CMIP6 Model Documentation

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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

Enter TEXT:

1.1.1.2 Keywords *

Keywords associated with coupled model

Enter COMMA SEPARATED list:

1.1.1.3 Overview *

Top level overview of coupled model

Enter TEXT:

1.2.1 Flux Correction

Flux correction properties of the model

1.2.1.1 Details *

Describe if/how flux corrections are applied in the model

Enter TEXT:

1.3.1 Genealogy

Genealogy and history of the model

1.3.1.1 Year Released *

Year the model was released

2018

1.3.1.2 CMIP3 Parent

CMIP3 parent if any

Enter TEXT:

1.3.1.3 CMIP5 Parent

CMIP5 parent if any

NICAM.09

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.

NICAM.16

1.4.1.3 Code Languages

Code language(s).

Fortran90, C

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 convervation 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 convervation 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 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

Enter TEXT:

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.

In the radiative transfer calculation, gaseous matters except for water vapor are prescribed. Global annual mean values of volumetric concentration [PPM] of CO2, CH4, N2O, and CFCs are given according to the CMIP6 protocol. In particular, the radiative transfer model MSTRNX calculated 25 types of CFCs and 17 types of those are specified.

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.).

MSTNX refers to the gas absorption coefficients of CFCs from the HITRAN database (see Sekiguchi and Nakajima, 2008, JQSRT). We used the historical global annual mean values of CFC-11, CFC-12, CFC-14, CFC-113, CFC-114, CFC-115, HCFC-22, HCFC-141b, HCFC-142b, HFC-32, HFC-125, HFC-134a, HFC-143a, HFC-152a, SF6, CCl4, and C2F6 given by the CMIP6 protocol.

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.).

In the HighResMIP protocol, the anthropogenic aerosols are specified by the MACv2-SP aerosol scheme (Stevens et al., 2017, GMD). Optical properties of SO4 are described in Takemura et al. (2005) JGR.

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.).

In the HighResMIP protocol, the anthropogenic aerosols are specified by the MACv2-SP aerosol scheme (Stevens et al., 2017, GMD). Optical properties of carbonaceous aerosols are described in Takemura et al. (2005) JGR.

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.).

In the HighResMIP protocol, the anthropogenic aerosols are specified by the MACv2-SP aerosol scheme (Stevens et al., 2017, GMD). Optical properties of carbonaceous aerosols are described in Takemura et al. (2005) JGR.

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.).

In the HighResMIP protocol, cloud albedo effect related to the anthropogenic aerosols is specified by the MACv2-SP aerosol scheme (Stevens et al., 2017, GMD).

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.).

We estimate equivalent modification of cloud droplet number concentration related to the cloud albedo effect by the MACv2-SP aerosol scheme (Stevens et al., 2017, GMD) and then use the modified cloud droplet number concentration in cloud microphysics.

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.).

We run NICAM with an aerosol transport model SPRTINARS (Takemura et al., 2005, JGR) for 100 years and then made the climatological monthly mean aerosol database from the latter 90 years results. We used the monthly climatological values. Optical properties of dust aerosols are described in Takemura et al. (2005) JGR.

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

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.)

☐ 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.)

☐ 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.).

We run NICAM with an aerosol transport model SPRTINARS (Takemura et al., 2005, JGR) for 100 years and then made the climatological monthly mean aerosol database from the latter 90 years results. We used the monthly climatological values. Optical properties of dust aerosols are described in Takemura et al. (2005) JGR.

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: