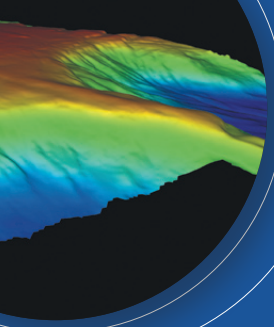
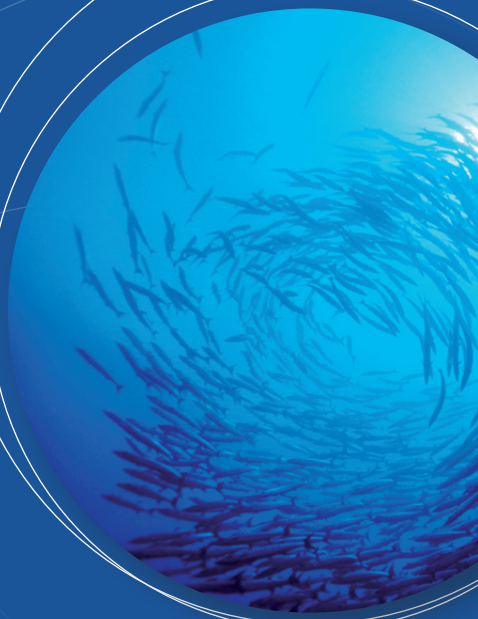


EMODNET

The European Marine Observation and Data Network



EMODNET is essential for the EU to improve the quantity, quality and accessibility of marine observation and information for evidence-based ocean governance and to open up new economic opportunities in the marine and maritime sectors of Europe, for the ultimate benefit of the European citizen and the global community.

EUROPEAN SCIENCE FOUNDATION | MARINE BOARD

European Global Ocean Observing System

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Cover page:
picture 1: Multibeam seabed survey of Horse Shoe Sea Mount, North Atlantic Ocean
source: Royal NIOZ
picture 2: Swirl of fish
picture 3: Autosub Autonomous Underwater Vehicle surfaced next to Research Vessel Calanus in the Firth of Lorne, Scotland
source: Steve Hall, NOCS

inside cover:
a Tabular iceberg, West Antartic peninsula *source: Steve Hall, NOCS*
page 1: Three Cliffs Bay, Gower, Wales UK
source: Steve Hall, NOCS
page 2: Liverpool Bay Coastal Observatory;
source: *POL*
page 7: Multibeam seabed survey of the W. Porcupine Bank, North Atlantic Ocean
source: Royal NIOZ
page 9: deployment of a 'Bongo' net off the coast of East Africa
source: Adrian New, NOCS

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VISION STATEMENT
Marine Board – EuroGOOS perspective

EMODNET will be an end-to-end, integrated and inter-operable network of systems of European marine observations and data communications, management and delivery systems, supported by a comprehensive user-oriented toolkit to enable implementation of the Integrated Maritime Policy for Europe.

Vision is the art of seeing what's invisible to others
Jonathan Swift

Why EMODNET?

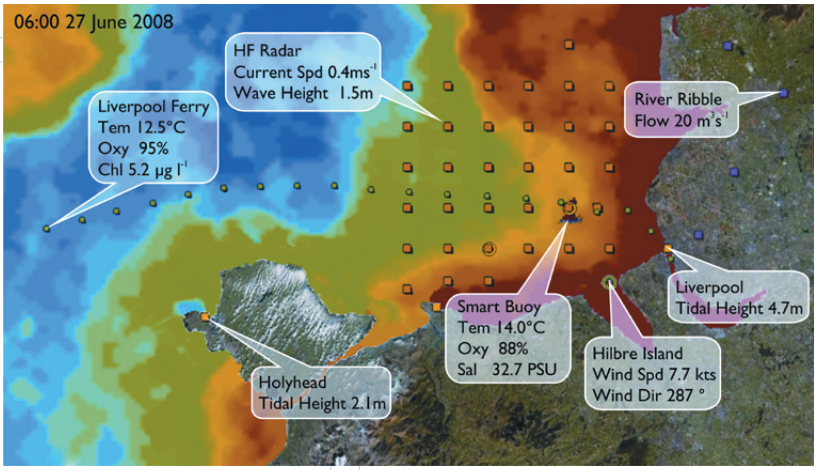
Rapid increases in human uses of marine resources and the impacts of climate change are making the European shelf and coastal seas more susceptible to natural hazards, more exposed to and threatened by pollution, and could potentially result in depletion of resources of economic importance to Member States. Conflicts between commerce, recreation, development, environmental protection, and the management of living resources are becoming increasingly contentious and politically charged. It is essential therefore that we overcome current limitations to rapidly monitor indicative parameters and provide predictions of change.

Progress will only be achieved if there is a shared understanding of the drivers of change, the pressures they create and the corresponding impacts on the environment and associated ecosystems, including people, their quality of life and economic well being. The sciences – physical, biological, chemical, economic and social – can help to unravel these elements, but only if the data required to describe and understand key processes and facts are accessible. Capable end-to-end systems are needed to acquire, process, manage and deliver the resulting information.

Some necessary data are available; they have been captured over many years. However, responsibility for collecting data in Europe's seas and oceans is shared between a fragmented patchwork of regional, national, public and private organisations for various purposes. As a result, many valuable datasets are inaccessible. These datasets must be unlocked and made easily accessible so that they can be used in new ways.

There are huge gaps in data and observation provision also, either because the necessary measurements have not been made or because observing networks are inadequate. The variability of the sea surface is very evident from images captured from space, but there is huge physical, biological and chemical variability below the surface that is largely unobserved. These gaps must be filled.

Policies to control eutrophication in the seas must be based on information about the distribution of excess nutrients, and also on their transport and life cycles, so that actions can be targeted effectively on their sources. Required data are captured in quite different ways by different disciplines. For example, some nutrient transport is episodic, being driven by storms in the atmosphere, other fluxes are more gradual and seasonal; all must be characterised and modelled and married with data from chemical and biological sampling programmes.



Key:

Chl = chlorophyll,
Dir = direction,
HF = High Frequency,
Oxy = oxygen,
Spd = speed,
Sal = salinity,
Tem = temperature

What is EMODNET?

EMODNET will be a network of existing and developing European observation systems, linked by a data management structure covering all European coastal waters, shelf seas and surrounding ocean basins, accessible to everyone.

EMODNET will thus provide the link between observations in different European waters and European environmental information which can then be assessed by scientists and the general public. This will create a large number of marine services in the field of monitoring, forecasting and marine safety.

EMODNET will provide an end-to-end system linking the modules "Sensors & Platforms", "Surveys", "Communication Systems", "Data Management " and "Information Tools". Depending on the specific tasks and problems in the different regions, there may be differences in details on the application of strategies and methods.

The main tasks in EMODNET will be to: (i) build on and integrate the combined *in situ* and remote sensing of open ocean, shelf seas and coastal observation systems; (ii) harmonise different methodologies and strategies for data management under common protocols, data formats and quality control, and (iii) ensure that data can be consistently distributed for user applications including regional data interpretation, environmental assessments and modelling.

From Observation to Information

Analysis and Assessment

- Combination of different data Model Application Data interpretation
- Environmental Assessment

Data Processing and Management

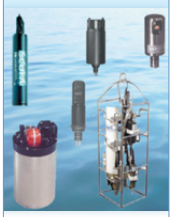
- Data check, -conversion and -storage
- Quality control
- Data presentation

Observations

- from automated systems
- during ship cruises
- from remote sensing

Essential Components of an Observation Network

Sensors to measure continuously and automously physical, chemical and biological parameters



- salinity, temperature
- turbidity, oxygen
- chlorophyll, nutrients
- pH, alkalinity
- bathymetry
- primary production

Platforms or structures anchored on the seabed, floating in the water column or drifting at the sea surface, and remote sensing from satellites.

- buoys, floats
- gliders
- mooring
- AUVs, lander
- FerryBox
- cabled networks
- remote sensing
- living Argo

Sampling and consecutive laboratory analyses from research ships, or shore, including water, sediments and biota (phytoplankton, bacteria, zooplankton, fish)

- inorganic trace compounds
- gases, e.g. CO2, CH4, DMS
- organic micropolluants
- abundance & function of biota
- food web
- HABs

Communication systems to transfer in real-time data from sensors to the network and to the land stations

- satcom
- GSM, GPRS
- fibre optics
- acoustics

Data collection and management system for direct control of data quality, and data storage systems to enable data analysis and use for model applications

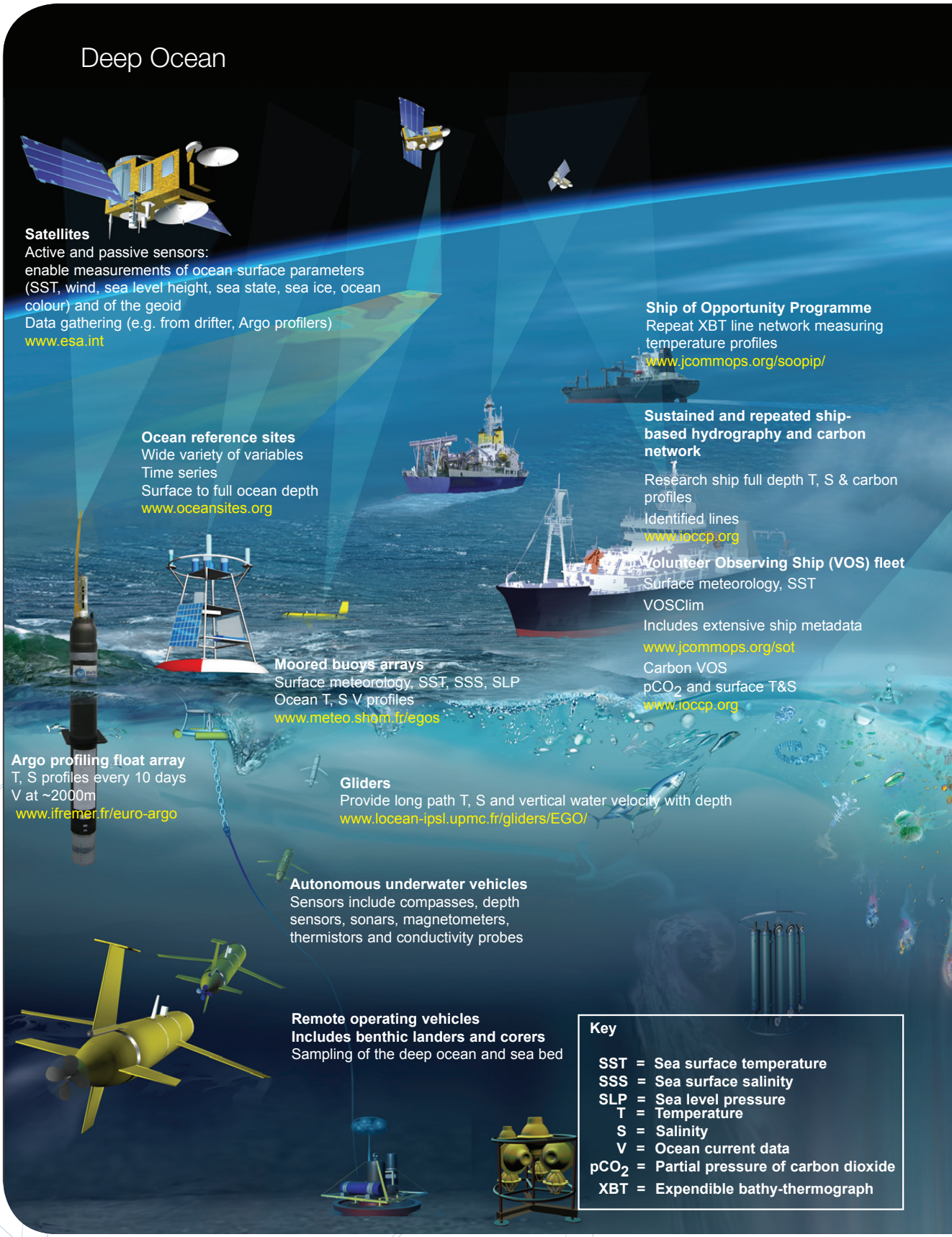
- data bases
- quality control
- data standards

Software and web based information tools to analyse data for trends, compliance to EU directives, to distribute and disseminate data to end users

- analysis
- Presentation
- web
- GIS

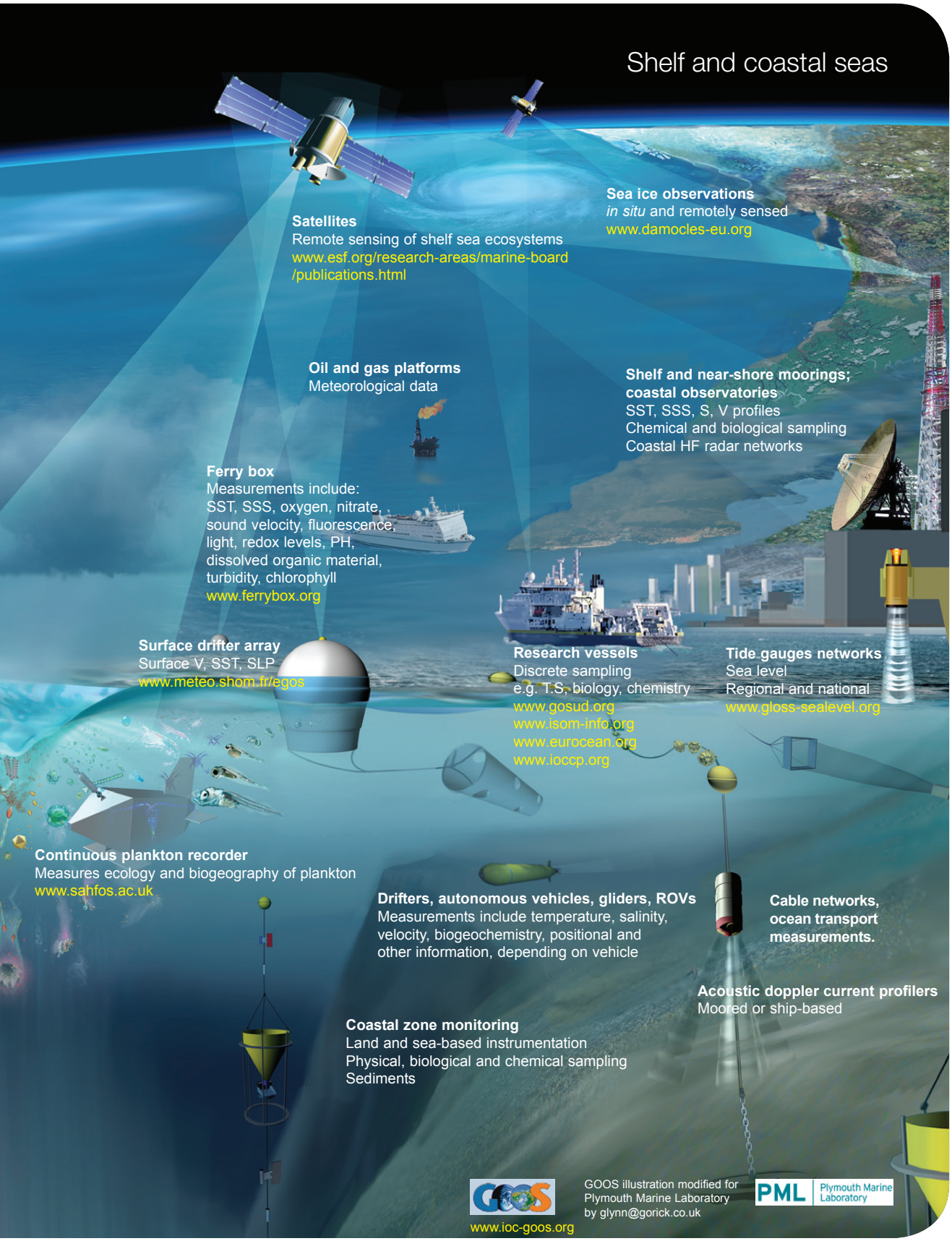
Ocean Observing Systems

A comprehensive system of ocean observations covering coastal and regional seas and the wider global ocean lies at the core of EMODNET. This requires investment in proven technologies enabling the gathering of data from a variety of *in-situ* and remote sensing platforms.



Ocean Observing Systems

For EMODNET to be successful efforts must be made to both maintain and extend the present network of observing systems and to ensure continuity of remote sensing satellite missions. Strong investment in new and emerging technologies is also needed.



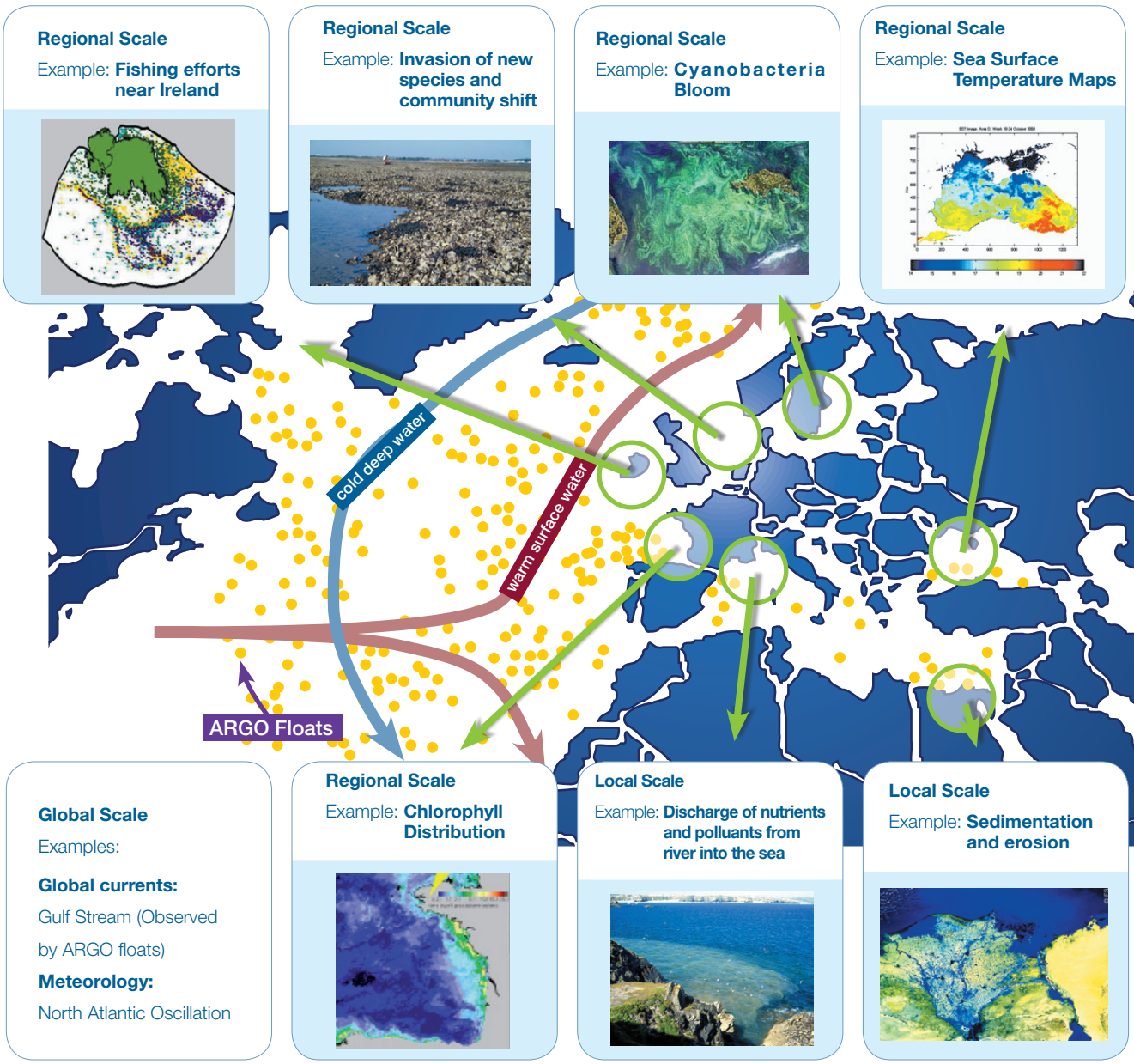
Scales of EMODNET

GLOBAL: European seas and oceans are an integral component of the Earth's ecosystem. They are influenced by the global oceans, particularly through internal transport between them, but also indirectly through interactions between the atmosphere and the oceans.

REGIONAL: Europe's regional oceans and seas include the Arctic and Atlantic Oceans and the Baltic, Mediterranean and Black Seas and sub-regional seas such as the North and Adriatic Seas. They have specific and distinct characteristics. Although it is possible to use some common techniques and protocols, each region must be monitored in different ways to provide a context in which to interpret local/coastal trends and conditions.

LOCAL: the coastal zone, because it is an area of great physical and biological diversity and the area of greatest interaction between nature and anthropogenic forces, represents one of the greatest challenges for observation, monitoring and assessment.

It is for these reasons that Europe needs to develop a multi-scale Marine Observation and Data Network (the proposed EMODNET) to support the sustainable development of its marine and maritime resources and provide a functional tool for Marine Spatial Planning (including Integrated Coastal Zone Management).



Data Management

It is vital that users can easily discover and access available data and data products from the oceans and seas, in common formats with known quality.

A great wealth of data exists, for a wide range of disciplines, derived from *in situ* and remote sensing observations, in real-time, near-real-time, and delayed mode. These data are acquired as part of routine monitoring activities and as part of scientific surveys by more than a thousand institutes and agencies throughout Europe.

One of the challenges for EMODNET is to organise a common data management approach to be adopted by all actors to ensure that these data are available.

A number of on-going initiatives and organisations are progressing in mobilising and coordinating a large part of the marine and ocean data management field in Europe. These include SeaDataNet (EC FP6) for delayed mode data, ESO-NET (EC FP6) for long-term, sea floor, multi-disciplinary observatories, national efforts coordinated within the EuroGOOS regions for real-time and near-real-time data, and EUMETSAT for satellite data, images and products. ICES holds a large bank of oceanographic data supplied by its member countries, dating back to the beginning of the twentieth century.

EMODNET must engage and build upon existing initiatives to harmonise data management practices overall.

Technically, EMODNET will be established as a system of systems. Interoperability between systems will be achieved by adopting the EU-INSPIRE principles, in adherence with the objectives of WISE - Marine.

Key elements of the harmonisation process:

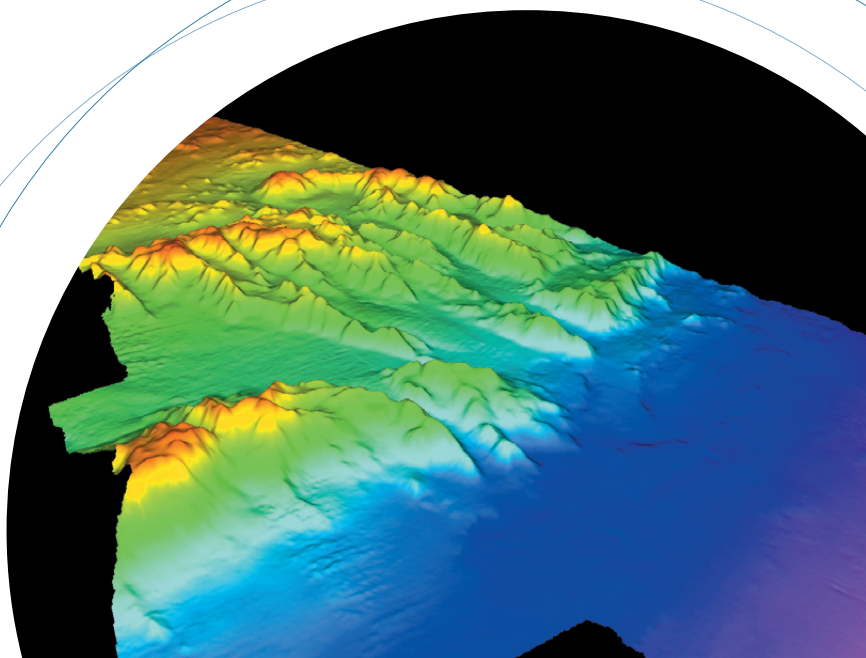
- A common data policy which enables free and open access to data, preferably without restriction on use
- Common standards and protocols for quality control procedures, metadata formats and descriptions, and data exchange formats

The Water Information System for Europe (WISE) was launched in March 2007. It will gradually be developed further to become a main harmonised, tool for water-related data and information at the European level:

WISE is the water-related component of the environmental data reporting under INSPIRE.

WISE is the formal compliance reporting tool under EU water policy between Members States and the European Commission.

WISE provides access to water-related data available on the European level including data used by European and international organisations in their State of the Environment assessments.



How to implement EMODNET?

A number of distinct actions will be necessary to build and sustain an effective EMODNET; these include:

- **Discovery** of existing holdings of marine data relevant to the identified needs.
  This task requires a dedicated resource and the collaboration of national marine data centres, many of which are participating in the SeaDataNet project (EC FP6).

- Performance of **gap analyses to determine where** the shortcomings in existing data lie for the coastal and open oceans.
  An expert review of this topic is required. Observing System Simulation Experiments provide one tool and much can be learned from the experience of marine observatories within Europe, the USA and globally* .

- **Coordinated, joint investment** in sustainable, efficient observing systems that exploit:
  - The complementary strengths of remote sensing and *in situ* methods
  - Platforms of opportunity (e.g. ships in transit, research and fishing vessels)
  - National networks
  - Autonomous, adaptive vehicles
  - Highly capable observatories in key locations.

  The most difficult part of this unfulfilled task is likely to be tackled initially by the *in situ* Observations Working Group (ISOWG) that is being administered by the EEA and staffed by Member States under the auspices of the GMES Initiative. By comparison the space based component is well developed and generally has the resources to carry out the necessary work.

- Removal of the **impediments to exchange and effective access** to data:
  A data policy must be put in place for the future which enables **full and open access** to data, preferably without restriction on use. But data capture, collection and management are not cost free. To meet the purposes of EMODNET, the data need to be treated as public goods, with the implication that appropriate funding will be jointly provided by the EU and Member States.
  A **common data management approach** must be adopted by all organisations involved in data acquisition and management. This requires formulation and adoption of common standards and protocols for quality control procedures, metadata formats and descriptions, and data exchange formats.

- Implementing **collaboration and governance** arrangements to sustain the EMODNET:
  Intergovernmental agreement involving the EU and Member States will be essential to provide an adequate level of governance and ensure long term investment. The experience from the space sector demonstrates this very clearly; the GMES initiative provides a suitable framework for this.

The **EU's Data Collection Regulation** (DCR), issued under the Common Fishery Policy (2000), aims at increasing the quality of the reporting of captured fish by Member States' fishing fleets. To increase the quality of the Total Allowed Catch and quota evaluation, and to fuel the ecosystem based management of fisheries, the European Commission finances half of the costs from the collection to its use by the end users. The regulation covers the collection of data for scientific purposes and gives access to satellite monitoring (VMS) data required for effective spatial planning. The data collected are made available not only to the scientific bodies which advise the European Commission, but to all stakeholders interested in fisheries management. Socio-economy data are now being incorporated in order to evaluate the impact of regulatory measures.

The nine countries surrounding the Baltic Sea have long traditions in cooperation in operational oceanography ranging from observations and data exchange to joint operational products. Under the framework of the **Baltic Marine Environment Protection Commission** (HELCOM), the countries started the joint marine monitoring programme in 1979 covering physical, chemical and biological observations. The programme is coordinated by HELCOM and all the Contracting Parties are committed to an annual sampling and data exchange programme.

* Global initiatives of relevance (and related websites): POGO - Partnership for Observation of the Global Oceans - www.ocean-partners.org; Group on Earth Observations (GEO) and Global Earth Observation System of Systems (GEOSS) - http://earthobservations.org; Global Ocean Observing System (GOOS) - www.ioc-goos.org; European Regional Committee (EuroCoML) for Census of Marine Life (CoML) - www.coml.org & www.eurocoml.org; Global Biodiversity information Facility (GBIF) - www.gbif.org

Recommendations for sustainability of EMODNET

There are specific actions to be taken to ensure that appropriate, sustainable investments are made in EMODNET. These include:

- An evaluation of the costs and benefits of various observing system scenarios must be undertaken to determine the benefits to be derived from implementation of EMODNET. This evaluation should consider the cost of no action.

- The appropriate level of funding, responsibility and cooperation for investment to fill identified data gaps and the provision of data management must be determined among Member States and at EU level. There are good examples of networks and management activities which are best implemented by Member States, e.g. for the individual regional seas, and others, such as the EuroArgo initiative, which might be better organised at EU level.

- In view of the improved collection and scientific use of data by Member States under existing EU agreements, directives or regulations, methods must be established to gain access to the data coming from, for example, the Water Information System for Europe (WISE), the Water Framework Directive (for transitional and coastal waters), the European Marine Strategy (for marine waters), the Data Collection Regulation (for fisheries), the Habitat Directive and Natura 2000 (for biodiversity). The prospective EU Shared European Information System will facilitate this action.

- As far as possible, the data collected by military and industry (e.g. oil and gas, fishing, transport) should be included in the EMODNET. In the same way, data collected through networks operated by local authorities should be considered for inclusion.

- Data collected via EMODNET should be used to contribute to the multidimensional mapping of Member State waters and to the production of a European Atlas of the Seas, outlined as a priority in the Action Plan of the European Integrated Maritime Policy.

- Development of new technologies (e.g. deep sea observatories) and new sensors (e.g. oxygen sensors on Argo floats) should be encouraged by EU and Member States to help fill identified data gaps using for instance the European Maritime Research Strategy.

The **Marine Board - ESF**, established in 1995 by its Member Organisations, facilitates enhanced co-ordination between the directors of European marine science organisations (research institutes, funding agencies and research councils) and the development of strategies for marine science in Europe. The Marine Board currently represents 29 Member Organisations from 19 countries.

The Marine Board operates via four principal approaches:

- **Voice:** Expressing a collective vision of the future for European marine science in relation to developments in Europe and world-wide, and improving the public understanding of science in these fields;
- **Forum:** Bringing together 29 marine research organisations from 19 European countries to share information, to identify common problems and, find solutions, to develop common positions, and to cooperate;
- **Strategy:** Identifying and prioritising emergent disciplinary and interdisciplinary marine scientific issues of strategic European importance, initiating analyses and studies (where relevant, in close association with the European Commission) in order to develop a European strategy for marine research;
- **Synergy:** Fostering European added value to component national programmes, facilitating access and shared use of national marine research facilities, and promoting synergy with international programmes and organisations.

www.esf.org/marineboard

EuroGOOS is an Association of national agencies, founded in 1994, committed to European scale operational oceanography within the context of the intergovernmental Global Ocean Observing System (GOOS). EuroGOOS has 33 members, carrying out marine research and/or providing operational oceanographic services, from 17 different countries.

Collaboration is essential between agencies and institutes in different countries, in order to realise the social and economic benefits resulting from efficient operations and sustainable management of the oceans and coastal zones. With support from the European Commission for Research and Technological Development, and from national governments, the European maritime institutions are providing a strong base for rapid expansion of operational oceanography, with great benefit to Europe both at the regional and global scale. Work is coordinated through a small EuroGOOS Office which aims to:

- Promote Operational Oceanography and the implementation of the infrastructure on which it depends
- Promote and facilitate dialogues between users and service providers
- Assist in the initialisation of projects between members
- Provide and facilitate forums in which task sharing and best practice can be discerned, agreed upon and implemented.

www.eurogoos.org

Acronyms

Argo:
Broad-scale global array of temperature/ salinity profiling floats

AUV:
Autonomous Underwater Vehicule

CoML (and EuroCoML):
(European Regional Committee for) Census of Marine Life

EC:
European Commission

EEA:
European Environment Agency

EMODNET:
European Marine Observations and Data Network

ESO-NET:
European Sea Floor Observatory Network
(EC FP6 project)

EU:
European Union

EUMETSAT:
European Organisation for the Exploitation of Meteorological Satellites

FP:
Research and Technology Framework Programme
of the European Union

GBIF:
Global Biodiversity Information Facility

GEO:
Group on Earth Observations

GEOSS:
Global Earth Observation System of Systems

GIS:
Geographic Information System

GMES:
Global Monitoring for Environment and Security

GOOS:
Global Ocean Observing System

GSM:
Global System for Mobile communications

GPRS:
General Packet Radio Service

HAB:
Harmful Algal Bloom

ICES:
International Council for the Exploration of the Sea

INSPIRE:
European Directive establishing Infrastructure for Spatial Information in the European Community

POGO:
Partnership for Observation of the Global Oceans

ROV:
Remote Operated Vehicles

SeaDataNet :
Pan-European Marine Data Management Infrastructure project
(EC FP6 project)

WISE:
Water Information System for Europe