

# CMIP6 Model Documentation

<b>Institute:</b>	MOHC
<b>Model:</b>	UKESM1-0-LL
<b>Topic:</b>	Top Level
<b>Doc. Generated:</b>	2018-02-06
<b>Specialization Version:</b>	0.5.0
<b>Further Info:</b>	<a href="https://es-doc.org/cmip6">https://es-doc.org/cmip6</a> <a href="https://specializations.es-doc.org/cmip6">https://specializations.es-doc.org/cmip6</a>

# Documentation Contents

<b>1</b>	<b>Key Properties</b>	<b>1</b>
1.1	Key Properties . . . . .	1
1.2	Flux Correction . . . . .	1
1.3	Genealogy . . . . .	1
1.4	Software Properties . . . . .	2
1.5	Coupling . . . . .	3
1.6	Tuning Applied . . . . .	4
1.7	Heat . . . . .	5
1.8	Fresh Water . . . . .	6
1.9	Salt . . . . .	8
1.10	Momentum . . . . .	8
<b>2</b>	<b>Radiative Forcings</b>	<b>9</b>
2.1	Radiative Forcings . . . . .	9
2.2	CO <sub>2</sub> . . . . .	9
2.3	CH <sub>4</sub> . . . . .	10
2.4	N <sub>2</sub> O . . . . .	10
2.5	Tropospheric O <sub>3</sub> . . . . .	11
2.6	Stratospheric O <sub>3</sub> . . . . .	12
2.7	CFC . . . . .	12
2.8	SO <sub>4</sub> . . . . .	13
2.9	Black Carbon . . . . .	14
2.10	Organic Carbon . . . . .	15
2.11	Nitrate . . . . .	15
2.12	Cloud Albedo Effect . . . . .	16
2.13	Cloud Lifetime Effect . . . . .	17
2.14	Dust . . . . .	18
2.15	Tropospheric Volcanic . . . . .	19
2.16	Stratospheric Volcanic . . . . .	20
2.17	Sea Salt . . . . .	22
2.18	Land Use . . . . .	22
2.19	Solar . . . . .	23

# 1 Key Properties

*Key properties of the model*

## 1.1 Key Properties

*Key properties of the model*

### 1.1.1 Model Overview

*Top level overview of coupled model*

**Spec. ID:** cmip6.toplevel.key\_properties.model\_overview

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.1.2 Model Name

*Name of coupled model.*

**Spec. ID:** cmip6.toplevel.key\_properties.model\_name

**Is Required ?** TRUE

**Enter TEXT value:**

## 1.2 Flux Correction

*Flux correction properties of the model*

### 1.2.1 Details

*Describe if/how flux corrections are applied in the model*

**Spec. ID:** cmip6.toplevel.key\_properties.flux\_correction.details

**Is Required ?** TRUE

**Enter TEXT value:**

## 1.3 Genealogy

*Genealogy and history of the model*

### 1.3.1 Year Released

*Year the model was released*

**Spec. ID:** cmip6.toplevel.key\_properties.genealogy.year\_released

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.3.2 CMIP3 Parent

*CMIP3 parent if any*

**Spec. ID:** cmip6.toplevel.key\_properties.genealogy.cmip3\_parent

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.3.3 CMIP5 Parent

*CMIP5 parent if any*

**Spec. ID:** cmip6.toplevel.key\_properties.genealogy.cmip5\_parent

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.3.4 Previous Name

*Previously known as*

**Spec. ID:** cmip6.toplevel.key\_properties.genealogy.previous\_name

**Is Required ?** FALSE

**Enter TEXT value:**

## 1.4 Software Properties

*Software properties of model*

### 1.4.1 Repository

*Location of code for this component.*

**Spec. ID:** cmip6.toplevel.key\_properties.software\_properties.repository

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.4.2 Code Version

*Code version identifier.*

**Spec. ID:** cmip6.toplevel.key\_properties.software\_properties.code\_version

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.4.3 Code Languages

*Code language(s).*

**Spec. ID:** cmip6.toplevel.key\_properties.software\_properties.code\_languages

**Is Required ?** FALSE

Enter TEXT value(s):

#### 1.4.4 Components Structure

*Describe how model realms are structured into independent software components (coupled via a coupler) and internal software components.*

**Spec. ID:** cmip6.toplevel.key\_properties.software\_properties.components\_structure

**Is Required ?** FALSE

Enter TEXT value:

#### 1.4.5 Coupler

*Overarching coupling framework for model.*

**Spec. ID:** cmip6.toplevel.key\_properties.software\_properties.coupler

**Is Required ?** FALSE

Select value:

- ☐ OASIS - The OASIS coupler - prior to OASIS-MCT
- ☐ OASIS3-MCT - The MCT variant of the OASIS coupler
- ☐ ESMF - Vanilla Earth System Modelling Framework
- ☐ NUOPC - National Unified Operational Prediction Capability variant of ESMF
- ☐ Bespoke - Customised coupler developed for this model
- ☐ Unknown - It is not known what/if-a coupler is used
- ☐ None - No coupler is used
- ☐ Other - please specify:

### 1.5 Coupling

#### 1.5.1 Overview

*Overview of coupling in the model*

**Spec. ID:** cmip6.toplevel.key\_properties.coupling.overview

**Is Required ?** TRUE

Enter TEXT value:

#### 1.5.2 Atmosphere Double Flux

*Is the atmosphere passing a double flux to the ocean and sea ice (as opposed to a single one)xxx?*

**Spec. ID:** cmip6.toplevel.key\_properties.coupling.atmosphere\_double\_flux

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

### 1.5.3 Atmosphere Fluxes Calculation Grid

*Where are the air-sea fluxes calculated*

**Spec. ID:** cmip6.toplevel.key\_properties.coupling.atmosphere\_fluxes\_calculation\_grid

**Is Required ?** FALSE

**Select value:**

☐ Atmosphere grid  
☐ Ocean grid  
☐ Specific coupler grid  
☐ Other - please specify:

### 1.5.4 Atmosphere Relative Winds

*Are relative or absolute winds used to compute the fluxes? I.e. do ocean surface currents enter the wind stress calculation?*

**Spec. ID:** cmip6.toplevel.key\_properties.coupling.atmosphere\_relative\_winds

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

## 1.6 Tuning Applied

*Tuning methodology for model*

### 1.6.1 Description

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

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.description

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.6.2 Global Mean Metrics Used

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

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.global\_mean\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

### 1.6.3 Regional Metrics Used

*List of regional metrics/diagnostics of mean state (e.g THC, AABW, regional means etc) used in tuning model/component*

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.regional\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

### 1.6.4 Trend Metrics Used

*List observed trend metrics/diagnostics used in tuning model/component (such as 20th century)*

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.trend\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

### 1.6.5 Energy Balance

*Describe how energy balance was obtained in the full system: in the various components independently or at the components coupling stage???*

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.energy\_balance

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.6.6 Fresh Water Balance

*Describe how fresh\_water balance was obtained in the full system: in the various components independently or at the components coupling stage???*

**Spec. ID:** cmip6.toplevel.key\_properties.tuning\_applied.fresh\_water\_balance

**Is Required ?** TRUE

**Enter TEXT value:**

## 1.7 Heat

*Global heat conservation properties of the model*

### 1.7.1 Global

*Describe if/how heat is conserved globally*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.global

**Is Required ?** TRUE

**Enter TEXT value:**

### **1.7.2 Atmos Ocean Interface**

*Describe if/how heat is conserved at the atmosphere/ocean coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.atmos\_ocean\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### **1.7.3 Atmos Land Interface**

*Describe if/how heat is conserved at the atmosphere/land coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.atmos\_land\_interface

**Is Required ?** TRUE

**Enter TEXT value:**

### **1.7.4 Atmos Sea-ice Interface**

*Describe if/how heat is conserved at the atmosphere/sea-ice coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.atmos\_sea-ice\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### **1.7.5 Ocean Seaice Interface**

*Describe if/how heat is conserved at the ocean/sea-ice coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.ocean\_seaice\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### **1.7.6 Land Ocean Interface**

*Describe if/how heat is conserved at the land/ocean coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.heat.land\_ocean\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

## **1.8 Fresh Water**

*Global fresh water conservation properties of the model*



### 1.8.1 Global

*Describe if/how fresh\_water is conserved globally*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.global

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.8.2 Atmos Ocean Interface

*Describe if/how fresh\_water is conserved at the atmosphere/ocean coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.atmos\_ocean\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.3 Atmos Land Interface

*Describe if/how fresh water is conserved at the atmosphere/land coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.atmos\_land\_interface

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.8.4 Atmos Sea-ice Interface

*Describe if/how fresh water is conserved at the atmosphere/sea-ice coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.atmos\_sea-ice\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.5 Ocean Seaice Interface

*Describe if/how fresh water is conserved at the ocean/sea-ice coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.ocean\_seaice\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.6 Runoff

*Describe how runoff is distributed and conserved*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.runoff

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.7 Iceberg Calving

*Describe if/how iceberg calving is modeled and conserved*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.iceberg\_calving

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.8 Endoreic Basins

*Describe if/how endoreic basins (no ocean access) are treated*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.endoreic\_basins

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.8.9 Snow Accumulation

*Describe how snow accumulation over land and over sea-ice is treated*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.fresh\_water.snow\_accumulation

**Is Required ?** FALSE

**Enter TEXT value:**

## 1.9 Salt

*Global salt conservation properties of the model*

### 1.9.1 Ocean Seaice Interface

*Describe if/how salt is conserved at the ocean/sea-ice coupling interface*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.salt.ocean\_seaice\_interface

**Is Required ?** FALSE

**Enter TEXT value:**

## 1.10 Momentum

*Global momentum conservation properties of the model*

### 1.10.1 Details

*Describe if/how momentum is conserved in the model*

**Spec. ID:** cmip6.toplevel.key\_properties.conservations.momentum.details

**Is Required ?** FALSE

**Enter TEXT value:**

## 2 Radiative Forcings

*Radiative forcings of the model for historical and scenario (aka Table 12.1 IPCC AR5)*

### 2.1 Radiative Forcings

*Radiative forcings of the model for historical and scenario (aka Table 12.1 IPCC AR5)*

#### 2.1.1 Overview

*Overview of radiative forcings (GHG and aerosols) implementation in model*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.overview

**Is Required ?** TRUE

**Enter TEXT value:**

### 2.2 CO2

*Carbon dioxide forcing*

#### 2.2.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.co2.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

#### 2.2.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.co2.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.3 CH4

### *Methane forcing*

#### 2.3.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.ch4.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

#### 2.3.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.ch4.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.4 N2O

### *Nitrous oxide forcing*

#### 2.4.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.n2o.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data

- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.4.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.n2o.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.5 Tropospheric O3

*Tropospheric ozone forcing*

### 2.5.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.tropospheric\_o3.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.5.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.tropospheric\_o3.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.6 Stratospheric O3

*Stratospheric ozone forcing*

### 2.6.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.stratospheric\_o3.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.6.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.stratospheric\_o3.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.7 CFC

*Ozone-depleting and non-ozone-depleting fluorinated gases forcing*

### 2.7.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.cfc.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data

- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.7.2 Equivalence Concentration

*Details of any equivalence concentrations used*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.cfc.equivalence\_concentration

**Is Required ?** TRUE

**Select value:**

- ☐ N/A - Not applicable (CFCs not included or emissions and concentrations determined by the model state)
- ☐ Option 1 - CFCs, including CFC-12, are provided as actual concentrations
- ☐ Option 2 - CFC-12 is provided as actual concentrations and any other gases are provided as an equivalence concentration of CFC-11
- ☐ Option 3 - Ozone depleting gases, including CFC-12, are provided as an equivalence concentration of CFC-12 and all other fluorinated gases are provided as an equivalence concentration of HFC-134a
- ☐ Other - please specify:

### 2.7.3 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.greenhouse\_gases.cfc.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.8 SO4

*SO4 aerosol forcing*

### 2.8.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.so4.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included

- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

## 2.8.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.so4.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.9 Black Carbon

*Black carbon aerosol forcing*

### 2.9.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.black\_carbon.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.9.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*



**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.black\_carbon.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.10 Organic Carbon

*Organic carbon aerosol forcing*

### 2.10.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.organic\_carbon.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.10.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.organic\_carbon.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.11 Nitrate

*Nitrate forcing*

### 2.11.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.nitrate.provision

**Is Required ?** TRUE

Select value(s):

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.11.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.nitrate.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.12 Cloud Albedo Effect

*Cloud albedo effect forcing (RFaci)*

### 2.12.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_albedo\_effect.provision

**Is Required ?** TRUE

Select value(s):

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.12.2 Aerosol Effect On Ice Clouds

*Radiative effects of aerosols on ice clouds are represented:xxx?*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_albedo\_effect.aerosol\_effect\_on\_ice\_clouds

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

### 2.12.3 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_albedo\_effect.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.13 Cloud Lifetime Effect

*Cloud lifetime effect forcing (ERFaci)*

### 2.13.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_lifetime\_effect.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.13.2 Aerosol Effect On Ice Clouds

*Radiative effects of aerosols on ice clouds are represented:xxx?*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_lifetime\_effect.aerosol\_effect\_on\_ice\_clouds

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

### 2.13.3 RFaci From Sulfate Only

*Radiative forcing from aerosol cloud interactions from sulfate aerosol onlyxxx?*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_lifetime\_effect.rfaci\_from\_sulfate\_only

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

### 2.13.4 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.cloud\_lifetime\_effect.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.14 Dust

*Dust forcing*

### 2.14.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.dust.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.14.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.dust.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.15 Tropospheric Volcanic

*Tropospheric volcanic forcing*

### 2.15.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.tropospheric\_volcanic.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.15.2 Historical Explosive Volcanic Aerosol Implementation

*How explosive volcanic aerosol is implemented in historical simulations*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.tropospheric\_volcanic.historical\_explosive\_volcanic\_aerosol\_implementation

**Is Required ?** TRUE

**Select value:**

- ☐ Type A - Explosive volcanic aerosol returns rapidly to zero (or near-zero) background.
- ☐ Type B - Explosive volcanic aerosol returns rapidly to constant (average volcano)
- ☐ Type C - Explosive volcanic aerosol returns slowly (over several decades) to constant (average volcano) background.
- ☐ Type D - Explosive volcanic aerosol set to zero

- ☐ Type E - Explosive volcanic aerosol set to constant (average volcano) background
- ☐ Other - please specify:

### 2.15.3 Future Explosive Volcanic Aerosol Implementation

*How explosive volcanic aerosol is implemented in future simulations*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.tropospheric\_volcanic.future\_explosive\_volcanic\_aerosol\_implementation

**Is Required ?** TRUE

**Select value:**

- ☐ Type A - Explosive volcanic aerosol returns rapidly to zero (or near-zero) background.
- ☐ Type B - Explosive volcanic aerosol returns rapidly to constant (average volcano)
- ☐ Type C - Explosive volcanic aerosol returns slowly (over several decades) to constant (average volcano) background.
- ☐ Type D - Explosive volcanic aerosol set to zero
- ☐ Type E - Explosive volcanic aerosol set to constant (average volcano) background
- ☐ Other - please specify:

### 2.15.4 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.tropospheric\_volcanic.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.16 Stratospheric Volcanic

*Stratospheric volcanic forcing*

### 2.16.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.stratospheric\_volcanic.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data

- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.16.2 Historical Explosive Volcanic Aerosol Implementation

*How explosive volcanic aerosol is implemented in historical simulations*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.stratospheric\_volcanic.historical\_explosive\_volcanic\_aerosol\_implementation

**Is Required ?** TRUE

**Select value:**

- ☐ Type A - Explosive volcanic aerosol returns rapidly to zero (or near-zero) background.
- ☐ Type B - Explosive volcanic aerosol returns rapidly to constant (average volcano)
- ☐ Type C - Explosive volcanic aerosol returns slowly (over several decades) to constant (average volcano) background.
- ☐ Type D - Explosive volcanic aerosol set to zero
- ☐ Type E - Explosive volcanic aerosol set to constant (average volcano) background
- ☐ Other - please specify:

### 2.16.3 Future Explosive Volcanic Aerosol Implementation

*How explosive volcanic aerosol is implemented in future simulations*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.stratospheric\_volcanic.future\_explosive\_volcanic\_aerosol\_implementation

**Is Required ?** TRUE

**Select value:**

- ☐ Type A - Explosive volcanic aerosol returns rapidly to zero (or near-zero) background.
- ☐ Type B - Explosive volcanic aerosol returns rapidly to constant (average volcano)
- ☐ Type C - Explosive volcanic aerosol returns slowly (over several decades) to constant (average volcano) background.
- ☐ Type D - Explosive volcanic aerosol set to zero
- ☐ Type E - Explosive volcanic aerosol set to constant (average volcano) background
- ☐ Other - please specify:

#### 2.16.4 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.stratospheric\_volcanic.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

#### 2.17 Sea Salt

*Sea salt forcing*

##### 2.17.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.sea\_salt.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

##### 2.17.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.aerosols.sea\_salt.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

#### 2.18 Land Use

*Land use forcing*



### 2.18.1 Provision

*How this forcing agent is provided (e.g. via concentrations, emission precursors, prognostically derived, etc.)*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.other.land\_use.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - forcing agent is not included
- ☐ M - Emissions and concentrations determined by the model state rather than externally prescribed
- ☐ Y - Prescribed concentrations, distributions or time series data
- ☐ E - Concentrations calculated interactively driven by prescribed emissions or precursor emissions
- ☐ ES - Surface emissions (and 3-D concentrations away from the surface) derived via the model from the prescribed surface concentration
- ☐ C - Fixed prescribed climatology of concentrations with no year-to-year variability
- ☐ Other - please specify:

### 2.18.2 Crop Change Only

*Land use change represented via crop change onlyxxx?*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.other.land\_use.crop\_change\_only

**Is Required ?** TRUE

**Select value:**

- ☐ True
- ☐ False

### 2.18.3 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.other.land\_use.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**

## 2.19 Solar

*Solar forcing*

### 2.19.1 Provision

*How solar forcing is provided*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.other.solar.provision

**Is Required ?** TRUE

**Select value(s):**

- ☐ N/A - Not applicable - solar forcing is not included
- ☐ Irradiance - Solar irradiance forcing
- ☐ Proton - Proton pathway to solar forcing
- ☐ Electron - Electron pathway to solar forcing
- ☐ Cosmic ray - Cosmic ray pathway to solar forcing
- ☐ Other - please specify:

### 2.19.2 Additional Information

*Additional information relating to the provision and implementation of this forcing agent (e.g. citations, use of non-standard datasets, explaining how multiple provisions are used, etc.).*

**Spec. ID:** cmip6.toplevel.radiative\_forcings.other.solar.additional\_information

**Is Required ?** FALSE

**Enter TEXT value:**