

# CMIP6 Model Documentation

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<b>Model:</b>	UKESM1-0-LL
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# Documentation Contents

<b>1</b>	<b>Key Properties</b>	<b>3</b>
<b>2</b>	<b>Radiative Forcings</b>	<b>10</b>

# 1 Key Properties

*Key properties of the model*

## 1.1.1 Top level properties

*Key properties of the model*

### 1.1.1.1 Name \*

*Name of coupled model*

**Enter TEXT:**

### 1.1.1.2 Keywords \*

*Keywords associated with coupled model*

**Enter COMMA SEPARATED list:**

### 1.1.1.3 Overview \*

*Top level overview of coupled model*

**Enter TEXT:**

## 1.2.1 Flux Correction

*Flux correction properties of the model*

### 1.2.1.1 Details \*

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

**Enter TEXT:**

## 1.3.1 Genealogy

*Genealogy and history of the model*

### 1.3.1.1 Year Released \*

*Year the model was released*

**Enter TEXT:**

### 1.3.1.2 CMIP3 Parent

*CMIP3 parent if any*

**Enter TEXT:**

### 1.3.1.3 CMIP5 Parent

*CMIP5 parent if any*

**Enter TEXT:**

### 1.3.1.4 CMIP5 Differences

*Briefly summarize the differences between this model and its CMIP5 parent, if applicable*

**Enter TEXT:**

### 1.3.1.5 Previous Name

*Previously known as*

**Enter TEXT:**

## 1.4.1 Software Properties

*Software properties of model*

### 1.4.1.1 Repository

*Location of code for this component.*

**Enter TEXT:**

### 1.4.1.2 Code Version

*Code version identifier.*

**Enter TEXT:**

### 1.4.1.3 Code Languages

*Code language(s).*

**Enter COMMA SEPARATED list:**

### 1.4.1.4 Components Structure

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

**Enter TEXT:**

#### 1.4.1.5 Coupler

*Overarching coupling framework for model.*

Select **SINGLE** option:

- ☐ 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:

### 1.5.1 Coupling

#### 1.5.1.1 Atmosphere Double Flux \*

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

Select either **TRUE** or **FALSE**:

- ☐ True
- ☐ False

#### 1.5.1.2 Atmosphere Fluxes Calculation Grid

*Where are the air-sea fluxes calculated*

Select **SINGLE** option:

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

#### 1.5.1.3 Atmosphere Relative Winds \*

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

Select either **TRUE** or **FALSE**:

- ☐ True
- ☐ False

## 1.6.1 Tuning Applied

*Tuning methodology for model*

### 1.6.1.1 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.*

**Enter TEXT:**

### 1.6.1.2 Global Mean Metrics Used

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

**Enter COMMA SEPARATED list:**

### 1.6.1.3 Regional Metrics Used

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

**Enter COMMA SEPARATED list:**

### 1.6.1.4 Trend Metrics Used

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

**Enter COMMA SEPARATED list:**

### 1.6.1.5 Energy Balance \*

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

**Enter TEXT:**

### 1.6.1.6 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?*

**Enter TEXT:**

## 1.6.2 Heat

*Global heat conervation properties of the model*

### 1.6.2.1 Global \*

*Describe if/how heat is conserved globally*

**Enter TEXT:**

#### **1.6.2.2 Atmos Ocean Interface**

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

**Enter TEXT:**

#### **1.6.2.3 Atmos Land Interface \***

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

**Enter TEXT:**

#### **1.6.2.4 Atmos Sea-ice Interface**

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

**Enter TEXT:**

#### **1.6.2.5 Ocean Seaice Interface**

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

**Enter TEXT:**

#### **1.6.2.6 Land Ocean Interface**

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

**Enter TEXT:**

### **1.6.3 Fresh Water**

*Global fresh water conservation properties of the model*

#### **1.6.3.1 Global \***

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

**Enter TEXT:**

#### **1.6.3.2 Atmos Ocean Interface**

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

**Enter TEXT:**

#### **1.6.3.3 Atmos Land Interface \***

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

**Enter TEXT:**

#### **1.6.3.4 Atmos Sea-ice Interface**

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

**Enter TEXT:**

#### **1.6.3.5 Ocean Seaice Interface**

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

**Enter TEXT:**

#### **1.6.3.6 Runoff**

*Describe how runoff is distributed and conserved*

**Enter TEXT:**

#### **1.6.3.7 Iceberg Calving**

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

**Enter TEXT:**

#### **1.6.3.8 Endoreic Basins**

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

**Enter TEXT:**

#### **1.6.3.9 Snow Accumulation**

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

**Enter TEXT:**

### **1.6.4 Salt**

*Global salt conervation properties of the model*

#### **1.6.4.1 Ocean Seaice Interface**

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

**Enter TEXT:**

### **1.6.5 Momentum**

*Global momentum conervation properties of the model*



#### 1.6.5.1 Details

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

**Enter TEXT:**

## 2 Radiative Forcings

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

### 2.1.1 Top level properties

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

#### 2.1.1.1 Name

*Commonly used name for the radiative forcings in toplevel model.*

**Enter TEXT:**

#### 2.1.1.2 Overview

*Overview of radiative forcings of the model for historical and scenario (aka table 12.1 ipcc ar5) in toplevel model.*

**Enter TEXT:**

### 2.1.2 CO2

*Carbon dioxide forcing*

#### 2.1.2.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

#### 2.1.2.2 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.).*

**Enter TEXT:**

## 2.1.3 CH4

### *Methane forcing*

#### 2.1.3.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

#### 2.1.3.2 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.).*

**Enter TEXT:**

## 2.1.4 N2O

### *Nitrous oxide forcing*

#### 2.1.4.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

#### 2.1.4.2 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.).*

Enter TEXT:

#### 2.1.5 Tropospheric O3

*Tropospheric ozone forcing*

##### 2.1.5.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

##### 2.1.5.2 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.).*

Enter TEXT:

#### 2.1.6 Stratospheric O3

*Stratospheric ozone forcing*

##### 2.1.6.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

#### 2.1.6.2 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.).*

Enter TEXT:

#### 2.1.7 CFC

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

##### 2.1.7.1 Provision \*

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

Select **MULTIPLE** options:

- ☐ 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:

##### 2.1.7.2 Equivalence Concentration \*

*Details of any equivalence concentrations used*

Select **SINGLE** option:

- ☐ 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:

### 2.1.7.3 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.).*

Enter TEXT:

### 2.1.8 SO<sub>4</sub>

*SO<sub>4</sub> aerosol forcing*

#### 2.1.8.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

#### 2.1.8.2 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.).*

Enter TEXT:

### 2.1.9 Black Carbon

*Black carbon aerosol forcing*

#### 2.1.9.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

#### 2.1.9.2 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.).*

Enter TEXT:

### 2.1.10 Organic Carbon

*Organic carbon aerosol forcing*

#### 2.1.10.1 Provision \*

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

Select MULTIPLE options:

☐ 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:

#### 2.1.10.2 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.).*

Enter TEXT:

### 2.1.11 Nitrate

*Nitrate forcing*

#### 2.1.11.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

#### 2.1.11.2 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.).*

Enter TEXT:

#### 2.1.12 Cloud Albedo Effect

*Cloud albedo effect forcing (RFaci)*

##### 2.1.12.1 Provision \*

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

Select **MULTIPLE** options:

- ☐ 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:

##### 2.1.12.2 Aerosol Effect On Ice Clouds \*

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

Select either **TRUE** or **FALSE**:

- ☐ True      ☐ False



### 2.1.12.3 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.).*

Enter TEXT:

### 2.1.13 Cloud Lifetime Effect

*Cloud lifetime effect forcing (ERFaci)*

#### 2.1.13.1 Provision \*

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

Select MULTIPLE options:

- ☐ 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:

#### 2.1.13.2 Aerosol Effect On Ice Clouds \*

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

Select either TRUE or FALSE:

- ☐ True      ☐ False

#### 2.1.13.3 RFaci From Sulfate Only \*

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

Select either TRUE or FALSE:

- ☐ True      ☐ False

### 2.1.13.4 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.).*

Enter TEXT:

## 2.1.14 Dust

*Dust forcing*

### 2.1.14.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

### 2.1.14.2 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.).*

**Enter TEXT:**

## 2.1.15 Tropospheric Volcanic

*Tropospheric volcanic forcing*

### 2.1.15.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

### 2.1.15.2 Historical Explosive Volcanic Aerosol Implementation \*

*How explosive volcanic aerosol is implemented in historical simulations*

Select **SINGLE** option:

- ☐ 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:

### 2.1.15.3 Future Explosive Volcanic Aerosol Implementation \*

*How explosive volcanic aerosol is implemented in future simulations*

Select **SINGLE** option:

- ☐ 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:

### 2.1.15.4 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.).*

Enter **TEXT**:

## 2.1.16 Stratospheric Volcanic

*Stratospheric volcanic forcing*

### 2.1.16.1 Provision \*

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

Select **MULTIPLE** options:

- ☐ 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:

#### 2.1.16.2 Historical Explosive Volcanic Aerosol Implementation \*

*How explosive volcanic aerosol is implemented in historical simulations*

**Select SINGLE option:**

- ☐ 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:

#### 2.1.16.3 Future Explosive Volcanic Aerosol Implementation \*

*How explosive volcanic aerosol is implemented in future simulations*

**Select SINGLE option:**

- ☐ 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:

#### 2.1.16.4 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.).*

**Enter TEXT:**

## 2.1.17 Sea Salt

*Sea salt forcing*

### 2.1.17.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

### 2.1.17.2 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.).*

**Enter TEXT:**

## 2.1.18 Land Use

*Land use forcing*

### 2.1.18.1 Provision \*

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

**Select MULTIPLE options:**

- ☐ 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:

#### 2.1.18.2 Crop Change Only \*

*Land use change represented via crop change only?*

Select either **TRUE** or **FALSE**:

☐ True ☐ False

#### 2.1.18.3 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.).*

Enter **TEXT**:

#### 2.1.19 Solar

*Solar forcing*

##### 2.1.19.1 Provision \*

*How solar forcing is provided*

Select **MULTIPLE** options:

- ☐ 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:

##### 2.1.19.2 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.).*

Enter **TEXT**: