



PRODUCT USER MANUAL

For the North-West Shelf Physical Forecast Product NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_013

Issue: 1.0

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CHANGE RECORD

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GLOSSARY AND ABBREVIATIONS

MFC	Monitoring and Forecasting Centre
NWS	North-West Shelf
NetCDF	Network Common Data Form
CF	Climate Forecast (convention for NetCDF)
SSS	Sea surface salinity.
SSC	Sea surface currents
SSH	Sea surface height
RMS	Root mean square
PC	Production Centre
PU	Production Unit
Meridional Velocity	West to East component of the horizontal velocity vector
Zonal Velocity	South to North component of the horizontal velocity vector
TMB	Top, Middle, Bottom. Refers to terrain following water column levels for certain fields
ftp	Protocol to download files
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)
Subsetter	CMEMS service tool to download a NetCDF file of a selected geographical box using values of longitude and latitude, and time range
DirectGetFile - DGF	CMEMS service tool (FTP like) to download a NetCDF file

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I INTRODUCTION

NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_013 is the analysis and forecast physical product of the NWS MFC from the UK Met Office, and includes:

- 3D daily mean fields of temperature, salinity, zonal velocity, meridional velocity,
- 2D daily mean files of Mixed Layer Depth and Temperature at the sea floor
- 3D hourly fields of temperature, salinity, zonal velocity and meridional velocity
- 2D hourly sea surface height
- surface, middle and bottom hourly fields of temperature, salinity, zonal velocity and meridional velocity, sea surface height (surface only)

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II DESCRIPTION OF THE PRODUCT SPECIFICATION

II.1 General Information about product

Product Lines	NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_013
Geographical coverage	16°W → 13°E ; 46°N → 63°N
Variables	Potential temperature Salinity Sea surface height Horizontal velocity (eastward and northward components) Bottom temperature Mixed layer depth
Analysis	Yes
Forecast	Yes 6 days forecast
Available time series	01/01/2017– present
Temporal resolution	<ul style="list-style-type: none"> • Daily mean • Hourly Instantaneous
Target delivery time	Daily 1200 UTC
Delivery mechanism	Subsetter, FTP, DGF
Horizontal resolution	~1.5km– Regular grid
Number of vertical levels	<ul style="list-style-type: none"> • 33 levels [0, 3, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 550, 600, 750, 1000, 1500, 2000, 3000, 4000, 5000]
Format	Netcdf CF1.0

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II.2 Details of the datasets

NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_013	
Hourly Instantaneous (hi) and Daily means (dm) fields of: <ul style="list-style-type: none"> • Potential temperature, salinity, zonal and meridional velocity (3D); • Sea Surface Height (SSH), sea bottom temperature , and Mixed layer depth (2D) 	
TMB=Top-Middle-Bottom vertical levels.	
DATASETS	Variables name in the NetCDF file and Unit Long_name CF Standard_name
MetO-NWS-PHY- hi -CUR	vo [ms ⁻¹] Northward Current Velocity in the Water Column
MetO-NWS-PHY- hi -TMB-CUR	northward_sea_water_velocity
MetO-NWS-PHY- dm -CUR	uo [ms ⁻¹] Eastward Current Velocity in the Water Column
MetO-NWS-PHY- hi -TEM	thetao [degrees_C]
MetO-NWS-PHY- hi -TMB-TEM	Sea Water Potential Temperature
MetO-NWS-PHY- dm -TEM	sea_water_potential_temperature
MetO-NWS-PHY- hi -SAL	so [1e-3]
MetO-NWS-PHY- hi -TMB-SAL	Sea Water Salinity
MetO-NWS-PHY- mm -SAL	sea_water_salinity
MetO-NWS-PHY- dm -BED	bottomT [degrees_C]
	Sea floor potential temperature
	sea_water_potential_temperature_at_sea_floor
MetO-NWS-PHY- dm -MLD	mldst [m]
	Ocean mixed layer thickness defined by density
	ocean_mixed_layer_thickness_defined_by_sigma_theta
MetO-NWS-PHY- hi -SSH	zos [m]
	Sea surface height above geoid
	sea_surface_height_above_geoid

II.3 Details on some parameters

mldst [m]	ocean_mixed_layer_thickness_defined_by_sigma_theta. It is the depth where the
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	density increase compared to density at 3m depth corresponds to a temperature decrease of 0.2°C in local surface conditions.
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.

II.4 Product System Description

Domain	REGIONAL(16°W → 13°E ; 46°N → 63°N) ~1.5km and 33 vertical levels (-5000m to 0)												
Resolution and grid Geographic coverage	Regular grid												
	<table border="1"> <thead> <tr> <th>LON MIN</th> <th>LON MAX</th> <th>LAT MIN</th> <th>LAT MAX</th> <th>XPOINT</th> <th>YPOINT</th> </tr> </thead> <tbody> <tr> <td>16.000°W</td> <td>13.000°E</td> <td>46.000°N</td> <td>62.750°N</td> <td>958</td> <td>1092</td> </tr> </tbody> </table>	LON MIN	LON MAX	LAT MIN	LAT MAX	XPOINT	YPOINT	16.000°W	13.000°E	46.000°N	62.750°N	958	1092
LON MIN	LON MAX	LAT MIN	LAT MAX	XPOINT	YPOINT								
16.000°W	13.000°E	46.000°N	62.750°N	958	1092								
	<p><i>NWS bathymetry (m) showing in yellow the domain of the AMM15 products and in red the domain of the AMM7 product, NORTHWESTSHELF_ANALYSIS_FORECAST_004_001).</i></p>												
Vertical grid	Hybrid S-σ-z-coordinates: the terrain-following coordinates system uses a stretching function to maintain near uniform vertical resolution at the surface. The products are interpolated into a standard z-depth set of levels before dissemination.												

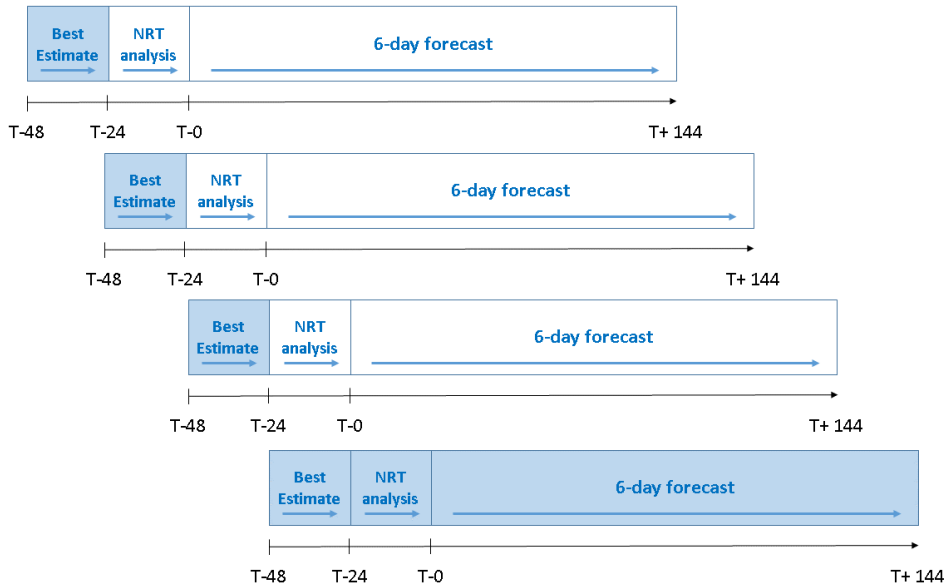
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Model Version	NEMO 3.6
Atmospheric forcing	ECMWF NWP
Assimilation scheme	3D Var FGAT
Assimilated observations	In situ and satellite (L2/L3 products) SST + satellite SLA from CMEMS SL-TAC + temperature and salinity subsurface profiles from GTS and CMEMS INS-TAC
Boundaries conditions	Atlantic lateral boundary: UK Met Office North Atlantic 1/12
	Baltic lateral boundary: BALTICSEA_ANALYSYS_FORECAST_PHY_003_005
	River discharge: daily discharge data from a climatology for 279 rivers (from Global River Discharge Data Base and from data prepared by the UK Centre for Ecology and Hydrology).
Initial conditions	The model run started On 10/01/206 from initial condition from a long simulation..
Bathymetry	EMODnet

II.5 Processing information

II.5.1 Update Time

The products are updated daily at 12:00 UTC.(noon).



Each day the (T-48h,T-24h] and (T-24h,T+00h] analyses are provided along with a 6 days forecast for all products (with the first day of the forecast being for the day of production). An archive of the (T48h,T-24h] Best Estimate analyses will be retained indefinitely (as described in Table above).

II.5.2 Time coverage

The products are available from 01/01/2017.

II.5.3 Time averaging

For the forecast products, hourly instantaneous and daily mean values are available. Hourly instantaneous values are the output from the model at the model time step closest to the hour in UTC. There is no temporal averaging or interpolation performed, and thus the sum of the hourly instantaneous values will not exactly match the time averaged properties. Daily mean values are calculated as means of 25 hours, starting at midnight (UTC) and finishing on the following midnight to remove both diurnal and tidal cycles.

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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 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>

The ftp site is accessed using your CMEMS user name and password and the files are located in the directory called NORTHWESTSHELF_FORECAST_PHY_004_013.

III.3 Download a product through the CMEMS DGF (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#3> will guide you on How to download a product through the CMEMS Web Portal DGF Service.

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IV FILES NOMENCLATURE AND FORMAT

The nomenclature of the downloaded files differs on the basis of the chosen download mechanism **Subsetter** or **CMEMS FTP** and **DGF** service.

IV.1 Nomenclature of files when downloaded through the CMEMS Web Portal **Subsetter** Service

The NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_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 MIS.

The scheme is: **datasetname-nnnnnnnnnnnnn.nc**

where :

- **datasetname:** as described in table 2
- **nnnnnnnnnnnnnn:** 13 digit integer corresponding to the current time (download time) in milliseconds since January 1, 1970 midnight UTC.
- **.nc:** standard NetCDF filename extension.

Example:

MetO-NWS-PHYS-dm-CUR -1303461772348.nc

IV.2 Nomenclature of files when downloaded through the CMEMS DGF Service

The NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_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 MIS.

The scheme is: **datasetname-nnnnnnnnnnnnn.zip**

where :

- **datasetname:** as described in table 2
- **nnnnnnnnnnnnnn:** 13 digit integer corresponding to the current time (download time) in milliseconds since January 1, 1970 midnight UTC.
- **.nc:** standard NetCDF filename extension.

Example:

MetO-NWS-PHYS-dm-CUR -1303461772348.zip

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IV.3 Nomenclature of files when downloaded through the CMEMS FTP Service

The below describes the near-real time forecast products:

- NORTHWESTSHELF_ANALYSIS_FORECAST_PHY_004_013

The files are delivered containing data for:

- * the full spatial coverage of the model domain
- * one variable or variable group
- * a single day data

For example an analysis and five-day forecast is distributed in six daily files, each of which contain a single daily mean or multiple higher-frequency values. The filenames contain fields that identify the model, domain, variable and time of the contents:

metoffice_foam1_amm15_NWS_XXXX_b20180825_dm20180827.nc

- * metoffice: production centre that produced the file
- * foam1: model system and version
- * amm7: model configuration
- * NWS: region
- * XXXX: variable or variable group, see table 4 below
- * b20180825: bulletin (production) date YYYYMMDD
- * dm20180827: dm = daily mean or hi = hourly instantaneous, then data validity date YYYYMMDD

TEM	Potential temperature (including SST)
SAL	Salinity
CUR	Water velocities
SSH	Sea surface height
MLD	Mixed layer depth
BED	Temperature at the sea floor

Table 4: Variable naming convention for the filenames

IV.4 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-

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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.5 File size

DATASET NAME	NAME OF FILE	DIMENSION [MB]
MetO-NWS-PHY-dm-BED	metoffice_foam1_amm15_NWS_BED_b{{yyyymmdd}}_dm{{yyyymmdd}}.nc	0.9
MetO-NWS-PHY-dm-CUR	metoffice_foam1_amm15_NWS_CUR_b{{yyyymmdd}}_dm{{yyyymmdd}}.nc	30
MetO-NWS-PHY-dm-MLD	metoffice_foam1_amm15_NWS_MLD_b{{yyyymmdd}}_dm{{yyyymmdd}}.nc	0.8
MetO-NWS-PHY-dm-SAL	metoffice_foam1_amm15_NWS_SAL_b{{yyyymmdd}}_dm{{yyyymmdd}}.nc	14
MetO-NWS-PHY-dm-TEM	metoffice_foam1_amm15_NWS_TEM_b{{yyyymmdd}}_dm{{yyyymmdd}}.nc	17
MetO-NWS-PHY-hi-CUR	metoffice_foam1_amm15_NWS_CUR_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	752

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MetO-NWS-PHY-hi-SAL	metoffice_foam1_amm15_NWS_SAL_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	342
MetO-NWS-PHY-hi-SSH	metoffice_foam1_amm15_NWS_SSH_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	14
MetO-NWS-PHY-hi-TEM	metoffice_foam1_amm15_NWS_TEM_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	420
MetO-NWS-PHY-hi-TMB-CUR	metoffice_foam1_amm15_NWS_TMB_CUR_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	73
MetO-NWS-PHY-hi-TMB-SAL	metoffice_foam1_amm15_NWS_TMB_SAL_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	33
MetO-NWS-PHY-hi-TMB-TEM	metoffice_foam1_amm15_NWS_TMB_TEM_b{{yyyymmdd}}_hi{{yyyymmdd}}.nc	41

IV.6 Remember: scale_factor & add_offset / missing_value / land mask

Real_Value = (Display_Value X scale_factor) + add_offset

Land mask are equal to “_FillValue” (see variable attribute on NetCDF file).

missing_value = -32768s

IV.7 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...
- ✓ PANOPLY (NASA): <https://www.giss.nasa.gov/tools/panoply/>

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