European Commission

When Geosciences tell us more about planet Earth

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Earthquakes and tsunamis, like the ones that struck Fukushima in Japan in March 2011, are examples of natural disasters with dramatic consequences. Earth Sciences or "Geosciences", known as Sciences of the planet Earth, are disciplines which could help to better predict or reduce the damages that would occur in such circumstances.

Geosciences embrace disciplines as diverse as volcanology, climatology, atmospheric sciences, seismology and oceanography. Geoscientists aim to better understand the interactions between the Earth's geology, atmosphere, oceans, biosphere and the human responses towards them.

The European Research Council (ERC) that funds junior and senior world-class researchers based in Europe, is keen on promoting fundamental research in all areas, including Earth Sciences. Around 150 projects are currently being funded by the ERC in this field, with a total budget of €270 million. Whereas some projects clearly fall into the ERC "Universe Sciences" or "Earth system Sciences" panels, others have an interdisciplinary nature, for instance projects looking at the impact of natural hazards on populations and environment.

Determined by policy-makers as an ever important field of research that knows no boundaries, Geosciences have acquired a higher visibility across the globe, including the US academic curricula.

Many ERC projects in the Geosciences address key societal challenges. The projects presented in this brochure are investigating the role of organic aerosols in climate change and air pollution, the long-term management of forests in the preservation of the ecosystem, microscopic processes that govern the flow of magma in volcanic eruptions, the development of a new 3 dimensional model of the Earth's mantle or the monitoring of the atmosphere through GPS for predicting tsunamis.

Measuring "*the fragility of the Earth*": a **new approach** for **predicting volcanos?**

Volcanos are remarkable, unpredictable, and alarming geological phenomena: we know they will erupt but we do not know when and how. ERC Starting grantee, Dr Yan Lavallée, based at the University of Liverpool (UK) proposes to add geo-material mechanics to the current models for volcano eruption. In order to better understand magma transport under the earth surface and during eruption, he will focus on "strain localisation in magma" (SLiM). He will apply a truly innovative and interdisciplinary approach to study microscopic processes governing the flow of magma and the deformations of rocks composing it, in particular at the exact moment when the risk of an eruption becomes high. This threshold moment is also a measure of the "*fragility of the Earth*". Results of these measurements combined with existing multidisciplinary datasets could help refine models simulating and monitoring volcano eruption and contribute to developing the new models of the Earth.

Principal Investigator: Dr Yan Lavallée

Host Institution: The University of Liverpool, United Kingdom

ERC Project: Strain Localisation in Magma (SLiM)

ERC Call: Starting Grant 2012

ERC Funding: €1.9 million for five years

Volcano eruption at Santiaguito (Guatemala).

Characterising organic particles and their **impact** on **climate change** and **pollution**

Organic aerosols (OA) are particles in the atmosphere that play an important role in climate change and air pollution. They are also known to be a potential cause of health problems. However, the source and exact properties of OA are still not well understood. Professor Spyros Pandis, an ERC Advanced grantee based at the Foundation for Research and Technology Hellas (Greece) investigates OA by studying their volatility (i.e. their tendency to evaporate) and their oxygen content using a new methodological approach combining state-of-the-art instrumentation and theoretical models. He studies OA in different indoor and outdoor environmental settings (ranging from chamber work to field measurements). The outcome of Prof. Pandis' research will allow to better characterise OA, to determine the different sources and pathways leading to their formation and to establish their direct and indirect role on climate. This work will improve our understanding of climate change. It may also aid in the development of air pollution mitigation strategies and could help improve people's health.

Researcher's webpage:
http://laqs.iceht.forth.gr/

Principal Investigator: Prof. Spyros Pandis

Host Institution: Foundation for Research and Technology Hellas, Greece

ERC Project: Atmospheric Organic Particulate Matter, Air Quality and Climate Change Studies (ATMOPACS)

ERC Call: Advanced Grant 2010

ERC Funding: €2.5 million for five years

Could we estimate tsunami wave heights from the ionosphere?

Some years ago, it was found that earthquakes can generate pressure waves in one of the atmospheric layers - the ionosphere - which in turn can affect Global Positioning System (GPS) signals. Since atmospheric signals travel much faster than tsunamis, they constitute a potential means to warn countries of upcoming tsunamis. With her ERC Starting Grant, Dr Elvira Astafyeva at the Institut de Physique du Globe de Paris (France) studies the ionosphere's response to large earthquakes by continuous GPS monitoring of the upper atmosphere. The outcome of her innovative research would contribute to determine parameters of seismic source from ionospheric data shortly after an earthquake. This would open new possibilities of early tsunami warnings.

Researcher's webpage:
http://www.ipgp.fr/~astafyeva/

Principal Investigator: Dr Elvira Astafyeva

Host Institution: Institut de Physique du Globe de Paris, France

ERC Project: Seismology in the ionosphere? This is REAL! Ionosphere as a natural indicator of numerous geophysical events (SIREAL)

ERC Call: Starting Grant 2012

ERC Funding: €858,000 for five years

Exploring the history of Central European woodlands and landscapes

The woodland vegetation of Central Europe has been influenced by humans for more than eight millennia and its successive management has profoundly altered its structure and species composition. By combining sources and approaches from history, palaeoecology, archaeology and ecology, ERC Starting grantee Dr Péter Szabó and his research team aim to reconstruct the long-term (Neolithic to present) patterns of woodland cover, structure, composition and management in a vast geographical region (Moravia, the Czech Republic, ca. 27,000 km^2) by using techniques with the highest spatio-temporal resolution possible. This project will contribute to building a more reliable methodology for forest management and conservation in Central Europe. It will also foster a paradigm shift in ecology positioning humans as an internal, constitutive element of ecosystems.

Researcher's webpage:
http://ekolbrno.ibot.cas.cz/index.php/en/projects/67-longwood.html

Principal Investigator: Dr Péter Szabó
Host institution: Institute of Botany ASCR, Czech Republic
ERC Project: Long-term woodland dynamics in Central Europe: from estimations to a realistic model (LONGWOOD)
ERC Call: Starting Grant 2011
ERC funding: €1.4 million for five years

Beech woods in Czech Republic

A 3D image of the inner Earth structure and dynamics

The theory of Plate Tectonics has been accepted for almost 40 years, explaining how the plates forming the Earth's crust slowly move, driven by large-scale convective circulation in the earth interior. These motions cause continental drift, and frictions between the plates are at the origin of earthquakes and tsunamis. Yet, what exactly happens in the Earth's subsurface is still a subject of debate between different disciplines. With her ERC Advanced Grant, Professor Barbara Romanowicz sets out to characterise the structure and dynamics of the deep Earth in greater detail than currently available. Her project aims to obtain a detailed, high-resolution 3D model of the Earth's mantle (the outer shell of the Earth, constituting 84% of its volume), by developing novel, highly innovative approaches for modelling seismological data (forward and inverse seismic waveform modelling) and by combining the results with the best available data from mineral physics and geodynamics. The project will also shed light on the structure of the Earth's inner core (the innermost, solid part of the Earth) and it will improve our understanding of how the Earth behaves and how it has evolved though geological times.

Researcher's webpage:
http://www.college-de-france.fr/site/en-barbara-romanowicz/

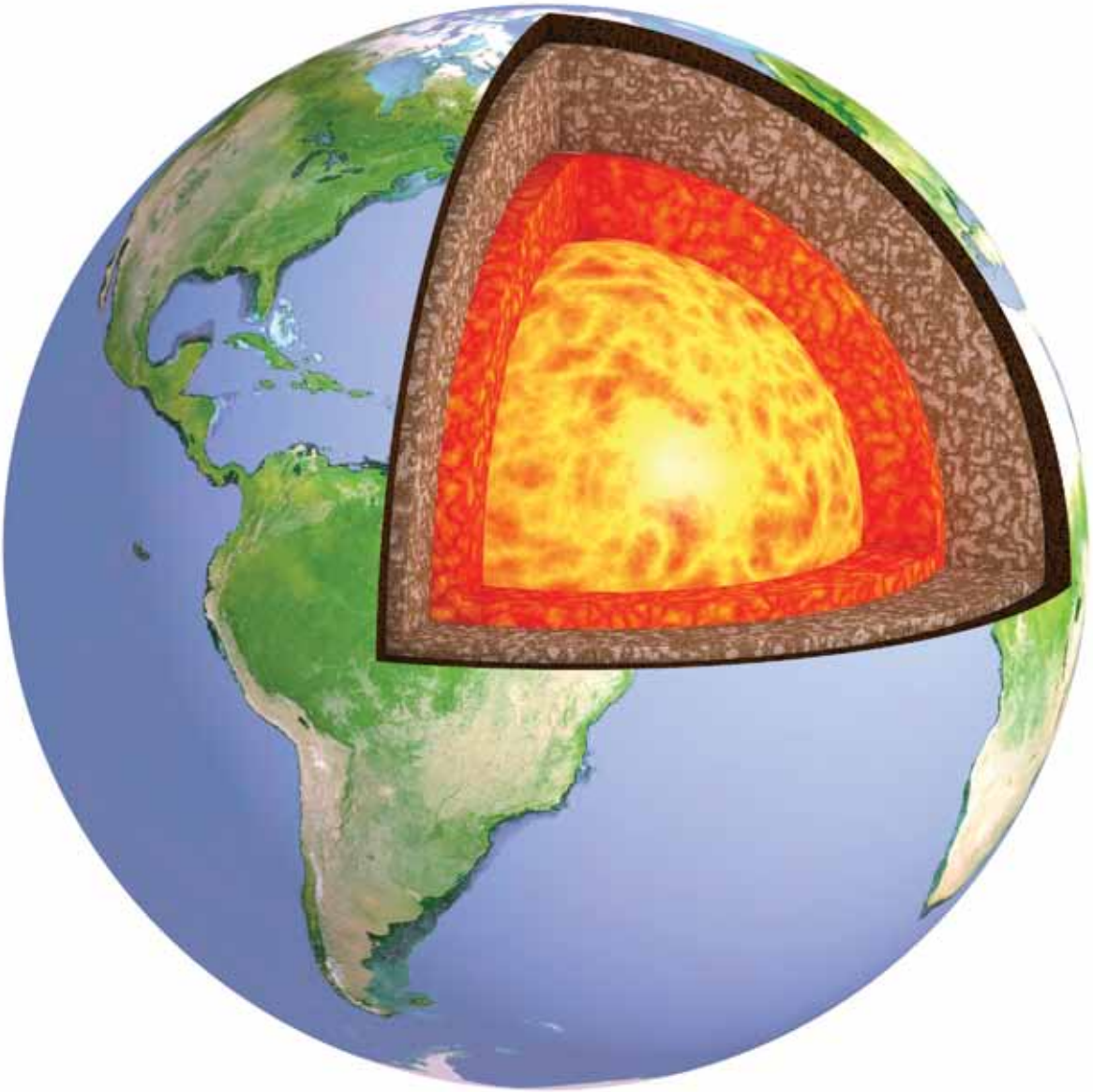
Principal Investigator: Prof. Barbara Romanowicz

Host institution: Institut de Physique du Globe de Paris, France

ERC Project: Imaging earth's internal structure using full waveform tomography (WAVETOMO)

ERC Call: Advanced Grant 2010

ERC funding: €2.5 million for five years



Watch Euronews report about **Greenland's ice** and **climate change**

A project led by **ERC grantee**
Dorthe Dahl-Jensen,
University of Copenhagen, Denmark

Euronews report:
http://www.euronews.com/2012/06/28/greenland-s-water-mistery/


THE NORTH FACE

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Prof Helga Nowotny
ERC President and Chair of its Scientific Council

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