SAFE WAVE

STREAMLIING THE ASSESSMENT OF ENVIRONMENTAL EFFECTS OF WAVE ENERGY

DELIVERABLE 4.2
Data Organization Concepts: prepare and upload data

Co-funded by the EMFF programme of the European Union

WP 4

Deliverable 4.2 Data Organization Concepts: prepare and upload data

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1. SAFE WAVE project synopsis

The Atlantic seaboard offers a vast marine renewable energy (MRE) resource which is still far from being exploited. These resources include offshore wind, wave and tidal. This industrial activity holds considerable potential for enhancing the diversity of energy sources, reducing greenhouse gas emissions and stimulating and diversifying the economies of coastal communities. As stated by the European Commissioner of Energy, Kadri Simson, during the Energy Day in the framework of the climate conference (COP25) held in Madrid (2-13 December 2019), "the European experience shows that the benefits of clean energy go beyond reduced greenhouse gas emissions and an healthier environment. Clean energy transition boosts the economy and creates jobs. The European Green Deal is also a growth strategy". In the same framework of COP25 and during the Oceans Day, the European Commissioner for environment, oceans and fisheries, Virginijus Sinkevičius explained that "fighting climate change and protecting marine life biodiversity is a centrepiece of the EU's ocean policy. Due to climate change, our oceans are facing serious challenges, which require an urgent and comprehensive response. But oceans are also a part of the solution". Therefore, ocean energy is one of the pillars of the EU's Blue Growth strategy. Ocean energy could provide clean, predictable, indigenous and reliable energy and contribute to the EU's objective of reaching a share of renewables of at least 32% of the EU's gross final consumption by 2030. As it was underlined by Virginijus Sinkevičius, "Marine renewable energy has an incredible potential. The offshore wind sector is growing strongly enough to compete with traditional energy sources. The emerging technologies such as wave and tidal energy will take the same pathway".

The nascent status of the Marine Renewable Energy (MRE) sector and Wave Energy (WE) in particular, yields many unknowns about its potential environmental pressures and impacts, some of them still far from being completely understood. Wave Energy Converters' (WECs) operation in the marine environment is still perceived by regulators and stakeholders as a risky activity, particularly for some groups of species and habitats.

The complexity of MRE licensing processes is also indicated as one of the main barriers to the sector development. The lack of clarity of procedures (arising from the lack of specific laws for this type of projects), the varied number of authorities to be consulted

and the early stage of Marine Spatial Planning (MSP) implementation are examples of the issues identified to delay projects' permitting.

Finally, there is also a need to provide more information on the sector not only to regulators, developers and other stakeholders but also to the general public. Information should be provided focusing on the ocean energy sector technical aspects, effects on the marine environment, role on local and regional socio-economic aspects and effects in a global scale as a sector producing clean energy and thus having a role in contributing to decarbonise human activities. Only with an informed society would be possible to carry out fruitful public debates on MRE implementation at the local level.

These non-technological barriers that could hinder the future development of WE in EU, are being addressed by the WESE project funded by EMFF in 2018. The present project builds on the results of the WESE project and aims to move forward through the following specific objectives:

1. Development of an **Environmental Research Demonstration Strategy** based on the collection, processing, modelling, analysis and sharing of environmental data collected in WE sites from different European countries where WECs are currently operating (Mutriku power plant and BIMEP in Spain, Aguçadoura in Portugal and SEMREV in France); the SafeWAVE project aims to enhance the understanding of the negative, positive and negligible effects of WE projects. The SafeWAVE project will continue previous work, carried out under the WESE project, to increase the knowledge on priority research areas, enlarging the analysis to other types of sites, technologies and countries. This will increase information robustness to better inform decision-makers and managers on real environmental risks, broad the engagement with relevant stakeholders, related sectors and the public at large and reduce environmental uncertainties in consenting of WE deployments across Europe;

2. Development of a **Consenting and Planning Strategy** through providing guidance to ocean energy developers and to public authorities tasked with consenting and licensing of WE projects in France and Ireland; this strategy will build on country-specific licensing guidance and on the application of the MSP decision support tool developed for Spain and Portugal in the framework of the WESE project; the results

will complete guidance to ocean energy developers and public authorities for most of the EU countries in the Atlantic Arch.

3. Development of a **Public Education and Engagement Strategy** to work collaboratively with coastal communities in France, Ireland, Portugal and Spain, to co-develop and demonstrate a framework for education and public engagement (EPE) of MRE enhancing ocean literacy and improving the quality of public debates.

2. Executive summary

The present document includes the guidelines to prepare the data source to upload it to the MARENDATA Platform.

Before uploading a data source to the platform, it is important to know all the formats supported by the platform to select the best format to import the data according to the type of data and the objective to be imported into the data platform.

3. MARENDATA Data Platform

3.1 History

The first data were collected during the SOWFIA project[1]. This project ended in October 2013 and back then the name was SOWFIA's Data Management Platform (Leitão et al., 2013 and Magagna et al., 2012). In 2018 it got funds from projects WESE (http://wese-project.eu/) and SeaWAVE (http://www.seawave-emff.eu/) After a poll proposed to all partners of both consortia, the name MARENDATA was chosen for the Data Platform.

The latest project that started using this platform is SafeWAVE (https://www.safewave-project.eu/).

Data from SOWFIA were integrated into the MARENDATA platform and complemented with new data collected in the WESE and SeaWAVE project. Environmental data are collected in sites where devices are operating in Spanish, Portuguese and Scottish coastal waters, representing different types of marine environment (onshore, nearshore and offshore) that can potentially be affected by wave energy projects.

3.2 Present context

The data collection around wave energy harnessing devices currently operating at sea will increase the knowledge on positive, negative, and negligible environmental impacts of the following priority research areas:

1. Risk to marine animals from sound generated by wave devices.
2. Changes in physical systems (energy removal).
3. Effects of Electromagnetic Fields (EMF).
4. Seafloor integrity effects.
5. Reef-effect: generally speaking, any submerged structure located in the sea may cause an attraction effect on fish communities, especially if it is floating.

[1] Further information on this project can be seen at https://ec.europa.eu/energy/intelligent/projects/en/projects/sowfia and https://www.plymouth.ac.uk/research/coast-engineering-research-group/sowfia-project

Data measured by project partners must be structured for dissemination purposes and to ensure transferability with existing data platforms.

Then, the Data Platform is where project generated primary raw data is organized along with validated metadata information (compliant with Spatial Information in the European Community INSPIRE Directive) and secondary data (post-processed data, if any). In addition, numerical results from wave hindcast models are also included in the platform.

The organization of data within the Data Platform has undergone some changes to ensure that the data is findable, accessible, interoperable, and reusable. To this end, some standard rules of the European Marine Observation and Data Network (EMODnet) but also a set of recommendations from the Columbus project, funded by the EU, have been followed.

3.3 Framework

The Vision and the Mission put forward for MARENDATA frames the long-term goals and helps establish partnerships with new financing projects and organizations.

Vision:

- The renewable energy industry requires complex environmental information to overcome the challenges of harnessing energy from the marine environment.
- This will be delivered through an established open platform aggregating multiple sources of raw and secondary data to ensure access to meaningful information for the user.

Mission:

- Establish an adequate IT platform that links with existing and new data repositories;
- Enable access to raw and secondary data;
- Disseminate data and knowledge previously reviewed by experts;
- Survive individual projects' financing constraints;
- Reach a significant audience in the industry.

4. Metadata

4.1 Introduction

The metadata concept that was adopted by the MARENDATA Platform follows the INSPIRE data specification model in its relevant parts, that is, dataset-level, service metadata and data quality. This information was defined and summarized in **Deliverable 6.2. Primary data structure** of the WESE Project.

Metadata was generated by partners who also generate the data. To help on this task, a software tool was made available by Hidromod. In this tool, metadata information is also validated against the relevant standards. This tool is based on GeoNetwork opensource[2]. The procedure required to create metadata and upload a data set in the MARENDATA Platform is described in the document's annex (Guide to upload data in MARENDATA).

4.2 General concepts

Metadata refers to the description of datasets and services in a compliant form as it has been defined by the *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)*[3] and *Commission Regulation No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata*[4].

Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is essential for understanding stored information. It describes the content, quality, condition, and other characteristics of a data set or the capabilities of a service. Creating metadata or data documentation for geospatial datasets is crucial to the data development process. Metadata is a valuable part of a dataset and can be used to:

- **Organize** data holdings (Do you know what you have?).

[2] GeoNetwork is a catalog application to manage spatially referenced resources. It provides powerful metadata editing and search functions as well as an interactive web map viewer. It is currently used in numerous Spatial Data Infrastructure initiatives across the world (https://geonetwork-opensource.org/).
[3] https://inspire.ec.europa.eu/documents/directive-20072ec-european-parliament-and-council-14-march-2007-establishing
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.354.01.0008.01.ENG

- Provide **information about** data holdings (Can you describe to someone else what you have?).
- Provide information **to data users** (Can they figure out if your data are useful to them?).
- **Maintain the value** of your data (Can they figure out if your data are useful 20 years from now?).

In the geographical domain we can have a description of spatial data (**spatial data** metadata), a service (**service** metadata) or a special analysis process (**process** metadata). Most for the standardization work is done for data metadata, however service and process metadata become increasingly important. Metadata is used in discovery mechanisms to bring spatial information providers and users together. The following mechanisms are recognized:

- **Discovery**: which data source contains the information that I am looking for?
- **Exploration (or evaluation)**: do I find within the data sources the right information to suit my information needs?
- **Exploitation (use and access)**: how can I obtain and use the data sources?

Each mechanism has its own use of metadata. The selected standards should fulfil the needs to carry out services using these mechanisms. Metadata is required to provide information about an organisation's data holdings. Data resources are a major asset, and information of what datasets exist within different organisations, particularly in the public sector, is required to improve efficiencies and reduce data duplication. Data catalogues and data discovery services enable potential users to find, evaluate and use that data, thereby increasing its value. In addition, metadata received from an external source may require further information supplied to metadata to allow easy process and interpretation.

In this context and according to SeaDataNet - Data Quality control Procedures, Version 2.0, May 2010[5], for all types of data the following information is required:

- **Where** the data were collected: location (preferably as latitude and longitude) and depth/height;

[5] https://www.seadatanet.org/content/download/596/3118/file/SeaDataNet_QC_procedures_V2_(May_2010).pdf?version=1

- **When** the data were collected (date and time in UTC or clearly specified local time zone);
- **How** the data were collected (e.g., sampling methods, instrument types, analytical techniques). How do we organize the data (e.g., in terms of station numbers, cast numbers);
- **Who** collected the data, including name and institution of the data originator(s) and the principal investigator;
- **What** has been done to the data (e.g., details of processing and calibrations applied, algorithms used to compute derived parameters);
- **Watch** points for other users of the data (e.g., problems encountered and comments on data quality).

The ICES[6] Working Group on Data and Information Management (WGDIM)[7] has developed a number of data type guidelines which itemize these elements that are required for thirteen different data types (Table 1).

Table 1. ICES Data Type Guidelines

CTD	Moored ADCP	Moored Current Meter
Shipborne ADCP	Seasoar (Batfish)	Surface (Underway)
Water Level	XBT	Net Tow (Plankton)
Surface Drifting Buoy	Profiling Float and Drifting Buoy	Discrete water sample
Multibeam echosounder data		

These Data Type Guidelines have been developed using the expertise of the oceanographic data centres of ICES Member Countries. They have been designed to describe the elements of data and metadata which are most important for the ocean research community. These guidelines are targeted towards most physical-chemical-biological data types collected on oceanographic research vessel cruises. Each guideline addresses the data and metadata requirements of a specific data type. This covers three main areas:

[6] International Council for the Exploration of the Sea (www.ices.dk)
[7] https://www.ices.dk/community/groups/Pages/DIG.aspx

- What the data collector should provide to the data centre (e.g., collection information, processing, etc.);
- How the data centre handles data supplied (e.g., value added, quality control, etc.);
- What the data centre can provide in terms of data, referral services and expertise back to the data collector.

A list of ICES's guideline documents is presented in the Appendix bellow.

4.3 Reference documents

Two reference documents cited above must be used, along with the present Deliverable, in the course of the project:

1. COMMISSION REGULATION (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata;
2. SeaDataNet - Data Quality control Procedures, Version 2.0, May 2010.

5. Type of data sources

The MARENDATA platform, at the moment, accepts different file formats and the way of presenting this data on the platform also differs depending on the file format (Table 2). Before uploading a data source to the platform, it is important to know all the formats supported by the platform and select the best format to import the new data to the MARENDATA Platform.

Table 2. Types of data sources in the MARENDATA platform.

Data type
CSV - Time, properties
NetCDF
PDF
External sources
Youtube video
Shapefile
XYZ - X, Y, Properties
Other type

The user can import data in format:

- **CSV – Time, properties**: this type of file format allows the user to view the data in graph format. You can configure the time interval and change between the available properties. For this, the imported file must have the format of the example below (Figure 1and 2).

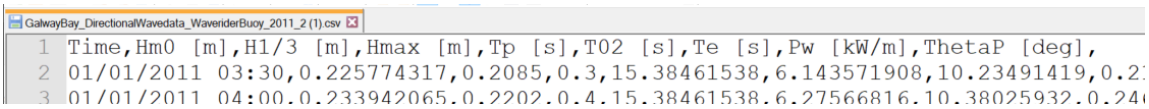

Figure 1. Format to allow the visualization of the data in graph, in the MARENDATA platform.

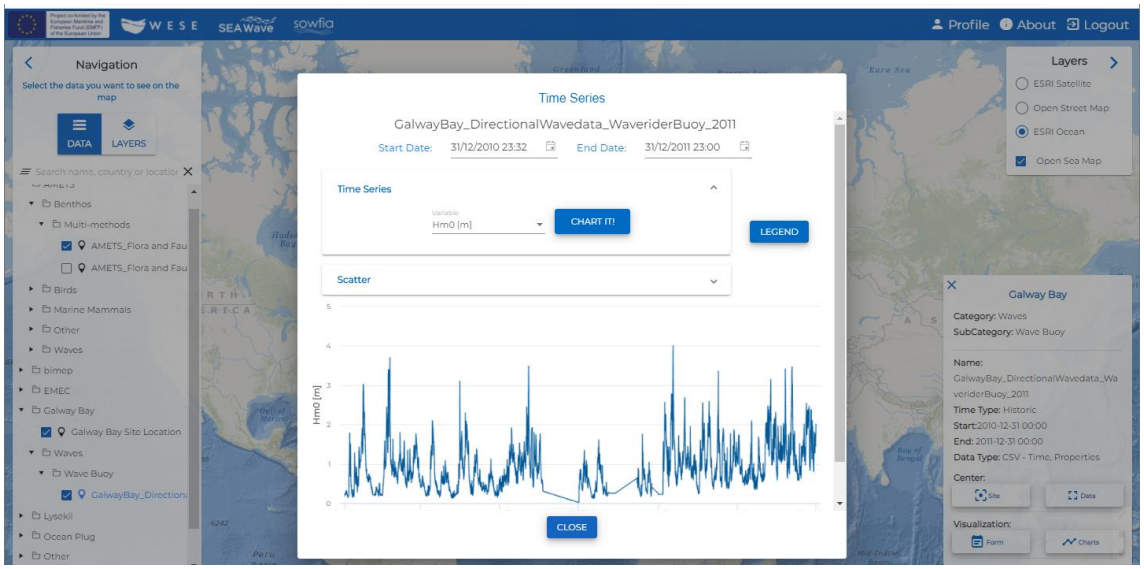

Figure 2. Example of a data source with file in CSV format

- NetCDF: this type of format is widely used in these areas of study. NetCDF is an abstraction that supports a view of data as a collection of self-describing, portable objects that can be accessed through a simple interface. On the current platform, it is possible to download the NetCDF file. However, in the next version it will be possible to view the data spatially, in a WMS field, if the NetCDF file is a spatial field (Figure 3).

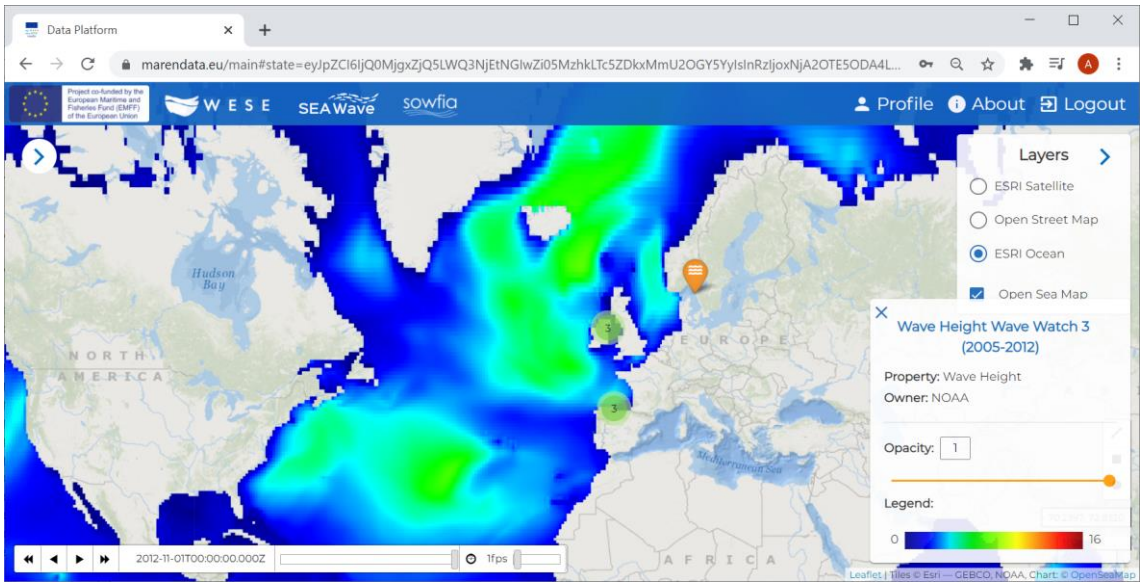

Figure 3. Example of a data source with file in NetCDF format

- PDF or Zip files: on the platform, this file type is available as download. There is a button where you can download the file (s). This type of format is used to import

articles / documents, or a set of documents related to the data source to be imported (Figure 4).

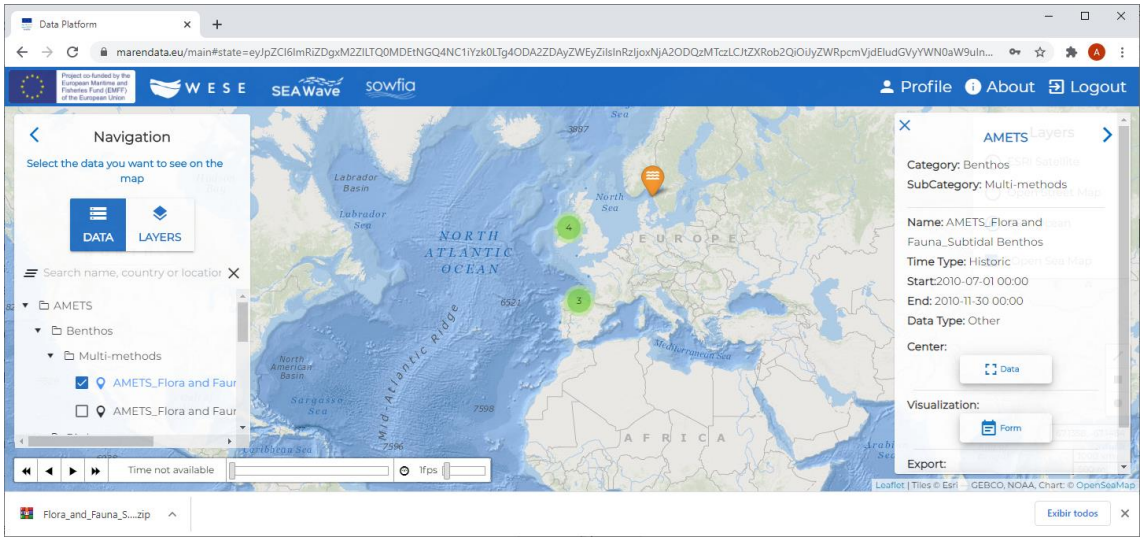

Figure 4. Example of a data source with file in Zip format.

- External Sources: the MARENDATA platform allows you to redirect to another webpage. The information properly inserted in the metadata contains the information necessary for this redirection to be done.
- YouTube video: Videos can be inserted into the MARENDATA channel or any other channel. You just must indicate the URL of the video and it will be made available directly on the MARENDATA platform (Figure 5).

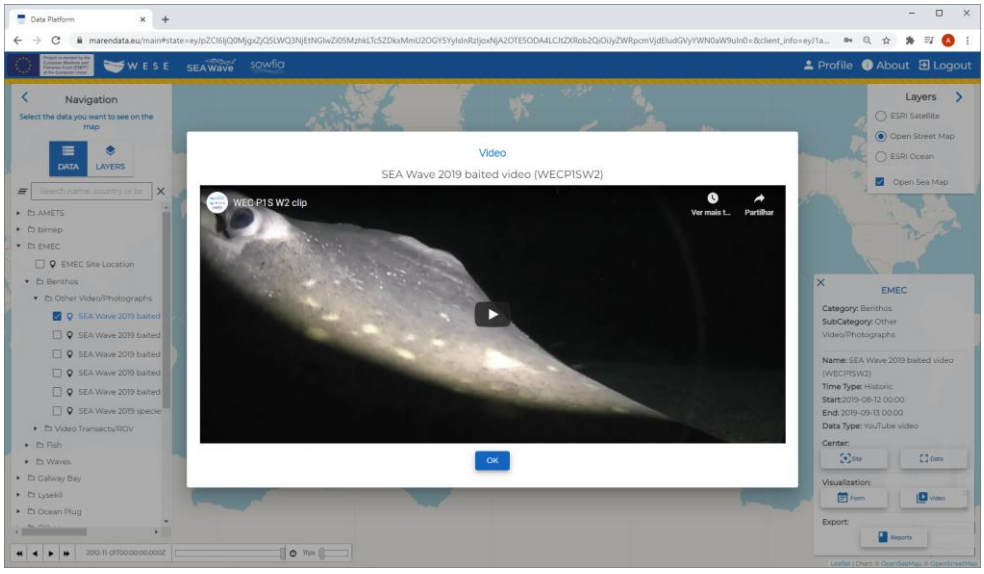

Figure 5. Example of a data source with a YouTube video.

- Shapefile: files with this format can be viewed directly on the platform or you can download the file from the respective button.
- XYZ - X, Y, Properties: this format allows indicating the position in which each data was collected. You can download the file from the respective button.
- Other: if your data source does not have one of the formats listed above, it is classified as "other". In this type, you can insert a file with any other format and the file will be available in the form of right download of the file.

6. Uploading data for MARENDATA

The process of uploading data to Marendata is detailed in Annex 1. This Annex addresses:

1. The configuration of an FTP client;
2. Creation of metadata in Geonetwork.

Raw data will be uploaded to the ftp site. If data is a video, it can be uploaded to YouTube and Marendata will link to it and show the videos in the User interface.

If data is uploaded as "external source", an URL should be given. Otherwise, only metadata will be available to users of the platform.

After adding the new record, HIDROMOD proceeds to insert the data source in MARENDATA. Once inserted in the platform, users can download the data, consult the metadata, locate the data source and, according to the import format, view the information in video, map or graphic format.

7. References

Leitão, J.C., Aires, E., Magagna, D., Conley, D., Greaves, D., Simas, T., Witt, M., Embling, C., Godley, B.J., Saulnier, J.B., O'Hagan, A.M., O'Callaghan, J., Holmes, B., Sundberg, J., Torre-Enciso, Y., 2013, Data Management Platform for wave energy tests centres within the SOWFIA Project, Proc. of EWTEC 2013, Aalborg, Denmark.

Magagna, D., Greaves, D., Conley, D., Leitão, J.C., Aires, Embling, C., E., Godley, B.J., Witt, M., Simas, T., Saulnier, J.B., Mouslim, H., O'Callaghan, J., O'Hagan, A.M., Holmes, B., Torre-Enciso, Y., Sundberg, J., 2012, Development of a Data Management Platform for the integration of European Wave Energy Impact Assessment datasets, Proc. of ICOE 2012, Dublin, Ireland.

8. ANNEX 1 – Guide for uploading data to MARENDATA

8.1 Forward

This Guide is addressed at users of MARENDATA who need to upload raw data and metadata into the platform.

This upload process has two main steps: The configuration of an ftp client for file upload and the creation of metadata thar describes the data that will be uploaded.

If data is uploaded to another site, the ftp upload step is not needed.

8.2 Configuration of an FTP client

In data types where file transfer is needed to import a new data source on the MARENDATA platform, FTP is used (youtube.com/watch?v=igoQq6BuY7c). To access the project's FTP, you must enter the information contained in Table 3.

Table 3. Credentials of FTP for the WESE project.

Server	ftp://marendata.eu
User	marendata.eu|wese
Password	Provided by email (from HIDROMOD)

Click in Menu File / Site Manager / New Site and insert the information contained in **¡Error! No se encuentra el origen de la referencia.** and then in Connect (Figure 6). Copy files from local directories to the remote FTP site. Right click on a file there will allow to copy the link to this file (Figure 7).

8.3 Create metadata

The metadata should be uploaded to this location: https://nautilus.hidromod.com:8443/geonetwork. To access insert the information contained in Table 4.

Table 4. Credentials to geonetwork.

User	WESE
Password	Provided by email (from HIDROMOD)

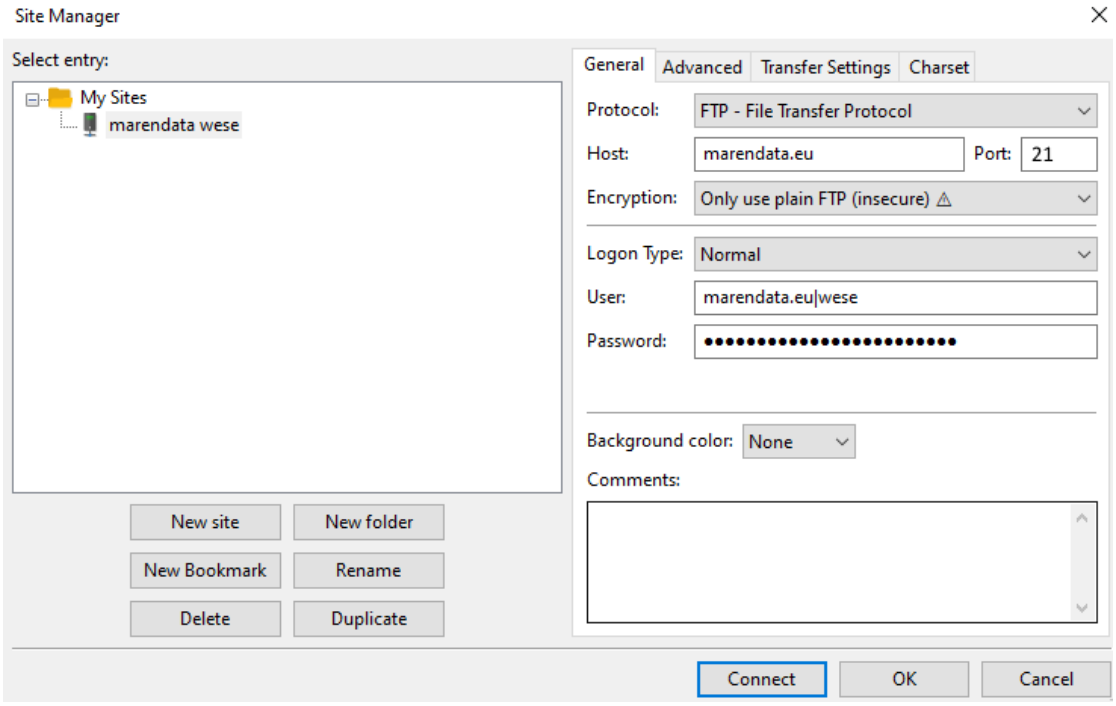

Figure 6. FTP settings.

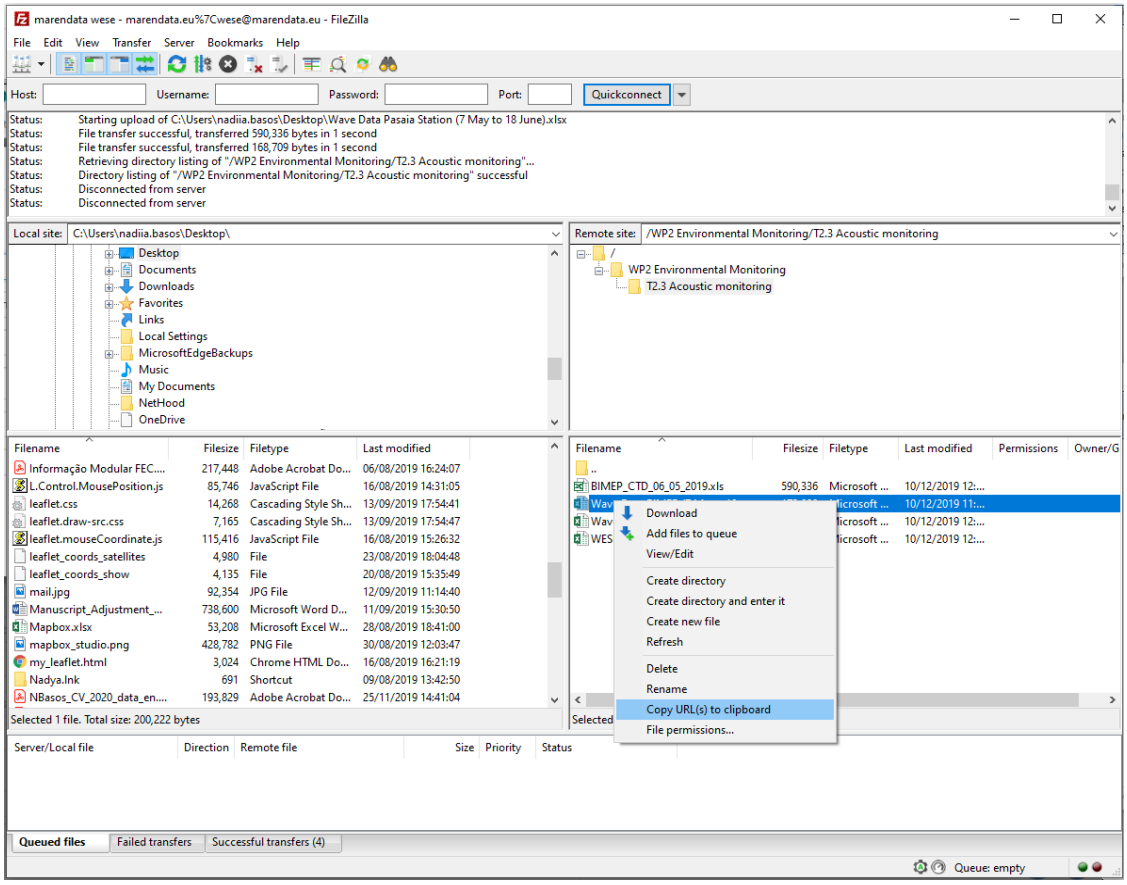

Figure 7. Import an existing metadata (Step 1).

8.3.1 Import an existing metadata

If you already have INSPIRE compliant XML metadata file about your dataset, you can upload it via the upper panel menu Contribute / Import new records (Figure 8).

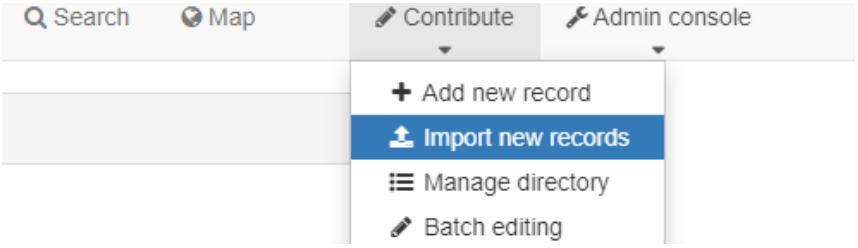

Figure 8. Import an existing metadata (Step 1).

There choose the XML file and click Import (Figure 9).

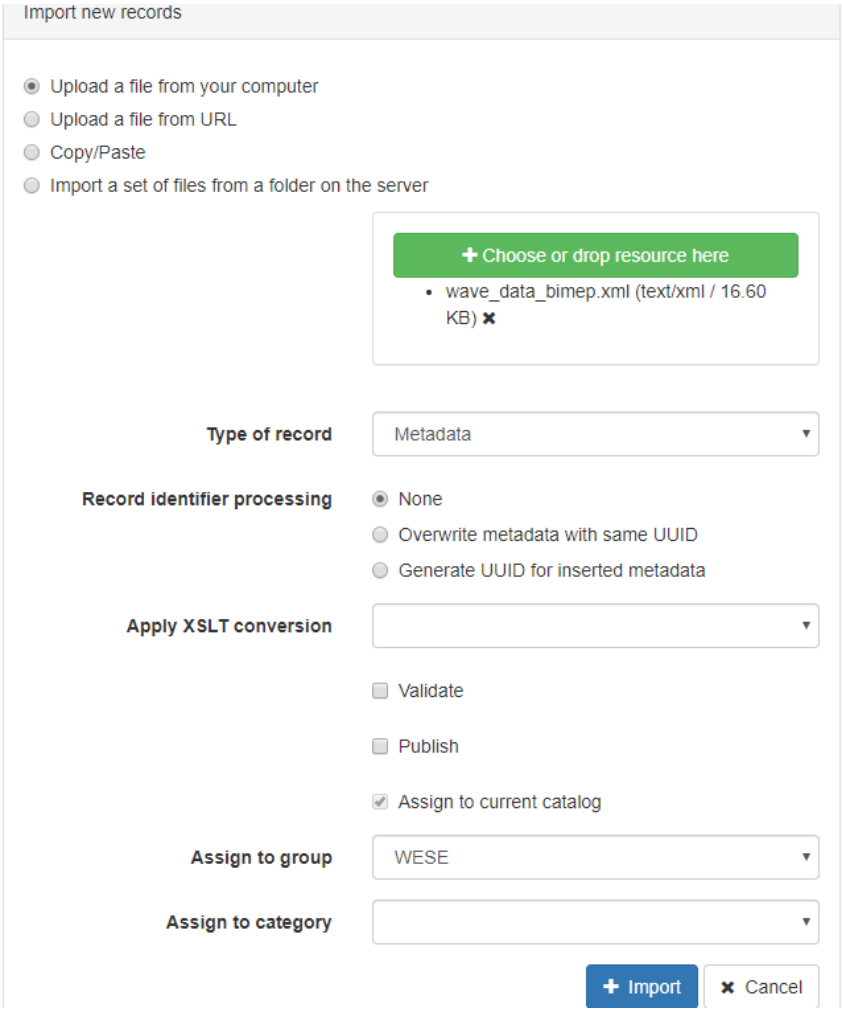

Figure 9. Import an existing metadata (Step 2).

8.3.2 Create new metadata

If you don't have INSPIRE compliant metadata files, you can create it in the following way. To add a dataset, go to the upper panel menu Contribute / Add new record (Figure 10).

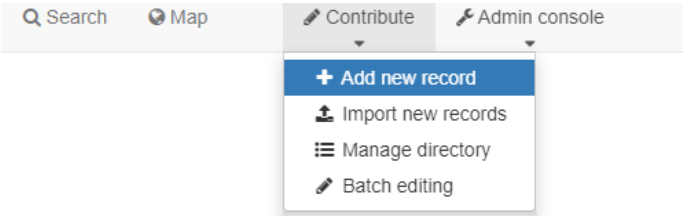

Figure 10. Figure 1 – Create the metadata (Step 1).

There select Dataset / Template for Vector data in ISO19139 and click on the button + Create (¡Error! No se encuentra el origen de la referencia.).

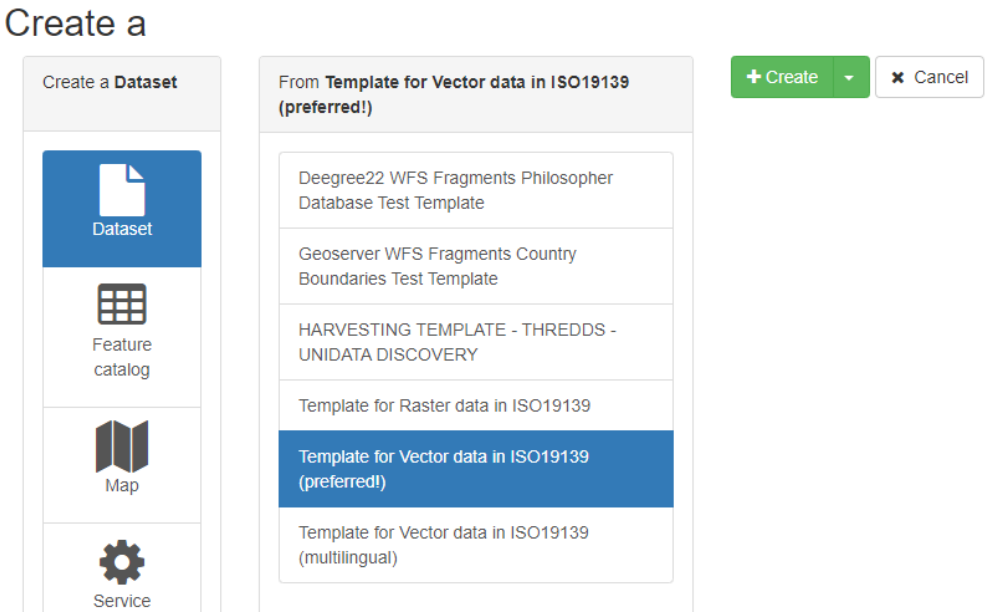

Figure 11. Create the metadata (Step 2).

In the field Title write the Common Data Designation which will appear on the platform as the layer name. In the field Abstract write Why Monitoring Data for the platform. In the Abstract field, you must also indicate the location of the name of the Test Site (ex. AMETS, BIMEP, EMEC, Galway Bay, Lysekil, Ocean Plug, SEMREV) and define one of the Environmental parameters / Methods listed in Table 5.

Table 5. Environmental parameters and methods.

Environmental parameters/ Methods	
Acoustics/Airborne Noise Monitoring	Fish/Dive Surveys
Acoustics/Drifting Hydrophones/Transects	Fish/Multi-methods
Acoustics/Fixed Hydrophones	Fish/None
Acoustics/Multi-methods	Fish/Sampling Using Fishing Gear
Acoustics/None	Fish/Sonar
Acoustics/Other	Fish/Use of Fisheries Catch Statistics
Bathymetry/Multi-beam Echosounder Surveys	Hydrography/CTD
Bathymetry/Multi-methods	Hydrography/Multi-methods
Bathymetry/None	Hydrography/None
Bathymetry/Side-scan Sonar	Hydrography/Plankton Tow Net Sampling
Bathymetry/Single-beam Echosounder Surveys	Hydrography/Temperature (Other)
Benthos/Biofouling Studies	Hydrography/TSS Assessment (Turbidity)
Benthos/Dive Surveys	Marine Mammals/Acoustic Monitoring
Benthos/Dredge Sampling	Marine Mammals/Aerial Survey
Benthos/Grab Sampling	Marine Mammals/Boat Survey
Benthos/Multi-methods	Marine Mammals/Land-based/Fixed Point Survey
Benthos/None	Marine Mammals/Multi-methods
Benthos/Other Video/Photographs	Marine Mammals/None
Benthos/Sediment Cores	Marine Mammals/Strandings Surveys
Benthos/Video Transects/ROV	Marine Mammals/Tracking
Birds/Aerial Survey	Other/Archaeological Assessment
Birds/Boat Survey	Other/EMF
Birds/Land-based/Fixed Point Survey	Other/Intertidal Ecosystem Studies
Birds/Multi-methods	Other/Terrestrial Ecosystem Studies
Birds/None	Sediments/Core Sampling
Birds/Remote Sensing	Sediments/Dive Survey - Sediment Profile Images
Birds/Tracking	Sediments/Grab Sampling
Coastal Morphology/Beach Profiling	Sediments/Magnetometer (Archaeological Survey)
Coastal Morphology/Multi-methods	Sediments/Multi-methods
Coastal Morphology/None	Sediments/None
Coastal Morphology/Video Imaging	Sediments/Seismic Surveys
Currents/ADCP	Sediments/Side-scan Sonar
Currents/Multi-methods	Waves/ADCP
Currents/None	Waves/HF Radar
Currents/Other Current Profiler	Waves/Multi-methods
Currents/Radar	Waves/None
Fish/Acoustic Sensors/Tags	Waves/Wave Buoy
Fish/Aerial Survey (Large Pelagics)	Wind/Meteorological Station (On Land)
Fish/Boat Survey (Large Pelagics)	Wind/Weather Buoys

Then, fill the Date and Point of Contact, select relevant keywords, choose the Spatial resolution (choose the most suitable category) and Extent (Figure 12).

In the Data Quality info section in the Distribution Information add Distribution format (the file format). In the Lineage write any text about quality of the data or just "none" (for INSPIRE compliance). Add Contact information in the end. After filling all the fields, in the upper right corner click Save metadata and then click in the Validate button (Figure 13).

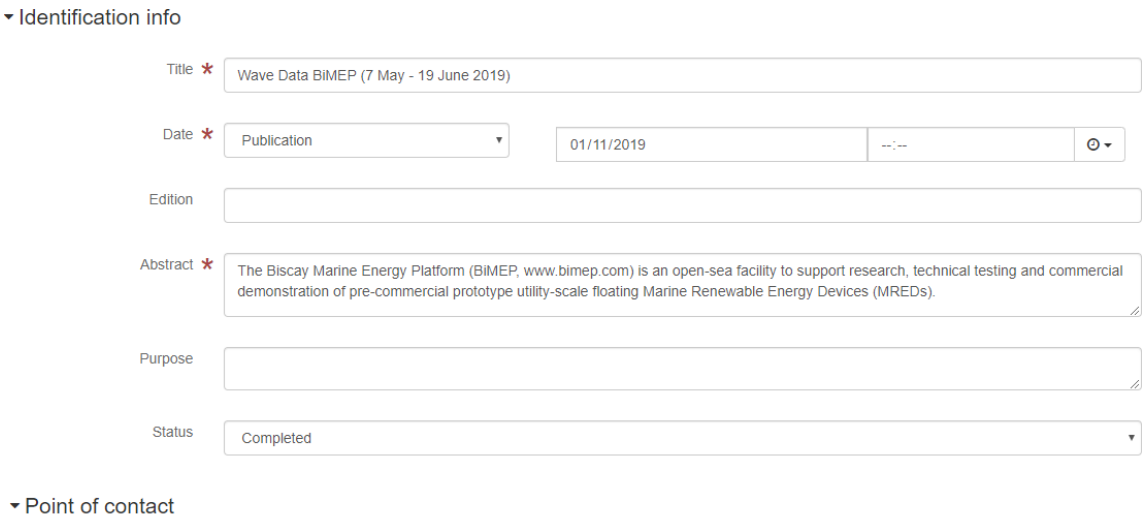

Figure 12. Create a metadata (Step 3).

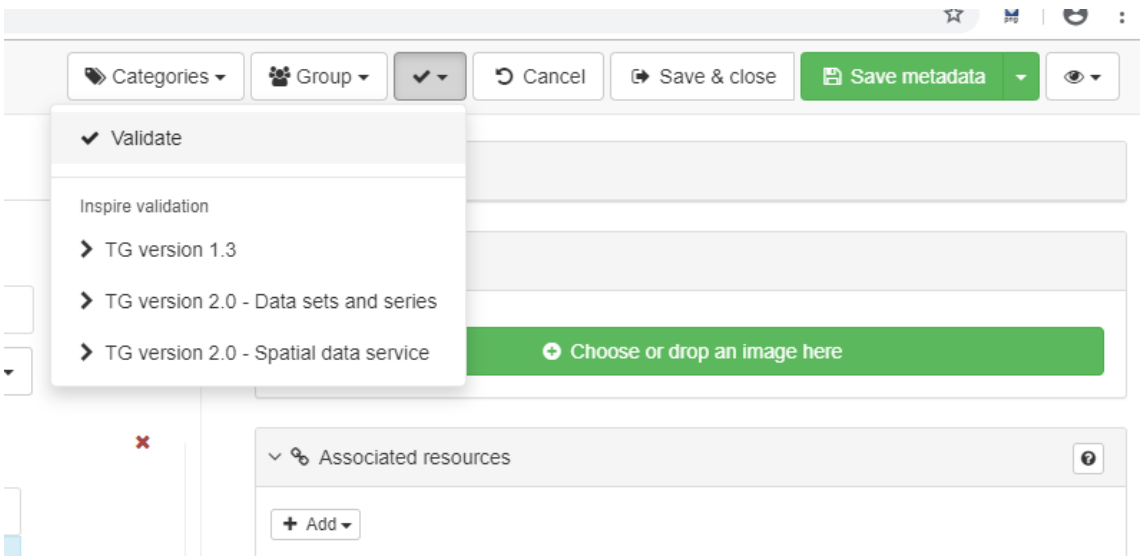

Figure 13. Create a metadata (Step 3).

If it reports errors, click on the red thumb down and correct the identified errors (Figure 14).

Scroll the metadata page, find the missing field and fill it. Then save and validate again (Figure 15).

To add the link to the FTP or to the YouTube video, click +Add in the Associated Resources section (Figure 16).

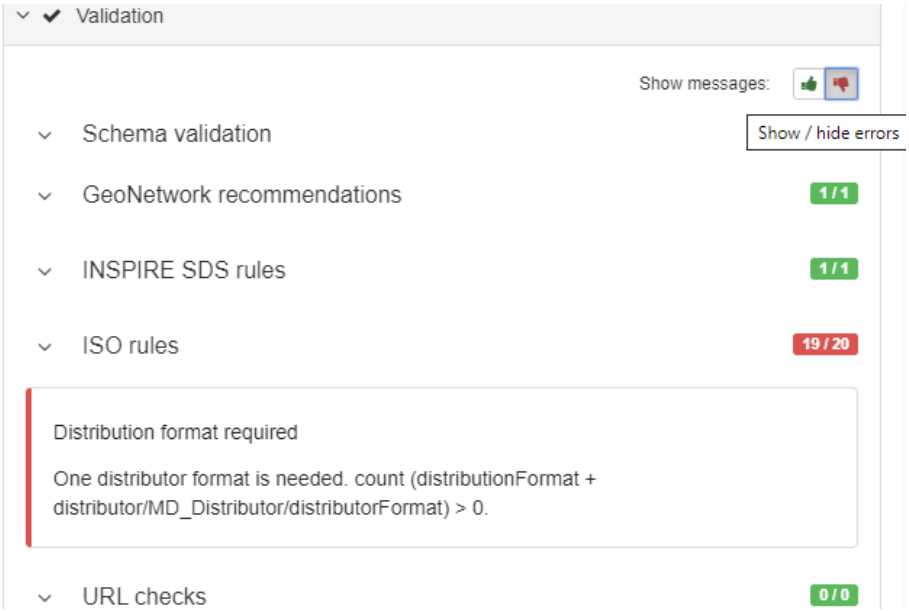

Figure 14. Metadata validation and Error identification.

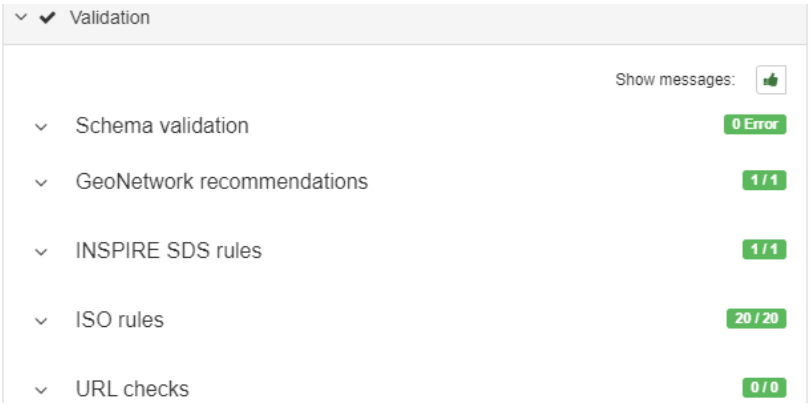

Figure 15. Metadata validation without errors.

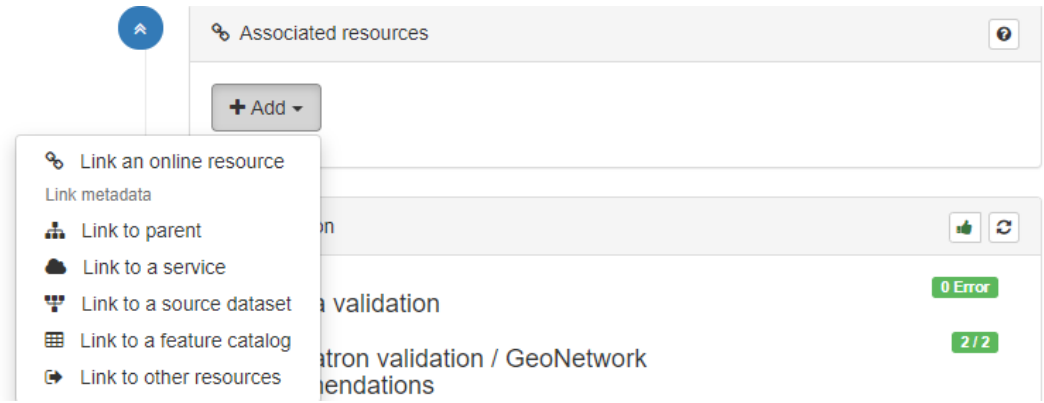

Figure 16. Add the link to an online resource.

There choose the Link to an online resource option.

To add the link to the FTP, in the Protocol choose the File for download through FTP option and in the URL add the link to the file on the FTP, starting from the root folder (for example /WP2%20Environmental%20Monitoring/T2.3%20Acoustic%20monitoring/Wave%20Data%20BiMEP%20%287%20May%20-%2019%20June%202019%29.xlsx).

Too add the link to the YouTube video or the external sources, in the Protocol choose URL option and, in the URL, add the link to the video (for example https://www.youtube.com/watch?v=lPaCeaOYLFg).

Finish by clicking in the button Add online resource (Figure 17).

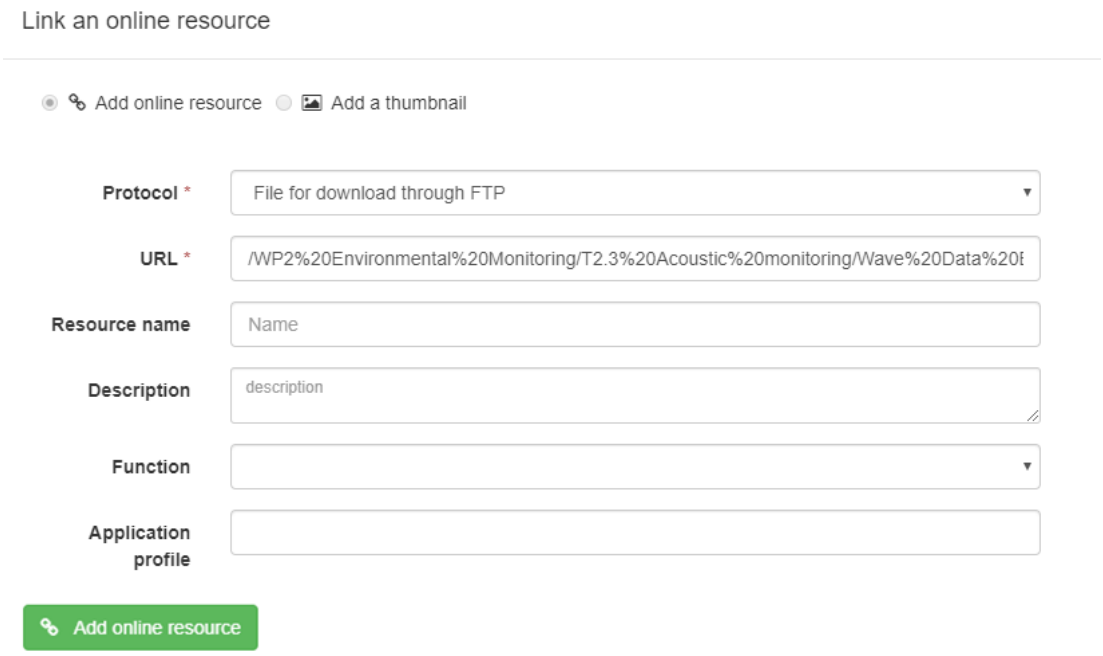

Figure 17. Add the link to the FTP or the link to the YouTube video.

Save and close the metadata. To see all the files, go to Contribute / Editor board (Figure 18).

After adding the new record, HIDROMOD proceeds to insert the data source in MARENDATA. Once inserted in the platform, you can download the data, consult the metadata, locate the data source and, according to the import format, view the information in video, map or graphic format.

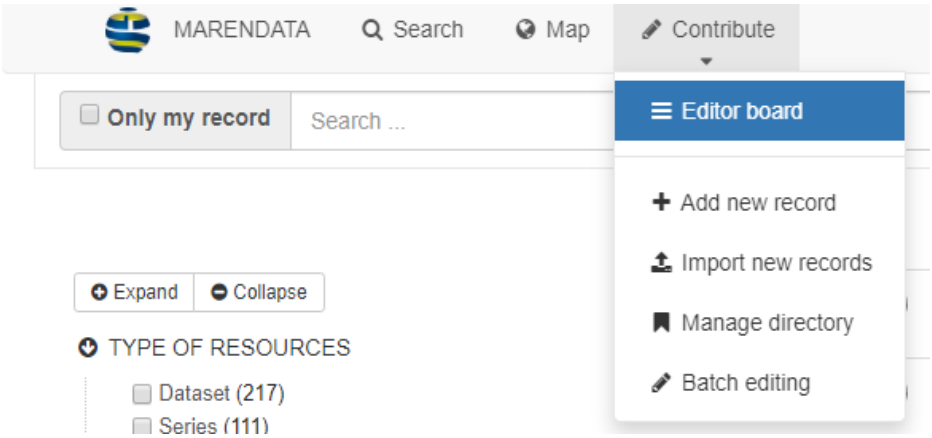

Figure 18. List of all available data sources.