PRODUCT USER MANUAL

For REProcessed IN SITU product (ADCP):

INSITU_GLO_UV_L2_REP_OBSERVATIONS_013_044
Dataset: GLOBAL_REP_ADCP

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CHANGE RECORD

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Content

GLOSSARY AND ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
CF	Climate Forecast (convention for NetCDF)
CMEMS	Copernicus Marine Environment Monitoring Service
CORIOLIS	In situ data system for operational oceanography
DT	Delayed Time
EU	European Union
FTP	File Transfer Protocol
GDAC	Global Data Archiving Centre
GTS	Global Transmission System
INS	In situ
MFC	Monitoring and Forecasting Centre
NetCDF	Network Common Data Form
NRT	Near Real Time
PUM	Product User Manual
REP	Reprocessed
R&D	Research and Development
RT	Real Time
S	Sea Salinity
T	Sea Temperature
TAC	Thematic Assembly Centre

I INTRODUCTION

I.1 Scope of this document

This Product User Manual describes the reprocessed ADCP dataset called INSITU_GLO_UV_L2_REP_OBSERVATIONS_013_044 - GLOBAL_REP_ADCP distributed by the CMEMS in situ Thematic Assembly Centre: how it is built, what is the content, what data services are available to access them, and how to use the files.

The INS-TAC is a distributed system built on the existing activities and services developed previously within the EU supported projects (MyOcean, Mersea, MFSTEP, FerryBox, SEPRISE ...) and EuroGOOS Regional alliances (ROOSes). It 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 but also regional needs either for monitoring, modelling or downstream service development.

I.2 The CMEMS project

The main objective of the CMEMS project is to deliver and operate a rigorous, robust and sustainable Ocean Monitoring and Forecasting system of the Copernicus Marine Service to users for all marine applications: maritime safety, marine resources, marine and coastal environment and climate, seasonal and weather forecasting. The CMEMS INS-TAC prepares quality controlled and / or re-analysed datasets for reanalysis activities performed by the CMEMS MFCs and external users in collaboration with the SeaDataNet infrastructure first for the global ocean and as prototype for the regional seas.

I.3 Short introduction to the product

The in situ reprocessed ADCP dataset integrates updated quality flags from NRT products (INSITU_GLO_NRT_OBSERVATIONS_013_030) history directory files downloaded from the Global Production Unit at IFREMER. Quality flags have been set up after a more accurate in delayed mode using updated real-time and delayed mode quality assessment procedures for ADCP parameters.

This product is designed to be assimilated into or to be used for validation purposes of operational models operated by ocean forecasting centres for reanalysis purposes or for research community. These users need data aggregated and quality controlled in a reliable and documented manner.

II PRODUCT DESCRIPTION

II.1 General information

The reprocessed ADCP product is based on the NRT product (INSITU_GLO_NRT_OBSERVATIONS_013_030) history directory files downloaded from the Global Distribution Unit operated by IFREMER. Quality flags for the most relevant parameters have been reprocessed using updated quality assessment procedures. This work has been performed for all platforms

Quality control procedures were developed and tested by Ifremer and the European project AtlantOS : Cascade ADCP data delayed mode data processing.

More information on these procedures and on the ADCP product quality assessment is available on https://www.umr-lops.fr/en/Technology/Software/CASCADE-7.2 and on *"EuroGOOS DATA-MEQ working group. Recommendations for in-situ data Near Real Time Quality Control. https://doi.org/10.13155/36230"*

II.2 Content of the product

This is a global coverage product formatted like the the INSITU_GLO_NRT_OBSERVATIONS_013_030 product history data files and contains the same variables as those found in the source files. Hence, variables found in each product file may vary. However, each file is supposed to contain one or more ADCP parameters. A list of variables relevant to this manual is presented in **Erreur ! Source du renvoi introuvable.**. Other variables have been left unchanged and are described in the INSITU_GLO_NRT_OBSERVATIONS_013_030 product PUM. The time period covered spans from April 1990 to December 2018. For details refer to the quality information document INSITU_GLO_ADCP_REP_OBSERVATIONS_013_044.

The Acoustic Doppler Current Profiler (ADCP) reports trajectories of vertical profiles of seawater currents. This sensor is fitted on moving platforms such as vessel, auv, saildrone or glider. It can also be fitted on a fixed buoy or mooring to report time series.

The file type is time series: « TS »

A specific data type «VA» is used for vessel mounted ADCP.

ADCP parameters

- EWCT West-east current component m s-1 eastward_sea_water_velocity
- NSCT South-north current component m s-1 northward_sea_water_velocity
- VCSP Bottom-top current component m s-1 upward_sea_water_velocity

For a more efficient data storage, ADCP parameters have a specific variable type:

- Unsigned "short" variable
- add_offset and scale_factor dynamically calculated (file content dependant)

II.3 QC Procedures

Guided by the necessity of using high-quality current data for its research projects, the Laboratory of Physical Oceanography developed a software called CASCADE to process and analyse the data provided by the Acoustic Doppler Current Profilers mounted on the hull of the research ships (VMADCP or SADCP).

Each vessel transect is checked by a specialist with the Cascade software.

Cascade quality control tool description:

- Le Bot Philippe, Kermabon Catherine, Lherminier Pascale, Gaillard Fabienne. CASCADE V6.1 : Validation and visual quality control of ship hull mounted ADCP. https://archimer.ifremer.fr/doc/00342/45285

Quality assessments of the product can be found in the QUID document of product INSITU_GLO_UV_L2_REP_OBSERVATIONS_013_044 GLOBAL_REP_ADCP DOI .

II.4 Data 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. These codes are used in the <*DATA*>_QC variables to describe the quality of each measurement.

Examples: EWCT_QC, NSCT _QC

Code	Meaning	Comment
0	No QC was performed	-
1	Good data	All 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 1: Data flags.

III PRODUCT DISTRIBUTION

III.1 Which Download mechanism is available for this product?

The download mechanisms available for this product are:

- CMEMS FTP service available from the CMEMS catalogue

III.2 How to download this product?

You first need to register. Please find the registration steps on our website:

http://marine.copernicus.eu/web/56-user-registration-form.php

Once registered, the CMEMS FAQ http://marine.copernicus.eu/web/34-products-and-services-faq.php#1 will guide you on how to download a product through the CMEMS Web Portal FTP Service.

III.3 Portal ftp structure

The Global reprocessed ADCP in-situ observations dataset is available in the INSITU_GLO_ADCP_REP_OBSERVATIONS_013_044 directory.

IV FILES NOMENCLATURE AND FORMAT

IV.1 File Format: NetCDF

The products are stored using the NetCDF format.

NetCDF (network Common Data Form) is an interface for array-oriented data access and a library that provides an implementation of the interface. The NetCDF library also defines a machine-independent format for representing scientific data. Together, the interface, library, and format support the creation, access, and sharing of scientific data. The NetCDF software was developed at the Unidata Program Centre in Boulder, Colorado. The NetCDF libraries define a machine-independent format for representing scientific data.

Please see Unidata NetCDF pages for more information, and to retrieve NetCDF software package.

NetCDF data is:

- Self-Describing. A NetCDF file includes information about the data it contains.
- Architecture-independent. A NetCDF file is represented in a form that can be accessed by computers with different ways of storing integers, characters, and floating-point numbers.
- Direct-access. A small subset of a large dataset may be accessed efficiently, without first reading through all the preceding data.
- Appendable. Data can be appended to a NetCDF dataset along one dimension without copying the dataset or redefining its structure. The structure of a NetCDF dataset can be changed, though this sometimes causes the dataset to be copied.
- Sharable. One writer and multiple readers may simultaneously access the same NetCDF file.

Within in situ TAC the NetCDF format implementation is documented in:

- *Copernicus Marine In Situ Tac Data Management Team (2019). Copernicus Marine in situ NetCDF format reference manual. https://doi.org/10.13155/59938*

The Copernicus in situ NetCDF metadata is compliant with CF-1.6 convention (Climate and Forecast). It is designed to promote the processing and sharing of files created with the NetCDF API. The CF conventions are adopted by a number of projects and groups as a primary standard. The conventions define metadata that provide a definitive description of what the data in each variable represents, and the spatial and temporal properties of the data. This enables users of data from different sources to decide which quantities are comparable, and facilitates building applications with powerful extraction and display capabilities. More on http://cfconventions.org/.

IV.2 File nomenclature

NetCDF file names are as follow: GL_XX_YY_CODE_<_ZZZ>.nc

- GL: region bigram corresponding to global area

- XX: TS (timeseries) (PR –profile- is not used for ADCP data)
- YY: data type (see
- CODE: platform code
- ZZZ: optional subsetting code, may be a year, a group of CTDs, a cruise code…

Examples: GL_TS_VA_FMCY.nc

Table 2 Codes for data types

Name	Meaning
DB	Drifting Buoys
MO	fixed buoys, mooring time series, fixed observations

More detailed information can be found in:

- *Copernicus Marine In Situ Tac Data Management Team (2019).* ***Copernicus Marine in situ NetCDF format reference manual****.* *https://doi.org/10.13155/59938*
- *Copernicus Marine In Situ Tac Data Management Team (2019).* ***Copernicus in situ TAC - CMEMS System Requirements Document****. CMEMS-INS-SRD.* *https://doi.org/10.13155/40846*

IV.3 Global attributes

Global attributes are described in document CMEMS System Requirements Document, CMEMS-INS-SRD (http://doi.org/10.13155/40846). No additional attributes have been added at global level in these files.

IV.4 Structure and semantic of NetCDF files

```
netcdf GL_TS_VA_FMCY {
dimensions:
        TIME = 306547 ;
        DEPTH = 93 ;
        LATITUDE = 306547 ;
        LONGITUDE = 306547 ;
        POSITION = 306547 ;
        STRING256 = 256 ;
variables:
        double TIME(TIME) ;
                TIME:_FillValue = 9.96920996838687e+36 ;
                TIME:standard_name = "time" ;
                TIME:long_name = "Time" ;
                TIME:units = "days since 1950-01-01T00:00:00Z" ;
                TIME:valid_min = -90000 ;
                TIME:valid_max = 90000 ;
                TIME:axis = "T" ;
```

```
		TIME:QC_indicator = 1 ;
		TIME:QC_procedure = 1 ;
		TIME:uncertainty = " " ;
		TIME:comment = " " ;
	byte TIME_QC(TIME) ;
		TIME_QC:_FillValue = -127b ;
		TIME_QC:long_name = "quality flag" ;
		TIME_QC:conventions = "OceanSITES reference table 2" ;
		TIME_QC:valid_min = 0 ;
		TIME_QC:valid_max = 9 ;
		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:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
	float LATITUDE(LATITUDE) ;
		LATITUDE:_FillValue = 9.96921e+36f ;
		LATITUDE:units = "degree_north" ;
		LATITUDE:long_name = "Latitude of each location" ;
		LATITUDE:standard_name = "latitude" ;
		LATITUDE:valid_min = -90. ;
		LATITUDE:valid_max = 90. ;
		LATITUDE:axis = "Y" ;
		LATITUDE:QC_indicator = 1 ;
		LATITUDE:QC_procedure = 1 ;
		LATITUDE:uncertainty = " " ;
		LATITUDE:comment = " " ;
	float LONGITUDE(LONGITUDE) ;
		LONGITUDE:_FillValue = 9.96921e+36f ;
		LONGITUDE:units = "degree_east" ;
		LONGITUDE:long_name = "Longitude of each location" ;
		LONGITUDE:standard_name = "longitude" ;
		LONGITUDE:valid_min = -180. ;
		LONGITUDE:valid_max = 180. ;
		LONGITUDE:axis = "X" ;
		LONGITUDE:QC_indicator = 1 ;
		LONGITUDE:QC_procedure = 1 ;
		LONGITUDE:uncertainty = " " ;
		LONGITUDE:comment = " " ;
	byte POSITION_QC(POSITION) ;
		POSITION_QC:_FillValue = -127b ;
		POSITION_QC:long_name = "quality flag" ;
		POSITION_QC:conventions = "OceanSITES reference table 2" ;
		POSITION_QC:valid_min = 0 ;
		POSITION_QC:valid_max = 9 ;
		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:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
	int DC_REFERENCE(TIME) ;
		DC_REFERENCE:_FillValue = -2147483648 ;
		DC_REFERENCE:long_name = "Station/Location unique identifier in data centre" ;
		DC_REFERENCE:conventions = "Data centre convention" ;
	float DEPH(TIME, DEPTH) ;
		DEPH:_FillValue = 9.96921e+36f ;
		DEPH:axis = "Z" ;
		DEPH:positive = "down" ;
		DEPH:standard_name = "depth" ;
		DEPH:long_name = "Depth" ;
		DEPH:units = "m" ;
	byte DEPH_QC(TIME, DEPTH) ;
		DEPH_QC:_FillValue = -127b ;
		DEPH_QC:long_name = "quality flag" ;
		DEPH_QC:conventions = "OceanSITES reference table 2" ;
		DEPH_QC:valid_min = 0 ;
		DEPH_QC:valid_max = 9 ;
		DEPH_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" ;
		DEPH_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
	ushort EWCT(TIME, DEPTH) ;
```

```
                EWCT:_FillValue = 65535US ;
                EWCT:standard_name = "eastward_sea_water_velocity" ;
                EWCT:long_name = "West-east current component" ;
                EWCT:units = "m s-1" ;
                EWCT:scale_factor = 0.000117864988174258 ;
                EWCT:add_offset = -3.7247388 ;
        byte EWCT_QC(TIME, DEPTH) ;
                EWCT_QC:_FillValue = -127b ;
                EWCT_QC:long_name = "quality flag" ;
                EWCT_QC:conventions = "OceanSITES reference table 2" ;
                EWCT_QC:valid_min = 0 ;
                EWCT_QC:valid_max = 9 ;
                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:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
        ushort NSCT(TIME, DEPTH) ;
                NSCT:_FillValue = 65535US ;
                NSCT:standard_name = "northward_sea_water_velocity" ;
                NSCT:long_name = "South-north current component" ;
                NSCT:units = "m s-1" ;
                NSCT:scale_factor = 0.000120546977950713 ;
                NSCT:add_offset = -3.9098206 ;
        byte NSCT_QC(TIME, DEPTH) ;
                NSCT_QC:_FillValue = -127b ;
                NSCT_QC:long_name = "quality flag" ;
                NSCT_QC:conventions = "OceanSITES reference table 2" ;
                NSCT_QC:valid_min = 0 ;
                NSCT_QC:valid_max = 9 ;
                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:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;
        ushort VCSP(TIME, DEPTH) ;
                VCSP:_FillValue = 65535US ;
                VCSP:standard_name = "upward_sea_water_velocity" ;
                VCSP:long_name = "Bottom-top current component" ;
                VCSP:units = "m s-1" ;
                VCSP:scale_factor = 32768.5000412604 ;
                VCSP:add_offset = -2147483647. ;
        byte VCSP_QC(TIME, DEPTH) ;
                VCSP_QC:_FillValue = -127b ;
                VCSP_QC:long_name = "quality flag" ;
                VCSP_QC:conventions = "OceanSITES reference table 2" ;
                VCSP_QC:valid_min = 0 ;
                VCSP_QC:valid_max = 9 ;
                VCSP_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" ;
                VCSP_QC:flag_values = 0b, 1b, 2b, 3b, 4b, 5b, 6b, 7b, 8b, 9b ;

// global attributes:
                :data_type = "OceanSITES trajectory data" ;
                :format_version = 1.2 ;
                :platform_code = "FMCY" ;
                :date_update = "2019-11-22T15:32:39Z" ;
                :institution = "IFREMER  Institut Francais de Recherche pour l\'Exploitation de la Mer" ;
                :institution_edmo_code = "1054" ;
                :site_code = "" ;
                :wmo_platform_code = "FMCY" ;
                :platform_name = "POURQUOI PAS?" ;
                :source = "research vessel" ;
                :source_platform_category_code = "31" ;
                :history = "2019-11-22T15:32:39Z  : Creation" ;
                :data_mode = "D" ;
                :quality_control_indicator = "6" ;
                :quality_index = "A" ;
                :references = "http://marine.copernicus.eu,http://www.coriolis.eu.org" ;
                :comment = "" ;
```

```
               :Conventions = "CF-1.6 OceanSITES-Manual-1.2 Copernicus-InSituTAC-SRD-1.4 Copernicus-
InSituTAC-ParametersList-3.1.0" ;
               :netcdf_version = "netCDF-4 classic model" ;
               :title = "Global Ocean - In Situ Observation Copernicus" ;
               :summary = "" ;
               :naming_authority = "OceanSITES" ;
               :id = "GL_TS_VA_FMCY" ;
               :cdm_data_type = "Trajectory" ;
               :family_label = "" ;
               :family_code = "VA" ;
               :area = "Global Ocean" ;
               :geospatial_lat_min = -34.94555 ;
               :geospatial_lat_max = 76.26637 ;
               :geospatial_lon_min = -61.67878 ;
               :geospatial_lon_max = 64.60751 ;
               :geospatial_vertical_min = "14.99" ;
               :geospatial_vertical_max = "1832.74" ;
               :time_coverage_start = "2006-04-25T09:19:56Z" ;
               :time_coverage_end = "2017-07-27T20:21:13Z" ;
               :institution_references = "" ;
               :contact = "codac@ifremer.fr" ;
               :author = "Coriolis and Copernicus data provider" ;
               :data_assembly_center = "Coriolis" ;
               :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 = "daily" ;
               :qc_manual = "OceanSITES User's Manual v1.2" ;
               :date_creation = "2019-11-22T15:32:39Z" ;
               :last_date_observation = "2017-07-27T20:21:13Z" ;
               :last_latitude_observation = 38.46765 ;
               :last_longitude_observation = -28.78596 ;
}
```

V GUIDANCE FOR THE USERS

V.1 How to find a particular platform?

Each file corresponds to a particular platform. It is indicated by the platform ID contained in the file name (A search can be made using the WMO ID (also indicated in the file name). In this case, more than one files can be found, considering that the WMO ID can be reassigned.

V.2 How to use Quality Flags?

Quality control flags use the same definition for each variable. For any variable, the most relevant associated quality control flags are

Table 3 Most relevant quality control flags.

QC	Meaning
0	No QC performed
1	All tests passed
4	Not all tests passed

In addition to the biogeochemical variable flag, a test on the quality control flags from common parameters such as TIME_QC, POISITION_QC and DEPH_QC have to be performed. See section for more information on the flags meaning.

VI APPLICABLE DOCUMENT REFERENCES

- Copernicus Marine in situ data management (2019). Copernicus Marine In Situ TAC quality information document for REProcessed ADCP (QUID REP ADCP). http://doi.org/10.13155/XXXX

VII OTHER DOCUMENTS

- **Legrand, J.**, Marta Alfonso, Roberto Bozzano, Gerard Goasguen, Henrik Lindh, Alberto Ribotti, Ignacio Rodríguez and Christos Tziavos. (2002). Monitoring the marine environment operational practices in Europe Proceedings of the Third International Conference on EuroGOOS, Athens Greece.