PRODUCT USER MANUAL
For Global Biogeochemical Analysis and Forecasting Product
GLOBAL_ANALYSIS_FORECAST_BIO_001_014

Issue: 3.1

Contributors: Julien Paul, Coralie Perruche, Angélique Hameau, Abdelali El Moussaoui
CMEMS version scope : Version 3.0
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## CHANGE RECORD

<table>
<thead>
<tr>
<th>Issue</th>
<th>Date</th>
<th>§</th>
<th>Description of Change</th>
<th>Author</th>
<th>Validated By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>22/04/2014</td>
<td>All</td>
<td>Initial version</td>
<td>J. Paul</td>
<td>Y. Drillet, L. Crosnier</td>
</tr>
<tr>
<td>2.0</td>
<td>10/12/2014</td>
<td></td>
<td>Forecast update</td>
<td>A. El Moussaoui</td>
<td>Y. Drillet</td>
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<tr>
<td>2.1</td>
<td>17/12/2014</td>
<td></td>
<td>MyOF modifications</td>
<td>Y. Drillet</td>
<td>Y. Drillet, L. Crosnier</td>
</tr>
<tr>
<td>2.2</td>
<td>May 1 2015</td>
<td>all</td>
<td>Change format to fit CMEMS graphical rules</td>
<td>L. Crosnier</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Feb 2016</td>
<td></td>
<td>Update old MyOcean references/paths</td>
<td>M Drevillon</td>
<td>Y Drillet</td>
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<tr>
<td>3.0</td>
<td>Sep 2016</td>
<td></td>
<td>New release forced by global_analysis_forecast_phys_001_024</td>
<td>J. Paul and C. Perruche</td>
<td>Y. Drillet</td>
</tr>
<tr>
<td>3.1</td>
<td>Sep 2017</td>
<td>§III.4</td>
<td>Grid files now available</td>
<td>J. Paul and C. Perruche</td>
<td>Y. Drillet</td>
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### GLOSSARY AND ABBREVIATIONS

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<tr>
<td>NetCDF</td>
<td>Network Common Data Form</td>
</tr>
<tr>
<td>MO</td>
<td>Mercator Océan</td>
</tr>
<tr>
<td>PUM</td>
<td>Product User Manual</td>
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</table>
I EXECUTIVE SUMMARY

I.1 Description summary of Products covered by this document

This document describes the global ocean biogeochemical analysis and forecast product GLOBAL_ANALYSIS_FORECAST_BIO_001_014.

The product GLOBAL_ANALYSIS_FORECAST_BIO_001_014 is a global biogeochemical simulation forced off-line by daily fields provided by a physical simulation PSY3V3R3 (described hereafter and in Lellouche et al., 2013) until October 2016. From October 19th 2016, it is forced by Copernicus product GLOBAL_ANALYSIS_FORECAST_PHYS_001_024, which is run at 1/12° and degraded offline to ¼°.

The GLOBAL_ANALYSIS_FORECAST_BIO_001_014 product contains the following biogeochemical variables:

- Nitrate
- Phosphate
- Silicate
- Iron
- Dissolved oxygen
- Chlorophyll concentration
- Phytoplankton concentration in carbon
- Primary production

The Global Ocean biogeochemical analysis and forecast system is providing every Thursday noon weekly mean analysis and forecast fields for the time coverage [2 years ago- until real time aggregated with 1-weekly mean forecast updated weekly], on a standard regular grid at 1/2 degree (all variables on the same grid point) with 50 vertical levels. A two-year running window is available on the CMEMS Website.

I.2 History of changes

- On October 19 2016, GLOBAL_ANALYSIS_BIO_001_014 is superseded by GLOBAL_ANALYSIS_FORECAST_BIO_001_014 forced by Copernicus product GLOBAL_ANALYSIS_FORECAST_PHYS_001_024 instead of the Mercator-Ocean system PSY3R3V3.

- On April 8 2015, GLOBAL_ANALYSIS_BIO_001_014 is superseded by GLOBAL_ANALYSIS_FORECAST_BIO_001_014 by adding the weekly mean forecast field updated every week.

- In September 2014, product GLOBAL_ANALYSIS_BIO_001_014 is superseding former product GLOBAL_ANALYSIS_BIO_001_008_a which is removed from catalogue.

The four main differences between GLOBAL_ANALYSIS_BIO_001_008_a and GLOBAL_ANALYSIS_FORECAST_BIO_001_014 are described below:
1. Two additional variables are now delivered in GLOBAL_ANALYSIS_FORECAST_BIO_001_014:
   o mole concentration of Silicate.
   o mole concentration of Dissolved iron.

   The following variables, which were delivered in GLOBAL_ANALYSIS_BIO_001_008_a are still delivered in GLOBAL_ANALYSIS_FORECAST_BIO_001_014:
   o mass_concentration_of_chlorophyll_a_in_sea_water
   o mole_concentration_of_dissolved_molecular_oxygen_in_sea_water
   o mole_concentration_of_nitrate_in_sea_water
   o mole_concentration_of_phosphate_in_sea_water
   o mole_concentration_of_phytoplankton_expressed_as_carbon_in_sea_water
   o net_primary_productivity_of_carbon

2. Analysis is done and provided until real time aggregated with 1-week forecast in GLOBAL_ANALYSIS_FORECAST_BIO_001_014. It used to stop 2 weeks before real time in GLOBAL_ANALYSIS_BIO_001_008_a.

3. Physical forcing fields used in GLOBAL_ANALYSIS_FORECAST_BIO_001_014 are now daily average fields whereas in the previous system GLOBAL_ANALYSIS_BIO_001_008_a they were weekly average fields.

4. As physical forcing, biogeochemical system now uses an ORCA025 (with ¼ degree horizontal resolution) tri-polar grid in GLOBAL_ANALYSIS_FORECAST_BIO_001_014. It used to be an ORCA1 (i.e. with a 1 degree horizontal resolution grid) resulting from a resolution degradation method which was used in GLOBAL_ANALYSIS_BIO_001_008_a. Note that for both products GLOBAL_ANALYSIS_FORECAST_BIO_001_014 and GLOBAL_ANALYSIS_BIO_001_008_a, the product delivered to user is then interpolated on the same standard collocated grid at 1/2 degree. Hence, the user is not impacted by the fact that the biogeochemical system changes its horizontal resolution from 1 degree (for GLOBAL_ANALYSIS_BIO_001_008_a) to ¼ degree (for GLOBAL_ANALYSIS_FORECAST_BIO_001_014) as the final product delivered is interpolated on the same standard collocated grid at 1/2 degree as before, with 50 vertical levels. For more information see the system description below.
II SYSTEM DESCRIPTION

II.1 Numerical Biogeochemical Model: PISCES

The biogeochemical model used is PISCES (Aumont, in prep). It is a model of intermediate complexity designed for global ocean applications (Aumont and Bopp, 2006) and is part of NEMO modeling platform. It has 24 prognostic variables and simulates biogeochemical cycles of oxygen, carbon and the main nutrients controlling phytoplankton growth (nitrate, ammonium, phosphate, silicic acid and iron). The model distinguishes four plankton functional types based on size: two phytoplankton groups (small = nanophytoplankton and large = diatoms) and two zooplankton groups (small = microzooplankton and large = mesozooplankton). Prognostic variables of phytoplankton are total biomass in C, Fe, Si (for diatoms) and chlorophyll and hence the Fe/C, Si/C, Chl/C ratios are variable. For zooplankton, all these ratios are constant and total biomass in C is the only prognostic variable. The bacterial pool is not modeled explicitly. PISCES distinguishes three non-living pools for organic carbon: small particulate organic carbon, big particulate organic carbon and semi-labile dissolved organic carbon. While the C/N/P composition of dissolved and particulate matter is tied to Redfield stoichiometry, the iron, silicon and carbonate contents of the particles are computed prognostically. Next to the three organic detrital pools, carbonate and biogenic siliceous particles are modeled. Besides, the model simulates dissolved inorganic carbon and total alkalinity. In PISCES, phosphate and nitrate + ammonium are linked by constant Redfield ratio (C/N/P = 122/16/1), but cycles of phosphorus and nitrogen are decoupled by nitrogen fixation and denitrification.

The distinction of two phytoplankton size classes, along with the description of multiple nutrient co-limitations allows the model to represent ocean productivity and biogeochemical cycles across major biogeographic ocean provinces (Longhurst, 1998). PISCES has been successfully used in a variety of biogeochemical studies (e.g. Bopp et al. 2005; Gehlen et al. 2006; 2007; Schneider et al. 2008; Steinacher et al. 2010; Tagliabue et al. 2010, Séférian et al., 2013). The biogeochemical model is initialized with World Ocean Atlas 2001 for nitrate, phosphate, oxygen and silicate (Conkright et al. 2002), with GLODAP climatology including anthropogenic CO2 for Dissolved Inorganic Carbon and Alkalinity (Key et al. 2004) and, in the absence of corresponding data products, with model fields for dissolved iron and dissolved organic carbon.

II.2 Forcing of the biogeochemical model

II.2.1 Ocean dynamical forcing

II.2.1.1 Until October 19th 2016

Biogeochemical model PISCES (NEMO3.2) is forced offline by daily fields of Mercator Ocean PSY3V3R3 ¼ degree horizontal resolution physics system (Lellouche et al., 2013). The main features of this dynamical ocean are:

- NEMO 3.1
- Atmospheric forcing from 3-hourly ECMWF analysis products, CORE bulk formulation
- Vertical diffusivity coefficient is computed by solving the TKE equation
- Sea-Ice model: LIM2 with the Elastic-Viscous-Plastic rheology
- Initial conditions: Levitus 2005 climatology for temperature and salinity, Ifremer/Cersat data for sea ice concentration and GLORYS2V1 for sea ice thickness.
- Data assimilation scheme: SAM2v1 (Kalman filter with SEEK formulation) + 3D-Var biases correction in temperature and salinity for the slowly evolving large-scale, both with Incremental Analysis Update.
- Data assimilated: Sea Surface Temperature (Reynolds AVHRR-AMSR 1/4°); Sea Surface Height (Jason2, Cryosat, Saral, HY2); InSitu temperature and salinity vertical profiles from Coriolis Center with Extra Quality control; hybrid MSSH.

A special treatment is done on vertical diffusivity coefficient (Kz): the daily mean is done on Log10(Kz) after a filtering of enhanced convection (Kz increased artificially to 10 m².s⁻¹ when the water column is unstable). The purpose of this Log10 is to average the orders of magnitudes and to give more weight to small values of vertical diffusivity.

Daily ocean dynamical fields used to force PISCES are described more precisely in Table 1.

**II.2.1.2 From October 19th 2016 on**

The physical model of ocean is the Copernicus product GLOBAL_ANALYSIS_FORECAST_PHYS_001_024 coarsened at ¼° resolution. The main features of this dynamical ocean are:
- NEMO 3.1 – ¼° - 50 levels
- Atmospheric forcing from 3-hourly ECMWF analysis products, CORE bulk formulation
- Vertical diffusivity coefficient is computed by solving the TKE equation
- Sea-Ice model: LIM2 with the Elastic-Viscous-Plastic rheology
- Data assimilation scheme: SAM2V1 (Kalman filter with SEEK formulation) + 3D-Var biases correction in temperature and salinity for the slowly evolving large-scale, both with Incremental Analysis Update.
- Data assimilated: Sea Surface Temperature (Reynolds AVHRR-AMSR 1/4°); Sea Surface Height (Jason2, Cryosat, Saral); InSitu temperature and salinity vertical profiles from Coriolis Center with Extra Quality control; sea ice concentration; hybrid MSSH.

See for more details the QUID and PUM documents for product GLOBAL_ANALYSIS_FORECAST_PHYS_001_024.

**II.2.2 Atmospheric forcings**

The atmospheric forcings are daily averages from ECMWF analysis product (CORE bulk formulation). The variable needed to force PISCES biogeochemical model are described in Table 1.

**II.2.3 External sources of nutrients**

Boundary fluxes account for nutrient supply from three different sources: Atmospheric deposition (Aumont et al., 2008), rivers for nutrients, dissolved inorganic carbon and alkalinity (Ludwig et al., 1996) and inputs of Fe from marine sediments. River and dust inputs are balanced with sediment trapping of NO₃, Si and Carbon. An annual and global value of atmospheric carbon dioxide is imposed at sea surface. More details are provided in Table 1.
Table 1: Forcing of PISCES model

II.3 Configuration

The horizontal grid is the standard ORCA025 tri-polar grid (1440 x 1021 grid points). The three poles are located over Antarctica, Central Asia and North Canada. The ¼ degree resolution corresponds to the resolution at the equator. The vertical grid has 50 levels, with a resolution of 1 meter near the surface and 500 meters in the deep ocean.

Outputs are interpolated on a standard collocated grid at 1/2 degree with 50 vertical levels.

The main features of the biogeochemical simulation are summarized in Table 2.
### Initial conditions

- WOA 2001 for NO3, O2, PO4 and Si
- GLODAP with anthropogenic part for DIC and Alkalinity
- A 3000-year PISCES run for DOC and Iron

### Vertical mixing

- TKE 1.5 closure scheme + Average on the Log10(Kz) and filtering of enhanced convection

### Advection

- MUSCL scheme

### Explicit Tracer diffusion

- No

### NetCDF convention

- CF 1.4

*Table 2: Main Characteristics of PISCES model simulation*

### II.4 Data Assimilation

There is **no assimilation** of biogeochemical data in this system.
III PRODUCT DESCRIPTION

III.1 General Information

Product GLOBAL_ANALYSIS_FORECAST_BIO_001_014 produced by Mercator Ocean in Toulouse, France, is a global Ocean Biogeochemical analysis and forecast product at 1/2°. It provides 3D global ocean biogeochemical weekly mean analysis for the past 2 years updated every week aggregated with 1-weekly mean forecast updated weekly. This product includes weekly mean files of dissolved iron, nitrate, phosphate, silicate, dissolved oxygen, chlorophyll concentration, phytoplankton concentration and primary production parameters from the top to the bottom of the Global Ocean on a 1/2° regular grid projection interpolated from the 1/4° ARAKAWA-C native grid. Vertical coverage includes 50 levels ranging from 0 to 5500 meters.

Outputs are delivered as weekly mean files with Netcdf format (CF-1.4 convention). Files are updated weekly.

- Geographical coverage: Global Ocean (180°W-180°E; 80°S-90°N)
- Grid and spatial horizontal resolution: 1/2° ~55.5km at the equator, equirectangular projection
- Spatial vertical resolution: 50 vertical levels (from -5500.0m to 0.0m)
- Temporal resolution: Weekly mean
- Temporal coverage: Analyses (2 years long)
- Update frequency: Weekly update.

III.2 Details of datasets

There is only one dataset: dataset-global-analysis-forecast-bio-001-014

- Dataset containing: mole concentration of Dissolved iron (mmol/m^3), mole concentration of Nitrate (mmol/m^3), mole concentration of Dissolved Oxygen (mmol/m^3), mole concentration of Phosphate (mmol/m^3), mole concentration of Silicate (mmol/m^3), net Primary Productivity of Carbon Per Unit Volume (g/m^3/day), mass concentration of Chlorophyll (mg/m^3), and mole concentration of Phytoplankton expressed as carbon (mmol/m^3).

III.3 Details of variables and units

- Fe: mole concentration of Dissolved iron (mmol/m^3)
- NO3: mole concentration of Nitrate (mmol/m^3)
- O2: mole concentration of Dissolved Oxygen (mmol/m^3)
- PO4: mole concentration of Phosphate (mmol/m^3)
- Si: mole concentration of Silicate (mmol/m^3)
- PP: net Primary Productivity of Carbon Per Unit Volume (g/m^3/day)
- CHL: mass concentration of Chlorophyll (mg/m^3)
- PHYC: mole concentration of Phytoplankton expressed as carbon (mmol/m^3)
III.4 Grid Characteristics and Geographical Projection

Product is displayed on a regular grid with a 1/2° horizontal resolution ~55.5km at the equator, with an equirectangular projection.

Two netcdf files describing the grid are available on CMEMS FTP: GLO-MFC_001_014_coordinates.nc and GLO-MFC_001_014_mask_bathy.nc

III.5 Update Time and Production Cycle

The weekly mean analysis fields are updated weekly aggregated with 1-week forecast, on Thursday at 12:00 a.m.

Production cycle is described in the following schematic:

To run the biogeochemical analysis and forecast along the weeks D0-14 to D0+7, we need physical forcing fields from D0-15 to D0+8...

III.6 Temporal extent of analysis and forecasting stored on delivery mechanism

Temporal coverage stored on delivery mechanism is:

- 2 years of Analysis (running window with a 2 years length)

An Analysis and forecast output file contains 7 days mean fields centered on Saturday at noon.
IV PRODUCT DISTRIBUTION

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

The download mechanisms available for this product are:

- Subsetter
- DirectGetFile
- CMEMS FTP

IV.2 How to download this product?

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

http://marine.copernicus.eu/web/34-products-and-services-faq.php#1

Once registered, the CMEMS FAQ#4 http://marine.copernicus.eu/web/34-products-and-services-faq.php#4 will guide you on how to download a product through the CMEMS Web Portal Subsetter, DirectGetfile and FTP Services

IV.3 How to write and run a script to download this product?

FAQ#4 will guide you on how to proceed:

V FILES NOMENCLATURE AND FORMAT

The nomenclature of the downloaded files differs on the basis of the chosen download mechanism Subsetter, Directgetfile or CMEMS FTP services.

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

GLOBAL_ANALYSIS_FORECAST_BIO_001_014 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 is dataset-global-analysis-forecast-bio-001-014
   . nnnnnnnnnnnnn: 13 digit integer corresponding to the current time (download time) in milliseconds since January 1, 1970 midnight UTC.
   .nc: standard NetCDF filename extension.
   Example:
   dataset-global-analysis-forecast-bio-001-014_1397635486725.nc

V.2 Nomenclature of files when downloaded through the Directgetfile and CMEMS FTP Services

GLOBAL_ANALYSIS_FORECAST_BIO_001_014 files nomenclature when downloaded through the CMEMS Web Portal Directgetfile or FTP is based as follows:
mercatorbiomer4v1r1_glo_mean_{valid date}_R{bul date}.nc
where
   · valid date YYYYMMDD is the validity day of the data in the file
   · bul date YYYYMMDD is the bulletin date the product was produced

V.3 Land mask and missing values

Land mask are equal to “_FillValue” (see variable attribute on NetCDF file). There are no missing values.

V.4 File Format: Netcdf

The products are stored using the NetCDF-CF format version 3.0.

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.

V.5 Structure and semantic of NetCDF maps files

```plaintext
cdf mercatorbiomer4v1r1_glo_mean_20120107_R20120111 {
    dimensions:
    longitude = 720 ;
    latitude = 359 ;
    depth = 50 ;
    time_counter = UNLIMITED ; // (1 currently)

    variables:
    float longitude(longitude) ;
        longitude:valid_min = -180.f ;
        longitude:valid_max = 179.5f ;
        longitude:step = 0.5f ;
        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 = -89.f ;
        latitude:valid_max = 90.f ;
        latitude:step = 0.5f ;
```
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_counter(time_counter);
time_counter:long_name = "Time (hours since 1950-01-01)"

time_counter:standard_name = "time_counter";
time_counter:calendar = "gregorian"

time_counter:valid_min = 543636.f;
time_counter:valid_max = 543636.f;
time_counter:units = "hours since 1950-01-01 00:00:00"

time_counter:axis = "T"

float Fe(time_counter, depth, latitude, longitude);
Fe:long_name = "Mole Concentration of Dissolved iron in Sea Water"
Fe:standard_name = "mole_concentration_of_dissolved_iron_in_sea_water"
Fe:units = "mmol/m^3"
Fe:unit_long = "millimoles of Iron per cubic meter"
Fe_:FillValue = 9.96921e+36f
Fe:valid_min = 2.978516e-06f
Fe:valid_max = 0.03174923f

float NO3(time_counter, depth, latitude, longitude);
NO3:long_name = "Mole Concentration of Nitrate in Sea Water"
NO3:standard_name = "mole_concentration_of_nitrate_in_sea_water"
NO3:units = "mmol/m^3"
NO3:unit_long = "millimoles of Nitrate per cubic meter"
NO3:FillValue = 9.96921e+36f
NO3:valid_min = 5.045193e-10f
NO3:valid_max = 91.88657f;
float O2(time_counter, depth, latitude, longitude);
    O2:long_name = "Mole Concentration of Dissolved Oxygen in Sea Water";
    O2:standard_name = "mole_concentration_of_dissolved_molecular_oxygen_in_sea_water";
    O2:units = "mmol/m^3";
    O2:valid_min = 1.11173e-10f;
    O2:valid_max = 548.7545f;
float PO4(time_counter, depth, latitude, longitude);
    PO4:long_name = "Mole Concentration of Phosphate in Sea Water";
    PO4:standard_name = "mole_concentration_of_phosphate_in_sea_water";
    PO4:units = "mmol/m^3";
    PO4:valid_min = 5.379255e-06f;
    PO4:valid_max = 5.9552951f;
float Si(time_counter, depth, latitude, longitude);
    Si:long_name = "Mole Concentration of Silicate in Sea Water";
    Si:standard_name = "mole_concentration_of_silicate_in_sea_water";
    Si:units = "mmol/m^3";
    Si:valid_min = 0.07347398f;
    Si:valid_max = 345.1436f;
float PP(time_counter, depth, latitude, longitude);
    PP:long_name = "Net Primary Productivity of Carbon Per Unit Volume";
    PP:standard_name = "net_primary_production_of_biomass_expressed_as_carbon_per_unit_volume_in_sea_water";
    PP:units = "g/m^3/day";
    PP:valid_min = 2.305284e-10f;
    PP:valid_max = 2.112171f;
float CHL(time_counter, depth, latitude, longitude);
    CHL:long_name = "Mass Concentration of Chlorophyll in Sea Water";
CHL:standard_name = "mass_concentration_of_chlorophyll_in_sea_water";
CHL:units = "mg/m^3";
CHL:unit_long = "milligram of Chlorophyll per cubic meter";
CHL:_FillValue = 9.96921e+36f;
CHL:valid_min = 0.004345424f;
CHL:valid_max = 36.46511f;

float PHYC(time_counter, depth, latitude, longitude);

PHYC:long_name = "Mole Concentration of Phytoplankton expressed as carbon in sea water";
PHYC:standard_name = "mole_concentration_of_phytoplankton_expressed_as_carbon_in_sea_water";
PHYC:units = "mmol/m^3";
PHYC:unit_long = "millimoles of Carbon per cubic meter";
PHYC:_FillValue = 9.96921e+36f;
PHYC:valid_min = 0.01995402f;
PHYC:valid_max = 149.5936f;

// global attributes:
:title = "weekly mean fields from Global Ocean Biogeochemistry Analysis";
:easting = "longitude";
:northing = "latitude";
:history = "2014/04/11 22:54:26 MERCATOR OCEAN Netcdf creation";
:source = "MERCATOR BIOMER4V1R1";
:institution = "MERCATOR OCEAN";
:references = "http://www.mercator-ocean.fr";
:comment = "Class1 metrics";
:Conventions = "CF-1.4";
:domain_name = "GLO";
:field_type = "mean";
:field_date = "2012-01-04 00:00:00";
:field_julian_date = 22648.f;
:julian_day_unit = "days since 1950-01-01 00:00:00";
:forecast_range = "7-day average";
:forecast_type = "hindcast";
:bulletin_date = "2012-01-11 00:00:00";
:bulletin_type = "operational";
:longitude_min = -180.f;
:longitude_max = 180.f ;
:latitude_min = -89.f ;
:latitude_max = 90.f ;
:z_min = 0.494025f ;
:z_max = 5727.917f ;

)}
VI REFERENCES

Aumont O.: PISCES. In prep (For Geoscientific Model Development).


