



**Preparatory Actions for European Marine Observation and Data
Network**

**FOURTH PROGRESS REPORT
FOR THE PERIOD
DECEMBER 2009 – JANUARY 2010**

**Service Contract No. “MARE/2008/03 - Lot 1 Hydrography –
SI2.531515”**

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1. INTRODUCTION

EMODNET (European Marine Observation and Data Network) is a contribution to the EU Integrated Maritime Policy. Currently there are 5 Lots (pilots) under development. This progress report nr 3 gives an overview of the activities undertaken for the Hydrography Lot during the months December 2009 and January 2010. This is an extensive report also because there was a projectgroup meeting in January 2010 at which many important issues were discussed and agreed.

The EMODNET Hydrography pilot has officially started 29th May 2009, so the first important contractual milestone will be 29th May 2010. At that date the proto-type EMODNET Hydrographic portal must be operational and serving out a number of hydrographic data products and metadata, describing the background data sets, that were used for the making of the data products. The data products will also be provided as data layers to the European Atlas of the Seas and to the European broad-scale seabed habitat mapping project.

2. PROGRESS REPORT AND ACTIONS

Following the technical annex of the original tender proposal and the action list as agreed at the kick-off meeting end June 2009 further project progress has been made in this period. A concise report of activities and progress is given below.

- **Website, extranet and dissemination**

The website is almost ready and the draft version can be found at <http://www.emodnet-hydrography.eu/welcome.asp>. The partner section mentions each of the partners. This can be extended with a section 'associate partners' mentioning possible external data providers.

The EU has recently released a new version of the EMODNET logo.

Action: MARIS will check whether the new logo is final and if so, include it in the website, that will be finalised and launched soon.

The **Extranet** gives registered partners an archive of all contract documents and project documents.

Partners can use the mailing list projectgroup@emodnet-hydrography.eu, which includes all partners. Only included partners can write to this list, which then distributes their message to all partners.

Action: MARIS will prepare a leaflet, once the website is open.

Action: MARIS awaits the logo design activities of the EU and will incorporate the official logo, once available from the EU.

MARIS also prepared and submitted in January 2010 an abstract for the IMDIS conference, that will take place 29th – 31st March 2010 in Paris – France. See <http://www.seadatanet.org/imdis2010>

- **Contractual arrangements**

The **Consortium Agreement**, prepared by MARIS, has been finalised after a review by partners. It has recently been signed by all partners. The fully signed Consortium Agreement is available via the Extranet.

MARIS has reported so far twice to the EU: the first 2-months report for June-July 2009 and the power point report at the EU Concertation meeting in November 2009. These reports are available at the extranet.

MARIS recently prepared and submitted the 2-months report for August-September 2009, for October-November 2009 and the December 2009 – January 2010 reports.

- **Data products to be delivered**

IFREMER, NOCS and MARIS make progress in analysing the list of data products, to be delivered, and preparing a practical translation and specifications of the deliverables. This list was presented and discussed at the Projectgroup meeting in January 2010 at NERC-NOCS in Southampton – United Kingdom.

Contractually the following geographical information system layers must be produced and provided to users:

- a. water depth in gridded form over whole of maritime basin on a grid of at least quarter a minute of longitude and latitude.
- b. water depth in vector form with isobaths at a scale of at least one to one million.
- c. depth profiles along tracklines
- d. multibeam surveys along tracklines
- e. coastlines
- f. underwater features – wrecks, seabed obstructions etc

It is important that we define exactly what we understand by each layer and what we are going to deliver.

Ad a: water depth in gridded form

The waterdepth parameters will be calculated from source data and delivered as DTM. The grid size (y,x) of the DTM is a quarter of a minute of latitude and longitude. The waterdepth parameters are defined for the centre of each grid. The geodetic system for the grid is chosen as 'WGS84'.

Source data are preferably **survey data** (single and multi beam surveys, echo soundings, ..). But a number of external providers might opt to deliver only **composite data products** (DTM's with a specific grid resolution), that are derived by the external data providers themselves (e.g. HO's) from survey data. In those cases partners must encourage data suppliers to provide a high resolution DTM and still also metadata for the underlying surveys. Alternatively GEBCO gridded data will be used to complete area coverage. In that case metadata of survey data will be missing completely. It is accepted that the accuracy and precision of the gridded data will vary over the basins in question. No new data will be collected specifically for this project.

In case of multiple survey data for a cell **all** surveys will be used for the calculations.

In practice the coverage of each grid cell by source waterdepth values thus will depend on the source material. There might be grid cells with a large number of values and others with a minimal number.

The waterdepth parameters to be delivered for the centre pixel of each DTM grid cell are now defined and agreed as followed:

- Depth minimum
- Depth maximum
- Depth average
- Depth standard deviation
- Number of values used for interpolation

The vertical reference is defined and agreed as 'Lowest Astronomical Tide (LAT)', which is recommended by IHO.

Action: IFREMER and NOCS will explore in deliberation with modellers whether an overall transformation from LAT to Mean Sea Level (MSL) is feasible and can be added. This action is planned for the second project year.

The unit of measure for the waterdepths is 'metres'.

In addition each grid cell will indicate a reference, that depending on the used source material will refer to:

- ID('s) of related CDI metadata records (in practice partners will deliver a Local_CDI_ID, that is locally unique. During central compilation MARIS together with ATLAS will convert the Local_CDI_ID to a centrally unique Central_CDI_ID, both in the DTM data and in the CDI Metadata).
- Documentation of the used composite survey data (DTM data from external source)
- GEBCO

The way for calculating the waterdepth parameters will be defined in the QA/QC method, that is described below. This might also bring forward additional quality parameters.

The DTM data product (waterdepth parameters and references info) will be made freely available for all users without any restriction or registration. The distribution can take place by **download services** for portal users and by **OGC services** that can be used by remote servers. The formats, types of services and functionality will be worked out in the agenda item on the Portal Specifications.

Ad b: water depth in vector form in isobaths

The waterdepth isolines (=isobaths) will be calculated automatically, including some smoothing, by the portal software from the stored DTM values for:

- Depth minimum
- Depth maximum
- Depth average

The isobaths data products will be made freely available for all users without any restriction or registration. The distribution can take place by **download services** for portal users and by **OGC services** that can be used by remote servers. The formats, types of services and functionality will be worked out in the agenda item on the Portal Specifications.

Ad c: depth profiles along tracklines

The portal user interface will provide the functionality for users to draw transects on the gridded waterdepth maps or isobaths maps, both for Depth minimum, Depth maximum and Depth average, and then to see the vertical layout of the seabed along the transects.

This functionality will be made freely available for all users without any restriction or registration.

Ad d: multibeam surveys along tracklines

The portal and its databases will provide access to the DTM data products and the CDI metadata, that will be produced for the background survey data sets, that are used for the DTM production. As explained above we strive for a complete coverage of background data surveys, but in practice this will be difficult, because external data suppliers might provide composite data products (DTM's) themselves with limited references to used background data surveys, and in a number of cases only GEBCO data might be available without background references.

Thus where possible CDI metadata records will be produced for background data surveys. Note: CDI's can not be used to describe DTM data sets or GEBCO data sets. The background survey data sets themselves will not be stored at the portal, but remain under management of their data providers. The portal will facilitate users in requesting access to the background datasets from their managers via the CDI metadata and a shopping mechanism. The agenda item on CDI metadata will explain the metadata format, the method for producing CDI records and the data requesting service.

Considering the distributed storage and management of the background survey data sets it is not possible to provide direct access to multibeam surveys along tracklines. Alternatively it is therefore agreed that the portal will provide users insight in the geographical position and coverage of identified multibeam surveys as part of the CDI metadata.

Action: The CDI metadata can include the tracklines (navigation tracks) or the geographical coverage (polygons of the beam coverages) of identified multibeam surveys. The polygons of identified individual multibeam surveys should be complimented with polygon outlines of composite DTM data, that are provided by external data suppliers based upon multibeam surveys. Pragmatically it is decided to deliver in the first year tracklines and/or polygons coverages of individual multibeam surveys by means of the CDI metadata as a data product layer. This depends on availability at the sources. The regional taskleaders (IFREMER, NERC-NOCS, and ATLAS) will undertake action.

The track and area coverage layers will be made freely available for all users without any restriction or registration. This also applies for the CDI metadata.

Ad e: coastlines

The EMODNET pilots have asked for a common coastline for the European seas. This should be an existing data product, because compiling a coastline or upgrading an existing one is not part of the project. There are a number of options:

- **World Vector Shoreline (WVS):**
WVS was produced by the US National Imagery and Mapping Agency (formerly the US Defense Mapping Agency) and has been adopted as the standard world coastline for the updating of GEBCO north of 60°S. South of 60°S, the WVS has been replaced for GEBCO use by the SCAR (Scientific Committee on Antarctic Research) coastline of Antarctica. The WVS provides a digital coastline with consistent global coverage at a scale of 1 : 250.000. The WVS is used as the coastline in the GEBCO's digital chart of the world. It has also been adopted as the standard coastline for use in IOC's Regional Ocean Mapping Projects. A description of the WVS may be found in Soluri, E.A. and V.A. Woodson (1990), 'World Vector Shoreline', International Hydrographic Review, Vol. LXVII(1), p27-36.
- **Prototype Global Shoreline Data (GDS) (Satellite Derived High Water Line Data):**
The NGA Office of Global Navigation, Maritime Division is in the process of developing a new version of World Vector Shoreline and in support of this effort has acquired a prototype Global Shoreline Data set. This new shoreline is an approximation of the High Water Line. Plans are in work to fill cloud gaps. The prototype aims for a scale of 1 : 75.000. However it is not ready yet.
- **Global Self-consistent, Hierarchical, High-resolution Shoreline Database (GSHHS):**
GSHHS is a high-resolution shoreline data set amalgamated from two databases (WVS and WDB) in the public domain. The data have undergone extensive processing and are free of internal inconsistencies such as erratic points and crossing segments. The shorelines are constructed entirely from hierarchically arranged closed polygons. The data can be used to simplify data searches and data selections, or to study the statistical characteristics of shorelines and land-masses. It comes with access software and routines to facilitate decimation based on a standard line-reduction algorithm. One can say that it is an upgraded version of the WVS with a comparable scale of 1 : 250.000. A description of the GSHHS may be found in Wessel, P. and Smith, W.H.F. (1996), 'A global self-consistent, hierarchical, high-resolution shoreline database', Journal of Geophysical Research, Vol. 101, No B4, p8741-8743, April 10, 1996. (see Annex).

After consideration of the proposal it is decided that the GSHHS coastline database provides the best choice and will be adopted in the EMODNET Hydrography lot. The portal will not

provide a way to download the dataset, but it will refer to the official GSHHS website, where other users can download the product and can find additional background information and possible updates. The official website is:

<http://www.ngdc.noaa.gov/mgg/shorelines/gshhs.html>

Ad f: underwater features – wrecks, seabed obstructions etc

As described in the Tender document, which is annex to the contract, it is planned to provide only underwater features derived from data supplies by HO's. These will comprise those underwater features, that are included in the nautical charts and ENC's. Most probably the license with the HO's will only allow for including the layer in the portal and OGC WMS services, but not as downloadable files.

Action: ATLIS will negotiate with HO's the availability of underwater features for the EMODNET Hydrography portal.

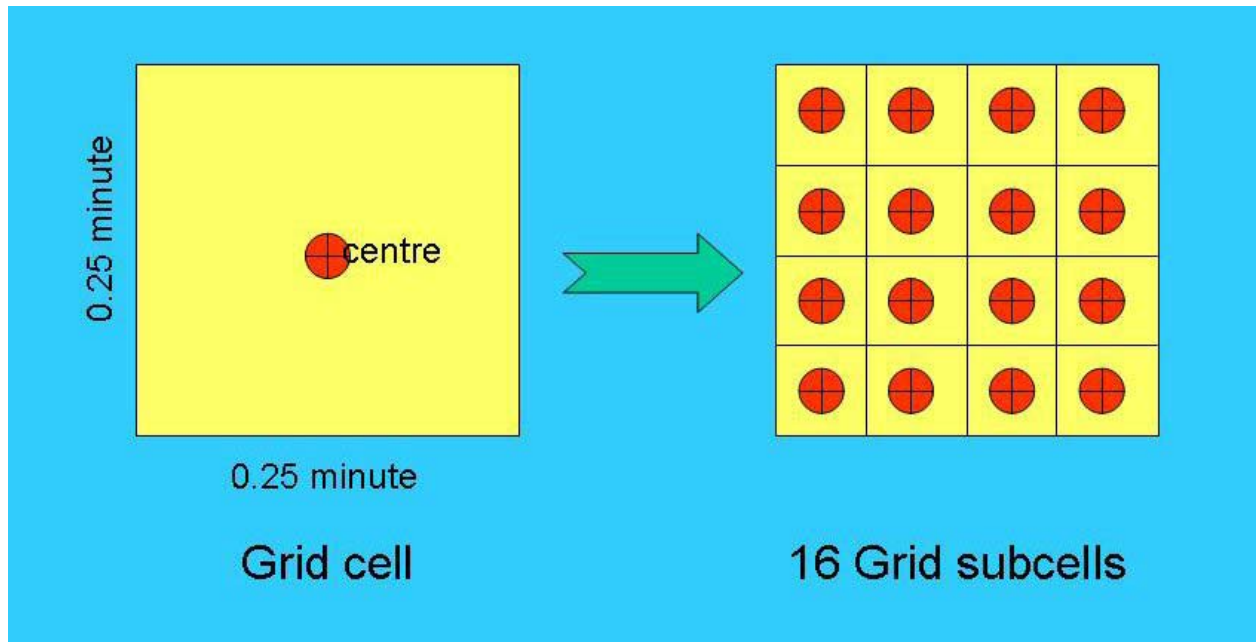
- **Quality Assurance / Quality Control**

There has been work on-going by IFREMER, SHOM, NOCS and Atlis to prepare and finetune a QA/QC document. Recently the latest draft of IFREMER has been discussed at the projectgroup meeting in January 2010. Partners agree on the DTM reference framework as follows:

- The waterdepth parameters will be calculated from source data and delivered as DTM. The grid size (y,x) of the DTM is a quarter of a minute of latitude and longitude. The waterdepth parameters are defined for the centre of each grid cell. The geodetic system for the grid is chosen as 'WGS84'. The convention is X = longitude in decimal degrees from -180 to +180 with East >0; Y = latitude in decimal degrees from -90 to +90 with North > 0.
- The outline of the overall DTM, covering all European seas, is defined as a bounding box, made up of the South West corner of the most South West grid cell and the North East corner of the most North East grid cell.

Action: Atlis will define a.s.a.p. the outline of the overall bounding box in such a way that it covers all European seas. Also Atlis, IFREMER and NOCS will define the outlines of the bounding boxes of each regional DTM so that these can be nested in the overall DTM grid. There should be a limited overlapping between adjoining DTM's; this should be well defined!

- The parameters per grid cell will be calculated for the centre pixel and are defined as follows (see also Agenda item 3): Waterdepth maximum [m to LAT], Waterdepth minimum [m to LAT], Waterdepth average [m to LAT], Waterdepth standard deviation [m] and Number of sounding/DTM values used for interpolation.
- It is agreed to do the calculation as follows: depending on the source material and its resolutions there might multiple sounding/DTM values in a grid cell. Every available value will be taken into account in the calculations. Of course only from the surveys satisfying the QA/QC conditions. Their density might differ over the grid cell surface, which might bias the interpolation. Therefore each grid cell of a quarter minute by a quarter minute will be subdivided in 16 equidistant rectangles and for the centre pixel of each subcell the Waterdepth parameters will be calculated. Thereafter the 16 subcell parameter sets will be averaged per grid cell to represent a more balanced grid centre parameters set. Note: This is called 'cell registred' method. There is also a grid registred method possible whereby values are calculated at the intersections of the grid and not in the centre.



- There might be grid cells without any sounding / DTM values. In those cases it is agreed to calculate the gridcell values by interpolating from the values of bounding grid cells.
- It can be difficult to produce a homogeneous DTM. Therefore it is decided to include also a 'smoothed depth' for the average waterdepth, that is calculated by means of a spline function. The 'smoothed average waterdepth' should be provided together with the offset between the average smoothed waterdepth and the average water depth and an indicator (as percentage) of the offsets greater than 1% of the water depth. This together with the minimum, maximum and standard deviation values will thus give a good indication of the quality and accuracy of the waterdepth parameters in each grid cell.
- Each grid cell will include indicators, that depending on the used source material refer to:
 - ID('s) of related CDI metadata records via one or more Local_CDI_ID's.
 - Documentation of the used composite survey data (DTM data from external source)
 - Documentation to GEBCO
- Finally it is considered to include as indicators also the age of the youngest sounding in each gridcell as well as the oldest sounding, both expressed by year of survey. This extra is postponed till the second year.
- The regional taskleaders with contributions of partners will gather and process relevant survey data sets and composite DTM data sets and produce from these the grid parameters and metadata records as defined, for the regional DTM areas. Thereafter the 3 DTM's and CDI metadata sets will be loaded and integrated into the portal DTM and the central CDI metadatabase by ATLIS and MARIS together. The exchange of DTM values is done following the ASCII format, that ATLIS has defined and distributed earlier (this is available on the Extranet). MARIS and ATLIS will add Central_CDI_ID's to the DTM and CDI metadata sets, whereby the relation Local_CDI_ID – Central_CDI_ID is managed for supporting future updates. Note: to users of the portal and CDI service only Central_CDI_ID's will be known and used; between the portal and regional managers the Local_CDI_ID's are used.

Action: IFREMER, SHOM and NOCS will finalise a.s.a.p. the QA/QC document, documenting the DTM production method, the QA/QC principles and the resulting parameters, as summarised above.

- **Available data sets**

Partners are making progress with identifying and gathering data sets for the maritime regions. However the cooperation by external providers in a number of cases goes not as well as anticipated beforehand. Some identified suppliers do not want to deliver survey data sets, but only composite DTM data at specific resolutions. The delivery of sufficient metadata is a problem in specific cases.

The overall strategy should be, that we try to get good external cooperation and gather as much as possible data sets in the first year. This can be encouraged by making financial arrangements with suppliers, e.g. for preparing metadata, from the budget that we have set aside. This in combination with naming data suppliers as associate partners at the website and in other promotional activities. Also it should be stressed to potential suppliers, that they will stay in control of their data sets, that we will not distribute their data sets, but that the metadata portal will provide an excellent shop window to reach other users in search of data. That this can be applied by data suppliers in economic and scientific ways.

However in case of delays or unwillingness by external sources, we should fill up the missing areas for the time being with GEBCO data, and report the situation to the EU. Possibly the EU can then assist us by applying pressure.

Action: The regional taskmanagers will continue the gathering process and at a regular interval will keep the coordinator informed of progress and possible issues.

- **Metadata**

TheSeaDataNet Common Data Index (CDI) V1 metadata format is the basis for the background survey metadata. Considerable progress has been made by MARIS together with the SeaDataNet Technical Task Team (TTT, that is governing the CDI format) and members of the EMODNET Hydrography project and the EU Geo-Seas project to formulate a number of extensions to the CDI format and to have these accepted.

The original CDI V1 format is fit for all types of observations, but so far only for point observations or by using bounding boxes to schematise tracks and polygons. For the purpose of Geo-Seas and EMODNET Hydrography work has been undertaken to extend the CDI V1 format with a GML object, so that tracks and polygons can be described in much more geographical detail, and an extra service bindings element. Following the requirements by the EMODNET Hydrography group also recently 2 extra elements have been added to the core CDI V1 GML format:

- Option to include positioning systems via multiple entries of measurement devices and supported by a new class L056 of the L05 device categories vocabulary
- Option to include a resolution in space or time via entry of a numeric value in combination with a unit from the P061 vocabulary. This way e.g. the survey resolution (gridsize) can be added, which together with the positioning system info gives more insight in the data quality.

The CDI extension proposal has been fully documented and favourably discussed at the SeaDataNet TTT meeting in January 2010. The full CDI V1 GML documentation, XML examples and schema for the extended CDI V1 format are included in the Extranet.

The number of coordinates for describing the tracks and later the beam polygons might be quite large. Therefore it is recommended to use a freely available PC programme 'Ends and Bends' that previously has been used in the EuroSeismics project to filter out coordinates and to generate a lower resolution smooth track or polygon, that is perfectly suited for discovery purposes.

Action: MARIS will make the 'Ends and Bends' software program available from the Extranet.

We strive for a complete coverage of background data surveys, but in practice this will be difficult, because external data suppliers might provide composite data products (DTM's) themselves with limited references to used background data surveys, and in a number of cases only GEBCO data might be available without background references. CDI's can only be used for describing survey data sets and not for DTM data sets or GEBCO data sets.

Action: Partners must urge external data providers to provide good background information in case of DTM's data products, pref at CDI level.

Full acceptance of the CDI upgrade is expected mid February 2010. Once accepted also the CDI editing tool MIKADO has to be upgraded by IFREMER to suit the extensions in the format and Schema. Also the SeaDataNet CDI import and retrieval options of the portal have to be adapted for the upgraded CDI format. This can take place in February – March 2010. However in the meantime partners are advised to prepare CDI metadata entries using the existing format and MIKADO version, thereby keeping the lists of coordinates of tracks and polygons as separate files.

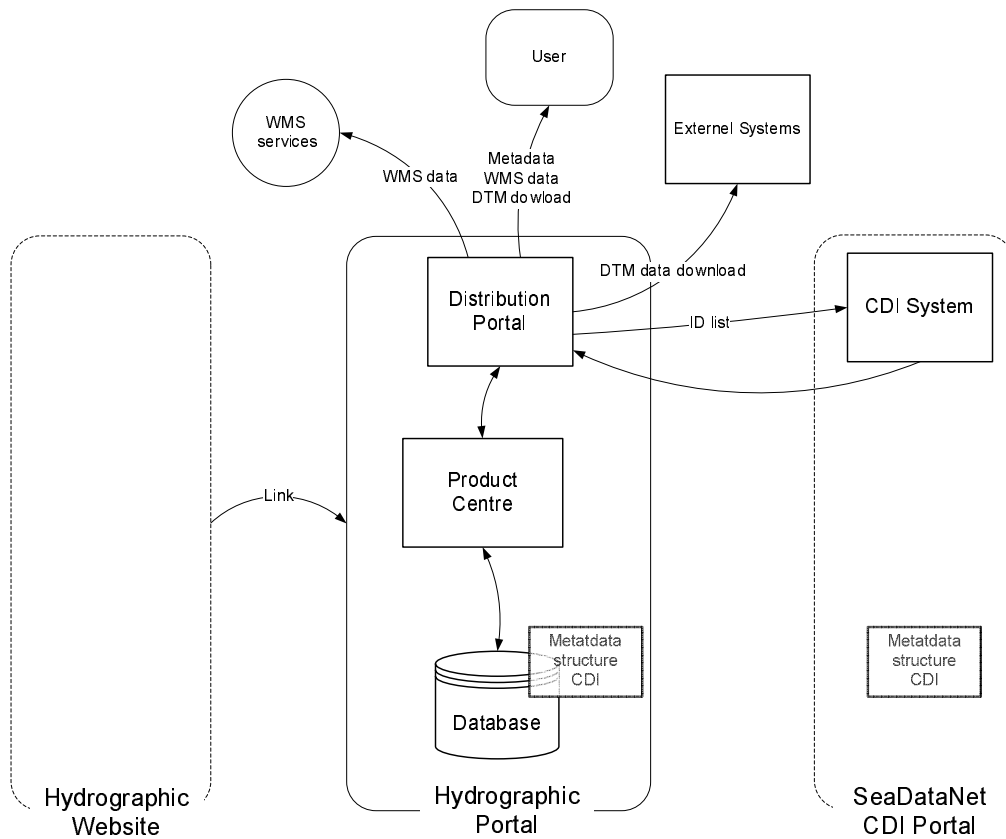
Action: MARIS coordinates the finalisation and acceptance of the upgraded CDI V1 GML format. IFREMER undertakes the MIKADO upgrading. MARIS undertakes the portal import and retrieval upgrading. Deadline: March 2010.

Action: Partners undertake action to gather metadata in the CDI format.

- **Portal – user interface - functionalities**

The EMODNET Hydrography portal will provide various services and functionalities to users for viewing and downloading the hydrographic data products. The central integrated DTM and the central integrated CDI metadatabase will provide the basis databases, on which the user applications will be provided. The Hydrographic portal will be embedded in the Hydrography website via a link and extra tab / new browser window. The Hydrographic portal will also communicate with the SeaDataNet CDI service to submit and follow-up requests by users for possible access to the background survey data sets.

Atlis and MARIS made good progress on formulating the planned portal functionalities and in particular details about the foreseen downloading services (for users of the portal) and OGC services (for remote servers). This was discussed at the projectgroup meeting in January 2010.

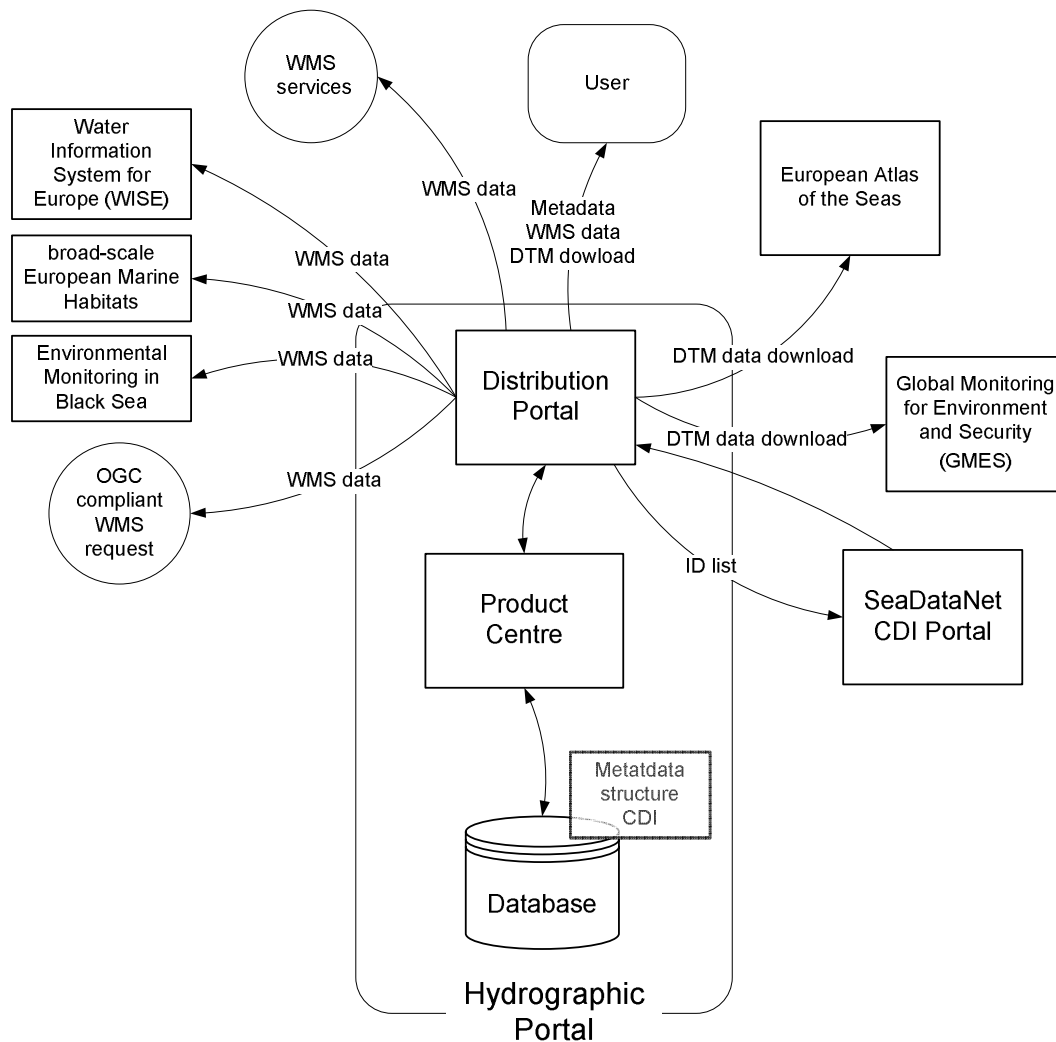


The following draft table gives the output formats as used by the download services and the OGC services per data products layer.

No.	Source	Product			
		Type	Format	Interface	User
1	Underwater features	WMS	WMS jpeg / gif	WMS	Systems
2	Coastlines	WMS (1:250K)	WMS jpeg / gif	WMS + URL for users to retrieve the dataset	Systems
3	DTM – waterdepth parameter sets	WMS layer	WMS - geotiff layer for waterdepth parameters	WMS, with identify option to retrieve full set per grid cell	Systems
4		gridded data for downloading	X,y,z, Covering all waterdepth parameters	CSV file	Public
5			X,y,z, Covering all waterdepth parameters	ESRI ASCII	Public
6			X,y,z, Covering all waterdepth parameters	Fledemaus SD file for free viewer	Public

7			Geotiff, Covering all waterdepth parameters	Geotiff file	Public
8			NetCDF CF, Covering all waterdepth parameters	NetCDF CF file	Public
9	DTM – isobaths	WMS (1:1M)	WMS – geotiff automatically calculated from DTM parameters	WMS	Systems
10		gridded data for downloading	X,y,z, Min, max and av	See filetypes above	Public
10	Depth profile along track lines	Cross sections	jpeg / gif	User defined Cross sections	Public
11	DTM (GEBCO)	-	-	-	Public
12	Surveys (demo)	In 2 nd Year			
13	Map location of surveys (tracks / polygons)	WMS	WMS – jpeg / gif	WMS	Systems
14	Requesting access to Surveys	CDI portal	CDI portal	CDI portal	Registered user
15	World map	-	-	-	Public

Action: Atlis and MARIS will finalise the portal specifications document a.s.a.p. The download will take place on pre-processed files, that cover specific tiles. The portal document will include how to tune the tiles to the DTM bounding box and grid per maritime region. This will indicate to users for which regions data sets can be downloaded. Also it will document the format of the ASCII CSV, ESRI ASCII, NetCDF (CF), GeoTIFF and Fledermaus SD file formats, taking into account the agreed set of DTM waterdepth parameters..



- **Exchange with EMODNET Habitat Mapping Lot**

JNCC participated in the projectgroup meeting of january 2010. The Habitat project's initial requirement from the Hydrography lot is DTM water depth outputs as ASCII files (they will be used in raster modeling and threshold analysis, using ESRI ArcGIS). The project will also link to the WMS layers through its webportal. For the time being the EUSeaMap project can use alternative bathymetry, e.g. GEBCO, but access to the bathymetry produced by the Hydrography group as soon as possible will help improve in particular our threshold analysis and hence the final habitat maps.

Action: We will keep JNCC up to date on our progress and will try to deliver our first DTM release by end April 2010.