CMIP6 Model Documentation

Institute:	NIWA
Model:	UKESM1-0-LL
Topic:	Aerosol
Doc. Generated:	2018-02-12
Doc. Seeded From:	N/A
Specialization Version:	0.2.0
Further Info:	https://es-doc.org/cmip6 https://specializations.es-doc.org/cmip6

Documentation Contents

1 Key Properties

Key properties of the aerosol model

1.1 Key Properties

Key properties of the aerosol model

1.1.1 Model Overview

Overview of aerosol model.

Spec. ID: cmip6.aerosol.key_properties.model_overview

Is Required ? TRUE

Enter TEXT value:

1.1.2 Model Name

Name of aerosol model code

Spec. ID: cmip6.aerosol.key_properties.model_name

Is Required ? TRUE

Enter TEXT value:

1.1.3 Scheme Scope

Atmospheric domains covered by the aerosol model

Spec. ID: cmip6.aerosol.key_properties.scheme_scope

Is Required ? TRUE

Select value(s):

- ☐ Troposhere
- ☐ Stratosphere
- ☐ Mesosphere
- ☐ Mesosphere
- ☐ Whole atmosphere
- ☐ Other - please specify:

1.1.4 Basic Approximations

Basic approximations made in the aerosol model

Spec. ID: cmip6.aerosol.key_properties.basic_approximations

Is Required ? TRUE

Enter TEXT value:

1.1.5 Prognostic Variables Form

Prognostic variables in the aerosol model

Spec. ID: cmip6.aerosol.key_properties.prognostic_variables_form

Is Required ? TRUE

Select value(s):

☐ 3D mass/volume ratio for aerosols

☐ 3D number concenttration for aerosols

☐ Other - please specify:

1.1.6 Number Of Tracers

Number of tracers in the aerosol model

Spec. ID: cmip6.aerosol.key_properties.number_of_tracers

Is Required ? TRUE

Enter INTEGER value:

1.1.7 Family Approach

Are aerosol calculations generalized into families of speciesxxx?

Spec. ID: cmip6.aerosol.key_properties.family_approach

Is Required ? TRUE

Select value:

☐ True ☐ False

1.2 Software Properties

Software properties of aerosol code

1.2.1 Repository

Location of code for this component.

Spec. ID: cmip6.aerosol.key_properties.software_properties.repository

Is Required ? FALSE

Enter TEXT value:

1.2.2 Code Version

Code version identifier.

Spec. ID: cmip6.aerosol.key_properties.software_properties.code_version

Is Required ? FALSE

Enter TEXT value:

1.2.3 Code Languages

Code language(s).

Spec. ID: cmip6.aerosol.key_properties.software_properties.code_languages

Is Required ? FALSE

Enter TEXT value(s):

1.3 Timestep Framework

Physical properties of seawater in ocean

1.3.1 Method

Mathematical method deployed to solve the time evolution of the prognostic variables

Spec. ID: cmip6.aerosol.key_properties.timestep_framework.method

Is Required ? TRUE

Select value:

- ☐ Uses atmospheric chemistry time stepping
- ☐ Specific timestepping (operator splitting)
- ☐ Specific timestepping (integrated)
- ☐ Other - please specify:

1.3.2 Split Operator Advection Timestep

Timestep for aerosol advection (in seconds)

Spec. ID: cmip6.aerosol.key_properties.timestep_framework.split_operator_advection_timestep

Is Required ? FALSE

Enter INTEGER value:

1.3.3 Split Operator Physical Timestep

Timestep for aerosol physics (in seconds).

Spec. ID: cmip6.aerosol.key_properties.timestep_framework.split_operator_physical_timestep

Is Required ? FALSE

Enter INTEGER value:

1.3.4 Integrated Timestep

Timestep for the aerosol model (in seconds)

Spec. ID: cmip6.aerosol.key_properties.timestep_framework.integrated_timestep

Is Required ? TRUE

Enter INTEGER value:

1.3.5 Integrated Scheme Type

Specify the type of timestep scheme

Spec. ID: cmip6.aerosol.key_properties.timestep_framework.integrated_scheme_type

Is Required ? TRUE

Select value:

- ☐ Explicit
- ☐ Implicit
- ☐ Semi-implicit
- ☐ Semi-analytic
- ☐ Impact solver
- ☐ Back Euler
- ☐ Newton Raphson
- ☐ Rosenbrock
- ☐ Other - please specify:

1.4 Meteorological Forcings

1.4.1 Variables 3D

Three dimensionsal forcing variables, e.g. U, V, W, T, Q, P, conventive mass flux

Spec. ID: cmip6.aerosol.key_properties.meteorological_forcings.variables_3d

Is Required ? FALSE

Enter TEXT value:

1.4.2 Variables 2D

Two dimensionsal forcing variables, e.g. land-sea mask definition

Spec. ID: cmip6.aerosol.key_properties.meteorological_forcings.variables_2d

Is Required ? FALSE

Enter TEXT value:

1.4.3 Frequency

Frequency with which meteological forcings are applied (in seconds).

Spec. ID: cmip6.aerosol.key_properties.meteorological_forcings.frequency

Is Required ? FALSE

Enter INTEGER value:

1.5 Resolution

Resolution in the aersosol model grid

1.5.1 Name

This is a string usually used by the modelling group to describe the resolution of this grid, e.g. ORCA025, N512L180, T512L70 etc.

Spec. ID: cmip6.aerosol.key_properties.resolution.name

Is Required ? TRUE

Enter TEXT value:

1.5.2 Canonical Horizontal Resolution

Expression quoted for gross comparisons of resolution, eg. 50km or 0.1 degrees etc.

Spec. ID: cmip6.aerosol.key_properties.resolution.canonical_horizontal_resolution

Is Required ? FALSE

Enter TEXT value:

1.5.3 Number Of Horizontal Gridpoints

Total number of horizontal (XY) points (or degrees of freedom) on computational grid.

Spec. ID: cmip6.aerosol.key_properties.resolution.number_of_horizontal_gridpoints

Is Required ? FALSE

Enter INTEGER value:

1.5.4 Number Of Vertical Levels

Number of vertical levels resolved on computational grid.

Spec. ID: cmip6.aerosol.key_properties.resolution.number_of_vertical_levels

Is Required ? FALSE

Enter INTEGER value:

1.5.5 Is Adaptive Grid

Default is False. Set true if grid resolution changes during execution.

Spec. ID: cmip6.aerosol.key_properties.resolution.is_adaptive_grid

Is Required ? FALSE

Select value:

☐ True ☐ False

1.6 Tuning Applied

Tuning methodology for aerosol model

1.6.1 Description

General overview description of tuning: explain and motivate the main targets and metrics retained. andDocument the relative weight given to climate performance metrics versus process oriented metrics, andand on the possible conflicts with parameterization level tuning. In particular describe any struggle andwith a parameter value that required pushing it to its limits to solve a particular model deficiency.

Spec. ID: cmip6.aerosol.key_properties.tuning_applied.description

Is Required ? TRUE

Enter TEXT value:

1.6.2 Global Mean Metrics Used

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

Spec. ID: cmip6.aerosol.key_properties.tuning_applied.global_mean_metrics_used

Is Required ? FALSE

Enter TEXT value(s):

1.6.3 Regional Metrics Used

List of regional metrics of mean state used in tuning model/component

Spec. ID: cmip6.aerosol.key_properties.tuning_applied.regional_metrics_used

Is Required ? FALSE

Enter TEXT value(s):

1.6.4 Trend Metrics Used

List observed trend metrics used in tuning model/component

Spec. ID: cmip6.aerosol.key_properties.tuning_applied.trend_metrics_used

Is Required ? FALSE

Enter TEXT value(s):

2 Grid

Aerosol grid

3 Transport

Aerosol transport

3.1 Transport

Aerosol transport

3.1.1 Overview

Overview of transport in atmosperic aerosol model

Spec. ID: cmip6.aerosol.transport.overview

Is Required ? TRUE

Enter TEXT value:

3.1.2 Scheme

Method for aerosol transport modeling

Spec. ID: cmip6.aerosol.transport.scheme

Is Required ? TRUE

Select value:

- ☐ Uses Atmospheric chemistry transport scheme
- ☐ Specific transport scheme (eulerian)
- ☐ Specific transport scheme (semi-lagrangian)
- ☐ Specific transport scheme (eulerian and semi-lagrangian)
- ☐ Specific transport scheme (lagrangian)

3.1.3 Mass Conservation Scheme

Method used to ensure mass conservation.

Spec. ID: cmip6.aerosol.transport.mass_conservation_scheme

Is Required ? TRUE

Select value(s):

- ☐ Uses Atmospheric chemistry transport scheme
- ☐ Mass adjustment
- ☐ Concentrations positivity
- ☐ Gradients monotonicity
- ☐ Other - please specify:

3.1.4 Convention

Transport by convention

Spec. ID: cmip6.aerosol.transport.convention

Is Required ? TRUE

Select value(s):

- ☐ Uses Atmospheric chemistry transport scheme
- ☐ Convective fluxes connected to tracers
- ☐ Vertical velocities connected to tracers
- ☐ Other - please specify:

4 Emissions

Atmospheric aerosol emissions

4.1 Emissions

Atmospheric aerosol emissions

4.1.1 Overview

Overview of emissions in atmosperic aerosol model

Spec. ID: cmip6.aerosol.emissions.overview

Is Required ? TRUE

Enter TEXT value:

4.1.2 Method

Method used to define aerosol species (several methods allowed because the different species may not use the same method).

Spec. ID: cmip6.aerosol.emissions.method

Is Required ? TRUE

Select value(s):

- ☐ None
- ☐ Prescribed (climatology)
- ☐ Prescribed CMIP6
- ☐ Prescribed above surface
- ☐ Interactive
- ☐ Interactive above surface
- ☐ Other - please specify:

4.1.3 Sources

Sources of the aerosol species are taken into account in the emissions scheme

Spec. ID: cmip6.aerosol.emissions.sources

Is Required ? FALSE

Select value(s):

- ☐ Vegetation
- ☐ Volcanos
- ☐ Bare ground

- ☐ Sea surface
- ☐ Lightning
- ☐ Fires
- ☐ Aircraft
- ☐ Anthropogenic
- ☐ Other - please specify:

4.1.4 Prescribed Climatology

Specify the climatology type for aerosol emissions

Spec. ID: cmip6.aerosol.emissions.prescribed_climatology

Is Required ? FALSE

Select value:

- ☐ Constant
- ☐ Interannual
- ☐ Annual
- ☐ Monthly
- ☐ Daily

4.1.5 Prescribed Climatology Emitted Species

List of aerosol species emitted and prescribed via a climatology

Spec. ID: cmip6.aerosol.emissions.prescribed_climatology_emitted_species

Is Required ? FALSE

Enter TEXT value:

4.1.6 Prescribed Spatially Uniform Emitted Species

List of aerosol species emitted and prescribed as spatially uniform

Spec. ID: cmip6.aerosol.emissions.prescribed_spatially_uniform_emitted_species

Is Required ? FALSE

Enter TEXT value:

4.1.7 Interactive Emitted Species

List of aerosol species emitted and specified via an interactive method

Spec. ID: cmip6.aerosol.emissions.interactive_emitted_species

Is Required ? FALSE

Enter TEXT value:

4.1.8 Other Emitted Species

List of aerosol species emitted and specified via an other method

Spec. ID: cmip6.aerosol.emissions.other_emitted_species

Is Required ? FALSE

Enter TEXT value:

4.1.9 Other Method Characteristics

Characteristics of the other method used for aerosol emissions

Spec. ID: cmip6.aerosol.emissions.other_method_characteristics

Is Required ? FALSE

Enter TEXT value:

5 Concentrations

Atmospheric aerosol concentrations

5.1 Concentrations

Atmospheric aerosol concentrations

5.1.1 Overview

Overview of concentrations in atmosperic aerosol model

Spec. ID: cmip6.aerosol.concentrations.overview

Is Required ? TRUE

Enter TEXT value:

5.1.2 Prescribed Lower Boundary

List of species prescribed at the lower boundary.

Spec. ID: cmip6.aerosol.concentrations.prescribed_lower_boundary

Is Required ? FALSE

Enter TEXT value:

5.1.3 Prescribed Upper Boundary

List of species prescribed at the upper boundary.

Spec. ID: cmip6.aerosol.concentrations.prescribed_upper_boundary

Is Required ? FALSE

Enter TEXT value:

5.1.4 Prescribed Fields Mmr

List of species prescribed as mass mixing ratios.

Spec. ID: cmip6.aerosol.concentrations.prescribed_fields_mmr

Is Required ? FALSE

Enter TEXT value:

5.1.5 Prescribed Fields Mmr

List of species prescribed as AOD plus CCNs.

Spec. ID: cmip6.aerosol.concentrations.prescribed_fields_mmr

Is Required ? FALSE

Enter TEXT value:

6 Optical Radiative Properties

Aerosol optical and radiative properties

6.1 Optical Radiative Properties

Aerosol optical and radiative properties

6.1.1 Overview

Overview of optical and radiative properties

Spec. ID: cmip6.aerosol.optical_radiative_properties.overview

Is Required ? TRUE

Enter TEXT value:

6.2 Absorption

Absortion properties in aerosol scheme

6.2.1 Black Carbon

Absorption mass coefficient of black carbon at 550nm (if non-absorbing enter 0)

Spec. ID: cmip6.aerosol.optical_radiative_properties.absorption.black_carbon

Is Required ? FALSE

Enter FLOAT value:

6.2.2 Dust

Absorption mass coefficient of dust at 550nm (if non-absorbing enter 0)

Spec. ID: cmip6.aerosol.optical_radiative_properties.absorption.dust

Is Required ? FALSE

Enter FLOAT value:

6.2.3 Organics

Absorption mass coefficient of organics at 550nm (if non-absorbing enter 0)

Spec. ID: cmip6.aerosol.optical_radiative_properties.absorption.organics

Is Required ? FALSE

Enter FLOAT value:

6.3 Mixtures

6.3.1 External

Is there external mixing with respect to chemical compositionxxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.mixtures.external

Is Required ? TRUE

Select value:

☐ True ☐ False

6.3.2 Internal

Is there internal mixing with respect to chemical compositionxxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.mixtures.internal

Is Required ? TRUE

Select value:

☐ True ☐ False

6.3.3 Mixing Rule

If there is internal mixing with respect to chemical composition then indicate the mixinrg rule

Spec. ID: cmip6.aerosol.optical_radiative_properties.mixtures.mixing_rule

Is Required ? FALSE

Enter TEXT value:

6.4 Impact Of H2o

6.4.1 Size

Does H2O impact sizexxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.impact_of_h2o.size

Is Required ? TRUE

Select value:

☐ True ☐ False

6.4.2 Internal Mixture

Does H2O impact internal mixturexxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.impact_of_h2o.internal_mixture

Is Required ? TRUE

Select value:

☐ True ☐ False

6.5 Radiative Scheme

Radiative scheme for aerosol

6.5.1 Overview

Overview of radiative scheme

Spec. ID: cmip6.aerosol.optical_radiative_properties.radiative_scheme.overview

Is Required ? TRUE

Enter TEXT value:

6.5.2 Shortwave Bands

Number of shortwave bands

Spec. ID: cmip6.aerosol.optical_radiative_properties.radiative_scheme.shortwave_bands

Is Required ? TRUE

Enter INTEGER value:

6.5.3 Longwave Bands

Number of longwave bands

Spec. ID: cmip6.aerosol.optical_radiative_properties.radiative_scheme.longwave_bands

Is Required ? TRUE

Enter INTEGER value:

6.6 Cloud Interactions

Aerosol-cloud interactions

6.6.1 Overview

Overview of aerosol-cloud interactions

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.overview

Is Required ? TRUE

Enter TEXT value:

6.6.2 Twomey

Is the Twomey effect includedxxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.twomey

Is Required ? TRUE

Select value:

☐ True ☐ False

6.6.3 Twomey Minimum Ccn

If the Twomey effect is included, then what is the minimum CCN numberxxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.twomey_minimum_ccn

Is Required ? FALSE

Enter INTEGER value:

6.6.4 Drizzle

Does the scheme affect drizzlexxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.drizzle

Is Required ? TRUE

Select value:

☐ True ☐ False

6.6.5 Cloud Lifetime

Does the scheme affect cloud lifetimexxx?

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.cloud_lifetime

Is Required ? TRUE

Select value:

☐ True ☐ False

6.6.6 Longwave Bands

Number of longwave bands

Spec. ID: cmip6.aerosol.optical_radiative_properties.cloud_interactions.longwave_bands

Is Required ? TRUE

Enter INTEGER value:

7 Model

Aerosol model

7.1 Model

Aerosol model

7.1.1 Overview

Overview of atmosperic aerosol model

Spec. ID: cmip6.aerosol.model.overview

Is Required ? TRUE

Enter TEXT value:

7.1.2 Processes

Processes included in the Aerosol model.

Spec. ID: cmip6.aerosol.model.processes

Is Required ? TRUE

Select value(s):

- ☐ Dry deposition
- ☐ Sedimentation
- ☐ Wet deposition (impaction scavenging)
- ☐ Wet deposition (nucleation scavenging)
- ☐ Coagulation
- ☐ Oxidation (gas phase)
- ☐ Oxidation (in cloud)
- ☐ Condensation
- ☐ Ageing
- ☐ Advection (horizontal)
- ☐ Advection (vertical)
- ☐ Heterogeneous chemistry
- ☐ Nucleation

7.1.3 Coupling

Other model components coupled to the Aerosol model

Spec. ID: cmip6.aerosol.model.coupling

Is Required ? FALSE

Select value(s):

- ☐ Radiation
- ☐ Land surface
- ☐ Heterogeneous chemistry
- ☐ Clouds
- ☐ Ocean
- ☐ Cryosphere
- ☐ Gas phase chemistry
- ☐ Other - please specify:

7.1.4 Gas Phase Precursors

List of gas phase aerosol precursors.

Spec. ID: cmip6.aerosol.model.gas_phase_precursors

Is Required ? TRUE

Select value(s):

- ☐ DMS
- ☐ SO2
- ☐ Ammonia
- ☐ Iodine
- ☐ Terpene
- ☐ Isoprene
- ☐ VOC
- ☐ NOx
- ☐ Other - please specify:

7.1.5 Scheme Type

Type(s) of aerosol scheme used by the aerosols model (potentially multiple: some species may be covered by one type of aerosol scheme and other species covered by another type).

Spec. ID: cmip6.aerosol.model.scheme_type

Is Required ? TRUE

Select value(s):

- ☐ Bulk
- ☐ Modal
- ☐ Bin
- ☐ Other - please specify:

7.1.6 Bulk Scheme Species

List of species covered by the bulk scheme.

Spec. ID: cmip6.aerosol.model.bulk_scheme_species

Is Required ? TRUE

Select value(s):

- ☐ Sulphate
- ☐ Nitrate
- ☐ Sea salt
- ☐ Dust
- ☐ Ice
- ☐ Organic
- ☐ Black carbon / soot
- ☐ SOA (secondary organic aerosols)
- ☐ POM (particulate organic matter)
- ☐ Polar stratospheric ice
- ☐ NAT (Nitric acid trihydrate)
- ☐ NAD (Nitric acid dihydrate)
- ☐ STS (supercooled ternary solution aerosol particule)
- ☐ Other - please specify: