



A Forward Look to a Roadmap for Solid Earth Science in Europe

17-18 October 2012

Institut de Physique du Globe de Paris

Meeting Report

Quoting Michel Diament, co-organiser and director of Earth sciences from CNRS:

- *People like to dream: about the origin of the Earth, the universe and life*
- *People Want to be safe: from natural hazards especially catastrophic events*
- *People want to be comfortable: to have a secure supply of energy, water and raw materials*

Earth sciences research helps underpin all of this.

The MISSION of our community is thus:

To provide our society with data, science and knowledge to better understand the internal dynamics of our planet and its history, for better management of resources, natural hazards and global changes.

*There are a number of initiatives in Europe involving both research programmes and infrastructure development across the scientific community, and roadmaps exist or are in preparation in various parts of this broad community. Many sectors also have recognised boards or platforms to represent them on the EU and wider world stage. It was therefore felt timely to bring together representatives of the Earth Science community to discuss the future science requirements. As a result, this initial meeting was hosted by IPG in Paris as a starting point for the process. Invitees included key representatives from across the earth science community in Europe. A final list of attendees and their affiliations is presented in **Annex 1**.*

Aims

- To enhance the scientific credibility of Earth science by establishing a **coherent roadmap** for Solid Earth Science, to deliver the science Europe needs.
- The target area is the **earth sciences** [geology, geophysics and geochemistry] applied to the solid Earth and its interactions with the hydrosphere and atmosphere.
- Broad areas of impact of the research are principally in Earth's resources and their secure exploitation and natural hazards associated with the Earth system.

Why now?

- The launch of [Horizon2020](#) (H2020) which includes scientific research from fundamental science to applied science to address the grand societal challenges training programmes and infrastructure;
- A number of European infrastructure programmes and Joint Programming Initiatives (JPIs) in the earth science sector that are in the preparation phase;
- Renewal and review processes in some key international programmes such as [IODP](#), [ICDP](#), [IGCP](#), [TopoEurope](#), [ILP](#), etc.
- Publication of national earth science infrastructure and science plans/roadmaps by Germany, UK, Australia, USA and Chinese governments, etc.
- New Earth observing satellite systems
- An increasingly robust science base in [BRICS](#) countries for potential develop partnerships.

<http://www.earthscienceeurope.org>





Earth Science Europe

Key Questions

- *What do we think are the top research priorities in the Earth Sciences?*
- *What infrastructure do we need to undertake the research to address these priorities?*
- *What specific research programmes would be of value for Earth Sciences in Europe?*
- *How can we translate science into impact?*

The Organising Committee

John Ludden, NERC-BGS, Natural Environment Research Council, British Geological Survey, UK

Massimo Cocco INGV-EPOS, Istituto Nazionale di Geofisica e Vulcanologia, Italy

Domenico Giardini ETH, Die Eidgenössische Technische Hochschule Zürich, Switzerland

Joern Lauterjung GFZ, Gemeinschaft Deutscher Forschungszentren, Helmholtz Centre Potsdam Germany

Michel Diament INSU- Cnrs, L'Institut national des sciences de l'Univers (INSU), France

Michael Rast ESA, European Space Agency

Sierd Cloetingh University of Utrecht, The Netherlands

Claude Jaupart Institut de Physique du Globe de Paris (meeting host)

Meeting outputs

The meeting was opened by John Ludden on behalf of the organisers, with a welcome and general introduction of the initiative, its rationale and the programme. Invited speakers then gave c.10 minute presentations on key European infrastructures and programmes:

- EPOS (*Massimo Cocco, INGV*)
- OneGeology Europe/EGDI-scope (*Rob Van der Krogt, TNO*)
- IODP (International Ocean Drilling Programme) (*Kiyoshi Suyehiro, president & CEO IODP Management Office*)
- EMSO (European Multidisciplinary Seafloor Observatory) (*Achim Kopf, MARUM Bremen*)
- Earth sector satellites (*Pierre-Philippe Mathieu, ESA*)
- GEMIS Consortium of ES National Laboratories (*Joern Lauterjung, GFZ*)
- Deep Carbon Observatory (*Chris Ballentine, Manchester University*)
- TOPO-Europe ESF EUROCORES programme (*Sierd Cloetingh, Utrecht University*)
- EUROPICS European Partnership in Ice Core Sciences (*Carlo Barbante, University of Venice*)

All of these presentations are now available on the website: <http://www.earthscienceeurope.org>

Breakout groups then addressed three key questions:

1. *What will be on the **key research questions** in Earth Sciences?*
2. *What **Research Infrastructure** is needed and how best to use / link what we have*
3. *Identify key areas for **Joint Programme** and their general characteristics*

The unedited outputs from each of the breakout groups, as presented in **Annex 2**.



<http://www.earthscienceeurope.org>

Earth Science Europe

Consensus of Breakout groups' reports and subsequent discussion

Key themes for the next 20 years

- Integration of research and monitoring efforts
- Harmonisation of methodologies
- Sharing/establish shared facilities
- Data and sample sharing – and storage/archiving

Three pillars

- Science
- Infrastructure
- Society (Impact and communication/KT)

1. Key research questions

*The overarching challenge for the research community is to understand the **Geosystem as a whole**, understand processes acting in the different compartments of System Earth and processes interlinking deep earth with surface and atmosphere/hydrosphere. How can we develop a 4D model of the earth? Specific areas of research identified include fundamental research and understanding through to addressing more defined societal challenges:*

Major challenges:

- Climate Change
- Natural Hazards and Risks
- Resources (Water, Rare materials, Energy)
- Origins
- Earth Dynamics

Climate Change

1. How to mitigate / eventually eliminate risk from hazards and make society more resilient to them
2. Climate sensitivity, based on past changes, with Quaternary palaeo-climatology playing key role and how can we integrate the different proxies and sample types
3. Impact and response of the earth, ecosystems including civilization to past and future climate change through hydrologic processes and mass wasting.

Natural Hazards and Risk

4. Establish better physical basis for earthquake, landslides and tsunamis and other natural hazards. Material basis for processes; the brittle-ductile transition controls in e.g. Volcanic systems, earthquakes
5. Natural hazards interface from the data to society

Resources

6. Establish better means to assess extent, genesis, conservation, and means to safely exploit natural resources including energy, renewable and non-renewable, water, and metals, and deal with waste.

Origins

7. Early Earth – The co-evolution of life, the atmosphere, water, segregated core, mantle and continental crust.
8. Using process understanding from basic research to make forecasts of, for example, global change.



Earth Science Europe

Earth Dynamics

9. Connections between deep Earth dynamics, surface processes, hydrology and climate
10. Multi-scale understanding of plate tectonics and plate motion timescales, linking many disciplines and infrastructure, studying linkage of deep earth (mantle and core processes) and shallow (crustal) process.

2. Research Infrastructure

Common themes, as well as specific needs came out of these discussions for new European infrastructures. It was the general consensus that much of the necessary infrastructure already exists at National level, but there is a need for increased coordination and additional European component/dimension and development of the necessary infrastructure to share outputs (basic data, derived data, models etc.).

Specific Infrastructure needs identified:

- Multi-parameter Observatories (linking geophysics, geochemistry, hydrology, meteorology, environmental parameters etc.) at supersites providing permanent integrated monitoring of key, integrating land-marine-remote components, including continental shelves, the Arctic, faults and natural hazards.
- Multi-parameter equipment pools to enable increased resolution on specific areas/problems and bridge with exploration geophysics .
- Mobile field equipment for large scale European field experiments
- Dedicated multi-parameter-satellite missions for the earth science sector
- Drilling equipment: Seabed, land, fault zones, Ice
- Network of borehole observatories (Basin studies, Modeling)
- Marine cable networks (high synergy effects to other communities)
- Linking of existing ice and sediment core data, linkage of marine and continental infrastructure e.g. a data portal for climate proxies in Europe
- Analytical facilities: Geochemical, geomechanical, geochronological laboratories –many already exist and there is a need to identify best labs; jointly decide on access; joint training, European standard laboratory facilities including sample preparation
- IT (including HPC)
- High-grade curation facilities for safe/biosafe environments
- Data and information sharing and service provision to the different user communities: academic, industry, government and public.

3. Joint Programming

The need for long-term multi-disciplinary international programmes was clearly recognised. Possible themes for large-scale programs of value for Earth Sciences in Europe, many with obvious demonstrable component of societal relevance, which could be developed under Horizon2020 as **coordinated research (CR) or infrastructure programmes (RI)** and/or Joint Programming Initiatives (JPIs) are listed below:

- Geosciences and society – impacts and communication (CR)
- Georesources (possible JPI) (CR)
- Geosecurity (including megacities) (CR)
- Extremes and threats (natural and man-induced) (CR)
- Climate Sensitivity, Impacts and Adaptation (CR)

<http://www.earthscienceeurope.org>





- Deep Earth and surface interactions (including climate) (CR)
- Origins (life, Old Earth, Solar System and other planets, sudden onsets, volatiles) (CR)
- Fluid-flows (CR)
- Geomicrobiology (CR)
- How does Plate Tectonics work?? A new plate tectonic paradigm (RP)
- Multiparameter observatories (RI)
- Satellite arrays – deep observations and improved temporal and spatial resolution (RI)
- Drilling Europe (RI)
- Data sharing (RI)

4. General Considerations/Questions

- Need to improvement of information flow within Earth Sciences community
- Need for better understanding between disciplines and integration of different parts of the community's specialist skills and knowledge
- Drive for increasingly multidisciplinary working – and integration with bio-, hydro-, atmo- and cryo-sphere studies
- Need to for the academic and research community to work more closely with industry, i.e. exploration
- Need for true international collaboration, Europe and beyond, geoscience is global.
- Long-term funding is a key requirement to allow the scientific potential to be achieved.
- Need for efficient instruments (funding/policy) to select, launch and coordinate large-scale science and Europe-wide programs maximizing synergies and multi-disciplinary approaches
- Need to align with Horizon2020, but maintain the bottom-up proposition capacity of science
- Geoscience and Society, the need to work with the social science community, especially in the areas of managing geohazards and geo-resources
- Requirement to translate science outputs into products that benefit society: outreach component , the scientific community should be more directly involved in public outreach, especially in themes or critical relevance.
- How can we as Geoscientists convince society of our level of understanding? Need to improve information flow at Interface with stakeholders/the public to build confidence
- Recognition of training needs for the next generation of earth scientist, specialist teaching by specialists in their fields.

Key drivers for the production of a roadmap

A roadmap document is critical to leverage funds to achieve the above.

As H2020 stands, the expressed challenges are almost entirely societally driven. There is no explicit mention of geosciences or issues such as geohazard (risk is the generic issue included) although the need for geoscience to address many of the challenges is implicit. It was felt that these should not be the primary drivers for the *science of the next 20-30 years*.

It was also agreed that this initiative should aim to ensure basic science and enquiry, fundamental earth science research is not squeezed out in favour of work driven by today's societal needs/perceived needs and political agenda. Breakthroughs in basic research trickle down into application and applied research, and to the solutions society seeks.

What's next? Follow up

- Input to EC RI consultation (22 October 2012) (Completed)
- Preparation of a "position paper" (November 2012) (in draft)
A statement capturing the outcomes of this meeting, its conclusions and the consensus views from the breakouts
- Consultation phase (position paper: online) open to the wider earth science community, its stakeholders and other interested parties
- Wider stakeholder meeting (winter 2013)
- Presentation of draft Roadmap documents (April 2013).
Organize a "town hall" meeting or similar at the next EGU meeting 7-12 April 2013 in Vienna
- Start organizing and lobbying individual initiatives directly (including JPI on geo-resources)

Deliverables

Roadmap documents

1. A general high-level document, a relatively short glossy document summarising the science, scientific needs and relevance to European citizens for the next 10-20 years, such as The Royal Astronomical Society's : [A New View of the Universe: Big Science for the Big Society](#).
2. A pure science document for scientific community's use, rather than the wider stakeholder use e.g. the US National Science Foundation [GeoVision](#) etc.

Goals

- To influence forthcoming H2020 calls and work programmes
- To raise geoscience on National Agendas
- To lobby for a JPI in Georesources
- To form the basis of an independent [Solid] Earth Science Board cf. the EU Marine Board **Annex 3** to represent the Geosciences, to promote collaboration and with the ability to lobby.

Writing team:

The Organisers with invited contribution from:

- Sean Willett, *ETH Zurich*,
- James Badro, *Institut de Physique du Globe de Paris (IPGP)*,
- Chris Ballentine, *University of Manchester, UK*,
- Jan W. de Leeuw, *Royal NIOZ and King Saud University*,
- Jens Turowski, *Swiss Federal Research Institute WSL / EGU Geomorphology Division*
- Martha Heitzmann, *AREVA France*
- Jean-Jacques Jarrige, *EAGE, Oil & Gas Division*
- Graham Brown, *Anglo American*



Annex 1 Attendees

Name	Affiliation
Achim Kopf	MARUM Bremen
Anna Maria Johansson	European Commission, DG Research & Innovation
Barbara Romanowicz	Institut de Physique du Globe de Paris (IPGP)
Bernard Marty	CRPG-CNRS / Université de Lorraine
Bonnie Wolff-Boenisch	Head of Research Affairs, Science Europe
Branislav Zec	Director, State Geological Institute of Dionyz Stur Geological Survey of Slovak Republic
Brian McConnell	Geological Survey of Ireland
Carlo Barbante	Institute for the Dynamics of Environmental Processes-CNR University of Venice, Italy
Chris Ballentine	University of Manchester, UK
Chrystele Sanloup	School of Physics & Astronomy, University of Edinburgh, UK
Claude Jaupart	Institut de Physique du Globe de Paris (IPGP)
Domenico Giardini	ETH Zürich
Don Dingwell	Munich/Brussels
François Robida	Bureau de Recherches Géologiques et Minières (BRGM)
G. Hilmar Gudmundsson	British Antarctic Survey, Cambridge, UK
James Badro	Institut de Physique du Globe de Paris (IPGP)
Jan W. de Leeuw	Royal NIOZ and King Saud Univ.
Jannick Ingrin	UMET, Université de Lille
Jean-Jacques Jarrige	EAGE, Oil & Gas Division
Jens Turowski	Swiss Federal Research Institute WSL /EGU Geomorphology Division
Jerzy Nawrocki	Polish Geological Institute - NRI
John Ludden	British Geological Survey
Jörn Lauterjung	GFZ - GeoForschungsZentrum, Germany
Josep Gallart	Institute of Earth Sciences – CSIC, Barcelone, Spain
Karel Schulmann	Czech Geological Survey
Kiyoshi Suyehiro	IODP Management International
Laurent Jolivet	Universite D'Orleans
Ludwig Stroink	Helmholtz-Centre Potsdam GFZ - GeoForschungsZentrum, Germany
Marc Chaussidon	Institut national des sciences de l'Univers - INSU - CNRS
Marc de Jonge	Netherlands Organisation for Scientific Research Earth and Life Sciences Division
Marek Lewandowski	Professor of Earth Sciences, Director Institute of Geological Sciences P.A.S. Warsaw
Markku Poutanen	Finnish Geodetic Institute
Massimo Cocco	INGV Rome / EPOS PP Coordinator
Michel Diament	Institut national des sciences de l'Univers - INSU - CNRS
Mireille Perrin	INSU-CNRS / CEREGE



Earth Science Europe

Name

Montserrat Torne
Nick Arndt
Oksana A. Tarasova
Patrick Landais
Paola Campus
Paul Bogaard

Pawel Rowinski
Pierre-Philippe Matthieu
Rob van der Krogt

Sean Willett
Sierd Cloetingh
Stefano Tinti
Stuart Marsh
Trond H. Torsvik
Ulrich Achauer
Vicky Hards
Yves LE-STUNFF

Affiliation

Institute of Earth Sciences – CSIC, Barcelona, Spain
University of Grenoble
World Meteorological Organization
ANDRA
European Science Foundation (ESF)
International Policy Officer
Geological Survey of the Netherlands - TNO
Institute of Geophysics, Polish Academy of Science
ESA
Coordinator EGDI-Scope
Geological Survey of the Netherlands - TNO
ETH Zurich
Utrecht University
Università degli Studi di Bologna
British Geological Survey
University of Oslo (PGP)
EOST-IPGS, Seismology Lab
British Geological Survey
Total





Annex 2

Breakout Group Reports

These are exactly as presented to the workshop attendees by respective rapporteurs, excepting formatting no editing has been carried out.

BG1

Research Infrastructures

Identified themes for new European infrastructures, to be developed starting from the existing national RI (+coordination) and adding a European component/dimension

- ✓ Supersites, for permanent integrated multi-disciplinary monitoring of key, integrating land-marine-remote components, including continental shelves, Arctic, fault observatories
- ✓ Multiparameters pools to enable increased resolution on specific areas/problems and bridge with exploration geophysics
- ✓ Drilling
- ✓ IT (including HPC)
- ✓ High-grade curation facilities for safe/biosafe environments

Joint Programmes

Identified themes for large-scale programs with a strong component of societal relevance, to be developed as JPI in Horizon2020 or as coordinated research programs,

- ✓ Georesources (possible JPI with ES coordination)
- ✓ Geosecurity (including megacities)
- ✓ Extremes and threats (natural and man-induced)
- ✓ Origins
- ✓ Deep Earth and surface interactions (including climate)
- ✓ Origins (life, planets, sudden onsets, volatiles)
- ✓ Fluid-flows

General Considerations

- ✓ We need efficient instruments to select, launch and coordinate large-scale science and Europe-wide programs (i.e. ESF), maximizing synergies and multi-disciplinary approaches.
- ✓ ES should be more directly involved in public outreach, especially in themes or critical relevance
- ✓ We need more coordination of the large national labs (i.e. geochemistry, high P/T) - both science programs and technical – rather than European facilities
- ✓ Integration with bio, hydro, atmo and cryospheres
- ✓ Align with Horizon2020 and Rio+20, but maintain the bottom-up proposition capacity of science
- ✓ Work more closely with industry, i.e. exploration
- ✓ Improve dissemination and promote role of ES in society



Earth Science Europe

BG2

What do we think are the top research priorities in the Earth Sciences?

We felt uncomfortable with the top research priorities, therefore we concentrated the discussion on major challenges

General challenge is to understand the Geosystem as a whole, understand processes acting in the different compartments of System Earth and processes interlinking deep earth with surface and atmosphere/hydrosphere

Major challenges:

- *Climate Change*
- *Natural Hazards and Risks*
- *Resources (Water, Rare materials, Energy)*
- *The deep biosphere*

Interface to stakeholders/the public

Improvement of information flow within Earth Sciences

Research Infrastructures

Multiparameter Observatories (linking geophysics, geochemistry, hydrology, meteorology,....)

Dedicated (multi)-satellite missions for gravity, magnetic field, etc.

Network of borehole observatories (Basinstudies, Modelling)

Marine cable networks (high synergy effects to other communities)

Seabed drilling equipment

Mobile field equipment for large scale european field experiments

European Lab facilities including sample preparation

Four key Programme Initiatives

- Multiparameter Observatories + Satellites
- Drilling Europe
- Raw Materials Initiative
- Data sharing





BG3

Priority Areas for Earth Science Research

1. Early Earth – The co-evolution of life, the atmosphere, water, segregated core, mantle and continental crust.
2. Understanding fault dynamics from the seismic cycle to plate motion timescales.
3. Connections between deep Earth dynamics, crustal tectonics, surface processes, hydrology and climate.
4. Impact and response of the earth, ecosystems including civilization to past and future climate change through hydrologic processes and mass wasting.
5. Links between physical erosion, chemical weathering, the long-term carbon cycle, climate and geobiochemical cycles.
6. Establish better means to assess extent, genesis, conservation, and means to safely exploit natural resources including energy, renewable and non-renewable, water, and metals.
7. Establish better physical basis for earthquake, landslides and tsunamis and other natural hazards.

Research Infrastructures

- General feeling that a lot of equipment facilities / observatories are available, but what lacks is cross-border networking
- Specific examples
 - Geophysical networks / arrays and experiments -> coordinate joint use of nationally available instruments on large scale experiments
 - Geochemical and geomechanical laboratories – specifically Ion microprobes / micro-analysis -> need to identify best labs; jointly decide on access; joint training
 - Ships, airplanes,

Joint Programmes

What specific research programmes would be of value for Earth Sciences in Europe?

- What mechanisms are there to fund certain initiatives
 - Can we fund long term observatories?
 - What about real international collaboration?
 - Individual funding in US is downgraded; collaborative funding promoted
- Intermediate size science projects are missing
- organising Joint Programming Initiatives -> metrology example
- ESFRI: Joint Programming Initiatives
- S-organise this -> start with small groups and force national agencies
- How do you organise this? -> set up larger scale competitive calls, or
- Need for a long-term program for international, multi-disciplinary projects





Earth Science Europe

BG4

Key Research Questions

- Material basis for processes; the brittle-ductile transition controls in e.g. Volcanic systems, EQ
- Multi-scale understanding of plate tectonics, linking many disciplines and infrastructure, studying linkage of deep earth/mantle and shallow/crustal process
- Related to this, Early Earth and the origin of life
- How to mitigate / eventually eliminate risk from hazards and make society more resilient to them
- How geo/fluid dynamics concentrate geo-resources (driven by EU political focus on minerals and energy) inc. surface processes enriching deposits e.g. erosion
- Climate sensitivity, based on past changes, with Quaternary palaeo-climatology playing key role
- Bridging the gap from earthquakes to geological deformation, in between major events
- Better understanding shale gas systems including fracturing process, how to explore for resources
- Where and how to store and then monitor CO₂?
- Can a resource economy be sustained in Europe?
- Using process understanding from basic research to make forecasts of, for example, global change

Research Infrastructures

- Natural hazards should be a focus in own right, needing specific infrastructure to address them including an interface from the data to society
- Bathymetry for submarine/coastal landslides
- Linking of existing ice and sediment core data, linkage of marine and continental infrastructure e.g. a data portal for climate proxies in Europe
- Better integration of the top geochronology labs, as one element of improved time calibration
- **Less invasive geophysical exploration techniques**

General Considerations

- Funding mechanisms are part of the infrastructure; we should look at how they can help the roadmap
- We need a mechanism to fund major programmes, like Earthscope; are we exploiting existing ones well?
- Infrastructure needs to be built to share more than basic data; it is needed for models, too, for example
- This needs better understanding between disciplines and integration of our specialist skills and knowledge
- Requirement to translate our science outputs into products that benefit society: outreach component

Joint Programmes

- Geoscience and Society, with social sciences where there are major future funding sources, including both geohazards and geo-resources; e.g. how can we mine sustainably in Europe?
- How does Plate Tectonics work? Coupling deep & crustal processes? Whole Earth System? Solid Earth dynamics? Engine Earth? New Tectonics?
- Climate Sensitivity, Impacts and Adaptation
- Old Earth, Solar System and other planets.



Annex 3

European Marine Board

The European Marine Board provides a pan-European platform for its member organisations to develop common priorities, to advance marine research and to bridge the gap between science and policy, in order to meet future marine science challenges and opportunities.

The European Marine Board facilitates enhanced cooperation between national organisations involved in marine science (both research institutes and research funding agencies), European stakeholder networks and wider marine and maritime stakeholder communities, towards the development of common positions on the research priorities and strategies for marine science in Europe.

As an independent non-governmental advisory body, the Marine Board develops insight and foresight, recognising opportunities and trends, presenting compelling and persuasive arguments that shape the future of marine research in Europe. The Marine Board provides the essential components for transferring knowledge for leadership in marine research. Adopting a strategic role, the Board serves its Member Organisations by providing a forum within which marine research policy advice to national agencies and governments and to the European institutions and agencies is developed, with the objective of promoting the establishment of the European *Marine Research Area*.

The European Marine Board operates via four principle approaches which underpin the Board's main objective of bridging the gap between science and policy

1. **Forum** – bringing together European marine research stakeholders to share knowledge, to identify common priorities and approaches, to develop common positions and perspectives, and to collaborate;
2. **Synergy** – fostering European added value to national programmes, facilitating access and shared use of national marine research facilities, and promoting synergy among international programmes and organisations;
3. **Strategy** – identifying disciplinary and inter-disciplinary marine scientific issues of strategic importance for Europe, initiating analysis and studies, and providing high-level recommendations for European and national programme managers, research funders and policy makers as well as the scientific community;
4. **Voice** – expressing a collective vision of marine research priorities towards a European strategy for marine research, in order to meet future science and societal challenges and opportunities.

History

In the early 1990s, leading members of the marine research community in Europe identified a need to create a platform to promote enhanced cooperation in marine science at European level. Building on the momentum of the European Committee for Ocean and Polar Sciences (ECOPS) 1994 conference, *The Grand Challenges*, the Marine Board was established by its Member Organizations (with support from the European Commission FP MAST programme) in 1995 as part of the European Marine and Polar Sciences Board (EMaPS). It was decided that a joint secretariat would be hosted at the ESF headquarters in Strasbourg to support EMaPS activities. On the basis of an independent 1998 review, EMaPS was dissolved in 1999 and the Marine Board and Polar Board were retained independently.

Since 1999, the Marine Board has evolved into a dynamic, innovative and creative organization drawing on its membership and the wider marine science community to advance the European marine research and policy agenda. The creation of [Expert Working Groups](#), the publication of [Strategic Position Papers](#) and the [Navigating the Future series](#) as well as the facilitation of major marine science conferences (e.g.

<http://www.earthscienceeurope.org>

A thick, wavy green line runs horizontally across the bottom of the page, mirroring the design element at the top.

Earth Science Europe

[EurOCEAN conferences](#)) have all contributed to the development and implementation of a European Strategy for Marine and Maritime Research (adopted by the European Commission in September 2008). The Marine Board plays a major role in promoting the importance of science and technology in sustainable ocean development and governance. A number of targeted instruments provide perspectives on the challenges and opportunities facing marine science and technology and the societal issues that need to be addressed. The biennial [Marine Board Open Forum](#), brings together stakeholders from science, policy and industry to tackle research, technology and innovation issues of strategic importance for Europe.

In 2007, the Marine Board moved its Secretariat from the ESF headquarters in Strasbourg (France) to the InnovOcean site in Ostend (Belgium), offered and supported through an *in-kind* contribution from the Flemish Government.

<http://www.marineboard.eu/>



<http://www.earthscienceeurope.org>