

# CMIP6 Model Documentation

<b>Institute:</b>	MPI-M
<b>Model:</b>	MPI-ESM1-2-LR
<b>Topic:</b>	Top Level
<b>Doc. Generated:</b>	2020-04-08
<b>Doc. Seeded From:</b>	Spreadsheet
<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

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# 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*

**MPI Earth System Model running on low resolution grid**

### 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*

**ECHAM6 and JSBACH / MPIOM and HAMOCC coupled via OASIS3. \_\_x000D\_\_ For experiments with the MPI-ESM-LR /MR (compared to MPI-ESM-P): dynamic feedback of vegetation and land use on the climate development is fully included, land cover change data are included from external file, orbital parameters are calculated at every radiation time step.**

## 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**: