

# CMIP6 Model Documentation

<b>Institute:</b>	NOAA-GFDL
<b>Model:</b>	GFDL-CM4C192
<b>Topic:</b>	Land Surface
<b>Doc. Generated:</b>	2018-12-16
<b>Doc. Seeded From:</b>	N/A
<b>Specialization Version:</b>	1.1.0
<b>Further Info:</b>	<a href="https://es-doc.org/cmip6">https://es-doc.org/cmip6</a>
<b>Note:</b>	* indicates a required property

## Documentation Contents

<b>1</b>	<b>Key Properties</b>	<b>3</b>
<b>2</b>	<b>Grid</b>	<b>6</b>
<b>3</b>	<b>Soil</b>	<b>7</b>
<b>4</b>	<b>Snow</b>	<b>13</b>
<b>5</b>	<b>Vegetation</b>	<b>16</b>
<b>6</b>	<b>Energy Balance</b>	<b>21</b>
<b>7</b>	<b>Carbon Cycle</b>	<b>23</b>
<b>8</b>	<b>Nitrogen Cycle</b>	<b>28</b>
<b>9</b>	<b>River Routing</b>	<b>29</b>
<b>10</b>	<b>Lakes</b>	<b>32</b>

# 1 Key Properties

*Land surface key properties*

## 1.1.1 Top level properties

*Land surface key properties*

### 1.1.1.1 Name \*

*Name of land model code*

**Enter TEXT:**

### 1.1.1.2 Keywords \*

*Keywords associated with land model code*

**Enter COMMA SEPERATED list:**

### 1.1.1.3 Overview \*

*Overview of land model.*

**Enter TEXT:**

### 1.1.1.4 Description \*

*General description of the processes modelled (e.g. dymanic vegetation, prognostic albedo, etc.)*

**Enter TEXT:**

### 1.1.1.5 Land Atmosphere Flux Exchanges

*Fluxes exchanged with the atmopshere.*

**Select MULTIPLE options:**

- ☐ Water
- ☐ Energy
- ☐ Carbon
- ☐ Nitrogen
- ☐ Phosphorous
- ☐ Other - please specify:

### 1.1.1.6 Atmospheric Coupling Treatment \*

*Describe the treatment of land surface coupling with the Atmosphere model component, which may be different for different quantities (e.g. dust: semi-implicit, water vapour: explicit)*

**Enter TEXT:**

#### 1.1.1.7 Land Cover \*

*Types of land cover defined in the land surface model*

**Select MULTIPLE options:**

- ☐ Bare soil
- ☐ Urban
- ☐ Lake
- ☐ Land ice
- ☐ Lake ice
- ☐ Vegetated
- ☐ Other - please specify:

#### 1.1.1.8 Land Cover Change

*Describe how land cover change is managed (e.g. the use of net or gross transitions)*

**Enter TEXT:**

#### 1.1.1.9 Tiling \*

*Describe the general tiling procedure used in the land surface (if any). Include treatment of physiography, land/sea, (dynamic) vegetation coverage and orography/roughness*

**Enter TEXT:**

### 1.2.1 Conservation Properties

*Conservation*

#### 1.2.1.1 Energy

*Describe if/how energy is conserved globally and to what level (e.g. within  $X$  [units]/year)*

**Enter TEXT:**

#### 1.2.1.2 Water

*Describe if/how water is conserved globally and to what level (e.g. within  $X$  [units]/year)*

**Enter TEXT:**

#### 1.2.1.3 Carbon

*Describe if/how carbon is conserved globally and to what level (e.g. within  $X$  [units]/year)*

**Enter TEXT:**

### 1.3.1 Timestepping Framework

*Timestepping*

### 1.3.1.1 Timestep Dependent On Atmosphere \*

*Is a time step dependent on the frequency of atmosphere coupling?*

Select either TRUE or FALSE:

☐

True

☐

False

### 1.3.1.2 Time Step \*

*Overall timestep of land surface model (i.e. time between calls)*

Enter INTEGER value:

### 1.3.1.3 Timestepping Method \*

*General description of time stepping method and associated time step(s)*

Enter TEXT:

## 1.4.1 Software Properties

*Software properties of land surface code*

### 1.4.1.1 Repository

*Location of code for this component.*

Enter TEXT:

### 1.4.1.2 Code Version

*Code version identifier.*

Enter TEXT:

### 1.4.1.3 Code Languages

*Code language(s).*

Enter COMMA SEPERATED list:

## 1.5.1 Tuning Applied

*Tuning methodology for land component*

### 1.5.1.1 Description \*

*General overview description of tuning (if any): 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.*

Enter TEXT:

## 2 Grid

*Land surface grid*

### 2.1.1 Top level properties

*Land surface grid*

#### 2.1.1.1 Name

*Name of grid in land model.*

**Enter TEXT:**

#### 2.1.1.2 Overview

*Overview of grid in land model.*

**Enter TEXT:**

### 2.2.1 Horizontal

*The horizontal grid in the land surface*

#### 2.2.1.1 Description \*

*Describe the general structure of the horizontal grid (not including any tiling)*

**Enter TEXT:**

#### 2.2.1.2 Matches Atmosphere Grid \*

*Does the horizontal grid match the atmosphere?*

**Select either TRUE or FALSE:**

☐

True

☐

False

### 2.3.1 Vertical

*The vertical grid in the soil*

#### 2.3.1.1 Description \*

*Describe the general structure of the vertical grid in the soil (not including any tiling)*

**Enter TEXT:**

#### 2.3.1.2 Total Depth \*

*The total depth of the soil (in metres)*

**Enter INTEGER value:**

## 3 Soil

*Land surface soil*

### 3.1.1 Top level properties

*Land surface soil*

#### 3.1.1.1 Name

*Commonly used name for the soil in land model.*

**Enter TEXT:**

#### 3.1.1.2 Overview

*Overview of land surface soil in land model.*

**Enter TEXT:**

#### 3.1.1.3 Heat Water Coupling \*

*Describe the coupling between heat and water in the soil*

**Enter TEXT:**

#### 3.1.1.4 Number Of Soil layers \*

*The number of soil layers*

**Enter INTEGER value:**

#### 3.1.1.5 Prognostic Variables \*

*List the prognostic variables of the soil scheme*

**Enter COMMA SEPERATED list:**

### 3.2.1 Soil Map

*Key properties of the land surface soil map*

#### 3.2.1.1 Description \*

*General description of soil map*

**Enter TEXT:**

#### 3.2.1.2 Structure

*Describe the soil structure map*

**Enter TEXT:**

### 3.2.1.3 Texture

*Describe the soil texture map*

**Enter TEXT:**

### 3.2.1.4 Organic Matter

*Describe the soil organic matter map*

**Enter TEXT:**

### 3.2.1.5 Albedo

*Describe the soil albedo map*

**Enter TEXT:**

### 3.2.1.6 Water Table

*Describe the soil water table map, if any*

**Enter TEXT:**

### 3.2.1.7 Continuously Varying Soil Depth \*

*Does the soil properties vary continuously with depth?*

**Select either TRUE or FALSE:**

☐

True

☐

False

### 3.2.1.8 Soil Depth

*Describe the soil depth map*

**Enter TEXT:**

## 3.3.1 Snow Free Albedo

*Snow free albedo*

### 3.3.1.1 Prognostic \*

*Is snow free albedo prognostic?*

**Select either TRUE or FALSE:**

☐

True

☐

False

### 3.3.1.2 Functions

*If prognostic, describe the dependancies on snow free albedo calculations*

**Select MULTIPLE options:**

☐

Vegetation type

☐

Soil humidity



- ☐ Vegetation state
- ☐ Other - please specify:

### 3.3.1.3 Direct Diffuse

*If prognostic, describe the distinction between direct and diffuse albedo*

Select **SINGLE** option:

- ☐ Distinction between direct and diffuse albedo
- ☐ No distinction between direct and diffuse albedo
- ☐ Other - please specify:

### 3.3.1.4 Number Of Wavelength Bands

*If prognostic, enter the number of wavelength bands used*

Enter **INTEGER** value:

## 3.4.1 Hydrology

*Key properties of the soil hydrology*

### 3.4.1.1 Description \*

*General description of the soil hydrological model*

Enter **TEXT**:

### 3.4.1.2 Time Step \*

*Time step of river soil hydrology in seconds*

Enter **INTEGER** value:

### 3.4.1.3 Tiling

*Describe the soil hydrology tiling, if any.*

Enter **TEXT**:

### 3.4.1.4 Vertical Discretisation \*

*Describe the typical vertical discretisation*

Enter **TEXT**:

#### 3.4.1.5 Number Of Ground Water Layers \*

*The number of soil layers that may contain water*

Enter INTEGER value:

#### 3.4.1.6 Lateral Connectivity \*

*Describe the lateral connectivity between tiles*

Select MULTIPLE options:

- ☐ Perfect connectivity - Common soil for multiple tiles
- ☐ Darcian flow - Darcian flow among hillslope tiles
- ☐ Other - please specify:

#### 3.4.1.7 Method \*

*The hydrological dynamics scheme in the land surface model*

Select SINGLE option:

- ☐ Bucket
- ☐ Force-restore
- ☐ Choisnel
- ☐ Explicit diffusion
- ☐ Other - please specify:

### 3.4.2 Freezing

*Frozen soil treatment*

#### 3.4.2.1 Number Of Ground Ice Layers \*

*How many soil layers may contain ground ice*

Enter INTEGER value:

#### 3.4.2.2 Ice Storage Method \*

*Describe the method of ice storage*

Enter TEXT:

#### 3.4.2.3 Permafrost \*

*Describe the treatment of permafrost, if any, within the land surface scheme*

Enter TEXT:

### 3.4.3 Drainage

*Drainage treatment in the soil*

#### 3.4.3.1 Description \*

*General describe how drainage is included in the land surface scheme*

**Enter TEXT:**

#### 3.4.3.2 Types

*Different types of runoff represented by the land surface model*

**Select MULTIPLE options:**

- ☐ Gravity drainage
- ☐ Horton mechanism
- ☐ Topmodel-based
- ☐ Dunne mechanism
- ☐ Lateral subsurface flow
- ☐ Baseflow from groundwater
- ☐ Other - please specify:

### 3.5.1 Heat Treatment

*Soil heat treatment*

#### 3.5.1.1 Description \*

*General description of how heat treatment properties are defined*

**Enter TEXT:**

#### 3.5.1.2 Time Step \*

*Time step of soil heat scheme in seconds*

**Enter INTEGER value:**

#### 3.5.1.3 Tiling

*Describe the soil heat treatment tiling, if any.*

**Enter TEXT:**

#### 3.5.1.4 Vertical Discretisation \*

*Describe the typical vertical discretisation*

**Enter TEXT:**

### **3.5.1.5 Heat Storage \***

*Specify the method of heat storage*

**Select SINGLE option:**

- ☐ Force-restore
- ☐ Explicit diffusion
- ☐ Other - please specify:

### **3.5.1.6 Processes \***

*Describe processes included in the treatment of soil heat*

**Select MULTIPLE options:**

- ☐ Soil moisture freeze-thaw
- ☐ Coupling with snow temperature
- ☐ Other - please specify:

## 4 Snow

*Land surface snow*

### 4.1.1 Top level properties

*Land surface snow*

#### 4.1.1.1 Name

*Commonly used name for the snow in land model.*

**Enter TEXT:**

#### 4.1.1.2 Overview

*Overview of land surface snow in land model.*

**Enter TEXT:**

#### 4.1.1.3 Tiling

*Describe the snow tiling, if any.*

**Enter TEXT:**

#### 4.1.1.4 Number Of Snow Layers \*

*The number of snow levels used in the land surface scheme/model*

**Enter INTEGER value:**

#### 4.1.1.5 Density \*

*Description of the treatment of snow density*

**Select SINGLE option:**

- ☐ Prognostic
- ☐ Constant
- ☐ Other - please specify:

#### 4.1.1.6 Water Equivalentt \*

*Description of the treatment of the snow water equivalent*

**Select SINGLE option:**

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 4.1.1.7 Heat Content \*

*Description of the treatment of the heat content of snow*

Select **SINGLE** option:

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 4.1.1.8 Temperature \*

*Description of the treatment of snow temperature*

Select **SINGLE** option:

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 4.1.1.9 Liquid Water Content \*

*Description of the treatment of snow liquid water*

Select **SINGLE** option:

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 4.1.1.10 Snow Cover Fractions \*

*Specify cover fractions used in the surface snow scheme*

Select **MULTIPLE** options:

- ☐ Ground snow fraction
- ☐ Vegetation snow fraction
- ☐ Other - please specify:

#### 4.1.1.11 Processes \*

*Snow related processes in the land surface scheme*

Select **MULTIPLE** options:

- ☐ Snow interception
- ☐ Snow melting

- ☐ Snow freezing
- ☐ Blowing snow
- ☐ Other - please specify:

#### 4.1.1.12 Prognostic Variables \*

*List the prognostic variables of the snow scheme*

**Enter COMMA SEPERATED list:**

### 4.2.1 Snow Albedo

*Snow albedo*

#### 4.2.1.1 Type \*

*Describe the treatment of snow-covered land albedo*

**Select SINGLE option:**

- ☐ Prognostic
- ☐ Prescribed
- ☐ Constant
- ☐ Other - please specify:

#### 4.2.1.2 Functions

*Describe the function types if prognostic snow albedo*

**Select MULTIPLE options:**

- ☐ Vegetation type
- ☐ Snow age
- ☐ Snow density
- ☐ Snow grain type
- ☐ Aerosol deposition
- ☐ Other - please specify:

## 5 Vegetation

*Land surface vegetation*

### 5.1.1 Top level properties

*Land surface vegetation*

#### 5.1.1.1 Name

*Commonly used name for the vegetation in land model.*

**Enter TEXT:**

#### 5.1.1.2 Overview

*Overview of land surface vegetation in land model.*

**Enter TEXT:**

#### 5.1.1.3 Time Step \*

*Time step of vegetation scheme in seconds*

**Enter INTEGER value:**

#### 5.1.1.4 Dynamic Vegetation \*

*Is there dynamic evolution of vegetation?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

#### 5.1.1.5 Tiling

*Describe the vegetation tiling, if any.*

**Enter TEXT:**

#### 5.1.1.6 Vegetation Representation \*

*Vegetation classification used*

**Select SINGLE option:**

- ☐ Vegetation types
- ☐ Biome types
- ☐ Other - please specify:



#### 5.1.1.7 Vegetation Types

*List of vegetation types in the classification, if any*

**Select MULTIPLE options:**

- ☐ Broadleaf tree
- ☐ Needleleaf tree
- ☐ C3 grass
- ☐ C4 grass
- ☐ Vegetated
- ☐ Other - please specify:

#### 5.1.1.8 Biome Types

*List of biome types in the classification, if any*

**Select MULTIPLE options:**

- ☐ Evergreen needleleaf forest
- ☐ Evergreen broadleaf forest
- ☐ Deciduous needleleaf forest
- ☐ Deciduous broadleaf forest
- ☐ Mixed forest
- ☐ Woodland
- ☐ Wooded grassland
- ☐ Closed shrubland
- ☐ Open shrubland
- ☐ Grassland
- ☐ Cropland
- ☐ Wetlands
- ☐ Other - please specify:

#### 5.1.1.9 Vegetation Time Variation \*

*How the vegetation fractions in each tile are varying with time*

**Select SINGLE option:**

- ☐ Fixed (not varying)
- ☐ Prescribed (varying from files)

- ☐ Dynamical (varying from simulation)
- ☐ Other - please specify:

#### 5.1.1.10 Vegetation Map

*If vegetation fractions are not dynamically updated , describe the vegetation map used (common name and reference, if possible)*

**Enter TEXT:**

#### 5.1.1.11 Interception \*

*Is vegetation interception of rainwater represented?*

**Select either TRUE or FALSE:**

- ☐ True                      ☐ False

#### 5.1.1.12 Phenology \*

*Treatment of vegetation phenology*

**Select SINGLE option:**

- ☐ Prognostic
- ☐ Diagnostic (vegetation map)
- ☐ Other - please specify:

#### 5.1.1.13 Phenology Description

*General description of the treatment of vegetation phenology*

**Enter TEXT:**

#### 5.1.1.14 Leaf Area Index \*

*Treatment of vegetation leaf area index*

**Select SINGLE option:**

- ☐ Prescribed
- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 5.1.1.15 Leaf Area Index Description

*General description of the treatment of leaf area index*

**Enter TEXT:**

#### 5.1.1.16 Biomass \*

*Treatment of vegetation biomass*

Select **SINGLE** option:

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 5.1.1.17 Biomass Description

*General description of the treatment of vegetation biomass*

Enter **TEXT**:

#### 5.1.1.18 Biogeography \*

*Treatment of vegetation biogeography*

Select **SINGLE** option:

- ☐ Prognostic
- ☐ Diagnostic
- ☐ Other - please specify:

#### 5.1.1.19 Biogeography Description

*General description of the treatment of vegetation biogeography*

Enter **TEXT**:

#### 5.1.1.20 Stomatal Resistance \*

*Specify what the vegetation stomatal resistance depends on*

Select **MULTIPLE** options:

- ☐ Light
- ☐ Temperature
- ☐ Water availability
- ☐ CO<sub>2</sub>
- ☐ O<sub>3</sub>
- ☐ Other - please specify:

#### 5.1.1.21 Stomatal Resistance Description

*General description of the treatment of vegetation stomatal resistance*

Enter **TEXT**:

#### **5.1.1.22 Prognostic Variables \***

*List the prognostic variables of the vegetation scheme*

**Enter COMMA SEPERATED list:**

## 6 Energy Balance

*Land surface energy balance*

### 6.1.1 Top level properties

*Land surface energy balance*

#### 6.1.1.1 Name

*Commonly used name for the energy balance in land model.*

**Enter TEXT:**

#### 6.1.1.2 Overview

*Overview of land surface energy balance in land model.*

**Enter TEXT:**

#### 6.1.1.3 Tiling

*Describe the energy balance tiling, if any.*

**Enter TEXT:**

#### 6.1.1.4 Number Of Surface Temperatures \*

*The maximum number of distinct surface temperatures in a grid cell (for example, each subgrid tile may have its own temperature)*

**Enter INTEGER value:**

#### 6.1.1.5 Evaporation \*

*Specify the formulation method for land surface evaporation, from soil and vegetation*

**Select MULTIPLE options:**

- ☐ Alpha
- ☐ Beta
- ☐ Combined
- ☐ Monteith potential evaporation
- ☐ Other - please specify:

#### 6.1.1.6 Processes \*

*Describe which processes are included in the energy balance scheme*

**Select MULTIPLE options:**

- ☐ Transpiration

☐ Other - please specify:

## 7 Carbon Cycle

*Land surface carbon cycle*

### 7.1.1 Top level properties

*Land surface carbon cycle*

#### 7.1.1.1 Name

*Commonly used name for the carbon cycle in land model.*

**Enter TEXT:**

#### 7.1.1.2 Overview

*Overview of land surface carbon cycle in land model.*

**Enter TEXT:**

#### 7.1.1.3 Tiling

*Describe the carbon cycle tiling, if any.*

**Enter TEXT:**

#### 7.1.1.4 Time Step \*

*Time step of carbon cycle in seconds*

**Enter INTEGER value:**

#### 7.1.1.5 Anthropogenic Carbon

*Describe the treatment of the anthropogenic carbon pool*

**Select MULTIPLE options:**

- ☐ Grand slam protocol
- ☐ Residence time
- ☐ Decay time
- ☐ Other - please specify:

#### 7.1.1.6 Prognostic Variables \*

*List the prognostic variables of the carbon scheme*

**Enter COMMA SEPERATED list:**

### 7.2.1 Vegetation

*Vegetation treatment in carbon cycle*

#### **7.2.1.1 Number Of Carbon Pools \***

*Enter the number of carbon pools used*

**Enter INTEGER value:**

#### **7.2.1.2 Carbon Pools**

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

#### **7.2.1.3 Forest Stand Dynamics**

*Describe the treatment of forest stand dyanmics*

**Enter TEXT:**

### **7.2.2 Photosynthesis**

*Photosynthesis treatment in carbon cycle*

#### **7.2.2.1 Method**

*Describe the general method used for photosynthesis (e.g. type of photosynthesis, distinction between C3 and C4 grasses, Nitrogen depencence, etc.)*

**Enter TEXT:**

### **7.2.3 Autotrophic Respiration**

*Autotrophic respiration treatment in carbon cycle*

#### **7.2.3.1 Maintainance Respiration**

*Describe the general method used for maintainence respiration*

**Enter TEXT:**

#### **7.2.3.2 Growth Respiration**

*Describe the general method used for growth respiration*

**Enter TEXT:**

### **7.2.4 Allocation**

*Allocation treatment in carbon cycle*

#### **7.2.4.1 Method \***

*Describe the general principle behind the allocation scheme*

**Enter TEXT:**



#### 7.2.4.2 Allocation Bins \*

*Specify distinct carbon bins used in allocation*

**Select SINGLE option:**

- ☐ Leaves + stems + roots
- ☐ Leaves + stems + roots (leafy + woody)
- ☐ Leaves + fine roots + coarse roots + stems
- ☐ Whole plant (no distinction)
- ☐ Other - please specify:

#### 7.2.4.3 Allocation Fractions \*

*Describe how the fractions of allocation are calculated*

**Select SINGLE option:**

- ☐ Fixed
- ☐ Function of vegetation type
- ☐ Function of plant allometry
- ☐ Explicitly calculated
- ☐ Other - please specify:

### 7.2.5 Phenology

*Phenology treatment in carbon cycle*

#### 7.2.5.1 Method \*

*Describe the general principle behind the phenology scheme*

**Enter TEXT:**

### 7.2.6 Mortality

*Vegetation mortality treatment in carbon cycle*

#### 7.2.6.1 Method \*

*Describe the general principle behind the mortality scheme*

**Enter TEXT:**

### 7.3.1 Litter

*Litter treatment in carbon cycle*

#### **7.3.1.1 Number Of Carbon Pools \***

*Enter the number of carbon pools used*

**Enter INTEGER value:**

#### **7.3.1.2 Carbon Pools**

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

#### **7.3.1.3 Decomposition**

*List the decomposition methods used*

**Enter COMMA SEPERATED list:**

#### **7.3.1.4 Method**

*Describe the general method used*

**Enter TEXT:**

### **7.4.1 Soil**

*Soil treatment in carbon cycle*

#### **7.4.1.1 Number Of Carbon Pools \***

*Enter the number of carbon pools used*

**Enter INTEGER value:**

#### **7.4.1.2 Carbon Pools**

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

#### **7.4.1.3 Decomposition**

*List the decomposition methods used*

**Enter COMMA SEPERATED list:**

#### **7.4.1.4 Method**

*Describe the general method used*

**Enter TEXT:**

### **7.5.1 Permafrost Carbon**

*Permafrost carbon treatment in carbon cycle*

#### **7.5.1.1 Is Permafrost Included \***

*Is permafrost included?*

**Select either TRUE or FALSE:**

☐

True

☐

False

#### **7.5.1.2 Emitted Greenhouse Gases**

*List the GHGs emitted*

**Enter COMMA SEPERATED list:**

#### **7.5.1.3 Decomposition**

*List the decomposition methods used*

**Enter COMMA SEPERATED list:**

#### **7.5.1.4 Impact On Soil Properties**

*Describe the impact of permafrost on soil properties*

**Enter TEXT:**

## 8 Nitrogen Cycle

*Land surface nitrogen cycle*

### 8.1.1 Top level properties

*Land surface nitrogen cycle*

#### 8.1.1.1 Name

*Commonly used name for the nitrogen cycle in land model.*

**Enter TEXT:**

#### 8.1.1.2 Overview

*Overview of land surface nitrogen cycle in land model.*

**Enter TEXT:**

#### 8.1.1.3 Tiling

*Describe the nitrogen cycle tiling, if any.*

**Enter TEXT:**

#### 8.1.1.4 Time Step \*

*Time step of nitrogen cycle in seconds*

**Enter INTEGER value:**

#### 8.1.1.5 Prognostic Variables \*

*List the prognostic variables of the nitrogen scheme*

**Enter COMMA SEPERATED list:**

## 9 River Routing

*Land surface river routing*

### 9.1.1 Top level properties

*Land surface river routing*

#### 9.1.1.1 Name

*Commonly used name for the river routing in land model.*

**Enter TEXT:**

#### 9.1.1.2 Overview

*Overview of land surface river routing in land model.*

**Enter TEXT:**

#### 9.1.1.3 Tiling

*Describe the river routing, if any.*

**Enter TEXT:**

#### 9.1.1.4 Time Step \*

*Time step of river routing scheme in seconds*

**Enter INTEGER value:**

#### 9.1.1.5 Grid Inherited From Land Surface \*

*Is the grid inherited from land surface?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

#### 9.1.1.6 Grid Description

*General description of grid, if not inherited from land surface*

**Enter TEXT:**

#### 9.1.1.7 Number Of Reservoirs \*

*Enter the number of reservoirs*

**Enter INTEGER value:**

#### 9.1.1.8 Water Re Evaporation \*

*TODO*

Select **MULTIPLE** options:

- ☐ Flood plains
- ☐ Irrigation
- ☐ Other - please specify:

#### 9.1.1.9 Coupled To Atmosphere

*Is river routing coupled to the atmosphere model component?*

Select either **TRUE** or **FALSE**:

- ☐ True
- ☐ False

#### 9.1.1.10 Coupled To Land

*Describe the coupling between land and rivers*

Enter **TEXT**:

#### 9.1.1.11 Quantities Exchanged With Atmosphere

*If couple to atmosphere, which quantities are exchanged between river routing and the atmosphere model components?*

Select **MULTIPLE** options:

- ☐ Heat
- ☐ Water
- ☐ Tracers
- ☐ Other - please specify:

#### 9.1.1.12 Basin Flow Direction Map \*

*What type of basin flow direction map is being used?*

Select **SINGLE** option:

- ☐ Present day
- ☐ Adapted for other periods
- ☐ Other - please specify:

#### 9.1.1.13 Flooding

*Describe the representation of flooding, if any*

Enter **TEXT**:

#### 9.1.1.14 Prognostic Variables \*

*List the prognostic variables of the river routing*

Enter COMMA SEPERATED list:

#### 9.2.1 Oceanic Discharge

*Oceanic discharge treatment in river routing*

##### 9.2.1.1 Discharge Type \*

*Specify how rivers are discharged to the ocean*

Select SINGLE option:

- ☐ Direct (large rivers)
- ☐ Diffuse
- ☐ Other - please specify:

##### 9.2.1.2 Quantities Transported \*

*Quantities that are exchanged from river-routing to the ocean model component*

Select MULTIPLE options:

- ☐ Heat
- ☐ Water
- ☐ Tracers
- ☐ Other - please specify:

## 10 Lakes

*Land surface lakes*

### 10.1.1 Top level properties

*Land surface lakes*

#### 10.1.1.1 Name

*Commonly used name for the lakes in land model.*

**Enter TEXT:**

#### 10.1.1.2 Overview

*Overview of land surface lakes in land model.*

**Enter TEXT:**

#### 10.1.1.3 Coupling With Rivers \*

*Are lakes coupled to the river routing model component?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

#### 10.1.1.4 Time Step \*

*Time step of lake scheme in seconds*

**Enter INTEGER value:**

#### 10.1.1.5 Quantities Exchanged With Rivers

*If coupling with rivers, which quantities are exchanged between the lakes and rivers*

**Select MULTIPLE options:**

☐ Heat  
☐ Water  
☐ Tracers  
☐ Other - please specify:

#### 10.1.1.6 Vertical Grid

*Describe the vertical grid of lakes*

**Enter TEXT:**



#### 10.1.1.7 Prognostic Variables \*

*List the prognostic variables of the lake scheme*

**Enter COMMA SEPERATED list:**

#### 10.2.1 Method

*Lakes treatment*

##### 10.2.1.1 Ice Treatment \*

*Is lake ice included?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

##### 10.2.1.2 Albedo \*

*Describe the treatment of lake albedo*

**Select SINGLE option:**

☐ Prognostic  
☐ Diagnostic  
☐ Other - please specify:

##### 10.2.1.3 Dynamics \*

*Which dynamics of lakes are treated? horizontal, vertical, etc.*

**Select MULTIPLE options:**

☐ No lake dynamics  
☐ Vertical  
☐ Horizontal  
☐ Other - please specify:

##### 10.2.1.4 Dynamic Lake Extent \*

*Is a dynamic lake extent scheme included?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

#### **10.2.1.5 Endorheic Basins \***

*Basins not flowing to ocean included?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

### **10.3.1 Wetlands**

*Wetlands treatment*

#### **10.3.1.1 Description**

*Describe the treatment of wetlands, if any*

**Enter TEXT:**