European Commission

PRODUCT USER MANUAL

For Global Ocean Physical Analysis and Forecasting Product

GLOBAL_ANALYSISFORECAST_PHY_001_024
Issue: 2.0

Contributors : O. Le Galloudec, S. Law Chune, L. Nouel, E. Fernandez, C. Derval, M. Tressol, R. Dussurget, A. Biardeau, M. Tonani

Approval Date : JUNE 2024

Copernicus
Europe's eyes on Earth

Copernicus
Marine Service

Implemented by
MERCATOR OCEAN INTERNATIONAL

RECORD TABLE

Issue	Date	§	Description of Change	Author	Validated By
1.1	2016/09/21	All	Initial version	L.NOUEL	Y Drillet
1.2	2017/09/19	All	Addition of static and monthly datasets – Reformatting to follow new template	E. Fernandez	L. Nouel
1.3	2018/04/26	II.3	Addition of Information on SSH	C. Derval	C. Derval
1.4	2019/01/18		Addition of a new dataset of 3 merged : general circulation, tides & waves	S. Law Chune	C. Derval
1.5	2019/11/19		Addition of new datasets for instantaneous data	M. Tressol	
1.6	2020/07/01	IV	Nomenclature description & FTP download behaviour.	M. Tressol	C. Derval
1.7	2021/05/03		10D forecast for SMOC	C. Derval	C. Derval
1.8	2021/10/01	IV	Correction of standard names for SMOC dataset	S. Law Chune	C. Derval
1.9	2022/09/12	I	Update of the introduction regarding the archive availability of the product	O. Le Galloudec	Copernicus Marine Product Management
2.0	2024/02/28	All	Add dataset and 10D forecast for dataset 3D 6h	O. Le Galloudec	Copernicus Marine Product Management

TABLE OF CONTENTS

GLOSSARY AND ABBREVIATIONS

MFC	Monitoring and Forecasting Centre
TAC	Thematic Assembly Center
ECMWF	European Centre for Medium Range Weather forecast
GLO	Global
MFWAM	Meteo France WAve Model
NRT	Near Real Time
MY	Multi Year
PUM	Product User Manual
QUID	Quality Information Document
CMEMS	Copernicus Marine Environment Monitoring Service
NetCDF	Network Common Data Form
CF	Climate Forecast (convention for NetCDF)
FTP	Protocol to download files
Subsetter	Copernicus Marine service tool to download a NetCDF file of a selected geographical box and time ranfe
OPENDAP	Open-Source Project for a Network Data Access Protocol. Protocol to download subset of data from a n-dimensional gridded dataset (ie: 4 dimensions: lon-lat, depth, time)
MDS	Marine Data Store
FORECAST	An assessment of the future state of the ocean variables made using numerical models.
HINDCAST	An assessment of the past state of the ocean variables made using numerical models with or without data assimilation. Simulations and analyses are hindcasts.
SIMULATION	An hindcast done without data assimilation.

NRT-ANALYSIS:	An hindcast done with data assimilation for a period very close to present. The quality and the number of available observations it's not optimal (less observations and/or less accurate than in a best-analysis).
BEST-ANALYSIS:	An hindcast done with data assimilation for a period close to present. The quality and the number of available observations it's the best available (more observations and/or more accurate than in a NRT-analysis).

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.

1) INTRODUCTION

a) Summary

This document is the user manual for the Copernicus Marine global analysis and forecast product GLOBAL_ANALYSISFORECAST_PHY_001_024: it provides with aggregated analyses updated weekly with 10-day forecast (updated daily). A 2-years rolling archive is available on the Marine Data Store.

It contains 3D potential temperature, salinity and currents information from top to bottom and 2D sea surface level, bottom potential temperature, mixed layer thickness, sea ice thickness, sea ice fraction and sea ice velocities information. This product is global. It is defined on a standard grid at 1/12 degree (approx. 8km) and on 50 standard levels. It is interpolated from the 1/12 degree and 50 vertical levels Arakawa C native grid. All variables are on the same grid points.

GLOBAL_ANALYSISFORECAST_PHY_001_024 product is organised in sixteen datasets:

- **cmems_mod_glo_phy_anfc_0.083deg_P1D-m** which contains the 2D daily mean fields: sea surface level, bottom pressure, bottom salinity, bottom potential temperature, mixed layer thickness, sea ice albedo, sea ice age, sea ice surface temperature, sea ice speed, snow thickness, sea ice thickness, sea ice fraction and sea ice velocities information.

- **cmems_mod_glo_phy-so_anfc_0.083deg_P1D-m** which contains the 3D daily mean salinity information from top to bottom.

- **cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m** which contains the 3D daily mean potential temperature information from top to bottom.

- **cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m** which contains the 3D daily mean horizontal currents information from top to bottom.

- **cmems_mod_glo_phy-wcur_anfc_0.083deg_P1D-m** which contains the 3D daily mean vertical current information from top to bottom.

- **cmems_mod_glo_phy_anfc_0.083deg_PT1H-m** which contains the hourly mean surface fields: potential temperature, currents and sea surface level information.

- **cmems_mod_glo_phy_anfc_0.083deg_P1M-m** which contains the 2D monthly mean fields: sea surface level, bottom pressure, bottom salinity, bottom potential temperature, mixed layer thickness, sea ice albedo, sea ice age, sea ice surface temperature, sea ice speed, snow thickness, sea ice thickness, sea ice fraction and sea ice velocities information.

- **cmems_mod_glo_phy-so_anfc_0.083deg_P1M-m** which contains the 3D monthly mean salinity information from top to bottom.

- **cmems_mod_glo_phy-thetao_anfc_0.083deg_P1M-m** which contains the 3D monthly mean potential temperature information from top to bottom.

- **cmems_mod_glo_phy-cur_anfc_0.083deg_P1M-m** which contains the 3D monthly mean horizontal currents information from top to bottom.

- **cmems_mod_glo_phy-wcur_anfc_0.083deg_P1M-m** which contains the 3D monthly mean vertical current information from top to bottom.

- **cmems_mod_glo_phy_anfc_merged-uv_PT1H-i** (Surface and Merged Ocean Currents SMOC) which contains one dataset: dataset-hourly-merged-uv, that distributes hourly zonal (u) and meridional (v) surface velocity fields (full temporal resolution) for three physical components, namely the general circulation (uo, vo), tides (utide, vtide) and waves (ustokes, vstokes) on a 1/12° regular grid. The linear addition of the three physical components is also distributed as (utotal, vtotal). This product is a combination between data-assimilated models that describe the ocean circulation, tides and waves, some of them been Copernicus Marine systems like the global high resolution physical system (CMEMS GLOBAL_ANALYSISFORECAST_PHY_001_024) or the global high resolution wave model (CMEMS GLOBAL_ANALYSIS_FORECAST_WAV_001_027)

- **cmems_mod_glo_phy-thetao_anfc_0.083deg_PT6H-i** which contains the instantaneous 3D fields every 6 hour for potential temperature

- **cmems_mod_glo_phy-so_anfc_0.083deg_PT6H-i** which contains the instantaneous 3D fields every 6 hour for salinity

- **cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i** which contains the instantaneous 3D fields every 6 hour for currents

- cmems_mod_glo_phy_anfc_0.083deg-climatology-uncertainty_P1M-m which contains the monthly uncertainty fields for sea surface temperature.

- **cmems_mod_glo_phy_anfc_0.083deg_static** which contains the static fields for the system: coordinates, mean sea surface level, mask and bathymetry.

The product is published on the MDS after automatic and human quality controls. The analysis and forecast system is described and evaluated in the Quality Information Document (QUID- see link in REFERENCES).

Files downloaded are in NetCDF format and follow CF-1.4 convention.

2) DESCRIPTION OF THE PRODUCT SPECIFICATION

a) General Information

Product Lines	GLOBAL_ANALYSISFORECAST_PHY_001_024
Geographical coverage	Global : 180°W-180°E ; 89°S – 90°N
Variables	See full list of variables in the tables below (c)
Product Type	Near Real Time - Analysis and Forecast
Available time series	-2Y to 10 Days- forecast
Temporal resolution	Hourly - Daily - Monthly means
Update Frequency	Daily
Target delivery time	daily at 12 pm (noon) UTC
Horizontal resolution	1/12 degree
Number of vertical levels	50
Format	NetCDF4

b) Production System Description

The Operational Mercator global ocean analysis and forecast system at 1/12 degree is providing 10 days of 3D global ocean forecasts updated daily. This product includes daily and monthly mean files of temperature, salinity, currents, sea level, mixed layer depth and ice parameters from the top to the bottom over the global ocean. It also includes hourly mean surface fields for sea level height, temperature and currents. Rolling archive of 2 years is available.

Data from 05/10/2016 generated by the latest version of the system, GLO12, are available upon request.

An archive of analysis and forecast is also available, see Help Center Article .

The analysis and forecasting system quality is described in the Quality Information Document (QUID – see link in REFERENCES)

GLOBAL (180°W-180°E; 89°S – 90°N): 1/12°, regular grid, 4320 x 2041

This product is global with dedicated projection and spatial resolution. It is defined on a standard collocated grid at 1/12 degree (approx. 8 km). The parameters are interpolated from the native grid model, the 1/12 degree and 50 vertical levels Arakawa C native grid
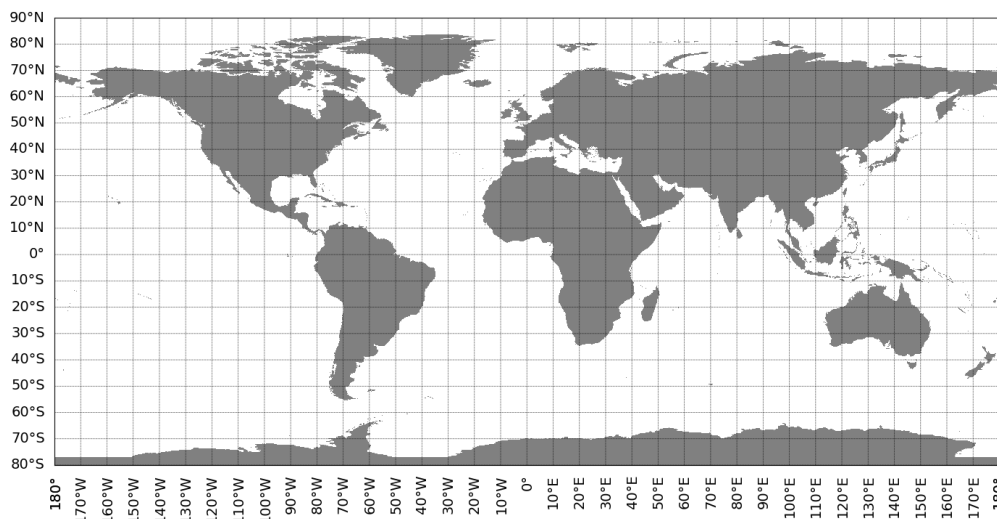
Vertical grid	50 vertical levels
System Name	GLO12v4
Model version	NEMO3.6 (Madec et al., 2017)
Horizontal Resolution	1/12°
Vertical Resolution	50 Z levels
Interpolation method	Only horizontal interpolation : bicubic

Implemented by
Copernicus
Europe's eyes on Earth
Copernicus
Marine Service
MERCATOR
OCEAN
INTERNATIONAL

Coupling	N/A
Sea Ice Model	LIM3 Multi-categories sea ice model with the Elastic-Viscous-Plastic rheology formulation and 11 sea ice categories
Bathymetry	ETOPO1 for the deep ocean and GEBCO8 in regions shallower than 200 m with a linear interpolation in the 200-300 m layer
Initial conditions	GLO12v3 restart file in October 2016
Atmospheric forcings	Product :ECMWF IFS HRES Frequency: 1-3-6-hourly Resolution : 1/10° Other : 1-hourly interpolated
Tidal constituents	
Rivers	100 major rivers from Dai et al., 2009 and runoff fluxes coming from Greenland and Antarctica
Data Assimilation scheme	SAM2 (SEEK Kernel) 4D + IAU + 3D-Var bias correction (1 month time window) + QC on T/S vertical profiles + New 3D observation errors files for assimilation of in situ profiles + + Use of method "super-observation" to reduce the representativeness error+ Global mean increment of the total SSH is set to zero
Assimilated observations	L3S SST (ODYSSEA), SIC (OSI SAF), SLA (AVISO), T/S profiles (CORIOLIS database) MDT adjusted based on CNES-CLS18, Mulet et al., 2021 WOA 2013 climatology (temperature and salinity) below 2000 m (assimilation using a non-Gaussian error at depth)

c) Details of the datasets

Product Lines	GLOBAL_ANALYSISFORECAST_PHY_001_024
Geographical coverage	Global
Datasets:	

Datasets:
cmems_mod_glo_phy_anfc_0.083deg_P1D-m
cmems_mod_glo_phy-so_anfc_0.083deg_P1D-m
cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m
cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m
cmems_mod_glo_phy-wcur_anfc_0.083deg_P1D-m
cmems_mod_glo_phy-so_anfc_0.083deg_PT6H-i
cmems_mod_glo_phy-thetao_anfc_0.083deg_PT6H-i
cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i
cmems_mod_glo_phy_anfc_0.083deg_PT1H-m
cmems_mod_glo_phy_anfc_0.083deg_P1M-m
cmems_mod_glo_phy-so_anfc_0.083deg_P1M-m

cmems_mod_glo_phy-thetao_anfc_0.083deg_P1M-m cmems_mod_glo_phy-cur_anfc_0.083deg_P1M-m cmems_mod_glo_phy-wcur_anfc_0.083deg_P1M-m cmems_mod_glo_phy_anfc_0.083deg-climatology-uncertainty_P1M-m cmems_mod_glo_phy_anfc_merged-uv_PT1H-i		
Product Type	Analysis	Forecast
Update frequency	Weekly	Daily
Available time series	-2Y - up to real-time	10-days forecast
Target delivery time	On Thursdays at 12pm (noon) UTC	Daily at 12pm (noon) UTC
Temporal resolution	Daily mean Hourly mean 6 hourly instantaneous Monthly mean	

Dataset : cmems_mod_glo_phy_anfc_0.083deg_P1D-m contains the 2D daily mean fields: sea surface level, bottom pressure, bottom salinity, bottom potential temperature, mixed layer thickness, sea ice albedo, sea ice age, sea ice surface temperature, sea ice speed, snow thickness, sea ice thickness, sea ice fraction and sea ice velocities information
zos [m] Sea surface height sea_surface_height_above_geoid
mlotst [m] Mixed Layer Depth ocean_mixed_layer_thickness_defined_by_sigma_theta
pbo [m] Sea Water Pressure at Sea Floor sea_water_pressure_at_sea_floor
tob [°C] Sea bottom temperature sea_water_potential_temperature_at_sea_floor
sob [psu] Sea bottom salinity sea_water_salinity_at_sea_floor
siconc [1] Ice concentration sea_ice_area_fraction
sithick [m] Sea ice thickness sea_ice_thickness
sisnthick [m] Surface snow thickness surface_snow_thickness
sialb [%] Mean albedo over sea ice sea_ice_albedo
siage [years] Mean sea ice age

age_of_sea_ice
ist [°C] Sea ice surface temperature sea_ice_surface_temperature
sivelo [m/s] Sea ice speed sea_ice_speed
usi [m/s] Sea ice eastward velocity eastward_sea_ice_velocity
vsi [m/s] Sea ice northward velocity northward_sea_ice_velocity
Dataset : cmems_mod_glo_phy-so_anfc_0.083deg_P1D-m contains the <u>3D daily mean field</u>: salinity.
so [psu] Salinity sea_water_salinity
Dataset : cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m contains the <u>3D daily mean field</u>: potential temperature.
thetao [°C] Potential temperature sea_water_potential_temperature
Dataset : cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m contains the <u>3D daily mean fields</u>: horizontal currents information from top to bottom
uo [m/s] Eastward ocean current velocity eastward_sea_water_velocity
vo [m/s] Northward ocean current velocity northward_sea_water_velocity
Dataset : cmems_mod_glo_phy-wcur_anfc_0.083deg_P1D-m contains the <u>3D daily mean fields</u>: vertical currents information from top to bottom
wo [m/s] Upward sea water velocity upward_sea_water_velocity
Dataset: cmems_mod_glo_phy-so_anfc_0.083deg_PT6H-i contains the <u>6h instantaneous fields</u>: salinity.
so [psu] Salinity sea_water_salinity
Dataset: cmems_mod_glo_phy-thetao_anfc_0.083deg_PT6H-i contains the <u>6h instantaneous fields</u>: potential temperature.
thetao [°C] Potential temperature sea_water_potential_temperature
Dataset: cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i contains the <u>6h instantaneous fields</u>: currents information.
uo [m/s] zonal velocity

eastward_sea_water_velocity
vo [m/s] Northward ocean current velocity northward_sea_water_velocity
Dataset cmems_mod_glo_phy_anfc_0.083deg_PT1H-m contains the <u>hourly mean surface fields</u>: potential temperature, currents and surface sea surface level information.
thetao [°C] Potential temperature sea_water_potential_temperature
so [PSU] Sea surface salinity sea_water_salinity
uo [m/s] Eastward ocean current velocity eastward_sea_water_velocity
vo [m/s] Northward ocean current velocity northward_sea_water_velocity
zos [m] Sea surface height sea_surface_height_above_geoid
Dataset cmems_mod_glo_phy_anfc_0.083deg_P1M-m contains the <u>2D monthly mean fields</u>: sea surface level, bottom pressure, bottom salinity, bottom potential temperature, mixed layer thickness, sea ice albedo, sea ice age, sea ice surface temperature, sea ice speed, snow thickness, sea ice thickness, sea ice fraction and sea ice velocities information
zos [m] Sea surface height sea_surface_height_above_geoid
mlotst [m] Mixed Layer Depth ocean_mixed_layer_thickness_defined_by_sigma_theta
pbo [m] Sea Water Pressure at Sea Floor sea_water_pressure_at_sea_floor
tob [°C] Sea bottom temperature sea_water_potential_temperature_at_sea_floor
sob [psu] Sea bottom salinity sea_water_salinity_at_sea_floor
siconc [1] Ice concentration sea_ice_area_fraction
sithick [m] Sea ice thickness sea_ice_thickness
sisnthick [m] Surface snow thickness

surface_snow_thickness
sialb [%] Mean albedo over sea ice sea_ice_albedo
siage [years] Mean sea ice age age_of_sea_ice
ist [°C] Sea ice surface temperature sea_ice_surface_temperature
sivelo [m/s] Sea ice speed sea_ice_speed
usi [m/s] Sea ice eastward velocity eastward_sea_ice_velocity
vsi [m/s] Sea ice northward velocity northward_sea_ice_velocity
Dataset cmems_mod_glo_phy-so_anfc_0.083deg_P1M-m contains the 3D monthly mean fields: salinity.
so [psu] Salinity sea_water_salinity
Dataset cmems_mod_glo_phy-thetao_anfc_0.083deg_P1M-m contains the 3D monthly mean fields: potential temperature.
thetao [°C] Potential temperature sea_water_potential_temperature
Dataset cmems_mod_glo_phy-cur_anfc_0.083deg_P1M-m contains the 3D monthly mean fields: currents information from top to bottom.
uo [m/s] Eastward ocean current velocity eastward_sea_water_velocity
vo [m/s] Northward ocean current velocity northward_sea_water_velocity
Dataset cmems_mod_glo_phy-wcur_anfc_0.083deg_P1M-m contains the 3D monthly mean fields: vertical current information from top to bottom.
wo [m/s] Upward ocean current velocity upward_sea_water_velocity
Dataset : cmems_mod_glo_phy_anfc_merged-uv_PT1H-i (SMOC) contains all the variables.
uo [meter per second] zonal velocity eastward_sea_water_velocity
vo [meter per second] meridional velocity northward_sea_water_velocity;

ustokes [meter per second] zonal velocity eastward_sea_water_velocity
vstokes [meter per second] meridional velocity northward_sea_water_velocity;
utide [meter per second] zonal velocity surface_sea_water_x_velocity_due_to_tide
vtide [meter per second] meridional velocity surface_sea_water_y_velocity_due_to_tide;
utotal [meter per second] zonal velocity surface_sea_water_x_velocity;
vtotal [meter per second] meridional velocity surface_sea_water_y_velocity;
Dataset: cmems_mod_glo_phy_anfc_0.083deg-climatology-uncertainty_P1M-m
rmsd [°C] sea_surface_temperature_rmsd_uncertainty
md[°C] sea_surface_temperature_md_uncertainty
nbobs sea_surface_temperature_number_of_observations
Dataset: global-analysis-forecast-phy-001-024-statics contains the static fields for the system: coordinates, mean sea surface level, mask and bathymetry.
e1t [m] Cell dimension along X axis
e2t [m] Cell dimension along Y axis
e3t [m/s] Cell dimension along Z axis cell_thickness
mask [1] Land-sea mask: 1 = sea ; 0 = land sea_binary_mask
deptho [m] Bathymetry sea_floor_depth_below_geoid
deptho_lev [1] Model level number at sea floor model_level_number_at_sea_floor
mdt [m] Mean dynamic topography sea_surface_height_above_geoid

d) Additional information on some parameters

© EU Copernicus Marine Service – Public
CMEMS-GLO-PUM-001-024
   Issue 2.0 – June 2024

Copernicus
Europe's eyes on Earth

Copernicus
Marine Service

Implemented by
MERCATOR
OCEAN
INTERNATIONAL

mlotst [m]	ocean_mixed_layer_thickness_defined_by_sigma_theta. It is the depth where the density increase compared to density at 10 m depth corresponds to a temperature decrease of 0.2°C in local surface conditions (θ10m, S10m, P0= 0 db, surface pressure)
zos [m]	sea_surface_height_above_geoid. The geoid is a surface of constant geopotential with which mean sea level would coincide if the ocean were at rest. The parameter "zos" is the difference between the actual sea surface height at any given time and place, and that which it would have if the ocean were at rest.
ssh [m]	See the Help Center article

e) Processing information

Product disseminating schedule :

Type of product (forecast/ hindcast)	Forecast run (base time)	Product temporal coverage (hours)	Product disseminating scheduled time	Dissemination day
Forecast	00 UTC	0 to 240	08am -> 12 noon	Every day
Hindcast-simulation	00 UTC	-24 to 0	08am -> 12 noon	Every day
Hindcast-NRT analysis	00 UTC	-192 to -24	01am _> 12 noon	Thursday
Hindcast-best analysis	00 UTC	-360 to -192	01am _> 12 noon	Thursday

This information is for all the datasets except for the monthly. High frequency products, (6-hourly-instantaneous, have a shorter forecast lead time of 24-hour instead of 240-hour.

f) Catalogue updating

Every day the **forecast** delivered the previous day is overwritten by one day of simulation and the new 10-day **forecast**. Weekly, the simulations are replaced by the **NRT-analyses** (from -192 to -24 hr) and the **NRT-analysis** by the **best analyses** (from -360 to -192 hr). The last 11-15 days of the historical time series of simulation/analysis/forecast are overwritten every day.

The catalogue data from 2-year before present to 15-21 days before present are not updated anymore. These data have the best quality because are all **best analysis** (orange bar in the pictures).

We provide an example for products delivered with validity data of 1st December.
The first time that information is available for the 1st of December is on the 22nd of November. The 2st December is the last day of forecast (10th day of forecast). The information fo the 1st of December is since that day (22nd November) continuously updated, overwriting the catalogue with more accurate information until the final release of the 15th of December. This is the final release for the data of 1st of December, and it will not be overwritten because it has the most accurate information, provided by a best-analysis. This sequence is illustrated in the table and in the figure below.

Copernicus
Europe's eyes on Earth

Copernicus
Marine Service

Implemented by
**MERCATOR
OCEAN**
INTERNATIONAL

The figure shows the timeline for the delivery to the catalogue versus the validity time of the products and how the different releases for the same validity date overwrites and concatenated for building up the historical hindcast timeseries. The red-rectangular highlights all the subsequent releases of information for the day of the 1st December 2022.
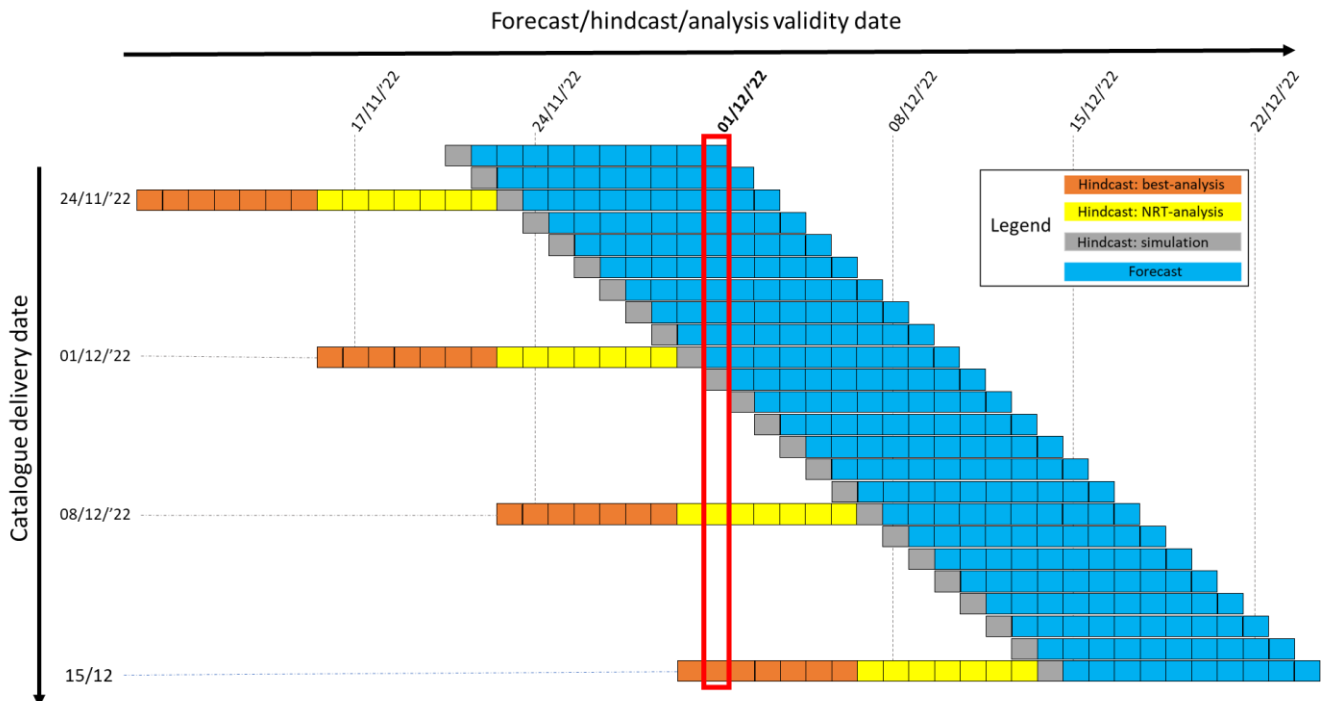
The product is updated **daily** by **1200 UTC for the daily and hourly datasets**.
The monthly dataset is updated monthly on the 20th (addition of the monthly mean of the previous month best-analysis).

g) Time averaging

Dataset frequency	Time averaging	Forecast lead time
montlhy	monthly means over the calendar month (first to last day of the month)	10-day (240-hr)
daily	daily means over a day (midnight to midnight, centered at noon).	
Hourly-mean	hourly means (centered every half-hour).	
Hourly (SMOC)	1-hourly (e.g.: 01:00; 02:00, 03:00, ….)	
6-hourly	6-hourly instantaneous (e.g.: 00, 06, 09, 12, 18, 21)	

3) FILE FORMAT

The products are stored using the NetCDF format.

To know more about the NetCDF format, please follow this link:
What is the format of Copernicus Marine products ? NetCDF

4) FILES NOMENCLATURE

Information about nomenclature of files when downloaded can be found in this articles (paragraph "Files Nomenclature and format") : Files Nomenclature and Format

Additional Information

The missing value for this product is: 10.E36
Land mask are equal to "_FillValue" (see variable attribute on NetCDF file).

5) FILE SIZE

DATASET NAME	NAME OF FILE	DIMENSION [GB]
cmems_mod_glo_phy _anfc_0.083deg_P1D-m	glo12_rg_1d-m_${date1}-${date1}_2D_${mode}_R${date2}.nc	0.14
cmems_mod_glo_phy-so_anfc_0.083deg_P1D-m	glo12_rg_1d-m_${date1}-${date1}_3D-so_${mode}_R${date2}.nc	0.68
cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m	glo12_rg_1d-m_${date1}-${date1}_3D-thetao_${mode}_R${date2}.nc	0.86
cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m	glo12_rg_1d-m_${date1}-${date1}_3D-uovo_${mode}_R${date2}.nc	1.93
cmems_mod_glo_phy-wcur_anfc_0.083deg_P1D-m	glo12_rg_1d-m_${date1}-${date1}_3D-wo_${mode}_R${date2}.nc	0.97
cmems_mod_glo_phy-so_anfc_0.083deg_PT6H-i	glo12_rg_6h-i_${date1}-${HH}h_3D-so_${mode}_R${date2}.nc	0.68
cmems_mod_glo_phy-thetao_anfc_0.083deg_PT6H-i	glo12_rg_6h-i_${date1}-${HH}h_3D-thetao_${mode}_R${date2}.nc	0.86
cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i	glo12_rg_6h-i_${date1}-${HH}h_3D-uovo_${mode}_R${date2}.nc	1.93
cmems_mod_glo_phy _anfc_0.083deg_PT1H-m	glo12_rg_1h-m_${date1}-${date1}_2D_${mode}_R${date2}.nc	2.5
cmems_mod_glo_phy _anfc_0.083deg_P1M-m	glo12_rg_1m-m_${YYYYMM}-${YYYYMM}_2D_${mode}.nc	0.14
cmems_mod_glo_phy-so_anfc_0.083deg_P1M-m	glo12_rg_1m-m_${YYYYMM}-${YYYYMM}_3D-so_${mode}.nc	0.68
cmems_mod_glo_phy-thetao_anfc_0.083deg_P1M-m	glo12_rg_1m-m_${YYYYMM}-${YYYYMM}_3D-thetao_${mode}.nc	0.86
cmems_mod_glo_phy-cur_anfc_0.083deg_P1M-m	glo12_rg_1m-m_${YYYYMM}-${YYYYMM}_3D-uovo_${mode}.nc	1.93
cmems_mod_glo_phy-wcur_anfc_0.083deg_P1M-m	glo12_rg_1m-m_${YYYYMM}-${YYYYMM}_3D-wo_${mode}.nc	0.97
cmems_mod_glo_phy _anfc_merged-uv_PT1H-i	SMOC_${date1}_R${date2}.nc	0.826

cmems_mod_glo_phy _anfc_0.083deg- climatology- uncertainty_P1M-m	**cmems_mod_glo_phy_anfc_0.083deg- climatology-uncertainty_P1M- m_${MM}.nc**	1.3
cmems_mod_glo_phy _anfc_0.083deg_static	GLO-MFC_001_024_${field}.nc	2.3

Where :
- ${date1} is the date : format YYYYMMDD,
- ${date2} is the run (bulletin) date : format (YYYYMMDD),
- ${YYYYMM} is the date field for monthly mean file,
- ${HH} is the hour field for instantaneous file,

- ${field} : coordinates (longitude, latitude, depth), mdt (mean dynamical topography) or mask_bathy (ocean/land mask).

6) STRUCTURE AND SEMANTIC OF NetCDF MAP FILES

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

7) REFERENCES

Quality Information Document
https://catalogue.marine.copernicus.eu/documents/QUID/CMEMS-GLO-QUID-001-024.pdf

8) ANNEX

a) Structure and semantic of NetCDF maps files

For cmems_mod_glo_phy_anfc_0.083deg_P1D-m
dimensions:
longitude = 4320 ;
latitude = 2041 ;
time = UNLIMITED ; // (1 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float sialb(time, latitude, longitude) ;
sialb:long_name = "Mean albedo over sea ice" ;
sialb:standard_name = "sea_ice_albedo" ;
sialb:units = "%" ;
sialb:_FillValue = 9.96921e+36f ;
sialb:valid_min = -0.1f ;
sialb:valid_max = 1.5f ;
sialb:cell_methods = "area: mean" ;
float siage(time, latitude, longitude) ;
siage:long_name = "Mean sea ice age" ;
siage:standard_name = "age_of_sea_ice" ;
siage:units = "years" ;
siage:_FillValue = 9.96921e+36f ;
siage:valid_min = -1000.f ;
siage:valid_max = 1000.f ;
siage:cell_methods = "area: mean where sea_ice" ;
float siconc(time, latitude, longitude) ;

```
siconc:long_name = "Ice concentration" ;
siconc:standard_name = "sea_ice_area_fraction" ;
siconc:units = "1" ;
siconc:unit_long = "Fraction" ;
siconc:_FillValue = 9.96921e+36f ;
siconc:valid_min = -1.f ;
siconc:valid_max = 2.f ;
siconc:cell_methods = "area: mean where sea_ice" ;
float ist(time, latitude, longitude) ;
ist:long_name = "sea ice surface temperature" ;
ist:standard_name = "sea_ice_surface_temperature" ;
ist:units = "degrees_C" ;
ist:unit_long = "Degrees Celsius" ;
ist:_FillValue = 9.96921e+36f ;
ist:valid_min = -50.f ;
ist:valid_max = 50.f ;
ist:cell_methods = "area: mean where sea_ice" ;
float sivelo(time, latitude, longitude) ;
sivelo:long_name = "Sea ice speed" ;
sivelo:standard_name = "sea_ice_speed" ;
sivelo:units = "m s-1" ;
sivelo:unit_long = "Meters per second" ;
sivelo:_FillValue = 9.96921e+36f ;
sivelo:valid_min = -1.f ;
sivelo:valid_max = 5.f ;
sivelo:cell_methods = "area: mean where sea_ice" ;
float sithick(time, latitude, longitude) ;
sithick:long_name = "Sea ice thickness" ;
sithick:standard_name = "sea_ice_thickness" ;
sithick:units = "m" ;
sithick:unit_long = "Meters" ;
sithick:_FillValue = 9.96921e+36f ;
sithick:valid_min = 0.f ;
sithick:valid_max = 50.f ;
sithick:cell_methods = "area: mean where sea_ice" ;
float sisnthick(time, latitude, longitude) ;
sisnthick:long_name = "Surface snow thickness" ;
sisnthick:standard_name = "surface_snow_thickness" ;
sisnthick:units = "m" ;
sisnthick:unit_long = "Meters" ;
sisnthick:_FillValue = 9.96921e+36f ;
sisnthick:valid_min = -0.1f ;
sisnthick:valid_max = 5.f ;
sisnthick:cell_methods = "area: mean where sea_ice" ;
float mlotst(time, latitude, longitude) ;
mlotst:long_name = "Mixed Layer Depth (|dT| = 0.01 wrt 10m)" ;
mlotst:standard_name = "ocean_mixed_layer_thickness_defined_by_sigma_theta" ;
mlotst:units = "m" ;
mlotst:unit_long = "Meters" ;
mlotst:_FillValue = 9.96921e+36f ;
mlotst:valid_min = -50.f ;
mlotst:valid_max = 8000.f ;
mlotst:cell_methods = "area: mean" ;
float pbo(time, latitude, longitude) ;
```

© EU Copernicus Marine Service – Public
CMEMS-GLO-PUM-001-024
Issue 2.0 – June 2024

Copernicus
Europe's eyes on Earth

Copernicus
Marine Service

Implemented by
MERCATOR
OCEAN
INTERNATIONAL

```
pbo:long_name = "Sea Water Pressure at Sea Floor" ;
pbo:standard_name = "sea_water_pressure_at_sea_floor" ;
pbo:units = "dbar" ;
pbo:unit_long = "decibar" ;
pbo:_FillValue = 9.96921e+36f ;
pbo:valid_min = -1000.f ;
pbo:valid_max = 8000.f ;
pbo:cell_methods = "area: mean" ;
float sob(time, latitude, longitude) ;
sob:long_name = "Sea bottom salinity" ;
sob:standard_name = "sea_water_salinity_at_sea_floor" ;
sob:units = "1e-3" ;
sob:unit_long = "Practical Salinity Unit" ;
sob:_FillValue = 9.96921e+36f ;
sob:valid_min = -1.f ;
sob:valid_max = 50.f ;
sob:cell_methods = "area: mean" ;
float zos(time, latitude, longitude) ;
zos:long_name = "Sea surface height" ;
zos:standard_name = "sea_surface_height_above_geoid" ;
zos:units = "m" ;
zos:unit_long = "Meters" ;
zos:_FillValue = 9.96921e+36f ;
zos:valid_min = -5.f ;
zos:valid_max = 5.f ;
zos:cell_methods = "area: mean" ;
float tob(time, latitude, longitude) ;
tob:long_name = "Sea bottom temperature" ;
tob:standard_name = "sea_water_potential_temperature_at_sea_floor" ;
tob:units = "degrees_C" ;
tob:unit_long = "Degrees Celsius" ;
tob:_FillValue = 9.96921e+36f ;
tob:valid_min = -10.f ;
tob:valid_max = 50.f ;
tob:cell_methods = "area: mean" ;
float usi(time, latitude, longitude) ;
usi:long_name = "Sea ice eastward velocity" ;
usi:standard_name = "eastward_sea_ice_velocity" ;
usi:units = "m s-1" ;
usi:unit_long = "Meters per second" ;
usi:_FillValue = 9.96921e+36f ;
usi:valid_min = -5.f ;
usi:valid_max = 5.f ;
usi:cell_methods = "area: mean where sea_ice" ;
float vsi(time, latitude, longitude) ;
vsi:long_name = "Sea ice northward velocity" ;
vsi:standard_name = "northward_sea_ice_velocity" ;
vsi:units = "m s-1" ;
vsi:unit_long = "Meters per second" ;
vsi:_FillValue = 9.96921e+36f ;
vsi:valid_min = -5.f ;
vsi:valid_max = 5.f ;
vsi:cell_methods = "area: mean where sea_ice" ;
```

```
// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;
```

For cmems_mod_glo_phy-so_anfc_0.083deg_P1D-m
```
dimensions:
longitude = 4320 ;
latitude = 2041 ;
depth = 50 ;
time = UNLIMITED ; // (1 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float so(time, depth, latitude, longitude) ;
```

```
so:long_name = "Salinity" ;
so:standard_name = "sea_water_salinity" ;
so:units = "1e-3" ;
so:unit_long = "Practical Salinity Unit" ;
so:_FillValue = 9.96921e+36f ;
so:valid_min = 0.f ;
so:valid_max = 50.f ;
so:cell_methods = "area: mean" ;

// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;
```

For cmems_mod_glo_phy-thetao_anfc_0.083deg_P1D-m
```
dimensions:
longitude = 4320 ;
latitude = 2041 ;
depth = 50 ;
time = UNLIMITED ; // (1 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
```

```
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float thetao(time, depth, latitude, longitude) ;
thetao:long_name = "Temperature" ;
thetao:standard_name = "sea_water_potential_temperature" ;
thetao:units = "degrees_C" ;
thetao:unit_long = "Degrees Celsius" ;
thetao:_FillValue = 9.96921e+36f ;
thetao:valid_min = -10.f ;
thetao:valid_max = 40.f ;
thetao:cell_methods = "area: mean" ;

// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;
```

For cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m
```
dimensions:
longitude = 4320 ;
latitude = 2041 ;
depth = 50 ;
time = UNLIMITED ; // (1 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
```

```
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float uo(time, depth, latitude, longitude) ;
uo:long_name = "Eastward velocity" ;
uo:standard_name = "eastward_sea_water_velocity" ;
uo:units = "m s-1" ;
uo:unit_long = "Meters per second" ;
uo:_FillValue = 9.96921e+36f ;
uo:valid_min = -5.f ;
uo:valid_max = 5.f ;
uo:cell_methods = "area: mean" ;
float vo(time, depth, latitude, longitude) ;
vo:long_name = "Northward velocity" ;
vo:standard_name = "northward_sea_water_velocity" ;
vo:units = "m s-1" ;
vo:unit_long = "Meters per second" ;
vo:_FillValue = 9.96921e+36f ;
vo:valid_min = -5.f ;
vo:valid_max = 5.f ;
vo:cell_methods = "area: mean" ;

// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;
```

For cmems_mod_glo_phy-wcur_anfc_0.083deg_P1D-m
dimensions:
longitude = 4320 ;
latitude = 2041 ;

```
depth = 50 ;
time = UNLIMITED ; // (1 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float wo(time, depth, latitude, longitude) ;
wo:long_name = "ocean vertical velocity" ;
wo:standard_name = "upward_sea_water_velocity" ;
wo:units = "m s-1" ;
wo:unit_long = "Meters per second" ;
wo:_FillValue = 9.96921e+36f ;
wo:valid_min = -0.1f ;
wo:valid_max = 0.1f ;
wo:cell_methods = "area: mean" ;

// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
```

:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;

For cmems_mod_glo_phy-so_anfc_0.083deg_PT6H-i
dimensions:
time = UNLIMITED ; // (1 currently)
depth = 50 ;
latitude = 2041 ;
longitude = 4320 ;
variables:
float so(time, depth, latitude, longitude) ;
so:_FillValue = 9.96921e+36f ;
so:long_name = "Salinity" ;
so:standard_name = "sea_water_salinity" ;
so:units = "1e-3" ;
so:unit_long = "Practical Salinity Unit" ;
so:valid_min = 0s ;
so:valid_max = 50s ;
so:cell_methods = "area: mean" ;
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:axis = "T" ;
time:units = "hours since 1950-01-01" ;
time:calendar = "gregorian" ;

```
// global attributes:
:title = "Instantaneous fields for product GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:references = "http://marine.copernicus.eu" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:contact = "servicedesk.cmems@mercator-ocean.eu" ;
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:institution = "Mercator Ocean" ;
:Conventions = "CF-1.6" ;
:area = "GLOBAL" ;
:product = "GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:source = "MERCATOR GLO12" ;
:product_user_manual = "http://marine.copernicus.eu/documents/PUM/CMEMS-GLO-PUM-001-024.pdf" ;
:quality_information_document = "http://marine.copernicus.eu/documents/QUID/CMEMS-GLO-QUID-001-024.pdf" ;
:_NCProperties = "version=2,netcdf=4.7.3,hdf5=1.10.4" ;
```

For cmems_mod_glo_phy-thetao_anfc_0.083deg_PT6H-i
```
dimensions:
time = UNLIMITED ; // (1 currently)
depth = 50 ;
latitude = 2041 ;
longitude = 4320 ;
variables:
float thetao(time, depth, latitude, longitude) ;
thetao:_FillValue = 9.96921e+36f ;
thetao:long_name = "Temperature" ;
thetao:standard_name = "sea_water_potential_temperature" ;
thetao:units = "degrees_C" ;
thetao:unit_long = "Degrees Celsius" ;
thetao:valid_min = -10s ;
thetao:valid_max = 40s ;
thetao:cell_methods = "area: mean" ;
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
```

```
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:axis = "T" ;
time:units = "hours since 1950-01-01" ;
time:calendar = "gregorian" ;

// global attributes:
:title = "Instantaneous fields for product GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:references = "http://marine.copernicus.eu" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:contact = "servicedesk.cmems@mercator-ocean.eu" ;
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:institution = "Mercator Ocean" ;
:Conventions = "CF-1.6" ;
:area = "GLOBAL" ;
:product = "GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:source = "MERCATOR GLO12" ;
:product_user_manual = "http://marine.copernicus.eu/documents/PUM/CMEMS-GLO-PUM-
001-024.pdf" ;
:quality_information_document = "http://marine.copernicus.eu/documents/QUID/CMEMS-
GLO-QUID-001-024.pdf" ;
:_NCProperties = "version=2,netcdf=4.7.3,hdf5=1.10.4" ;
```

For cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i
```
dimensions:
time = UNLIMITED ; // (1 currently)
depth = 50 ;
latitude = 2041 ;
longitude = 4320 ;
variables:
float uo(time, depth, latitude, longitude) ;
uo:_FillValue = 9.96921e+36f ;
uo:long_name = "Eastward velocity" ;
uo:standard_name = "eastward_sea_water_velocity" ;
uo:units = "m s-1" ;
uo:unit_long = "Meters per second" ;
uo:valid_min = -5s ;
uo:valid_max = 5s ;
uo:cell_methods = "area: mean" ;
float vo(time, depth, latitude, longitude) ;
vo:_FillValue = 9.96921e+36f ;
vo:long_name = "Northward velocity" ;
vo:standard_name = "northward_sea_water_velocity" ;
```

```
vo:units = "m s-1" ;
vo:unit_long = "Meters per second" ;
vo:valid_min = -5s ;
vo:valid_max = 5s ;
vo:cell_methods = "area: mean" ;
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 5727.917f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:axis = "T" ;
time:units = "hours since 1950-01-01" ;
time:calendar = "gregorian" ;

// global attributes:
:title = "Instantaneous fields for product GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:references = "http://marine.copernicus.eu" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:contact = "servicedesk.cmems@mercator-ocean.eu" ;
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:institution = "Mercator Ocean" ;
:Conventions = "CF-1.6" ;
:area = "GLOBAL" ;
:product = "GLOBAL_ANALYSISFORECAST_PHY_001_024" ;
:source = "MERCATOR GLO12" ;
:product_user_manual = "http://marine.copernicus.eu/documents/PUM/CMEMS-GLO-PUM-
001-024.pdf" ;
```

:quality_information_document = "http://marine.copernicus.eu/documents/QUID/CMEMS-GLO-QUID-001-024.pdf" ;
:_NCProperties = "version=2,netcdf=4.7.3,hdf5=1.10.4" ;

For cmems_mod_glo_phy_anfc_0.083deg_PT1H-m
dimensions:
longitude = 4320 ;
latitude = 2041 ;
depth = 1 ;
time = UNLIMITED ; // (24 currently)
variables:
float longitude(longitude) ;
longitude:valid_min = -180.f ;
longitude:valid_max = 179.9167f ;
longitude:step = 0.08332825f ;
longitude:units = "degrees_east" ;
longitude:unit_long = "Degrees East" ;
longitude:long_name = "Longitude" ;
longitude:standard_name = "longitude" ;
longitude:axis = "X" ;
float latitude(latitude) ;
latitude:valid_min = -80.f ;
latitude:valid_max = 90.f ;
latitude:step = 0.08333588f ;
latitude:units = "degrees_north" ;
latitude:unit_long = "Degrees North" ;
latitude:long_name = "Latitude" ;
latitude:standard_name = "latitude" ;
latitude:axis = "Y" ;
float depth(depth) ;
depth:valid_min = 0.494025f ;
depth:valid_max = 0.494025f ;
depth:units = "m" ;
depth:positive = "down" ;
depth:unit_long = "Meters" ;
depth:long_name = "Depth" ;
depth:standard_name = "depth" ;
depth:axis = "Z" ;
float time(time) ;
time:long_name = "Time (hours since 1950-01-01)" ;
time:standard_name = "time" ;
time:calendar = "gregorian" ;
time:units = "hours since 1950-01-01 00:00:00" ;
time:axis = "T" ;
float so(time, depth, latitude, longitude) ;
so:long_name = "sea surface salinity" ;
so:standard_name = "sea_water_salinity" ;
so:units = "1e-3" ;
so:unit_long = "Practical Salinity Unit" ;
so:_FillValue = 9.96921e+36f ;
so:valid_min = 0.f ;
so:valid_max = 50.f ;
so:cell_methods = "area: mean" ;
float zos(time, depth, latitude, longitude) ;

zos:long_name = "Sea surface height" ;
zos:standard_name = "sea_surface_height_above_geoid" ;
zos:units = "m" ;
zos:unit_long = "Meters" ;
zos:_FillValue = 9.96921e+36f ;
zos:valid_min = -5.f ;
zos:valid_max = 5.f ;
zos:cell_methods = "area: mean" ;
float thetao(time, depth, latitude, longitude) ;
thetao:long_name = "sea_surface_temperature" ;
thetao:standard_name = "sea_water_potential_temperature" ;
thetao:units = "degrees_C" ;
thetao:unit_long = "Degrees Celsius" ;
thetao:_FillValue = 9.96921e+36f ;
thetao:valid_min = -10.f ;
thetao:valid_max = 40.f ;
thetao:cell_methods = "area: mean" ;
float uo(time, depth, latitude, longitude) ;
uo:long_name = "Eastward surface velocity" ;
uo:standard_name = "eastward_sea_water_velocity" ;
uo:units = "m s-1" ;
uo:unit_long = "Meters per second" ;
uo:_FillValue = 9.96921e+36f ;
uo:valid_min = -10.f ;
uo:valid_max = 10.f ;
uo:cell_methods = "area: mean" ;
float vo(time, depth, latitude, longitude) ;
vo:long_name = "Northward surface velocity" ;
vo:standard_name = "northward_sea_water_velocity" ;
vo:units = "m s-1" ;
vo:unit_long = "Meters per second" ;
vo:_FillValue = 9.96921e+36f ;
vo:valid_min = -10.f ;
vo:valid_max = 10.f ;
vo:cell_methods = "area: mean" ;

// global attributes:
:producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
:title = "daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily" ;
:area = "Global" ;
:Conventions = "CF-1.8" ;
:credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
:contact = "https://marine.copernicus.eu/contact" ;
:references = "http://marine.copernicus.eu" ;
:source = "MOI GLO12" ;
:licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
:institution = "Mercator Ocean International" ;
:_NCProperties = "version=2,netcdf=4.7.1,hdf5=1.8.18," ;

For dataset cmems_mod_glo_phy_anfc_merged-uv_PT1H-i_YYYYMMT0000Z_PYYYYMMDDThhmmZ.nc
dimensions:
        longitude = 4320 ;

```
        latitude = 2041 ;
        depth = 1 ;
        time = UNLIMITED ; // (24 currently)
variables:
        float longitude(longitude) ;
                longitude:valid_min = -180.f ;
                longitude:valid_max = 179.9167f ;
                longitude:long_name = "longitude coordinate" ;
                longitude:standard_name = "longitude" ;
                longitude:units = "degrees_east" ;
                longitude:step = 0.08332825 ;
        float latitude(latitude) ;
                latitude:valid_min = -80.f ;
                latitude:valid_max = 90.f ;
                latitude:long_name = "latitude coordinate" ;
                latitude:standard_name = "latitude" ;
                latitude:units = "degrees_north" ;
                latitude:step = 0.08332825 ;
        float depth(depth) ;
                depth:valid_min = 0.494025f ;
                depth:valid_max = 0.494025f ;
                depth:long_name = "Depth" ;
                depth:standard_name = "depth" ;
                depth:units = "m" ;
                depth:positive = "down" ;
        float time(time) ;
                time:units = "hours since 1950-01-01 0:0:0" ;
                time:calendar = "standard" ;
                time:long_name = "time" ;
                time:standard_name = "time" ;
                time:step = 1L ;
        float uo(time, depth, latitude, longitude) ;
                uo:_FillValue = 1.e+20f ;
                uo:least_significant_digit = 3L ;
                uo:long_name = "Eastward Eulerian velocity (Navier-Stokes current)" ;
                uo:standard_name = "eastward_sea_water_velocity" ;
                uo:units = "m s-1" ;
        float vo(time, depth, latitude, longitude) ;
                vo:_FillValue = 1.e+20f ;
                vo:least_significant_digit = 3L ;
                vo:long_name = "Northward Eulerian velocity (Navier-Stokes current)" ;
                vo:standard_name = "northward_sea_water_velocity" ;
                vo:units = "m s-1" ;
        float vsdx(time, depth, latitude, longitude) ;
                vsdx:_FillValue = 1.e+20f ;
                vsdx:least_significant_digit = 3L ;
                vsdx:long_name = "Eastward wave-induced velocity (Stokes drift)" ;
                vsdx:standard_name = "sea_surface_wave_stokes_drift_x_velocity" ;
                vsdx:units = "m s-1" ;
        float vsdy(time, depth, latitude, longitude) ;
                vsdy:_FillValue = 1.e+20f ;
                vsdy:least_significant_digit = 3L ;
                vsdy:long_name = "Northward wave-induced velocity (Stokes drift)" ;
                vsdy:standard_name = "sea_surface_wave_stokes_drift_y_velocity" ;
```

```
                vsdy:units = "m s-1" ;
        float utide(time, depth, latitude, longitude) ;
                utide:_FillValue = 1.e+20f ;
                utide:least_significant_digit = 3L ;
                utide:long_name = "Eastward tide-induced velocity (Tide current)" ;
                utide:standard_name = " surface_sea_water_x_velocity_due_to_tide" ;
                utide:units = "m s-1" ;
        float vtide(time, depth, latitude, longitude) ;
                vtide:_FillValue = 1.e+20f ;
                vtide:least_significant_digit = 3L ;
                vtide:long_name = "Northward tide-induced velocity (Tide current)" ;
                vtide:standard_name = " surface_sea_water_y_velocity_due_to_tide" ;
                vtide:units = "m s-1" ;
        float utotal(time, depth, latitude, longitude) ;
                utotal:_FillValue = 1.e+20f ;
                utotal:least_significant_digit = 3L ;
                utotal:long_name = "Eastward total velocity (Eulerian + Waves + Tide)" ;
                utotal:standard_name = " surface_sea_water_x_velocity" ;
                utotal:units = "m s-1" ;
        float vtotal(time, depth, latitude, longitude) ;
                vtotal:_FillValue = 1.e+20f ;
                vtotal:least_significant_digit = 3L ;
                vtotal:long_name = "Northward total velocity (Eulerian + Waves + Tide) " ;
                vtotal:standard_name = " surface_sea_water_y_velocity" ;
                vtotal:units = "m s-1" ;

// global attributes:
                :_NCProperties = "version=1|netcdflibversion=4.5.0|hdf5libversion=1.8.18" ;
                :product = "GLOBAL_ANALYSIS_FORECAST_PHY_001_024" ;
                :producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
                :title = "hourly mean merged surface currents from oceanic circulation, tides and
waves" ;
                :area = "GLOBAL" ;
                :quality_information_document =
"http://marine.copernicus.eu/documents/QUID/CMEMS-GLO-QUID-001-024.pdf" ;
                :Conventions = "CF-1.6" ;
                :credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
                :contact = "servicedesk.cmems@mercator-ocean.eu" ;
                :references = "http://marine.copernicus.eu" ;
                :source = "MERCATOR PSY4QV3R1, mfwamglo, FES2014" ;
                :licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-
licence/" ;
                :dataset = " cmems_mod_glo_phy_anfc_merged-uv_PT1H-i " ;
                :product_user_manual = "http://marine.copernicus.eu/documents/PUM/CMEMS-
GLO-PUM-001-024.pdf" ;
                :institution = "MERCATOR OCEAN" ;
                :julian_day_unit = "hours since 1950-01-01 00:00:00" ;
                :latitude_min = -80L ;
                :latitude_max = 90. ;
                :longitude_min = -180. ;
                :longitude_max = 179.91667175293 ;
```

For dataset cmems_mod_glo_phy_anfc_0.083deg-climatology-uncertainty_P1M-m

```
netcdf cmems_mod_glo_phy_anfc_0.083deg-climatology-uncertainty_P1M-m {
 dimensions:
      time = 12 ;
      forecast_reference_time = 1 ;
      lat = 2041 ;
      lon = 4320 ;
      longitude = 4320 ;
      latitude = 2041 ;
      nv = 2 ;
 variables:
      float sea_surface_temperature_md_uncertainty(time, forecast_reference_time, lat, lon) ;
            sea_surface_temperature_md_uncertainty:_FillValue = 9.96921e+36f ;
            string sea_surface_temperature_md_uncertainty:units = "°C" ;
            sea_surface_temperature_md_uncertainty:long_name = "mean difference
uncertainty" ;
            sea_surface_temperature_md_uncertainty:standard_name = "md_uncertainty" ;
      float sea_surface_temperature_rmsd_uncertainty(time, forecast_reference_time, lat, lon)
;
            sea_surface_temperature_rmsd_uncertainty:_FillValue = 9.96921e+36f ;
            string sea_surface_temperature_rmsd_uncertainty:units = "°C" ;
            sea_surface_temperature_rmsd_uncertainty:long_name = "root mean square
difference uncertainty" ;
            sea_surface_temperature_rmsd_uncertainty:standard_name = "rmsd_uncertainty" ;
      float sea_surface_temperature_number_of_observations(time, forecast_reference_time,
lat, lon) ;
            sea_surface_temperature_number_of_observations:_FillValue = 9.96921e+36f ;
            sea_surface_temperature_number_of_observations:units = "" ;
            sea_surface_temperature_number_of_observations:long_name = "number of
observations" ;
            sea_surface_temperature_number_of_observations:standard_name =
"number_of_observations" ;
      float longitude(longitude) ;
            longitude:units = "degrees_east" ;
            longitude:unit_long = "Degrees East" ;
            longitude:standard_name = "longitude" ;
            longitude:axis = "X" ;
      float latitude(latitude) ;
            latitude:units = "degrees_north" ;
            latitude:unit_long = "Degrees North" ;
            latitude:standard_name = "latitude" ;
            latitude:axis = "Y" ;
      int64 climatology_bounds(time, nv) ;
            climatology_bounds:units = "days since 1900-01-01 00:00:00" ;
      int64 time(time) ;
            time:units = "days since 1900-01-01 00:00:00" ;
            time:standard_name = "time" ;
            time:long_name = "time" ;
            time:calendar = "standard" ;
            time:climatology = "climatology_bounds" ;


// global attributes:
            :title = "Monthly mean climatological fields SST uncertainty from the period 2017-
```

2022 for Global Ocean Physics Analysis and Forecast" ;
        :producer = "CMEMS - Global Monitoring and Forecasting Centre" ;
        :area = "Global" ;
        :Conventions = "CF-1.8" ;
        :credit = "E.U. Copernicus Marine Service Information (CMEMS)" ;
        :contact = "https://marine.copernicus.eu/contact" ;
        :references = "http://marine.copernicus.eu" ;
        :source = "MOI GLO12" ;
        :licence = "http://marine.copernicus.eu/services-portfolio/service-commitments-and-licence/" ;
        :institution = "Mercator Ocean International" ;
        :author = "Mercator Ocean International" ;
        :creation_date = "2023-09-29 17:12:29.211449" ;
        :coordinates = "climatology_bounds" ;