PRODUCT USER MANUAL

For Multi-Year WAVE In Situ Product

INSITU_GLO_WAV_DISCRETE_MY_013_045

Issue: 2.2

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RECORD TABLE

Issue	Date	§	Description of Change	Author	Validated By
1.0	04/09/2020	all	Creation of the document from the previous doc with NRT products	Marta de Alfonso, Fernando Manzano, Alex Gallardo and In Situ TAC Partners	
1.1	03/09/2021		Change in frequency variable name in spectra files	Marta de Alfonso, Fernando Manzano, Alex Gallardo and In Situ TAC Partners	Stéphane Tarot
1.1	30/11/2021		Correction of external links	Stéphane Tarot	Stéphane Tarot
1.2	21/02/2022		Update for Copernicus Marine 2 & added update frequency	Marta de Alfonso, Fernando Manzano, Alex Gallardo	Stéphane Tarot
2.0	06/06/2022		New product naming, new Production Unit and new template	Marta de Alfonso, Fernando Manzano, Alex Gallardo	Stéphane Tarot
2.1	02/06/2023		New dataset with hourly data	Marta de Alfonso, Fernando Manzano, Alex Gallardo	Stéphane Tarot
2.2	24/05/2024		Update index format Update file access Update TS and WS files examples	Alex Gallardo, Marta de Alfonso, Fernando Manzano	Stéphane Tarot

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GLOSSARY AND ABBREVIATIONS

JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology,
OCEANSITES, EMSO	OceanSITES is a worldwide system of long-term, open-ocean reference stations (OceanSITES is a worldwide system of long-term, open-ocean reference stations) and its European component (http://www.emso-eu.org/)
DBCP, ESURFMAR	Data Buoy collaboration panel (http://www.jcommops.org/dbcp/) and its European component (http://www.eumetnet.eu/e-surfmar)
EMODNet	European Marine Observation and Data Network (EMODnet) (http://www.emodnet.eu/) and the Physical component http://www.emodnet-physics.eu/Portal
SeaDataNet	European Network of National Oceanographic Data Centres (NODCs) (http://www.seadatanet.org/)
TAC	Copernicus Marine Service Thematic Assembly Centre
EUROGOOS, ROOS Arctic ROOS BOOS NOOS IBI-ROOS MOON Black Sea GOOS	The European Global Ocean Observing System (http://eurogoos.eu/) and its Regional Operational Oceanographic System Arctic ocean Baltic sea North West Shelf region Iberia-Biscay-Ireland Seas Mediterranean Sea Black Sea
NetCDF	Network Common Data Form
CF	Climate and Forecast convention for NetCDF formats
CMEMS	Copernicus Marine Environment Monitoring Service
CMT	Copernicus Marine Toolbox
MDS	Marine Data Store
DSG	Discrete Sampling Geometries

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 user manual for the Multi-Year WAVE In Situ product INSITU_GLO_WAV_DISCRETE_MY_013_045 (see Table 1). This guide describes the data product files, the available services to access them, and how to use these files and services.

Short Description	Product code	Area	Delivery Time
GLOBAL WAVE MY	INSITU_GLO_WAV_DISCRETE_MY_013_045	GLOBAL	Twice a year

Table 1: List of INS TAC products for which this document applies.

This product integrates observations aggregated and validated from the Regional EuroGOOS consortium (Arctic-ROOS, BOOS, NOOS, IBI-ROOS, MONGOOS) and Black Sea GOOS as well as from National Data Centers (NODCs), JCOMM global systems (OceanSITES, DBCP) and the Global telecommunication system (GTS) used by the Metoffices. The In Situ TAC relies on observing systems maintained by institutes that are not part of the In Situ TAC and Copernicus Marine Service is not contributing to the maintenance and setting up of the observing systems it uses.

Data are distributed on full level (no interpolation) and are available in a dedicated directory to waves (INSITU_GLO_WAV_DISCRETE_MY_013_045) of Copernicus Marine Data Store in one or two files per platform.

The Multi-Year WAVE product is a global product and provides two kinds of files: one with integrated parameters computed from the wave spectrum (e.g. significant wave height, peak period, mean direction) or zero crossing parameters (e.g. maximum wave height, mean height) and another one with the spectral information when available (scalar spectrum and directional functions like mean direction and angular spreading depending on the frequency). The files with integrated parameters contain also other physical and meteorological variables measured by the same platform. The complete list of variables distributed by the In Situ TAC can be found in the Copernicus Marine In Situ TAC physical parameters list (https://doi.org/10.13155/53381).

This product is updated twice a year after a validation process carried out at centralized level by the Production Unit and described in detail in the Quality Information Document CMEMS-INS-QUID-013-045 (https://doi.org/10.13155/54846).

Since December 2020, files with wave spectra are included in the Multi-Year WAVE product. Since 2023, hourly data is delivered in a dedicated dataset: cmems_obs-ins_glo_wav_my_na_PT1H.

More detailed information can be obtained from the Copernicus Marine Service web page (https://marine.copernicus.eu/) and the In Situ TAC web page (http://www.marineinsitu.eu/).

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.2 History of changes

Date	Description of changes and impacted product
2018/04	Release of wave REP product, formerly named: INSITU_GLO_WAVE_REP_OBSERVATIONS_013_045
2020/12	Inclusion of wave spectra
2021/12	Change in frequency (FREQUENCY => FREQ) variable name in spectra files (WS type)
2022/11	Centralized production. Product renamed as INSITU_GLO_WAV_DISCRETE_MY_013_045, dataset renamed as cmems_obs-ins_glo_wav_my_na_irr
2023/11	New dataset with hourly data: cmems_obs-ins_glo_wav_my_na_PT1H
2024/11	Implementation of DSG (Discrete Sampling Geometries) from CF Conventions Use of MDS (Marine Data Store) and CMT (Copernicus Marine Tool) to download files

II DESCRIPTION OF THE PRODUCT SPECIFICATION

II.1 General Information

In the following table we summarize the main characteristics of the product. The parameters listed are all the possible wave parameters, but the files include only the ones available in the corresponding platform.

Product Lines	INSITU_GLO_WAV_DISCRETE_MY_013_045
Geographical coverage	Global
Variables	• Generic significant wave height (Hs) • Spectral significant wave height (Hm0) • Average height highest 1/3 wave (H1/3) • Average height highest 1/10 wave (H1/10) • Average zero crossing wave height (Hzm) • Estimated maximum wave height • Maximum zero crossing wave height (Hmax) • Maximum crest trough wave height (Hc,max) • Depth of the deepest trough • Height of the highest crest • Wave spectrum peak energy (Smax) • Spectral moments (-1,0) wave period (Tm-10) • Spectral moments (0,2) wave period (Tm02) • Average zero crossing wave period (Tz) • Generic average wave period • Wave period at spectral peak / peak period (Tp) • Average period highest 1/3 wave (T1/3) • Average period highest 1/10 wave (T1/10) • Maximum wave period (Tmax) • Period of the highest wave (Thmax) • Mean wave direction from (Mdir) • Wave direction rel. true north • Wave principal direction at spectral peak • Maximum wave steepness • Wave directional spreading at spectral peak • Wave scalar spectral density • Central frequency of the band • Mean wave from direction • Directional spread around THETA1

	• Principal wave from direction • Directional spread around THETA2
Product Type	Observations Multi Year
Available time series	Since 1990 regularly updated
Temporal resolution	Variable (e.g: 3h / 1h / 30 mn, depending on the platform) for the original time sampling, one hour for the hourly dataset
Target delivery time	Twice a year
Delivery mechanism	Marine Data Store
Horizontal resolution	N/A
Number of vertical levels	N/A
Format	NetCDF-4 classic model

Table 2: Description of the INS TAC Multi-Year WAVE product

II.2 Details of datasets

INSITU_GLO_WAV_DISCRETE_MY_013_045
Dataset:cmems_obs-ins_glo_wav_my_na_irr **Variables name in the NetCDF file and Unit: Long_name & Standard_name**
VGHS [m] Generic significant wave height (Hs) sea_surface_wave_significant_height
VHM0 [m] Spectral significant wave height (Hm0) sea_surface_wave_significant_height
VAVH [m] Average height highest 1/3 wave (H1/3) sea_surface_wave_significant_height
VH110 [m] Average height highest 1/10 wave (H1/10) sea_surface_wave_mean_height_of_highest_tenth
VHZA [m] Average zero crossing wave height (Hzm)

sea_surface_wave_mean_height
VEMH [m] Estimated maximum wave height sea_surface_wave_maximum_height
VZMX [m] Maximum zero crossing wave height (Hmax) sea_surface_wave_maximum_height
VCMX [m] Maximum crest trough wave height (Hc,max) sea_surface_wave_maximum_height
VMNL [m] Depth of the deepest trough sea_surface_wave_maximum_trough_depth
VMXL [m] Height of the highest crest sea_surface_wave_maximum_crest_height
VEPK [m2s] Wave spectrum peak energy (Smax) sea_surface_wave_energy_at_variance_spectral_density_maximum
VTM10 [s] Spectral moments (-1,0) wave period (Tm-10) sea_surface_wave_mean_period_from_variance_spectral_density_inverse_frequency_moment
VTM02 [s] Spectral moments (0,2) wave period (Tm02) sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment
VTZA [s] Average zero crossing wave period (Tz) sea_surface_wave_mean_period
VGTA [s] Generic average wave period sea_surface_wave_mean_period
VTPK [s] Wave period at spectral peak / peak period (Tp) sea_surface_wave_period_at_variance_spectral_density_maximum
VAVT [s] Average period highest 1/3 wave (T1/3) sea_surface_wave_significant_period
VT110 [s] Average period highest 1/10 wave (T1/10) sea_surface_wave_mean_period_of_highest_tenth
VTMX [s] Maximum wave period (Tmax) sea_surface_wave_maximum_period
VTZM [s] Period of the highest wave (Thmax) sea_surface_wave_period_of_highest_wave
VMDR [degree]

Mean wave direction from (Mdir) sea_surface_wave_from_direction
VDIR [degree] Wave direction rel. true north sea_surface_wave_from_direction
VPED [degree] Wave principal direction at spectral peak sea_surface_wave_from_direction_at_variance_spectral_density_maximum
VST1 [1] Maximum wave steepness sea_surface_wave_maximum_steepness
VPSP [degree] Wave directional spreading at spectral peak sea_surface_wave_directional_spread_at_variance_spectral_density_maximum
VSPEC1D [m2s] Wave scalar spectral density sea_surface_wave_variance_spectral_density
FREQ [s-1] Central frequency of the band wave_frequency
THETA1 [degree] Mean wave from direction sea_surface_wave_from_direction
STHETA1 [degree] Directional spread around THETA1 sea_surface_wave_directional_spread
THETA2 [degree] Principal wave from direction sea_surface_wave_from_direction
STHETA2 [degree] Directional spread around THETA2 sea_surface_wave_directional_spread
Dataset: **cmems_obs-ins_glo_wav_my_na_PT1H** **Variables name in the NetCDF file and Unit: Long_name & Standard_name**
VGHS [m] Generic significant wave height (Hs) sea_surface_wave_significant_height
VHM0 [m] Spectral significant wave height (Hm0) sea_surface_wave_significant_height
VAVH [m] Average height highest 1/3 wave (H1/3) sea_surface_wave_significant_height
VH110 [m] Average height highest 1/10 wave (H1/10) sea_surface_wave_mean_height_of_highest_tenth

VHZA [m] Average zero crossing wave height (Hzm) sea_surface_wave_mean_height
VEMH [m] Estimated maximum wave height sea_surface_wave_maximum_height
VZMX [m] Maximum zero crossing wave height (Hmax) sea_surface_wave_maximum_height
VCMX [m] Maximum crest trough wave height (Hc,max) sea_surface_wave_maximum_height
VMNL [m] Depth of the deepest trough sea_surface_wave_maximum_trough_depth
VMXL [m] Height of the highest crest sea_surface_wave_maximum_crest_height
VEPK [m2s] Wave spectrum peak energy (Smax) sea_surface_wave_energy_at_variance_spectral_density_maximum
VTM10 [s] Spectral moments (-1,0) wave period (Tm-10) sea_surface_wave_mean_period_from_variance_spectral_density_inverse_frequency_moment
VTM02 [s] Spectral moments (0,2) wave period (Tm02) sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment
VTZA [s] Average zero crossing wave period (Tz) sea_surface_wave_mean_period
VGTA [s] Generic average wave period sea_surface_wave_mean_period
VTPK [s] Wave period at spectral peak / peak period (Tp) sea_surface_wave_period_at_variance_spectral_density_maximum
VAVT [s] Average period highest 1/3 wave (T1/3) sea_surface_wave_significant_period
VT110 [s] Average period highest 1/10 wave (T1/10) sea_surface_wave_mean_period_of_highest_tenth
VTMX [s] Maximum wave period (Tmax) sea_surface_wave_maximum_period
VTZM [s] Period of the highest wave (Thmax)

sea_surface_wave_period_of_highest_wave
VMDR [degree] Mean wave direction from (Mdir) sea_surface_wave_from_direction
VDIR [degree] Wave direction rel. true north sea_surface_wave_from_direction
VPED [degree] Wave principal direction at spectral peak sea_surface_wave_from_direction_at_variance_spectral_density_maximum
VST1 [1] Maximum wave steepness sea_surface_wave_maximum_steepness
VPSP [degree] Wave directional spreading at spectral peak sea_surface_wave_directional_spread_at_variance_spectral_density_maximum
VSPEC1D [m2s] Wave scalar spectral density sea_surface_wave_variance_spectral_density
FREQ [s-1] Central frequency of the band wave_frequency
THETA1 [degree] Mean wave from direction sea_surface_wave_from_direction
STHETA1 [degree] Directional spread around THETA1 sea_surface_wave_directional_spread
THETA2 [degree] Principal wave from direction sea_surface_wave_from_direction
STHETA2 [degree] Directional spread around THETA2 sea_surface_wave_directional_spread

Table 3: list of the datasets and variable names and units for the INSITU_GLO_WAV_DISCRETE_MY_013_045 product

II.3 Production System Description

The In Situ TAC Multi-Year WAVE product starts with the previous version of the product and a frozen copy of the Global multiparameter NRT product (INSITU_GLO_PHYBGCWAV_DISCRETE_MYNRT_013_030) for the time extension (usually 6 months). After filtering wave data, several validation procedures are applied and all of them are detailed in the Quality Information Document (QuID) associated to the product. After the validation, the NetCDF files are generated and checked, the product is assessed through the metrics described in the mentioned QuID and the documentation is prepared. The following

figure (Figure 1) shows the elaboration process of the INSITU_GLO_WAV_DISCRETE_MY_013_045 product.

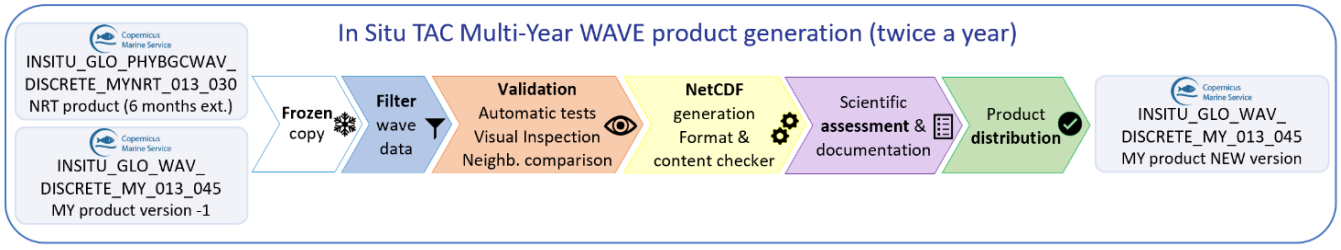

Figure 1: scheme of the generation process of INS TAC Multi-Year WAVE product.

The Production Unit performs the wave validation in a centralized way twice a year: around June for temporal extension of six months and at the end of the year (November-December) for temporal extension of six months and also several possible modifications or improvements of the product including full reprocessing.

II.4 Processing information

II.4.1 Update Time

This product is updated twice a year.

II.4.2 Time averaging

For the dataset cmems_obs-ins_glo_wav_my_na_irr, no time averaging is produced, data is delivered with the original time sampling from one-minute data provided by some platforms to daily data provided by some others.

In the dataset cmems_obs-ins_glo_wav_my_na_PT1H hourly data are delivered with rounded timestamps. Parameters data have been produced by subsampling the original series for samplings lower than one hour and by linear interpolation for samplings between one hour and six hours. Data with one hour sampling is delivered with no modification. For directional parameters, the interpolation has been performed decomposing the directions in u-v projections. All the values generated by interpolation have an associated quality index ([VARIABLE]_QC) equal to 8 (interpolated value). No interpolation has been performed for gaps grater then 6 hours due to the decreasing reliability in the results. In this hourly dataset, spectral information has been included only for time samplings equal to one hour (no modification) or less than one hour (subsampling). Details about a study of the reliability of the interpolated data for different gap lengths can be found in the QuID of this product.

II.5 Data distribution

Product distribution is based on a unique Production Unit that provides data to the Copernicus Marine Data Store (MDS), according to the production schedule specified in Processing Information section.

II.5.1 Data organisation

The Multi-Year WAVE product has a dedicated product entry in the Marine Data Store, with two datasets sublevels. In the dataset level, there is a directory (called "part" in the Marine Data Store) named "history" and the corresponding index file (index_history.txt) and inside it, there is one directory per data type (DB: drifters; MO: moorings; TG: tide gauges; SD: saildrones). In every data type directory, we can find one file per platform with the wave parameters (height, period and direction). In addition, there is one file per platform with the wave spectral information (when available) for the original sampling dataset. The Multi-Year WAVE product contents organisation is shown in the Figure 2.

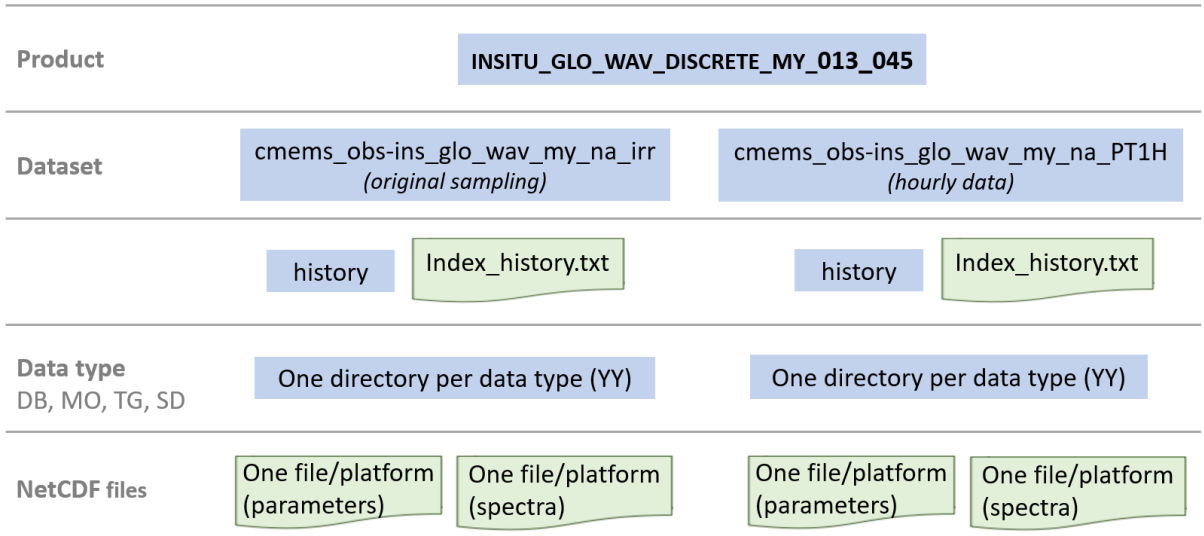

Figure2. INS TAC Multi-Year WAVE product organisation.

II.5.2 Index file

The index file (index_history.txt) describes the content of dataset directory. It is useful for data discovery and for regular synchronization between the Marine Data Store and operational users.

They contain a list of all available data files by providing the relative path to the file (such path can be directly used by Copernicus Marine Toolbox), together with a selection of relevant metadata (temporal and spatial ranges, parameters…) that describes the data file contents.

The index file contains one line per file with the following elements:

- product_id
  COP-XX-YY
  - COP: Copernicus trigram
  - XX: region bigram
  - YY: product version

  Example: COP-NO-01
- file_name
- geospatial_lat_min
- geospatial_lat_max
- geospatial_lon_min
- geospatial_lon_max
- time_coverage_start
- time_coverage_end
- institution
- date_update
- data_mode
  - R: real-time data
  - D: delayed-mode data
  - M: mixed real-time and delayed mode data
- parameters (separator: blank)

The field separator character is "," (comma). Within each field, the commas found in the content are replaced by "-". Some fields contain a list of values. They are separated by blank (example: the list of parameters) or separated by semicolon (if blank is a valid character in the values).

The index lines are sorted by file name and time coverage start.

The "parameters" field contains the physical parameters as listed in the "physical parameters list" (https://doi.org/10.13155/53381) and candidate parameters (not yet approved in the official list).

Coordinates, pseudo-coordinates and metadata variables are ignored.

From the "physical parameters list" the following variables are thus ignored: TIME, LATITUDE, LONGITUDE, _QC, POSITION_QC, _ADJUSTED_QC, _ADJUSTED_ERROR, _DM, _UNCERTAINTY, DC_REFERENCE, DIRECTION, POSITIONING_SYSTEM, VERTICAL_SAMPLING_SCHEME

Date is ISO8601 format: YYYY-MM-DDThh:mm:ssZ.

The header is composed of several lines starting with '#' character. It contains metadata about the content of the index file.

```
# Title: in-situ files catalog
# Description: catalog of available in-situ files compliant with Marine Data Store
# Project: Copernicus Marine In Situ TAC
```

Format version: 3.0
Date of update: 2022-04-27T11:26:07Z
#product_id,file_name,geospatial_lat_min,geospatial_lat_max,geospatial_lon_min,
geospatial_lon_max,time_coverage_start,time_coverage_end,institution,date_update,
data_mode, parameters

II.5.3 File distribution rules

A data file is not distributed in case of:

- Bad coordinates: the file contains only bad (qc flag 4) coordinates. A bad coordinate is a bad date or a bad position
- Bad parameters: the file contains only bad data (qc flag 4)

Within a file, a parameter having only bad data is not distributed.

The geospatial_lat_min, geospatial_lat_max, geospatial_lon_min, geospatial_lon_max attributes only consider values with valid POSITION_QC. Otherwise, is not useful for spatial filtering.

The last_latitude_observation / last_longitude_observation / last_date_observation global attributes are associated with the last observation with valid date and position: TIME_QC in (1, 2, 3, 5, 7, 8) and POSITION_QC in (1, 2, 3, 5, 7, 8).

IN THE DATASET CMEMS_OBS-INS_GLO_WAV_MY_NA_PT1H WITH HOURLY DATA, ALL THE INTERPOLATED VALUES HAVE AN ASSOCIATED [VARIABLE]_QC EQUAL TO 8 (INTERPOLATED VALUE). THE DATA PRESELECTION TO BE INTERPOLATED INCLUDES ONLY VALID DATA ([VARIABLE]_QC EQUAL TO 1).

III FILES NOMENCLATURE

Information about nomenclature of files when downloaded can be found in this article: " How is defined the nomenclature of Copernicus Marine data? | Copernicus Marine Help Center "

III.1.1 Nomenclature of files

Files nomenclature is consistent along the different directories within the datasets:

File naming convention follows this pattern:

Dataset/history/YY/RR_XX_YY_CODE<_ZZZ>.nc where:

- RR: region bigram
- XX: file type
- YY: data type
- CODE: platform code
- <_ZZZ>: optional information
- .nc: NetCDF file name suffix

Region bigram (RR) corresponds to the region producer:

- GL: Global
- AR: Arctic
- BO: Baltic Sea
- NO: NorthWestShelf
- IR: Iberia-Biscay-Ireland
- MO: Mediterranean Sea
- BS: Black Sea

File type (XX) can be:

- TS: timeseries (with parameters)
- WS: wave spectral information

Data type (YY) can be:

- DB: drifting buoy
- MO: fixed buoys, mooring time series, fixed observations
- TG: Tide gauge station
- SD: Saildrone

<_ZZZ> field is generally absent; it is used in specific cases such as a platform having data with multiple time-sampling.

Examples:

- 1801577 saildrone, produced by the Global region, time series (with parameters):

  GL_TS_SD_1801577.nc

- OostendBuoy mooring, produced by the NothWestShelf region, time series (with parameters):

  NO_TS_MO_OostendBuoy.nc

- 6200082 mooring, produced by the Iberia-Biscay-Ireland region, wave spectra:

  IR_WS_MO_6200082.nc

IV FILE FORMAT

IV.1 NetCDF 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.2 In Situ TAC NetCDF Format Implementation

Copernicus In Situ TAC distributes data and metadata following the NetCDF CF convention implementation specified in "Copernicus Marine In Situ NetCDF format manual" https://doi.org/10.13155/59938

IV.2.1 Content and format rules

IV.2.1.1 File format and content checkers

Every Copernicus In Situ TAC data file submitted by a PU (Production Unit) for distribution has its format and data consistency checked by the Copernicus file format and content checkers. Their application ensures the file format and content match the Copernicus In Situ TAC standards.

Files with format or consistency errors are rejected by the PU and are not distributed. Less serious problems may generate warnings and the file will still be distributed on the PU.

The file format checker is publicly available on:

- *NetCDF file format checker for Argo floats, Copernicus In Situ TAC, EGO gliders, OceanSITES,* https://doi.org/10.17882/45538

The file content checker is publicly available on:

- Copernicus Marine in situ NetCDF file content checker https://doi.org/10.17882/95058

IV.3 Structure of files

Examples of the header of output NetCDF files are inserted in annex, for each dataset.

V REFERENCES

De Alfonso Alonso-Muñoyerro Marta, Manzano Fernando, Gallardo Alejandro. Quality information document for reprocessed In Situ waves. CMEMS-INS-QUID-013-045. https://doi.org/10.13155/58696

Copernicus Marine In Situ Tac Data Management Team. Copernicus Marine In Situ NetCDF format manual. https://doi.org/10.13155/59938

Copernicus Marine In Situ Tac Data Management Team. Copernicus Marine In Situ TAC - physical parameters list. https://doi.org/10.13155/53381

Copernicus, EGO, OceanSITES, Argo data management. NetCDF file format checker for Argo floats, Copernicus In Situ TAC, EGO gliders, OceanSITES. SEANOE. https://doi.org/10.17882/45538

VI ANNEX

In the following tables we show an example of the NetCDF files header from a file with wave parameters and from a file with wave spectral information that follow the Discrete Sampling Geometries from CF Conventions

NetCDF file with parameters example

```
netcdf NO_TS_MO_6200042 {
dimensions:
        TIME = 289272 ;
        DEPTH = 1 ;
        STRLEN = 64 ;
variables:
        double TIME(TIME) ;
                TIME:long_name = "Time" ;
                TIME:standard_name = "time" ;
                TIME:units = "days since 1950-01-01T00:00:00Z" ;
                TIME:valid_min = -90000. ;
                TIME:valid_max = 90000. ;
                TIME:axis = "T" ;
                TIME:ancillary_variables = "TIME_QC" ;
                TIME:calendar = "standard" ;
        byte TIME_QC(TIME) ;
                TIME_QC:long_name = "Time quality flag" ;
                TIME_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                TIME_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_val
ue missing_value" ;
        float LATITUDE ;
                LATITUDE:long_name = "Latitude of each location" ;
                LATITUDE:standard_name = "latitude" ;
                LATITUDE:units = "degree_north" ;
                LATITUDE:valid_min = -90.f ;
                LATITUDE:valid_max = 90.f ;
                LATITUDE:axis = "Y" ;
        float LONGITUDE ;
                LONGITUDE:long_name = "Longitude of each location" ;
                LONGITUDE:standard_name = "longitude" ;
                LONGITUDE:units = "degree_east" ;
                LONGITUDE:valid_min = -180.f ;
                LONGITUDE:valid_max = 180.f ;
                LONGITUDE:axis = "X" ;
        float DEPH(DEPTH) ;
                DEPH:long_name = "Depth" ;
                DEPH:standard_name = "depth" ;
                DEPH:_FillValue = 9.96921e+36f ;
                DEPH:units = "m" ;
                DEPH:positive = "down" ;
                DEPH:valid_min = -12000.f ;
                DEPH:valid_max = 12000.f ;
                DEPH:axis = "Z" ;
                DEPH:reference = "sea_level" ;
        char STATION(STRLEN) ;
                STATION:long_name = "station" ;
                STATION:cf_role = "timeseries_id" ;
        float PRECISE_LONGITUDE(TIME) ;
                PRECISE_LONGITUDE:standard_name = "longitude" ;
                PRECISE_LONGITUDE:units = "degree_east" ;
                PRECISE_LONGITUDE:_FillValue = 9.96921e+36f ;
                PRECISE_LONGITUDE:long_name = "Longitude of each location" ;
                PRECISE_LONGITUDE:standard_name = "longitude" ;
                PRECISE_LONGITUDE:units = "degree_east" ;
                PRECISE_LONGITUDE:_FillValue = 9.96921e+36f ;
                PRECISE_LONGITUDE:long_name = "Longitude of each location" ;
                PRECISE_LONGITUDE:valid_min = -180.f ;
                PRECISE_LONGITUDE:valid_max = 180.f ;
                PRECISE_LONGITUDE:ancillary_variables = "POSITION_QC" ;
        float PRECISE_LATITUDE(TIME) ;
                PRECISE_LATITUDE:standard_name = "latitude" ;
                PRECISE_LATITUDE:units = "degree_north" ;
                PRECISE_LATITUDE:_FillValue = 9.96921e+36f ;
                PRECISE_LATITUDE:long_name = "Latitude of each location" ;
                PRECISE_LATITUDE:valid_min = -90.f ;
                PRECISE_LATITUDE:valid_max = 90.f ;
                PRECISE_LATITUDE:ancillary_variables = "POSITION_QC" ;
        byte POSITION_QC(TIME) ;
```

```
                POSITION_QC:long_name = "Position quality flag" ;
                POSITION_QC:_FillValue = -127b ;
                POSITION_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                POSITION_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
        float VPED(TIME, DEPTH) ;
                VPED:standard_name = "sea_surface_wave_from_direction_at_variance_spectral_density_maximum" ;
                VPED:units = "degree" ;
                VPED:_FillValue = 9.96921e+36f ;
                VPED:long_name = "Wave principal direction at spectral peak" ;
                VPED:valid_min = 0.f ;
                VPED:valid_max = 360.f ;
                VPED:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
                VPED:ancillary_variables = "VPED_QC" ;
                VPED:data_mode = "D" ;
                VPED:type_of_analysis = "spectral analysis" ;
        byte VPED_QC(TIME, DEPTH) ;
                VPED_QC:long_name = "Wave principal direction at spectral peak quality flag" ;
                VPED_QC:_FillValue = -127b ;
                VPED_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                VPED_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
                VPED_QC:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
        float VTPK(TIME, DEPTH) ;
                VTPK:standard_name = "sea_surface_wave_period_at_variance_spectral_density_maximum" ;
                VTPK:units = "s" ;
                VTPK:_FillValue = 9.96921e+36f ;
                VTPK:long_name = "Wave period at spectral peak / peak period (Tp)" ;
                VTPK:valid_min = 1.f ;
                VTPK:valid_max = 30.f ;
                VTPK:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
                VTPK:ancillary_variables = "VTPK_QC" ;
                VTPK:data_mode = "D" ;
                VTPK:type_of_analysis = "spectral analysis" ;
        byte VTPK_QC(TIME, DEPTH) ;
                VTPK_QC:long_name = "Wave period at spectral peak / peak period (Tp) quality flag" ;
                VTPK_QC:_FillValue = -127b ;
                VTPK_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                VTPK_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
                VTPK_QC:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
        float VTM02(TIME, DEPTH) ;
                VTM02:standard_name = "sea_surface_wave_mean_period_from_variance_spectral_density_second_frequency_moment" ;
                VTM02:units = "s" ;
                VTM02:_FillValue = 9.96921e+36f ;
                VTM02:long_name = "Spectral moments (0,2) wave period (Tm02)" ;
                VTM02:valid_min = 1.f ;
                VTM02:valid_max = 25.f ;
                VTM02:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
                VTM02:ancillary_variables = "VTM02_QC" ;
                VTM02:data_mode = "D" ;
                VTM02:type_of_analysis = "spectral analysis" ;
        byte VTM02_QC(TIME, DEPTH) ;
                VTM02_QC:long_name = "Spectral moments (0,2) wave period (Tm02) quality flag" ;
                VTM02_QC:_FillValue = -127b ;
                VTM02_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                VTM02_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
                VTM02_QC:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
        float VZMX(TIME, DEPTH) ;
                VZMX:standard_name = "sea_surface_wave_maximum_height" ;
                VZMX:units = "m" ;
                VZMX:_FillValue = 9.96921e+36f ;
                VZMX:long_name = "Maximum zero crossing wave height (Hmax)" ;
                VZMX:valid_min = 0.f ;
                VZMX:valid_max = 40.f ;
                VZMX:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
                VZMX:ancillary_variables = "VZMX_QC" ;
                VZMX:data_mode = "D" ;
                VZMX:type_of_analysis = "zero crossing" ;
        byte VZMX_QC(TIME, DEPTH) ;
                VZMX_QC:long_name = "Maximum zero crossing wave height (Hmax) quality flag" ;
                VZMX_QC:_FillValue = -127b ;
                VZMX_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                VZMX_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
                VZMX_QC:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
        float VHM0(TIME, DEPTH) ;
                VHM0:standard_name = "sea_surface_wave_significant_height" ;
                VHM0:units = "m" ;
                VHM0:_FillValue = 9.96921e+36f ;
                VHM0:long_name = "Spectral significant wave height (Hm0)" ;
                VHM0:valid_min = 0.f ;
                VHM0:valid_max = 25.f ;
                VHM0:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
                VHM0:ancillary_variables = "VHM0_QC" ;
                VHM0:data_mode = "D" ;
                VHM0:type_of_analysis = "spectral analysis" ;
        byte VHM0_QC(TIME, DEPTH) ;
                VHM0_QC:long_name = "Spectral significant wave height (Hm0) quality flag" ;
                VHM0_QC:_FillValue = -127b ;
                VHM0_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
                VHM0_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed value_below_detection nominal_value interpolated_value missing_value" ;
```

```
                VHM0_QC:coordinates = "TIME LATITUDE LONGITUDE DEPH PRECISE_LATITUDE PRECISE_LONGITUDE STATION" ;
// global attributes:
                :platform_code = "6200042" ;
                :platform_name = "Blakeney Overfalls wave buoy" ;
                :data_mode = "D" ;
                :title = "Global Ocean - In Situ Wave Observation Re-Analysis" ;
                :id = "NO_TS_MO_6200042" ;
                :naming_authority = "Copernicus Marine In Situ" ;
                :source = "mooring" ;
                :source_platform_category_code = "48" ;
                :wmo_platform_code = "6200042" ;
                :cdm_data_type = "timeSeries" ;
                :featureType = "timeSeries" ;
                :area = "North Atlantic Ocean" ;
                :bottom_depth = "23" ;
                :institution = "Environment Agency Geomatics (EA Geomatics);National Network of Regional Coastal Monitoring
Programmes (NNRCMP)" ;
                :institution_references = "https://coastalmonitoring.org/anglian/ https://coastalmonitoring.org/" ;
                :institution_edmo_code = "4345 5715" ;
                :institution_country = "United Kingdom;United Kingdom" ;
                :references = "http://marine.copernicus.eu http://www.marineinsitu.eu
https://coastalmonitoring.org/ccoresources/dataqualitycontrol/WavesQCManual_v1.1.pdf" ;
                :citation = "These data were collated within the Copernicus Marine Service (In Situ) and EMODnet collaboration
framework. Data is made freely available by the Copernicus Marine Service and the programs that contribute to it. Data provided to
the Copernicus Marine Service by the National Network of Regional Coastal Monitoring Programmes of England (NNRCMP) under the terms
of the Open Government Licence." ;
                :summary = "Wave data from the Directional Waverrider buoys of the National Network of Regional Coastal Monitoring
Programmes of England (NNRCMP). Real time quality control in this file is performed by the Copernicus Marine Service. Delayed mode
quality controlled data is provided by NNRCMP on a yearly basis." ;
                :Conventions = "CF-1.11 Copernicus-InSituTAC-FormatManual-2.0.0 Copernicus-InSituTAC-ParametersList-3.3.0
Copernicus-InSituTAC-AttributesList-1.0.0" ;
                :format_version = "2.0" ;
                :netcdf_version = "netCDF-4 classic model" ;
                :license = "https://marine.copernicus.eu/user-corner/service-commitments-and-licence" ;
                :publisher_email = "cmems-service@puertos.es" ;
                :publisher_institution = "Puertos del Estado" ;
                :publisher_name = "Copernicus Marine Service" ;
                :publisher_url = "https://marine.copernicus.eu/ http://www.marineinsitu.eu/" ;
                :geospatial_vertical_min = "0" ;
                :geospatial_vertical_max = "0" ;
                :time_coverage_start = "2006-09-27T07:30:00Z" ;
                :time_coverage_end = "2023-12-30T23:30:00Z" ;
                :update_interval = "P6M" ;
                :date_modified = "2024-05-14T12:53:57Z" ;
                :date_created = "2024-05-14T11:13:55Z" ;
                :creator_name = "Marta de Alfonso" ;
                :creator_email = "mar@puertos.es cmems-service@puertos.es" ;
                :creator_url = "https://orcid.org/my-orcid?orcid=0000-0002-9297-8342" ;
                :creator_type = "person" ;
                :last_latitude_observation = "53.05783373" ;
                :last_longitude_observation = "1.09982706" ;
                :geospatial_lat_min = "53.05783373" ;
                :geospatial_lat_max = "53.05783373" ;
                :geospatial_lon_min = "1.09982706" ;
                :geospatial_lon_max = "1.09982706" ;
                :last_date_observation = "2023-12-30T23:30:00Z" ;
                :history = "2024-05-14T11:13:55Z : Creation";
}
```

NetCDF file with spectra example

```
netcdf IR_WS_MO_6200082 {
dimensions:
        TIME = 181243 ;
        FREQUENCY = 14 ;
        nv = 2 ;
        STRLEN = 64 ;
variables:
        char STATION(STRLEN) ;
            STATION:long_name = "station" ;
            STATION:cf_role = "timeseries_id" ;
        double TIME(TIME) ;
            TIME:long_name = "Time" ;
            TIME:standard_name = "time" ;
            TIME:units = "days since 1950-01-01T00:00:00Z" ;
            TIME:valid_min = -90000.f ;
            TIME:valid_max = 90000.f ;
            TIME:comment = " " ;
            TIME:axis = "T" ;
            TIME:ancillary_variables = "TIME_QC" ;
            TIME:calendar = "standard" ;
```

```
        byte TIME_QC(TIME) ;
            TIME_QC:long_name = "Time quality flag" ;
            TIME_QC:_FillValue = -127b ;
            TIME_QC:valid_min = 0b ;
            TIME_QC:valid_max = 9b ;
            TIME_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
            TIME_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable bad_data
value_changed value_below_detection nominal_value interpolated_value missing_value" ;
        float FREQ(TIME, FREQUENCY) ;
            FREQ:long_name = "Central frequency of the band" ;
            FREQ:standard_name = "wave_frequency" ;
            FREQ:units = "s-1" ;
            FREQ:_FillValue = 9.96921e+36f ;
            FREQ:bounds = "FREQ_BOUNDS" ;
            FREQ:comment = " " ;
            FREQ:ancillary_variables = "FREQ_QC" ;
        byte FREQ_QC(TIME, FREQUENCY) ;
            FREQ_QC:long_name = "Central frequency of the band quality flag" ;
            FREQ_QC:_FillValue = -127b ;
            FREQ_QC:valid_min = 0b ;
            FREQ_QC:valid_max = 9b ;
            FREQ_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
            FREQ_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable bad_data
value_changed value_below_detection nominal_value interpolated_value missing_value" ;
        float FREQ_BOUNDS(TIME, FREQUENCY, nv) ;
        float LATITUDE ;
            LATITUDE:long_name = "Latitude of each location" ;
            LATITUDE:standard_name = "latitude" ;
            LATITUDE:units = "degree_north" ;
            LATITUDE:valid_min = -90.f ;
            LATITUDE:valid_max = 90.f ;
            LATITUDE:comment = " " ;
            LATITUDE:axis = "Y" ;
        float LONGITUDE ;
            LONGITUDE:long_name = "Longitude of each location" ;
            LONGITUDE:standard_name = "longitude" ;
            LONGITUDE:units = "degree_east" ;
            LONGITUDE:valid_min = -180.f ;
            LONGITUDE:valid_max = 180.f ;
            LONGITUDE:comment = " " ;
            LONGITUDE:axis = "X" ;
        float VSPEC1D(TIME, FREQUENCY) ;
            VSPEC1D:standard_name = "sea_surface_wave_variance_spectral_density" ;
            VSPEC1D:units = "m2 s" ;
            VSPEC1D:_FillValue = 9.96921e+36f ;
            VSPEC1D:long_name = "Wave scalar spectral density" ;
            VSPEC1D:valid_min = 0.f ;
            VSPEC1D:valid_max = 10000.f ;
            VSPEC1D:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;
            VSPEC1D:type_of_analysis = "1st order spectral analysis" ;
            VSPEC1D:data_mode = "D" ;
            VSPEC1D:ancillary_variables = "VSPEC1D_QC" ;
        byte VSPEC1D_QC(TIME, FREQUENCY) ;
            VSPEC1D_QC:long_name = "Wave scalar spectral density quality flag" ;
            VSPEC1D_QC:_FillValue = -127b ;
            VSPEC1D_QC:valid_min = 0b ;
            VSPEC1D_QC:valid_max = 9b ;
            VSPEC1D_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
            VSPEC1D_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable bad_data
value_changed value_below_detection nominal_value interpolated_value missing_value" ;
            VSPEC1D_QC:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;
        float THETA1(TIME, FREQUENCY) ;
            THETA1:standard_name = "sea_surface_wave_from_direction" ;
            THETA1:units = "degree" ;
            THETA1:_FillValue = 9.96921e+36f ;
            THETA1:long_name = "Mean wave from direction" ;
            THETA1:valid_min = 0.f ;
            THETA1:valid_max = 360.f ;
            THETA1:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;
            THETA1:type_of_analysis = "1st order spectral analysis" ;
            THETA1:data_mode = "D" ;
            THETA1:direction_convention = "clockwise from North" ;
            THETA1:direction_reference = "True North" ;
            THETA1:ancillary_variables = "THETA1_QC" ;
        byte THETA1_QC(TIME, FREQUENCY) ;
            THETA1_QC:long_name = "Mean wave from direction quality flag" ;
            THETA1_QC:_FillValue = -127b ;
            THETA1_QC:valid_min = 0b ;
            THETA1_QC:valid_max = 9b ;
            THETA1_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
            THETA1_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable bad_data
value_changed value_below_detection nominal_value interpolated_value missing_value" ;
            THETA1_QC:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;
        float STHETA1(TIME, FREQUENCY) ;
            STHETA1:standard_name = "sea_surface_wave_directional_spread" ;
            STHETA1:units = "degree" ;
            STHETA1:_FillValue = 9.96921e+36f ;
            STHETA1:long_name = "Directional spread around THETA1" ;
            STHETA1:valid_min = 0.f ;
            STHETA1:valid_max = 360.f ;
            STHETA1:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;
            STHETA1:type_of_analysis = "1st order spectral analysis" ;
            STHETA1:data_mode = "D" ;
            STHETA1:ancillary_variables = "STHETA1_QC" ;
```

```
        byte STHETA1_QC(TIME, FREQUENCY) ;
            STHETA1_QC:long_name = "Directional spread around THETA1 quality flag" ;
            STHETA1_QC:_FillValue = -127b ;
            STHETA1_QC:valid_min = 0b ;
            STHETA1_QC:valid_max = 9b ;
            STHETA1_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
            STHETA1_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable bad_data
value_changed value_below_detection nominal_value interpolated_value missing_value" ;
            STHETA1_QC:coordinates = "TIME LATITUDE LONGITUDE FREQ STATION" ;

// global attributes:
            :platform_code = "6200082" ;
            :platform_name = "Estaca de Bares buoy" ;
            :data_mode = "D" ;
            :title = "Global Ocean - In Situ Wave Observation Re-Analysis" ;
            :summary = "" ;
            :naming_authority = "Copernicus Marine In Situ" ;
            :id = "IR_WS_MO_6200082" ;
            :wmo_platform_code = "6200082" ;
            :ices_platform_code = " " ;
            :source = "mooring" ;
            :source_platform_category_code = "48" ;
            :institution_edmo_code = "2751" ;
            :institution = "Puertos del Estado" ;
            :institution_country = "Spain" ;
            :institution_references = "http://www.puertos.es/" ;
            :institution_abbreviated = "PdE" ;
            :site_code = " " ;
            :comment = " " ;
            :area = "North Atlantic Ocean" ;
            :geospatial_vertical_min = 0.f ;
            :geospatial_vertical_max = 0.f ;
            :time_coverage_start = "1998-11-07T12:00:00Z" ;
            :time_coverage_end = "2023-12-31T23:30:00Z" ;
            :cdm_data_type = "timeSeries" ;
            :featureType = "timeSeries" ;
            :bottom_depth = 1800 ;
            :format_version = "2.0" ;
            :Conventions = "CF-1.11 Copernicus-InSituTAC-FormatManual-2.0.0 Copernicus-InSituTAC-ParametersList-3.3.0 Copernicus-
InSituTAC-AttributesList-1.0.0" ;
            :netcdf_version = "netCDF-4 classic model" ;
            :references = "http://marine.copernicus.eu http://www.marineinsitu.eu" ;
            :update_interval = "P6M" ;
            :citation = "These data were collated within the Copernicus Marine Service (In Situ) and EMODnet collaboration framework.
Data is made freely available by the Copernicus Marine Service and the programs that contribute to it. " ;
            :license = "https://marine.copernicus.eu/user-corner/service-commitments-and-licence" ;
            :doi = "https://doi.org/10.13155/59938 https://doi.org/10.13155/40846 https://doi.org/10.13155/53381
https://doi.org/10.13155/36230 https://doi.org/10.13155/43494" ;
            :publisher_email = "cmems-service@puertos.es" ;
            :publisher_name = "Copernicus Marine Service" ;
            :publisher_url = "https://marine.copernicus.eu/ http://www.marineinsitu.eu/" ;
            :publisher_institution = "Puertos del Estado" ;
            :date_modified = "2024-05-14T09:45:33Z" ;
            :history = "2024-05-14T09:45:33ZCreation" ;
            :last_date_observation = ""2023-12-31T23:30:00Z" ;
            :last_latitude_observation = "44.12" ;
            :last_longitude_observation = "-7.68" ;
            :geospatial_lat_min = "44.05" ;
            :geospatial_lat_max = "44.16" ;
            :geospatial_lon_min = "-7.7264" ;
            :geospatial_lon_max = "-7.2229" ;
}
```