https://www.youtube.com/watch?v=7taT9croynk&feature=youtu.be
Introduction to EMODnet and EuroGOOS

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Marine Data Workshop
15-16 April 2015, Atlantic Hotel, Bremen, Germany
Introduction to EMODnet

Introduction EuroGOOS

Focus on EMODnet Physics

Hands-on (explore the portals)

Challenge
Maria Damanaki, previous Commissioner for Maritime Affairs and Fisheries

(..) the data collected through these observations can only generate knowledge and innovation if Europe's engineers and scientists are able to find, access, assemble and apply them efficiently and rapidly. At present this is often not the case.
"You need data but the real challenge is to help scientist access and use it to innovate"

"Observational data can only generate innovation if data is interoperable and accessible"

"Budgets for data collection are enormous compared to budgets for bringing data together"
What is EMODnet?

Network of organisations assembling marine data, metadata & data products from diverse sources within Europe in a uniform way to

- make marine data more (i) easily accessible, (ii) free of restrictions on use and (iii) interoperable
- Develop data products of common interest
- Initiated by the European Commission in response to the EU GP on Future Maritime Policy, launched in June 2006 – now core part of Marine Knowledge 2020 initiative
Core principles for development

- Collect data once; use many times -> reduce costs
- “Sustainable” funding at a European level
- Free and unrestricted access to data and data products
- Build on existing efforts where data communities have already organised themselves - develop new initiatives where necessary to actively fill gaps and breakdown barriers
- Put the user first when developing priorities
- Develop data standards across disciplines as well as within them
- Process and validate data at different scales: regional, basin and pan-European

- EMODnet is a programme – not a project
- Aim = to unlock fragmented/hidden marine data
Phase I (2009-2013) - developed a prototype (so called ur-EMODnet) with coverage of a limited selection of sea-basins, parameters and data products at low resolution;

Phase II (2013-2016) - aims to move from a prototype to an operational service with full coverage of all European sea-basins, a wider selection of parameters and medium resolution data products;

Phase III (2015-2020) - will work towards providing a seamless multi-resolution digital map of the entire seabed of European waters providing highest resolution possible in areas that have been surveyed, including topography, geology, habitats and ecosystems; accompanied by timely information on physical, chemical and biological state of the overlying water column as well as oceanographic forecasts.
Phase 1 - limited sea basins

Phase 2 - low resolution

Phase 3 - multi-resolution

Bathymetry
Geology
Physics
Chemistry
Biology
Physical habitats
Human activity

Learn
Measure

Bathymetry
Geology
Physics
Chemistry
Biology
Physical habitats

Secretariat – Central portal
Mediterranean check point
North Sea Check point

Artic check point
Atlantic check point
Baltic Check point
Black Sea Check point

Euro ARGO
Multi Source Data
EMODnet Secretariat

Hosted by the Flemish Government at the InnovOcean site in Oostende, (Belgium)
The EMODnet Secretariat

Overarching goal to develop a more efficient, effective, fit for purpose EMODnet which is better known and more widely used

1. Coordination & internal communication
   - Steering Committee / internal updates / guide entry portal / support MODEG

2. Monitoring
   - Test functionality / implement progress indicators / collect user-feedback / progress reports /
     report lessons learned / guide portals to improve them

3. Dissemination and Outreach
   - Prepare/give on-line demonstrations / videos / brochure/ posters etc.
The Central Portal

www.emodnet.eu

- Acts as a gateway to the other thematic and regional EMODnet portals
- Also develops own data products combining data from at least 2 thematic data portals
1. EMODnet Bathymetry

Welcome to the EMODnet Bathymetry portal

The EMODnet-Bathymetry portal is being developed in the framework of the European Marine Observation and Data Network (EMODnet) as initiated by the European Commission. It provides services for discovery and requesting access to bathymetric data (survey data sets and composite DTMs) as managed by an increasing number of data providers from government and research. The portal also provides a service for viewing and downloading a harmonised Digital Terrain Model (DTM) for the European sea regions that is generated by the EMODnet Bathymetry partnership on the basis of the gathered data sources. The image below gives the workflow and direct access to each of the interrelated services.

Survey data sets

Composite DTMs

Harmonised QA+QC and DTM processing

EMODnet DTM

More background on EMODnet...
1. EMODnet Bathymetry (1)

• Providing overview and access to bathymetric survey data
• Generating and providing free access to a harmonised medium resolution Digital Terrain Model (DTM) for all European seas
• Data (single beam, multibeam, plummets, LIDAR, ..) comes from national hydrographic services, marine research institutes and industry
• Adopted SeaDataNet CDI Data Discovery and Acess service for survey data sets
EMODnet Bathymetry (2)

- > 13,000 surveys indexed
- Makes use of > 6000 survey data sets from 29 data providers from 16 countries
- DTM can be downloaded freely in a range of formats: EMODnet ASCII, ESRI csv, NetCDF, SD, GeoTiff, XYZ
- Various functions for browsing DTM and retrieving information and WMS services
- Next release expected Summer 2015 including high resolution coastal pilots
EMODnet DTM in rainbow colour
EMODnet Bathymetry (4)

EMODnet DTM detail near Sicily in atlas colour
EMODnet Bathymetry (6)
The EMODnet-Geology project is one of seven that bring together information on the Geology, Chemistry, Biology, Physics, Bathymetry, Seabed Habitats, and Human Activities in the European marine environment. Each project assembles marine data, data products and metadata from a wide range of sources. In the EMODnet-Geology project the information made available to the network is principally provided by the project partners, although other organisations contribute to the geological mapping objectives in many of the participating countries. The full phase of the EMODnet-Geology Project started in October 2013 and will run for 3 years. The partnership includes 30 marine organisations from 30 countries that contribute information in all of the European Regional Seas.

During the preparatory phase of the EMODnet-Geology Project (2009-2012), maps for the Baltic Sea, Greater North Sea and Celtic Sea were delivered through the OneGeology-Europa (1G-E) project. In the current phase of the project, a portal will be developed that will serve information not only to 1G-E, but to a wider range of marine websites. The 1G-E portal allows the delivery of both onshore and offshore geological information via a single website.

The geology data available includes:
- sea-bed substrate
- sediment accumulation rate
- sea-floor geology
- benthic lithology
- benthic substratigraphy
- coastline migration
- mineral resources (oil and gas, aggregates, metallic minerals)
- geological events (earthquakes, submarine landslides, volcanic centres)

Further information about the EMODnet Programmes is available on the EMODnet Central Portal.
• Portal provides access to information primarily held by national geological surveys:
  – harmonised **sea-bed substrate** and bedrock geology at 1:250,000 scale where available;
  – Information on **coastal behaviour** (migration; erosion; accretion);
  – Locations of earthquake activity, volcanoes, submarine landslides. Links to updated sources of information using WMS;
  – **Mineral localities**; oil and gasfields; aggregate resources.
• Advantages
  – Central access to **geological information from 30 countries**;
  – Building on **open-source platform** providing access to national geological survey information and to **provide best available data and access to national data catalogues**.

• Challenges
  – Accessing third party data held by industry, research community etc.
3. EMODnet Seabed habitats (1)
3. EMODnet Seabed habitats (2)

- Building on the highly successful INTERREG IIIB-funded MESH and BALANCE projects, EUSeaMap phase 1 (2009-2012)

- The portal presents predicted broad-scale habitat maps Based on:
  - Maps from surveys
  - Modelled distributions of single habitats (e.g. Mediseh, Habmap)
  - Habitat sample data (e.g. Ospar’s) - no biology in map form! (only samples)

- Data come from?
  - A number of single organizations (habitat samples)
3. EMODnet Seabed habitats (3)

www.emodnet-seabedhabitats.eu
4. EMODnet Chemistry (1)

EMODnet Chemistry has a focus on measurement data for groups of chemical variables. The Matrix below indicates per sea region and per chemicals group by map and table how many measurement data are available. Hovering over a coloured square in the table gives the exact number of data sets and a map with their geospatial distribution. Clicking on a coloured square triggers a query on the Common Data Index (CDI) Data Discovery and Access service that allows you to browse the metadata of these data sets in more detail, to narrow down your query and to request access to a selection of data sets.
EMODnet Chemistry has a focus on measurement data for groups of chemical variables.
4. EMODnet Chemistry (1)

Methodology for Data Assembly

- DIVA (Data-Interpolating Variational Analysis) concentration maps for parameters with homogeneous coverage, measured at basin scale;

- Dynamic plots and coastal visualizations for not homogeneous data (coastal points repeated in time, datasets with fragmented coverage)
4. EMODnet Chemistry (2)

Horizontal distribution maps, produced with 10-year moving window

Mean summer NO3 at first 10 m, over the area N43.5-46, E12-15

Mean: 0.6000
Std: 0.0736
5. EMODnet Biology

This project website provides information on the biological project of the European Marine Observation and Data Network and gives access to the marine biological data portal and metadata catalogue.

Marine biodiversity data are essential to measure and study the ecosystem health of marine basins. These data are often collected with limited spatial and temporal scope and are scattered over different organisations in small datasets for a specific species group or habitat. Therefore, there is a need to assemble these individual datasets, and process them into interoperable biological data products for assessing the environmental state of coastal ecosystems and marine basins.

The Marine Environment Policy Framework, adopted by the European Council in 2007, announced that the European Commission would take steps to set up a European Marine Observation and Data Network (EMODnet) to improve access to high quality marine data for private bodies, public authorities and researchers.

- 2009-2013: A set of preparatory actions on biological data, hydrographic data, physical data, chemical data, geological data and broad scale hazards have been launched for a limited set of Sea Basins. It aims at gathering experience for a future permanent operational system. The main objective of the biology project was the development of an online marine biological data portal, allowing the access and downloading of marine biological data across Europe. The biological data will be focused on gathering available information and on the temporal and spatial distribution of species composition, abundance and biomass of phytoplankton, zooplankton, angiosperms, macroalgae, invertebrate fauna, birds communities, sea mammals and reptiles you can consult the final report of the biology preparatory action.

- 2013-2016: In the follow up project, a consortium of 21 government agencies and research institutes with national and international expertise in marine biological data monitoring and data management will build further upon the work carried out during the biological preparatory action of EMODnet and will deliver data, metadata and data products of surveys in the water column and on the sea bed from phytoplankton, zooplankton, angiosperms, macroalgae, invertebrate fauna, birds communities, sea mammals and reptiles. The EMODnet biological data portal will provide access to different thematic databases and to several long-term national marine biological monitoring datasets from all European marine areas. The project will identify and focus on biological data types, species, species attributes, sampling methods and biological indicators to support the variety of legislations, and will create biological data products to support environmental legislations including the Marine Strategy Framework Directive.
5. EMODnet Biology (2)

• Data on **temporal and spatial distribution of species abundance and biomass** from several species groups.

• Main components
  – WoRMS
  – EurOBIS-OBIS
6. EMODnet Physics (1)

www.emodnet-physics.eu
7. EMODnet Human Activities (1)

**Objectives**

Human Activities is a new Lot not covered in EMODnet Phase I. Its main objective is to disseminate information on the geographical position, spatial extent, and attributes of a wide array of human activities related to the sea and its bed. Particular attention is given to providing historical time series (when possible) to indicate the temporal variation of activities. Through a single entry portal it is possible to view, query and download data and metadata from public and private sources all across Europe. The data is harmonised into interoperable formats that include agreed standards, common baselines or reference conditions; assessments of their accuracy and precision.

**Data Sources and Methodology**

Since this Lot deals with a differentiated set of marine and maritime human activities, a multitude of public and private data sources at EU, international, national, and local level is feeding into our portal. Each partner of the consortium is in charge of surveying existing data sources for a given activity. The approach adopted is that as far as possible each activity should be covered by a single source that can provide data for all EU sea basins. This makes it possible to obtain complete and already harmonised datasets, thus reducing the risk of data gaps. When it is not possible to have a single source covering an entire activity, or of course national and local sources will be surveyed. In addition, as a general rule, EU and other public sources are privileged in order not to duplicate existing initiatives, ensure data continuity and reliability, and provide data with as few restrictions as possible.

**Data Products and Services**

Users can view, query, and download datasets or subsets of them, via web GIS. Metadata are also available for download. The portal offers access to the following datasets:

- see available datasets

**Technical Infrastructure**

The portal is based on free, open-source technology, using both MapServer and OpenLayers. MapServer is used as the geographic data rendering engine. MapServer is designed to render vector and raster data using advanced cartographic output. OpenLayers is a map viewing library that provides a JavaScript API which makes it easy to incorporate maps from a variety of sources into a webpage or application and configure map tools. The portal uses MySQL database technology to hold and serve the GIS data. Web Feature Services will be used to allow request for geographical features across the web using platform-independent calls.
7. EMODnet Human Activities (2)

- Human Activities is a relatively **new Lot**
- Its main objective is to provide information on the geographical position, spatial extent, and attributes of a wide array of **marine activities** (e.g. hydrocarbon extraction, renewable energy, mariculture, shipping, etc.)
- Particular attention is given to providing **historical time series** (when possible) to indicate the temporal variation of activities.
- Data from public and private data sources at EU, international, national, and local level
- Priority = public sources (data continuity, no restrictions)
EMODnet Human Activities (3)

• **Status:**
  – making available as much data as possible
  – Future: implementation of interactive features for spatial analysis

• **Main challenges**
  – not all sources are willing or allowed to share their data;
EMODnet Human Activities (4)

www.emodnet.eu/human-activities
The Central Portal

www.emodnet.eu

- **Bathymetry**: Data on bathymetry (water depth), coastlines, and geographical location of underwater features: wrecks.
- **Geology**: Data on seabed substrate, sea-floor geology, coastal behaviour, geological events, and minerals.
- **Seabed Habitats**: Data on modelled seabed habitats based on seafloor substrate, energy, biological zone, and salinity.
- **Chemistry**: Data on the concentrations of pesticides, heavy metals, and contaminants, in water, sediments, and biota.
- **Biology**: Data on temporal and spatial distribution of species abundance and biomass from several taxa.
- **Physics**: Data on salinity, temperature, waves, currents, sea-level, light attenuation, and FerryBoxes.
- **Human Activities**: Data on the intensity and spatial extent of human activities.
Use Case I: Query products simultaneously

Retrieve Data from specified coordinates at a given time or for a time interval

- Physical Parameters
- Bathymetry
- Seabed Substrate
- Marine Region
- Species Abundance
Concluding remarks

• EMODnet is a long term marine data initiative
• Developed through stepwise approach – now halfway – the service is already useful and picking up speed to make it
  ✓ Fully operational
  ✓ Provide the best available data, free of restrictions on use
  ✓ Become more user friendly & fit for purpose
• Can only be done together with the DATA PROVIDERS AND USERS
• Bringing observations, products, services and knowledge to users and public requires appropriate tools and guidance
  www.emodnet.eu or via info@emodnet.eu
Preparatory Actions for European Marine Observation and Data Network MARE 2010/02 - Physical Parameters [SI2.579120]

Knowledge base for growth and innovation in ocean economy: assembly and dissemination of marine data for seabed mapping
MARE/2012/10 - Lot 6 Physics [SI2.656795]
EuroGOOS, the European Global Ocean Observing System

EuroGOOS is an International Non-Profit Organisation committed to European-scale operational oceanography within the context of the Global Ocean Observing System of the Intergovernmental Oceanographic Commission of UNESCO (IOC GOOS).

It was founded in 1994 as an informal association. Since February 2013, it is established as an International Non-Profit Organisation in Belgium (EuroGOOS AIOF), increasing in this way its efficiency and improving the representation of its members towards the EC and other EU or international bodies.

EuroGOOS has 37 members from 18 European countries providing operational oceanographic services and carrying out marine research.

We work towards the collective interest of our members, to improve the quality and cost effectiveness in the production of operational oceanographic services at national, regional and global levels for a wide variety of users.

www.eurogoos.eu
Ocean Observations

- Technologically complex and high cost infrastructures. Variety of platforms/technologies:
  - Remote sensing (satellite and coastal radars)
  - Drifting-profiling floats
  - Fixed moorings (time-series stations)
  - Ships of opportunity
  - Gliders
  - Research vessels
  - Coastal networks

- Diversity of operators (national, local, research, .....) & funding mechanisms
Operational Oceanography is not a new invention

An international conference established the basic principles of operational meteorology and oceanography:

– Common standards/formats for data
– Common standards for data quality
– Free and open exchange of data

Modern principles, but when?
Maury early became convinced that adequate scientific knowledge of the sea could be obtained only through international cooperation.

Within a few years after the Brussels conference in 1853, nations all over the world were sending their oceanographic observations to Maury.

These observations were evaluated and the results given worldwide distribution.

Also as a result of the Brussels conference, a large number of nations agreed to cooperate in the sharing of ocean data using uniform standards.
•Since 19th century a lot of measurements have been made by diverse communities for their own needs (Scientists, fishermen, commercial navigators…)

BUT

– Not done in an organized way
– Shared only among small communities
– Measured over limited periods and areas
– Not properly archived

Nowadays the ways of using data and the user needs have changed…..
• Global scale applications requiring an integrated observing system (climate change, ocean health monitoring, fisheries assessment,...)

• Important demand for real-time data access

• Information Technology and Data Management techniques are no more an obstacle to information sharing

Core parameters:
- Assimilation in global/regional models: T, S
- Validation: Sea Level, Current, Oxygen, Chlorophyll, Nutrients, Wave.

Data accessible easily from a unique point

Data coherent in terms of:
- Data format
- Data Quality
- Processing chain (clearly documented)
- Coherent at basin scale level

Data are available
- In real time/near real time (within less than 24 hours)
- In delayed mode after calibration and/or validation with estimation of the accuracy

Long time series

Coordination and cooperation is absolutely necessary
EuroGOOS AISBL is an International Non Profit Association of 37 national agencies, institutes and research organisations in Europe promoting and implementing Operational Oceanography. Founded in 1994, EuroGOOS operates in the framework of the Global Ocean Observing System (GOOS) of UNESCO/IOC.
EuroGOOS is one of the twelve GOOS Regional Alliances (GRAs) that develop the system in different parts of the World Ocean.

GOOS is a platform for:
- International cooperation for sustained observations of the oceans
- Generation of oceanographic products and services
- Interaction between research, operational, and user communities
The ROOSs - Regional Operational Oceanographic Systems are the operational arm(s) of EuroGOOS.

About 60 additional partners in ROOSs.

The ROOSs cooperation focus on improved national and regional services and products.

ROOSs coordinate the observations and the data transfer for internal use and to other users.

Regional data portals in every ROOS simplifying the data transfer and enable interoperability.
EuroGOOS and data - development
EuroGOOS and data

Three initiatives for marine information

DG ENTERPRISE & INDUSTRY
MyOcean
www.myocean.eu

DG RESEARCH & INNOVATION
FP7
SeaDataNet
www.seadatanet.org

DG MARITIME AFFAIRS & FISHERIES
EMODnet
Physics
www.emodnet-physics.eu

EuroGOOS
Operational oceanography community

EuroGOOS has the cross cutting role in these initiatives
EuroGOOS and data

Network of NODC

Data Discovery, archiving, standards, services,.....

Data discovery, view, download, new platforms (type + number), interoperability layers

In SITU TAC

Assessment, RT QC, products,.....

Data collection, processing

End Users
EuroGOOS and data

- Data Discovery, archiving, standards, services.....

- Data discovery, view, download, new platforms (type + number), interoperability layers

- Assessment, RT QC, value added products,.....
Preparatory Actions for European Marine Observation and Data Network MARE 2010/02 - Physical Parameters [SI2.579120]

Knowledge base for growth and innovation in ocean economy: assembly and dissemination of marine data for seabed mapping
MARE/2012/10 - Lot 6 Physics [SI2.656795]
EMODnet Physics objectives:

- **Provide a single point of access** to marine near real time and achieved data on **physical conditions** as monitored by:
  - Fixed Stations\(^1\), Ferrybox\(^1\), Argo\(^2\), Gliders\(^2\), HF Radars\(^2\)

Parameters:

- Sea Temperature\(^1\), Sea Level\(^1\), Sea Salinity\(^1\), Winds\(^1\), Waves\(^1\), Sea Currents\(^1\), Light Attenuation\(^1\), Ice Coverage\(^2\), Sea Level trends\(^2\)

- **Build up on existing infrastructures** by adding value – not complexity

- **Ensure data access to any user**

- **Facilitate integration and interoperability** with further systems (INSPIRE compliant, WMS, WFS, etc.)

- **Bring together the main European Marine Observation and Data Communities** (EuroGOOS ROOSs, MyOcean, SeaDataNet, etc)

- **Attract new data and new data providers**

- **Attract new users and stakeholders**

- **Full engagement of the EuroGOOS ROOSs**\(^*\) (50% of the budget to empower ROOSs data interoperability infrastructure)

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\(^1\) MARE/2010/06 (2011-2013)

\(^2\) MARE/2012/10 Lot 6 (2013 – 2016)
Welcome to EMODnet - Physical Parameters

The EMODnet Physical Parameters portal is aimed at providing users with physical data and metadata available for use by public authorities, scientists and industry, and contributes towards the definition of an operational European Marine Observation and Data Network (EMODnet) and contributes to developing of the definition of the Global Monitoring for Environment and Security (GMES) marine core service. The portal is being developed by a European consortium and operated in cooperation between EuroGOOS, its Regional components (ROOGs), and exploiting SeaDataNet and MyOcean infrastructures and services bringing together many marine data users and providers.

The EMODnet Physical Parameters portal provides access to near real-time and archived data series from fixed stations and buoy data lines in the European seas and provides OGC services (WMS, WFS, and WCS) for data discovery, view and download.

EMODnet-Physics Test System

News from web

Europe still playing catch-up on air pollution, despite reduction successes
Many Europeans still exposed to harmful air pollutants

More

Meetings

GROOM General Assembly - Trieste, Italy
ROOG Annual Meeting - Tallinn, Estonia

More

Tag Cloud

biodiversity oer emodnet area

eurogoos home myocean

SeaDataNet

www.emodnet-physics.eu
EMODnet Physics

Existing Infrastructure and approach

Interoperability & Visibility

Sustain

WMS
WFS
Web services
... socials

contacts@emodnet-physics.eu
EMODnet Physics approach

- Build on existing infrastructures and avoid duplication of efforts
- Improve back office infrastructure for the benefit of the ROOSs and contributing institutes
- Give visibility and awareness to everyone
- Create added value interoperability layers on top of the existing infrastructure
- Reach new stakeholders and users
- Increase the amount of available data from additional platforms and platforms types (gliders, HF radars,....)
- Give feedback and support to contributing institutes
- Contribute to a stronger community on local, regional, European and global scales
Direct data access web service to the IOC sea level system hosted at VLIZ
www.emodnet.eu

www.eurogoos.eu

patrick.gorringe@eurogoos.eu

Marine Data Workshop
15-16 April 2015, Atlantic Hotel, Bremen, Germany
Challenge:
If we plan to set up a wind farm in the Southern North Sea – What data do we need to consider to answer the challenge?

Take into account:
• Mapping of current sea-use, for instance avoid siting a wind farm in an area of seabed already in use through existing infrastructure, human activity etc.
• Mapping of environmental parameters
• Other factors?
MARINE DATA NETWORKS, SERVICES AND DATA BASES (EMODNET, COPERNICUS, EUROARGO, ETC)

- Wind Farm siting
- Marine Protected Areas
- Oil platform leaks
- Climate & coastal protection
- Fishery Management
- Marine Environment
- River Inputs

VALUE-ADDED PRODUCTS, DECISION SUPPORT SYSTEMS FOR CHALLENGES
Table 4.1: Site suitability scoring index

<table>
<thead>
<tr>
<th>Grade</th>
<th>Level</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Very High</td>
<td>Red</td>
<td>The presence of a variable makes the area unsuitable for wind farm development</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>Orange</td>
<td>The proximity to a suitability receptor or marine activity is adversely affected by the new wind farm or may put the wind farm at risk</td>
</tr>
<tr>
<td>3</td>
<td>Medium</td>
<td>Yellow</td>
<td>The marine activity or sensitive receptor may be adversely affected by the installation and presence of a wind farm although the site may be suitable for development</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
<td>Blue</td>
<td>The site is suitable for development and there are only minor adverse impacts anticipated on the sensitive receptor or marine activity</td>
</tr>
<tr>
<td>1</td>
<td>Very Low</td>
<td>Green</td>
<td>The site is suitable for development and there are no adverse impacts anticipated on the sensitive receptor or marine activity</td>
</tr>
</tbody>
</table>
North Sea wind farm challenge

Data sources

(1) Mapping of current sea-use:
To avoid siting a wind farm in an area of seabed already in use the following datasets were mapped and defined:

• Existing sea-use:
  • Administrative/legislative boundaries
  • Cables and pipelines
  • Other wind farms and renewable energy devices
  • Oil and gas installations
  • Marine aggregate dredging grounds
  • Offshore disposal sites
  • Military training and disposal grounds

• Seabed obstructions e.g. ship wrecks
• Shipping lanes
• Environmental sensitivities
  • Marine protected areas
North Sea wind farm challenge

Data sources

(2) Mapping of Environmental Parameters:

- Bathymetry
- Seafloor geology
- Distance from grid/supply chain
- Wind strength
  - Maxima, Averages, Gusting, Long-term data, Direction
- Tidal data
- Wave data
- Topography

Also:

- Environmental sensitivities:
  - Bird migration routes
- Commercial fishing grounds
- Distance from shore (visibility)