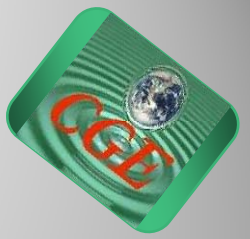
*É*vora *G*eophysics *C*enter

Workshop on Earth Science Research - New Perspectives
4th June 2008

http:// www.cge.uevora.pt

Started its activities in 1993 and was funded in 1991 under the framework of "Programa Ciência"



Scientific Team:

60 scientific members, 40 Ph.D organized in two main Groups:

FIDAC - Physics and Dynamics of the Atmosphere and Climate

Atmospheric Physics and Climate – Ana Maria Silva

Transfer phenomena in the Geosphere – Rui Namorado Rosa

SEISMOLITOS - Seismotectonics and processes of lithospheric deformation

Internal Geophysics – Mourad Bezzeghoud

Dynamics of Geological Processes – Alexandre Araújo

Technical and Administrative Team:

5 members

- Anual Evaluation by Scientific Advisor Committee consisting of three senior scientists

- Four Anual Evaluation by FCT

- Current Funding – per Ph.D member and according to the evaluation grade of the Unit

Main Activities:

- ***R&D Projects;***
- ***Advanced Training: Ph.D, Master and Bachelor Students;***
- ***Organization of Conferences/Workshops and Advanced Courses;***
- ***Cooperation with other institutions, promotion of scientific awareness and providing technical advice.***

Integrative/Multidisciplinary Activities :

- **Integration in different national and international networks***: AERONET,WM Broad-Band Seismological Network, National Geophysics Network, IMERNET (Ibero-Maghrebian Earthquake Risk Reduction Network), Portuguese Coordinated Seismic Initiative on Broad Band Observation Network, EMEPC (Estrutura de Missão para a extensão da Plataforma Continental)*

- **Integration in national scientific organizations***: IPY 2007-2009; member of European-Mediterranean Seismological Centre (EMSC); member of the "Sismicidad, Sismotectónica y Riesgo Sísmico" research Group of UCM, etc)*

- **Cooperation with national and international scientific Institutions**: **IM, INETI, Uaveiro, IST,** ***Pratt School of Engineering - Duke University, and I.N.S.A – Toulouse), Institut de Physique du Globe (IPG), Institute of Atmospheric Sciences and Climate (ISAC-CNR), Bologna, Institute of Geophysics of the Sciences Academy of Check Republic, Institute for Tropospheric Research, Leipzig.***

Infrastructures:

Colégio Luis Verney e Mitra:
Évora Geophysics Observatory (Atmospheric Physics, Seismology, Geothermal), Laboratory of Geology, Cluster.

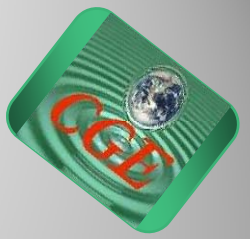
Cabo Raso:
Atmospheric Physics Observatory – Cabo Raso

Estremoz:
Centro de Ciência Viva

Colaborations:

Industry: EDP, SNPC,EDISOFT/NITEC, SKYSOFT
Secondary Schools
PALOPS, MAGREB countries

FIDAC



Fidac " **P**hysics and **D**ynamics of the **A**tmosphere and **C**limate" include research themes encompassing a broad spectrum of scales, ranging from the **p**rediction of hazardous weather and **r**egional **c**limate **i**mpacts using mesoscale models, to the **q**uantitative **a**ssessment of the direct and indirect effects of **a**erosols and **g**ases at the **r**egional and **l**ocal scales, **c**louds, the mechanisms of **t**ransport and **d**eposition of aerosols in buildings and the investigation of **a**tmospheric **e**lectricity and its relationship with clouds and fog.

Through the combination of **d**ifferent **a**pproaches (local/global scale monitoring systems and modelling) a **r**egiona**l** **a**erosol **c**limatology for southern Europe , a **r**egiona**l** **c**haracterization of the **i**nteraction between **a**erosols and **c**louds over Portugal as well as **a**ir **q**uality characterization (Ozone, NOx, SO2), will be achieved.

Aerosols, mainly from the **s**ubmicroscopic range, can **i**nduce serious **r**espiratory **d**iseases . Consequently, air quality and particle control are fundamental issues to be considered.

Development of **s**cientific **p**rototypes for **a**tmospheric **m**onitoring

Atmospheric Physics and Climate

Ana Maria Silva
Andrea Ramos
Augustin Garcia
Bruno Mendes
Daniele Bortoli
David Berry
Fábio Cunha Conde
Frank Wagner
Maria João Costa
Paulo Sérgio Lúcio
Rui Salgado
Thierry Elias

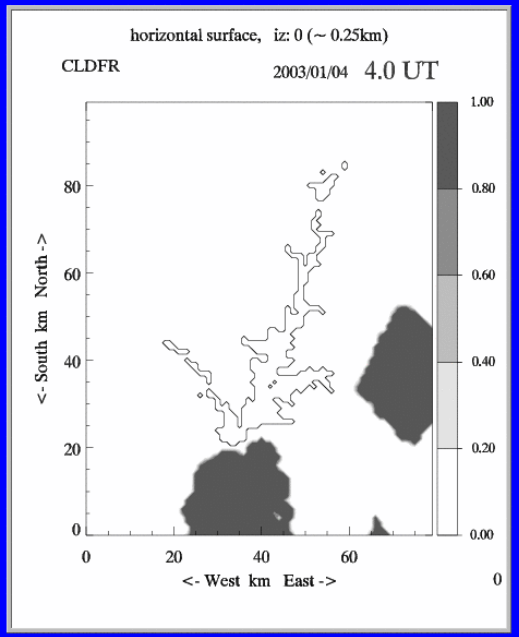
Ana Isabel Serrano (Ph.D)
Dina Santos (Ph.D)
Francisco Neves
Lourdes Bugalho (Ph.D)
Maria da Graça Carraça (Ph.D)
Miguel Potes
Nuno Belo
Sérgio Pereira (Ph.D)

Microclimatology of the atmospheric boundary layer

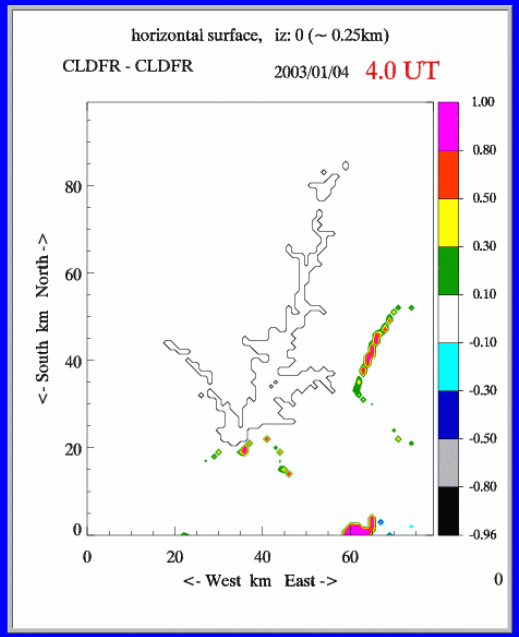
Melhorar a representação das interacções lago - atmosfera nos modelos numéricos de simulação e previsão do tempo

- Validar modelo de lago para aplicações meteorológicas
- Introdução de um modelo de lago (FLake) nos modelos atmosféricos de previsão do tempo (AROME) e de mesoscala (Meso-NH)
- Colaboração com o CNRM / MeteoFrance

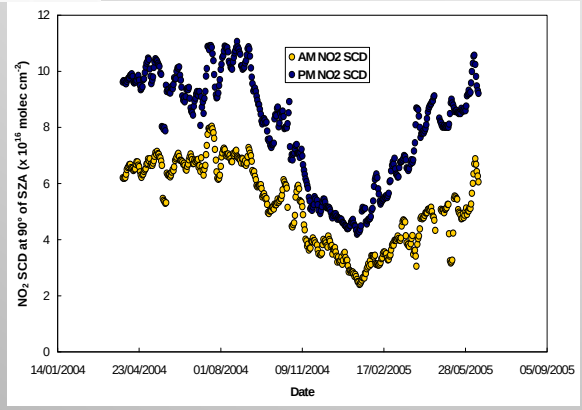
controlo

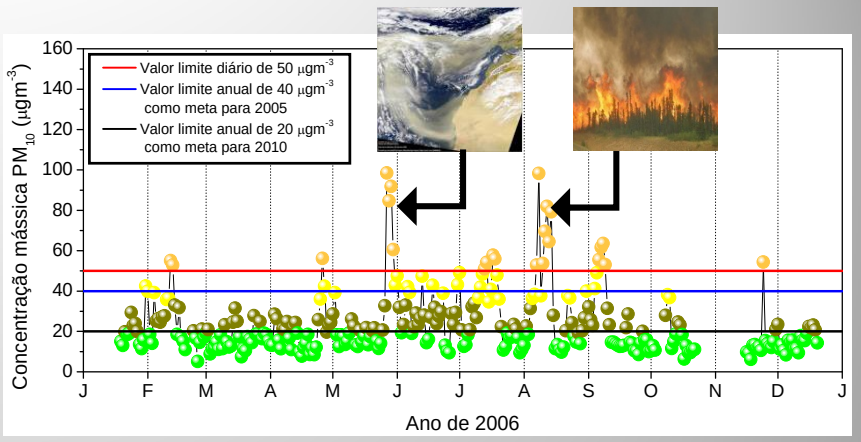


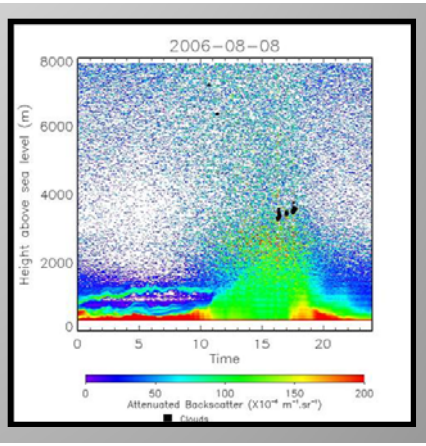
anomalia



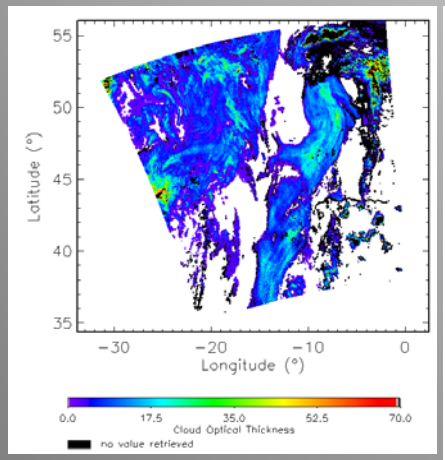
Caracterization of aerosols, gases and clouds: remote sensing, "in situ" observations and modelling

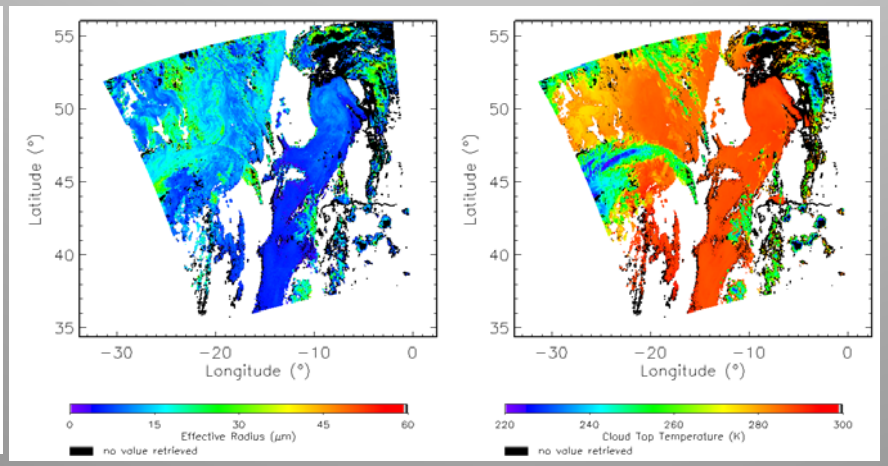


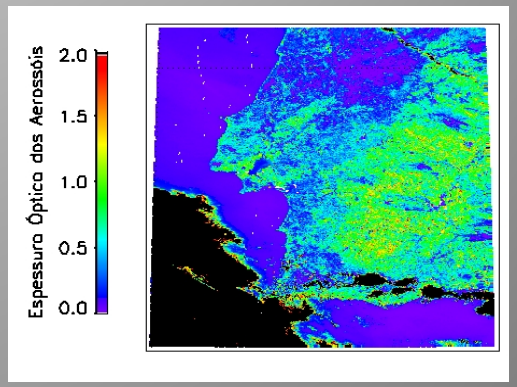




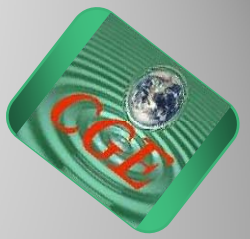
Cloud optical thickness **Droplet effective radius(mm)** **Cloud top temperature(K)**







Scientific Problems to be solved



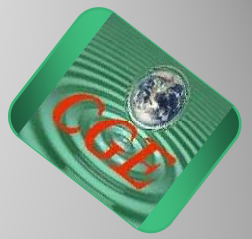
- Some Examples:

- **D**iscrimination between **C**louds and **A**erosols, **s**imultaneously present, from **m**ultispectral satellite images;

- **D**iscrimination **b**etween **d**ifferent **w**ater **c**onstituints from **m**ultispectral **r**adiometric **m**easuremets;

- **H**ow to improve the **p**hysical **d**escription of the **l**ake-atmosphere interactions in weather forecast and climate models?

Transfer Phenomena in the Geosphere



Prof. Rui Namorado Rosa

Prof. António Ferreira Miguel

Prof. António Heitor Reis

Doctor Murat Aydin

Cláudia Serrano (PhD student)

Paulo Canhoto (PhD student)

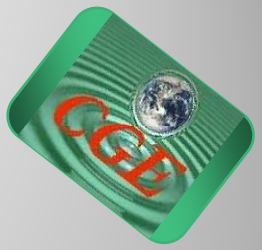
Richardson Teixeira

Ana Serrenho (graduation student)

José do Ó (graduation student)

Sofia Kruz (graduation student)

Research Subjects



1. Porous Media – fluid and particle transfer

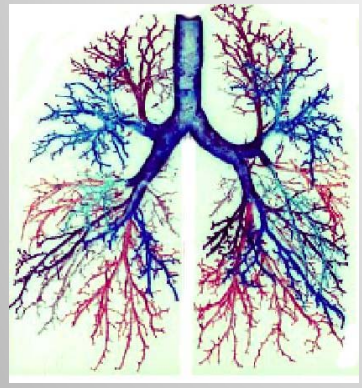
2. Complex flow structures – Constructal Theory

3. Atmospheric Electricity

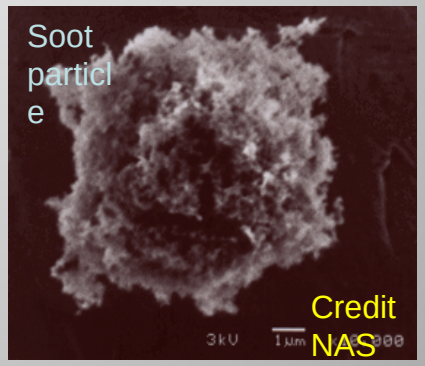
4. Environmental Exergy sources and flows and conversion systems

5. Energy resources – Exergetic assessment of mineral resources and the *Peak Oil* issue

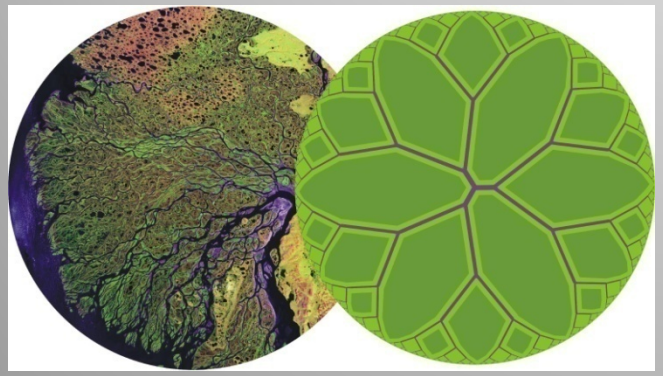
- **Biological structures: lung tree; sea corals**



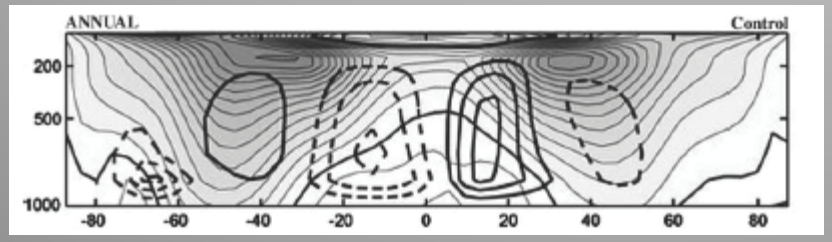
Particle Aggregation – aerosols

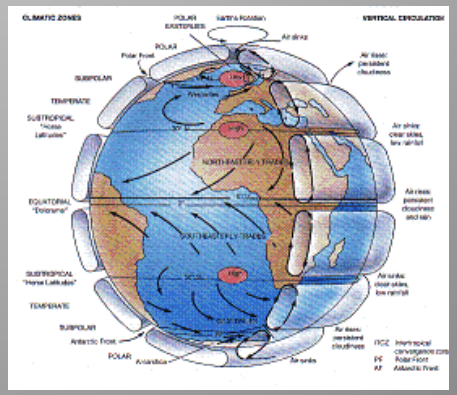


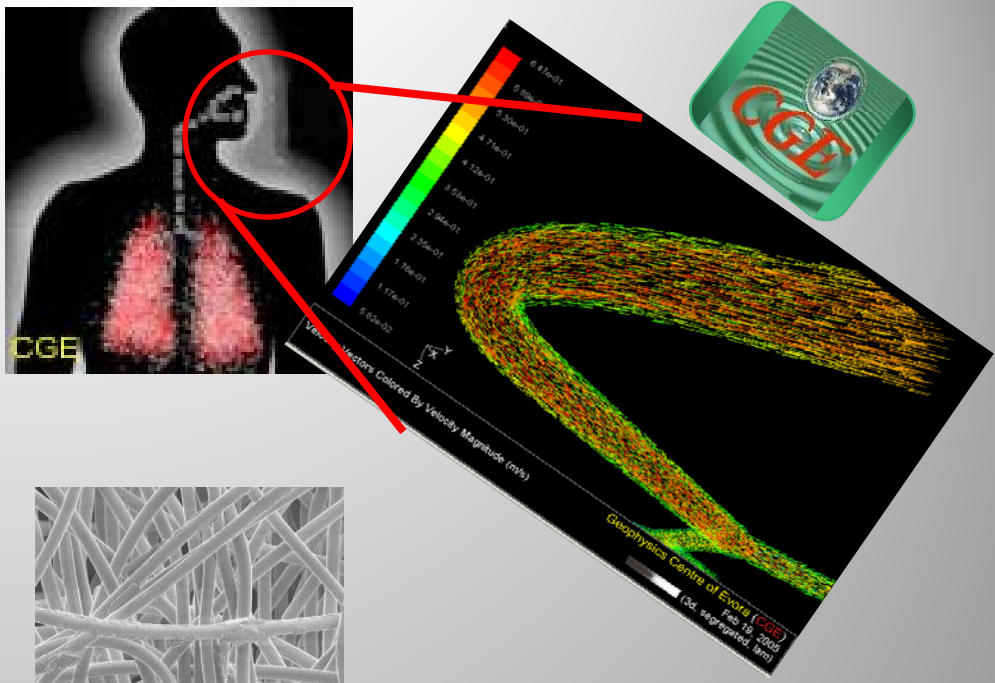
- **Surface flows (hydrographic basins)**



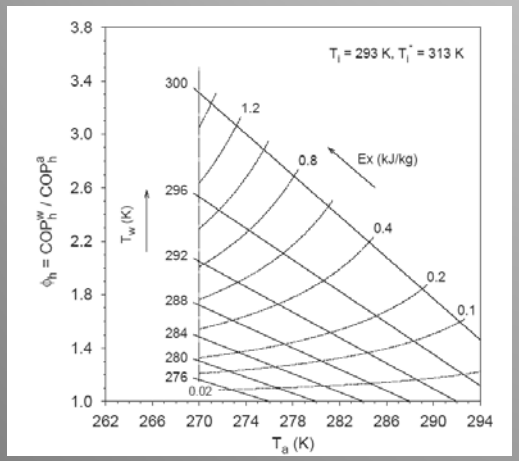
- **Atmosphere: general circulation structure**

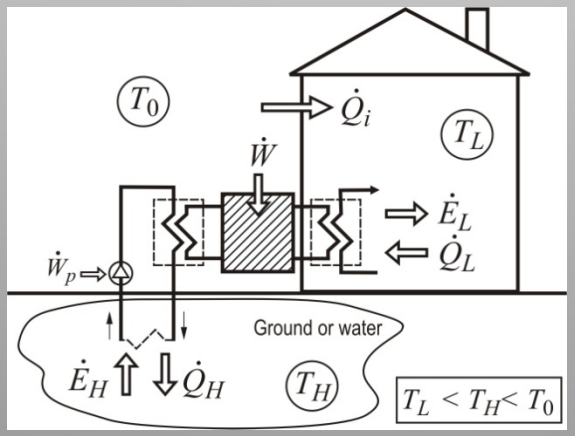


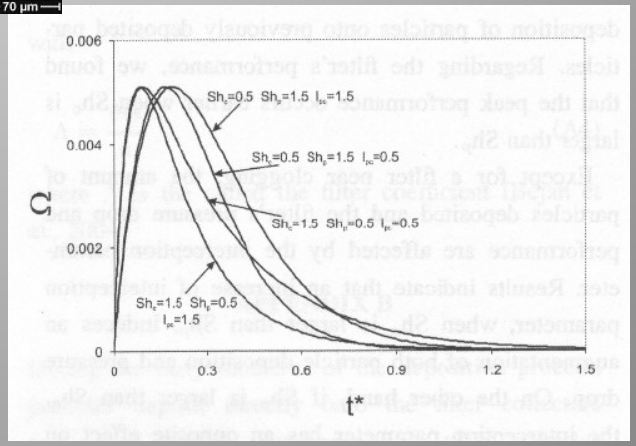



CGE
Vectors Colored By Velocity Magnitude (m/s)
Geophysics Centre of Evora (CGE)
Feb 19, 2005
(3d, segregated, lam)

70 µm

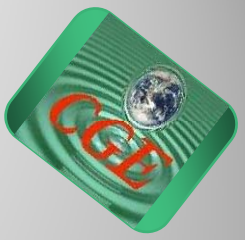

T_i = 293 K, T_i^* = 313 K
Ex (kJ/kg)
T_w (K)
$\phi_h = COP_h^w / COP_h^a$
T_a (K)


T_0
$\dot{Q}_i$
T_L
$\dot{W}$
$\dot{E}_L$
$\dot{Q}_L$
$\dot{W}_p$
Ground or water
$\dot{E}_H$
$\dot{Q}_H$
T_H
$T_L < T_H < T_0$


Ω
t*
Sh_c=0.5 Sh_s=1.5 l_{sc}=1.5
Sh_c=0.5 Sh_s=1.5 l_{sc}=0.5
Sh_c=1.5 Sh_s=0.5 l_{sc}=0.5
Sh_c=1.5 Sh_s=0.5 l_{sc}=1.5

Scientific Problems to be solved

Seismolitos

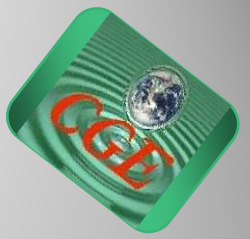


Seismolitos aims to cover a number of research themes possessing distinct scales, being part of an **Integrated Vision of the Earth System**. Reinforcement and acquisition of scientific instrumentation for the **observation**, study, **modelling** and **experimentation** of the **continental and oceanic lithosphere** to better understand **structure, dynamics and processes**, and involving, data acquisition, modelling and prediction of their evolution. Particularly emphasize will be given to **hazard situations**, where risk affects earth systems, in order to increase our scientific knowledge and technical capacity to produce information useful to **society**.

Studies of surface processes, structure and composition of ***other planets*** *(Planet physics / Planet formation).*

Instrumentation & Control Signal Processing & Signal Conditioning applied to multi sensing systems and observational networks.

Internal Geophysics



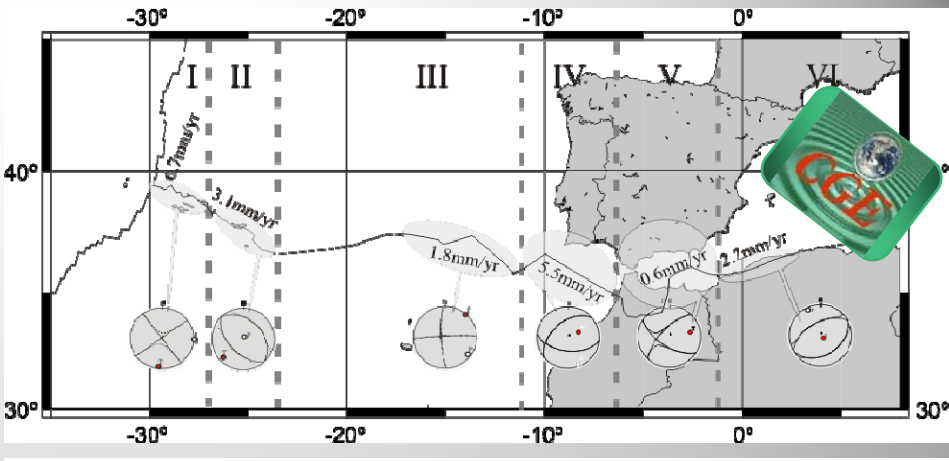
Team

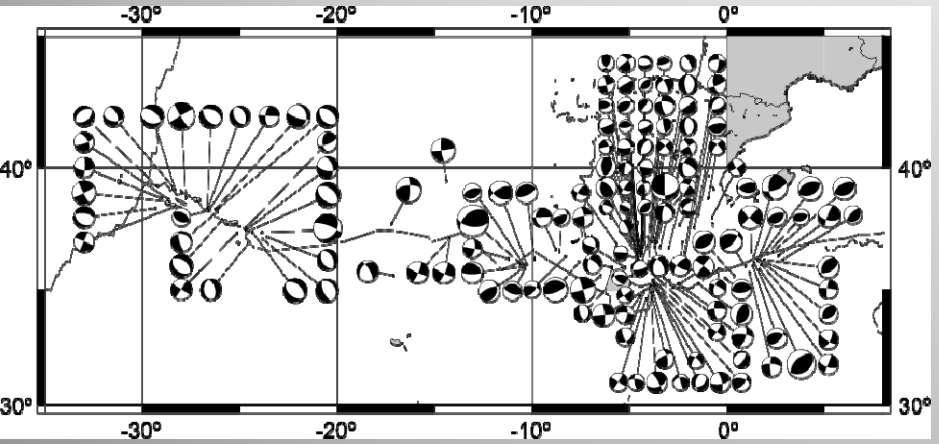
Mourad Bezzeghoud
António Correia
Bento Caldeira
Cármen Pró Munoz
José Fernando Borges
Maria Rosa Duque
Mouhaydine Tlemçani
André Jalobeanu
Delphine Fitzenz
Matthieu Ferry
Claudia Adam

Collaborators

Augusto Fitas
Filipa Vilallonga
João Casqueira
João Pedro Rocha
Nuno Cardoso Santos
Raphaël Grandin

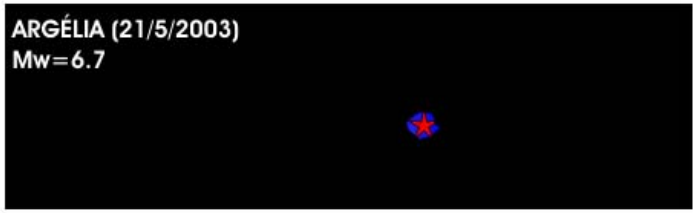
Earthquake source mechanism

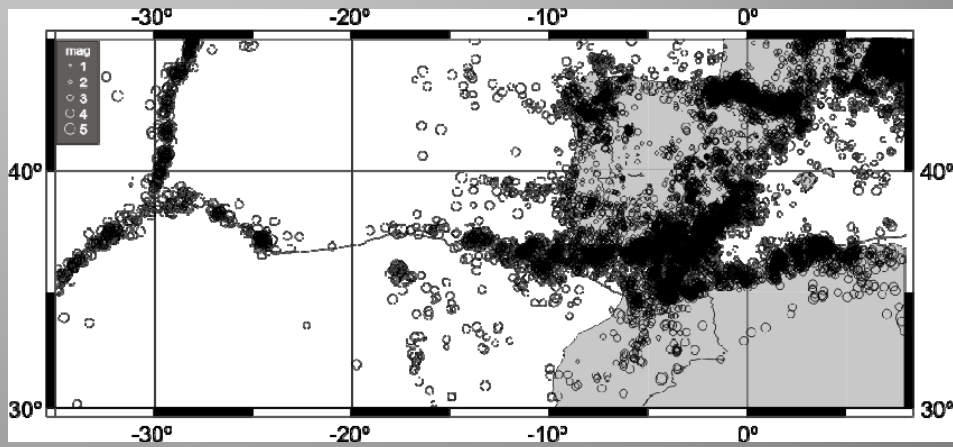




The study of the seismicity, seismotectonics and other topics related to the nature and effects of earthquakes for the assessment of earthquake risk in the Ibero-Maghrebian region

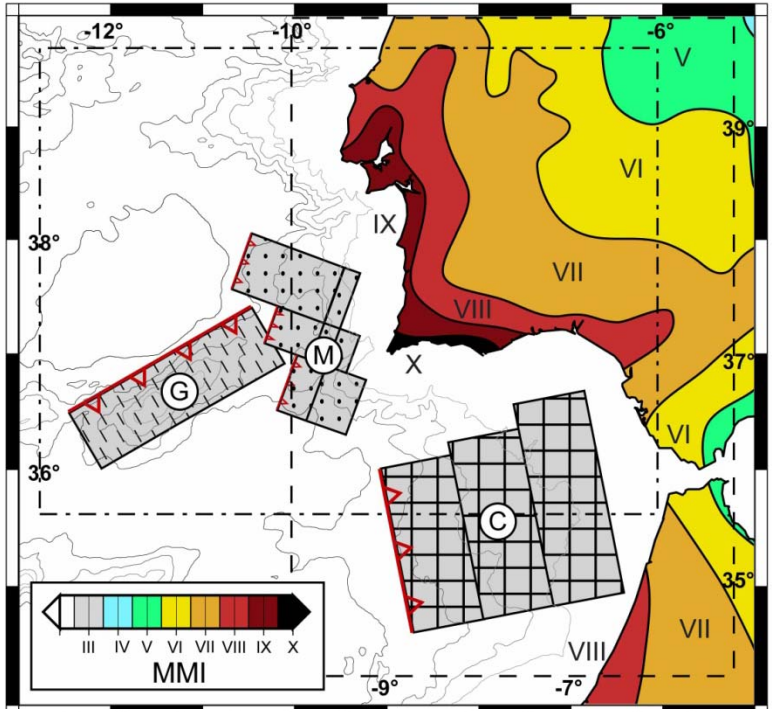
Seismic slip, rupture process and directivity

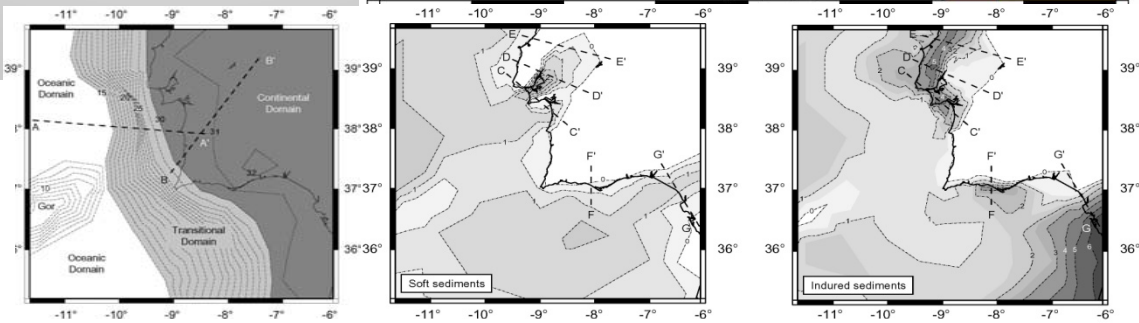


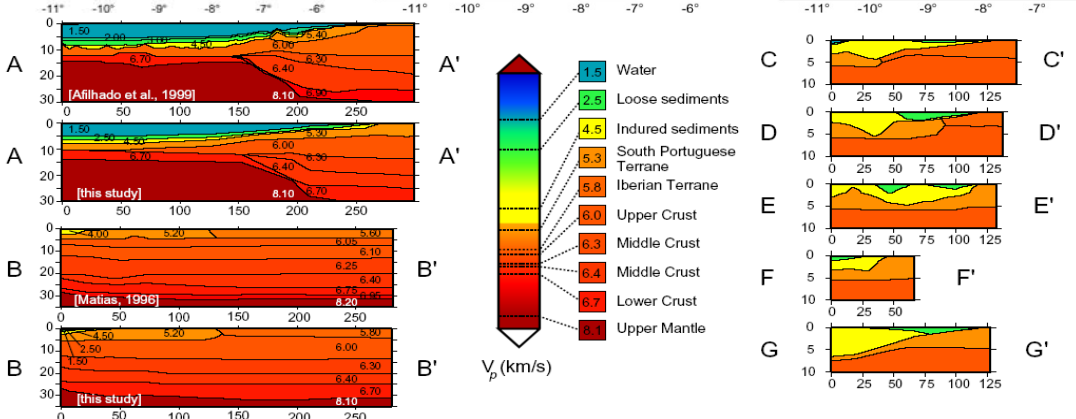


Earthquake source and
strong ground motion modelling

Structure of lithosphere
3D velocity model

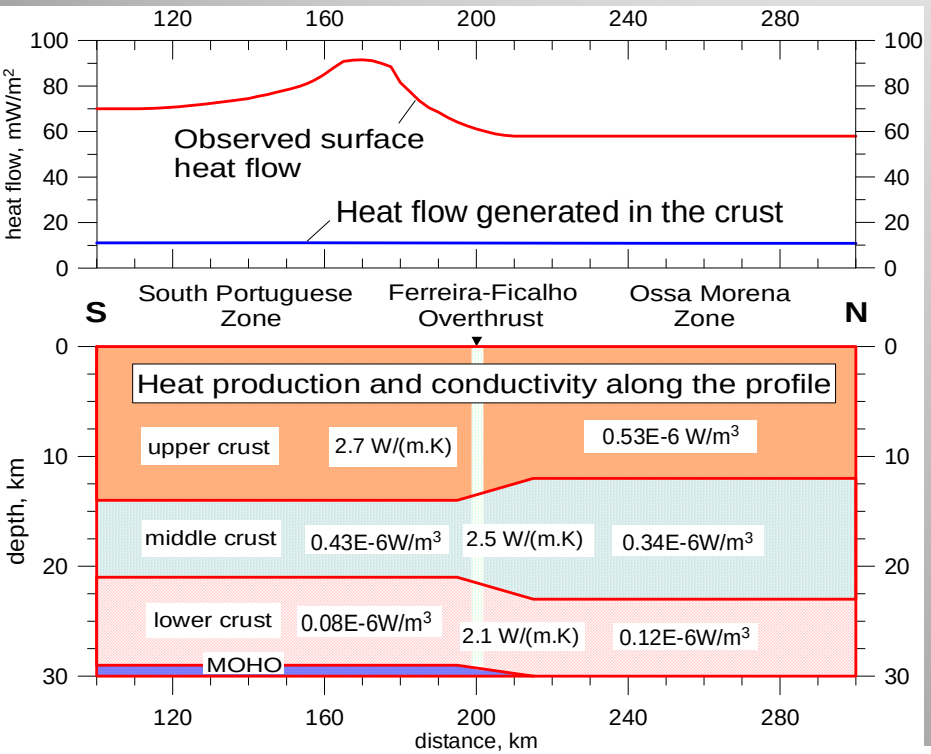


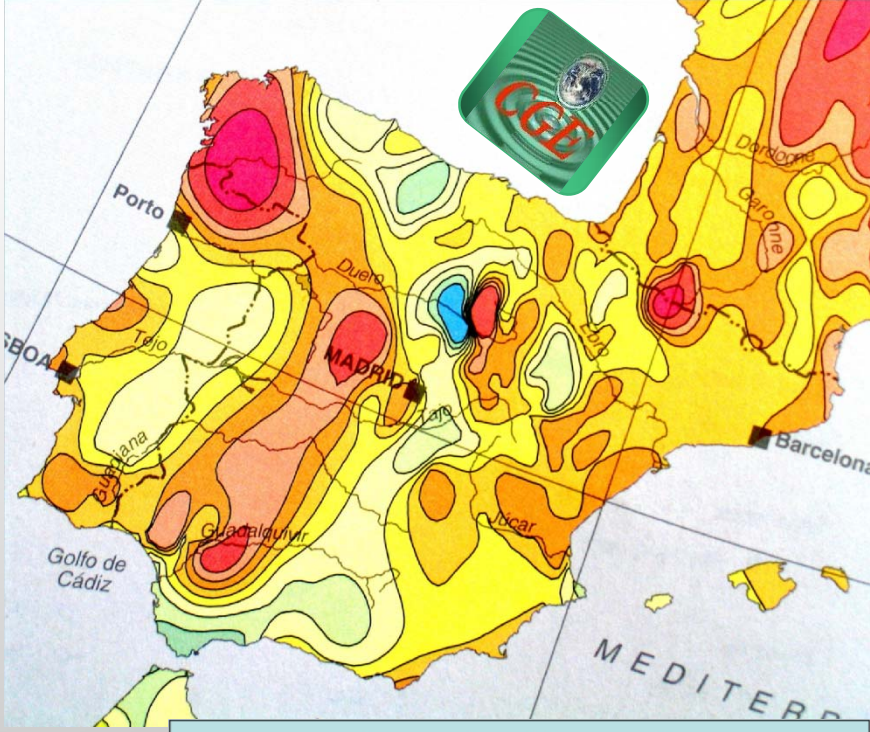


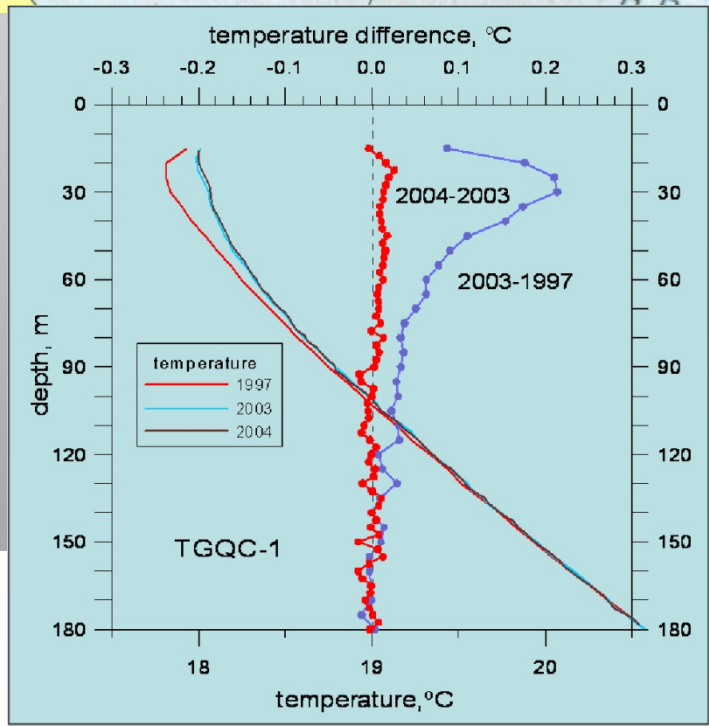


Applied Geophysics

- *Study of the climatic change in Portugal using geothermal information.*
- *Study of the thermal regime the crust in southern Portugal.*
- *Study of the geoelectrical structure of the crust in southern Portugal.*
- *Study of the Curie point depth in Portugal.*
- *Archaeomagnetism: study of the past geomagnetic field in Portugal using kiln data.*

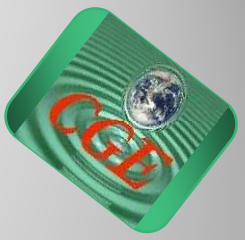






Temperature change
in southern Portugal
using geothermal information

Scientific Problems to be solved



Seismology, Geodynamic, Active tectonics

• Study of extended ruptures (finite seismic sources) from seismologic and geodesic data;
• Characterization of the deep structure beneath the Iberian Peninsula, mainly in its South and Southwestern margins (collision zone between Eurasia and Africa);
• Study of strong ground motions prediction and seismic risk assessment in Portugal, Spain and Morocco;
•Origin of the Azores;

Planetary Geophysics

• Study of transiting extra-solar planets and mass-radius relationship for low mass planets;

Applied Geophysics

• Reconstruction of the past climate in Portugal from borehole temperatures;
• Permafrost and Climate Change in the Maritime Antarctic. Contribution to the Global science; effort to bridge the gap in the knowledge of Antarctic permafrost characteristics, sensitivity and implications for climate change;
• Two-phase flow in fractured aquifers: degassing effects and resource sustainability;
• Identification of zones of high geothermal potential, in Portugal, improving soil knowledge and management with GeoElectrical and Geothermal properties;

Instrumentation Signal processing and signal conditioning :

Shape and pattern recognition using digital image processing

Dynamics of Geolocical Processes

PhD:
Alexandre Araújo
Rui Dias
António Chambel Pedro
António Martins
Carlos Madeira Coke
Carlos Ribeiro
Cristina Gama
Joaquim Luís Lopes
José Mirão
Júlio Carneiro
Manuel Francisco Pereira
Martim Chichorro
Pedro Madureira
Patrícia Martins Moita

MsC:

José dos Santos Borrego
Luís Barcínio Pinto
Mohamed Hadani
Rodrigo Rocha

LITHOSPHERIC STRUCTURES

Geological and structural mapping, tectonic analysis mainly in Ossa-Morena Zone.

Genesis and evolution of sedimentary basins. Sedimentary processes versus deformation.

Sedimentary instabilities and sin tectonic sedimentation.

Structural analysis in the exploitation of ornamental rocks.

Genesis and structure of gold ore-deposits in Algueireiras-Mosteiros (Tomar-Badajoz-Córdoba Shear Zone).

Fluvial fans analysis and crustal uplift evaluation (at Iberian Peninsula scale).

Experimental tectonics

PETROLOGY, GEOCHEMISTRY AND MINERALOGY

Mantle sources, evolution and emplacement of magmas in Azores region

Geochemical and geochronological mapping of Edicarian to Carboniferous formations in SW Peninsula and North of Africa.

Retention of toxic metals by secondary minerals in old mines (Mina de S. Domingos)

Crustal recycling, interactions mantle-crust.

Diagenetic processes in carbonated rocks.

Geological materials, Archaeology and Heritage

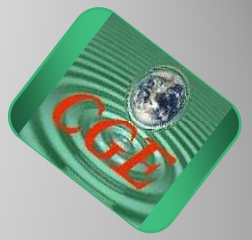
WATER, FLUID FLOW AND RECENT DYNAMICS

Veins and fractures connectivity, relation with folding during progressive deformation in an accretionary prism.

Coastal Geology and coastal dynamics: Morphological and sedimentary monitorization of the SW portuguese coast.

Groundwater resources

Scientific Problems to be solved



Can the use of **satellite imagery replace** the DGPS (Differential Global Positioning System) field surveys alongshore, giving **h**igh **a**ccuracy **di**gital elevation models (DEM)?

The role of **m**antle **p**lumes in the **A**zores region: the paradigm and the paradoxes

Major **l**ithospheric **a**nisotropies, **m**antle **p**lume **l**ocalizations and the **b**reak-up of continents!

Satellite **i**mage **a**nalyses and **m**ajor **t**ectonic **s**tructures; applications to Moroco.

Analogical **m**odelling of lithospheric structures

Mineral **d**etection through remote-sensing

Microseismicity, remote–sensing and how to find small active structures.