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EMODnet for Horizon Europe and EU Mission Restore our Ocean and Waters: Guidelines for European project data submissions

EMODnet
European Marine Observation and Data Network

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Marine data as valuable assets:

Data from the marine environment are a valuable asset. Rapid access to reliable and accurate marine data and information is vital in addressing threats to the marine environment, in the development of policies and legislation to protect vulnerable areas of our coasts and oceans, in supporting research with the evidence-base to understand the complexity of marine ecosystems, trends, and in forecasting future changes. Likewise, better quality and more easily accessible marine data is a prerequisite for further sustainable economic development, so-called 'blue growth', and to achieve the ambitious targets of the EU Green Deal and EU Mission: Restore our Ocean and Waters.

EMODnet:

The European Marine Observation and Data Network (EMODnet)1 is an established European Commission *in situ* marine data service, and a flagship initiative funded by EC DG MARE. Complementary to Copernicus Marine, EMODnet is one of the main Marine Knowledge Initiatives of the European Union. Through its Portal (**https://emodnet.ec.europa.eu/en**) EMODnet provides access to European marine data across seven discipline-based themes and its Ingestion service:
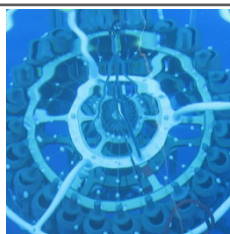
Bathymetry
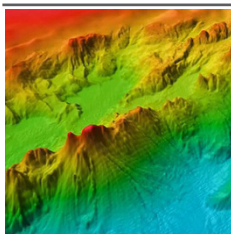
Data and maps on bathymetry (water depth), and coastlines, e.g., Digital Terrain Model
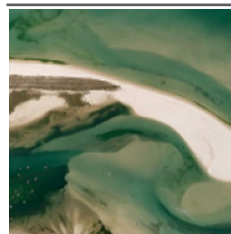
Biology

Data and maps on temporal and spatial distribution of species abundance and biomass from several taxa.

Chemistry

Data and maps on the concentration of nutrients, organic matter, contaminants, and marine litter in water, sediment and biota.
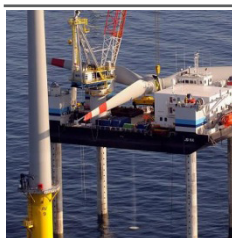
Geology

Data and maps on seabed substrate, sea-floor geology, coastal behaviour, geological events, minerals, and submerged landscapes.
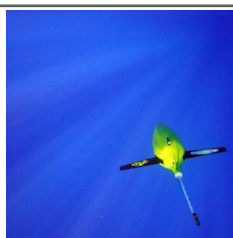
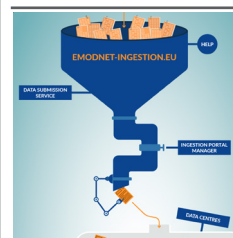| Human Activities	Physics	Seabed Habitats	Ingestion
Data and maps on the intensity and spatial extent of human activities at sea, e.g., Vessel Density maps and National Maritime Spatial Planning	Data and maps on salinity, temperature, waves, winds, currents, sea-level, light attenuation, ice, river outflow, underwater noise.	Data, maps on the spatial distribution and extent of seabed habitats and communities, e.g., EUSeaMap broad-scale seabed habitat map for European seas	Reaching out to potential new data providers and operating services and support for uptake of their data assets, for ingestion into relevant EMODnet thematics and data/ data products.

Flow of data to EMODnet:

EMODnet is deployed by a network of > 120 organisations that work together on bringing together data and processing these into high-quality and interoperable data layers and data products, that are freely made available to users by a central map viewer, products catalogue, and data sub-setting service, as well as by standard machine-to-machine services. For the data throughput, the EMODnet thematic groups rely on and interact with European marine data infrastructures such as SeaDataNet, EurOBIS, EGDI, ICES, and others. Their data centres offer validation, long term stewardship, and FAIR documentation, following agreed community standards, for data, observed by currently more than a thousand data originators from public, research and private sector in the European marine data landscape. In addition, EMODnet experts create pan-European data products that are fully open and accessible for use e.g., Bathymetry Digital Terrain Model, EUSeaMap broad-scale seabed habitat map for European seas, Vessel Density composite maps, etc.

What is the value of EMODnet for EU Research and Innovation Projects:

Firstly, EMODnet supports research and innovation (R&I) by providing an open and free service for accessing baseline pan-European marine data and data products that can be used to inform and underpin R&I activities towards a better understanding of the ocean environment, ocean applications, conservation and management. Examples of EMODnet's use by EU R&I projects and by wider users is available on the EMODnet Portal[2].
European research projects that are collecting *in situ* marine environmental and/or human activities data have a contractual obligation to make their data openly available. The EC aims to streamline this through EMODnet, as its in-situ data service. For European projects, contributing to EMODnet will facilitate them to make their data compliant to FAIRness principles, and getting wider recognition by acknowledgement in EMODnet products and by wider use of their data. Furthermore, it will enable them to extend the reach of their work, as EMODnet is feeding into larger initiatives such as the EU Digital Twin Ocean (DTO) and contributing to global efforts like the UN Ocean Decade. Likewise, several of the EMODnet services and products might be useful for the research activities in the European projects as these give access to validated data products and their underpinning data sets.
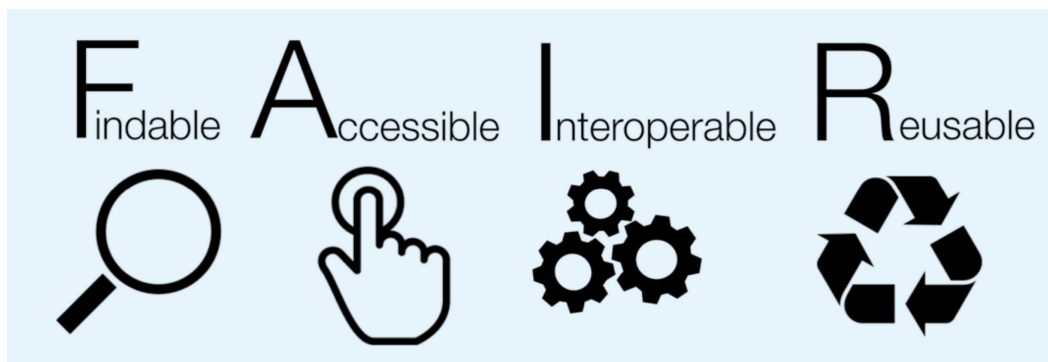
FAIR data principles describe standards of Findability, Accessibility, Interoperability and Reusability. FAIR data are essential for large-scale, machine-driven, multidisciplinary analyses to realize the full scientific and societal value of data.

Marine Data Management Guidelines:

Marine data include a very wide range of measurements and variables derived from a broad spectrum of multidisciplinary research projects and monitoring programmes. Depending on the data type, the acquisition systems, the delivery time frame or operations of the archiving centre, there is not a unique used data model and structure and the original measurement format may not be the same as the format that the archiving centre can accept. However, there are a number of **general principles** that should be followed. In addition, it is strongly advised that data submitters adopt the common formats for metadata and data within the existing marine community practices of EMODnet and make use of these **common standards** for their data management and exchange towards EMODnet. This will enable the easiest integration of their data sets into the current data systems and make them re-usable.

Connecting operational oceanography stations:

In addition to **delayed mode** data sets and derived products, EMODnet also provides discovery and access to **Near Real Time** data streams from an increasing number of operational observation platforms and networks on a global scale. For this, EMODnet Ingestion works together with EMODnet Physics and Copernicus In-Situ TAC to give support for connecting data output streams from new stations to EMODnet in a **two-stage process**, going from an easy 'as-is' connection to more elaborated exchange, including adoption of standard metadata formats and possible inclusion of data archives through SeaDataNet. See the joint EMODnet – Copernicus Marine Service communication[3] for more information.

Recommendations to EU projects:

The handling and management of large volumes of heterogeneous data generated from different observation-based infrastructures is a key challenge. Users of marine data infrastructures require high-quality FAIR metadata and data. European research projects are recommended:

» Adopt community standards as in use in EMODnet for formulating **Data Management Plans** (DMP) for handling and documenting data collection and data processing steps in their project to contribute to long-term data preservation and accessibility. This will ultimately allow their data to be FAIR and machine-readable;

» DMPs should be defined by the goals of a research project or observation program and data should be documented through metadata following the EMODnet community standards;

3   EMODnet and Copernicus Marine Service release joint communication on European *In Situ* Marine Data Service Landscape | European Marine Observation and Data Network (EMODnet) (europa.eu)

» Design and implement the DMPs in collaboration with marine data management infrastructures and their national nodes that are feeding EMODnet and who provide standards and operate tools for submitting data and metadata, and facilitate long-term data archiving;

» Establish contact with EMODnet from the start of the project to explore data flow and long-term uptake of data into EMODnet. This can be done via project partners involved in EMODnet and/or with Data Ingestion, to get advice on possible data flow and ways to ensure long-term storage and uptake of the project data into EMODnet as an EC marine data service.

Support by EMODnet Ingestion for EU projects:

The EU projects should initiate, formulate, and deploy DMPs themselves, taking into account their research and data collection plans, and considering the community standards and practices as promoted and used by EMODnet. However, EU projects can seek support from EMODnet Ingestion for reviewing their DMPs, before these are published and deployed, and for possible matchmaking with relevant data centres. For this purpose, EMODnet Ingestion manages a network of data management experts, consisting of coordinators of each EMODnet thematic group and representatives of the European marine data management infrastructures such as SeaDataNet, EurOBIS, EGDI, and others, which have nodes in many European countries. Moreover, the data submission service of EMODnet Ingestion might be used for transfer, albeit for well documented and formatted metadata and data sets, while EMODnet Ingestion could also assist for sharing operational data streams with the EMODnet operational oceanography data exchange. However, it should be clear that EU projects themselves are and stay responsible for the quality and results of their data management activities, while EMODnet can give support, where possible. Those projects, that adopt the indicated common standards and concern original and new collected data sets, will qualify for uptake by EMODnet thematic groups.