

# CMIP6 Model Documentation

<b>Institute:</b>	CNRM-CERFACS
<b>Model:</b>	CNRM-ESM2-1-HR
<b>Topic:</b>	Atmospheric Chemistry
<b>Doc. Generated:</b>	2018-02-12
<b>Doc. Seeded From:</b>	N/A
<b>Specialization Version:</b>	0.2.0
<b>Further Info:</b>	<a href="https://es-doc.org/cmip6">https://es-doc.org/cmip6</a> <a href="https://specializations.es-doc.org/cmip6">https://specializations.es-doc.org/cmip6</a>

# Documentation Contents

<b>1</b>	<b>Key Properties</b>	<b>1</b>
1.1	Key Properties . . . . .	1
1.2	Software Properties . . . . .	2
1.3	Timestep Framework . . . . .	3
1.4	Split Operator Order . . . . .	5
1.5	Tuning Applied . . . . .	7
<b>2</b>	<b>Grid</b>	<b>8</b>
2.1	Grid . . . . .	8
2.2	Resolution . . . . .	8
<b>3</b>	<b>Transport</b>	<b>10</b>
3.1	Transport . . . . .	10
<b>4</b>	<b>Emissions Concentrations</b>	<b>11</b>
4.1	Emissions Concentrations . . . . .	11
4.2	Surface Emissions . . . . .	11
4.3	Atmospheric Emissions . . . . .	12
4.4	Concentrations . . . . .	14
<b>5</b>	<b>Gas Phase Chemistry</b>	<b>15</b>
5.1	Gas Phase Chemistry . . . . .	15
<b>6</b>	<b>Stratospheric Heterogeneous Chemistry</b>	<b>18</b>
6.1	Stratospheric Heterogeneous Chemistry . . . . .	18
<b>7</b>	<b>Tropospheric Heterogeneous Chemistry</b>	<b>20</b>
7.1	Tropospheric Heterogeneous Chemistry . . . . .	20
<b>8</b>	<b>Photo Chemistry</b>	<b>22</b>
8.1	Photo Chemistry . . . . .	22
8.2	Photolysis . . . . .	22

# 1 Key Properties

*Key properties of the atmospheric chemistry*

## 1.1 Key Properties

*Key properties of the atmospheric chemistry*

### 1.1.1 Model Overview

*Overview of atmospheric chemistry model.*

**Spec. ID:** cmip6.atmoschem.key\_properties.model\_overview

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.1.2 Model Name

*Name of atmospheric chemistry model code.*

**Spec. ID:** cmip6.atmoschem.key\_properties.model\_name

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.1.3 Chemistry Scheme Scope

*Atmospheric domains covered by the atmospheric chemistry model*

**Spec. ID:** cmip6.atmoschem.key\_properties.chemistry\_scheme\_scope

**Is Required ?** TRUE

**Select value(s):**

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

### 1.1.4 Basic Approximations

*Basic approximations made in the atmospheric chemistry model*

**Spec. ID:** cmip6.atmoschem.key\_properties.basic\_approximations

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.1.5 Prognostic Variables Form

*Form of prognostic variables in the atmospheric chemistry component.*

**Spec. ID:** cmip6.atmoschem.key\_properties.prognostic\_variables\_form

**Is Required ?** TRUE

**Select value(s):**

- ☐ 3D mass/mixing ratio for gas
- ☐ Other - please specify:

### 1.1.6 Number Of Tracers

*Number of advected tracers in the atmospheric chemistry model*

**Spec. ID:** cmip6.atmoschem.key\_properties.number\_of\_tracers

**Is Required ?** TRUE

**Enter INTEGER value:**

### 1.1.7 Family Approach

*Atmospheric chemistry calculations (not advection) generalized into families of speciesxxx?*

**Spec. ID:** cmip6.atmoschem.key\_properties.family\_approach

**Is Required ?** TRUE

**Select value:**

- ☐ True ☐ False

### 1.1.8 Coupling With Chemical Reactivity

*Atmospheric chemistry transport scheme turbulence is couple with chemical reactivityxxx?*

**Spec. ID:** cmip6.atmoschem.key\_properties.coupling\_with\_chemical\_reactivity

**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.atmoschem.key\_properties.software\_properties.repository

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.2.2 Code Version

*Code version identifier.*

**Spec. ID:** cmip6.atmoschem.key\_properties.software\_properties.code\_version

**Is Required ?** FALSE

**Enter TEXT value:**

### 1.2.3 Code Languages

*Code language(s).*

**Spec. ID:** cmip6.atmoschem.key\_properties.software\_properties.code\_languages

**Is Required ?** FALSE

**Enter TEXT value(s):**

## 1.3 Timestep Framework

*Timestepping in the atmospheric chemistry model*

### 1.3.1 Method

*Mathematical method deployed to solve the evolution of a given variable*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.method

**Is Required ?** TRUE

**Select value:**

- ☐ Operator splitting
- ☐ Integrated
- ☐ Other - please specify:

### 1.3.2 Split Operator Advection Timestep

*Timestep for chemical species advection (in seconds)*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_advection\_timestep

**Is Required ?** FALSE

**Enter INTEGER value:**

### 1.3.3 Split Operator Physical Timestep

*Timestep for physics (in seconds).*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_physical\_timestep

Is Required ? FALSE

Enter INTEGER value:

### 1.3.4 Split Operator Chemistry Timestep

*Timestep for chemistry (in seconds).*

Spec. ID: cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_chemistry\_timestep

Is Required ? FALSE

Enter INTEGER value:

### 1.3.5 Split Operator Alternate Order

*xxx?*

Spec. ID: cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_alternate\_order

Is Required ? FALSE

Select value:

☐ True ☐ False

### 1.3.6 Integrated Timestep

*Timestep for the atmospheric chemistry model (in seconds)*

Spec. ID: cmip6.atmoschem.key\_properties.timestep\_framework.integrated\_timestep

Is Required ? TRUE

Enter INTEGER value:

### 1.3.7 Integrated Scheme Type

*Specify the type of timestep scheme*

Spec. ID: cmip6.atmoschem.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 Split Operator Order

### 1.4.1 Turbulence

*Call order for turbulence scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.turbulence

**Is Required ?** FALSE

**Enter INTEGER value:**

### 1.4.2 Convection

*Call order for convection scheme This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.convection

**Is Required ?** FALSE

**Enter INTEGER value:**

### 1.4.3 Precipitation

*Call order for precipitation scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.precipitation

**Is Required ?** FALSE

**Enter INTEGER value:**

### 1.4.4 Emissions

*Call order for emissions scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.emissions

**Is Required ?** FALSE

**Enter INTEGER value:**

### 1.4.5 Deposition

*Call order for deposition scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.deposition

Is Required ? FALSE

Enter INTEGER value:

#### 1.4.6 Gas Phase Chemistry

*Call order for gas phase chemistry scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.gas\_phase\_chemistry

Is Required ? FALSE

Enter INTEGER value:

#### 1.4.7 Tropospheric Heterogeneous Phase Chemistry

*Call order for tropospheric heterogeneous phase chemistry scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.tropospheric\_heterogeneous\_phase\_chemistry

Is Required ? FALSE

Enter INTEGER value:

#### 1.4.8 Stratospheric Heterogeneous Phase Chemistry

*Call order for stratospheric heterogeneous phase chemistry scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.stratospheric\_heterogeneous\_phase\_chemistry

Is Required ? FALSE

Enter INTEGER value:

#### 1.4.9 Photo Chemistry

*Call order for photo chemistry scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.photo\_chemistry

Is Required ? FALSE

Enter INTEGER value:

#### 1.4.10 Aerosols

*Call order for aerosols scheme. This should be an integer greater than zero, and may be the same value as for another process if they are calculated at the same time.*

**Spec. ID:** cmip6.atmoschem.key\_properties.timestep\_framework.split\_operator\_order.aerosols

Is Required ? FALSE

Enter INTEGER value:



## 1.5 Tuning Applied

*Tuning methodology for atmospheric chemistry component*

### 1.5.1 Description

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

**Spec. ID:** cmip6.atmoschem.key\_properties.tuning\_applied.description

**Is Required ?** TRUE

**Enter TEXT value:**

### 1.5.2 Global Mean Metrics Used

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

**Spec. ID:** cmip6.atmoschem.key\_properties.tuning\_applied.global\_mean\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

### 1.5.3 Regional Metrics Used

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

**Spec. ID:** cmip6.atmoschem.key\_properties.tuning\_applied.regional\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

### 1.5.4 Trend Metrics Used

*List observed trend metrics used in tuning model/component*

**Spec. ID:** cmip6.atmoschem.key\_properties.tuning\_applied.trend\_metrics\_used

**Is Required ?** FALSE

**Enter TEXT value(s):**

## 2 Grid

*Atmospheric chemistry grid*

### 2.1 Grid

*Atmospheric chemistry grid*

#### 2.1.1 Overview

*Describe the general structure of the atmospheric chemistry grid*

**Spec. ID:** cmip6.atmoschem.grid.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 2.1.2 Matches Atmosphere Grid

*Does the atmospheric chemistry grid match the atmosphere gridxxx?*

**Spec. ID:** cmip6.atmoschem.grid.matches\_atmosphere\_grid

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

## 2.2 Resolution

*Resolution in the atmospheric chemistry grid*

### 2.2.1 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.atmoschem.grid.resolution.name

**Is Required ?** TRUE

**Enter TEXT value:**

### 2.2.2 Canonical Horizontal Resolution

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

**Spec. ID:** cmip6.atmoschem.grid.resolution.canonical\_horizontal\_resolution

**Is Required ?** FALSE

**Enter TEXT value:**

### 2.2.3 Number Of Horizontal Gridpoints

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

**Spec. ID:** cmip6.atmoschem.grid.resolution.number\_of\_horizontal\_gridpoints

**Is Required ?** FALSE

**Enter INTEGER value:**

### 2.2.4 Number Of Vertical Levels

*Number of vertical levels resolved on computational grid.*

**Spec. ID:** cmip6.atmoschem.grid.resolution.number\_of\_vertical\_levels

**Is Required ?** FALSE

**Enter INTEGER value:**

### 2.2.5 Is Adaptive Grid

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

**Spec. ID:** cmip6.atmoschem.grid.resolution.is\_adaptive\_grid

**Is Required ?** FALSE

**Select value:**

☐ True      ☐ False

## 3 Transport

*Atmospheric chemistry transport*

### 3.1 Transport

*Atmospheric chemistry transport*

#### 3.1.1 Overview

*General overview of transport implementation*

**Spec. ID:** cmip6.atmoschem.transport.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 3.1.2 Use Atmospheric Transport

*Is transport handled by the atmosphere, rather than within atmospheric chemistry?*

**Spec. ID:** cmip6.atmoschem.transport.use\_atmospheric\_transport

**Is Required ?** TRUE

**Select value:**

☐

True

☐

False

#### 3.1.3 Transport Details

*If transport is handled within the atmospheric chemistry scheme, describe it.*

**Spec. ID:** cmip6.atmoschem.transport.transport\_details

**Is Required ?** FALSE

**Enter TEXT value:**

## 4 Emissions Concentrations

*Atmospheric chemistry emissions*

### 4.1 Emissions Concentrations

*Atmospheric chemistry emissions*

#### 4.1.1 Overview

*Overview atmospheric chemistry emissions*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.overview

**Is Required ?** TRUE

**Enter TEXT value:**

### 4.2 Surface Emissions

#### 4.2.1 Sources

*Sources of the chemical species emitted at the surface that are taken into account in the emissions scheme*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.sources

**Is Required ?** FALSE

**Select value(s):**

- ☐ Vegetation
- ☐ Soil
- ☐ Sea surface
- ☐ Anthropogenic
- ☐ Biomass burning
- ☐ Other - please specify:

#### 4.2.2 Method

*Methods used to define chemical species emitted directly into model layers above the surface (several methods allowed because the different species may not use the same method).*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.method

**Is Required ?** FALSE

**Select value(s):**

- ☐ Climatology

- ☐ Spatially uniform mixing ratio
- ☐ Spatially uniform concentration
- ☐ Interactive
- ☐ Other - please specify:

#### 4.2.3 Prescribed Climatology Emitted Species

*List of chemical species emitted at the surface and prescribed via a climatology, and the nature of the climatology (E.g. CO (monthly), C2H6 (constant))*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.prescribed\_climatology\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.2.4 Prescribed Spatially Uniform Emitted Species

*List of chemical species emitted at the surface and prescribed as spatially uniform*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.prescribed\_spatially\_uniform\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.2.5 Interactive Emitted Species

*List of chemical species emitted at the surface and specified via an interactive method*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.interactive\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.2.6 Other Emitted Species

*List of chemical species emitted at the surface and specified via any other method*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.surface\_emissions.other\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

### 4.3 Atmospheric Emissions

*TO DO*

#### 4.3.1 Sources

*Sources of chemical species emitted in the atmosphere that are taken into account in the emissions scheme.*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.sources

**Is Required ?** FALSE

**Select value(s):**

- ☐ Aircraft
- ☐ Biomass burning
- ☐ Lightning
- ☐ Volcanos
- ☐ Other - please specify:

#### 4.3.2 Method

*Methods used to define the chemical species emitted in the atmosphere (several methods allowed because the different species may not use the same method).*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.method

**Is Required ?** FALSE

**Select value(s):**

- ☐ Climatology
- ☐ Spatially uniform mixing ratio
- ☐ Spatially uniform concentration
- ☐ Interactive
- ☐ Other - please specify:

#### 4.3.3 Prescribed Climatology Emitted Species

*List of chemical species emitted in the atmosphere and prescribed via a climatology (E.g. CO (monthly), C2H6 (constant))*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.prescribed\_climatology\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.3.4 Prescribed Spatially Uniform Emitted Species

*List of chemical species emitted in the atmosphere and prescribed as spatially uniform*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.prescribed\_spatially\_uniform\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.3.5 Interactive Emitted Species

*List of chemical species emitted in the atmosphere and specified via an interactive method*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.interactive\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.3.6 Other Emitted Species

*List of chemical species emitted in the atmosphere and specified via an other method*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.atmospheric\_emissions.other\_emitted\_species

**Is Required ?** FALSE

**Enter TEXT value:**

### 4.4 Concentrations

*TO DO*

#### 4.4.1 Prescribed Lower Boundary

*List of species prescribed at the lower boundary.*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.concentrations.prescribed\_lower\_boundary

**Is Required ?** FALSE

**Enter TEXT value:**

#### 4.4.2 Prescribed Upper Boundary

*List of species prescribed at the upper boundary.*

**Spec. ID:** cmip6.atmoschem.emissions\_concentrations.concentrations.prescribed\_upper\_boundary

**Is Required ?** FALSE

**Enter TEXT value:**



## 5 Gas Phase Chemistry

*Atmospheric chemistry transport*

### 5.1 Gas Phase Chemistry

*Atmospheric chemistry transport*

#### 5.1.1 Overview

*Overview gas phase atmospheric chemistry*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 5.1.2 Species

*Species included in the gas phase chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.species

**Is Required ?** FALSE

**Select value(s):**

- ☐ HO<sub>x</sub>
- ☐ NO<sub>y</sub>
- ☐ O<sub>x</sub>
- ☐ Cl<sub>y</sub>
- ☐ HSO<sub>x</sub>
- ☐ Br<sub>y</sub>
- ☐ VOCs
- ☐ Isoprene
- ☐ H<sub>2</sub>O
- ☐ Other - please specify:

#### 5.1.3 Number Of Bimolecular Reactions

*The number of bi-molecular reactions in the gas phase chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_bimolecular\_reactions

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.4 Number Of Termolecular Reactions

*The number of ter-molecular reactions in the gas phase chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_\_termolecular\_reactions

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.5 Number Of Tropospheric Heterogenous Reactions

*The number of reactions in the tropospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_\_tropospheric\_heterogenous\_reactions

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.6 Number Of Stratospheric Heterogenous Reactions

*The number of reactions in the stratospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_\_stratospheric\_heterogenous\_reactions

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.7 Number Of Advected Species

*The number of advected species in the gas phase chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_\_advected\_species

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.8 Number Of Steady State Species

*The number of gas phase species for which the concentration is updated in the chemical solver assuming photo-chemical steady state*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.number\_of\_\_steady\_state\_species

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 5.1.9 Interactive Dry Deposition

*Is dry deposition interactive (as opposed to prescribed)xxx? Dry deposition describes the dry processes by which gaseous species deposit themselves on solid surfaces thus decreasing their concentration in the air.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.interactive\_dry\_deposition

**Is Required ?** TRUE

**Select value:**

☐ True      ☐ False

#### 5.1.10 Wet Deposition

*Is wet deposition includedxxx? Wet deposition describes the moist processes by which gaseous species deposit themselves on solid surfaces thus decreasing their concentration in the air.*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.wet\_deposition

**Is Required ?** TRUE

**Select value:**

☐ True      ☐ False

#### 5.1.11 Wet Oxidation

*Is wet oxidation includedxxx? Oxidation describes the loss of electrons or an increase in oxidation state by a molecule*

**Spec. ID:** cmip6.atmoschem.gas\_phase\_chemistry.wet\_oxidation

**Is Required ?** TRUE

**Select value:**

☐ True      ☐ False

## 6 Stratospheric Heterogeneous Chemistry

*Atmospheric chemistry stratospheric heterogeneous chemistry*

### 6.1 Stratospheric Heterogeneous Chemistry

*Atmospheric chemistry stratospheric heterogeneous chemistry*

#### 6.1.1 Overview

*Overview stratospheric heterogeneous atmospheric chemistry*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 6.1.2 Gas Phase Species

*Gas phase species included in the stratospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.gas\_phase\_species

**Is Required ?** FALSE

**Select value(s):**

- ☐ Cly
- ☐ Bry
- ☐ NO<sub>y</sub>

#### 6.1.3 Aerosol Species

*Aerosol species included in the stratospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.aerosol\_species

**Is Required ?** FALSE

**Select value(s):**

- ☐ Sulphate
- ☐ Polar stratospheric ice
- ☐ NAT (Nitric acid trihydrate)
- ☐ NAD (Nitric acid dihydrate)
- ☐ STS (supercooled ternary solution aerosol particule))

#### 6.1.4 Number Of Steady State Species

*The number of steady state species in the stratospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.number\_of\_steady\_state\_species

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 6.1.5 Sedimentation

*Is sedimentation is included in the stratospheric heterogeneous chemistry scheme or not?*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.sedimentation

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

#### 6.1.6 Coagulation

*Is coagulation is included in the stratospheric heterogeneous chemistry scheme or not?*

**Spec. ID:** cmip6.atmoschem.stratospheric\_heterogeneous\_chemistry.coagulation

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

## 7 Tropospheric Heterogeneous Chemistry

*Atmospheric chemistry tropospheric heterogeneous chemistry*

### 7.1 Tropospheric Heterogeneous Chemistry

*Atmospheric chemistry tropospheric heterogeneous chemistry*

#### 7.1.1 Overview

*Overview tropospheric heterogenous atmospheric chemistry*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 7.1.2 Gas Phase Species

*List of gas phase species included in the tropospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.gas\_phase\_species

**Is Required ?** FALSE

**Enter TEXT value:**

#### 7.1.3 Aerosol Species

*Aerosol species included in the tropospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.aerosol\_species

**Is Required ?** FALSE

**Select value(s):**

- ☐ Sulphate
- ☐ Nitrate
- ☐ Sea salt
- ☐ Dust
- ☐ Ice
- ☐ Organic
- ☐ Black carbon/soot
- ☐ Polar stratospheric ice
- ☐ Secondary organic aerosols
- ☐ Particulate organic matter

#### 7.1.4 Number Of Steady State Species

*The number of steady state species in the tropospheric heterogeneous chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.number\_of\_steady\_state\_species

**Is Required ?** TRUE

**Enter INTEGER value:**

#### 7.1.5 Interactive Dry Deposition

*Is dry deposition interactive (as opposed to prescribed)xxx? Dry deposition describes the dry processes by which gaseous species deposit themselves on solid surfaces thus decreasing their concentration in the air.*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.interactive\_dry\_deposition

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

#### 7.1.6 Coagulation

*Is coagulation included in the tropospheric heterogeneous chemistry scheme or notxxx?*

**Spec. ID:** cmip6.atmoschem.tropospheric\_heterogeneous\_chemistry.coagulation

**Is Required ?** TRUE

**Select value:**

☐ True ☐ False

## 8 Photo Chemistry

*Atmospheric chemistry photo chemistry*

### 8.1 Photo Chemistry

*Atmospheric chemistry photo chemistry*

#### 8.1.1 Overview

*Overview atmospheric photo chemistry*

**Spec. ID:** cmip6.atmoschem.photo\_chemistry.overview

**Is Required ?** TRUE

**Enter TEXT value:**

#### 8.1.2 Number Of Reactions

*The number of reactions in the photo-chemistry scheme.*

**Spec. ID:** cmip6.atmoschem.photo\_chemistry.number\_of\_reactions

**Is Required ?** TRUE

**Enter INTEGER value:**

## 8.2 Photolysis

*Photolysis scheme*

### 8.2.1 Method

*Photolysis scheme*

**Spec. ID:** cmip6.atmoschem.photo\_chemistry.photolysis.method

**Is Required ?** TRUE

**Select value:**

- ☐ Offline (clear sky)
- ☐ Offline (with clouds)
- ☐ Online

### 8.2.2 Environmental Conditions

*Describe any environmental conditions taken into account by the photolysis scheme (e.g. whether pressure- and temperature-sensitive cross-sections and quantum yields in the photolysis calculations are modified to reflect the modelled conditions.)*

**Spec. ID:** cmip6.atmoschem.photo\_chemistry.photolysis.environmental\_conditions

**Is Required ?** FALSE



Enter TEXT value: