PRODUCT USER MANUAL

For Mediterranean Sea Physical Analysis and Forecasting Product MEDSEA_ANALYSIS_FORECAST_PHY_006_013

Issue: 1.4

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RECORD TABLE

Issue	Date	§	Description of Change	Author	Validated By
1.0	25/09/2017	all	Initial version	R. Lecci, M. Drudi, A. Grandi, C. Fratianni, D. Padeletti	1
1.1	25/01/2018	all	Changes for product upgrade	R. Lecci, A. Grandi, C. Fratianni, E. Clementi, M. Drudi	
1.2	21/01/2019	all	New template and new datasets	R. Lecci, A. Grandi, E. Clementi, M. Drudi	
1.3	06/12/2019	all	Release of daily-mean products centred at 12:00Z instead of 00:00Z	R. Lecci, A. Grandi, M. Drudi, E. Clementi	
1.4	10/09/2020	all	Revision of timeseries temporal coverage and new atmospheric forcing	R. Lecci, A. Grandi, E. Clementi	C. Derval

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GLOSSARY AND ABBREVIATIONS

Analysis (Numerical)	a detailed study of the state of the ocean done in Near real Time based on observations and numerical model. The operational prediction centre produces 3D time-space analysis systems. A long series of analyses is of great utility for studying the behavior of the ocean system.
CF	Climate Forecast (convention for NetCDF)
CMCC	Centro Euro-Mediterraneo sui Cambiamenti Climatici
CMEMS	Copernicus Marine Environment Monitoring Service
CTD	Conductivity Temperature Depth
DGF	DirectGetFile
DirectGetFile	CMEMS service tool (FTP like) to download a NetCDF file
ECMWF	European Centre for Medium-Range Weather Forecasts
FAQ	Frequently Asked Question
Forecast (Numerical)	a computer forecast or prediction based on equations governing the motions and the forces affecting motion of fluids. The equations are based, or initialized, on specified ocean conditions at a certain place and time (NOAA Glossary).
FTP	File Transfer Protocol
MDT	Mean Dynamic Topography
Med/MED	Mediterranean
Meridional Velocity	South to North component of the horizontal velocity vector
MFC	Monitoring and Forecasting Centre
MFS	Mediterranean Forecasting System
NEMO	Nucleous for European Modelling of the Ocean
NetCDF	Network Common Data Form
NOAA	National Oceanic and Atmospheric Administration

OA	Objective Analyses
OCEANVAR	Oceanographic variational data assimilation scheme developed at CMCC.
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)
PU	Production Unit
SL	Sea Level
SLA	Sea Level Anomaly
SSH	Sea Surface Height
SST	Sea Surface Temperature
Subsetter	CMEMS service tool to download a NetCDF file of a selected geographical box using values of longitude and latitude, and time range
XBT	eXpandable BathyThermograph
WW3	WaveWatch-III
Zonal Velocity	West to East component of the horizontal velocity vector
3DVAR	Three-Dimensional Variational

I INTRODUCTION

I.1 Summary

This document is the user manual for the CMEMS analysis and forecast product **MEDSEA_ANALYSIS_FORECAST_PHY_006_013**. A rolling archive of analysis over the last two years up to real-time is available on the CMEMS server.

It contains 3D, monthly mean fields, 24 hours mean fields and hourly mean fields of Potential Temperature, Bottom Temperature, Salinity, Zonal and Meridional Velocity, and by 2D, monthly mean fields, 24 hours mean fields and hourly mean fields of Sea Surface Height, Mixed Layer Depth and Bottom Potential Temperature.

MEDSEA_ANALYSIS_FORECAST_PHY_006_013 product is organised in 19 datasets:

- 5 datasets contain monthly mean fields: 3D potential temperature, salinity and currents information from top to bottom and 2D sea surface level, bottom potential temperature, mixed layer thickness information.
  - **med00-cmcc-tem-an-fc-m**
  - **med00-cmcc-cur-an-fc-m**
  - **med00-cmcc-ssh-an-fc-m**
  - **med00-cmcc-mld-an-fc-m**
  - **med00-cmcc-sal-an-fc-m**
- 5 datasets contain daily mean fields: 3D potential temperature, salinity and currents information from top to bottom and 2D sea surface level, bottom potential temperature, mixed layer thickness information.
  - **med00-cmcc-tem-an-fc-d**
  - **med00-cmcc-cur-an-fc-d**
  - **med00-cmcc-ssh-an-fc-d**
  - **med00-cmcc-mld-an-fc-d**
  - **med00-cmcc-sal-an-fc-d**
- 3 datasets contain hourly mean fields: 3D potential temperature, salinity and currents information from top to bottom and 2D bottom potential temperature.
  - **med00-cmcc-tem-an-fc-h**
  - **med00-cmcc-sal-an-fc-h**
  - **med00-cmcc-cur-an-fc-h**
- 5 datasets contain hourly mean fields: 3D potential temperature, salinity and currents information from top to 400 m and 2D sea surface level, bottom potential temperature, mixed layer thickness information.

- **med00-cmcc-tem-an-fc-hts**
- **med00-cmcc-sal-an-fc-hts**
- **med00-cmcc-cur-an-fc-hts**
- **med00-cmcc-ssh-an-fc-hts**
- **med00-cmcc-mld-an-fc-hts**

- **1** dataset contains the static fields for the system: coordinates, mean sea surface level, mask and bathymetry: **MEDSEA_ANALYSIS_FORECAST_PHY_006_013-statics**

The product is published on the CMEMS dissemination server after automatic and human quality controls. Product is available on-line and disseminated through the CMEMS Information System. Files downloaded are in NetCDF format.

The analysis and forecasting system is described in the Quality Information Document (QUID) CMEMS-MED-QUID-006-013 (http://marine.copernicus.eu/documents/QUID/CMEMS-MED-QUID-006-013.pdf).

More detailed information can be obtained from the CMEMS Service Desk (servicedesk.cmems@mercator-ocean.eu).

Disclaimer: The quality of the product may vary during the proposed time series depending on the possible update of the system.

I.2 History of changes

21.01.2019	New template and inclusion of new datasets
06.12.2019	Release of daily-mean products centered at 12:00Z instead of 00:00Z
10.09.2020	New timeseries temporal coverage and new atmospheric forcing

II PRODUCT DESCRIPTION: MEDSEA_ANALYSIS_FORECAST_PHY_006_013

II.1 General Information about products

Product name	MEDSEA_ANALYSIS_FORECAST_PHY_006_013		
Geographical coverage	17.29°W → 36.30°E; 30.18°N → 45.98°N		
Variables	Temperature Salinity Sea Surface Height Horizontal velocity (eastward and northward components) Ocean mixed layer thickness Sea floor potential temperature		
	Analysis	**Forecast**	
Update frequency	Weekly	Daily	
Available time series	last two years up to real-time	10-days forecast	
Target delivery time	On Tuesday at 16:00 UTC	Daily at 16:00 UTC	
Temporal resolution	• med00-cmcc-tem-an-fc-hts, med00-cmcc-sal-an-fc-hts, med00-cmcc-cur-an-fc-hts, med00-cmcc-ssh-an-fc-hts, med00-cmcc-mld-an-fc-hts, med00-cmcc-tem-an-fc-h, med00-cmcc-sal-an-fc-h, med00-cmcc-cur-an-fc-h: hourly mean • med00-cmcc-tem-an-fc-d, med00-cmcc-sal-an-fc-d, med00-cmcc-cur-an-fc-d, med00-cmcc-ssh-an-fc-d, med00-cmcc-mld-an-fc-d: daily mean • med00-cmcc-tem-an-fc-m, med00-cmcc-sal-an-fc-m, med00-cmcc-cur-an-fc-m, med00-cmcc-ssh-an-fc-m, med00-cmcc-mld-an-fc-m: monthly mean		
Horizontal resolution	1/24 °		
Number of vertical levels	141		
Format	NetCDF CF1.0		
Delivery mechanisms	Subsetter	DGF	FTP

II.2 Details of the datasets

MEDSEA_ANALYSIS_FORECAST_PHY_006_013	
med00-cmcc-tem-an-fc-m	contains the 3D monthly mean fields: 3D potential temperature information from top to bottom and 2D bottom potential temperature information.
	thetao [°C] Potential temperature sea_water_potential_temperature
	bottomT [°C] Sea floor potential temperature sea_water_potential_temperature_at_sea_floor
med00-cmcc-sal-an-fc-m	contains the 3D monthly mean fields: 3D salinity information from top to bottom.
	so [psu] Salinity sea_water_salinity
med00-cmcc-cur-an-fc-m	contains the 3D monthly mean fields: 3D 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
med00-cmcc-ssh-an-fc-m	contains the 2D monthly mean fields: 2D sea surface level information.

	zos [m] Sea surface height sea_surface_height_above_geoid
med00-cmcc-mld-an-fc-m	contains the 2D monthly mean fields: 2D mixed layer thickness information.
	mlotst [m] Mixed layer thickness ocean_mixed_layer_thickness_defined_by_sigma_theta
med00-cmcc-tem-an-fc-d	contains the 3D daily mean fields: 3D potential temperature information from top to bottom and 2D bottom potential temperature information.
	thetao [°C] Potential temperature sea_water_potential_temperature
	bottomT [°C] Sea floor potential temperature sea_water_potential_temperature_at_sea_floor
med00-cmcc-sal-an-fc-d	contains the 3D daily mean fields: 3D salinity information from top to bottom.
	so [psu] Salinity sea_water_salinity
med00-cmcc-cur-an-fc-d	contains the 3D daily mean fields: 3D 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
med00-cmcc-ssh-an-fc-d	contains the 2D daily mean fields: 2D sea surface level information.
	zos [m] Sea surface height sea_surface_height_above_geoid
med00-cmcc-mld-an-fc-d	contains the 2D daily mean fields: 2D mixed layer thickness information.
	mlotst [m] Mixed layer thickness ocean_mixed_layer_thickness_defined_by_sigma_theta
med00-cmcc-tem-an-fc-h	contains the 3D hourly mean fields: 3D potential temperature information from top to bottom and 2D bottom potential temperature information.
	thetao [°C] Potential temperature sea_water_potential_temperature
	bottomT [°C] Sea floor potential temperature sea_water_potential_temperature_at_sea_floor
med00-cmcc-sal-an-fc-h	contains the 3D hourly mean fields: 3D salinity information from top to bottom.
	so [psu] Salinity

	sea_water_salinity
med00-cmcc-cur-an-fc-h	contains the 3D hourly mean fields: 3D 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
med00-cmcc-tem-an-fc-hts	contains the 3D hourly mean fields: 3D potential temperature information from top to 400m and 2D bottom potential temperature information.
	thetao [°C] Potential temperature sea_water_potential_temperature
	bottomT [°C] Sea floor potential temperature sea_water_potential_temperature_at_sea_floor
med00-cmcc-sal-an-fc-hts	contains the 3D hourly mean fields: 3D salinity information from top to 400m.
	so [psu] Salinity sea_water_salinity
med00-cmcc-cur-an-fc-hts	contains the 3D hourly mean fields: 3D currents information from top to 400m.
	uo [m/s] Eastward ocean current velocity

	eastward_sea_water_velocity
	vo [m/s] Northward ocean current velocity northward_sea_water_velocity
med00-cmcc-ssh-an-fc-hts	contains the 2D hourly mean fields: 2D sea surface level information.
	zos [m] Sea surface height sea_surface_height_above_geoid
med00-cmcc-mld-an-fc-hts	contains the 2D hourly mean fields: 2D mixed layer thickness information.
	mlotst [m] Mixed layer thickness ocean_mixed_layer_thickness_defined_by_sigma_theta
MEDSEA_ANALYSIS_FORECAST_PHY_006_013-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] 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

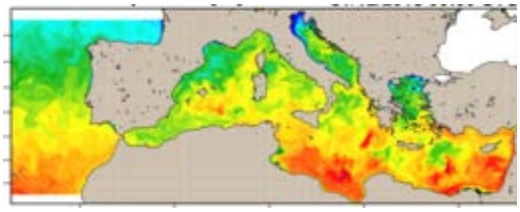
II.3 Details on some parameters

mlotst [m]	ocean_mixed_layer_thickness_defined_by_sigma_theta. It is the depth where the density increases of 0.01 kg.m-3 compared to density at 10 m depth
*-hts datasets	Hourly 3D variables are available at 15 surface and subsurface levels: 1: (L1) 1.02m, 2: (L2) 3.17m, 3: (L3) 5.46m, 4:(L4) 7.92m, 5: (L5) 10.54m, 6:(L8) 19.40m, 7: (L11) 29.89m, 8: (L16) 51.38m, 9: (L20) 72.62m, 10: (L24) 97.93m, 11: (L31) 153.43m, 12: (L36) 203.17m, 13: (L40) 249.92m, 14: (L44) 303.56m, 15: (L50) 398.54m

II.4 Product System Description

The physical component of the Mediterranean Forecasting System (Med-Currents) is a coupled hydrodynamic-wave modeling system implemented over the whole Mediterranean Basin. The model horizontal grid resolution is 1/24˚ (ca. 4 km) and has 141 unevenly spaced vertical levels. The hydrodynamics are supplied by the Nucleous for European Modelling of the Ocean (NEMO v3.6) while the wave component is provided by WaveWatch-III; the model solutions are corrected by a

variational data assimilation scheme (3DVAR) of temperature and salinity vertical profiles and along track satellite Sea Level Anomaly observations. Objective Analyses-Sea Surface Temperature fields are used for the correction of surface heat fluxes with the relaxation constant of 110 W m-2 K-1 applied close to midnight.

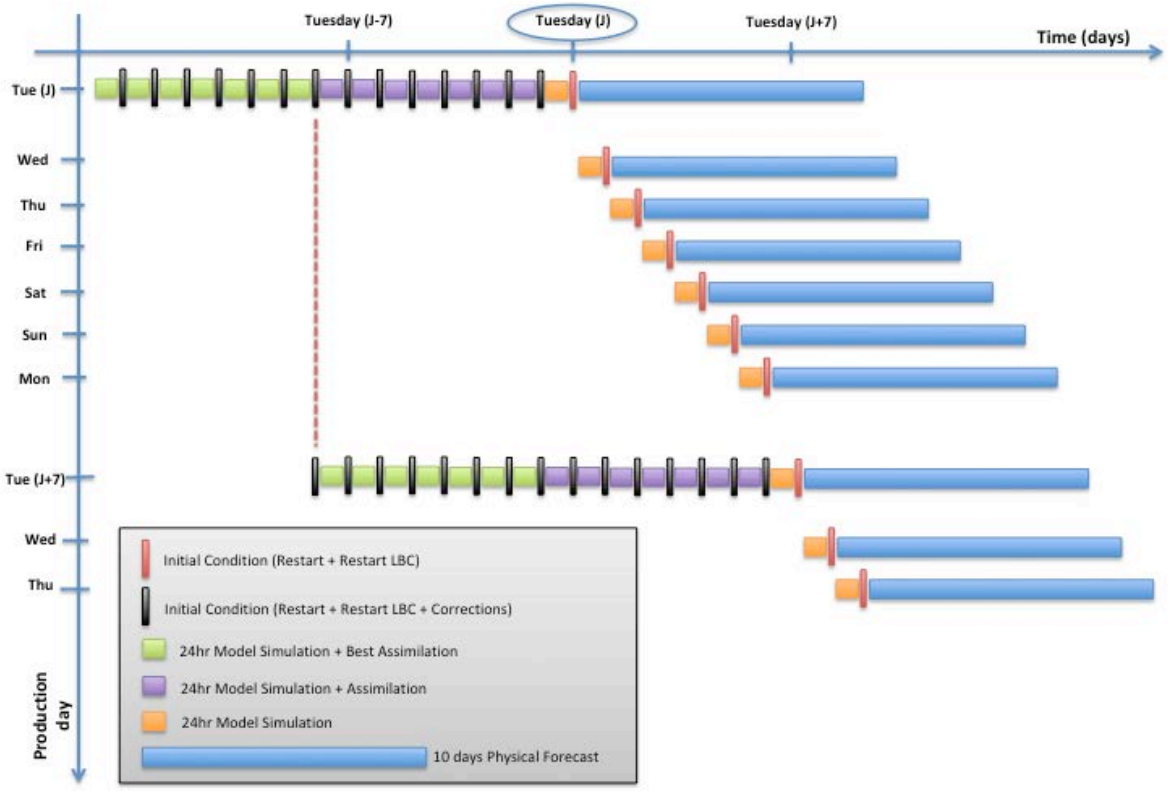
Domain Resolution and grid Geographic coverage	MEDSEA (17.29°W-36.29°E; 30.19°N – 45.98°N) 1/24º; regular grid; 1287 x 380 x 141 This is a regional product covering the Mediterranean Sea and a box in the adjacent Atlantic Ocean. It is defined on a regular grid at 1/24 degree (approx. 4km) and 141 vertical levels. 
Model version	NEMO-WW3
Tides	N/A
Atmospheric forcings	ECMWF atmospheric forcings at 1/10 degrees: 6-hourly analysis; 1 hour for the first 3 days of forecast, 3 hours for the following 3 days of forecast and 6 hours for the last 4 days of forecast
Assimilation scheme	OceanVar (3DVAR)
Assimilated observations	Insitu vertical profiles of Temperature and Salinity from ARGO, XBT, CTD; Sea Level Anomaly (SLA) from available satellites Jason 2 & 3, Saral-Altika, Cryosat; Sentinel-3A/3B. Objective Analyses-Sea Surface Temperature (SST) fields are used to correct surface heat fluxes.
Initial conditions	World Ocean Atlas (WOA) 2013 V2, winter climatology at 01/01/2015
Bathymetry	GEBCO 30sec interpolated on the model grid

II.5 Processing information

The processing is based on two cycles: a daily cycle for the production of forecast data, and a weekly cycle for the production of analysis data.

The daily cycle is delivered each day (J), for the next 10 days. The forecast is initialized by a hindcast every day. Every day the product is updated with a hindcast for day J-1 and 10-day forecast.

The weekly cycle is delivered on Tuesday, for the previous 14 days. The assimilation cycle is daily (24hr) and is produced in filter mode. Every Tuesday the product is updated with the analyses from day J-15 to day J-2, a hindcast for day J-1 and 10-day forecast.



II.5.1 Update Time

The product is updated daily at 16:00 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).

II.5.2 Time coverage

A rolling archive of analysis over the last two years up to real-time is available on CMEMS portal. The table below shows the time coverage in detail for the time-series of each dataset.

Dataset	Time-series available from	Time-series available up to
monthly mean : med00-cmcc-tem-an-fc-m, med00-cmcc-sal-an-fc-m, med00-cmcc-cur-an-fc-m, med00-cmcc-ssh-an-fc-m, med00-cmcc-mld-an-fc-m	last two years	Previous Month Update the 20th of current month
daily mean : med00-cmcc-tem-an-fc-d, med00-cmcc-sal-an-fc-d, med00-cmcc-cur-an-fc-d, med00-cmcc-ssh-an-fc-d, med00-cmcc-mld-an-fc-d		J+9 Updated by processing of day J
hourly mean – 2D fields and 3D fields from top to 400m in depth : med00-cmcc-tem-an-fc-hts, med00-cmcc-sal-an-fc-hts, med00-cmcc-cur-an-fc-hts, med00-cmcc-ssh-an-fc-hts, med00-cmcc-mld-an-fc-hts		J+4 Updated by processing of day J
hourly mean – 3D fields from top to bottom: med00-cmcc-tem-an-fc-h, med00-cmcc-sal-an-fc-h, med00-cmcc-cur-an-fc-h	31/03/2020	

II.5.3 Time averaging

For the monthly dataset, the fields are monthly means over the calendar month (first to last day of the month). For the daily dataset, the fields are daily means over a day (midnight to midnight, centered at midday). For the hourly dataset, the fields are hourly means (centered every half-hour).

III HOW TO DOWNLOAD A PRODUCT

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

You first need to register. Please find below the registration steps: http://marine.copernicus.eu/web/34-products-and-services-faq.php#1

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

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

You first need to register. Please find below the registration steps: http://marine.copernicus.eu/web/34-products-and-services-faq.php#1

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

III.3 Download a product through the CMEMS Web Portal Direct Get File Service

You first need to register. Please find below the registration steps: http://marine.copernicus.eu/web/34-products-and-services-faq.php#1

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

IV FILES NOMENCLATURE AND FORMAT

IV.1 Nomenclature of files when downloaded through the Subsetter Service

MEDSEA_ANALYSIS_FORECAST_PHY_006_013 files nomenclature when downloaded through the CMEMS Web Portal Subsetter is based on product dataset name and a numerical reference related to the request date on the portal.

The scheme is: **datasetname_nnnnnnnnnnnn.nc**

where:

- **datasetname**: as described previously
- **nnnnnnnnnnnn**: 13 digit integer corresponding to the current time (download time) in milliseconds since January 1, 1970 midnight UTC.
- **.nc**: standard NetCDF filename extension.

Example: med00-cmcc-sal-an-fc-d_1303461772348.nc

IV.2 Nomenclature of files when downloaded through the DGF and CMEMS FTP Services

MEDSEA_ANALYSIS_FORECAST_PHY_006_013 files nomenclature when downloaded through the CMEMS Web Portal DGF or FTP service is based as follows:

{valid date}_{freq flag}-{producer}--{parameter}-{config}-{region}-{bul date}_{product type}-sv{file version}.nc

where

- **valid date** YYYYMMDD is the validity day of the data in the file
- **freq flag** is the frequency of data values in the file (h = hourly, hts = hourly time series, d = daily, m=monthly)
- **producer** is a short version of the CMEMS production unit
- **config** identifies the producing system and configuration
- **region** is a six-letter code for the region
- **parameter** is a four-letter code for the parameter or parameter set from Standard BODC.
- **bul date** bYYYYMMDD is the bulletin date the product was produced
- **product type** is a two-letter code for the product type, for example fc for forecast, an for analysis and sm for hindcast.
- **file version** is xx.yy where xx is the CMEMS version (03, 04 or 05) and yy is an incremental version number

Table 1 shows the nomenclature for the MEDSEA_ANALYSIS_FORECAST_PHY_006_013 products.

Table 1 Description of the nomenclature for MEDSEA_ANALYSIS_FORECAST_PHY_006_013

valid date	YYYYMMDD
freq flag	m (monthly) d (daily) h (hourly) hts (hourly time series)
producer	CMCC
config	MFSeas5
region	MEDATL
parameter	TEMP PSAL ASLV RFVL AMXL
bul date	bYYYYYMMDD
product type	fc (forecast) an (analysis) sm (hindcast)
file version	06.00

Example for a file of Salinity:

20180309_d-CMCC--PSAL-MFSeas5-MEDATL-b20180306_fc-sv06.00.nc

This is the mean field of salinity centered at 00:00 UTC of the 9thMarch 2018, and the time coverage is from midnight (00:00 UTC) of the 9thMarch 2018 to midnight (24:00 UTC) of the 9thMarch 2018 (see section IV.8).

20180309_h-CMCC--PSAL-MFSeas5-MEDATL-b20180306_fc-sv06.00.nc

This file contains the 24 hourly mean fields of salinity, each one centered at 30' of every hour from midnight (00:00 UTC) of the 9th March 2018 to midnight (24:00 UTC) of the 9th March 2018 (see section IV.9).

20180309_hts-CMCC--PSAL-MFSeas5-MEDATL-b20180306_fc-sv06.00.nc

This file contains the 24 hourly mean fields of salinity, each one centered at 30' of every hour from midnight (00:00 UTC) of the 9th March 2018 to midnight (24:00 UTC) of the 9th March 2018 (see section IV.9).

20180301_m-CMCC--PSAL-MFSeas5-MEDATL-b20180306_an-sv06.00.nc

This is the monthly mean field of salinity for the month of March 2018. The mean is computed from midnight (00:00 UTC) of the 1st March 2018 to midnight (24:00 UTC) of the 31th March 2018 (see section IV.9).

IV.3 File Format: format name

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 Center 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.

IV.4 File size

DATASET NAME	FILE NAME	DIMENSION [MB]
med00-cmcc-ssh-an-fc-d	{date1}_d-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_d-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_d-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	0.62
med00-cmcc-sal-an-fc-d	{date1}_d-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_d-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_d-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	36
med00-cmcc-tem-an-fc-d	{date1}_d-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_d-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_d-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	47
med00-cmcc-cur-an-fc-d	{date1}_d-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_fc-sv06.nc {date1}_d-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_d-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	131
med00-cmcc-mld-an-fc-d	{date1}_d-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_d-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_d-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	0.73

med00-cmcc-sal-an-fc-h	{date1}_h-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_h-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_h-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	820
med00-cmcc-tem-an-fc-h	{date1}_h-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_h-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_h-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	110
med00-cmcc-cur-an-fc-h	{date1}_h-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_h-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_h-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	310
med00-cmcc-ssh-an-fc-hts	{date1}_hts-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_hts-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_hts-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	14
med00-cmcc-sal-an-fc-hts	{date1}_hts-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_hts-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_hts-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	160
med00-cmcc-tem-an-fc-hts	{date1}_hts-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_hts-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_hts-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	200

med00-cmcc-cur-an-fc-hts	{date1}_hts-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_hts-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_hts-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	510
med00-cmcc-mld-an-fc-hts	{date1}_hts-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_fc-sv06.00.nc {date1}_hts-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_sm-sv06.00.nc {date1}_hts-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	14
med00-cmcc-ssh-an-fc-m	{date1}_m-CMCC--ASLV-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	0.62
med00-cmcc-sal-an-fc-m	{date1}_m-CMCC--PSAL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	36
med00-cmcc-tem-an-fc-m	{date1}_m-CMCC--TEMP-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	47
med00-cmcc-cur-an-fc-m	{date1}_m-CMCC--RFVL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	131
med00-cmcc-mld-an-fc-m	{date1}_m-CMCC--AMXL-MFSeas5-MEDATL-b{date2}_an-sv06.00.nc	0.73
MEDSEA_ANALYSIS_FORECAST_PHY_006_013-statics	MED-MFC_006_013_${field}.nc	3.4

IV.5 Remember: scale_factor & add_offset / missing_value / land mask

The missing value for this product is: 1.e+20

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

IV.6 Reading Software

NetCDF data can be browsed and used through a number of software, like:

- ✓ ncBrowse: http://www.epic.noaa.gov/java/ncBrowse/,
- ✓ NetCDF Operator (NCO): http://nco.sourceforge.net/
- ✓ IDL, Matlab, GMT…

Useful information on UNIDATA: http://www.unidata.ucar.edu/software/netcdf/

IV.7 Structure and semantic of netCDF maps files

Table 8 Dimensions and variables included in the files NetCDF of MEDSEA_ANALYSIS_FORECAST_PHY_006_013.

DIMENSIONS	**VARIABLES**		
	NAME	**DIMENSIONS**	**TYPE**
lon=1287 lat=380 depth={141|1} time={1|24}	lon	lon	float
	lat	lat	float
	depth	depth	float
	time	time	int
	zos	time,lat,lon	float
	thetao	time,depth,lat,lon	float
	so	time,depth,lat,lon	float
	uo	time,depth,lat,lon	float
	vo	time,depth,lat,lon	float
	mlotst	time,lat,lon	float
	bottomT	time,lat,lon	float

For 20181205_d-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00.nc

```
netcdf \20181205_d-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00 {
dimensions:
        depth = 141 ;
        lat = 380 ;
        lon = 1287 ;
        time = UNLIMITED ; // (1 currently)
variables:
        float depth(depth) ;
                depth:units = "m" ;
                depth:axis = "Z" ;
                depth:standard_name = "depth" ;
                depth:long_name = "depth" ;
                depth:positive = "down" ;
        float lat(lat) ;
                lat:units = "degrees_north" ;
                lat:long_name = "latitude" ;
                lat:standard_name = "latitude" ;
                lat:axis = "Y" ;
        float lon(lon) ;
                lon:units = "degrees_east" ;
                lon:long_name = "longitude" ;
                lon:standard_name = "longitude" ;
                lon:axis = "X" ;
        int time(time) ;
                time:units = "seconds since 1970-01-01 00:00:00" ;
                time:calendar = "standard" ;
                time:long_name = "time" ;
                time:standard_name = "time" ;
                time:axis = "T" ;
        float thetao(time, depth, lat, lon) ;
                thetao:_FillValue = 1.e+20f ;
                thetao:missing_value = 1.e+20f ;
```

thetao:valid_min = 4.f ;

thetao:valid_max = 35.f ;

thetao:units = "degC" ;

thetao:coordinates = "time depth lat lon" ;

thetao:standard_name = "sea_water_potential_temperature" ;

thetao:long_name = "temperature" ;

float bottomT(time, lat, lon) ;

bottomT:_FillValue = 1.e+20f ;

bottomT:missing_value = 1.e+20f ;

bottomT:valid_min = 4.f ;

bottomT:valid_max = 35.f ;

bottomT:units = "degC" ;

bottomT:coordinates = "time lat lon" ;

bottomT:standard_name = "sea_water_potential_temperature_at_sea_floor" ;

bottomT:long_name = "Sea floor potential temperature" ;

// global attributes:

:bulletin_type = " analysis " ;

:institution = "Centro Euro-Mediterraneo sui Cambiamenti Climatici - CMCC, Italy" ;

:source = "MFS EAS5" ;

:contact = "servicedesk.cmems@mercator-ocean.eu" ;

:references = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:comment = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:Conventions = "CF-1.0" ;

:bulletin_date = "2018-12-31" ;

:field_type = "daily_mean_centered_at_time_field" ;

:title = "Potential Temperature (3D) - Hourly Mean " ;

}

For 20181205_h-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00.nc

netcdf \20181205_h-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00 {

dimensions:

depth = 141 ;

lat = 380 ;

lon = 1287 ;

time = UNLIMITED ; // (24 currently)

variables:

float depth(depth) ;

depth:units = "m" ;

depth:axis = "Z" ;

depth:standard_name = "depth" ;

depth:long_name = "depth" ;

depth:positive = "down" ;

float lat(lat) ;

lat:units = "degrees_north" ;

lat:long_name = "latitude" ;

lat:standard_name = "latitude" ;

lat:axis = "Y" ;

float lon(lon) ;

lon:units = "degrees_east" ;

lon:long_name = "longitude" ;

lon:standard_name = "longitude" ;

lon:axis = "X" ;

int time(time) ;

time:units = "seconds since 1970-01-01 00:00:00" ;

time:calendar = "standard" ;

time:long_name = "time" ;

time:standard_name = "time" ;

time:axis = "T" ;

float thetao(time, depth, lat, lon) ;

thetao:_FillValue = 1.e+20f ;

thetao:missing_value = 1.e+20f ;

thetao:valid_min = 4.f ;

thetao:valid_max = 35.f ;

thetao:units = "degC" ;

thetao:coordinates = "time depth lat lon" ;

thetao:standard_name = "sea_water_potential_temperature" ;

thetao:long_name = "temperature" ;

float bottomT(time, lat, lon) ;

bottomT:_FillValue = 1.e+20f ;

bottomT:missing_value = 1.e+20f ;

bottomT:valid_min = 4.f ;

bottomT:valid_max = 35.f ;

bottomT:units = "degC" ;

bottomT:coordinates = "time lat lon" ;

bottomT:standard_name = "sea_water_potential_temperature_at_sea_floor" ;

bottomT:long_name = "Sea floor potential temperature" ;

// global attributes:

:bulletin_type = "analysis" ;

:institution = "Centro Euro-Mediterraneo sui Cambiamenti Climatici - CMCC, Italy";

:source = "MFS EAS5" ;

:contact = "servicedesk.cmems@mercator-ocean.eu" ;

:references = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:comment = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:Conventions = "CF-1.0" ;

:bulletin_date = "2018-12-31" ;

:field_type = "hourly_mean_centered_at_time_field" ;

:title = "Potential Temperature (3D) - Daily Mean " ;

}

For 20180701_hts-CMCC--TEMP-MFSeas5-MEDATL-b20180627_an-sv06.00.nc

netcdf \20180701_hts-CMCC--TEMP-MFSeas5-MEDATL-b20180627_fc-sv06.00 {

dimensions:

time = UNLIMITED ; // (24 currently)

lat = 380 ;

lon = 1287 ;

depth = 15 ;

variables:

float bottomT(time, lat, lon) ;

bottomT:_FillValue = 1.e+20f ;

bottomT:missing_value = 1.e+20f ;

bottomT:valid_min = 4.f ;

bottomT:valid_max = 35.f ;

bottomT:units = "degC" ;

bottomT:coordinates = "time lat lon" ;

bottomT:standard_name = "sea_water_potential_temperature_at_sea_floor" ;

bottomT:long_name = "Sea floor potential temperature" ;

float depth(depth) ;

depth:units = "m" ;

depth:nav_model = "Grid T" ;

depth:positive = "down" ;

depth:standard_name = "depth" ;

depth:long_name = "depth" ;

depth:axis = "Z" ;

float lat(lat) ;

lat:units = "degrees_north" ;

lat:nav_model = "Grid T" ;

lat:standard_name = "latitude" ;

lat:long_name = "latitude" ;

lat:axis = "Y" ;

float lon(lon) ;

lon:units = "degrees_east" ;

lon:nav_model = "Grid T" ;

lon:standard_name = "longitude" ;

lon:long_name = "longitude" ;

lon:axis = "X" ;

float thetao(time, depth, lat, lon) ;

thetao:_FillValue = 1.e+20f ;

thetao:missing_value = 1.e+20f ;

thetao:valid_min = 4.f ;

thetao:valid_max = 35.f ;

thetao:units = "degC" ;

thetao:coordinates = "time depth lat lon" ;

thetao:standard_name = "sea_water_potential_temperature" ;

thetao:long_name = "temperature" ;

int time(time) ;

time:units = "seconds since 1970-01-01 00:00:00" ;

time:calendar = "standard" ;

time:long_name = "time" ;

time:standard_name = "time" ;

time:axis = "T" ;

// global attributes:

:bulletin_type = "forecast" ;

:institution = "Centro Euro-Mediterraneo sui Cambiamenti Climatici - CMCC, Italy" ;

:source = "MFS EAS5" ;

:contact = "servicedesk.cmems@mercator-ocean.eu" ;

:references = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:comment = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:Conventions = "CF-1.0" ;

:bulletin_date = "2018-06-27" ;

:field_type = "hourly_mean_centered_at_time_field" ;

:title = "Potential Temperature (3D) - Hourly Mean " ;

}

For 20181201_m-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00.nc

netcdf \20181201_m-CMCC--TEMP-MFSeas5-MEDATL-b20181231_an-sv06.00 {

dimensions:

depth = 141 ;

lat = 380 ;

```
        lon = 1287 ;
        time = UNLIMITED ; // (1 currently)
variables:
        float depth(depth) ;
                depth:units = "m" ;
                depth:axis = "Z" ;
                depth:standard_name = "depth" ;
                depth:long_name = "depth" ;
                depth:positive = "down" ;
        float lat(lat) ;
                lat:units = "degrees_north" ;
                lat:long_name = "latitude" ;
                lat:standard_name = "latitude" ;
                lat:axis = "Y" ;
        float lon(lon) ;
                lon:units = "degrees_east" ;
                lon:long_name = "longitude" ;
                lon:standard_name = "longitude" ;
                lon:axis = "X" ;
        int time(time) ;
                time:units = "seconds since 1970-01-01 00:00:00" ;
                time:calendar = "standard" ;
                time:long_name = "time" ;
                time:standard_name = "time" ;
                time:axis = "T" ;
        float thetao(time, depth, lat, lon) ;
                thetao:_FillValue = 1.e+20f ;
                thetao:missing_value = 1.e+20f ;
                thetao:valid_min = 4.f ;
                thetao:valid_max = 35.f ;
                thetao:units = "degC" ;
                thetao:coordinates = "time depth lat lon" ;
                thetao:standard_name = "sea_water_potential_temperature" ;
```

thetao:long_name = "temperature" ;

float bottomT(time, lat, lon) ;

bottomT:_FillValue = 1.e+20f ;

bottomT:missing_value = 1.e+20f ;

bottomT:valid_min = 4.f ;

bottomT:valid_max = 35.f ;

bottomT:units = "degC" ;

bottomT:coordinates = "time lat lon" ;

bottomT:standard_name = "sea_water_potential_temperature_at_sea_floor" ;

bottomT:long_name = "Sea floor potential temperature" ;

// global attributes:

:bulletin_type = " analysis " ;

:institution = "Centro Euro-Mediterraneo sui Cambiamenti Climatici - CMCC, Italy" ;

:source = "MFS EAS5" ;

:contact = "servicedesk.cmems@mercator-ocean.eu" ;

:references = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:comment = "Please check in CMEMS catalogue the INFO section for product MEDSEA_ANALYSIS_FORECAST_PHY_006_013 - http://marine.copernicus.eu" ;

:Conventions = "CF-1.0" ;

:bulletin_date = "2018-12-31" ;

:field_type = "monthly_mean_centered_at_time_field" ;

:title = "Potential Temperature (3D) - Monthly Mean " ;

}