centre National de la Recherche Scientifique (CNRS), France; Universitat Autònoma de Barcelona, Spain; Aristotle University of Thessaloniki, Greece; Laboratoire Souterrain del Centre National de la Recherche Scientifique (CNRS), France; Istituto di Geochronologia del Consiglio Nazionale delle Ricerche (CNR), Italy.

Period: 1995-1996

Funded by: Directorate General XII for Science, Research and Development (Human Capital and Mobility) European Union.

Investigation of radioactive elements and trace elements in experimental basins in France and Catalonia, and their implications on resource evaluation and environmental issues.



ResPyr. Réseau GPS des Pyrénées

Partners: Servei Geològic de Catalunya, Spain; Observatoire Midi-Pyrénées, France; Universitat de Barcelona, Spain; Escola d'Enginyers Tècnics en Topografia of the UPC, Spain.

Period: 1995-2005

Funded by: Departament de Política Territorial i Obres Públiques, Spain; Observatoire Midi-Pyrénées, France; Universitat de Barcelona, Spain; Escola d'Enginyers Tècnics en Topografia of the UPC, Spain.

Research project to study cortical movements on both sides of the Pyrenees, using space geodesy methods and techniques. Observation campaigns on the eastern and western parts of mountain chain.



AWARE. A Tool for Monitoring and Forecasting Available Water Resource in Mountain Environment

Partners: Servei Geològic de Catalunya, Spain; Istituto per il Rilevamento Elettromagnetico dell'Ambiente, Italy; Politecnico di Milano, Italy; Swiss Federal Institute for Snow and Avalanche Research, Switzerland; Institut für Hydraulik, Austria; University of Slovenia; Remote Sensing Data Engineering, Italy; Universitat Jaume I, Spain.

Period: 2005-2007

Funded by: 6th Framework Programme of the European Union.

The aim of the project was to offer innovation tools for monitoring and predicting the volume of water available in basins by measuring the quantity of snow. In this way medium and long-term water flow predictions can be made, with a view to more sustainable water resource management.



Experience exchange on seismic microzoning on urban areas. Salta, Argentina

Partners: Institut Geològic de Catalunya, Spain; Universitat de Salta, Argentina.

Period: 2010

Funded by: Agencia Española de Cooperación Internacional al Desarrollo (AECID)

Exchange of the status of investigations related to the knowledge of the ground's response to seismic vibrations caused by moderate and intense earthquakes, presented by each working group belonging to both institutions. With such knowledge, and based on the available resources at both institutions involved, clearly define a possible joint research project, within a framework of mutual cooperation, in which both parties contribute their knowledge and collaborate in terms of developing and applying different techniques in previously agreed areas to be studied and worked on.

Earthquakes

Determination of earthquake parameters from records obtained in the SMART-1 strong motion accelerometer array in Taiwan

Partners: Servei Geològic de Catalunya, Spain; University of California, United States of America.

Period: 1990-1992

Funded by: Departament de Política Territorial i Obres Públiques (DPTOP) of the Generalitat de Catalunya, Spain.

The objective of this project was the development and application of analysis methods of motion accelerograms for obtaining intense focal intensity parameters of earthquakes.

Research of Historical Seismicity in Europe

Partners: Servei Geològic de Catalunya, Spain; Istituto per la geofisica della Litosfera del Consiglio Nazionale delle Ricerche (CNR), Italy; Bureau de Recherches Géologiques et Minières (BRGM), France; Imperial College, United Kingdom; Observatoire Royal de Belgique, Belgique; National Kapodistrian University of Athens, Greece; Centre Seismologique Euro-Méditerranéen, France; Instituto Nacional de Meteorologia e Geofisica, Portugal

Period: 1989-1993

Funded by: Directorate General XII for Science, Research and Development (Climatology and Natural Hazards Research) of the European Union.

Review of some historical European earthquakes, which occurred mainly in border areas, to make available to the community a set of highly interesting data for seismic risk analysis, while laying down common methodologies for European seismologists and historians working in this field.

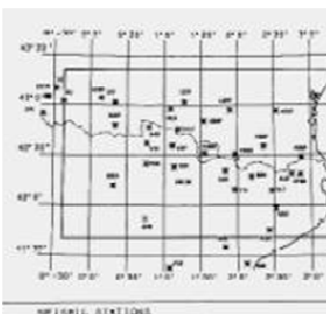
Observation and analysis of seismicity in the Pyrenees

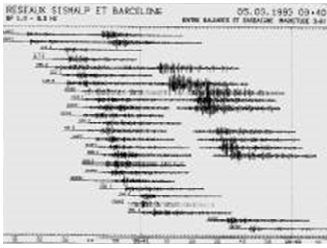
Partners: Servei Geològic de Catalunya, Spain; Observatoire Midi-Pyrénées, France.

Period: 1990-1995

Funded by: the participant institutions

Establishment, operation and data processing of the seismic observation network of the central-eastern Pyrenees. Data from the field stations are transmitted to the Meteosat satellite reception centres of Barcelona and Toulouse. The result of the analysis of these data is published in the joint annual bulletins "Seismic activity in the Pyrenees".





Seismicity study methods – instrumental network

Partners: Servei Geològic de Catalunya, Spain; Laboratoire de Géophysique Interne & Tectonophysique de la Université de Grenoble, France.

Hardware and software adjustments by telephonic transmission. Seismic data analyses in Catalonia.

Period: 1991-1995

Funded by: the participant institutions.



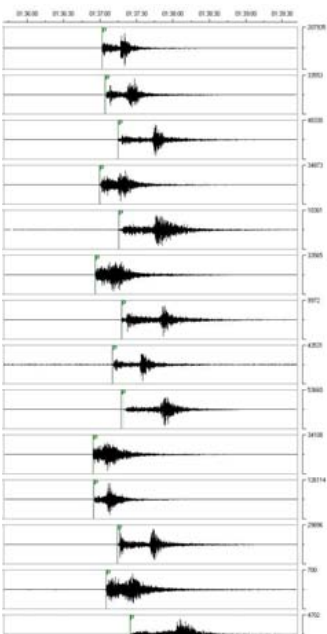
PotSis: Seismic Potentiality of Eastern Pyrenees

Partners: Servei Geològic de Catalunya, Spain; Institut de protection et de Sûreté Nucléaire du Paris, France; Observatoire Midi-Pyrénées, France; Université Montpellier II, France; Geoid Montpellier, France; Geologie Tectonique-Environnement et Risques, France; Université des Sciences et Technique du Languedoc, France; Institut für die Anwendung der Geodäsie in dem Bauwesen, Germany.

Current distribution of tectonic deformation studies for estimating the return periods of destructive seism in the eastern Pyrenees, applying geodesic techniques to measure recent cortical movements. This interdisciplinary project includes geodesic and seismological studies of neo tectonics and historical seismicity, etc. Project stages worthy of mention are: design and establishment of the network (24 vertexes); a first campaign of observations; calculation of the data of field campaigns, analysis and comparison. Due to the nature of the area and the work, significant results are expected during a time span of at least 10 years.

Period: 1991-2001

Funded by: Departament de Política Territorial i Obres Públiques (DPTOP), Spain; Institut de Protection et de Sûreté Nucléaire du Paris, France; Observatoire Midi-Pyrénées, Toulouse, France; Geoid and Geoter; Université des Sciences et Technique du Languedoc.



Implementation of methods for calculating strong motion earthquakes. Application to the Ashigara Valley experiment in Japan

Partners: Servei Geològic de Catalunya, Spain; Laboratoire de Géophysique Interne & Tectonophysique de la Université de Grenoble, France.

Adaptation and developing software as a tool for a study on local seismic effects study. Soil response data comparison between Catalonia and Ashigara Valley (Japan).

Period: 1992-1994

Funded by: Departament de Política Territorial i Obres Públiques (DPTOP) de la Generalitat de Catalunya, Spain; Laboratoire de Géophysique Interne & Tectonophysique de la Université de Grenoble; Centre Interdepartamental de Recerca i Innovació Tecnològica (CIRIT), Spain.



Study of the 1373 earthquake in the central Pyrenees

Partners: Servei Geològic de Catalunya, Spain; Bureau de Recherches Geologiques et Minières (BRGM), France; Observatoire Royal de Belgium, Belgium; Departament d'Història Medieval de la Universitat de Barcelona, Spain.

Collecting and analyzing information concerning 1373 earthquakes in the central Pyrenees. Its historical analysis and seismic interpretation contributed to the evaluation of seismic hazard.

Period: 1993-1994

Funded by: Departament de Política Territorial i Obres Públiques (DPTOP) de la Generalitat de Catalunya, Spain; Bureau de Recherches Geologiques et Minières (BRGM), France; Observatoire Royal de Belgique.



EUROSEISTEST. Volvi-Thessalonik: A European test site for Engineering Seismology and Seismology

Partners: Servei Geològic de Catalunya, Spain; Aristotle University of Thessaloniki, Greece; Laboratoire de Géophysique Interne & Tectonophysique de la Université de Grenoble, France; Institute of Engineering Seismology & Earthquake Engineering, Greece; Université de Liege, Belgique; Istituto di Geodesia & Geofisica, Italy; National Kapodistrian University of Athens, Greece; Laboratório Nacional de Engenharia Civil del Instituto Superior Técnico, Portugal; Centre d'Études Techniques de l'Équipement, France.

Study of the influence of sediment on earthquake ground motion and its effects on structures. A test site was defined in Volvi-Thessaloniki where a series of sensors and corresponding data acquisition systems were installed, in order to obtain detailed information about the movement in different locations of geotechnical characteristics. Several campaigns were carried out with geophysical and geotechnical methods to characterize subsurface and a small-scale model building was constructed.

Period: 1993-1996

Funded by: Directorate General XII for Science, Research and Development (Environment) European Union.



Comparative testing of strong ground motion accelerographs in Veletri, Italy

Partners: Servei Geològic de Catalunya, Spain; Ente Nazionale della Energia Elettrica (ENEL), Italy; Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (ENEA), Italy.

This project consisted of testing the comparative performance of different recording systems of intense movements produced by earthquakes. In particular, a system developed at the Cartografic Institute of Catalonia (ICC) was compared with another commercially available in Italy.

Period: 1994-1995

Funded by: Italian and Spanish Foreign Affairs Ministries.



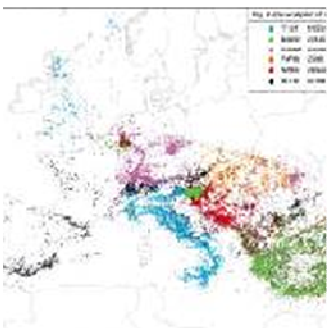
Installation of a digital seismic network to observe the seismicity of the Salta region, Argentina

Partners: Servei Geològic de Catalunya, Spain ; Universidad Nacional de Salta, Argentina; Museo Nacional de Ciencias Naturales del Consejo Superior de Investigaciones Científicas (CSIC), Spain; Instituto Andaluz de Geofísica y Prevención de Desastres Sísmicos, Spain.

The main goal was to develop digital equipment for seismic data acquisition based on personal and portable computers, operating in Salta (Argentina). Analysis of data recorded by the digital seismic network.

Period: 1995-1996

Funded by: Ministerio de Educación y Ciencia (Programa de Cooperación con Iberoamérica), Spain.



A basic European earthquake catalogue and a database for the evaluation of long-term seismicity and seismic hazard

Partners: Servei Geològic de Catalunya, Spain; Consiglio Nazionale delle Ricerche (CNR), Italy; Geo Forschung Zentrum, Germany; Imperial College of Science and Technology, United Kingdom; Osservatorio Geofísico Sperimentale, Italy; National Kapodistrian University of Athens, Greece; Schweizerisch Erdbebendienst, Switzerland; British Geological Survey, Scotland; Istituto Sperimentale Modelli e Strutture, Italy.

The objective of this project was to initiate the collection of a European seismic catalogue suitable for seismic risk assessment, using uniform criteria. An important part of the project involved the establishment of rigorous methodologies for the development of seismic catalogues, both in terms of historical seismicity data and instrumental seismicity data.

Period: 1995-1997

Funded by: Directorate General XII for Science, Research and Development (Environment) European Union.



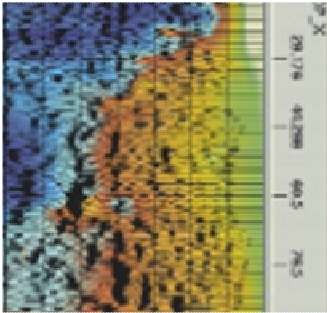
EUROSEISMOD. Development and experimental validation of Advanced modelisation techniques in seismology and seismic engineering

Partners: Servei Geològic de Catalunya, Spain; Aristotle University of Thessaloniki, Greece; Laboratoire de Géophysique Interne & Tectophysique de la Université de Grenoble, France; Institute of Engineering Seismology & earthquake Engineering, Greece; Laboratoire de Géologie de l'Ingenieur, d'Hydrogéologie & de Prospection Géophysique Belgium; Centro de Geofísica da Universidade de Lisboa, Portugal; Instituto di Geodesia & Geofísica, Italy; National Kapodistria University of Athens, Greece; Instituto Superior Técnico, Portugal; Centre d'Etudes Techniques de l'Equipement, France; Laboratoire de Ponts & Chaussées, France; Laboratoire de Mécanique des Sols-Structures-Matériaux, France; Aalborg University, Denmark.

Funded by: Directorate General XII for Science, Research and Development (Environment and Climate) of the European Union.

Continuation of the EUROSEISTEST projects. Development of methods for the modelling of ground movement and the structures produced by earthquakes and validation of these by experiments in the Volvi-Thessaloniki network 1D, 2D and 3D. Linear and non-linear methods are considered, and an assessment is made of seismic micro banding methods in urban areas and their application to several European cities: Thessaloniki, Barcelona, Benevento, Nice, Grenoble, Lisbon and Liege.

Period: 1996-1998



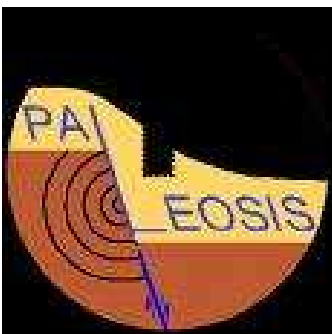
Research with seismic refraction in the area of Aínsa

Partners: Servei Geològic de Catalunya, Spain; University College of London, United Kingdom.

Period: 1997-1998

Funded by: Department of Geological Sciences of the University College of London.

Completion of seismic profiles with a depth of 500-600 meters, in order to define the geological evolution of the Aínsa basin (Huesca province, Spain).



PALEOSIS. New approaches and recent methodologies in Paleoseismology

Partners: Servei Geològic de Catalunya, Spain; Observatoire Royal de Belgique, Belgium; Geologisches Landesamt, Germany; Institut de Protection et de Sûreté Nucléaire, France; Instituto di Ricerca sulla Tettonica Recente, Italy; National Geological Survey of Netherlands; Universität zu Köln, Germany.

Period: 1998-2000

Funded by: Directorate general XII for Science, Research and Development of the European Union.

Two-year project to evaluate the potentiality of large earthquakes in areas where there is currently little seismic activity. The basis of the methodology used is that of repeated seismic movements on a fault with young sediment which lead to the availability of records of earthquakes in the form of typical morphological expressions.



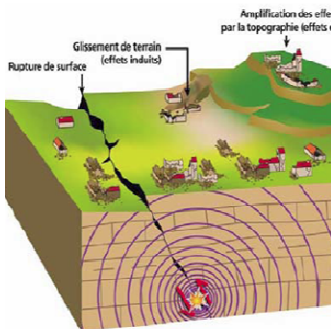
Seismic network of the Dominican Republic

Partners: Servei Geològic de Catalunya, Spain; Aurenca, Spain.

Period: 2001

Funded by: European Union.

Inspection and installation of a surveillance seismic network and accelerometer network in the Dominican Republic with the objective of recording, near real time, seismic information of the Caribbean island in order to have a technical tool for earthquake monitoring.



RISK-UE. Advanced methodology for seismic risk scenarios with applications in European cities

Partners: Servei Geològic de Catalunya, Spain; Institute of Earthquake Engineering and Engineering Seismology, Macedonia; Technical University of Civil Engineering, Romania; Politecnico-structural Engineering Department, Italy; Land Use Planification and natural Risks Services, France; Aristotle University of Thessaloniki, Greece; Laboratory of Seismic Mechanics and Earthquake Engineering, Bulgaria.

Period: 2001-2003

Funded by: Directorate General XII for Science, Research and Development of the European Union.

The main aim of the project was to develop a general and modular methodology for the accomplishment of seismic damage scenarios, considering the specificities of European cities, including buildings and historical sites. It is based on the evaluation of the seismic danger, on the systematic inventory and the typologies of the elements at risk and the analysis of the value and the vulnerability of these elements. The methodology was applied in seven European cities, among them, Barcelona.



Seismic risk in the Principality of Andorra

Partners: Servei Geològic de Catalunya, Spain; Institut d'Estudis Andorrans, Andorra.

Period: 2002

Funded by: jointly by the participant institutions.

Geo tectonic data summary of different zones were carried out in order to characterize the dynamic parameters of the Valira valley ground. With this data the functions of seismic transference with an equivalent 1D linear method (pro Shake) were estimated. On the other hand, a campaign to record seismic noise was carried out. Seismic shaping was defined by taking the previous parameters into account. Sliding probabilities produced by earthquakes were also estimated, adapting a Catalanian procedure.



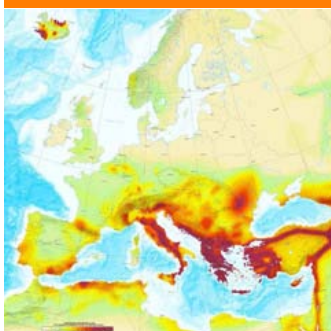
Study of the local seismic effects in Andorra

Partners: Servei Geològic de Catalunya, Spain; Institut d'Estudis Andorrans, Andorra.

Period: 2002

Funded by: jointly by the participants.

Preliminary study of the seismic micro banding in most urbanized areas of Andorra that included the estimation of the amplification functions of the earthquake, both in the zone of the valleys and on the mountain slopes, and a study of the danger of the generation of avalanches caused by earthquakes.



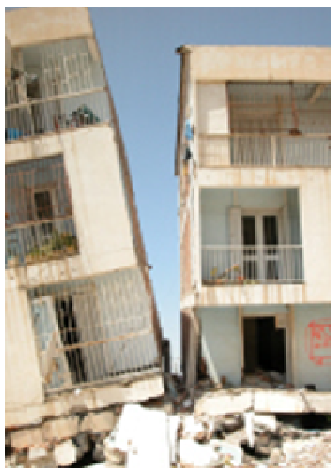
European-Mediterranean Seismic Hazard Map 1: 5 000 000

Partners: Servei Geològic de Catalunya, Spain; European Seismological Commission and International Geological Correlation Program.

Period: 2002-2003

Funded by: Swiss seismological Service, Switzerland.

Data integration methodology for Mediterranean seismic hazard map, at scale 1: 5 000 000.



EUROSEISRISK. Evaluation of seismic hazard, soil effects and soil-structure interaction in an instrumental basin

Partners: Servei Geològic de Catalunya, Spain; Aristoteleio Panepistimio Thessalonikis, Greece; Institute of Engineering seismology and Earthquake Engineering, Greece; Laboratoire Central des Ponts et Chaussées, France; Rheinisch-Westfaelisch Technische Hochschule Aachen, Germany; Università degli Studi di Trieste, Italy; University of Tokyo, Japan; Comenius University, Slovakia.

The aim of the project was the validation of computing codes, both of the effects of local amplification and of the soil-structure interaction of seismicity in the Volvi-Thessaloniki valley.

Period: 2002-2004

Funded by: The Energy, Environmental and Sustainable Development Programme of the European Union.



ISARD. Automatic information of seismic damage

Partners: Servei Geològic de Catalunya, Spain; Bureau de Recherche Géologique et Minières, France; Centre Scientifique et Technique du Bâtiment, France; Direcció General d'Emergències i Seguretat Civil of the Generalitat de Catalunya, Spain; Ajuntament de Puigcerdà, Spain; Centre de Recerca en Ciències de la Terra, Andorra.

The main objective is to obtain trans-border and unified zoning of Pyrenees to be used for preventive and operational information on seismic risk, without distortion on Spanish-French border. Soil effects, joint seismic stations, automatic seismic systems and damage estimation.

Period: 2003-2006

Funded by: FEDER funds of the European Union (Interreg III Program).



NERIES. Network of Research Infrastructures for European Seismology

Partners: ORFEUS, EMSC, ETHZ, KNMI, UU, CEA-LDG, UJF- LGIT, IPGP, GFZ, UP, INGV, DPC-SAPE, Imperial, BGS, NORSAR, ITSAK, KOERI, FFCUL, IST, IGC, AWI, UNLIV, NIEP, ZAMG, NOA-IG.

NERIES is a consortium of 23 universities and research centres that share the expertise and infrastructure in the field of seismology. The aim of the project is to integrate research infrastructure related to the study of seismicity: Distribution of historical earthquake data files, improvement of accelometric data dissemination and rapid development of shake-maps and loss estimation capability.

Period: 2006-2010

Funded by: 6th Framework Program of the European Union (Infrastructures).



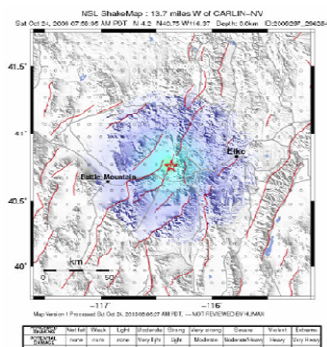
SISPYR. Seismic Information System of Pyrenees

Partners: Institut Geològic de Catalunya, Spain; Bureau de Recherche Geologique et Minière, France; Observatoire Midi-Pyrénées, France; Instituto Geográfico Nacional, Spain; Universitat Politècnica de Catalunya, Spain.

This project has the objective of starting a joint system for acquiring data on earthquakes and for a better adaptation of the scientific means for preparing the management of seismic crises in the Pyrenees.

Period: 2009-2011

Funded by: Feder funds. POCTEFA 2007-2013 programme.



IMERNET. Ibero-Maghrebian earthquake risk reduction network

Argelian partners: Centre de Recherche en Astronomie et Géophysique, Centre National de Recherche Appliquée en Génie Parasismique, University of Bab Ezzouar; **Morocco partners:** Institut Scientifique, Université Mohamed V, Centre National pour la Recherche Scientifique et Technique; **Portuguese partners:** Instituto de Meteorologia, Universidade de Evora; **Tunisian partners:** Institut National de la Météorologie; **Spanish partners:** Institut Geològic de Catalunya, Universidad Complutense de Madrid, Real Instituto y Observatorio de la Armada de Cádiz, Instituto Geográfico Nacional.

Earthquakes do not recognize national borders and, in consequence, large shocks which occur in the Ibero-Maghrebian region, including Algeria, Morocco, Portugal, Spain and Tunisia, may affect several of these countries, often with catastrophic consequences, and their study requires cooperation between these countries and regions. Also it is the framework to reinforce the importance of bilateral and multilateral collaborations for research and development, training, technological transfer and exchange of data and personnel.

Period: 2008-2012

Funded by: all participant institutions.

Tsunamis



CASABLANCA. Exchange of submarine seismographs experiences (OBS) between Mediterranean tsunami observers

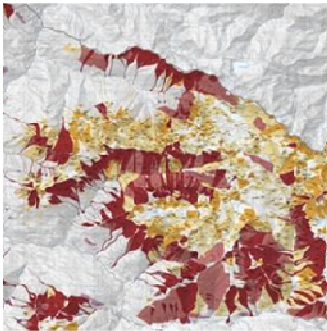
Partners: Institut Geològic de Catalunya, Spain. Observatorio del Ebro, Spain; Centre Geosciences Azur – Geoazur, France.

Period: 2008-2009

Funded by: Ministerio de Ciencia e Innovación, Spain.

Catalan seismic network improvement. The pressure sensor of the OBS will participate in a European network of the Western Mediterranean Tsunami prediction. Therefore, the exchange of experiences between Catalonia and Nice is of great interest, taking into account that a system built on a permanent OBS seismic network in real time has been implemented for the first time in Spain.

Snow Avalanches



Hazard maps of snow avalanches. Training in modelling in the field of natural phenomena

Partners: Servei Geològic de Catalunya, Spain; Centre National du Machinisme Agricole du Génie Rural des Eaux et des Forêts (CEMAGREF), France; Universitat de Barcelona, Spain; École Polytechnique Fédérale de Lausanne, Switzerland; Institut für Schnee und Lawinenforschung, Switzerland; Université Joseph Fourier, France; Norwegian Geotechnical Institute, Norway; Vedurstofe Islands, Iceland; Università di Torino, Italy.

Avalanche dynamics study through computer modelling of several pilot areas. Development of methodologies for snow avalanche mapping.

Period: 1994-1996

Funded by: Directorate General XII for Science, Research and Development (Human Capital and Mobility) European Union.



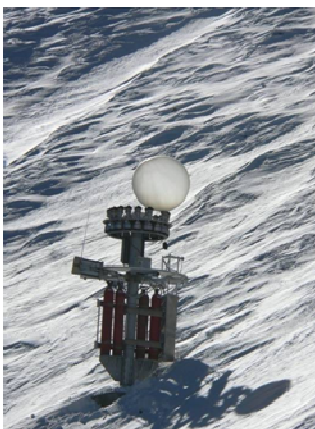
Work on the avalanche zones map in the north of Andorra

Partners: Servei Geològic de Catalunya, Spain; Centre National du Machinisme Agricole du Génie Rural des Eaux et des Forêts (CEMAGREF), France.

The objective of this project was to conduct field surveys on the avalanches in the area known as Arcalís for mapping snow avalanches in Andorra.

Period: 1995-1996

Funded by: Conselleria d'Obres Públiques del Govern d'Andorra.



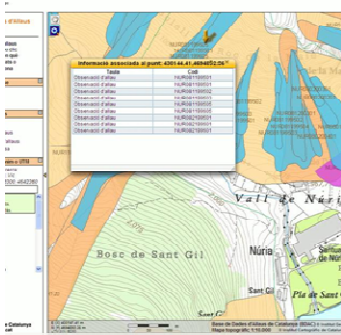
SAME. Snow Avalanche Modelling and Warning in Europe

Partners: Servei Geològic de Catalunya, Spain; Centre National du Machinisme Agricole du Génie Rural des eaux et des Forêts (CEMAGREF), France; Technische Universität Graz, Austria; Norwegian Geotechnical Institute, Norway; Icelandic Meteorological Office Reykjavík, Iceland; Centro Sperimentale Valanghe e Difesa Idrogeologica, Italy; Swiss Federal Institute for Forest, Snow and Landscape, Switzerland.

Coordinated work between several European institutions in order of use the same framework on cartography. A questionnaire has been drawn up to obtain all existing information about avalanches in Europe, so that all database and graphic information will be homogenized.

Period: 1995-1996

Funded by: Directorate General XII for Science, Research and Development (Environment and Climate) of the European Union.



Avalanche prediction in the Pyrenees

Partners: Servei Geològic de Catalunya, Spain; Instituto Nacional de Meteorología of the Ministerio de Medio Ambiente, Spain; Meteo-France, France; Departament de Transport i Energia of the Govern d'Andorra.

Period: 2001

Funded by: jointly by participant institutions.

Joint studies on avalanche danger for all the Pyrenean chain, including French, Spanish and Andorran Pyrenees. This materialized in a publication where the telephone numbers of interest for knowing the state of ski tracks and the weather are published, together with advice for skiers and the European scale of avalanche risk.



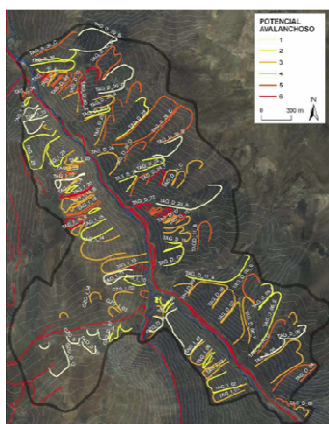
PARAMOUNT. Public Safety & Commercial Info-Mobility. Applications & Services in the Mountains

Partners: Servei Geològic de Catalunya, Spain; Gesellschaft fuer Satellitennavigation, Germany; University of Bundeswehr, Germany; Bayerische Bergwacht, Germany; Österreichischer Bergrettungsdienst, Austria.

Period: 2002-2003

Funded by: Programme IST of the European Union.

The main aim of this project has been to develop a location service for hikers and rescue services in the Alps and the Pyrenees, where two testing areas have been defined. Three types of services were developed: Infotour, to provide the user with a variety of local information and navigation directions; Safetour, to provide information related to mountain safety, and Datatour to involve users in the acquisition and maintenance of the Paramount database. Data transferred via http protocol using xml.



Avalanche risk evaluation and technical defence proposal in Mina Veladero. Chile

Partners: Institut Geològic de Catalunya, Spain.

Period: 2007

Funded by: Asistencia Profesional en materia de Montaña LTDA, Chile.

The objective of this study is to carry out two jobs: 1) a cartography of avalanche routes, which consists of locating the route followed by avalanches in the study area and cartographing in detail 30 routes located in the area considered to be of high interest, mainly in the 7 km access corridor to the Veladero Mine; and 2) a job consisting of modelling the behaviour of the larger avalanches, in around 30 avalanche routes. To do this, it is necessary to characterize the known avalanches, and to determine their main dynamic parameters (speed, pressures, flow heights).



Alternative protections against avalanches in the exploitation of the Rajo Sur mine, in El Teniente, Chile

Partners: Institut Geològic de Catalunya, Spain.

Period: 2008 - 2010

Funded by: Asistencia Profesional en materia de Montaña LTDA, Chile.

The realization of a study of alternative protection means against avalanches in the open pit area: Los Botaderos Lastre and the High and Low Assay Stocks of the future exploitation Rajo Sur in El Teniente mine (Machali Municipality, Chile).

Works to be undertaken:

- Cartography of the avalanche area, at scale 1:5 000, affecting some sectors.
- Geo-morphological characterization of each area.
- Realization of topographic profiles to define each one of the avalanche areas.
- Compilation of historical data from the existing bibliography and from the field campaign.
- Analysis of the available meteorological data on snow fall.
- Numerical spot modelling of avalanche areas where detailed knowledge of avalanche dynamics is necessary.
- Proposal for avalanche protection alternatives.

Volcanology



Seismicity instrumentation techniques applied to volcanology. Experimentation in Antarctica

Partners: Servei Geològic de Catalunya, Spain; Museo Nacional de Ciencias Naturales del Consejo Superior de Investigaciones Científicas (CSIC), Spain; Instituto Andaluz de Geofísica y Prevención de Desastres Sísmicos, Spain.

This project involved the development of seismic instrumentation and its applications in the recording of seismic activity associated to volcanism on Deception Island.

Period: 1992-1994

Funded by: Ministerio de Educación y Ciencia (Programa: Antártico), España.



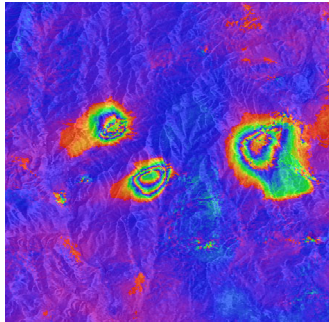
Compilation of seismic reflection profiles on the Reunion Island as part of a project to study volcanic risk

Partners: Servei Geològic de Catalunya, Spain; Laboratoire de Sismologie Expérimentale del Institut Physique du Globe, France; Institut de Ciències de la Terra “Jaume Almera” del Consejo Superior de Investigaciones Científicas (CSIC), Spain; École et Observatoire de Physique du Globe (EOPG), France; Université de Pau, France; Office pour la Recherche Scientifique et Technique d’Outremer (ORSTOM), France.

The objective of this project was to investigate the possibility of detecting the 3D heterogeneity of the active volcano Piton de la Fournaise, by conducting seismic experiments testing several different source-receiver geometries.

Period: 1993

Funded by: Directorate General XII for Science, Research and Development (Environment) European Union.



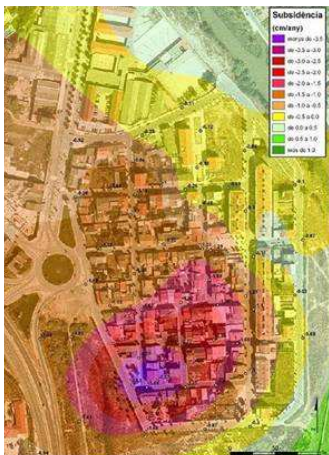
Radar Interferometers

Partners: Servei Geològic de Catalunya, Spain; Instituto Nacional de Estadística, Geografía e Informática, México.

Period: 1993

Funded by: jointly by participant institutions.

Development of a prototype and the celebration of a seminary-workshop to present the potentialities of radar interferometry, especially in the scope of subsidence phenomenon, analysis of problems and monitoring.



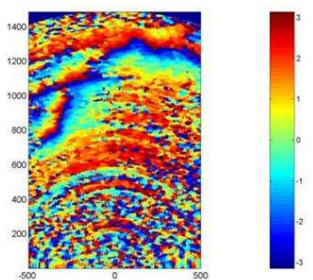
RISCMASS. Methodology for the risk management of ground movement in the scenario of insurance policy

Partners: Servei Geològic de Catalunya, Spain; Consiglio Nazionale delle Ricerche- Istituto di Ricerca per la Protezione Idrogeologica, Italy; Civil Defensa of Sicilia, Italy; Universitat d'Alacant, Spain; National Observatory of Athena, Greece.

Period: 2004-2006

Funded by: FEDER funds. Interreg IIIB Medoc program.

Project that studies the land movements, by means of radar interferometry, geophysical studies and establishment of a levelling network for the definition of the land movements models, elaboration of risk maps and analysis of the insurance policies.



Seminar "Introduction to radar technology and specific applications"

Partners: Institut Geològic de Catalunya, Spain; Institut Cartogràfic de Catalunya, Spain.

Period: 2010

Funded by: Petróleos de Venezuela, S.A. (PDVSA), Venezuela.

IGC has participated in the Seminar "Introduction to the radar technology and applications" teaching the subject "geological interpretation of the results MI DInSAR". The following topics were lectured: DInSAR products applied in geology, interpretation of MI DInSAR, monitoring of geological natural processes and the potentiality of DInSAR data in subsoil modelling.