

# CMIP6 Model Documentation

<b>Institute:</b>	NERC
<b>Model:</b>	HADGEM3-GC31-HM
<b>Topic:</b>	Top Level
<b>Doc. Generated:</b>	2018-10-04
<b>Doc. Seeded From:</b>	N/A
<b>Specialization Version:</b>	1.1.1
<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	Flux Correction . . . . .	1
1.3	Genealogy . . . . .	1
1.4	Software Properties . . . . .	2
1.5	Coupling . . . . .	3
1.6	Tuning Applied . . . . .	3
1.7	Conservation . . . . .	4
1.8	Heat . . . . .	4
1.9	Fresh Water . . . . .	5
1.10	Salt . . . . .	6
1.11	Momentum . . . . .	6
<b>2</b>	<b>Radiative Forcings</b>	<b>7</b>
2.1	Radiative Forcings . . . . .	7
2.2	Greenhouse Gases . . . . .	7
2.3	CO <sub>2</sub> . . . . .	7
2.4	CH <sub>4</sub> . . . . .	8
2.5	N <sub>2</sub> O . . . . .	8
2.6	Tropospheric O <sub>3</sub> . . . . .	9
2.7	Stratospheric O <sub>3</sub> . . . . .	9
2.8	CFC . . . . .	10
2.9	Aerosols . . . . .	11
2.10	SO <sub>4</sub> . . . . .	11
2.11	Black Carbon . . . . .	11
2.12	Organic Carbon . . . . .	12
2.13	Nitrate . . . . .	13
2.14	Cloud Albedo Effect . . . . .	13
2.15	Cloud Lifetime Effect . . . . .	14
2.16	Dust . . . . .	15
2.17	Tropospheric Volcanic . . . . .	15
2.18	Stratospheric Volcanic . . . . .	16
2.19	Sea Salt . . . . .	18
2.20	Other . . . . .	18
2.21	Land Use . . . . .	18
2.22	Solar . . . . .	19

# 1 Key Properties

*Key properties of the model*

## 1.1 Key Properties

*Key properties of the model*

### 1.1.1 Name \*

*Name of coupled model*

**Enter TEXT:**

### 1.1.2 Keywords \*

*Keywords associated with coupled model*

**Enter COMMA SEPERATED list:**

### 1.1.3 Overview \*

*Top level overview of coupled model*

**Enter TEXT:**

## 1.2 Flux Correction

*Flux correction properties of the model*

### 1.2.1 Details \*

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

**Enter TEXT:**

## 1.3 Genealogy

*Genealogy and history of the model*

### 1.3.1 Year Released \*

*Year the model was released*

**Enter TEXT:**

### 1.3.2 CMIP3 Parent

*CMIP3 parent if any*

**Enter TEXT:**

### 1.3.3 CMIP5 Parent

*CMIP5 parent if any*

**Enter TEXT:**

### 1.3.4 CMIP5 Differences

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

**Enter TEXT:**

### 1.3.5 Previous Name

*Previously known as*

**Enter TEXT:**

## 1.4 Software Properties

*Software properties of model*

### 1.4.1 Repository

*Location of code for this component.*

**Enter TEXT:**

### 1.4.2 Code Version

*Code version identifier.*

**Enter TEXT:**

### 1.4.3 Code Languages

*Code language(s).*

**Enter COMMA SEPERATED list:**

### 1.4.4 Components Structure

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

**Enter TEXT:**

### 1.4.5 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 Coupling

### 1.5.1 Overview

*Overview of in toplevel model.*

**Enter TEXT:**

### 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)?*

**Select either TRUE or FALSE:**

☐ True ☐ False

### 1.5.3 Atmosphere Fluxes Calculation Grid

*Where are the air-sea fluxes calculated*

**Select SINGLE option:**

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

### 1.5.4 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 Tuning Applied

*Tuning methodology for model*

### 1.6.1 Overview

*Overview of tuning methodology for model in toplevel model.*

**Enter TEXT:**

### 1.6.2 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:**

### 1.6.3 Global Mean Metrics Used

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

**Enter COMMA SEPERATED list:**

### 1.6.4 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 SEPERATED list:**

### 1.6.5 Trend Metrics Used

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

**Enter COMMA SEPERATED list:**

### 1.6.6 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:**

### 1.6.7 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:**

## 1.7 Conservation

*Global conervation properties of the model*

### 1.7.1 Overview

*Overview of global conervation properties of the model in toplevel model.*

**Enter TEXT:**

## 1.8 Heat

*Global heat conervation properties of the model*

### 1.8.1 Global \*

*Describe if/how heat is conserved globally*

**Enter TEXT:**

### **1.8.2 Atmos Ocean Interface**

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

**Enter TEXT:**

### **1.8.3 Atmos Land Interface \***

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

**Enter TEXT:**

### **1.8.4 Atmos Sea-ice Interface**

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

**Enter TEXT:**

### **1.8.5 Ocean Seaice Interface**

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

**Enter TEXT:**

### **1.8.6 Land Ocean Interface**

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

**Enter TEXT:**

## **1.9 Fresh Water**

*Global fresh water conervation properties of the model*

### **1.9.1 Global \***

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

**Enter TEXT:**

### **1.9.2 Atmos Ocean Interface**

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

**Enter TEXT:**

### **1.9.3 Atmos Land Interface \***

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

**Enter TEXT:**

### **1.9.4 Atmos Sea-ice Interface**

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

**Enter TEXT:**

### **1.9.5 Ocean Seaice Interface**

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

**Enter TEXT:**

### **1.9.6 Runoff**

*Describe how runoff is distributed and conserved*

**Enter TEXT:**

### **1.9.7 Iceberg Calving**

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

**Enter TEXT:**

### **1.9.8 Endoreic Basins**

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

**Enter TEXT:**

### **1.9.9 Snow Accumulation**

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

**Enter TEXT:**

## **1.10 Salt**

*Global salt conservation properties of the model*

### **1.10.1 Ocean Seaice Interface**

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

**Enter TEXT:**

## **1.11 Momentum**

*Global momentum conservation properties of the model*

### **1.11.1 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 Radiative Forcings

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

#### 2.1.1 Name

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

**Enter TEXT:**

#### 2.1.2 Overview

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

**Enter TEXT:**

## 2.2 Greenhouse Gases

*Greenhouse gas forcing agents*

### 2.2.1 Overview

*Overview of greenhouse gas forcing agents in toplevel model.*

**Enter TEXT:**

## 2.3 CO2

*Carbon dioxide forcing*

### 2.3.1 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:

### 2.3.2 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:

## 2.4 CH<sub>4</sub>

*Methane forcing*

### 2.4.1 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:

### 2.4.2 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:

## 2.5 N<sub>2</sub>O

*Nitrous oxide forcing*

### 2.5.1 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:

### 2.5.2 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:**

## 2.6 Tropospheric O3

*Tropospheric ozone forcing*

### 2.6.1 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:

### 2.6.2 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:**

## 2.7 Stratospheric O3

*Stratospheric ozone forcing*

### 2.7.1 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:

### 2.7.2 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:**

## 2.8 CFC

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

### 2.8.1 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:

### 2.8.2 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:

### 2.8.3 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:**

## 2.9 Aerosols

*Aerosol forcing agents*

### 2.9.1 Overview

*Overview of aerosol forcing agents in toplevel model.*

**Enter TEXT:**

## 2.10 SO<sub>4</sub>

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

### 2.10.1 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:

### 2.10.2 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:**

## 2.11 Black Carbon

*Black carbon aerosol forcing*

### 2.11.1 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:

### 2.11.2 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**:

## 2.12 Organic Carbon

*Organic carbon aerosol forcing*

### 2.12.1 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:

### 2.12.2 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**:

## 2.13 Nitrate

*Nitrate forcing*

### 2.13.1 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:

### 2.13.2 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**:

## 2.14 Cloud Albedo Effect

*Cloud albedo effect forcing (RFaci)*

### 2.14.1 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:

### 2.14.2 Aerosol Effect On Ice Clouds \*

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

Select either TRUE or FALSE:

☐ True ☐ False

### 2.14.3 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:

## 2.15 Cloud Lifetime Effect

*Cloud lifetime effect forcing (ERFaci)*

### 2.15.1 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:

### 2.15.2 Aerosol Effect On Ice Clouds \*

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

Select either TRUE or FALSE:

☐ True ☐ False

### 2.15.3 RFaci From Sulfate Only \*

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

Select either TRUE or FALSE:

☐ True ☐ False



#### 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.).*

Enter TEXT:

### 2.16 Dust

*Dust forcing*

#### 2.16.1 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:

#### 2.16.2 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:

### 2.17 Tropospheric Volcanic

*Tropospheric volcanic forcing*

#### 2.17.1 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:

### 2.17.2 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:

### 2.17.3 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:

### 2.17.4 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**:

## 2.18 Stratospheric Volcanic

*Stratospheric volcanic forcing*

### 2.18.1 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:

## 2.18.2 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:

## 2.18.3 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:

#### 2.18.4 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:

#### 2.19 Sea Salt

*Sea salt forcing*

##### 2.19.1 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:

##### 2.19.2 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:

#### 2.20 Other

*Miscellaneous forcing agents*

##### 2.20.1 Overview

*Overview of miscellaneous forcing agents in toplevel model.*

Enter TEXT:

#### 2.21 Land Use

*Land use forcing*

### 2.21.1 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:

### 2.21.2 Crop Change Only \*

*Land use change represented via crop change only?*

**Select either TRUE or FALSE:**

- ☐ True
- ☐ False

### 2.21.3 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:**

## 2.22 Solar

*Solar forcing*

### 2.22.1 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:

### 2.22.2 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:**