# CMIP6 Model Documentation

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|---|---|
| **Institute**: | IPSL |
| **Model**: | IPSL-CM6A-LR |
| **Topic**: | Top Level |
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| **Note**: | * indicates a required property |

# Documentation Contents

# 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*

**IPSL-CM6A-LR**

#### 1.1.1.2 Keywords *

*Keywords associated with coupled model*

**IPSL, climate model, earth system model, LMDz atmospheric general circulation model, NEMO oceanic general circulation model, ORCHIDEE land surface model**

#### 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*

**None.**

### 1.3.1 Genealogy

*Genealogy and history of the model*

#### 1.3.1.1 Year Released *

*Year the model was released*

**2018**

#### 1.3.1.2 CMIP3 Parent

*CMIP3 parent if any*

**IPSL-CM4**

#### 1.3.1.3 CMIP5 Parent

*CMIP5 parent if any*

**IPSL-CM5B-LR**

#### 1.3.1.4 CMIP5 Differences

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

**IPSL-CM6A-LR includes new versions of LMDz, of NEMO and of ORCHIDEE. Improved conservation of energy and water. Resolutions were increased from 96x95x39 to 144x142x79 for atmosphere and land-surface, and from 2 to 1 for ocean. The tuning phase was longer and more thorough with IPSL-CM6A-LR than with IPSL-CM5B-LR.**

#### 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.*

**Http://forge.ipsl.jussieu.fr/igcmg/svn/modipsl/trunk**

#### 1.4.1.2 Code Version

*Code version identifier.*

**6.1.1 to 6.1.8 with various changes in model output**

#### 1.4.1.3 Code Languages

*Code language(s).*

**Shell (ksh), XML, C++ (in XIOS), Fortran90**

#### 1.4.1.4 Components Structure

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

**LMDz atmospheric general circulation model and ORCHIDEE land surface model (incl. land surface carbon and a very simplified model of land ice) are grouped into a one executable (ORCHIDEE being embedded in LMDz). NEMO (ocean, sea ice, ocean biogeochemistry) is another executable. LMDz and NEMO are coupled through OASIS-MCT. XIOS (output) is a stand alone component in charge of managing all the output, driven by a set of XML files. Each of the components includes an XIOS client, that communicates to the XIOS server which flushes the output to disk.**

#### 1.4.1.5 Coupler

*Overarching coupling framework for model.*

- ☐ 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)?*

☐ True ☐ False

#### 1.5.1.2 Atmosphere Fluxes Calculation Grid

*Where are the air-sea fluxes calculated*

- ☒ 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?*

☐ 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 convervation properties of the model*

#### 1.6.2.1 Global *

*Describe if/how heat is conserved globally*

**The coupled model does not completely conserve energy as a number of (very) small fluxes between the components are not fully represented in the coupled model (e.g. energy flux in run-off or precipitation). Therefore the energy balance is not quite achieved, and the model equilibrates with a net top-of-atmosphere radiative imbalance of 0.7 W.m-2.**

#### 1.6.2.2 Atmos Ocean Interface

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

**Fluxes of latent heat, sensible heat and radiation are conserved at the atmos-ocean interface. Nevertheless fluxes of energy associated with the temperature of hydrometeors are not conserved at the surface (hydrometeors are assumed to reach the ocean surface at the sea surface (or sea-ice) temperature).**

#### 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*

**See 2.8.2.**

#### 1.6.2.5 Ocean Seaice Interface

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

**Perfectly conserved.**

#### 1.6.2.6 Land Ocean Interface

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

**Energy fluxes associated with lateral water fluxes at the land-ocean interface are not accounted for. Liquid water from river flow and coastal runoff are assumed to reach the ocean at the local SST. Iceberg (calving) are assumed to be at -4C, and their melting is assumed to be at 0C.**

### 1.6.3 Fresh Water

*Global fresh water convervation properties of the model*

#### 1.6.3.1 Global *

*Describe if/how fresh_water is conserved globally*

**The fresh water balance was achieved to a very good precision (0.002 Sv) by ensuring quasi-conservation within each model component and across components (atmosphere-land, atmosphere-land ice, ocean-land, ocean-atmosphere).**

#### 1.6.3.2 Atmos Ocean Interface

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

**Quasi-conserved.**

#### 1.6.3.3 Atmos Land Interface *

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

**Perfectly conserved.**

#### 1.6.3.4 Atmos Sea-ice Interface

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

**Quasi-conserved.**

#### 1.6.3.5 Ocean Seaice Interface

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

**Perfectly conserved.**

#### 1.6.3.6 Runoff

*Describe how runoff is distributed and conserved*

**Runoff is transferred to river flow and coastal runoff and is quasi-conserved into the ocean.**

#### 1.6.3.7 Iceberg Calving

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

**Snow accumulates but also evaporates over land ice. It generates iceberg calving when snowdepth exceeds a threshold. Hence freshwater is conserved when the change in snowpack over land ice is accounted for.**

#### 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 convervation properties of the model*

#### 1.6.4.1 Ocean Seaice Interface

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

**Perfectly conserved.**

### 1.6.5 Momentum

*Global momentum convervation 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.*

**GHG (CO2, CH4, N2O, CFC11, CFC12 including HCFC), aerosols (sulfate, OC, BC, nitrate), radiation and cloud interactions, landuse, Ndep, stratospheric aerosols, solar**

## 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.)*

☐ 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.)*

☐ 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.)*

☐ 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

*Troposheric ozone forcing*

### 2.1.5.1 Provision *

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

☐ 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.)*

☐ 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.)*

☐ 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*

☐ N/A - Not applicabale (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 SO4

*SO4 aerosol forcing*

#### 2.1.8.1 Provision *

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

☐ 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.)*

☐ 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.)*

☐ 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.)*

☐ 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.)*

☐ 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?*

☐ 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.)*

☒ 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?*

☐ True ☐ False

#### 2.1.13.3 RFaci From Sulfate Only *

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

☐ 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.)*

☐ 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.).*

**Concentrations obtained from LMDzORINCA v6 runs with interactive dust emission parametrization. Depositions obtained from LMDzORINCA v6 runs (for biogeochemistry).**

### 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.)*

☒ 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*

☐ 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*

☐ 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.)*

☐ 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*

☐ 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*

☐ 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.).*

**Future: return in 10 years to average historical conditions.**

### 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.)*

☐ 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.).*

**Obtained through LMDzORINCA v6 runs with interactive emission parametrization.**

### 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.)*

☐ 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?*

☐ 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*

☐ 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:**