

# CMIP6 Model Documentation

<b>Institute:</b>	NIMS-KMA
<b>Model:</b>	UKESM1-0-LL
<b>Topic:</b>	Ocean Biogeochemistry
<b>Doc. Generated:</b>	2018-10-04
<b>Doc. Seeded From:</b>	N/A
<b>Specialization Version:</b>	1.1.0
<b>Further Info:</b>	<a href="https://es-doc.org/cmip6">https://es-doc.org/cmip6</a>
<b>Note:</b>	* indicates a required property

# Documentation Contents

<b>1</b>	<b>Key Properties</b>	<b>1</b>
1.1	Key Properties . . . . .	1
1.2	Time Stepping Framework . . . . .	2
1.3	Passive Tracers Transport . . . . .	2
1.4	Biology Sources Sinks . . . . .	2
1.5	Transport Scheme . . . . .	3
1.6	Boundary Forcing . . . . .	3
1.7	Gas Exchange . . . . .	4
1.8	Carbon Chemistry . . . . .	7
1.9	Tuning Applied . . . . .	8
<b>2</b>	<b>Tracers</b>	<b>9</b>
2.1	Tracers . . . . .	9
2.2	Ecosystem . . . . .	10
2.3	Phytoplankton . . . . .	10
2.4	Zooplankton . . . . .	11
2.5	Disolved Organic Matter . . . . .	12
2.6	Particules . . . . .	12
2.7	Dic Alkalinity . . . . .	13

# 1 Key Properties

*Ocean Biogeochemistry key properties*

## 1.1 Key Properties

*Ocean Biogeochemistry key properties*

### 1.1.1 Name \*

*Name of ocnbgchem model code*

**Enter TEXT:**

### 1.1.2 Keywords \*

*Keywords associated with ocnbgchem model code*

**Enter COMMA SEPERATED list:**

### 1.1.3 Overview \*

*Overview of ocnbgchem model.*

**Enter TEXT:**

### 1.1.4 Model Type \*

*Type of ocean biogeochemistry model*

**Select SINGLE option:**

- ☐ Geochemical - No living compartments
- ☐ NPZD - No plankton types
- ☐ PFT - Several plankton types
- ☐ Other - please specify:

### 1.1.5 Elemental Stoichiometry \*

*Describe elemental stoichiometry (fixed, variable, mix of the two)*

**Select SINGLE option:**

- ☐ Fixed - Fixed stoichiometry
- ☐ Variable - Variable stoichiometry
- ☐ Mix of both - Both fixed and mixed stoichiometry

### 1.1.6 Elemental Stoichiometry Details \*

*Describe which elements have fixed/variable stoichiometry*

**Enter COMMA SEPERATED list:**

### 1.1.7 Prognostic Variables \*

*List of all prognostic tracer variables in the ocean biogeochemistry component*

**Enter COMMA SEPERATED list:**

### 1.1.8 Diagnostic Variables \*

*List of all diagnostic tracer variables in the ocean biogeochemistry component (derived from prognostic variables)*

**Enter COMMA SEPERATED list:**

### 1.1.9 Damping

*Describe any tracer damping used (such as artificial correction or relaxation to climatology,...)*

**Enter TEXT:**

## 1.2 Time Stepping Framework

*Time stepping framework for ocean biogeochemistry*

### 1.2.1 Overview

*Overview of time stepping framework for ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

## 1.3 Passive Tracers Transport

*Time stepping method for passive tracers transport in ocean biogeochemistry*

### 1.3.1 Method \*

*Time stepping framework for passive tracers*

**Select SINGLE option:**

- ☐ Use ocean model transport time step
- ☐ Use specific time step

### 1.3.2 Timestep If Not From Ocean

*Time step for passive tracers (if different from ocean)*

**Enter INTEGER value:**

## 1.4 Biology Sources Sinks

*Time stepping framework for biology sources and sinks in ocean biogeochemistry*

#### 1.4.1 Method \*

*Time stepping framework for biology sources and sinks*

Select SINGLE option:

- ☐ Use ocean model transport time step
- ☐ Use specific time step

#### 1.4.2 Timestep If Not From Ocean

*Time step for biology sources and sinks (if different from ocean)*

Enter INTEGER value:

### 1.5 Transport Scheme

*Transport scheme in ocean biogeochemistry*

#### 1.5.1 Overview

*Overview of transport scheme in ocean biogeochemistry in ocnbgchem model.*

Enter TEXT:

#### 1.5.2 Type \*

*Type of transport scheme*

Select SINGLE option:

- ☐ Offline
- ☐ Online

#### 1.5.3 Scheme \*

*Transport scheme used*

Select SINGLE option:

- ☐ Use that of ocean model
- ☐ Other - please specify:

#### 1.5.4 Use Different Scheme

*Describe transport scheme if different than that of ocean model*

Enter TEXT:

### 1.6 Boundary Forcing

*Properties of biogeochemistry boundary forcing*

### 1.6.1 Overview

*Overview of properties of biogeochemistry boundary forcing in ocnbgchem model.*

**Enter TEXT:**

### 1.6.2 Atmospheric Deposition \*

*Describe how atmospheric deposition is modeled*

**Select SINGLE option:**

- ☐ From file (climatology)
- ☐ From file (interannual variations)
- ☐ From Atmospheric Chemistry model

### 1.6.3 River Input \*

*Describe how river input is modeled*

**Select SINGLE option:**

- ☐ From file (climatology)
- ☐ From file (interannual variations)
- ☐ From Land Surface model

### 1.6.4 Sediments From Boundary Conditions

*List which sediments are specified from boundary condition*

**Enter COMMA SEPERATED list:**

### 1.6.5 Sediments From Explicit Model

*List which sediments are specified from explicit sediment model*

**Enter COMMA SEPERATED list:**

## 1.7 Gas Exchange

*Properties of gas exchange in ocean biogeochemistry*

### 1.7.1 Overview

*Overview of properties of gas exchange in ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

### 1.7.2 CO2 Exchange Present \*

*Is CO2 gas exchange modeled ?*

**Select either TRUE or FALSE:**

- ☐ True
- ☐ False

### 1.7.3 CO2 Exchange Type

*Describe CO2 gas exchange*

Select SINGLE option:

- ☐ OMIP protocol
- ☐ Other - please specify:

### 1.7.4 O2 Exchange Present \*

*Is O2 gas exchange modeled ?*

Select either TRUE or FALSE:

- ☐ True      ☐ False

### 1.7.5 O2 Exchange Type

*Describe O2 gas exchange*

Select SINGLE option:

- ☐ OMIP protocol
- ☐ Other - please specify:

### 1.7.6 DMS Exchange Present \*

*Is DMS gas exchange modeled ?*

Select either TRUE or FALSE:

- ☐ True      ☐ False

### 1.7.7 DMS Exchange Type

*Specify DMS gas exchange scheme type*

Enter TEXT:

### 1.7.8 N2 Exchange Present \*

*Is N2 gas exchange modeled ?*

Select either TRUE or FALSE:

- ☐ True      ☐ False

### 1.7.9 N2 Exchange Type

*Specify N2 gas exchange scheme type*

Enter TEXT:

#### 1.7.10 N2O Exchange Present \*

*Is N2O gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

#### 1.7.11 N2O Exchange Type

*Specify N2O gas exchange scheme type*

Enter TEXT:

#### 1.7.12 CFC11 Exchange Present \*

*Is CFC11 gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

#### 1.7.13 CFC11 Exchange Type

*Specify CFC11 gas exchange scheme type*

Enter TEXT:

#### 1.7.14 CFC12 Exchange Present \*

*Is CFC12 gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

#### 1.7.15 CFC12 Exchange Type

*Specify CFC12 gas exchange scheme type*

Enter TEXT:

#### 1.7.16 SF6 Exchange Present \*

*Is SF6 gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

#### 1.7.17 SF6 Exchange Type

*Specify SF6 gas exchange scheme type*

Enter TEXT:



### 1.7.18 $^{13}\text{CO}_2$ Exchange Present \*

*Is  $^{13}\text{CO}_2$  gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

### 1.7.19 $^{13}\text{CO}_2$ Exchange Type

*Specify  $^{13}\text{CO}_2$  gas exchange scheme type*

Enter TEXT:

### 1.7.20 $^{14}\text{CO}_2$ Exchange Present \*

*Is  $^{14}\text{CO}_2$  gas exchange modeled ?*

Select either TRUE or FALSE:

☐ True ☐ False

### 1.7.21 $^{14}\text{CO}_2$ Exchange Type

*Specify  $^{14}\text{CO}_2$  gas exchange scheme type*

Enter TEXT:

### 1.7.22 Other Gases

*Specify any other gas exchange*

Enter TEXT:

## 1.8 Carbon Chemistry

*Properties of carbon chemistry biogeochemistry*

### 1.8.1 Overview

*Overview of properties of carbon chemistry biogeochemistry in ocnbgchem model.*

Enter TEXT:

### 1.8.2 Type \*

*Describe how carbon chemistry is modeled*

Select SINGLE option:

☐ OMIP protocol  
☐ Other protocol

### 1.8.3 Ph Scale

*If NOT OMIP protocol, describe pH scale.*

**Select SINGLE option:**

- ☐ Sea water
- ☐ Free
- ☐ Other - please specify:

### 1.8.4 Constants If Not OMIP

*If NOT OMIP protocol, list carbon chemistry constants.*

**Enter COMMA SEPERATED list:**

## 1.9 Tuning Applied

*Tuning methodology for ocean biogeochemistry component*

### 1.9.1 Overview

*Overview of tuning methodology for ocean biogeochemistry component in ocnbgchem model.*

**Enter TEXT:**

### 1.9.2 Description \*

*General overview description of tuning: explain and motivate the main targets and metrics retained. and Document the relative weight given to climate performance metrics versus process oriented metrics, and and on the possible conflicts with parameterization level tuning. In particular describe any struggle and with a parameter value that required pushing it to its limits to solve a particular model deficiency.*

**Enter TEXT:**

### 1.9.3 Global Mean Metrics Used

*List set of metrics of the global mean state used in tuning model/component*

**Enter COMMA SEPERATED list:**

### 1.9.4 Regional Metrics Used

*List of regional metrics of mean state used in tuning model/component*

**Enter COMMA SEPERATED list:**

### 1.9.5 Trend Metrics Used

*List observed trend metrics used in tuning model/component*

**Enter COMMA SEPERATED list:**

## 2 Tracers

*Ocean biogeochemistry tracers*

### 2.1 Tracers

*Ocean biogeochemistry tracers*

#### 2.1.1 Name

*Commonly used name for the tracers in ocnbgchem model.*

**Enter TEXT:**

#### 2.1.2 Overview

*Overview of ocean biogeochemistry tracers in ocnbgchem model.*

**Enter TEXT:**

#### 2.1.3 Sulfur Cycle Present \*

*Is sulfur cycle modeled ?*

**Select either TRUE or FALSE:**

☐ True ☐ False

#### 2.1.4 Nutrients Present \*

*List nutrient species present in ocean biogeochemistry model*

**Select MULTIPLE options:**

- ☐ Nitrogen (N)
- ☐ Phosphorous (P)
- ☐ Silicon (S)
- ☐ Iron (Fe)
- ☐ Other - please specify:

#### 2.1.5 Nitrous Species If N

*If nitrogen present, list nitrous species.*

**Select MULTIPLE options:**

- ☐ Nitrates (NO3)
- ☐ Amonium (NH4)
- ☐ Other - please specify:

### 2.1.6 Nitrous Processes If N

*If nitrogen present, list nitrous processes.*

**Select MULTIPLE options:**

- ☐ Dentrification
- ☐ N fixation
- ☐ Other - please specify:

## 2.2 Ecosystem

*Ecosystem properties in ocean biogeochemistry*

### 2.2.1 Overview

*Overview of ecosystem properties in ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

### 2.2.2 Upper Trophic Levels Definition \*

*Describe how upper trophic levels are defined in model (e.g. based on size)*

**Enter TEXT:**

### 2.2.3 Upper Trophic Levels Treatment \*

*Describe how upper trophic levels are treated in model*

**Enter TEXT:**

## 2.3 Phytoplankton

*Phytoplankton properties in ocean biogeochemistry*

### 2.3.1 Type \*

*Type of phytoplankton*

**Select SINGLE option:**

- ☐ None
- ☐ Generic
- ☐ PFT including size based (specify both below) - Plankton functional type including size based
- ☐ Size based only (specify below)
- ☐ PFT only (specify below)

### 2.3.2 Pft

*Phytoplankton functional types (PFT) (if applicable)*

**Select MULTIPLE options:**

- ☐ Diatoms
- ☐ Nfixers
- ☐ Calcifiers
- ☐ Other - please specify:

### 2.3.3 Size Classes

*Phytoplankton size classes (if applicable)*

**Select MULTIPLE options:**

- ☐ Microphytoplankton
- ☐ Nanophytoplankton
- ☐ Picophytoplankton
- ☐ Other - please specify:

## 2.4 Zooplankton

*Zooplankton properties in ocean biogeochemistry*

### 2.4.1 Type \*

*Type of zooplankton*

**Select SINGLE option:**

- ☐ None
- ☐ Generic
- ☐ Size based (specify below)
- ☐ Other - please specify:

### 2.4.2 Size Classes

*Zooplankton size classes (if applicable)*

**Select MULTIPLE options:**

- ☐ Microzooplankton
- ☐ Mesozooplankton
- ☐ Other - please specify:

## 2.5 Dissolved Organic Matter

*Dissolved organic matter properties in ocean biogeochemistry*

### 2.5.1 Overview

*Overview of dissolved organic matter properties in ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

### 2.5.2 Bacteria Present \*

*Is there bacteria representation ?*

**Select either TRUE or FALSE:**

☐ True ☐ False

### 2.5.3 Lability \*

*Describe treatment of lability in dissolved organic matter*

**Select SINGLE option:**

- ☐ None
- ☐ Labile - Less than a few days
- ☐ Semi-labile - Few days to a few years
- ☐ Refractory - Over a few years
- ☐ Other - please specify:

## 2.6 Particles

*Particulate carbon properties in ocean biogeochemistry*

### 2.6.1 Overview

*Overview of particulate carbon properties in ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

### 2.6.2 Method \*

*How is particulate carbon represented in ocean biogeochemistry?*

**Select MULTIPLE options:**

- ☐ Diagnostic
- ☐ Diagnostic (Martin profile)
- ☐ Diagnostic (Balast)
- ☐ Prognostic

☐ Other - please specify:

### 2.6.3 Types If Prognostic

*If prognostic, type(s) of particulate matter taken into account*

**Select MULTIPLE options:**

- ☐ POC
- ☐ PIC (calcite)
- ☐ PIC (aragonite)
- ☐ BSi
- ☐ Other - please specify:

### 2.6.4 Size If Prognostic

*If prognostic, describe if a particle size spectrum is used to represent distribution of particles in water volume*

**Select SINGLE option:**

- ☐ No size spectrum used
- ☐ Full size spectrum
- ☐ Discrete size classes (specify which below)

### 2.6.5 Size If Discrete

*If prognostic and discrete size, describe which size classes are used*

**Enter TEXT:**

### 2.6.6 Sinking Speed If Prognostic

*If prognostic, method for calculation of sinking speed of particles*

**Select SINGLE option:**

- ☐ Constant
- ☐ Function of particle size
- ☐ Function of particle type (balast)
- ☐ Other - please specify:

## 2.7 Dic Alkalinity

*DIC and alkalinity properties in ocean biogeochemistry*

### 2.7.1 Overview

*Overview of dic and alkalinity properties in ocean biogeochemistry in ocnbgchem model.*

**Enter TEXT:**

### 2.7.2 Carbon Isotopes \*

*Which carbon isotopes are modelled (C13, C14)?*

**Select MULTIPLE options:**

☐ C13

☐ C14)

### 2.7.3 Abiotic Carbon \*

*Is abiotic carbon modelled ?*

**Select either TRUE or FALSE:**

☐ True

☐ False

### 2.7.4 Alkalinity \*

*How is alkalinity modelled ?*

**Select SINGLE option:**

☐ Prognostic

☐ Diagnostic)