

# CMIP6 Model Documentation

<b>Institute:</b>	NERC
<b>Model:</b>	HADGEM3-GC31-HH
<b>Topic:</b>	Land Surface
<b>Doc. Generated:</b>	2018-04-12
<b>Doc. Seeded From:</b>	N/A
<b>Specialization Version:</b>	1.0.1
<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>1</b>
1.1	Key Properties . . . . .	1
1.2	Conservation Properties . . . . .	2
1.3	Timestepping Framework . . . . .	3
1.4	Software Properties . . . . .	3
<b>2</b>	<b>Grid</b>	<b>4</b>
2.1	Grid . . . . .	4
2.2	Horizontal . . . . .	4
2.3	Vertical . . . . .	4
<b>3</b>	<b>Soil</b>	<b>6</b>
3.1	Soil . . . . .	6
3.2	Soil Map . . . . .	6
3.3	Snow Free Albedo . . . . .	7
3.4	Hydrology . . . . .	8
3.5	Freezing . . . . .	9
3.6	Drainage . . . . .	10
3.7	Heat Treatment . . . . .	10
<b>4</b>	<b>Snow</b>	<b>12</b>
4.1	Snow . . . . .	12
4.2	Snow Albedo . . . . .	14
<b>5</b>	<b>Vegetation</b>	<b>15</b>
5.1	Vegetation . . . . .	15
<b>6</b>	<b>Energy Balance</b>	<b>20</b>
6.1	Energy Balance . . . . .	20
<b>7</b>	<b>Carbon Cycle</b>	<b>22</b>
7.1	Carbon Cycle . . . . .	22
7.2	Vegetation . . . . .	22
7.3	Photosynthesis . . . . .	23
7.4	Autotrophic Respiration . . . . .	23
7.5	Allocation . . . . .	23
7.6	Phenology . . . . .	24
7.7	Mortality . . . . .	24
7.8	Litter . . . . .	25
7.9	Soil . . . . .	25
7.10	Permafrost Carbon . . . . .	26
<b>8</b>	<b>Nitrogen Cycle</b>	<b>27</b>
8.1	Nitrogen Cycle . . . . .	27
<b>9</b>	<b>River Routing</b>	<b>28</b>
9.1	River Routing . . . . .	28
9.2	Oceanic Discharge . . . . .	30

<b>10 Lakes</b>	<b>31</b>
10.1 Lakes . . . . .	31
10.2 Method . . . . .	32
10.3 Wetlands . . . . .	33

# 1 Key Properties

*Land surface key properties*

## 1.1 Key Properties

*Land surface key properties*

### 1.1.1 Name \*

*Name of land model code*

**Enter TEXT:**

### 1.1.2 Keywords \*

*Keywords associated with land model code*

**Enter COMMA SEPERATED list:**

### 1.1.3 Overview \*

*Overview of land model.*

**Enter TEXT:**

### 1.1.4 Description \*

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

**Enter TEXT:**

### 1.1.5 Land Atmosphere Flux Exchanges

*Fluxes exchanged with the atmopshere.*

**Select MULTIPLE options:**

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

### 1.1.6 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:**

### 1.1.7 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:

### 1.1.8 Land Cover Change

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

**Enter TEXT:**

### 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 Conservation Properties

*TODO*

### 1.2.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 1.2.2 Energy

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

**Enter TEXT:**

### 1.2.3 Water

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

**Enter TEXT:**

### 1.2.4 Carbon

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

**Enter TEXT:**

## 1.3 Timestepping Framework

*TODO*

### 1.3.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 1.3.2 Timestep Dependent On Atmosphere \*

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

**Select either TRUE or FALSE:**

☐ True      ☐ False

### 1.3.3 Time Step \*

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

**Enter INTEGER value:**

### 1.3.4 Timestepping Method \*

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

**Enter TEXT:**

## 1.4 Software Properties

*Software properties of land surface code*

### 1.4.1 Overview

*Overview of software properties of land surface code in land model.*

**Enter TEXT:**

### 1.4.2 Repository

*Location of code for this component.*

**Enter TEXT:**

### 1.4.3 Code Version

*Code version identifier.*

**Enter TEXT:**

### 1.4.4 Code Languages

*Code language(s).*

**Enter COMMA SEPERATED list:**

## 2 Grid

*Land surface grid*

### 2.1 Grid

*Land surface grid*

#### 2.1.1 Name

*Name of grid in land model.*

**Enter TEXT:**

#### 2.1.2 Overview

*Overview of grid in land model.*

**Enter TEXT:**

### 2.2 Horizontal

*The horizontal grid in the land surface*

#### 2.2.1 Overview

*Overview of the horizontal grid in the land surface in land model.*

**Enter TEXT:**

#### 2.2.2 Description \*

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

**Enter TEXT:**

#### 2.2.3 Matches Atmosphere Grid \*

*Does the horizontal grid match the atmosphere?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

### 2.3 Vertical

*The vertical grid in the soil*

#### 2.3.1 Overview

*Overview of the vertical grid in the soil in land model.*

**Enter TEXT:**

### **2.3.2 Description \***

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

**Enter TEXT:**

### **2.3.3 Total Depth \***

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

**Enter INTEGER value:**



## 3 Soil

*Land surface soil*

### 3.1 Soil

*Land surface soil*

#### 3.1.1 Name

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

**Enter TEXT:**

#### 3.1.2 Overview

*Overview of land surface soil in land model.*

**Enter TEXT:**

#### 3.1.3 Heat Water Coupling \*

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

**Enter TEXT:**

#### 3.1.4 Number Of Soil layers \*

*The number of soil layers*

**Enter INTEGER value:**

#### 3.1.5 Prognostic Variables \*

*List the prognostic variables of the soil scheme*

**Enter COMMA SEPERATED list:**

## 3.2 Soil Map

*Key properties of the land surface soil map*

### 3.2.1 Overview

*Overview of key properties of the land surface soil map in land model.*

**Enter TEXT:**

### 3.2.2 Description \*

*General description of soil map*

**Enter TEXT:**

### 3.2.3 Structure

*Describe the soil structure map*

**Enter TEXT:**

### 3.2.4 Texture

*Describe the soil texture map*

**Enter TEXT:**

### 3.2.5 Organic Matter

*Describe the soil organic matter map*

**Enter TEXT:**

### 3.2.6 Albedo

*Describe the soil albedo map*

**Enter TEXT:**

### 3.2.7 Water Table

*Describe the soil water table map, if any*

**Enter TEXT:**

### 3.2.8 Continuously Varying Soil Depth \*

*Does the soil properties vary continuously with depth?*

**Select either TRUE or FALSE:**

☐

True

☐

False

### 3.2.9 Soil Depth

*Describe the soil depth map*

**Enter TEXT:**

## 3.3 Snow Free Albedo

*TODO*

### 3.3.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 3.3.2 Prognostic \*

*Is snow free albedo prognostic?*

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

☐ True ☐ False

### 3.3.3 Functions

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

Select **MULTIPLE** options:

- ☐ Vegetation type
- ☐ Soil humidity
- ☐ Vegetation state
- ☐ Other - please specify:

### 3.3.4 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:

### 3.3.5 Number Of Wavelength Bands

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

Enter **INTEGER** value:

## 3.4 Hydrology

*Key properties of the land surface soil hydrology*

### 3.4.1 Overview

*Overview of key properties of the land surface soil hydrology in land model.*

Enter **TEXT**:

### 3.4.2 Description \*

*General description of the soil hydrological model*

Enter **TEXT**:

### 3.4.3 Time Step \*

*Time step of river soil hydrology in seconds*

Enter INTEGER value:

### 3.4.4 Tiling

*Describe the soil hydrology tiling, if any.*

Enter TEXT:

### 3.4.5 Vertical Discretisation \*

*Describe the typical vertical discretisation*

Enter TEXT:

### 3.4.6 Number Of Ground Water Layers \*

*The number of soil layers that may contain water*

Enter INTEGER value:

### 3.4.7 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:

### 3.4.8 Method \*

*The hydrological dynamics scheme in the land surface model*

Select SINGLE option:

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

## 3.5 Freezing

*TODO*

### 3.5.1 Number Of Ground Ice Layers \*

*How many soil layers may contain ground ice*

**Enter INTEGER value:**

### 3.5.2 Ice Storage Method \*

*Describe the method of ice storage*

**Enter TEXT:**

### 3.5.3 Permafrost \*

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

**Enter TEXT:**

## 3.6 Drainage

*TODO*

### 3.6.1 Description \*

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

**Enter TEXT:**

### 3.6.2 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:

## 3.7 Heat Treatment

*TODO*

### 3.7.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 3.7.2 Description \*

*General description of how heat treatment properties are defined*

Enter TEXT:

### 3.7.3 Time Step \*

*Time step of soil heat scheme in seconds*

Enter INTEGER value:

### 3.7.4 Tiling

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

Enter TEXT:

### 3.7.5 Vertical Discretisation \*

*Describe the typical vertical discretisation*

Enter TEXT:

### 3.7.6 Heat Storage \*

*Specify the method of heat storage*

Select SINGLE option:

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

### 3.7.7 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 Snow

*Land surface snow*

#### 4.1.1 Name

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

**Enter TEXT:**

#### 4.1.2 Overview

*Overview of land surface snow in land model.*

**Enter TEXT:**

#### 4.1.3 Tiling

*Describe the snow tiling, if any.*

**Enter TEXT:**

#### 4.1.4 Number Of Snow Layers \*

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

**Enter INTEGER value:**

#### 4.1.5 Density \*

*Description of the treatment of snow density*

**Select SINGLE option:**

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

#### 4.1.6 Water Equivalent \*

*Description of the treatment of the snow water equivalent*

**Select SINGLE option:**

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

#### 4.1.7 Heat Content \*

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

Select **SINGLE** option:

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

#### 4.1.8 Temperature \*

*Description of the treatment of snow temperature*

Select **SINGLE** option:

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

#### 4.1.9 Liquid Water Content \*

*Description of the treatment of snow liquid water*

Select **SINGLE** option:

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

#### 4.1.10 Snow Cover Fractions \*

*Specify cover fractions used in the surface snow scheme*

Select **MULTIPLE** options:

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

#### 4.1.11 Processes \*

*Snow related processes in the land surface scheme*

Select **MULTIPLE** options:

- ☐ Snow interception
- ☐ Snow melting



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

#### 4.1.12 Prognostic Variables \*

*List the prognostic variables of the snow scheme*

**Enter COMMA SEPERATED list:**

## 4.2 Snow Albedo

*TODO*

### 4.2.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 4.2.2 Type \*

*Describe the treatment of snow-covered land albedo*

**Select SINGLE option:**

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

### 4.2.3 Functions

*If prognostic,*

**Select MULTIPLE options:**

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

## 5 Vegetation

*Land surface vegetation*

### 5.1 Vegetation

*Land surface vegetation*

#### 5.1.1 Name

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

**Enter TEXT:**

#### 5.1.2 Overview

*Overview of land surface vegetation in land model.*

**Enter TEXT:**

#### 5.1.3 Time Step \*

*Time step of vegetation scheme in seconds*

**Enter INTEGER value:**

#### 5.1.4 Dynamic Vegetation \*

*Is there dynamic evolution of vegetation?*

**Select either TRUE or FALSE:**

☐ True ☐ False

#### 5.1.5 Tiling

*Describe the vegetation tiling, if any.*

**Enter TEXT:**

#### 5.1.6 Vegetation Representation \*

*Vegetation classification used*

**Select SINGLE option:**

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

### 5.1.7 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:

### 5.1.8 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:

### 5.1.9 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:

#### 5.1.10 Vegetation Map

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

**Enter TEXT:**

#### 5.1.11 Interception \*

*Is vegetation interception of rainwater represented?*

**Select either TRUE or FALSE:**

- ☐ True                      ☐ False

#### 5.1.12 Phenology \*

*Treatment of vegetation phenology*

**Select SINGLE option:**

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

#### 5.1.13 Phenology Description

*General description of the treatment of vegetation phenology*

**Enter TEXT:**

#### 5.1.14 Leaf Area Index \*

*Treatment of vegetation leaf area index*

**Select SINGLE option:**

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

#### 5.1.15 Leaf Area Index Description

*General description of the treatment of leaf area index*

**Enter TEXT:**

#### 5.1.16 Biomass \*

*Treatment of vegetation biomass*

Select **SINGLE** option:

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

#### 5.1.17 Biomass Description

*General description of the treatment of vegetation biomass*

Enter **TEXT**:

#### 5.1.18 Biogeography \*

*Treatment of vegetation biogeography*

Select **SINGLE** option:

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

#### 5.1.19 Biogeography Description

*General description of the treatment of vegetation biogeography*

Enter **TEXT**:

#### 5.1.20 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:

#### 5.1.21 Stomatal Resistance Description

*General description of the treatment of vegetation stomatal resistance*

Enter **TEXT**:

### **5.1.22 Prognostic Variables \***

*List the prognostic variables of the vegetation scheme*

**Enter COMMA SEPERATED list:**

## 6 Energy Balance

*Land surface energy balance*

### 6.1 Energy Balance

*Land surface energy balance*

#### 6.1.1 Name

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

**Enter TEXT:**

#### 6.1.2 Overview

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

**Enter TEXT:**

#### 6.1.3 Tiling

*Describe the energy balance tiling, if any.*

**Enter TEXT:**

#### 6.1.4 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:**

#### 6.1.5 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:

#### 6.1.6 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 Carbon Cycle

*Land surface carbon cycle*

#### 7.1.1 Name

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

**Enter TEXT:**

#### 7.1.2 Overview

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

**Enter TEXT:**

#### 7.1.3 Tiling

*Describe the carbon cycle tiling, if any.*

**Enter TEXT:**

#### 7.1.4 Time Step \*

*Time step of carbon cycle in seconds*

**Enter INTEGER value:**

#### 7.1.5 Anthropogenic Carbon

*Describe the treatment of the anthropogenic carbon pool*

**Select MULTIPLE options:**

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

#### 7.1.6 Prognostic Variables \*

*List the prognostic variables of the carbon scheme*

**Enter COMMA SEPERATED list:**

## 7.2 Vegetation

*TODO*

### 7.2.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 7.2.2 Number Of Carbon Pools \*

*Enter the number of carbon pools used*

**Enter INTEGER value:**

### 7.2.3 Carbon Pools

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

### 7.2.4 Forest Stand Dynamics

*Describe the treatment of forest stand dyanmics*

**Enter TEXT:**

## 7.3 Photosynthesis

*TODO*

### 7.3.1 Method

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

**Enter TEXT:**

## 7.4 Autotrophic Respiration

*TODO*

### 7.4.1 Maintainance Respiration

*Describe the general method used for maintainence respiration*

**Enter TEXT:**

### 7.4.2 Growth Respiration

*Describe the general method used for growth respiration*

**Enter TEXT:**

## 7.5 Allocation

*TODO*

### 7.5.1 Method \*

*Describe the general principle behind the allocation scheme*

**Enter TEXT:**

### 7.5.2 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:

### 7.5.3 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:

## 7.6 Phenology

*TODO*

### 7.6.1 Method \*

*Describe the general principle behind the phenology scheme*

**Enter TEXT:**

## 7.7 Mortality

*TODO*

### 7.7.1 Method \*

*Describe the general principle behind the mortality scheme*

**Enter TEXT:**

## 7.8 Litter

*TODO*

### 7.8.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 7.8.2 Number Of Carbon Pools \*

*Enter the number of carbon pools used*

**Enter INTEGER value:**

### 7.8.3 Carbon Pools

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

### 7.8.4 Decomposition

*List the decomposition methods used*

**Enter COMMA SEPERATED list:**

### 7.8.5 Method

*Describe the general method used*

**Enter TEXT:**

## 7.9 Soil

*TODO*

### 7.9.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 7.9.2 Number Of Carbon Pools \*

*Enter the number of carbon pools used*

**Enter INTEGER value:**

### 7.9.3 Carbon Pools

*List the carbon pools used*

**Enter COMMA SEPERATED list:**

#### 7.9.4 Decomposition

*List the decomposition methods used*

Enter COMMA SEPERATED list:

#### 7.9.5 Method

*Describe the general method used*

Enter TEXT:

### 7.10 Permafrost Carbon

*TODO*

#### 7.10.1 Overview

*Overview of todo in land model.*

Enter TEXT:

#### 7.10.2 Is Permafrost Included \*

*Is permafrost included?*

Select either TRUE or FALSE:

☐ True      ☐ False

#### 7.10.3 Emitted Greenhouse Gases

*List the GHGs emitted*

Enter COMMA SEPERATED list:

#### 7.10.4 Decomposition

*List the decomposition methods used*

Enter COMMA SEPERATED list:

#### 7.10.5 Impact On Soil Properties

*Describe the impact of permafrost on soil properties*

Enter TEXT:

## 8 Nitrogen Cycle

*Land surface nitrogen cycle*

### 8.1 Nitrogen Cycle

*Land surface nitrogen cycle*

#### 8.1.1 Name

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

**Enter TEXT:**

#### 8.1.2 Overview

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

**Enter TEXT:**

#### 8.1.3 Tiling

*Describe the nitrogen cycle tiling, if any.*

**Enter TEXT:**

#### 8.1.4 Time Step \*

*Time step of nitrogen cycle in seconds*

**Enter INTEGER value:**

#### 8.1.5 Prognostic Variables \*

*List the prognostic variables of the nitrogen scheme*

**Enter COMMA SEPERATED list:**

## 9 River Routing

*Land surface river routing*

### 9.1 River Routing

*Land surface river routing*

#### 9.1.1 Name

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

**Enter TEXT:**

#### 9.1.2 Overview

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

**Enter TEXT:**

#### 9.1.3 Tiling

*Describe the river routing, if any.*

**Enter TEXT:**

#### 9.1.4 Time Step \*

*Time step of river routing scheme in seconds*

**Enter INTEGER value:**

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

*Is the grid inherited from land surface?*

**Select either TRUE or FALSE:**

☐ True      ☐ False

#### 9.1.6 Grid Description

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

**Enter TEXT:**

#### 9.1.7 Number Of Reservoirs \*

*Enter the number of reservoirs*

**Enter INTEGER value:**

### 9.1.8 Water Re Evaporation \*

*TODO*

Select **MULTIPLE** options:

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

### 9.1.9 Coupled To Atmosphere

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

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

- ☐ True
- ☐ False

### 9.1.10 Coupled To Land

*Describe the coupling between land and rivers*

Enter **TEXT**:

### 9.1.11 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:

### 9.1.12 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:

### 9.1.13 Flooding

*Describe the representation of flooding, if any*

Enter **TEXT**:



#### 9.1.14 Prognostic Variables \*

*List the prognostic variables of the river routing*

**Enter COMMA SEPERATED list:**

## 9.2 Oceanic Discharge

*TODO*

### 9.2.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 9.2.2 Discharge Type \*

*Specify how rivers are discharged to the ocean*

**Select SINGLE option:**

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

### 9.2.3 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 Lakes

*Land surface lakes*

#### 10.1.1 Name

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

**Enter TEXT:**

#### 10.1.2 Overview

*Overview of land surface lakes in land model.*

**Enter TEXT:**

#### 10.1.3 Coupling With Rivers \*

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

**Select either TRUE or FALSE:**

☐ True ☐ False

#### 10.1.4 Time Step \*

*Time step of lake scheme in seconds*

**Enter INTEGER value:**

#### 10.1.5 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:

#### 10.1.6 Vertical Grid

*Describe the vertical grid of lakes*

**Enter TEXT:**

### 10.1.7 Prognostic Variables \*

*List the prognostic variables of the lake scheme*

**Enter COMMA SEPERATED list:**

## 10.2 Method

*TODO*

### 10.2.1 Overview

*Overview of todo in land model.*

**Enter TEXT:**

### 10.2.2 Ice Treatment \*

*Is lake ice included?*

**Select either TRUE or FALSE:**

☐ True ☐ False

### 10.2.3 Albedo \*

*Describe the treatment of lake albedo*

**Select SINGLE option:**

- ☐ Prognostic  
☐ Diagnostic  
☐ Other - please specify:

### 10.2.4 Dynamics \*

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

**Select MULTIPLE options:**

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

### 10.2.5 Dynamic Lake Extent \*

*Is a dynamic lake extent scheme included?*

**Select either TRUE or FALSE:**

☐ True ☐ False

### 10.2.6 Endorheic Basins \*

*Basins not flowing to ocean included?*

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

☐ True      ☐ False

## 10.3 Wetlands

*TODO*

### 10.3.1 Overview

*Overview of todo in land model.*

Enter **TEXT**:

### 10.3.2 Description

*Describe the treatment of wetlands, if any*

Enter **TEXT**: