PRODUCT USER MANUAL

IBI_MULTIYEAR_WAV_005_006

Issue: 3.1

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RECORD TABLE

Issue	Date	§	Description of Change	Author	Validated By
1.0	**23/12/2017**	all	**[EIS March 2018: IBI-V4 version]** **First release** of the IBI-MFC MY **WAV-V4** product. Temporal coverage from 01/01/1992 to 31/12/2016	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
1.1	**15/01/2019**	all	**[EIS April 2019: IBI-V4 version]** **Temporal extension:** from 01/01/2017 to 30/05/2018	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
1.2	**08/04/2019**	all	**[EIS July 2019: IBI-V4 version]** **Temporal extension:** from 31/05/2018 to 30/12/2018. New dataset for static files.	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
1.3	**06/12/2019**		**[EIS March 2020: IBI-V4 version]** **Temporal extension:** from 31/12/2018 to 30/06/2019.	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
1.4	**03/04/2020**		**[EIS July 2020: IBI-V4 version]** **Temporal extension:** from 01/07/2019 to 30/12/2019.	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
2.0	**10/09/2020**		**[EIS December 2020: IBI-V6 version]** **First release** of the IBI-MFC MY **WAV-V6** product. Temporal coverage from 01/01/1993 to 31/12/2019. Update of the MFWAM model code. Horizontal resolution increased to 5 km. Implementation of SWH altimeter data assimilation using optimal interpolation algorithm and off-line coupling of current forcing. OSS	L. G. San Martín E. Barrera M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
2.1	**10/09/2021**		**[EIS December 2021: IBI-V6 version]** **Temporal extension:** from 30/12/2019 to 30/12/2020	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo
2.2	**08/08/2022**	all	**[EIS November 2022: IBI-V6 version]** **Temporal extension:** from 2020-12-31 to 2021-12-31. Adaptation of the document to the new template.	M. G. Sotillo A. Amo L. Aouf C. Toledano	M. G. Sotillo

3.0	**16/06/2023**	all	**[EIS November 2023: IBI-V7 version]** **First release** of the IBI-MFC MY **WAV-V7** product. Temporal coverage from 01/01/1993 to 30/12/2022. Update of the MFWAM model code. Horizontal resolution increased from 1/20 to 1/36º. New variables on the highest wave. New climatological dataset. Update of the static files. Renaming of the datasets. New format of the PUM document.	C. Toledano A. Amo L. Aouf R. Aznar	S. Cailleau M. G. Sotillo
3.1	**31/05/2024**	All	**[EIS November 2024: IBI-V7 version]** Extension of MY wave product back to 1980 Temporal extensions up to 2023 Delivery of air-sea fluxes for WAV MYP from 1980	B. Gómez L. Castrillo L. Aouf R. Aznar	S. Cailleau M. G. Sotillo

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GLOSSARY AND ABBREVIATIONS

CF	Climate Forecast (convention for NetCDF)
CMEMS	Copernicus Marine Environment Monitoring Service now referred as Copernicus Marine Service
ECMWF	European Centre for Medium Range Weather forecast
GLO	Global
IBI	Iberian Biscay Irish
Meridional Velocity	West to East component of the horizontal velocity vector
MFC	Monitoring and Forecasting Centre
MFWAM	Meteo France WAve Model
MY	Multi Year
NRT	Near Real Time
NWS	North West Shelf
NetCDF	Network Common Data Form
PUM	Product User Manual
QUID	Quality Information Document
SLA	Sea Level Anomalies
SSH	Sea surface height
Zonal Velocity	South to North component of the horizontal velocity vector

DATA ACCESS

After registration, you will be able to download our data. To assist you, our HelpCenter is available, and more specifically its section about download.

Information on operational issues on products and services can be found on our User Notification Service. If you have any questions, please contact us.

I INTRODUCTION

I.1 Summary

This document is the Product User Manual (PUM) for the wave Multi-Year (MY) reanalysis product **IBI_MULTIYEAR_WAV_005_006**, starting in **01/01/1980** and regularly updated, in the Atlantic -Iberia Biscay Ireland- area (generated and provided by the IBI-MFC). This document comprises a description of data files and user interfaces to get access to this product, as well as a brief description of the reanalysis system used in its generation.

This product is defined on a standard grid at **1/36 degree**, (approx. 2-3 km), extending from 19°W to 5°E and 26°N to 56°N.

The product is organized in the following datasets:

1. **cmems_mod_ibi_wav_my_0.027deg_PT1H-i:** containing hourly instantaneous fields, including wave Height, Period and Direction for total spectrum and fields of Wind Wave (or wind sea), Primary Swell Wave and Secondary Swell for partitioned wave spectra; and the highest wave variables, such as maximum crest height and maximum crest-to-trough height.
2. **cmems_mod_ibi_wav_my_0.027deg_static:** containing the coordinates, bathymetry and mask files used to generate this IBI product.
3. **cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i :** containing hourly instantaneous fields of the energy flux into ocean and the ocean side stress.
4. **cmems_mod_ibi_wav_my_0.027deg-climatology_P1M-m**: containing the climatological parameters (monthly mean) of significant wave height (VHM0) and mean period (VTM02), for the period 1993-2016.

The IBI-MFC Production Unit (run by Nologin with the support of CESGA, in terms of supercomputing resources) is responsible of the generation and delivery of the product.

The product is available on-line and disseminated through the Dissemination Unit of the Copernicus Marine Service after automatic and human quality controls. Files downloaded are in **NetCDF-4** format and follow **CF-1.8** convention.

The analysis and forecast system is described in the Quality Information Document (QUID – see link in References)

I.2 History of changes

System Version (Project/Service)	Operational launch	End of operations	Novelties
IBI-V4 EIS Mar 2018 (Copernicus-1 Phase-I)	26/04/2018	16/04/2019	**First release** of the IBI-MFC MY **WAV-V4** product. Temporal coverage from 01/01/1992 to 31/12/2016.
IBI-V4 EIS Apr 2019 (Copernicus-1 Phase-II)	16/04/2019	09/07/2019	**Temporal extension:** from 01/01/2017 to 30/05/2018
IBI-V4 EIS Jul 2019 (Copernicus-1 Phase-II)	09/07/2019	31/03/2020	**Temporal extension:** from 31/05/2018 to 30/12/2018. New dataset for the static file.
IBI-V4 EIS Mar 2020 (Copernicus-1 Phase-II)	31/03/2020	07/07/2020	**Temporal extension:** from 31/12/2018 to 30/06/2019. This temporal extension was carried out with no changes in terms of wave model set-up or atmospheric forcing.
IBI-V4 Jul 2020 (Copernicus-1 Phase-II)	07/07/2020	15/12/2020	**Temporal extension:** from 01/07/2019 to 30/12/2019. This temporal extension was carried out with ERA5 forcing as a result of the switch off the Era Interim, with consistency in the products.
IBI-V6 EIS Dec 2020 (Copernicus-1 Phase-II)	15/12/2020	14/12/2021	**First release** of the IBI-MFC MY **WAV-V6** product. Temporal coverage from 01/01/1993 to 31/12/2019. Horizontal resolution increased to 5 km. Implementation of SWH altimeter data assimilation using optimal interpolation algorithm and off-line coupling of current forcing.
IBI-V6 EIS Dec 2021 (Copernicus-1 Phase-II)	14/12/2021	29/11/2022	**Temporal extension:** from 30/12/2019 to 30/12/2020 This temporal extension is consistent with the rest of the reanalysis data. In its production, it was used same model set-up, same data sources for assimilation and forcing (same ERA5 winds and open boundary conditions, but the coupling with surface currents (IBI PHY MY currents for 2020 year was not available).
IBI-V6 EIS Nov 2022 (Copernicus-2 Phase-I)	29/11/2022	30/11/2923	**Temporal extension:** from 30/12/2020 to 30/12/2021

IBI-V7 **EIS Nov 2023** **(Copernicus-2 Phase-I)**	30/11/2023	26/11/2024	**First release** of the IBI-MFC MY **WAV-V7** product. Temporal coverage from 01/01/1993 to 30/12/2022. Update of the MFWAM model code: -Horizontal resolution increased from 1/20 to 1/36º. -Spectral resolution incresed from 24 direntions x 30 frequencies to 36 directions x 30 frequencies. -New assimilation sources: spectra from Envisat-SAR and CFOSAT. New variables on the highest wave: maximum crest and crest-to-trough heights. New climatological dataset (monthly means of significant wave height (VHM0) and mean period (VTM02). Update of the static files. Renaming of the datasets.
IBI-V7 **EIS Nov 2024** **(Copernicus-2 Phase-I)**	26/11/2024	…	Extension of MY wave product back to 1980 Temporal extensions up to 2023 Delivery of air-sea fluxes for WAV MYP from 1980

Table 1. Historical evolution of the IBI MFC MY wave reanalysis system along the Copernicus Marine Service. Time period in operation, as well as its main novelties with respect to the previous release, is provided for each system version.

II DESCRIPTION OF THE PRODUCT SPECIFICATION

II.1 General Information

Product Lines	**IBI_MULTIYEAR_WAV_005_006**
Geographical coverage	IBI longitude: [-19, 5] deg latitude: [26, 56] deg
Variables	**cmems_mod_ibi_wav_my_0.027deg_PT1H-i** Spectral significant wave height (Hm0) Spectral moments (0,2) wave period (Tm02) Spectral moments (-1,0) wave period (Tm-10) Mean wave direction from (Mdir) Wave principal direction at spectral peak Wave period at spectral peak /peak period (Tp) Maximum crest trough wave height (Hc,max) Height of the highest crest Spectral significant wind wave height Spectral significant primary swell wave height Spectral significant secondary swell wave height Mean wind wave direction from Mean primary swell wave direction from Mean secondary swell wave direction from Spectral moments (0,1) wind wave period Spectral moments (0,1) primary swell wave period Spectral moments (0,1) secondary swell wave period Stokes drift U Stokes drift V **cmems_mod_ibi_wav_my_0.027deg-climatology_P1M-m** Climatology monthly mean of the following variables: Spectral significant wave height (Hm0) Spectral moments (0,2) wave period (Tm02) **cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i** energy flux into ocean ocean side stress **cmems_mod_ibi_wav_my_0.027deg_static** Bathymetry Mask

	Coordinates (e1t, e2t)	
Product Type	Multiyear / Reanalysis	Yearly Temporal Extensions
	Assimilated observations: • Significant wave height (SWH) from altimeters: ERS1, TOPEX/POSEIDON, ERS2, GFO, Jason 2 & 3, Envisat, Saral, Cryosat-2 and Sentinel-3A; Sentinel-3. • Spectra from Envisat-SAR and CFOSAT.	
Model Set-Up	IFS-ECWAM-47R1 code. Model domain: 20°W-17°E; 25°N-64.6°N • 1h ECMWF analysed and forecasted winds as forcing. • IBI Copernicus Marine currents as forcings. • Daily Copernicus Marine GLOBAL wave data as Boundaries conditions (wave spectra). • Data assimilated from L3 Copernicus Marine altimeter data + Envisat-SAR and CFOSAT spectra.	
Available time series	From **1st January 1980** and regularly updated (typically twice a year).	
Horizontal resolution	1/36º	
Number of vertical levels	Surface product	
Temporal resolution	Instantaneous fields with hourly frequency	
Format	NetCDF CF1.8	
Delivery mechanism	Copernicus Marine Toolbox	

Table 2. General Information of the IBI_MULTIYEAR_WAV_005_006 product.

II.2 Details of datasets

IBI_MULTIYEAR_WAV_005_006
Dataset **cmems_mod_ibi_wav_my_0.027deg_PT1H-i**: contains hourly instantaneous fields. **cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i :** contains hourly instantaneous fields. **cmems_mod_ibi_wav_my_0.027deg_static**: contains coordinates, mask and bathymetry files. **cmems_mod_ibi_wav_my_0.027deg-climatology_P1M-m**: contains the climatological parameters (monthly mean) of significant wave height (VHM0) and mean period (VTM02), for the period 1993-2016. The **hourly instantaneous dataset** is composed of post-processed data into a regular 1/36º lat/lon grid that goes from 26°N to 56°N in latitude and 19°W to 5°E in longitude, called IBI service domain. Latitude and longitude step is 0.02778°, and the resulting horizontal grid extends to 1081 x 865 grid points. Information from all variables contained in these datasets is provided at the same grid points. The static dataset contains the static files used for the generation of this IBI product. **Variables name in the NetCDF file and Unit: Long_name & Standard_name**
cmems_mod_ibi_wav_my_0.027deg_PT1H-i
VHM0 [m] Spectral significant wave height (Hm0) sea_surface_wave_significant_height
VTM02 [s] Spectral moments (0,2) wave period (Tm02) sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment
VTM10 [s] Spectral moments (-1,0) wave period (Tm-10) sea_surface_wave_mean_period_from_variance_spectral_density_inverse_frequency_moment
VMDR [degree] Mean wave direction from (Mdir) sea_surface_wave_from_direction
VPED [degree] Wave principal direction at spectral peak sea_surface_wave_from_direction_at_variance_spectral_density_maximum

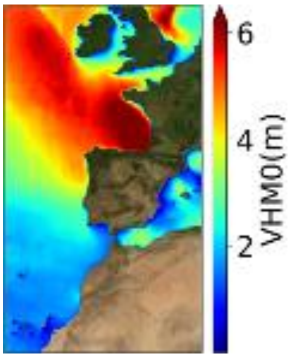
VTPK [s] Wave period at spectral peak / peak period (Tp) sea_surface_wave_period_at_variance_spectral_density_maximum
VCMX [m] Maximum crest trough wave height (Hc,max) sea_surface_wave_maximum_height
VMXL [m] Height of the highest crest sea_surface_wave_maximum_crest_height
VHM0_WW [m] Spectral significant wind wave height sea_surface_wind_wave_significant_height
VHM0_SW1 [m] Spectral significant primary swell wave height sea_surface_primary_swell_wave_significant_height
VHM0_SW2 [m] Spectral significant secondary swell wave height sea_surface_secondary_swell_wave_significant_height
VMDR_WW [degree] Mean wind wave direction from sea_surface_wind_wave_from_direction
VMDR_SW1 [degree] Mean primary swell wave direction from sea_surface_primary_swell_wave_from_direction
VMDR_SW2 [degree] Mean secondary swell wave direction from sea_surface_secondary_swell_wave_from_direction
VTM01_WW [s] Spectral moments (0,1) wind wave period sea_surface_wind_wave_mean_period
VTM01_SW1 [s] Spectral moments (0,1) primary swell wave period sea_surface_primary_swell_wave_mean_period

VTM01_SW2 [s] Spectral moments (0,1) secondary swell wave period sea_surface_secondary_swell_wave_mean_period
VSDX [m s-1] Stokes drift U sea_surface_wave_stokes_drift_x_velociy
VSDY [m s-1] Stokes drift V sea_surface_wave_stokes_drift_y_velocity
cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i
OSSX [Pa] Eastward ocean side stress surface_downward_eastward_stress_due_to_ocean_viscous_dissipation
OSSY [Pa] Northward ocean side stress Surface_downward_northward_stress_due_to_ocean_viscous_dissipation
EFIO [W m-2] Energy flux into ocean wave_mixing_energy_flux_into_sea_water
cmems_mod_ibi_wav_my_0.027deg_static
IBI-MFC_005_006_mask_bathy.nc **deptho [m]** Bathymetry sea_floor_depth_below_geoid **mask** [] Land-sea mask: 1 = sea; 0 = land sea_binary_mask
IBI-MFC_005_006_coordinates.nc **e1t [m]** Cell dimension along X axis **e2t [m]** Cell dimension along Y axis
cmems_mod_ibi_wav_my_0.027deg-climatology_P1M-m
VHM0_mean [m]

Spectral significant wave height (Hm0) - Climatology monthly mean sea_surface_wave_significant_height
VTM02_mean [s] Spectral moments (0,2) wave period (Tm02) - Climatology monthly mean sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment

Table 3. List of the datasets and variable names and unit for the IBI_MULTIYEAR_WAV_005_006 product.

II.3 Production System Description

Domain	IBI (19°W-5°E; 26°N – 56°N)
Resolution and grid	1/36º (2-3 km); regular grid; 1081 x 865
Geographic coverage	This product is regional. It is defined on a regular grid at 1/36 degree (approx. 2-3 km) that goes from 26°N to 56°N in latitude and 19°W to 5°E in longitude. Latitude and longitude step is 0.02778°. The resulting horizontal grid extends to 1081x865 grid points. Interpolated from native grid (20°W-17°E; 25°N-64.6°N). 
Model version	MFWAM, based on IFS-ECWAM-47R1 with the introduction of dissipation by water.-depth breaking and includes Hmax parameters from Latemar project.
Horizontal resolution	1/36°
Vertical coord.	Surface product
Spectral resolution	36 directions and 30 frequencies (start at 0.035Hz)
Atmospheric forcings	Hourly ECMWF winds

Currents forcings	Surface currents forcing taken from the IBI ocean circulation model (**IBI_MULTIYEAR_PHY_005_006**)
Bounday Conditions	Wave spectra at OBC from Copernicus Marine GLOBAL WAV System
Initial conditions	No
Bathymetry	ETOPO1
Assimilation scheme	Optimal interpolation of SWH (**Lionello et al., 1992**) and directional wave spectra from Envisat-SAR and CFOSAT.
Assimilated observations	-Significant wave height (SWH) from altimeters: ERS1, TOPEX/POSEIDON, ERS2, GFO, Jason 2 & 3, Envisat, Saral, Cryosat-2 and Sentinel-3A; Sentinel-3. -Spectra from Envisat-SAR and CFOSAT.

Table 4. Summary of the system characteristics.

Short description.

The IBI-MFC provides a high-resolution wave reanalysis product for the Iberia-Biscay-Ireland (IBI) area starting in 01/01/1980 and being regularly extended on a yearly basis. The model system is run by Nologin with the support of CESGA in terms of supercomputing resources.

The Multi-Year model configuration is based on the MFWAM model developed by Météo-France (MF), covering the same region as the IBI-MFC Near Real Time (NRT) analysis and forecasting product, but with an enhanced horizontal resolution (1/36º instead of 1/20º). The system assimilates significant wave height (SWH) altimeter data and wave spectral data (Envisat and CFOSAT), supplied by MF. Both, the MY and the NRT products, are fed by ECMWF hourly winds. Specifically, the MY system is forced by the ERA5 reanalysis wind data. As boundary conditions, the NRT system uses the 2D wave spectra from the Copernicus Marine GLOBAL forecast system, whereas the MY system is nested to the GLOBAL reanalysis.

The product offers hourly instantaneous fields of different wave parameters, including Wave Height, Period and Direction for total spectrum; fields of Wind Wave (or wind sea), Primary Swell Wave and Secondary Swell for partitioned wave spectra; and the highest wave variables, such as maximum crest height and maximum crest-to-trough height. Also some air-sea fluxes such us the energy flux into ocean and the ocean side stress. Additionally, climatological parameters of significant wave height (VHM0) and zero -crossing wave period (VTM02) are delivered for the time interval 1993-2016.

Detailed description.

The IBI-MFC wave reanalysis system provides hourly wave parameters starting in **01/01/1980**. The **MFWAM model** has been upgraded with **IFS-ECWAM-CY47R1**, with the introduction of dissipation by water-depth breaking and the inclusion of Hmax parameters from Latemar project. The MFWAM model uses an ST4 wave physics related to the dissipation by wave breaking and the swell damping source terms as developed by **Ardhuin et al. (2010).** The model physics has been updated with major improvements thanks to the FP7 European Research project MyWave (**Janssen et al. 2014**). The ST4 wave physics of the MFWAM model has been adjusted by including a tail shape of Philipps spectrum for high frequency part of the wave spectrum. In the IBI wave system, the MFWAM model is implemented on the IBI domain with a grid size of 5 km, and the wave spectrum is discretized in 36 directions and 30 frequencies starting from 0.035 Hz. The bathymetry used is the etopo1 updated in February 2018. The IBI wave model is driven by 1-hourly analyzed ECMWF winds and uses boundary conditions (wave spectra) from the Copernicus Marine GLOBAL wave system.

The assimilation scheme is based on optimal interpolation of SWH as described by **Lionello et al. (1992)**, and it is the same scheme used in the Copernicus Marine GLOBAL wave system. For the IBI ocean domain, the correlation length and the distance of influence of the observations were set to 170 km and 650 km, respectively. The ratio of background and observations errors are kept constant over the IBI domain. In other respects, by using empirical wave growth laws (**Lionello et al. 1992**), the analysed SWH after the assimilation induces a correction on the wave spectra mostly on the wind sea part in the frequency scale (**Aouf and Lefevre 2015**). The assimilation scheme was adjusted with the ST4 physics used in the IBI-wave model. This new IBI-MFC wave reanalysis system also includes directional spectra from CFOSAT an Envisat-SAR **(Aouf et al, 2006, Hasselman et al, 2013)**. The spectral assimilation uses optimal interpolation on mean wave number components of each wave partition describing a dominant wave train.

The **surface currents off-line forcing** are obtained from the IBI ocean circulation model. The upgraded IBI wave system includes improved computations of coupling parameters such as surface stress of momentum flux to ocean and wave breaking inducing turbulence in ocean mixed layer.

The IBI wave model performs a **partitioning technique** on wave spectra over all ocean grid points of the IBI domain. The partitioning technique is based on the watershedding method developed for image processing (**Gerling, 1992**). This process effectively treats the wave spectrum as a topographic map from which individual peaks in wave energy can be identified in order to define the separate wave components. First the wave spectrum is split in wind sea and swell wave spectra. Then, the partitioning is applied for the swell wave spectrum. The peaks on the spectrum are isolated and they are considered as partitions. Afterward the classification of swell partitions in primary and secondary swell is performed depending on the mean energy of each partition.

The Copernicus Marine IBI-MFC wave system also includes the upgraded in the **Copernicus Marine December 2020 release** to improve the **drag coefficient** variation with the wind speed, resulting in positive impacts in the surface stress characterization. This improvement of the surface stress is mostly needed for the coupling with the IBI ocean model (currently under development; some tests are on-going and its operational launch is expected for future releases). To this end, a new setting on the wave dissipation term, the sheltering parameter and the use of Phillips spectrum tail for the high frequency part of the wave spectrum was implemented in the previous IBI wave model system. Moreover, the minimum water depth is taken of 5 m (instead of the 1 m value used in the previous IBI wave model system). The validation of significant wave height with observations from independent altimeters (HY2A Chinese satellite mission) has showed significant improvements (in terms of scatter indexes) in comparison with the last IBI wave systems (for more details see the corresponding QUID in **Erreur ! Source du renvoi introuvable.**).

Finally, in the last releases some variables have been added. In the November 2023 release new highest variables (maximum crest height and maximum crest-to-trough height), and in the November 2024 release some air-sea fluxes (energy flux into ocean and ocean side stress).

II.4 Grid

Grid characteristics and geographical Projection.

The MFWAM model is run in a larger native lon/lat reduced grid with a 1/40º resolution. The IBI wave model outputs are then post-processed to be delivered to end-users in a regular lon/lat standard grid.

The regular standard grid presents a similar resolution (1/36º) and covers from 26.0ºN to 56.0ºN in latitude and 19.0ºW to 5.0ºE in longitude. The latitude and longitude step is 0.02778º and the resulting horizontal grid extends to 1081 x 865 grid points. Information from all surface variables contained in the dataset is provided at same grid points.

Domain coverage.

The figure below represents the spatial coverage of the **IBI_MULTIYEAR_WAV_005_006** product

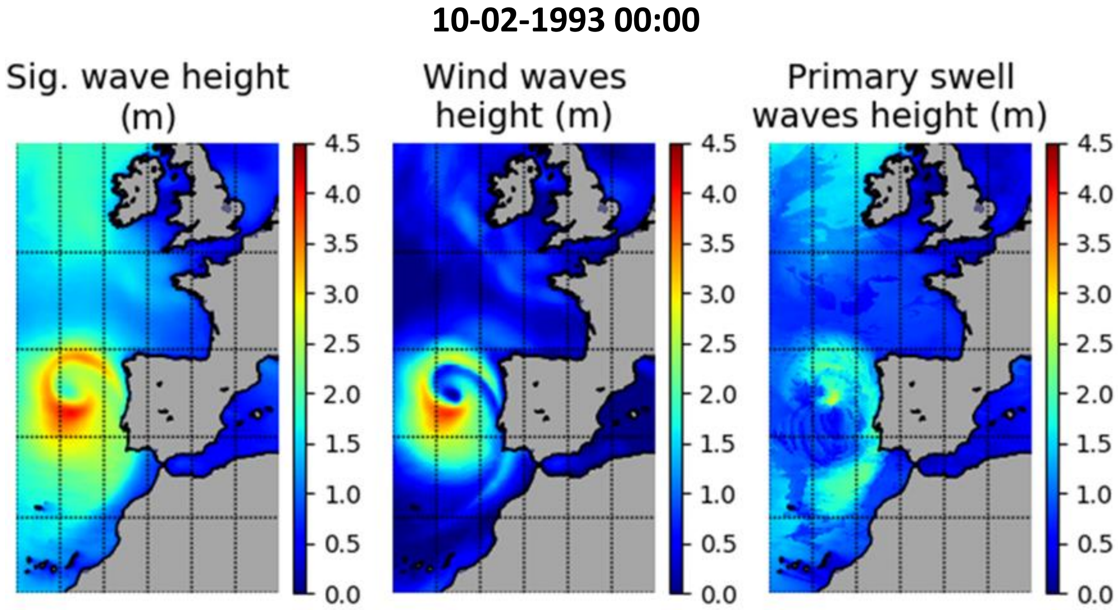


Figure 1. Spatial domain where IBI_MULTIYEAR_WAV_005_006 product is delivered. From left to right, examples of the Significant wave height, wind waves height and primary swell waves height fields of the IBI-MFC wave model application are shown.

II.5 Vertical Levels

This is a surface product.

II.6 Processing information

II.6.1 Update Time

The IBI reanalysis product is a static product and therefore no update time is applicable. It is regularly extended on a yearly basis.

II.6.2 Temporal extent of analysis and forecast stored on delivery mechanism

An archive of reanalysis starting in 1st January 1980, regularly updated, is available on the Copernicus Marine server. The product is extended in time on a yearly basis.

II.6.3 Time averaging.

- **cmems_mod_ibi_wav_my_0.027deg_PT1H-i & cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i:** the fields are hourly instantaneous values centered on the hour, from 00:00:00 to 23:00:00 per file.

III FILE FORMAT

The products are stored using the NetCDF format. To know more about the NetCDF format, please follow this link:

What is the format of Copernicus Marine products ? NetCDF

To understand the differences between netCDF and Zarr, please consult this article:

how-to-choose-between-netcdf-and-zarr-format-using-the-toolbox

IV FILES NOMENCLATURE

Information about nomenclature of files when downloaded can be found in this articles "[How is defined the nomenclature of Copernicus Marine data? | Copernicus Marine Help Center](#)"

IV.1 Nomenclature of the original file format (producer format)

File nomenclature, when downloaded through the Get function of the Copernicus Marine Toolbox or the File browser system. Based on production date and field date:

CMEMS_{fileVersion}_{region}_WAV_MY_NL_{freqFlag}_{datatype}_{validDate}_{validDate}_R{bulletinDate}_{productType}.nc

Where:

- **region:** a three-letter code for the region, IBI in this case.
- **fileVersion:** vxry, where x, y are the version and release number, respectively
- **freqFlag:** the frequency of data values in the file (01hsn = hourly snapshots, i.e.: hourly instantaneous fields).
- **datatype (optional):** it is a parameter which inform about the kind of included parameters.
- **validate:** YYYYMMDD is the valid date of the fields contained in the file.
- **bulletinDate:** RYYYYMMDD is the bulletin date, i.e.: data production date
- **productType:** is a two-letter code for the product type (RE01 for reanalysis).

Examples:

CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_20200101_20200101_R20200102_RE01.nc

IV.2 Other information: land mask value, missing value

The NetCDF-4 format is used with short integer coding for better compression, using an offset and scale factor as follows:

$$Real\_value = (Display\_value * scale\_factor) + add\_offset$$

The **missing value** for this product is: **-32767s**

Land mask is equal to **"_FillValue"** (see variable attribute on NetCDF file).

Land values are treated as missing value.

IV.3 File size

DATASET NAME FILE NAME	DIMENSION (no fixed size)
cmems_mod_ibi_wav_my_0.027deg_PT1H-i **CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_${validDate}_${validDate}_R${bulletinDate}_{productType}.nc** CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_20200826_20200826_R20200827_RE01.nc	200-230MB
cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i **CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_${validDate}_${validDate}_R${bulletinDate}_{productType}.nc** CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_aflux_20200826_20200826_R20200827_RE01.nc	35 MB
cmems_mod_ibi_wav_my_0.027deg_static IBI-MFC_005_006_coordinates.nc IBI-MFC_005_006_mask_bathy.nc	<1MB <1MB

Table 5. Name and size of files in each dataset (compressed values).

IV.4 Structure of files

Examples of the header of output NetCDF files are inserted in VI

V REFERENCES

Quality Information Document (QUID) :
https://catalogue.marine.copernicus.eu/documents/QUID/CMEMS-IBI-QUID-005-006.pdf.

Ardhuin, F., et al. (2010). Semi-empirical dissipation source functions for wind-wave models: Part I, Definition, calibration and validation, J. Phys. Oceanogr., 40(9), 1917–1941.

Gerling (1992). Partitioning sequences and arrays of directional ocean wave spectra intocomponents wave systems. J. Atmos. Oceanic Tech.

Lionello, P., Günther, H., & Janssen, P. A. (1992). Assimilation of altimeter data in a global third-generation wave model. Journal of Geophysical Research: Oceans, 97(C9), 14453-14474.

Janssen et al. (2014). Final report of Work Package I of the FP7 research project "My wave".

Aouf, L., J. Lefèvre, and D. Hauser, 2006: Assimilation of Directional Wave Spectra in the Wave Model WAM: An Impact Study from Synthetic Observations in Preparation for the SWIMSAT Satellite Mission. J. Atmos. Oceanic Technol., 23, 448–463, https://doi.org/10.1175/JTECH1861.1.

Hasselmann et al 2013 The ERS SAR wave mode - A breakthrough in global ocean wave observations

VI ANNEX

Examples of structure and header of **IBI_MULTIYEAR_WAV_005_006** files downloaded through the MDS.

cmems_mod_ibi_wav_my_0.027deg_PT1H-i

```
netcdf CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_20180115_20180115_R20231101_RE01.nc {
dimensions:
	time = 24 ;
	longitude = 865 ;
	latitude = 1081 ;
variables:
	float time(time) ;
		time:standard_name = "time" ;
		time:long_name = "time" ;
		time:units = "hours since 1950-01-01 00:00:00" ;
		time:calendar = "gregorian" ;
		time:axis = "T" ;
	float longitude(longitude) ;
		longitude:standard_name = "longitude" ;
		longitude:long_name = "Longitude" ;
		longitude:units = "degrees_east" ;
		longitude:unit_long = "Degrees East" ;
		longitude:step = "0.02777863f" ;
		longitude:axis = "X" ;
	float latitude(latitude) ;
		latitude:standard_name = "latitude" ;
		latitude:long_name = "Latitude" ;
		latitude:units = "degrees_north" ;
		latitude:unit_long = "Degrees North" ;
		latitude:step = "0.02777863f" ;
		latitude:axis = "Y" ;
	short VHM0(time, latitude, longitude) ;
		VHM0:add_offset = 0.f ;
		VHM0:scale_factor = 0.01f ;
		VHM0:standard_name = "sea_surface_wave_significant_height" ;
		VHM0:long_name = "Spectral significant wave height (Hm0)" ;
		VHM0:units = "m" ;
		VHM0:unit_long = "Meters" ;
		VHM0:valid_min = 0s ;
		VHM0:valid_max = 3000s ;
		VHM0:easting = "longitude" ;
		VHM0:northing = "latitude" ;
		VHM0:longitude_min = "-19" ;
		VHM0:longitude_max = "5" ;
		VHM0:latitude_min = "26" ;
```

```
        VHM0:latitude_max = "56" ;
        VHM0:_FillValue = -32767s ;
        VHM0:WMO_code = 100 ;
        VHM0:type_of_analysis = "spectral analysis" ;
    short VTM02(time, latitude, longitude) ;
        VTM02:add_offset = 0.f ;
        VTM02:scale_factor = 0.01f ;
        VTM02:standard_name =
"sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment" ;
        VTM02:long_name = "Spectral moments(0,2)wave period(Tm02)" ;
        VTM02:units = "s" ;
        VTM02:unit_long = "Second" ;
        VTM02:valid_min = 0s ;
        VTM02:valid_max = 3000s ;
        VTM02:easting = "longitude" ;
        VTM02:northing = "latitude" ;
        VTM02:longitude_min = "-19" ;
        VTM02:longitude_max = "5" ;
        VTM02:latitude_min = "26" ;
        VTM02:latitude_max = "56" ;
        VTM02:_FillValue = -32767s ;
        VTM02:WMO_code = 221 ;
        VTM02:type_of_analysis = "spectral analysis" ;
    short VTM10(time, latitude, longitude) ;
        VTM10:add_offset = 0.f ;
        VTM10:scale_factor = 0.01f ;
        VTM10:standard_name =
"sea_surface_wave_mean_period_from_variance_spectral_density_inverse_frequency_moment" ;
        VTM10:long_name = "Spectral moments(-1,0)wave period(Tm-10)" ;
        VTM10:units = "s" ;
        VTM10:unit_long = "Second" ;
        VTM10:valid_min = 0s ;
        VTM10:valid_max = 3000s ;
        VTM10:easting = "longitude" ;
        VTM10:northing = "latitude" ;
        VTM10:longitude_min = "-19" ;
        VTM10:longitude_max = "5" ;
        VTM10:latitude_min = "26" ;
        VTM10:latitude_max = "56" ;
        VTM10:_FillValue = -32767s ;
        VTM10:WMO_code = 201 ;
        VTM10:type_of_analysis = "spectral analysis" ;
    short VMDR(time, latitude, longitude) ;
        VMDR:add_offset = 180.f ;
        VMDR:scale_factor = 0.01f ;
        VMDR:standard_name = "sea_surface_wave_from_direction" ;
        VMDR:long_name = "Mean wave direction from(Mdir)" ;
        VMDR:units = "degree" ;
        VMDR:unit_long = "Degree" ;
```

```
        VMDR:valid_min = -18000s ;
        VMDR:valid_max = 18000s ;
        VMDR:easting = "longitude" ;
        VMDR:northing = "latitude" ;
        VMDR:longitude_min = "-19" ;
        VMDR:longitude_max = "5" ;
        VMDR:latitude_min = "26" ;
        VMDR:latitude_max = "56" ;
        VMDR:_FillValue = -32767s ;
        VMDR:WMO_code = 200 ;
        VMDR:type_of_analysis = "spectral analysis" ;
    short VPED(time, latitude, longitude) ;
        VPED:add_offset = 180.f ;
        VPED:scale_factor = 0.01f ;
        VPED:standard_name =
"sea_surface_wave_from_direction_at_variance_spectral_density_maximum" ;
        VPED:long_name = "Wave principal direction at spectral peak" ;
        VPED:units = "degree" ;
        VPED:unit_long = "Degree" ;
        VPED:valid_min = -18000s ;
        VPED:valid_max = 18000s ;
        VPED:easting = "longitude" ;
        VPED:northing = "latitude" ;
        VPED:longitude_min = "-19" ;
        VPED:longitude_max = "5" ;
        VPED:latitude_min = "26" ;
        VPED:latitude_max = "56" ;
        VPED:_FillValue = -32767s ;
        VPED:WMO_code = 999 ;
        VPED:type_of_analysis = "spectral analysis" ;
    short VTPK(time, latitude, longitude) ;
        VTPK:add_offset = 0.f ;
        VTPK:scale_factor = 0.01f ;
        VTPK:standard_name =
"sea_surface_wave_period_at_variance_spectral_density_maximum" ;
        VTPK:long_name = "Wave period at spectral peak/peak period(Tp)" ;
        VTPK:units = "s" ;
        VTPK:unit_long = "Second" ;
        VTPK:valid_min = 0s ;
        VTPK:valid_max = 3000s ;
        VTPK:easting = "longitude" ;
        VTPK:northing = "latitude" ;
        VTPK:longitude_min = "-19" ;
        VTPK:longitude_max = "5" ;
        VTPK:latitude_min = "26" ;
        VTPK:latitude_max = "56" ;
        VTPK:_FillValue = -32767s ;
        VTPK:WMO_code = 204 ;
        VTPK:type_of_analysis = "spectral analysis" ;
```

```
short VCMX(time, latitude, longitude) ;
    VCMX:add_offset = 0.f ;
    VCMX:scale_factor = 0.01f ;
    VCMX:standard_name = "sea_surface_wave_maximum_height" ;
    VCMX:long_name = "Maximum crest trough wave height (Hc, max)" ;
    VCMX:units = "m" ;
    VCMX:unit_long = "Meters" ;
    VCMX:valid_min = 0s ;
    VCMX:valid_max = 3000s ;
    VCMX:easting = "longitude" ;
    VCMX:northing = "latitude" ;
    VCMX:longitude_min = "-19" ;
    VCMX:longitude_max = "5" ;
    VCMX:latitude_min = "26" ;
    VCMX:latitude_max = "56" ;
    VCMX:_FillValue = -32767s ;
    VCMX:WMO_code = 218 ;
    VCMX:type_of_analysis = "spectral analysis" ;
short VMXL(time, latitude, longitude) ;
    VMXL:add_offset = 0.f ;
    VMXL:scale_factor = 0.01f ;
    VMXL:standard_name = "sea_surface_wave_maximum_crest_height" ;
    VMXL:long_name = "Height of the highest crest" ;
    VMXL:units = "m" ;
    VMXL:unit_long = "Meters" ;
    VMXL:valid_min = 0s ;
    VMXL:valid_max = 3000s ;
    VMXL:easting = "longitude" ;
    VMXL:northing = "latitude" ;
    VMXL:longitude_min = "-19" ;
    VMXL:longitude_max = "5" ;
    VMXL:latitude_min = "26" ;
    VMXL:latitude_max = “56" ;
    VMXL:_FillValue = -32767s ;
    VMXL:WMO_code = 0 ;
    VMXL:type_of_analysis = "spectral analysis" ;
short VHM0_WW(time, latitude, longitude) ;
    VHM0_WW:add_offset = 0.f ;
    VHM0_WW:scale_factor = 0.01f ;
    VHM0_WW:standard_name = "sea_surface_wind_wave_significant_height" ;
    VHM0_WW:long_name = "Spectral significant wind wave height" ;
    VHM0_WW:units = "m" ;
    VHM0_WW:unit_long = "Meters" ;
    VHM0_WW:valid_min = 0s ;
    VHM0_WW:valid_max = 3000s ;
    VHM0_WW:easting = "longitude" ;
    VHM0_WW:northing = "latitude" ;
    VHM0_WW:longitude_min = "-19" ;
    VHM0_WW:longitude_max = "5" ;
```

```
        VHM0_WW:latitude_min = "26" ;
        VHM0_WW:latitude_max = "56" ;
        VHM0_WW:_FillValue = -32767s ;
        VHM0_WW:WMO_code = 102 ;
        VHM0_WW:type_of_analysis = "spectral analysis" ;
    short VHM0_SW1(time, latitude, longitude) ;
        VHM0_SW1:add_offset = 0.f ;
        VHM0_SW1:scale_factor = 0.01f ;
        VHM0_SW1:standard_name = "sea_surface_primary_swell_wave_significant_height" ;
        VHM0_SW1:long_name = "Spectral significant primary swell wave height" ;
        VHM0_SW1:units = "m" ;
        VHM0_SW1:unit_long = "Meters" ;
        VHM0_SW1:valid_min = 0s ;
        VHM0_SW1:valid_max = 3000s ;
        VHM0_SW1:easting = "longitude" ;
        VHM0_SW1:northing = "latitude" ;
        VHM0_SW1:longitude_min = "-19" ;
        VHM0_SW1:longitude_max = "5" ;
        VHM0_SW1:latitude_min = "26" ;
        VHM0_SW1:latitude_max = "56" ;
        VHM0_SW1:_FillValue = -32767s ;
        VHM0_SW1:WMO_code = 202 ;
        VHM0_SW1:type_of_analysis = "spectral analysis" ;
    short VHM0_SW2(time, latitude, longitude) ;
        VHM0_SW2:add_offset = 0.f ;
        VHM0_SW2:scale_factor = 0.01f ;
        VHM0_SW2:standard_name = "sea_surface_secondary_swell_wave_significant_height" ;
        VHM0_SW2:long_name = "Spectral significant secondary swell wave height" ;
        VHM0_SW2:units = "m" ;
        VHM0_SW2:unit_long = "Meters" ;
        VHM0_SW2:valid_min = 0s ;
        VHM0_SW2:valid_max = 3000s ;
        VHM0_SW2:easting = "longitude" ;
        VHM0_SW2:northing = "latitude" ;
        VHM0_SW2:longitude_min = "-19" ;
        VHM0_SW2:longitude_max = "5" ;
        VHM0_SW2:latitude_min = "26" ;
        VHM0_SW2:latitude_max = "56" ;
        VHM0_SW2:_FillValue = -32767s ;
        VHM0_SW2:WMO_code = 203 ;
        VHM0_SW2:type_of_analysis = "spectral analysis" ;
    short VMDR_WW(time, latitude, longitude) ;
        VMDR_WW:add_offset = 180.f ;
        VMDR_WW:scale_factor = 0.01f ;
        VMDR_WW:standard_name = "sea_surface_wind_wave_from_direction" ;
        VMDR_WW:long_name = "Mean wind wave direction from" ;
        VMDR_WW:units = "degree" ;
        VMDR_WW:unit_long = "Degree" ;
        VMDR_WW:valid_min = -18000s ;
```

```
        VMDR_WW:valid_max = 18000s ;
        VMDR_WW:easting = "longitude" ;
        VMDR_WW:northing = "latitude" ;
        VMDR_WW:longitude_min = "-19" ;
        VMDR_WW:longitude_max = "5" ;
        VMDR_WW:latitude_min = "26" ;
        VMDR_WW:latitude_max = "56" ;
        VMDR_WW:_FillValue = -32767s ;
        VMDR_WW:WMO_code = 101 ;
        VMDR_WW:type_of_analysis = "spectral analysis" ;
    short VMDR_SW1(time, latitude, longitude) ;
        VMDR_SW1:add_offset = 180.f ;
        VMDR_SW1:scale_factor = 0.01f ;
        VMDR_SW1:standard_name = "sea_surface_primary_swell_wave_from_direction" ;
        VMDR_SW1:long_name = "Mean primary swell wave direction from" ;
        VMDR_SW1:units = "degree" ;
        VMDR_SW1:unit_long = "Degree" ;
        VMDR_SW1:valid_min = -18000s ;
        VMDR_SW1:valid_max = 18000s ;
        VMDR_SW1:easting = "longitude" ;
        VMDR_SW1:northing = "latitude" ;
        VMDR_SW1:longitude_min = "-19" ;
        VMDR_SW1:longitude_max = "5" ;
        VMDR_SW1:latitude_min = "26" ;
        VMDR_SW1:latitude_max = "56" ;
        VMDR_SW1:_FillValue = -32767s ;
        VMDR_SW1:WMO_code = 107 ;
        VMDR_SW1:type_of_analysis = "spectral analysis" ;
    short VMDR_SW2(time, latitude, longitude) ;
        VMDR_SW2:add_offset = 180.f ;
        VMDR_SW2:scale_factor = 0.01f ;
        VMDR_SW2:standard_name = "sea_surface_secondary_swell_wave_from_direction" ;
        VMDR_SW2:long_name = "Mean secondary swell wave direction from" ;
        VMDR_SW2:units = "degree" ;
        VMDR_SW2:unit_long = "Degree" ;
        VMDR_SW2:valid_min = -18000s ;
        VMDR_SW2:valid_max = 18000s ;
        VMDR_SW2:easting = "longitude" ;
        VMDR_SW2:northing = "latitude" ;
        VMDR_SW2:longitude_min = "-19" ;
        VMDR_SW2:longitude_max = "5" ;
        VMDR_SW2:latitude_min = "26" ;
        VMDR_SW2:latitude_max = "56" ;
        VMDR_SW2:_FillValue = -32767s ;
        VMDR_SW2:WMO_code = 109 ;
        VMDR_SW2:type_of_analysis = "spectral analysis" ;
    short VTM01_WW(time, latitude, longitude) ;
        VTM01_WW:add_offset = 0.f ;
        VTM01_WW:scale_factor = 0.01f ;
```

```
        VTM01_WW:standard_name = "sea_surface_wind_wave_mean_period" ;
        VTM01_WW:long_name = "Spectral moments(0,1)wind wave period" ;
        VTM01_WW:units = "s" ;
        VTM01_WW:unit_long = "Second" ;
        VTM01_WW:valid_min = 0s ;
        VTM01_WW:valid_max = 3000s ;
        VTM01_WW:easting = "longitude" ;
        VTM01_WW:northing = "latitude" ;
        VTM01_WW:longitude_min = "-19" ;
        VTM01_WW:longitude_max = "5" ;
        VTM01_WW:latitude_min = "26" ;
        VTM01_WW:latitude_max = "56" ;
        VTM01_WW:_FillValue = -32767s ;
        VTM01_WW:WMO_code = 223 ;
        VTM01_WW:type_of_analysis = "spectral analysis" ;
    short VTM01_SW1(time, latitude, longitude) ;
        VTM01_SW1:add_offset = 0.f ;
        VTM01_SW1:scale_factor = 0.01f ;
        VTM01_SW1:standard_name = "sea_surface_primary_swell_wave_mean_period" ;
        VTM01_SW1:long_name = "Spectral moments(0,1)primary swell wave period" ;
        VTM01_SW1:units = "s" ;
        VTM01_SW1:unit_long = "Second" ;
        VTM01_SW1:valid_min = 0s ;
        VTM01_SW1:valid_max = 3000s ;
        VTM01_SW1:easting = "longitude" ;
        VTM01_SW1:northing = "latitude" ;
        VTM01_SW1:longitude_min = "-19" ;
        VTM01_SW1:longitude_max = "5" ;
        VTM01_SW1:latitude_min = "26" ;
        VTM01_SW1:latitude_max = "56" ;
        VTM01_SW1:_FillValue = -32767s ;
        VTM01_SW1:WMO_code = 226 ;
        VTM01_SW1:type_of_analysis = "spectral analysis" ;
    short VTM01_SW2(time, latitude, longitude) ;
        VTM01_SW2:add_offset = 0.f ;
        VTM01_SW2:scale_factor = 0.01f ;
        VTM01_SW2:standard_name = "sea_surface_secondary_swell_wave_mean_period" ;
        VTM01_SW2:long_name = "Spectral moments(0,1)secondary swell wave period" ;
        VTM01_SW2:units = "s" ;
        VTM01_SW2:unit_long = "Second" ;
        VTM01_SW2:valid_min = 0s ;
        VTM01_SW2:valid_max = 3000s ;
        VTM01_SW2:easting = "longitude" ;
        VTM01_SW2:northing = "latitude" ;
        VTM01_SW2:longitude_min = "-19" ;
        VTM01_SW2:longitude_max = "5" ;
        VTM01_SW2:latitude_min = "26" ;
        VTM01_SW2:latitude_max = "56" ;
        VTM01_SW2:_FillValue = -32767s ;
```

```
        VTM01_SW2:WMO_code = 227 ;
        VTM01_SW2:type_of_analysis = "spectral analysis" ;
    short VSDX(time, latitude, longitude) ;
        VSDX:add_offset = 0.f ;
        VSDX:scale_factor = 0.01f ;
        VSDX:standard_name = "sea_surface_wave_stokes_drift_x_velocity" ;
        VSDX:long_name = "Stokes drift U" ;
        VSDX:units = "m s-1" ;
        VSDX:unit_long = "Meters per second" ;
        VSDX:valid_min = -500s ;
        VSDX:valid_max = 500s ;
        VSDX:easting = "longitude" ;
        VSDX:northing = "latitude" ;
        VSDX:longitude_min = "-19" ;
        VSDX:longitude_max = "5" ;
        VSDX:latitude_min = "26" ;
        VSDX:latitude_max = "56" ;
        VSDX:_FillValue = -32767s ;
        VSDX:WMO_code = 215 ;
        VSDX:type_of_analysis = "spectral analysis" ;
    short VSDY(time, latitude, longitude) ;
        VSDY:add_offset = 0.f ;
        VSDY:scale_factor = 0.01f ;
        VSDY:standard_name = "sea_surface_wave_stokes_drift_y_velocity" ;
        VSDY:long_name = "Stokes drift V" ;
        VSDY:units = "m s-1" ;
        VSDY:unit_long = "Meters per second" ;
        VSDY:valid_min = -500s ;
        VSDY:valid_max = 500s ;
        VSDY:easting = "longitude" ;
        VSDY:northing = "latitude" ;
        VSDY:longitude_min = "-19" ;
        VSDY:longitude_max = "5" ;
        VSDY:latitude_min = "26" ;
        VSDY:latitude_max = "56" ;
        VSDY:_FillValue = -32767s ;
        VSDY:WMO_code = 216 ;
        VSDY:type_of_analysis = "spectral analysis" ;

// global attributes:
        :Conventions = "CF-1.8" ;
        :title =  "CMEMS IBI MULTI-YEAR REANALYSIS: HOURLY WAVE PRODUCTS" ;
        :source = "MFWAM-CY47R2" ;
        :domain_name = "IBI36" ;
        :field_type = "instantaneous" ;
        :field_date =  "20180115" ;
        :institution = "Nologin-MeteoFrance" ;
        :references = "http://marine.copernicus.eu" ;
        :contact = "https://marine.copernicus.eu/contact" ;
```

```
        :licence = "https://marine.copernicus.eu/user-corner/service-commitments-and-licence" ;
        :comment = "" ;
}
```

cmems_mod_ibi_wav_my_aflux_0.027deg_P1H-i

```
netcdf CMEMS_v7r1_IBI_WAV_MY_NL_01hsn_aflux_20180115_20180115_R20231101_RE01.nc {
dimensions:
    time = 24 ;
    longitude = 865 ;
    latitude = 1081 ;
variables:
    float time(time) ;
        time:standard_name = "time" ;
        time:long_name = "time" ;
        time:units = "hours since 1950-01-01 00:00:00" ;
        time:calendar = "gregorian" ;
        time:axis = "T" ;
    float longitude(longitude) ;
        longitude:standard_name = "longitude" ;
        longitude:long_name = "Longitude" ;
        longitude:units = "degrees_east" ;
        longitude:unit_long = "Degrees East" ;
        longitude:step =  "0.02777863f" ;
        longitude:axis = "X" ;
    float latitude(latitude) ;
        latitude:standard_name = "latitude" ;
        latitude:long_name = "Latitude" ;
        latitude:units = "degrees_north" ;
        latitude:unit_long = "Degrees North" ;
        latitude:step =  "0.02777863f" ;
        latitude:axis = "Y" ;
  short OSSX(time, latitude, longitude) ;
        OSSX:add_offset = 0.f ;
        OSSX:scale_factor = 0.0003f ;
        OSSX:standard_name="
surface_downward_eastward_stress_due_to_ocean_viscous_dissipation " ;
        OSSX:long_name = " Eastward ocean side stress";
        OSSX:units = "Pa" ;
        OSSX:unit_long = "Pascal" ;
        OSSX:valid_min = 0s ;
        OSSX:valid_max = 30000s ;
        OSSX:easting = "longitude" ;
        OSSX:northing = "latitude" ;
        OSSX:longitude_min = "-19" ;
        OSSX:longitude_max = "5" ;
        OSSX:latitude_min = "26" ;
        OSSX:latitude_max = "56" ;
        OSSX:_FillValue = -32767s ;
short OSSY(time, latitude, longitude) ;
```

```
            OSSY:add_offset = 0.f ;
            OSSY:scale_factor = 0.0003f ;
            OSSY:standard_name =
"surface_downward_northward_stress_due_to_ocean_viscous_dissipation " ;
            OSSY:long_name = " Northward ocean side stress" ;
            OSSY:units = "Pa" ;
            OSSY:unit_long = "Pascal" ;
            OSSY:valid_min = 0s ;
            OSSY:valid_max = 30000s ;
            OSSY:easting = "longitude" ;
            OSSY:northing = "latitude" ;
            OSSY:longitude_min = "-19" ;
            OSSY:longitude_max = "5" ;
            OSSY:latitude_min = "26" ;
            OSSY:latitude_max = "56" ;
            OSSY:_FillValue = -32767s ;
short EFIO(time, latitude, longitude) ;
            EFIO:add_offset = 0.f ;
            EFIO:scale_factor = 0.01f ;
            EFIO:standard_name = " wave_mixing_energy_flux_into_sea_water " ;
            EFIO:long_name = "Energy flux into ocean" ;
            EFIO:units = "W m-2" ;
            EFIO:unit_long = "Watt per square meter" ;
            EFIO:valid_min = 0s ;
            EFIO:valid_max = 9900s ;
            EFIO:easting = "longitude" ;
            EFIO:northing = "latitude" ;
            EFIO:longitude_min = "-19" ;
            EFIO:longitude_max = "5" ;
            EFIO:latitude_min = "26" ;
            EFIO:latitude_max = "56" ;
            EFIO:_FillValue = -32767s ;

// global attributes:
            :Conventions = "CF-1.8" ;
            :title =  "CMEMS IBI MULTI-YEAR REANALYSIS: HOURLY WAVE PRODUCTS" ;
            :source = "MFWAM-CY47R2" ;
            :domain_name = "IBI36" ;
            :field_type = "instantaneous" ;
            :field_date =  "20180115" ;
            :institution = "Nologin-MeteoFrance" ;
            :references = "http://marine.copernicus.eu" ;
            :contact = "https://marine.copernicus.eu/contact" ;
            :licence = "https://marine.copernicus.eu/user-corner/service-commitments-and-licence" ;
            :comment = "" ;
}
```

cmems_mod_ibi_wav_my_0.027deg_static

This dataset only contains 2 files:
IBI-MFC_005_006_mask_bathy.nc
IBI-MFC_005_006_coordinates.nc

```
netcdf IBI-MFC_005_006_mask_bathy {
dimensions:
	latitude = 1081 ;
	longitude = 865 ;
variables:
	float latitude(latitude) ;
		latitude:standard_name = "latitude" ;
		latitude:units = "degrees_north" ;
		latitude:axis = "Y" ;
		latitude:step = "0.02777863f" ;
	float longitude(longitude) ;
		longitude:standard_name = "longitude" ;
		longitude:units = "degrees_east" ;
		longitude:axis = "X" ;
		longitude:step = "0.02777863f" ;
	float mask(latitude, longitude) ;
		mask:standard_name = "sea_binary_mask" ;
		mask:long_name = "Land-sea mask: 1 = sea ; 0 = land" ;
		mask:units = "1" ;
	float deptho(latitude, longitude) ;
		deptho:standard_name = "sea_floor_depth_below_geoid" ;
		deptho:long_name = "Bathymetry" ;
		deptho:units = "m" ;
		deptho:_FillValue = -32767.f ;

// global attributes:
		:Conventions = "CF-1.8" ;
		:title = "Static files for product IBI_MULTIYEAR_WAV_005_006" ;
		:domain_name = "IBI36" ;
		:institution = "Nologin-MeteoFrance" ;
		:references = "http://marine.copernicus.eu" ;
		:contact = "https://marine.copernicus.eu/contact" ;
		:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-
licence" ;
		:credit = "E.U. Copernicus Marine Service Information" ;
		:comment = "" ;
}

netcdf IBI-MFC_005_006_coordinates {
dimensions:
	latitude = 1081 ;
	longitude = 865 ;
variables:
	float latitude(latitude) ;
```

```
            latitude:standard_name = "latitude" ;
            latitude:units = "degrees_north" ;
            latitude:axis = "Y" ;
            latitude:step = "0.02777863f" ;
      float longitude(longitude) ;
            longitude:standard_name = "longitude" ;
            longitude:units = "degrees_east" ;
            longitude:axis = "X" ;
            longitude:step = "0.02777863f" ;
      float e1t(latitude, longitude) ;
            e1t:long_name = "Cell dimension along X axis" ;
            e1t:units = "m" ;
            e1t:_FillValue = -32767.f ;
      float e2t(latitude, longitude) ;
            e2t:long_name = "Cell dimension along Y axis" ;
            e2t:units = "m" ;
            e2t:_FillValue = -32767.f ;

// global attributes:
            :Conventions = "CF-1.8" ;
            :title = "Static files for product IBI_MULTIYEAR_WAV_005_006" ;
            :domain_name = "IBI36" ;
            :institution = "Nologin-MeteoFrance" ;
            :references = "http://marine.copernicus.eu" ;
            :contact = "https://marine.copernicus.eu/contact" ;
            :licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-
licence" ;
            :credit = "E.U. Copernicus Marine Service Information" ;
            :comment = "" ;
}
```

cmems_mod_ibi_wav_my_0.027deg-climatology_P1M-m

This dataset contains 12 files:

CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_01.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_02.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_03.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_04.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_05.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_06.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_07.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_08.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_09.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_10.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_11.nc
CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_12.nc

```
netcdf CMEMS_v7r1_IBI_WAV_MYCLIM_1993_2016_10.nc {
dimensions:
	time = 24 ;
	longitude = 865 ;
	latitude = 1081 ;
variables:
	float time(time) ;
		time:standard_name = "time" ;
		time:long_name = "time" ;
		time:units = "hours since 1950-01-01 00:00:00" ;
		time:calendar = "gregorian" ;
		time:axis = "T" ;
	float longitude(longitude) ;
		longitude:standard_name = "longitude" ;
		longitude:long_name = "Longitude" ;
		longitude:units = "degrees_east" ;
		longitude:unit_long = "Degrees East" ;
		longitude:step = "0.02777863f" ;
		longitude:axis  = "X" ;
	float latitude(latitude) ;
		latitude:standard_name = "latitude" ;
		latitude:long_name = "Latitude" ;
		latitude:units = "degrees_north" ;
		latitude:unit_long = "Degrees North" ;
		latitude:step = "0.02777863f" ;
		latitude:axis = "Y" ;
	short VHM0_mean(time, latitude, longitude) ;
		VHM0_mean:add_offset = 0.f ;
		VHM0_mean:scale_factor = 0.01f ;
		VHM0_mean:standard_name = "sea_surface_wave_significant_height" ;
		VHM0_mean:long_name = "Spectral significant wave height (Hm0) - Climatology monthly
mean" ;
		VHM0_mean:units = "m" ;
		VHM0_mean:unit_long = "Meters" ;
		VHM0_mean:valid_max = 3000s ;
		VHM0_mean:valid_min = 0s ;
		VHM0_mean:longitude_min = "-19" ;
		VHM0_mean:longitude_max = "5" ;
		VHM0_mean:latitude_min = "26" ;
		VHM0_mean:latitude_max = "56" ;
		VHM0_mean:_FillValue = -32767s ;
		VHM0_mean:WMO_code = 100 ;
		VHM0_mean:type_of_analysis = "spectral analysis" ;
	short VTM02_mean(time, latitude, longitude) ;
		VTM02_mean:add_offset = 0.f ;
		VTM02_mean:scale_factor = 0.01f ;
		VTM02_mean:standard_name =
"sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment" ;
```

```
        VTM02_mean:long_name = "Spectral moments(0,2)wave period(Tm02) - Climatology
monthly mean" ;
        VTM02_mean:units = "s" ;
        VTM02_mean:unit_long = "Second" ;
        VTM02_mean:valid_max = 3000s ;
        VTM02_mean:valid_min = 0s ;
        VTM02_mean:longitude_min = "-19" ;
        VTM02_mean:longitude_max = "5" ;
        VTM02_mean:latitude_min = "26" ;
        VTM02_mean:latitude_max = "56" ;
        VTM02_mean:_FillValue = -32767s ;
        VTM02_mean:WMO_code = 221 ;
        VTM02_mean:type_of_analysis = "spectral analysis" ;
// global attributes:
        :Conventions = "CF-1.8" ;
        :title = "Monthly climatology reference period 1993-2016";
        :source = "MFWAM-CY47R1" ;
        :domain_name = "IBI36" ;
        :institution = "Nologin-MeteoFrance" ;
        :references = "http://marine.copernicus.eu" ;
        :contact = "https://marine.copernicus.eu/contact" ;
        :licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-
licence" ;
        :credit = "E.U. Copernicus Marine Service Information" ;
        :comment = "Climatologies derived from cmems_mod_ibi_wav_my_0.027deg_PT1H-i" ;
}
```

The previous file structures shown as example correspond to the complete IBI files, which are downloaded through FTP. However, when data from the IBI forecast product are downloaded through the Subsetter interface, the file map and structure change slightly, and it is dependent on the parameter selection made by the user in the specific data request.