CMIP6 Model Documentation

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Documentation Contents

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 vegation, prognostic albedo, etc.)

Enter TEXT:

1.1.5 Land Atmosphere Flux Exchanges

Fluxes exchanged with the atmopshere.

Select MULTIPLE options:

- ☐ Water
- ☐ Energy
- ☐ Carbon
- ☐ Nitrogen
- ☐ Phospherous
- ☐ 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
- ☐ Opne 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
- ☐ CO2
- ☐ O3
- ☐ 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 treament 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 notrogen 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: