PRODUCT USER MANUAL

For Near Real-Time INSITU UV product

INSITU_GLO_PHY_UV_DISCRETE_NRT_013_048

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RECORD TABLE

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1.0	15/01/2019	All	Creation of the document	Nathalie Verbrugge, Hélène Etienne, Julien Mader, Lorenzo Corgnati, Carlo Mantovani, Emma Reyes, Anna Rubio, Paz Rotllán and Jose Luis Asensio.	L. Petit de la Villéon
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2.2	23/05/2022	All	New template, renaming of product & datasets, removal of drifter_filt dataset + additional data for the Mediterranean Sea	N. Verbrugge	Stéphane Tarot
2.3	30/05/2023	II.1 V.3.1.1	Add informations for undrogued drifters	H.Etienne, N. Verbrugge	Stéphane Tarot

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GLOSSARY AND ABBREVIATIONS

Acronym	Signification
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology,
Argo, Euro-Argo	International profiling float network (www.argo.net) and its European component (http://www.euro-argo.eu)
EGO, GROOM	International Glider network (http://www.ego-network.org) and its European coordination (http://www.groom-fp7.eu)
GOSUD	International Global Ocean Surface Underway Data (http://www.gosud.org/)
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/)
ICOS	Integrated Carbon Observation System (https://www.icos-cp.eu/)
TAC	Copernicus Marine Service Thematic Assembly Centre
CIS	Copernicus Marine Service Central Information System
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 Iberic-Biscay-Irish sea Mediterranean sea Black sea
NetCDF	Network Common Data Form
CF	Climate and Forecast convention for NetCDF formats

I INTRODUCTION

I.1 Summary

This Product User Manual describes the INSITU_GLO_PHY_UV_DISCRETE_NRT_013_048 product distributed by the Copernicus Marine Service In Situ Thematic Assembly Centre (In Situ TAC): how it is built, what is the content, what data services are available to access them, and how to use the files.

This product concerns three real-time datasets dedicated to near-surface and deep currents measurements coming from three platform categories (Lagrangian surface drifters, High Frequency radars and Argo floats):

- **cmems_obs-ins_glo_phy-cur_nrt_drifter_irr, named drifter in the rest of the document**:
    - For **GL**_TS_DC* files: near-surface zonal and meridional raw velocities measured by drifting buoys, wind & wind stress components, quality flags and metadada. These surface observations are part of the DBCP's Global Drifter Program (see Table 1)
    - For **MO**_TS_DC* : near-surface zonal and meridional raw velocities measured by drifting buoys, quality flags and metadada. These data are obtained from various sources (OGS, SOCIB, AOML, Coriolis, see Table 1) and correspond only to drifters on the Mediterranean region
- **cmems_obs-ins_glo_phy-cur_nrt_radar-total_irr, named radar total in the rest of the document**: near-surface zonal and meridional raw velocities measured by High Frequency radars (HFR), standard deviation of near-surface zonal and meridional raw velocities, Geometrical Dilution of Precision (GDOP), quality flags and metadata. These surface observations are part of the European HF radar Network (see Mader et al, 2017 and Corgnati et al., 2018)
- **cmems_obs-ins_glo_phy-cur_nrt_radar-radial_irr, named radar radial in the rest of the document**: near-surface zonal and meridional components of raw radial velocities measured by HFRs, magnitude and direction of near-surface zonal and meridional components of raw radial velocities (measured in the radial directions covered by each of the HFR stations), standard deviation of near-surface zonal and meridional components of raw radial velocities, quality flags and metadata. These surface observations are part of the European HF radar Network (see Mader et al, 2017 and Corgnati et al., 2018)
- **cmems_obs-ins_glo_phy-cur_nrt_argo_irr, named argo in the rest of the document**: ocean currents derived from the original trajectory data from Argo GDAC (Global Data

Assembly Center). Deep current is calculated from floats drift at parking depth, surface current is calculated from float surface drift.

The In Situ TAC aims at providing a research and operational framework to develop and deliver in situ observations and derived products based on such observations, to address progressively global (GLO) but also regional needs either for monitoring, modelling or downstream service development.

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
15/01/2019	First release
29/11/2019	Second release Update of existing dataset (radar_total). Addition of a new dataset (radar_radial)
11/09/2020	Addition of Argo current dataset (argo)
29/11/2022	Product and datasets names change, removal of drifter_filt dataset, new data [files MO_TS_DC] in Mediterranean Sea
11/2023	Drifters that have lost their drogue are now delivered together with the drifters with drogue.

II DESCRIPTION OF THE PRODUCT SPECIFICATION

II.1 General Information

The In Situ TAC is a distributed centre organized around 7 oceanographic regions: the global ocean and the 6 EUROGOOS regional alliances. It involves 14 partners from 11 countries in Europe. It doesn't deploy any observing system and relies on data, exclusively funded by other sources than Copernicus Marine Service.

Regarding the production of global ocean products like the present one, activities among partners are organized according to the expertise and background in data management for operational oceanography:

- **Drifter**
    - **For GL_TS_DC files:** sources derive from the French project Coriolis, which delivers near-surface (15 m depth) velocities measurements. Most of the drifters are of SVP type (or derived) and are part of the DBCP's Global Drifter Program, which transmits the data in, real-time to the GTS (Global Telecommunication system). Their drogue is centered at 15 meters depth. Drogued and undrogued drifters are provided. These data are first collected on the GTS, then analysed and pre-processed by the Marine meteorological Center of Meteo-France (CMM) in the frame of the French project Coriolis, dedicated to operational oceanography in situ observation management. Other operational qualification is also done by Coriolis before the final dissemination of the data to Copernicus Marine Service in Copernicus Marine Service file format.
    - **For MO_TS_DC files:** Drifter data were retrieved from the OGS Mediterranean drifter dataset (Menna et al., 2017) which in turn collect the raw data from different research institutions (e.g. OGS, SOCIB) and international data centers (AOML, Coriolis). All these data, obtained from various sources, were processed with the techniques illustrated in Menna et al. (2017, 2018). Data come from different drifter designs and are characterised by different drogue depths (between 0 m and 300 m; most are between 0 and 15 m). Data are disseminated daily.
- **Radar** sources derive from the data collected, analysed and pre-processed by the European HFR Node before the final dissemination of the data to In Situ TAC GLO in Copernicus Marine Service file format. Surface ocean velocities, both total and radial, estimated by HFRs provide current data only relative to the surface within an integration depth ranging from tens of

centimeters to a few meters, depending on the operating central frequency. This product comprises gridded maps of radial (referred to the radial measuring angles of each individual measuring HFR station) and total velocity fields of the surface current averaged over a time interval (mainly around the cardinal hour) and delivered at hourly basis.

Radial velocities are measured on a polar grid and then remapped on a Cartesian grid. The final product is a map of the zonal and meridional components of the radial ocean currents on a regular grid in the area covered by the individual radar stations. Total velocities are derived using un-weighted least square fit that maps radial velocities, measured by individual measurement stations, onto a Cartesian grid. The final product is a map of the zonal and meridional components of the ocean currents on a regular grid in the area of overlap of two or more radar stations.

- **Argo current** this product from Copernicus In Situ TAC is derived from the original trajectory data from Argo GDAC (Global Data Assembly Center). In 2020, the GDAC distributes data from more than 15,000 Argo floats. Deep ocean current is calculated from floats drift at parking depth, surface current is calculated from float surface drift.

II.2 Details of datasets

A detailed view of the product (INSITU_GLO_PHY_UV_DISCRETE_NRT_013_048) datasets follows next.

Datasets	Variables
drifter	For GL_TS_DC: Zonal and Meridional Velocities at 15-m depth, Surface Temperature if available, Zonal and Meridional wind stress from ECMWF[1], Zonal and Meridional 10-m wind from ECMWF[1]
	For MO_TS_DC: Zonal and meridional Velocities between 0 m and 15 m depth (a small part of drifters have deeper drogues between 45 m and 300 m)
radar_total	Zonal and Meridional Velocities at the surface (actual depth depending on the operating frequency), standard deviation of zonal and meridional velocities at the surface Geometrical Dilution of Precision (GDOP) + QC variables + metadata (global attributes)

radar_radial	Zonal and Meridional components and magnitude and direction of radial (referred to the individual measuring HFR stations) velocities at the surface (actual depth depending on the operating frequency), standard deviation of zonal and meridional components of the radial velocities at the surface, + QC variables + metadata (global attributes)
argo	Zonal and Meridional Velocities at surface and sub-surface derived from Argo trajectory files with QC variables and metadata.

Table 1.- Variables for the four datasets included in the product.

The drifter, radar_total, radar_radial and argo datasets common details are listed in Table 2 (particularities in Table 3)

Datasets	Delivery mechanism	Data Format
drifter	Copernicus Marine Service Information Service (with a backup FTP) (see section III)	NetCDF4 (see section **Erreur ! Source du renvoi introuvable.**)
radar_total		
radar_radial		
argo		

Table 2- Common details for the four datasets included in the product.

Datasets	Spatial		Temporal		Delivery time
	coverage	resolution	coverage	resolution	
Drifter GL_TS_DC files only	Global	Discrete	01/01/2002 to present	3 hours / 1 hour (before / after 25/03/2018)[2]	weekly (Mondays)
Drifter MO_TS_DC files only	Mediterranean Sea	Discrete	From 1986 to present	1 hour	daily

radar_total	European and US Seas from coast to up 200 km, depending on the operating frequency	Gridded (Typically ranges from a few hundred meters to 5-6 km, depending on HF Radar operating frequency and bandwidth)	12/2018 to present	1 hour (exceptions with 15' or 30')	hourly
radar_radial	European Seas from coast to up 200 km, depending on the operating frequency	Gridded (Typical spatial resolutions range from a few hundred meters to 5-6 km, depending on HF Radar operatingfrequency and bandwidth)[3]	12/2018 to present	1 hour (exceptions with 15' or 30')	hourly
argo	Global	Discrete	1997 to present	Every 10 days to daily (float dependent)	daily

Table 3- Specific details for the four datasets included in the product.

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[1] ECMWF 10m wind and wind stress components are interpolated at the drifters positions and delivered in the drifters files from the 25/03/2018.

[2] In 2017, the algorithm used to compute the currents has been changed to allow the estimation of the 1-hour time resolution field (**For 3-hour** resolution: krigging algorithm from D.V. Hansen et P.M Poulain, given by NOAA/AOML /// For **1-hour** resolution: Elipot et al 2016 - http://dx.doi.org/10.1002/2016JC011716; code : https://github.com/selipot/hourly-drifters)

[3] Radial currents are measured in a polar grid at a constant radial resolution ranging from 1 to 6º depending on the HFR operating frequency and bandwidth, so resulting in irregular spatial resolutions when measured in a cartesian grid (the closest to the antennas the highest the spatial resolution)

III DOWNLOAD A PRODUCT

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.

III.1 Download a product through the Copernicus Marine Service Web Portal Subsetter Service

Copernicus Marine Service Web Portal Subsetter Service IS NOT available for the products addressed in this document. The In Situ TAC is working in providing an operational API to enable this in the near future, nevertheless the current setup is still in test phase and therefore, not available yet for users.

III.2 Download a product through the Copernicus Marine Service Web Portal Ftp Service

Copernicus Marine Service Web Portal FTP service is the one guaranteeing the access to the 100% of the products addressed in this document. This is a secured FTP and therefore users need to request credentials to access it. In here you can find the form to fill in in order to get those: https://resources.marine.copernicus.eu/registration-form

Operational users can find useful python sample codes (jupyter notebooks) in the next public repository illustrating how-to *download* and *subset* the products addressed in this document by issuing FTP service: https://github.com/CopernicusMarineInsitu/2020-GLO-TrainingWorkshop (live at: https://mybinder.org/v2/gh/CopernicusMarineInsitu/2020-GLO-TrainingWorkshop/master); in particular, in the notebook named like *13-02-NearRealTtime-product-subsetting-download.ipynb.*

FTP be as well issued interactively via the In Situ TAC Dashboard viewer interface, available at: http://www.marineinsitu.eu/dashboard/. This viewer is nevertheless subject to periodic maintenance works so that it is better encouraged to issue FTP services programmatically (see previous paragraph) when possible.

III.3 Portal ftp structure

Data coming from drifter and HF radar platforms are grouped in 3 different directories Figure 1:

- The "**latest**" directory contains the latest 30 days of data. It contains one directory per day named YYYYMMDD. Each directory contains one file per platform per day.
- The "**monthly**" directory contains the latest 5 years of data. It contains one directory per month named YYYYMM, which contains a file per month and per platform.
- The "**history**" directory is dedicated to long series of observations. It is regularly updated but there is no fixed schedule for updates (planned to be yearly). The history directory contains one file per platform.

Additionally, there are 3 index files describing the content of latest, monthly and history directories: **index_latest.txt, index_monthly.txt and index_history.txt**. In addition to those, there is a platform index file (the **index_platform.txt** file) that is updated daily and that register the list of the individual platforms that are available on the server. These index files are useful for synchronization between the RDACs and the GDAC and for automatic data collection by users.

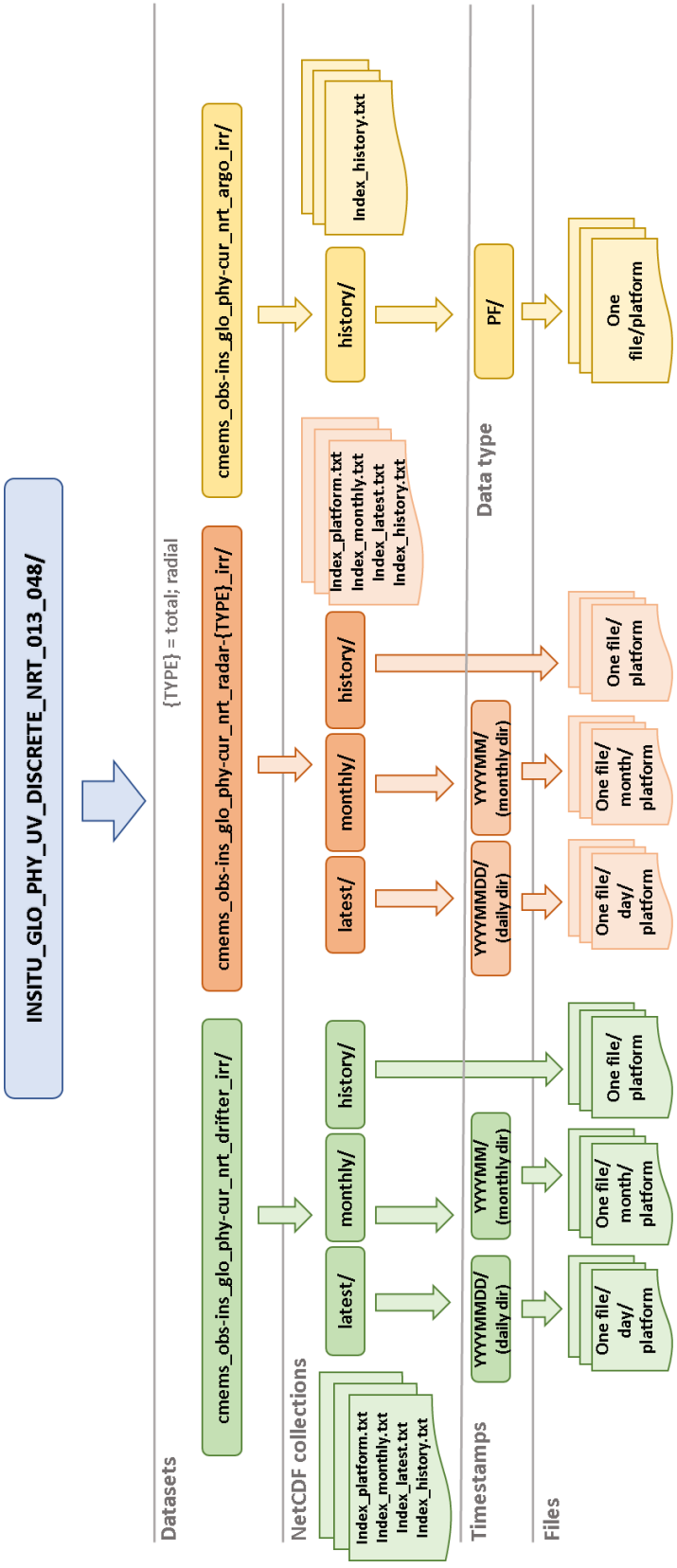

Figure 1: Directory tree of INSITU_GLO_PHY_UV_DISCRETE_NRT_013_048 product

IV FILES NOMENCLATURE

IV.1.1 File naming convention

The name convention of the four different directories for the datasets included in the product is as following:

Directory	Naming convention	Meaning[1]
latest	RR_XX_YY_CODE_YYYYMMDD.nc	§ **RR:** Region Bigram § **XX:** File type § **YY:** Data type § **CODE:** Platform code identifier § **YYYYMMDD and YYYYMM:** daily and monthly timestamp of observations § .nc: NetCDF file name suffix
monthly	RR_XX_YY_CODE_YYYYMM.nc	
history	RR_XX_YY_CODE.nc	

- **Region bigrams (RR)**
  - GL: The region bigram refers to the global component of the In Situ TAC.
  - MO: The region bigram refers to the Mediterranean component of the In Situ TAC.
- **File types (XX)**
  - TS: Time Series
  - TV: gridded total velocities (described in this document)
  - RV: gridded radials velocities (described in this document)
- **Data types (YY)**
  - DC: drifter buoy reporting calculated sea water current
  - HF: high frequency radar
  - PF : Argo floats
- **CODE**

  The platform code is a unique identifier of the platform within all Copernicus Marine Service In Situ TAC production units. For other identifiers the user should dive into the global attributes of the file where other codes are exposed if available (I.e *wmo_platform_code* assigned by World Meteorological Organization).

- **timestamp (YYYYMMDD and YYYYMM)**
  - **YYYYMMDD**: Daily files timestamp used to expose the date of the latest observation contained on a file belonging to the latest directory.
  - **YYYYMM:** Monthly files timestamp used to expose the date of the latest observation contained on a file belonging to the monthly directory.

This suffix is used to refer operations made over the files like sub-settings, filtering or resampling. This optional suffix differentiates, for example, regular drifter files from the filtered ones (suffixed with a *FILTR* at the end of the file name).

- Examples:

Dataset	Naming convention	Meaning
« drifter »	GL_TS_DC_1401664_20181201.nc	**Daily file** (December 1st 2018) from a Drifter buoy reporting calculated sea water current (id: 1401664) as Time Series (TS) and produced by the Global Production Unit (GL)
	GL_TS_DC_1401664_201812.nc	**Monthly file** (December 2018) from a Drifter buoy reporting calculated sea water current (id: 1401664) as Time Series (TS) and produced by the Global Production Unit (GL)
	GL_ TS_DC_4401751.nc	**Historical file** (platform lifespan) from a Drifter buoy reporting calculated sea water current (id: 1401664) as Time Series (TS) and produced by the Global Production Unit (GL)
« radar_total »	GL_TV_HF_HFR-TirLig_20181201.nc	**Daily file** (December 1st 2018) from a high frequency radar network (Id: HFR-TirLig) reporting Gridded Total velocities (TV) and produced by the Global Production Unit (GL).
	GL_TV_HF_HFR-TirLig_201812.nc	**Monthly file** (December 2018) from a high frequency radar network (Id: HFR-TirLig) reporting Gridded Total velocities (TV) and produced by the Global Production Unit (GL).
	GL_TV_HF_HFR-TirLig.nc	**Historical file** (platform lifespan) from a high frequency radar network (Id: HFR-TirLig) reporting Gridded Total velocities (TV) and produced by the Global Production Unit (GL).
« radar_radial »	GL_RV_HF_HFR-TirLig-TINO_20181201.nc	**Daily file** (December 1st 2018) from a high frequency radar station (Id: HFR-TirLig-TINO) reporting Gridded Radial velocities (RV) and produced by the Global Production Unit (GL).

	GL_RV_HF_HFR-TirLig-TINO_201812.nc	**Monthly file** (December 2018) from a high frequency radar station (Id: HFR-TirLig-TINO) reporting Gridded Radial velocities (RV) and produced by the Global Production Unit (GL).
	GL_RV_HF_HFR-TirLig-TINO.nc	**Historical file** (platform lifespan) from a high frequency radar station (Id: HFR-TirLig-TINO) reporting Gridded Radial velocities (RV) and produced by the Global Production Unit (GL).

IV.1.2 Description of the index files

- **Index file names:**
  - **index_latest.txt**
  - **index_monthly.txt**
  - **index_history.txt**

These index files are updated to describe all the files available in the latest, monthly and history directories.

Each index file contains one line per file exposing the *file_name* (ftp link) for downloading plus some metadata for early filtering. The lines in the index are sorted by file name and time coverage start.

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

  Example: COP-GL-0?
- file_name: *ftp link or absolute path of the file in the Copernicus Marine Service FTP server*
- geospatial_lat_min
- geospatial_lat_max
- geospatial_lon_min
- geospatial_lon_max
- time_coverage_start
- time_coverage_end
- provider
- date_update
- data_mode:
  - R: real-time data. Data coming from the (typically remote) platform through a communication channel without physical access to the instruments, disassembly or recovery of the platform.

- P: provisional data. Data obtained after instruments have been recovered or serviced; some calibrations or editing may have been done, but the data is not thought to be fully processed. Refer to the history attribute for more detailed information.
- D: delayed-mode data. Data published after all calibrations and quality control procedures have been applied on the internally recorded or best available original data. This is the best possible version of processed data.
- M: mixed real-time and delayed mode data. It indicates that the file contains data in more than one of the above states.

· Parameters (separator: blank)

Copernicus Marine Service In Situ data file index_latest.txt example

```
# Title : in-situ observations catalog
# Description : catalog of available in-situ observations per platform.
# Project : Coriolis
# Format version : 1.0
# Date of update : 20191127094029
#
catalog_id,file_name,geospatial_lat_min,geospatial_lat_max,geospatial_lon_min,geospatial_lon_max,time_coverage_start,
time_coverage_end,provider,date_update,data_mode,parameters
COP-GL-01,ftp://nrt.cmems-du.eu/Core/INSITU_GLO_PHY_UV_DISCRETE_NRT_013_048/cmems_obs-ins_glo_phy-
cur_nrt_radar-total_irr /latest/20191028/GL_TV_HF_HFR-COSYNA-Total_20191028.nc,53.666,55.5,6.166,9.166,2019-
10-28T00:50:00Z,2019-10-28T22:10:00Z,Helmholtz Zentrum Geesthacht,2019-11-11T14:13:49Z,R,DEPH EWCT NSCT
EWCS NSCS UACC VACC GDOP NARX NATX SLTR SLNR SLTT SLNT SCDR SCDT
```

Users are advised to use these index files to select and then download the files they are interested in.

For example, if a user is interested in retrieving the files that provide data in a specific area, he just has to select the lines for which Lat, Lon are included in the box [lat_min,lon_min: lat_max,lon_max] , store the complete file name in a list and then perform a get of all the files of the list.

Examples of scripts

- For downloading files is available at: http://www.coriolis.eu.org/content/download/10605/70781/file/index.sh
- For downloading files and processing are available at: http://www.marineinsitu.eu/material/

Index_platform.txt file

This file is updated daily. It registers the list of the individual platforms that are available on the server.

- platform_code,
- creation_date,
- update_date,
- wmo_platform_code,
- data_source,
- institution,
- institution_edmo_code,
- parameter (separator: blank)
- last_latitude_observation,
- last_longitude_observation,
- last_date_observation

Copernicus Marine Service In Situ data file platform index example

```
# Title : in-situ platforms catalog
# Description : catalog of available in-situ platforms.
# Project : Copernicus
# Format version : 1.0
# Date of update : 20191127094033
#
platform_code,creation_date,update_date,wmo_platform_code,data_source,institution,institution_edmo_code,parameters,last_latitude_observation,last_longitude_observation,last_date_observation
HFR-COSYNA-Total,2019-11-07T15:40:42Z,2019-11-27T10:40:28Z,,GL_TV_HF_HFR-COSYNA-Total_20191127.nc,Helmholtz Zentrum Geesthacht,2842,DEPH EWCT NSCT EWCS NSCS UACC VACC GDOP NARX NATX SLTR SLNR SLTT SLNT SCDR SCDT,53.39887,9.06162,2019-11-27T07:39:00Z
```

[1] From the Copernicus In Situ TAC SRD - System Requirement Document: http://dx.doi.org/10.13155/40846

V FILE FORMAT

V.1 Format and reading software

The products are stored using the NetCDF format.

To know more about the NetCDF format, please follow this link:

https://help.marine.copernicus.eu/en/articles/4427604-what-is-the-format-of-copernicus-marine-products-netcdf

The products are compliant with the NetCDF Climate and Forecast Convention CF-1.4 (see http://cf-pcmdi.llnl.gov/).

V.2 Structure and semantic of netCDF maps files

V.2.1 Content: variables

V.2.1.1 Drifter content

V.2.1.1.1 Drifter variables

This is a global coverage data set and available variables are listed in Table 4. Drifter files are TrajectoryProfile feature type.

Variable name	Description	Units
TIME	Date of the data	days since 1950-01-01T00:00:00Z
DEPH	Depth of the temperature and sea water velocity (indicated in the file)	m
LATITUDE	Latitude of the data position	Degree North

LONGITUDE	Longitude of the data position	Degree East
WSTN_MODEL	Drifter dataset only (MO_TS_DC* files excepted) North component of the 6-hour integrated wind stress from ECMWF model interpolated at the drifter's position	$N.m^{-2}$
WSTE_MODEL	Drifter dataset only (MO_TS_DC* files excepted) East component of the 6-hour integrated wind stress from ECMWF model interpolated at the drifter's position	$N.m^{-2}$
WSPN_MODEL	Drifter dataset only (MO_TS_DC* files excepted) South-North 6-hour integrated 10-m wind component from ECMWF model interpolated at the drifter's position	$m.s^{-1}$
WSPE_MODEL	Drifter dataset only (MO_TS_DC* files excepted) West-East 6 hour integrated 10-m wind component from ECMWF model interpolated at the drifter's position	$m.s^{-1}$
EWCT	West-East sea water velocity at the drogue depth from the drifter position	$m.s^{-1}$
NSCT	South-North sea water velocity at the drogue depth from the drifter position	$m.s^{-1}$
TEMP	Drifter dataset only (MO_TS_DC* files excepted)	Degrees Celsius

	Temperature 20-30 cm beneath the sea surface	
PLATFORM_CODE	Platform code relative to each measurement	-
CURRENT_TEST	Drifter dataset only Flag tests of drogue loss results. It contains the 3 flags value for the 3 tests in a float format [SAW] **[S]** submersion test **[A]** acceleration of the buoy: not done =1 **[W]** wind-currents correlation	-
TRAJECTORY_NAME	Trajectory identifier	-

Table 4- List of the available variables for drifter datasets.

Description of the flags for drogue loss tests (Example. CURRENT_TEST: _, _, 313, => Strong probably of drogue presence for submergence and wind-current correlations tests. Acceleration test has not been done) is done in Table 5.

Hence, drogue can be considering missing for CURRENT_TEST values equal to 011. In this case, velocity information provided in the file relates to the surface circulation and can be contaminated by a direct wind effect on the float.

For the MO_TS_DC files, both SVP and other instrument types (CODE, CARTHE,…) can be found. The tests done for drogue loss is relevant and designed for SVP drifters only.

Code	Meaning	Comment
0	Drogue probably missing	-
1	Test not performed or not relevant (case for some MO_TS_DC platforms)	-

2	Weak probability of drogue presence	-
3	Strong probability of drogue presence	-

Table 5 : Description of the tests done for drogue loss on SVP drifters

V.2.1.1.2 drifter dimensions

Name	Comment
TIME	Number of time steps.
DEPTH	Number of depth levels.
STRINGx	Length in characters of the strings used in the data file. It is mandatory that the string length dimension STRINGx has the value of x.

Table 6- List of the dimensions of the data variables for drifters current dataset.

V.2.1.2 Radar_total variables

This is a dataset covering European and US Seas whose available variables are listed in Table 7 (**mandatory variables**, i.e. variables that are always present in each data file, are listed in bold, recommended variables are listed in plain text).

Total velocity data		
Variable name	*Description*	*Units*

TIME	**Time of measurement**	**days (since 1950-01-01T00:00:00Z)**
LATITUDE	**Latitude of the data position**	**Degrees North**
LONGITUDE	**Longitude of the data position**	**Degrees East**
DEPH	**Depth of measurement** (from tens of cm to 1-2 m, depending on the operating frequency)	**m**
EWCT	**Surface Eastward Sea Water Velocity** (gridded maps of the surface current velocity component averaged over a time interval, mainly around the cardinal hour)	**m/s**
NSCT	**Surface Northward Sea Water Velocity** (same as EWCT)	**m/s**
EWCS (or UACC for phase array systems)	**Standard Deviation Of Surface Eastward Sea Water Velocity**	**m/s**
NSCS (or VACC for phase array systems)	**Standard Deviation Of Surface Northward Sea Water Velocity**	**m/s**
CCOV	Covariance of Surface Sea Water Velocity (for data measured by Codar systems)	m^2/s^2
GDOP	**Geometrical Dilution Of Precision (QC-related parameter)**	**dimensionless**

UACC (or EWCS for direction finding systems)	**Accuracy of Surface Eastward Sea Water Velocity**	**m/s**
VACC (or NSCS for direction finding systems)	**Accuracy of Surface Northward Sea Water Velocity**	**m/s**
NARX	Number of Receive Antennas	dimensionless
NATX	Number of Transmit Antennas	dimensionless
SLTR	Receive Antenna Latitudes	Degrees North
SLNR	Receive Antenna Longitudes	Degrees East
SLTT	Transmit Antenna Latitudes	Degrees North
SLNT	Transmit Antenna Longitudes	Degrees East
SCDR	Receive Antenna Codes	dimensionless
SCDT	Receive Antenna Codes	dimensionless

Table 7- List of the available variables for radar_total dataset.

Concerning the variables EWCS, NSCS, UACC and VACC, it has to be noted that EWCS and NSCS are related to the parameters defining the variance of the velocity component measurements present (mainly) in direction finding systems. They are computed at each time step, and therefore considered not statistically solid.

The UACC and VACC variables are related to the parameters defining the accuracy of the velocity component measurements and they are mainly present in phased array systems.

Thus, the two couples of variables are alternative, depending on the system producing the data.

V.2.1.3 Radar_total dimensions

NetCDF dimensions provide information on the size of the data variables, and additionally the coordinate variables to data. CF recommends that if any or all the dimensions of a variable have the interpretations of "date or time" (T), "height or depth" (Z), "latitude" (Y), or "longitude" (X) then those dimensions should appear in the relative order T, Z, Y, X in the variable's definition (see Table 8).

Name	Comment
TIME	Number of time steps.
DEPTH	Number of depth levels. Set to 1 for HFR data (equivalent to the sea surface).
LATITUDE	Dimension of the LATITUDE coordinate variable.
LONGITUDE	Dimension of the LONGITUDE coordinate variable.
STRINGx	Length in characters of the strings used in the data file. It is mandatory that the string length dimension STRINGx has the value of x.
MAXSITE	Maximum number of contributing antennas. Set as an upper bound.
MAXINST	Maximum number of collaborating institutions. Set as an upper bound.
REFMAX	Maximum number of external resource linkages. Set as an upper bound.

Table 8- List of the dimensions of the data variables for radar_total dataset.

Since HFR data have only one depth layer of measurement, i.e. the surface layer, the dimension DEPTH has size equal to 1 and value equal to 0 meter.

If non-physical variables are present in the data file, e.g. the processing parameters of the HFR device generating the data or the codes of the sites contributing to a total velocity data, related non-physical dimensions might be defined to expose the variables in the model.

More than one STRINGx dimension can be defined, provided that the string length dimension STRINGx has the value of x.

V.2.1.4 Radar total Quality Control variables

Since in HFR data the quality control values vary along one or more axes of the data variables, they are provided as separate numeric flag variables, with at least one dimension that matches the 'target' variable.

When QC information is provided as a separate flag variable, CF-1.6 requires that these variables carry the "flag_values" and "flag_meanings" attributes. These provide a list of possible values and their meanings.

QC variables (as defined in Table 9) can also exist not linked to a target physical variable (e.g. GDOP threshold QC variable linked to GDOP variable), but also as standalone variables reporting the results of a specific QC test (as detailed in the QUID report of this product), e.g. Over-water test.

QC variables (TIME_QC, POSITION_QC and DEPH_QC) for coordinate variables are mandated by the Copernicus Martine Service In Situ TAC profile.

No CF-1.6 standard names exist for QC variables; thus, long names are used. QC variables are of type byte.

Variable name	Long_name	Variable dimensionality
TIME_QC	Time Quality Flag	scalar
POSITION_QC	Position Quality Flags	gridded
DEPH_QC	Depth Quality Flag	scalar
QCflag	Overall Quality Flags	gridded

VART_QC	Variance Threshold Quality Flags	gridded
GDOP_QC	GDOP Threshold Quality Flags	gridded
DDNS_QC	Data Density Threshold Quality Flags	gridded
CSPD_QC	Velocity Threshold Quality Flags	gridded

Table 9- QC variables of radar_total dataset.

V.2.1.5 Radar_radial variables

This is a dataset covering European Seas whose available variables are listed in Table 10 (**mandatory variables**, i.e. variables that are always present in each data file, are listed in bold, recommended variables are listed in plain text).

Total velocity data		
Variable name	*Description*	*Units*
TIME	**Time of measurement**	**days (since 1950-01-01T00:00:00Z)**
BEAR	**Bearing (away from the instrument) of the measurement**	**Degrees true**
RNGE	**Range (away from the instrument) of the measurement**	**km**
LATITUDE	**Latitude of the data position**	**Degrees North**

LONGITUDE	**Longitude of the data position**	**Degrees East**
DEPH	**Depth of measurement** (from tens of cm to 1-2 m, depending on the operating frequency)	**m**
RDVA	**Radial Sea Water Velocity Away From Instrument** (gridded maps of the surface current velocity radial component averaged over a time interval, mainly around the cardinal hour)	**m/s**
DRVA	**Direction of Radial Sea Water Velocity Away From Instrument** (gridded maps of the direction of surface current velocity radial component averaged over a time interval, mainly around the cardinal hour)	**Degrees true**
EWCT	**Surface Eastward Sea Water Velocity** (gridded maps of the zonal component of the radial surface ocean current velocity averaged over a time interval, mainly around the cardinal hour)	**m/s**
NSCT	**Surface Northward Sea Water Velocity** (gridded maps of the meridional component of radial surface ocean current velocity averaged over a time interval, mainly around the cardinal hour)	**m/s**
ESPC (or HCSS for phase array systems)	**Radial Standard Deviation of Current Velocity over the Scatter Patch**	**m/s**
ETMP (or EACC for phase array systems)	**Radial Standard Deviation of Current Velocity over the Coverage Period**	**m/s**

HCSS (or ESPC for direction finding systems)	**Radial Variance of Current Velocity Over Coverage Period**	**m/s**
EACC (or ETMP for direction finding systems)	**Radial Accuracy of Current Velocity Over Coverage Period**	**m/s**
NARX	Number of Receive Antennas	dimensionless
NATX	Number of Transmit Antennas	dimensionless
SLTR	Receive Antenna Latitudes	Degrees North
SLNR	Receive Antenna Longitudes	Degrees East
SLTT	Transmit Antenna Latitudes	Degrees North
SLNT	Transmit Antenna Longitudes	Degrees East
SCDR	Receive Antenna Codes	dimensionless
SCDT	Receive Antenna Codes	dimensionless

Table 10- List of the available variables for radar_radial dataset.

Concerning the variables ESPC, ETMP, HCSS and EACC, it has to be noted that ESPC and ETMP are related to the parameters defining the standard deviation of the radial velocity component measurements present (mainly) in direction finding systems.

The HCSS and EACC variables are related to the parameters defining the variance and the accuracy of the radial velocity component measurements and they are mainly present in phased array systems. Thus, the two couples of variables are alternative, depending on the system producing the data.

V.2.1.6 Radar_radial dimensions

NetCDF dimensions provide information on the size of the data variables, and additionally on the coordinate variables defining the physical coordinated of the data. CF recommends that if any or all the dimensions of a variable have the interpretations of "date or time" (T), "height or depth" (Z), "latitude" or “range” (Y), "longitude" or “bearing” (X), then those dimensions should appear in the relative order T, Z, Y, X in the variable’s definition (see Table 11)

Name	Comment
TIME	Number of time steps.
DEPTH	Number of depth levels. Set to 1 for HFR data (equivalent to the sea surface).
BEAR	Dimension of the BEAR coordinate variable.
RNGE	Dimension of the RNGE coordinate variable.
LATITUDE	Dimension of the LATITUDE coordinate variable.
LONGITUDE	Dimension of the LONGITUDE coordinate variable.
STRINGx	Length in characters of the strings used in the data file. It is mandatory that the string length dimension STRINGx has the value of x.
MAXSITE	Maximum number of contributing antennas. Set as an upper bound.
MAXINST	Maximum number of collaborating institutions. Set as an upper bound.
REFMAX	Maximum number of external resource linkages. Set as an upper bound.

Table 11- List of the dimensions of the data variables for radar_radial dataset.

Bearing (BEAR) and range (RNGE) are the coordinate variables for radial surface ocean current velocity data measured on a polar geometry (e.g. Codar .ruv files). In this case, LATITUDE and LONGITUDE are data variables since they are evaluated starting from bearing and range. In order to distribute radial netCDF files as gridded data via THREDDS catalogues, every gridded variable in the netCDF file of radial data must have the "coordinates" attribute with value "TIME DEPH LATITUDE LONGITUDE". Thus, the coordinates of data and QC variables for radial surface ocean current velocities measured on a polar geometry shall be (TIME, DEPTH, BEAR, RNGE) and RNGE dimension shall have the 'axis' attribute set to 'Y' and BEAR dimension shall have the 'axis' attribute set to 'X'.

The coordinates of data and QC variables for radial current velocities measured on a Cartesian grid shall be (TIME, DEPTH, LATITUDE, LONGITUDE) and LONGITUDE dimension shall have the 'axis' attribute set to 'X' and LATITUDE dimension shall have the 'axis' attribute set to 'Y'.

Since HFR data have only one depth layer of measurement, i.e. the surface layer, the dimension DEPTH has size equal to 1 and value equal to 0 meter.

If non-physical variables are present in the data file, e.g. the processing parameters of the HFR device generating the data or the codes of the stations measuring the radial current velocity data or , related non-physical dimensions might be defined to expose the variables in the model.

More than one STRINGx dimension can be defined, provided that the string length dimension STRINGx has the value of x.

V.2.1.7 Radar_radial Quality Control variables

Since in HFR data the quality control values vary along one or more axes of the data variables, they are provided as separate numeric flag variables, with at least one dimension that matches the 'target' variable.

When QC information is provided as a separate flag variable, CF-1.6 requires that these variables carry the "flag_values" and "flag_meanings" attributes. These provide a list of possible values and their meanings.

QC variables (as defined in Table 12) can also exist not linked to a target physical variable (e.g. velocity threshold QC variable linked to RDVA variable), but also as standalone variables reporting the results of a specific QC test (as detailed in the QUID report of this product), e.g. Over-water test.

QC variables (TIME_QC, POSITION_QC and DEPH_QC) for coordinate variables are mandated by the Copernicus Marine Service In Situ TAC profile.

No CF-1.6 standard names exist for QC variables; thus, long names are used. QC variables are of type byte.

Variable name	Long_name	Variable dimensionality
TIME_QC	Time Quality Flag	scalar
POSITION_QC	Position Quality Flags	gridded
DEPH_QC	Depth Quality Flag	scalar
QCflag	Overall Quality Flags	gridded
OWTR_QC	Over-water Quality Flags	gridded
MDFL_QC	Median Filter Quality Flags	gridded
VART_QC	Variance Threshold Quality Flags	gridded
CSPD_QC	Velocity Threshold Quality Flags	gridded
AVRB_QC	Average Radial Bearing Quality Flag	scalar
RDCT_QC	Radial Count Quality Flag	scalar

Table 12- QC variables of radar_radial dataset.

V.2.1.8 Radar_total and radar_radial SeaDataNet identifiers

SeaDataNet (SDN) is the European project that federates the network of EU national oceanographic data centres. SDN is a data provider for Copernicus. Each SDN station distributed in Copernicus NetCDF data file have to include the following additional variables:

Name	Comment
SDN_CRUISE	Text string identifying the grouping label for the data object to which the data row belongs. For HFR data it is set equal to the site_code attribute, that is the EDIOS Series id of the HFR network.
SDN_STATION	Text string identifying the data object to which the data row belongs. For HFR data it is set equal to the platform_code attribute.
SDN_LOCAL_CDI_ID	The local identifier of the Common Data Index record associated with the data row.
SDN_EDMO_CODE	The key identifying the organization responsible for assigning the local CDI given in the European Directory of Marine Organizations (EDMO).
SDN_REFERENCES	Link to a single landing page - an XHTML document providing additional information.
SDN_XLINK	Text strings containing a URI (URN or URL) pointing to a web resource such as a usage metadata document for the data object to which the array element belongs.

I.2.9 Radar_total and radar_radial SDN namespace variables attributes

Variable attributes required in the SDC CF extension are part of the European common data and metadata model for NRT HFR current data. In particular, the SDN extensions to CF were concerned with providing storage for standardized semantics and metadata included in the SDN profiles format. The standardized semantics are included as four mandatory parameter attributes for each data or coordinate variable, which are:

Name	Comment
sdn_parameter_urn	URN (URL) for the parameter description taken from the P01 vocabulary.

sdn_parameter_name	Plain language label (Entryterm) for the parameter taken from the P01 vocabulary at the time of data file creation.
sdn_uom_urn	URN (URL) for the parameter units of measure taken from the P06 vocabulary.
sdn_uom_name	Plain language label (Entryterm) for the parameters' units of measure, taken from the P06 vocabulary at the time of data file creation.

According to SDC CF extension, the **ancillary_variables** attribute is mandatory and has to be set as the list of QC variables related to the specific variable.

Name	Meaning
date_update	Date of update of the file
wmo_platform_code	WMO id of the platform
platform_name	Type of platform. Equal to "**DRIFTING BUOY**" in present case
data_mode	Set to "**R**", for delayed mode data
id	Name of the NetCDF file
cdm_data_type	"**Trajectory**" is delivered in this dataset
area	Spatial coverage of the data. Set to "**Global Ocean**"

geospatial_lat_min	Minimum of the latitude displayed in the file
geospatial_lat_max	Maximum of the latitude displayed in the file
geospatial_lon_min	Minimum of the longitude displayed in the file
geospatial_lon_max	Maximum of the longitude displayed in the file
geospatial_vertical_min	Minimum depth measured by the platform
geospatial_vertical_max	Maximum depth measured by the platform
time_coverage_start	Begin date of the measurements
time_coverage_end	End date of the measurements
last_latitude_observation, **last_longitude_observation** **last_date_observation**	The last valid observation date and position is recorded in the NetCDF global attributes

Table 13- Description of some global attributes for drifter dataset that require more explanations.

Note that for a moving platform (drifting buoy, ship, float) the site_code global attribute is irrelevant. It is set to fill value (empty).

V.2.1.9 Radar_total and radar_radial global attributes

The global attribute section of a NetCDF file describes the contents of the file overall and allows for data discovery. All fields should be human-readable and use units that are easy to understand. Global attribute names are case sensitive.

The European common data and metadata model for real-time HFR data divides global attributes to be adopted for HFR data in three categories: Mandatory Attributes (always present in each HFR data file), Recommended Attributes (not always present in each HFR data file) and Suggested Attributes (not always present in each HFR data file).

The Mandatory Attributes include attributes necessary to comply with CF-1.6 and OceanSITES conventions. In Table 14, **Mandatory Attributes** are listed in bold type.

The Recommended Attributes include attributes necessary to comply with INSPIRE and Unidata Dataset Discovery conventions. In Table 14 *Recommended Attributes* are listed in italic type.

The Suggested Attributes include attributes that can be relevant in describing the data, whether it is part of the standard or not. In Table 14, Suggested Attributes are listed in plain type

Attributes are organized by function: Discovery and Identification, Geo-spatial-temporal, Conventions used, Publication information, and Provenance.

Notes on global attributes:

- The file dates, date_created and date_modified, are our interpretation of the ACDD file dates. Date_created is the time stamp on the file, date_modified may be used to represent the 'version date' of the geophysical data in the file. The date_created may change when e.g. metadata is added or the file format is updated, and the optional date_modified MAY be earlier.
- Geospatial extents (geospatial_lat_min, max, and lon_min, max) are preferred to be stored as strings, however numeric fields are acceptable.

Discovery and Identification	
Name	*Meaning*

site_code	The site code identifies a defined area where observations are performed. Site codes are defined in a homogeneous way. The policy for HFR data is to define a site_code for the network and one platform_code for the total current data files. **The site_code is set equal to the EDIOS Series id of the HFR network.** **It is mandatory to have the prefix 'HFR-' in the EDIOS Series id (the use of '_' is forbidden, please use '-' instead).** The EDIOS codes are managed by the SeaDataNet project; they are available at http://seadatanet.maris2.nl/v_edios_v2/search.asp
platform_code	The platform_code is used for indexing the files, and for data synchronization between the distribution units (the regions of the In Situ TAC). Therefore, it has to be unique for each platform, and common among the In Situ TAC. Platform codes are defined in a homogeneous way. The policy for he radar_total dataset is to define a site_code for the network and one platform_code for the total current data files. **The naming convention is: *platform_code=<EDIOS Series id>-Total*** **for total current data files** The EDIOS codes are managed by the SeaDataNet project; they are available at http://seadatanet.maris2.nl/v_edios_v2/search.asp
data_mode	Indicates if the file contains real-time, provisional or delayed-mode data. The list of valid data modes is in page 12
DoA_estimation_method	Specifies if the system is Direction Finding or Beam Forming. Possible values are "Direction Finding" and "Beam Forming".
calibration_type	Specifies if calibration has been performed. Possible values are: "None", "Ideal", "APM", "full", "internal", "physical", "AEA".

last_calibration_date	Reports the date of the last calibration. It must be specified as a string in the ISO8601 standard "YYYY-MM-DD-Thh:mm:ssZ". UTC must be used, and specified.
calibration_link	Indicates the link to a contact person able to provide data about the calibration.
title	Free format text describing the dataset, for use by human readers.
summary	Longer free format text describing the dataset. This attribute should allow data discovery for a human reader.
source	The method of production of the original data. **The term "coastal structure" from the SeaVoX Platform Categories (L06) list is used for HFR data.**
source_platform_category_code	SeaDataNet vocabulary L06 (SeaVoX) reports platform categories, as a code and a label. **For HFR data the code "17" is used.**
institution	Specifies institution where the original data was produced.
institution_edmo_code	The EDMO codes are managed by the SeaDataNet project; they are available at http://seadatanet.maris2.nl/edmo/
data_assembly_center	Institution in charge of the aggregation and distribution of data.
id	The "id" attribute is intended to provide a globally unique identification for each dataset. **The id contains the platform_code and the data time stamp specified as a string in the ISO8601 standard "YYYY-MM-DD-Thh:mm:ssZ".** **The naming convention is: id=platform_code_ YYYY-MM-DD-Thh:mm:ssZ**

project	The scientific project that produced the data. Each project must have its own EDMERP entry. The EDMERP codes are managed by the SeaDataNet project; they are available at http://seadatanet.maris2.nl/v_edmerp/search.asp
naming_authority	The organization that manages data set names. The **reverse-DNS naming** is used for the naming authority attribute.
keywords	Provide comma-separated list of terms that will aid in discovery of the dataset.
keywords_vocabulary	GCMD Science Keywords 'SeaDataNet Parameter Discovery Vocabulary' or 'AGU Index Terms'.
comment	Miscellaneous information about the data or methods used to produce it. Any free format text is appropriate.
data_language	The language in which the data elements are expressed.
data_character_set	The character set used for expressing data.
metadata_language	The language in which the metadata elements are expressed.
metadata_character_set	The character set used for expressing metadata.
topic_category	ISO 19115 topic category.
network	A grouping of sites based on common shore-based logistics or infrastructure.

Geo-spatial-temporal	
data_type	Copernicus In Situ NetCDF files family of data.
feature_type	Description of the spatio-temporal shape of the data held in the netCDF using a vocabulary specified in CF 1.6. The value used for HFR data is “surface”.
geospatial_lat_min	The southernmost latitude, a value between -90 and 90 degrees. It may be string or numeric, but string is strongly recommended.
geospatial_lat_max	The northernmost latitude, a value between -90 and 90 degrees. It may be string or numeric, but string is strongly recommended.
geospatial_lon_min	The westernmost longitude, a value between -180 and 180 degrees. It may be string or numeric, but string is strongly recommended.
geospatial_lon_max	The easternmost longitude, a value between -180 and 180 degrees. It may be string or numeric, but string is strongly recommended.
geospatial_vertical_min	The minimum depth of measurements. It may be string or numeric, but string is strongly recommended.
geospatial_vertical_max	The maximum depth of measurements. It may be string or numeric, but string is strongly recommended.
time_coverage_start	Start date of the data in UTC. Time is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ”.
time_coverage_end	Final date of the data in UTC. Time is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ”.

area	Geographical coverage.
geospatial_lat_units	Conforms to udunits. If not specified, then “degrees_north” is assumed.
geospatial_lon_units	Conforms to udunits. If not specified, then “degrees_east” is assumed.
geospatial_vertical_resolution	Vertical resolution of the measurement. For HFR data it is set as the maximum integration depth of the radar system, according to operating frequency.
geospatial_vertical_units	Units of depth. If not specified, then “m” is assumed.
geospatial_vertical_positive	Indicates which direction is positive; "up" means that z represents height, while a value of "down" means that z represents pressure or depth. If not specified then “down” is assumed.
time_coverage_resolution	Interval between records. ISO8601 standard is used: PnYnMnDTnHnMnS.
time_coverage_duration	Duration of the time coverage of the data. ISO8601 standard is used: PnYnMnDTnHnMnS.
reference_system	ESPG coordinate reference system.
grid_resolution	Resolution of the grid for total velocity data. *Recommended*.
cdm_data_type	The Unidata CDM (common data model) data type used by THREDDS. e.g. point, profile, section, station, station_profile, trajectory, grid, radial, swath, image; Grid is used for gridded HFR data. *Recommended* (ACDD)

Conventions used	
format_version	Version of the data model release.
Conventions	Names of the conventions followed by the dataset. The attribute Conventions is reported as follow: "CF-1.6 Jerico-Next-deliverable-D5.14 Copernicus-InSituTAC-Manual-1.0 Copernicus-InSituTAC-SRD-1.4 Copernicus-InSituTAC-ParametersList-3.1.0". Additional conventions can be appended at the list.
netcdf_version	NetCDF version used for the dataset.
netcdf_format	NetCDF format used for the dataset.
Publication information	
update_interval	Update interval for the file, in ISO8601 interval format: PnYnMnDTnHnM, where elements that are 0 may be omitted. "void" is used for HFR data that are not updated on a schedule. Used by inventory software.
citation	The citation to be used in publications using the dataset. The citation statement has to be reported as follows: "These data were collected and made freely available by the Copernicus project and the programs that contribute to it." An additional citation statement can be appended to the "citation" attribute.
distribution_statement	The distribution statement has to be reported as follows: "These data follow Copernicus standards; they are public and free of charge. User assumes all risk for use of data. User must display citation in any publication or product using data. User must contact PI prior to any

	commercial use of data."
publisher_name	Name of the person responsible for metadata and formatting of the data file.
publisher_email	Email address of the person responsible for metadata and formatting of the data file.
publisher_url	Web address of the institution or of the data publisher.
license	A statement describing the data distribution policy; it may be a project- or DAC-specific statement, but must allow free use of data.
acknowledgment	A place to acknowledge various types of support for the project that produced this data.
Provenance	
date_created	The date on which the data file was created. Version date and time for
	the data contained in the file. (UTC). Time is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ".
history	Provides an audit trail for modifications to the original data. It should contain a separate line for each modification, with each line beginning with a timestamp, and including user name, modification name, and modification arguments. The time stamp is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ".

date_modified	The date on which the data file was last modified. Time is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ"
date_update	Timestamp specifying when the contents (i.e. its attributes and/or values) of the file were last changed Time is specified as a string according to the ISO8601 standard: "YYYY-MM-DDThh:mm:ssZ" The value is set equal to the "date_modified" one.
processing_level	Level of processing and quality control applied to data. The radar_total data set delivered corresponds to LEVEL 3B data, following the definition of the processing levels for the identification of the different data produced during the processing workflow of a HF radar. Level 3B are surface currents mapped on uniform space-time grid scales and that have been processed with a minimum set of QC.[1]
contributor_name	A semi-colon-separated list of the names of any individuals or institutions that contributed to the creation of this data. **Mandatory**. (ACDD)
contributor_role	The roles of any individuals or institutions that contributed to the creation of this data, separated by semi-colons.
contributor_email	The email addresses of any individuals or institutions that contributed to the creation of this data, separated by semi-colons.

Table 14- Description of radar_total global attributes.

V.2.1.10 Argo content

V.2.1.10.1 Argo variables

The Argo current dataset contains the following variables.

Variable name	Description	Units

TIME	Date of the data	days since 1950-01-01T00:00:00Z
PRES	Representative pressure of the current observation. Can be 0 or parking depth pressure	decibar
LATITUDE	Latitude of the data position	Degree North
LONGITUDE	Longitude of the data position	Degree East
EWCT	West-East sea water velocity at the representative pressure	$m.s^{-1}$
NSCT	South-North sea water velocity at the representative pressure	$m.s^{-1}$
TIME_INTERVAL	Time interval of the current variable (measured between two locations)	day
PLATFORM_CODE	The float platform code	n/a
GROUNDED	Indicates the best estimate of whether the float touched the ground for that cycle. The conventions are described in Argo reference Table 16 here.	n/a
TRAJECTORY	Identifier of trajectory	n/a

Table 15- List of the available variables for Argo current dataset.

Table 16 : Argo reference ; GROUNDED flags

flag	Meaning
Y	Yes, the float touched the ground
B	Yes, the float touched the ground after bathymetry check with an outside database
N	No, the float did not touch the ground
S	Float is known to be drifting at a shallower depth than originally programmed
U	Unknown

V.2.1.10.2 Argo dimensions

Name	Comment
TIME	Number of time steps.
DEPTH	Number of depth levels.
STRINGx	Length in characters of the strings used in the data file. It is mandatory that the string length dimension STRINGx has the value of x.

Table 17- List of the dimensions of the data variables for Argo current dataset.

V.2.1.10.3 Argo global attributes

Name	Meaning

date_update	Date of update of the file
wmo_platform_code	WMO id of the platform
platform_name	Type of profiling float
data_mode	Set to "**R**" for real-time data
id	Name of the NetCDF file
cdm_data_type	"**Trajectory**" is delivered in this dataset
area	Spatial coverage of the data. Set to "**Global Ocean**"
geospatial_lat_min	Minimum of the latitude displayed in the file
geospatial_lat_max	Maximum of the latitude displayed in the file
geospatial_lon_min	Minimum of the longitude displayed in the file
geospatial_lon_max	Maximum of the longitude displayed in the file
geospatial_vertical_min	Minimum depth measured by the platform
geospatial_vertical_max	Maximum depth measured by the platform

time_coverage_start	Begin date of the measurements
time_coverage_end	End date of the measurements
last_latitude_observation, **last_longitude_observation** **last_date_observation**	The last valid observation date and position is recorded in the NetCDF global attributes

Table 18- Description of the main global attributes for Argo current dataset.

V.2.2 Quality control flags

The quality control flags indicate the quality of the data values in a file and are assigned after quality control procedures have been performed (as detailed in the QUID manual of the current product). These codes are used in the <DATA>_QC variables to describe the quality of each measurement (as specified in Table 19)

Code	Meaning	Comment
0	No QC was performed	-
1	Good data	All real-time QC tests passed.
2	Probably good data	-
3	Bad data that are potentially correctable	These data are not to be used without scientific correction.
4	Bad data	Data have failed one or more of the tests.

5	Value changed	Data may be recovered after transmission error.
6	Not used	-
7	Nominal value	-
8	Interpolated value	Missing data may be interpolated from neighbouring data in space or time.
9	Missing value	-

Table 19- Data flags for the three datasets included in this product.

A file with no valid time, depth and position is not distributed on Copernicus In Situ TAC.

A valid time has a TIME_QC variable set to 1, 2, 5, 7 or 8 (good, probably good, value changed, nominal, interpolated).

A valid depth has a DEPH_QC variable set to 1, 2, 5, 7 or 8 (good, probably good, value changed, nominal, interpolated).

A valid position has a POSITION_QC variable set to 1, 2, 5, 7 or 8 (good, probably good, value changed, nominal, interpolated).

V.2.2.1 Radar_total and radar_radial additional information

Since the datasets radar_total and radar_radial are gridded data, they are distributed even if the Qcflag (overall QC flag for the file) is not entirely filled with good_data (qc_flag=1). This is because it may happen that some vectors on the grid are labelled as good_data and some other as bad_data. Users can apply the QC variables (there is one QC variable per each QC test applied

V.2.2.2 Argo additional information

The data distributed have positions and dates quality flags equal to 1 (good data). The initial argo data used to compute the velocities with positions and dates that do not have a QC 1 are ignored.

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[1] Please refer to Appendix A of the JERICO-NEXT deliverable D5.14 “Recommendation Report 2 on improved common procedures for HFR QC analysis” for the processing level definition (as summarized in Table 12; http://www.jerico-ri.eu/download/jerico-next-deliverables/JERICO-NEXT-Deliverable_5.14_V1.pdf)

V.2.3 NetCDF samples (ncdump -h)

This chapter provides samples of Copernicus in situ NetCDF files headers.

V.2.3.1 Argo dataset sample file

Argo current sample file NetCDF header

```
netcdf GL_TS_PF_3901918 {
dimensions:
   TIME = 265 ;
   DEPTH = 1 ;
   STRING32 = 32 ;
   STRING256 = 256 ;
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:uncertainty = " " ;
            TIME:comment = " " ;
            TIME:axis = "T" ;
            TIME:ancillary_variables = "TIME_QC" ;
            TIME:calendar = "standard" ;
   byte TIME_QC(TIME) ;
            TIME_QC:_FillValue = -127b ;
            TIME_QC:long_name = "quality flag" ;
            TIME_QC:conventions = "Copernicus Marine In Situ reference table 2" ;
            TIME_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed not_used nominal_value interpolated_value missing_value" ;
            TIME_QC:valid_min = 0b ;
            TIME_QC:valid_max = 9b ;
            TIME_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
   float LATITUDE(TIME) ;
            LATITUDE:standard_name = "latitude" ;
            LATITUDE:long_name = "Latitude of each location" ;
            LATITUDE:units = "degree_north" ;
            LATITUDE:valid_min = -90. ;
            LATITUDE:valid_max = 90. ;
            LATITUDE:uncertainty = " " ;
            LATITUDE:comment = " " ;
            LATITUDE:axis = "Y" ;
            LATITUDE:ancillary_variables = "POSITION_QC" ;
```

```
   float LONGITUDE(TIME) ;
            LONGITUDE:standard_name = "longitude" ;
            LONGITUDE:long_name = "Longitude of each location" ;
            LONGITUDE:units = "degree_east" ;
            LONGITUDE:valid_min = -180. ;
            LONGITUDE:valid_max = 180. ;
            LONGITUDE:uncertainty = " " ;
            LONGITUDE:comment = " " ;
            LONGITUDE:axis = "X" ;
            LONGITUDE:ancillary_variables = "POSITION_QC" ;
   byte POSITION_QC(TIME) ;
            POSITION_QC:_FillValue = -127b ;
            POSITION_QC:long_name = "quality flag" ;
            POSITION_QC:conventions = "Copernicus Marine In Situ reference table 2" ;
            POSITION_QC:flag_meanings = "no_qc_performed good_data probably_good_data
bad_data_that_are_potentially_correctable bad_data value_changed not_used nominal_value interpolated_value missing_value" ;
            POSITION_QC:valid_min = 0b ;
            POSITION_QC:valid_max = 9b ;
            POSITION_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
   char GROUNDED(TIME) ;
            GROUNDED:_FillValue = " " ;
            GROUNDED:long_name = "Did the profiler touch the ground for that cycle?" ;
            GROUNDED:conventions = "Argo reference table 20" ;
   float PRES(TIME, DEPTH) ;
            PRES:_FillValue = 9.96921e+36f ;
            PRES:standard_name = "sea_water_pressure" ;
            PRES:long_name = "Sea pressure" ;
            PRES:units = "dbar" ;
            PRES:data_mode = "R" ;
            PRES:axis = "Z" ;
            PRES:positive = "down" ;
            PRES:uncertainty = " " ;
            PRES:reference = "sea_level" ;
            PRES:ancillary_variables = "PRES_QC" ;
   byte PRES_QC(TIME, DEPTH) ;
            PRES_QC:_FillValue = -127b ;
            PRES_QC:long_name = "quality flag" ;
            PRES_QC:conventions = "Copernicus Marine In Situ reference table 2" ;
            PRES_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed not_used nominal_value interpolated_value missing_value" ;
            PRES_QC:valid_min = 0b ;
            PRES_QC:valid_max = 9b ;
            PRES_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
   int EWCT(TIME, DEPTH) ;
            EWCT:_FillValue = -2147483647 ;
            EWCT:standard_name = "eastward_sea_water_velocity" ;
            EWCT:long_name = "West-east current component" ;
            EWCT:units = "m s-1" ;
            EWCT:scale_factor = 0.001f ;
            EWCT:add_offset = 0.f ;
            EWCT:data_mode = "R" ;
            EWCT:ancillary_variables = "EWCT_QC" ;
           .EWCT:coordinates = "TIME LONGITUDE LATITUDE DEPH TRAJECTORY" ;
   byte EWCT_QC(TIME, DEPTH) ;
            EWCT_QC:_FillValue = -127b ;
            EWCT_QC:long_name = "quality flag" ;
            EWCT_QC:conventions = "Copernicus Marine In Situ reference table 2" ;
            EWCT_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed not_used nominal_value interpolated_value missing_value" ;
            EWCT_QC:valid_min = 0b ;
            EWCT_QC:valid_max = 9b ;
            EWCT_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
   int NSCT(TIME, DEPTH) ;
            NSCT:_FillValue = -2147483647 ;
```

```
            NSCT:standard_name = "northward_sea_water_velocity" ;
            NSCT:long_name = "South-north current component" ;
            NSCT:units = "m s-1" ;
            NSCT:scale_factor = 0.001f ;
            NSCT:add_offset = 0.f ;
            NSCT:data_mode = "R" ;
            NCST:ancillary_variables = "NCST_QC" ;
           .NCST:coordinates = "TIME LONGITUDE LATITUDE DEPH TRAJECTORY" ;
  byte NSCT_QC(TIME, DEPTH) ;
            NSCT_QC:_FillValue = -127b ;
            NSCT_QC:long_name = "quality flag" ;
            NSCT_QC:conventions = "Copernicus Marine In Situ reference table 2" ;
            NSCT_QC:flag_meanings = "no_qc_performed good_data probably_good_data bad_data_that_are_potentially_correctable
bad_data value_changed not_used nominal_value interpolated_value missing_value" ;
            NSCT_QC:valid_min = 0b ;
            NSCT_QC:valid_max = 9b ;
            NSCT_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
  int DURATION(TIME) ;
            DURATION:_FillValue = -2147483647 ;
            DURATION:long_name = "duration of the current variable sampling" ;
            DURATION:units = "day" ;
            DURATION:scale_factor = 0.001f ;
            DURATION:add_offset = 0.f ;
            DURATION:data_mode = "R" ;
  char TRAJECTORY(NAME_STRLEN) ;
            TRAJECTORY:long_name = "trajectory" ;
            TRAJECTORY:cf_role = "trajectory_id" ;
            TRAJECTORY:_Encoding = "utf-8" ;

// global attributes:
            :data_type = "OceanSITES trajectory data" ;
            :format_version = "1.4" ;
            :platform_code = "3901918" ;
            :date_update = "2020-09-03T14:21:55Z" ;
            :institution = "Ifremer" ;
            :institution_edmo_code = " " ;
            :site_code = " " ;
            :wmo_platform_code = "3901918" ;
            :coriolis_platform_code = " " ;
            :platform_name = " " ;
            :ices_platform_code = " " ;
            :source = "drifting subsurface profiling float" ;
            :source_platform_category_code = "46" ;
            :history = "2020-09-03T14:21:55Z : Creation" ;
            :data_mode = "R" ;
            :references = "http://marine.copernicus.eu http://www.marineinsitu.eu" ;
            :comment = "The Argo current product produced by Copernicus in situ TAC" ;
            :Conventions = "CF-1.11 Copernicus-InSituTAC-FormatManual-2.0 Copernicus-InSituTAC-SRD-1.5 Copernicus-InSituTAC-
ParametersList-3.2.1" ;
            :netcdf_version = "netCDF-4 classic model" ;
            :title = "Global Ocean - Argo near-real time currents from drifting profiling floats" ;
            :summary = " " ;
            :naming_authority = "Copernicus Marine In Situ" ;
            :id = "GL_TS_PF_3901918" ;
            :cdm_data_type = "trajectory" ;
            :area = "Global Ocean" ;
            :geospatial_lat_min = "-40.36700" ;
            :geospatial_lat_max = "-26.77700" ;
            :geospatial_lon_min = "-7.22000" ;
            :geospatial_lon_max = "18.90000" ;
            :geospatial_vertical_min = "0.00" ;
            :geospatial_vertical_max = "1038.50" ;
            :time_coverage_start = "2016-12-03T04:11:31Z" ;
            :time_coverage_end = "2020-07-15T06:14:16Z" ;
```

:bottom_depth = " " ;
:institution_references = " " ;
:contact = "data.centre@socib.es cmems-service@ifremer.fr" ;
:author = "Coriolis for Copernicus Marine service" ;
:data_assembly_center = "Ifremer" ;
:pi_name = " " ;
:distribution_statement = "These data follow Copernicus standards; they are public and free of charge. User assumes all risk for use of data. User must display citation in any publication or product using data. User must contact PI prior to any commercial use of data." ;
:citation = "These data were collected and made freely available by the Copernicus project and the programs that contribute to it. " ;
:update_interval = "P1D" ;
:qc_manual = "Recommendations for in-situ data Near Real Time Quality Control https://doi.org/10.13155/36230" ;
: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" ;
:wmo_inst_type = "" ;
:last_latitude_observation = "-28.16400" ;
:last_longitude_observation = "-7.18000" ;
:time_coverage_duration = 1320.0852430556 ;
:last_date_observation = "2020-07-15T06:14:16Z" ;
:featureType = "trajectory" ;
}

VI REFERENCES

Corgnati et al, 2018 Building strong foundations towards a pan-European High Frequency Radar network.
https://imdis.seadatanet.org/content/download/122304/file/S3P104_IMDIS2018.pdf

Mader et al. 2017. THE EUROPEAN HF RADAR INVENTORY.
http://eurogoos.eu/download/reference_documents_/EU_HFRadar_inventory.pdf

Menna M, Poulain P-M, Bussani A, Gerin R. (2018). Detecting the drogue presence of SVP drifters from wind slippage in the Mediterranean Sea. . Measurement, 125, 447-453. https://doi.org/10.1016/j.measurement.2018.05.022.

Menna M, Gerin R, Bussani A, Poulain P-M (2017). The OGS Mediterranean drifter dataset: 1986-2016.OGS 2017/92 OCE 28 MAOS. 34pp.
http://maos.inogs.it/pub/Menna%20et%20al%202017_Drifter_database.pdf

Rubio et al. 2018. Present and future of the European HF radar network: outcomes of the INCREASE project. Proceedings of the 4th Orca meeting. Okinawa (Japan).
http://orca2018.official.jp/wp-content/uploads/2018/05/ExtendedAbstract_Session4.pdf

Rubio A, Mader J, Corgnati L, Mantovani C, Griffa A, Novellino A, Quentin C, Wyatt L, Schulz-Stellenfleth J, Horstmann J, Lorente P, Zambianchi E, Hartnett M, Fernandes C, Zervakis V, Gorringe P, Melet A and Puillat I (2017). HF Radar Activity in European Coastal Seas: Next Steps Towards a Pan-European HF Radar Network. Front. Mar. Sci. 4:8. doi:10.3389/fmars.2017.00008

Argo (2020). Argo float data and metadata from Global Data Assembly Centre (Argo GDAC). SEANOE. https://doi.org/10.17882/42182

Quality Information Document (QUID)
https://catalogue.marine.copernicus.eu/documents/QUID/CMEMS-INS-QUID-013_048.pdf