

# par.txt

Model parameters determine the function of the model. The model parameters are given in the file *par.txt*. A model parameter may have a dependency on some physical property, e.g. soil type, or a spatial division of the model domain or be a general value for the whole model domain. If a parameter is dependent on e.g. a property it will have one value for each code of that property. For instance if a model has two land uses, open and forest land, snow melt rate will have a (different) value for each open and forest land because the HYPE snow melt parameter is land use dependent.

Many model parameters are coefficients in the modelled processes, others define properties of the model domain. For example evapotranspiration depend on model parameters for the potential rate (land use dependent) and on the water holding capacity of the soil (soil type dependent). There are also parameters that set the initial stores or flows to a general value.

Most model parameters can be calibrated. A few parameters are switches for model options. These can't be calibrated. Model parameters, which also can be given in LakeData for specific lakes, cannot be calibrated.

There are also model parameters specially designed to be calibrated. They are correction parameters (sometimes called super parameters), often dependent on a larger region, that adjust the model in some general way. Some of them can simultanously adjust several processes (this is e.g. the case for nutrients). Others correct input data (precipitation and temperature).

The following dependencies exist for HYPE model parameters;

- general, i.e. no dependency
- land use (land cover), a code given for each SLC class
- soil type, a code given for each SLC class
- month
- parameter region (parreg), a user defined grouping of subbasins into larger regions
- water quality parameter region (wqparreg), a user defined grouping of subbasins into larger regions, used for some WQ parameters
- lake region, a user defined grouping of subbasins into larger regions, used for some lake and river parameters
- ilake region, a user defined grouping of subbasins into larger regions, used for some ilake parameters
- olake region, a user defined grouping of subbasins into larger regions, used for some olake parameters

## File content

The file is located in the [modeldir](#) folder. One parameter is given per row with parameter name first and then values for all dependencies or one value for a general parameter. A single value may not take up more than 10 positions. Comment rows are allowed anywhere in the file and start with a double exclamation mark !! followed by a blank (no empty lines allowed). In-line comments may crash the simulation. **Note:** If you import (and later export) a *par.txt* file into R using the [HYPETOOLS](#) package, in-line comments are moved to separate rows. The parameter names are not case sensitive, but some are written partly with capital letters to ease the interpretation. The default value is zero for all parameters except five glacier parameters for density and area-volume relationship.

Example snippet of a *par.txt* file structure:

```
!! water content for 11 soil types (defined in GeoClass.txt)
wcfc  0.100 0.120 0.120 0.050 0.250 0.250 0.150 0.050 0.500 0.500 0.050
!! threshold temperature for 2 land uses (defined in GeoClass.txt)
ttmp  0.0   0.0
!! potential evaporation limit, a general parameter
lp     0.8
...
```

The table below describes all available model parameters. Unit '-' mean the parameter is dimensionless. Unit *ts* means time step, which can be day or hour or of some other length. The general unit (U) is used in case of parameters and input data where the unit is not defined.

| Name   | Unit                                 | Dependency | Description                                                                                                              | Link                                                      |
|--------|--------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| wcfc   | -                                    | soil type  | fraction of soil available for evapotranspiration but not for runoff, same for all soil layers (used if wcfc1 not given) | <a href="#">water content</a>                             |
| wcwp   | -                                    | soil type  | wilting point as a fraction, same for all soil layers (used if wcwp1 not given)                                          | <a href="#">water content</a>                             |
| wcep   | -                                    | soil type  | effective porosity as a fraction, same for all soil layers (used if wcep1 not given)                                     | <a href="#">water content</a>                             |
| wcfc1  | -                                    | soil type  | fraction of soil available for evapotranspiration but not for runoff, for uppermost soil layer                           | <a href="#">water content</a>                             |
| wcwp1  | -                                    | soil type  | wilting point as a fraction, for uppermost soil layer                                                                    | <a href="#">water content</a>                             |
| wcep1  | -                                    | soil type  | effective porosity as a fraction, for uppermost soil layer                                                               | <a href="#">water content</a>                             |
| wcfc2  | -                                    | soil type  | fraction of soil available for evapotranspiration but not for runoff, for second soil layer                              | <a href="#">water content</a>                             |
| wcwp2  | -                                    | soil type  | wilting point as a fraction, for second soil layer                                                                       | <a href="#">water content</a>                             |
| wcep2  | -                                    | soil type  | effective porosity as a fraction, for second soil layer                                                                  | <a href="#">water content</a>                             |
| wcfc3  | -                                    | soil type  | fraction of soil available for evapotranspiration but not for runoff, for lowest soil layer                              | <a href="#">water content</a>                             |
| wcwp3  | -                                    | soil type  | wilting point as a fraction, for lowest soil layer                                                                       | <a href="#">water content</a>                             |
| wcep3  | -                                    | soil type  | effective porosity as a fraction, for lowest soil layer                                                                  | <a href="#">water content</a>                             |
| mperc1 | mm ts <sup>-1</sup>                  | soil type  | maximum percolation capacity from soil layer 1 to soil layer 2                                                           | <a href="#">perc</a>                                      |
| mperc2 | mm ts <sup>-1</sup>                  | soil type  | maximum percolation capacity from soil layer 2 to soil layer 3                                                           | <a href="#">perc</a>                                      |
| cmlt   | mm °C <sup>-1</sup> ts <sup>-1</sup> | land use   | melting parameter for snow                                                                                               | <a href="#">snow melt</a>                                 |
| ttmp   | °C                                   | land use   | threshold temperature for snow melt, snow density and evapotranspiration                                                 | <a href="#">snow melt</a><br><a href="#">snowfall PET</a> |

| Name     | Unit                          | Dependency | Description                                                                                                                                                  | Link                                              |
|----------|-------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| ttpd     | °C                            | general    | deviation from ttmp for threshold temperature for snow-/rainfall                                                                                             | <a href="#">snowfall</a>                          |
| ttpi     | °C                            | general    | half of temperature interval with mixed snow- and rainfall. Interval is (ttmp+ttpd) +/- ttpi.                                                                | <a href="#">snow melt snowfall</a>                |
| cevp     | $\frac{mm}{ts} ^\circ C^{-1}$ | land use   | evapotranspiration parameter                                                                                                                                 | <a href="#">PET</a>                               |
| tlevap   | -                             | general    | evaporation factor for substance T1 (0-1), default is 0, if 1 the substance evaporates with the water                                                        | <a href="#">tracer T1</a>                         |
| frost    | $cm ^\circ C^{-1}$ or -       | land use   | frost depth parameter (both frost and sfrost must be >0 for simulation to occur)                                                                             | <a href="#">frost</a>                             |
| sfrost   | - or $cm ^\circ C^{-1}$       | soil type  | frost depth parameter (both frost and sfrost must be >0 for simulation to occur)                                                                             | <a href="#">frost</a>                             |
| deepmem  | d                             | general    | deep soil temperature memory                                                                                                                                 | <a href="#">soil temp</a>                         |
| surfmem  | d                             | land use   | upper soil layer soil temperature memory                                                                                                                     | <a href="#">soil temp</a>                         |
| depthrel | $m^{-1}$                      | land use   | depth relation for soil temperature memory                                                                                                                   | <a href="#">soil temp</a>                         |
| rrcs1    | $ts^{-1}$                     | soil type  | recession coefficient for uppermost soil layer                                                                                                               | <a href="#">runoff</a>                            |
| rrcs2    | $ts^{-1}$                     | soil type  | recession coefficient for lowest soil layer                                                                                                                  | <a href="#">runoff</a>                            |
| rrcs3    | $ts^{-1} \%^{-1}$             | general    | recession coefficient for slope dependence (upper layer)                                                                                                     | <a href="#">runoff</a>                            |
| srrcs    | $ts^{-1}$                     | land use   | recession coefficient for surface runoff (fraction), should be set to 1 for lake and riverclasses with floodplains                                           | <a href="#">surface runoff</a>                    |
| trrcs    | $ts^{-1}$                     | soil type  | recession coefficient for tile drains                                                                                                                        | <a href="#">tile runoff</a>                       |
| rrcscorr | -                             | parreg     | correction factor for recession $rrcs=rrcs(1+rrcscorr)$ for rrcs1,rrcs2,trrcs and srrcs                                                                      | <a href="#">runoff tile runoff surface runoff</a> |
| cevpam   | -                             | general    | amplitude of sinus function (about 1) that corrects potential evapotranspiration.                                                                            | <a href="#">PET</a>                               |
| cevpph   | d                             | general    | phase of sinus function that corrects potential evapotranspiration                                                                                           | <a href="#">PET</a>                               |
| cevpcorr | -                             | parreg     | correction factor for evapotranspiration $cevap=evap(1+cevpcorr)$                                                                                            | <a href="#">PET</a>                               |
| lp       | -                             | general    | factor for calculating the soil water limit for potential evapotranspiration                                                                                 | <a href="#">evap</a>                              |
| gratk    | -                             | general    | parameter of rating curve for lake outflow<br>$Q = gratk \times (w - w_o)^{gratp}$                                                                           | <a href="#">rating curve</a>                      |
| gratp    | -                             | general    | parameter of rating curve for lake outflow<br>$Q = gratk \times (w - w_o)^{gratp}$                                                                           | <a href="#">rating curve</a>                      |
| grata    | -                             | general    | upstream area dependence of discharge curve for lake, if grata>0 and uparea>0<br>$Q = \left( gratk \times (uparea)^{grata} \right) \times (w - w_o)^{gratp}$ | <a href="#">rating curve</a>                      |

| Name       | Unit                    | Dependency | Description                                                                                                                                                                                                                                                                                                                                                                                                         | Link                  |
|------------|-------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| limqprod   | -                       | general    | limit for water stage with reduced production flow from dam (fraction of regulating volume) (can also be defined in <a href="#">LakeData.txt</a> )                                                                                                                                                                                                                                                                  |                       |
| krelflood  | -                       | general    | factor for increased production flow from flood control dam                                                                                                                                                                                                                                                                                                                                                         |                       |
| kthrflood  | -                       | general    | factor for flow threshold for increased production flow from flood control dam                                                                                                                                                                                                                                                                                                                                      |                       |
| klowflood  | -                       | general    | factor for water level threshold with production flow from flood control dam equal to inflow                                                                                                                                                                                                                                                                                                                        |                       |
| rivvel     | $m s^{-1}$              | general    | celerity of flood in watercourse (rivvel>0)                                                                                                                                                                                                                                                                                                                                                                         | <a href="#">river</a> |
| damp       | -                       | general    | fraction of delay in the watercourse which also causes damping                                                                                                                                                                                                                                                                                                                                                      | <a href="#">river</a> |
| deadl      | $m^2 km^{-2}$           | general    | parameter to calculate the dead volume in the local watercourse                                                                                                                                                                                                                                                                                                                                                     | <a href="#">river</a> |
| deadm      | $m^2 km^{-2}$           | general    | parameter to calculate the dead volume in the main watercourse                                                                                                                                                                                                                                                                                                                                                      | <a href="#">river</a> |
| tcalt      | $^{\circ}C (100m)^{-1}$ | general    | parameter for temperature's elevation dependence, uses SLC's deviation from subbasin mean height (=0.6°C/100m)                                                                                                                                                                                                                                                                                                      | <a href="#">temp</a>  |
| tempcorr   | $^{\circ}C$             | parreg     | correction parameter for temperature                                                                                                                                                                                                                                                                                                                                                                                | <a href="#">temp</a>  |
| tcelevadd  | $^{\circ}C (100m)^{-1}$ | general    | parameter for temperature's elevation dependence, uses subbasin mean height                                                                                                                                                                                                                                                                                                                                         | <a href="#">temp</a>  |
| tcobselev  | $^{\circ}C (100m)^{-1}$ | general    | parameter for temperature correction due to observation elevation deviation from subbasin elevation                                                                                                                                                                                                                                                                                                                 | <a href="#">temp</a>  |
| monthlapse | $^{\circ}C (100m)^{-1}$ | month      | alternative parameter for temperature correction with elevation, monthly temperature lapse rate (positive when decreasing with elevation, same as tcalt and tcelevadd)                                                                                                                                                                                                                                              | <a href="#">temp</a>  |
| pcaddg     | -                       | general    | correction parameter for precipitation                                                                                                                                                                                                                                                                                                                                                                              | <a href="#">prec</a>  |
| pcurain    | -                       | general    | undercatch correction for rainfall, rainfall = rainfall * (1+pcurain). The correction is applied at the observation level, before using any elevation corrections to basin mean elevation or class specific elevations. Since the snowfall threshold temperature is landuse specific, the correction is weighted depending on the areal fractions of the landuse classes. The same applies to the pcusnow parameter |                       |
| pcusnow    | -                       | general    | undercatch correction for snowfall, snowfall = snowfall*(1+pcusnow). See notes for pcurain.                                                                                                                                                                                                                                                                                                                         |                       |
| pcluse     | -                       | land use   | correction factor for precipitation<br>prec=prec(1-pcluse)                                                                                                                                                                                                                                                                                                                                                          | <a href="#">prec</a>  |
| pcelevadd  | $(100m)^{-1}$           | general    | correction parameter for precipitation (per 100 m elevation > pcelevth)                                                                                                                                                                                                                                                                                                                                             | <a href="#">prec</a>  |
| pcelevth   | m                       | general    | elevation above which the precipitation correction pcelevadd is used                                                                                                                                                                                                                                                                                                                                                | <a href="#">prec</a>  |
| pcelevmax  | -                       | general    | maximum for height dependent precipitation correction                                                                                                                                                                                                                                                                                                                                                               | <a href="#">prec</a>  |
| pcelevstd  | $(100m)^{-1}$           | general    | correction parameter for precipitation (per 100 m of elevation standard deviation)                                                                                                                                                                                                                                                                                                                                  | <a href="#">prec</a>  |

| Name      | Unit                               | Dependency | Description                                                                                                                                  | Link                                                          |
|-----------|------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| preccorr  | -                                  | parreg     | correction factor for precipitation<br>$prec = prec \left( 1 + preccorr \right)$                                                             | <a href="#">prec</a>                                          |
| gldepi    | m                                  | general    | depth for all lakes                                                                                                                          | <a href="#">lake</a>                                          |
| denitrлу  | d <sup>-1</sup>                    | land use   | parameter for denitrification rate in soil                                                                                                   | <a href="#">denitrif</a>                                      |
| denitrлу3 | d <sup>-1</sup>                    | land use   | denitrification rate in third soil layer, replaces denitrлу if set to >= 0. If only used for some land use classes, set to -1 for all other. | <a href="#">denitrif</a>                                      |
| degradhp  | d <sup>-1</sup>                    | land use   | decay of humus to fastP                                                                                                                      | <a href="#">NP soil</a>                                       |
| degradhn  | d <sup>-1</sup>                    | land use   | decay of humus to fastN                                                                                                                      | <a href="#">NP soil</a>                                       |
| minerfn   | d <sup>-1</sup>                    | land use   | mineralisation of fastN to inorganic N                                                                                                       | <a href="#">NP soil</a>                                       |
| minerfp   | d <sup>-1</sup>                    | land use   | mineralisation of fastP to SRP                                                                                                               | <a href="#">NP soil</a>                                       |
| dissolfp  | d <sup>-1</sup>                    | land use   | decay of fastP to dissolved PP                                                                                                               | <a href="#">NP soil</a>                                       |
| dissolfn  | d <sup>-1</sup>                    | land use   | decay of fastN to dissolved organic N                                                                                                        | <a href="#">NP soil</a>                                       |
| dissolhp  | d <sup>-1</sup>                    | land use   | decay of humusP to dissolved PP                                                                                                              | <a href="#">NP soil</a>                                       |
| dissolhn  | d <sup>-1</sup>                    | land use   | decay of humusN to dissolved organic N                                                                                                       | <a href="#">NP soil</a>                                       |
| wprodn    | kg m <sup>-3</sup> d <sup>-1</sup> | general    | production/decay of N in water (can also be defined in <a href="#">LakeData.txt</a> )                                                        | <a href="#">NP river lake</a>                                 |
| wprodp    | kg m <sup>-3</sup> d <sup>-1</sup> | general    | production/decay of P in water (can also be defined in <a href="#">LakeData.txt</a> )                                                        | <a href="#">NP river lake</a>                                 |
| wprodc    | kg m <sup>-3</sup> d <sup>-1</sup> | general    | production/decay of OC in water (can also be defined in <a href="#">LakeData.txt</a> )                                                       | <a href="#">C river lake</a>                                  |
| hsatTP    | mg L <sup>-1</sup>                 | general    | half saturation concentration of TP for production and mineralisation in surface water                                                       | <a href="#">NP river lake</a><br><a href="#">C river lake</a> |
| hsatINs   | mg L <sup>-1</sup>                 | general    | half saturation concentration of IN for denitrification in soil                                                                              | <a href="#">denitrif</a>                                      |
| hsatINw   | mg L <sup>-1</sup>                 | general    | half saturation concentration of IN for denitrification in surface water                                                                     | <a href="#">denitrif</a>                                      |
| denitwrl  | kg m <sup>-2</sup> d <sup>-1</sup> | general    | parameter for denitrification in local watercourse                                                                                           | <a href="#">denitrif</a>                                      |
| denitwrm  | kg m <sup>-2</sup> d <sup>-1</sup> | general    | parameter for denitrification in main watercourse                                                                                            | <a href="#">denitrif</a>                                      |
| denitwl   | kg m <sup>-2</sup> d <sup>-1</sup> | general    | parameter for denitrification in lakes (can also be defined in <a href="#">LakeData.txt</a> )                                                | <a href="#">denitrif</a>                                      |
| sedon     | m ts <sup>-1</sup>                 | general    | sedimentation rate of ON in lakes (can also be defined in <a href="#">LakeData.txt</a> )                                                     | <a href="#">NP lake</a>                                       |
| sedpp     | m ts <sup>-1</sup>                 | general    | sedimentation rate of PP in lakes (can also be defined in <a href="#">LakeData.txt</a> )                                                     | <a href="#">NP lake</a>                                       |
| sedexp    | -                                  | general    | parameter for sedimentation/resuspension in watercourses                                                                                     | <a href="#">P river</a>                                       |
| limsedON  | mg L <sup>-1</sup>                 | general    | concentration of ON deducted from conc in water when sedimentation is calculated. This should represent the dissolved organic nitrogen.      | <a href="#">NP lake</a>                                       |

| Name       | Unit                   | Dependency | Description                                                                                                                                                                                                                                     | Link                                         |
|------------|------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| limsedPP   | $mg\ L^{-1}$           | general    | concentration of PP deducted from concentration in water when sedimentation is calculated. This concentration is also deducted from the mean TP concentration when calculating half-saturation factor in the mineralization/production routine. | <a href="#">NP lake NP lake C river lake</a> |
| muptn      | $kg\ m^{-2}\ d^{-1}$   | general    | macrophyte uptake of IN in lake water (can also be defined in <a href="#">LakeData.txt</a> )                                                                                                                                                    | <a href="#">NP lake</a>                      |
| muptp      | $kg\ m^{-2}\ d^{-1}$   | general    | macrophyte uptake of SP in lake water (can also be defined in <a href="#">LakeData.txt</a> )                                                                                                                                                    | <a href="#">NP lake</a>                      |
| muptdep    | $m$                    | general    | macrophyte uptake production depth in lake                                                                                                                                                                                                      | <a href="#">NP lake</a>                      |
| muptnriv   | $kg\ m^{-2}\ d^{-1}$   | general    | macrophyte uptake of IN in river water                                                                                                                                                                                                          | <a href="#">NP river</a>                     |
| muptpriv   | $kg\ m^{-2}\ d^{-1}$   | general    | macrophyte uptake of SP in river water                                                                                                                                                                                                          | <a href="#">NP river</a>                     |
| muptdepriv | $m$                    | general    | macrophyte uptake production depth in river                                                                                                                                                                                                     | <a href="#">NP river</a>                     |
| humusN0    | $mg\ m^{-3}$           | land use   | starting concentration of humusN soil pool                                                                                                                                                                                                      | <a href="#">NP soil</a>                      |
| humusP0    | $mg\ m^{-3}$           | land use   | starting concentration of humusP soil pool                                                                                                                                                                                                      | <a href="#">NP soil</a>                      |
| fastN0     | $mg\ m^{-3}$           | general    | starting concentration of fastN soil pool                                                                                                                                                                                                       | <a href="#">NP soil</a>                      |
| partP0     | $mg\ m^{-3}$           | land use   | starting concentration of partP soil pool                                                                                                                                                                                                       | <a href="#">NP soil</a>                      |
| fastP0     | $mg\ m^{-3}$           | general    | starting concentration of fastP soil pool                                                                                                                                                                                                       | <a href="#">NP soil</a>                      |
| occonc0    | $mg\ L^{-1}$           | land use   | starting value, organic carbon concentration in soil                                                                                                                                                                                            |                                              |
| onconc0    | $mg\ L^{-1}$           | land use   | starting value, organic nitrogen concentration in soil                                                                                                                                                                                          | <a href="#">NP soil</a>                      |
| ppconc0    | $mg\ L^{-1}$           | land use   | starting value, particulate phosphorus concentration in soil                                                                                                                                                                                    | <a href="#">NP soil</a>                      |
| onpercred  | -                      | land use   | reduction of ON concentration during percolation                                                                                                                                                                                                | <a href="#">NP perc</a>                      |
| pppercred  | -                      | land use   | reduction of PP concentration during percolation                                                                                                                                                                                                | <a href="#">NP perc</a>                      |
| pPhalf     | $m$                    | land use   | half depth for partP soil pool                                                                                                                                                                                                                  | <a href="#">NP soil</a>                      |
| hPhalf     | $m$                    | land use   | half depth for humusP soil pool                                                                                                                                                                                                                 | <a href="#">NP soil</a>                      |
| hNhalf     | $m$                    | land use   | half depth for humusN soil pool                                                                                                                                                                                                                 | <a href="#">NP soil</a>                      |
| iniT1      | $\mu U\ L^{-1}$        | general    | starting value in soil, concentration T1                                                                                                                                                                                                        | <a href="#">tracer T1</a>                    |
| iniT1sw    | $\mu U\ L^{-1}$        | general    | starting value in surface water, concentration T1                                                                                                                                                                                               | <a href="#">tracer T1</a>                    |
| iniT2      | $^{\circ}C$            | general    | starting value in soil, T2 (temperature)                                                                                                                                                                                                        | <a href="#">tracer T2</a>                    |
| freuc      | $kg^{-1}$              | soil type  | parameter in Freundlich equation (coefficient)                                                                                                                                                                                                  | <a href="#">P soil</a>                       |
| freuexp    | -                      | soil type  | parameter in Freundlich equation (exponent)                                                                                                                                                                                                     | <a href="#">P soil</a>                       |
| freurate   | $d^{-1}$               | soil type  | parameter that steers adsorption/desorption speed                                                                                                                                                                                               | <a href="#">P soil</a>                       |
| locsoil    | -                      | general    | fraction of emission from rural waste water that is emitted to directly to the lowest soil layer (rest goes to the local watercourse)                                                                                                           | <a href="#">rural</a>                        |
| drydeppp   | $kg\ km^{-2}\ ts^{-1}$ | land use   | dry deposition of PP                                                                                                                                                                                                                            | <a href="#">deposition</a>                   |
| wetdepsp   | $\mu g\ L^{-1}$        | general    | wet deposition of SP                                                                                                                                                                                                                            | <a href="#">deposition</a>                   |
| wetdepspl  | $kg\ km^{-2}\ ts^{-1}$ | general    | wet deposition of SP on water surfaces                                                                                                                                                                                                          | <a href="#">deposition</a>                   |

| Name       | Unit          | Dependency  | Description                                                                                                                                                                                  | Link                                         |
|------------|---------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| aloadconst | -             | general     | status to keep wet deposition load constant if precipitation is corrected (if set to 1, 0 is default)                                                                                        | <a href="#">deposition</a>                   |
| ponatm     | -             | land use    | correction factor for atmospheric deposition of IN, fraction that goes to fastN-pool instead                                                                                                 | <a href="#">deposition</a>                   |
| srrate     | -             | soil type   | fraction for surface runoff                                                                                                                                                                  | <a href="#">surface runoff</a>               |
| macrate    | -             | soil type   | fraction for macro-pore flow                                                                                                                                                                 | <a href="#">macropore</a>                    |
| mactrinf   | $mm\ ts^{-1}$ | soil type   | threshold for macro-pore flow                                                                                                                                                                | <a href="#">macropore</a>                    |
| mactrsm    | -             | soil type   | threshold soil water for macro-pore flow and surface runoff (fraction of wcwp+wcfc i uppermost layer)                                                                                        | <a href="#">macropore and surface runoff</a> |
| soilcoh    | $kPa$         | soil type   | characteristic of soil for calculation of soil erosion (cohesion)                                                                                                                            | <a href="#">erosion</a>                      |
| soilerod   | $g\ J^{-1}$   | soil type   | characteristic of soil for calculation of soil erosion (erodibility)                                                                                                                         | <a href="#">erosion</a>                      |
| epotdist   | $m^{-1}$      | general     | coefficient in exponential function for potential evapotranspiration's depth dependency                                                                                                      | <a href="#">PET</a>                          |
| qmean      | $mm\ yr^{-1}$ | general     | initial value for calculation of mean flow (can also be defined in <a href="#">LakeData.txt</a> )                                                                                            |                                              |
| tpmean     | $mg\ L^{-1}$  | lake region | mean TP level in lakes, used for production if P not simulated, used also as starting value for concentration of particulate P in lakes. Can also be defined in <a href="#">LakeData.txt</a> | <a href="#">NP lake</a>                      |
| tnmean     | $mg\ L^{-1}$  | lake region | mean TN level i lakes, used as starting value for concentration of organic N in lakes. Can also be defined in <a href="#">LakeData.txt</a>                                                   |                                              |
| rivvel1    | -             | lake region | parameter for calculation of velocity of the water in the watercourse                                                                                                                        | <a href="#">river</a>                        |
| rivvel2    | -             | lake region | parameter for calculation of velocity of the water in the watercourse                                                                                                                        | <a href="#">river</a>                        |
| rivvel3    | -             | lake region | parameter for calculation of velocity of the water in the watercourse                                                                                                                        | <a href="#">river</a>                        |
| rivwidth1  | -             | lake region | parameter for calculation of the width of the watercourse                                                                                                                                    | <a href="#">river</a>                        |
| rivwidth2  | -             | lake region | parameter for calculation of the width of the watercourse                                                                                                                                    | <a href="#">river</a>                        |
| rivwidth3  | -             | lake region | parameter for calculation of the width of the watercourse                                                                                                                                    | <a href="#">river</a>                        |
| maxwidth   | $m$           | general     | parameter for limitation of width of the watercourse                                                                                                                                         | <a href="#">river</a>                        |
| sreroexp   | -             | general     | exponent in the equation for calculation of soil erosion caused by surface runoff                                                                                                            | <a href="#">erosion</a>                      |
| pprelmax   | $mm\ ts^{-1}$ | general     | parameter for delay of SS and PP from surface runoff and tile drains                                                                                                                         | <a href="#">erosion</a>                      |
| pprelexp   | -             | general     | parameter for delay of SS and PP from surface runoff and tile drains                                                                                                                         | <a href="#">erosion</a>                      |
| bufffilt   | -             | land use    | filtration of PartP with surface runoff through the buffer zone (fraction that slips through), 0 for land-uses where this is irrelevant                                                      | <a href="#">erosion</a>                      |

| Name       | Unit                  | Dependency | Description                                                                                                                                                     | Link                           |
|------------|-----------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| innerfilt  | -                     | land use   | filtration of PartP with surface runoff from agricultural land far from watercourse (fraction that slips through), 0 for land-uses where this is irrelevant     | <a href="#">erosion</a>        |
| otherfilt  | -                     | land use   | filtration of PartP with surface runoff from other land types than agricultural land (fraction that slips through), 0 for land-uses where this is irrelevant    | <a href="#">erosion</a>        |
| macrofilt  | -                     | soil type  | filtration (retention) of PartP with macropore flow (fraction)                                                                                                  | <a href="#">erosion</a>        |
| sdnsnew    | $g\ cm^{-3}$          | general    | density of new-fallen snow (former snowdens0)                                                                                                                   | <a href="#">snow snow melt</a> |
| snowdensdt | $g\ cm^{-3}\ ts^{-1}$ | general    | increase of snow density per day                                                                                                                                | <a href="#">snow</a>           |
| sdnsmax    | $g\ cm^{-3}$          | general    | maximum snow density                                                                                                                                            | <a href="#">snow</a>           |
| sdnsrate   | $ts^{-1}$             | general    | increase of snow density per timestep                                                                                                                           | <a href="#">snow</a>           |
| sdnsradd   | $ts^{-1}$             | general    | additional increase of snow density per timestep for warm days                                                                                                  | <a href="#">snow</a>           |
| snkika     | $m$                   | land use   | snow heat model, relation between snow thermal conductivity and surface heat exchange coefficient, unit is in meters, values in the range 10-100 approximately. | <a href="#">snow melt</a>      |
| whcsnow    | -                     | general    | water holding capacity of snow, typical value 0.08.                                                                                                             | <a href="#">snow</a>           |
| fertdays   | $d$                   | general    | number of days that fertiliser applications occur counting from application day 1 and forward using the same amount every day                                   | <a href="#">fertilizer</a>     |
| litterdays | $d$                   | general    | number of days that plant residuals are applied counting from application day 1 and forward using the same amount every day                                     |                                |
| humusc1    | $mg\ m^{-3}$          | land use   | starting concentration for humusC pool in soil's uppermost soil layer                                                                                           | <a href="#">C soil</a>         |
| fastc1     | $mg\ m^{-3}$          | land use   | starting concentration for fastC pool in soil's uppermost soil layer                                                                                            | <a href="#">C soil</a>         |
| humusc2    | $mg\ m^{-3}$          | land use   | starting concentration for humusC pool in soil's second soil layer                                                                                              | <a href="#">C soil</a>         |
| fastc2     | $mg\ m^{-3}$          | land use   | starting concentration for fastC pool in soil's second soil layer                                                                                               | <a href="#">C soil</a>         |
| humusc3    | $mg\ m^{-3}$          | land use   | starting concentration for humusC pool in soil lowest soil layer                                                                                                | <a href="#">C soil</a>         |
| fastc3     | $mg\ m^{-3}$          | land use   | starting concentration for fastC pool in soil lowest soil layer                                                                                                 | <a href="#">C soil</a>         |
| klh        | $d^{-1}$              | general    | parameter for speed of transformation from litter to humus                                                                                                      | <a href="#">C soil</a>         |
| klo        | $d^{-1}$              | general    | parameter for speed of transformation from litter to DOC                                                                                                        | <a href="#">C soil</a>         |
| kho        | $d^{-1}$              | general    | parameter for speed of transformation from humus to DOC                                                                                                         | <a href="#">C soil</a>         |
| kof        | $d^{-1}$              | general    | parameter for speed of transformation from DOC to fastC                                                                                                         | <a href="#">C soil</a>         |

| Name       | Unit                               | Dependency  | Description                                                                                                                                   | Link                                           |
|------------|------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| koflim     | -                                  | general     | parameter for threshold for wetness for transformation DOC to fastC                                                                           | <a href="#">C soil</a>                         |
| koc        | -                                  | general     | parameter for DOC-concentrations reduction for percolation                                                                                    | <a href="#">C soil</a>                         |
| kcgwreg    | -                                  | general     | parameter for DOC-concentrations reduction with flow out to regional groundwater                                                              | <a href="#">C soil</a>                         |
| sedoc      | $m\ ts^{-1}$                       | general     | sedimentation rate OC in lakes. Can also be defined in <a href="#">LakeData.txt</a> .                                                         | <a href="#">C lake</a>                         |
| ripz       | -                                  | land use    | parameter for OC processes in riparian zone                                                                                                   | <a href="#">C riparian</a>                     |
| ripe       | $m^{-1}$                           | general     | exponent for groundwater depth dependence of OC processes in riparian zones                                                                   | <a href="#">C riparian</a>                     |
| rips       | -                                  | general     | seasonal factor for OC processes in riparian zones                                                                                            | <a href="#">C riparian</a>                     |
| tocmean    | $mg\ L^{-1}$                       | lake region | mean OC fraction in lakes, used that starting value for concentrations of TOC in lakes (can also be defined in <a href="#">LakeData.txt</a> ) |                                                |
| minc       | -                                  | general     | fraction of transformation mineralised to DIC                                                                                                 | <a href="#">C soil</a>                         |
| ocsoimsat  | -                                  | land use    | saturation in soil moisture function for degradation of soil organic carbon                                                                   | <a href="#">C soil</a>                         |
| ocsoimslp  | %                                  | land use    | slope in soil moisture function for degradation of soil organic carbon                                                                        | <a href="#">C soil</a>                         |
| laketemp   | $d$                                | general     | maximum value for depth dependent lake temperature routine, 0 means that this function is not used.                                           |                                                |
| snalbmin   | -                                  | land use    | parameter for snowmelt model 2                                                                                                                |                                                |
| snalbmax   | -                                  | land use    | parameter for snowmelt model 2                                                                                                                |                                                |
| snalbkexp  | $ts^{-1}$                          | land use    | parameter for snowmelt model 2                                                                                                                |                                                |
| cmrad      | $mm\ m^2\ MJ^{-1}$                 | land use    | coefficient for radiation snow melt, parameter for snowmelt model 2                                                                           |                                                |
| t2trriver  | $J\ m^{-2}\ s^{-1}\ ^\circ C^{-1}$ | general     | heat transfer parameter for water temperature T2 of river                                                                                     |                                                |
| t2trlake   | $J\ m^{-2}\ s^{-1}\ ^\circ C^{-1}$ | general     | heat transfer parameter for water temperature T2 of lake                                                                                      |                                                |
| upper2deep | $J\ m^{-2}\ s^{-1}\ ^\circ C^{-1}$ | general     | heat transfer parameter for water temperature T2 between lake parts                                                                           |                                                |
| tcfriver   | $J\ m^{-2}\ s^{-1}\ ^\circ C^{-1}$ | general     | air-riverwater heat flow, temperature difference coefficient                                                                                  | <a href="#">water - atmosphere T2 exchange</a> |
| scfriver   |                                    | general     | air-riverwater heat flow, solar radiation coefficient                                                                                         | <a href="#">water - atmosphere T2 exchange</a> |
| ccfriver   |                                    | general     | air-riverwater heat flow, constant coefficient                                                                                                | <a href="#">water - atmosphere T2 exchange</a> |
| lcfriver   |                                    | general     | air-riverwater heat flow, linear coefficient                                                                                                  | <a href="#">water - atmosphere T2 exchange</a> |
| tcflake    | $J\ m^{-2}\ s^{-1}\ ^\circ C^{-1}$ | general     | air-lakewater heat flow, temperature difference coefficient                                                                                   | <a href="#">water - atmosphere T2 exchange</a> |

| Name       | Unit                  | Dependency | Description                                                                                     | Link                                           |
|------------|-----------------------|------------|-------------------------------------------------------------------------------------------------|------------------------------------------------|
| scflake    |                       | general    | air-lakewater heat flow, solar radiation coefficient                                            | <a href="#">water - atmosphere T2 exchange</a> |
| ccflake    |                       | general    | air-lakewater heat flow, constant coefficient                                                   | <a href="#">water - atmosphere T2 exchange</a> |
| lcflake    |                       | general    | air-lakewater heat flow, linear coefficient                                                     | <a href="#">water - atmosphere T2 exchange</a> |
| stbcorr1   |                       | general    | parameter for stability correction                                                              |                                                |
| stbcorr2   |                       | general    | parameter for stability correction                                                              |                                                |
| stbcorr3   |                       | general    | parameter for stability correction                                                              |                                                |
| licettf    | °C                    | general    | lake ice model, water temperature threshold for freeze-up                                       | <a href="#">ice</a>                            |
| licetf     | °C                    | general    | lake ice model, freezing temperature                                                            | <a href="#">ice</a>                            |
| licesndens | $g\ cm^{-3}\ ts^{-1}$ | general    | lake ice model, snow compaction parameter                                                       | <a href="#">ice</a>                            |
| licekika   | cm                    | general    | lake ice model, ratio between thermal conductivity of ice and heat exchange coefficient in air  | <a href="#">ice</a>                            |
| licekeexp  | -                     | general    | lake ice model, water temperature threshold for freeze-up                                       | <a href="#">ice</a>                            |
| licetmelt  | $cm\ ^\circ C^{-1}$   | general    | lake ice model, melt factor for ice                                                             | <a href="#">ice</a>                            |
| licewcorr  | -                     | general    | lake ice model, snowfall reduction for wind drift                                               | <a href="#">ice</a>                            |
| licessmft  | -                     | general    | lake ice model, subsurface melt fraction, temperature driven melt                               | <a href="#">ice</a>                            |
| licessmfr  | -                     | general    | lake ice model, subsurface melt fraction, radiation driven melt                                 | <a href="#">ice</a>                            |
| licermelt  | -                     | general    | lake ice model, radiation melt efficiency (fraction of radiation used for melt at T>0)          | <a href="#">ice</a>                            |
| licebupo   | -                     | general    | lake ice model, breakup porosity                                                                | <a href="#">ice</a>                            |
| liceqhw    | $W/m^2$               | general    | lake ice model, heat flux from water to ice                                                     | <a href="#">ice</a>                            |
| ricettf    | °C                    | general    | river ice model, water temperature threshold for freeze-up                                      | <a href="#">ice</a>                            |
| ricetf     | °C                    | general    | river ice model, freezing temperature                                                           | <a href="#">ice</a>                            |
| ricesndens | $g\ cm^{-3}\ ts^{-1}$ | general    | river ice model, snow compaction parameter                                                      | <a href="#">ice</a>                            |
| ricekika   | cm                    | general    | river ice model, ratio between thermal conductivity of ice and heat exchange coefficient in air | <a href="#">ice</a>                            |
| ricekeexp  | -                     | general    | river ice model, water temperature threshold for freeze-up                                      | <a href="#">ice</a>                            |
| ricetmelt  | $cm\ ^\circ C^{-1}$   | general    | river ice model, melt factor for ice                                                            | <a href="#">ice</a>                            |
| ricermelt  | -                     | general    | river ice model, radiation melt efficiency                                                      | <a href="#">ice</a>                            |
| ricessmft  | -                     | general    | river ice model, subsurface melt fraction, temp                                                 | <a href="#">ice</a>                            |
| ricessmfr  | -                     | general    | river ice model, subsurface melt fraction, radiation                                            | <a href="#">ice</a>                            |
| ricebupo   | -                     | general    | river ice model, breakup porosity                                                               | <a href="#">ice</a>                            |

| Name                   | Unit        | Dependency | Description                                                                                                                                                                                                           | Link                           |
|------------------------|-------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| riceqhm <sub>n</sub>   | $W/m^2$     | general    | river ice model, (min) heat flux from water to ice at waterflow                                                                                                                                                       | <a href="#">ice</a>            |
| riceqhm <sub>x</sub>   | $W/m^2$     | general    | river ice model, (max) heat flux from water to ice at waterflow                                                                                                                                                       | <a href="#">ice</a>            |
| ricecwi                | -           | general    | river ice model, heat exchange coefficient between stream flow and river ice                                                                                                                                          | <a href="#">ice</a>            |
| fsc <sub>max</sub>     | -           | general    | maximum fractional snow cover area                                                                                                                                                                                    | <a href="#">snow cover</a>     |
| fsc <sub>min</sub>     | -           | general    | minimum fractional snow cover area                                                                                                                                                                                    | <a href="#">snow cover</a>     |
| fsclim                 | -           | general    | limit of fractional snow cover area for onset of snowmax                                                                                                                                                              | <a href="#">snow cover</a>     |
| fscdist <sub>max</sub> | -           | land use   | maximum snow distribution factor                                                                                                                                                                                      | <a href="#">snow cover</a>     |
| fscdist <sub>0</sub>   | -           | land use   | minimum snow distribution factor                                                                                                                                                                                      | <a href="#">snow cover</a>     |
| fscdist <sub>1</sub>   | $m^{-1}$    | land use   | std coefficient for snow distribution factor                                                                                                                                                                          | <a href="#">snow cover</a>     |
| fsck <sub>1</sub>      | -           | general    | parameter for snowmax                                                                                                                                                                                                 | <a href="#">snow cover</a>     |
| fsckexp                | $s^{-1}$    | general    | parameter for snowmax                                                                                                                                                                                                 | <a href="#">snow cover</a>     |
| fsceff                 | -           | general    | efficiency of snow cover to influence snow melt and snow evaporation, should have values between 0 and 1. A value of 1 means that snow melt will be linearly scaled with snow cover: melt = melt*(1-fsc*(1-snowcov)). |                                |
| cmrefr                 | -           | general    | refreeze efficiency compared to the degree-day snow melt factor: refreeze=cmrefr*cmlt*(tt-temp) if temp<tt. Used for snow melt model 2.                                                                               |                                |
| fepotsnow              | -           | general    | fraction of snow-free potential evapotranspiration, used for calculation of snow evaporation.                                                                                                                         |                                |
| krs                    |             | general    | parameter for estimating shortwave radiation, also used in petmodel 3 - Modified Hargreaves-Samani, Hargreaves adjustment factor                                                                                      | <a href="#">PET input data</a> |
| jhtadd                 |             | general    | parameter for petmodel 2 - Modified Jensen-Haise/McGuiness                                                                                                                                                            | <a href="#">PET</a>            |
| jhtscale               |             | general    | parameter for petmodel 2 - Modified Jensen-Haise/McGuiness                                                                                                                                                            | <a href="#">PET</a>            |
| alfapt                 |             | general    | parameter for petmodel 4 - Priestly-Taylor                                                                                                                                                                            | <a href="#">PET</a>            |
| mwind                  | $m\ s^{-1}$ | general    | average wind speed, used for petmodel 5 when no wind forcing is available                                                                                                                                             | <a href="#">wind</a>           |
| zwind                  | $m$         | general    | wind observation height, typical value is 10                                                                                                                                                                          | <a href="#">wind</a>           |
| zwish                  | $m$         | general    | wanted wind height, typical value is 2                                                                                                                                                                                | <a href="#">wind</a>           |
| zpdh                   | $m$         | general    | zero plane displacement height                                                                                                                                                                                        | <a href="#">wind</a>           |
| roughness              | -           | general    | surface roughness (for observed wind)                                                                                                                                                                                 | <a href="#">wind</a>           |
| kc                     | -           | land use   | crop coefficient for petmodels, default parameter                                                                                                                                                                     | <a href="#">PET</a>            |
| kc2                    | -           | land use   | crop coefficient for petmodel 2, if not set kc is used                                                                                                                                                                | <a href="#">PET</a>            |
| kc3                    | -           | land use   | crop coefficient for petmodel 3, if not set kc is used                                                                                                                                                                | <a href="#">PET</a>            |
| kc4                    | -           | land use   | crop coefficient for petmodel 4, if not set kc is used                                                                                                                                                                | <a href="#">PET</a>            |
| kc5                    | -           | land use   | crop coefficient for petmodel 5, if not set kc is used                                                                                                                                                                | <a href="#">PET</a>            |

| Name      | Unit                | Dependency | Description                                                                                                                                                                                                                                                                                                                                                    | Link                                   |
|-----------|---------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| alb       | -                   | land use   | albedo for petmodels                                                                                                                                                                                                                                                                                                                                           | <a href="#">net downward radiation</a> |
| incorr    | -                   | wqparreg   | <p><i>super-parameter</i>, regional correction factor for parameter governing inorganic nitrogen:</p> $par = par \times (1 + incorr)$ <p>for degradhn and</p> $par = par \times (1 - incorr)$ <p>for denitrln, denitwl, denitwrm, and denitwrl</p> <p><b>Note:</b> denitwl in <a href="#">LakeData.txt</a> will also be affected by this correction factor</p> |                                        |
| oncorr    | -                   | wqparreg   | <p><i>super-parameter</i>, regional correction factor for parameter governing organic nitrogen:</p> $par = par \times (1 + oncorr)$ <p>for dissolhn and</p> $par = par \times (1 - oncorr)$ <p>for sedon</p> <p><b>Note:</b> sedon in <a href="#">LakeData.txt</a> will also be affected by this correction factor</p>                                         |                                        |
| phoscorr  | -                   | wqparreg   | <p><i>super-parameter</i>, regional correction factor for parameter governing phosphorus:</p> $par = par \times (1 + phoscorr)$ <p>for soilerod, dissolhP, fastP0, humusP0, and partP0</p>                                                                                                                                                                     |                                        |
| ratcorr   | -                   | parreg     | correction factor for discharge<br>gratk=gratk(1+ratcorr)                                                                                                                                                                                                                                                                                                      | <a href="#">rating curve</a>           |
| pirrs     | -                   | parreg     | irrigation abstraction fraction from surface water sources. Controls the amount of potentially withdrawable surface water that is in fact abstracted. pirrs=1 implies full withdrawal. pirrs=0 if not set.                                                                                                                                                     | <a href="#">irrigation abstraction</a> |
| pirrg     | -                   | parreg     | irrigation abstraction fraction from groundwater. Controls the amount of potentially withdrawable groundwater that is in fact abstracted. pirrg=1 implies full withdrawal. pirrg=0 if not set.                                                                                                                                                                 | <a href="#">irrigation abstraction</a> |
| sswcorr   | -                   | general    | rescaling factor for the soil water stress irrigation threshold. sswcorr=1 implies no rescaling. sswcorr=0 if not set.                                                                                                                                                                                                                                         | <a href="#">irrigation demand</a>      |
| iwdfrac   | -                   | general    | fraction of the irrigation threshold which constitutes irrigation water demand. Note iwdfrac can be >1. Only used if demandtype=3.                                                                                                                                                                                                                             | <a href="#">irrigation demand</a>      |
| regirr    | -                   | general    | connectivity scaling factor for the regional irrigation water abstractions. Regirr=1 implies full connectivity while regirr=0.5 implies that only half of regional demands are taken into account                                                                                                                                                              | <a href="#">irrigation abstraction</a> |
| irrdemand | mm ts <sup>-1</sup> | general    | the irrigation water demand for subbasins with demandtype=1                                                                                                                                                                                                                                                                                                    | <a href="#">irrigation demand</a>      |

| Name       | Unit                                               | Dependency           | Description                                                                                                                                                                            | Link                                                 |
|------------|----------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| immdepth   | mm                                                 | general              | target submergence depth for submerged irrigated crops                                                                                                                                 | <a href="#">irrigation demand</a>                    |
| cirrsink   | -                                                  | parreg               | concentration reduction fraction in settlement tanks at irrigation abstraction points                                                                                                  | <a href="#">irrigation abstraction</a>               |
| irrcomp    | -                                                  | general              | irrigation source compensation parameter. Irrcomp defines the fraction of the residual irrigation water demands which can be withdrawn from other local sources. Irrcomp=0 if not set. | <a href="#">irrigation abstraction</a>               |
| glacdens   | $\frac{m^3 \text{ water}}{(m^3 \text{ ice})^{-1}}$ | general              | density of glacier ice (default value=0.85)                                                                                                                                            |                                                      |
| glac2arlim | $m^2$                                              | general              | area limit for determine glacier type                                                                                                                                                  | <a href="#">glacier</a>                              |
| glacvcoef  | m                                                  | general              | coefficient of glacier area-volume relationship for glacier of type 0 (default), (default value=0.205)                                                                                 | <a href="#">glacier</a>                              |
| glacvexp   | -                                                  | general              | exponent of glacier area-volume relationship for glacier of type 0 (default), (default value=1.375)                                                                                    | <a href="#">glacier</a>                              |
| glacvcoef1 | m                                                  | general              | coefficient of glacier area-volume relationship for glacier of type 1, (default value=1.701)                                                                                           | <a href="#">glacier</a>                              |
| glacvexp1  | -                                                  | general              | exponent of glacier area-volume relationship for glacier of type 1, (default value=1.25)                                                                                               | <a href="#">glacier</a>                              |
| glaccmlt   | $\frac{mm}{s} ^\circ C^{-1}$                       | general              | melting parameter for glacier                                                                                                                                                          | <a href="#">glacier</a>                              |
| glacttmp   | $^\circ C$                                         | general              | threshold temperature for glacier melt                                                                                                                                                 | <a href="#">glacier</a>                              |
| glaccmrad  | $mm \ m^2 \ MJ^{-1}$                               | general              | coefficient for radiation glacier melt, parameter for snowmelt model 2                                                                                                                 | <a href="#">glacier</a>                              |
| glaccmrefr | -                                                  | general              | refreeze efficiency compared to the degree-day glacier melt factor, parameter for snow meltmodel 2                                                                                     | <a href="#">glacier</a>                              |
| glacalb    | -                                                  | general              | albedo for glacier ice                                                                                                                                                                 | <a href="#">glacier</a>                              |
| fepotglac  | -                                                  | general              | fraction of snow-free potential evapotranspiration, used for calculation of glacier evaporation (snowevaporation model 1).                                                             | <a href="#">glacier</a>                              |
| rcgrw      | -                                                  | general              | recession coefficient for regional groundwater outflow from soil layers (deepground=1 (and 2))                                                                                         | <a href="#">deep flow</a> or <a href="#">aquifer</a> |
| rcgrwst    | -                                                  | soil type            | recession coefficient for deep percolation flow out of soil layers (deepground=2)                                                                                                      | <a href="#">aquifer</a>                              |
| aqretcor   | -                                                  | parreg (of aquifer)  | adjustment of recession coefficients newpar=oldpar(1+aqcor) for aquifer return flow                                                                                                    | <a href="#">aquifer</a>                              |
| aqdelcor   | -                                                  | parreg (of aquifer)  | adjustment of deep percolation delay to aquifers newpar=oldpar(1+aqcor) for aquifer return flow                                                                                        | <a href="#">aquifer</a>                              |
| aqpercor   | -                                                  | parreg (of subbasin) | adjustment of deep percolation to aquifers newpar=oldpar(1+aqcor) for aquifer return flow                                                                                              | <a href="#">aquifer</a>                              |

| Name       | Unit                                    | Dependency | Description                                                                                                                                                                            | Link                         |
|------------|-----------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| optonoff   | -                                       | general    | switch (0/1) for using general parameters op1-opt8 instead of flooding data of <a href="#">FloodData.txt</a> (1=use opt1-opt8)                                                         |                              |
| opt1       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of floll                                                                                                                      | <a href="#">floodplain</a>   |
| opt2       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of flolp                                                                                                                      | <a href="#">floodplain</a>   |
| opt3       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of flmrr                                                                                                                      | <a href="#">floodplain</a>   |
| opt4       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of flmrp                                                                                                                      | <a href="#">floodplain</a>   |
| opt5       | -                                       | general    | parameter replacing <a href="#">FloodData.txt</a> values of rclfp and rcrfp                                                                                                            | <a href="#">floodplain</a>   |
| opt6       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of fymol                                                                                                                      | <a href="#">floodplain</a>   |
| opt7       | <i>m</i>                                | general    | parameter replacing <a href="#">FloodData.txt</a> values of fymmr                                                                                                                      | <a href="#">floodplain</a>   |
| opt8       | -                                       | general    | parameter replacing <a href="#">FloodData.txt</a> values of rcfpl and rcfpr                                                                                                            | <a href="#">floodplain</a>   |
| limT2exch  | <i>m</i>                                | general    | limit for which deeper river and lakes use surface water heat balance radiation term and other terms (used for modeloption lakeriverice 2)                                             |                              |
| t2mix      | -                                       | general    | switch (0/1) for using mixed lake T2 temperature on outflow of lake (can also be set in <a href="#">LakeData.txt</a> )                                                                 | <a href="#">lake outflow</a> |
| T1expdec   | <i>days</i>                             | general    | half time for exponential decay of T1. Applied to T1 in soil water and surface water (but not in snow). Also applied to T1 in pool above soil, adsorbed to soil and in river sediment. | <a href="#">tracer T1</a>    |
| T1freuc    | <i>L/kg soil or ( U/kg soil)/(U/L )</i> | general    | freundlich adsorption isotherm coefficient for adsorption/desorption of T1 to soil.                                                                                                    | <a href="#">tracer T1</a>    |
| T1rel      | <i>mm<sup>-1</sup></i>                  | general    | release of T1 from above soil pool. Typically the pool consist of manure.                                                                                                              | <a href="#">tracer T1</a>    |
| T1sedexp   | -                                       | general    | parameter for sedimentation/resuspension of T1 in watercourses                                                                                                                         | <a href="#">tracer T1</a>    |
| T1sedvel   | <i>m/timestep</i>                       | general    | sedimentation rate of T1 in lakes                                                                                                                                                      | <a href="#">tracer T1</a>    |
| T1leakluse | <i>μU/L or -</i>                        | land use   | typical leakage concentration of T1 depending on land use or a scaling factor to typical leakage concentration depending on soil type                                                  | <a href="#">tracer T1</a>    |
| T1leaksoil | <i>μU/L or -</i>                        | soil type  | typical leakage concentration of T1 depending on soil type or a scaling factor to typical leakage concentration depending on land use                                                  | <a href="#">tracer T1</a>    |
| soilcorr   | -                                       | land use   | factor used to adjust the thicknesses of soil layer 2 and 3 as given in GeoClass. Must be larger than zero if used.                                                                    |                              |
| ttrig      | <i>degree Celsius</i>                   | land use   | temperature threshold for soil temperature control on soil evapotranspiration                                                                                                          | <a href="#">evaporation</a>  |
| treda      | -                                       | land use   | soil temperature control on soil evapotranspiration                                                                                                                                    | <a href="#">evaporation</a>  |
| tredb      | -                                       | land use   | soil temperature control on soil evapotranspiration                                                                                                                                    | <a href="#">evaporation</a>  |

| Name      | Unit          | Dependency  | Description                                                                                                                                                                                                      | Link                          |
|-----------|---------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| gldepo    | <i>m</i>      | general     | depth of olake, used if lake_depth in GeoData/LakeData/DamData is zero or negative                                                                                                                               |                               |
| gicatch   | -             | general     | fraction of local runoff that goes through the local lake (ilake), the rests runs directly into the main watercourse. Replaces icatch in GeoData if that one is negative or column missing and ilicatch not set. |                               |
| ilratk    | -             | ilakeregion | parameter of rating curve for ilake outflow (rate), replaces gratk if above zero                                                                                                                                 |                               |
| ilratp    | -             | ilakeregion | parameter of rating curve for ilake outflow (exponent), replaces gratp if above zero                                                                                                                             |                               |
| illdepth  | <i>m</i>      | ilakeregion | depth for ilakes                                                                                                                                                                                                 |                               |
| ilicatch  | -             | ilakeregion | fraction of local runoff that goes through the local lake (ilake), the rests runs directly into the main watercourse. Replaces icatch in GeoData if negative or column missing.                                  |                               |
| olratk    | -             | olakeregion | parameter of rating curve for outlet lake outflow (rate), replaces gratk if above zero                                                                                                                           |                               |
| olratp    | -             | olakeregion | parameter of rating curve for outlet lake outflow (exponent), replaces gratp if above zero                                                                                                                       |                               |
| olldepth  | <i>m</i>      | olakeregion | depth for outlet lakes, replaces lake_depth in GeoData if zero or negative                                                                                                                                       |                               |
| glacannmb | <i>mm/yr</i>  | general     | annual mass balance for correction of initial glacier volume                                                                                                                                                     | <a href="#">glacier</a>       |
| denit3reg | $d^{-1}$      | wqparreg    | parameter for denitrification rate in soil layer 3, replaces other denitrification rate parameter (denitr <sub>lu</sub> or denitr <sub>lu3</sub> ) in third soil layer if >0                                     |                               |
| erodluse  | -             | land use    | erosion model 1 landuse erosion factor                                                                                                                                                                           | <a href="#">erosion</a>       |
| erodsoil  | -             | soil type   | erosion model 1 soil type erosion factor                                                                                                                                                                         | <a href="#">erosion</a>       |
| erodslope | -             | general     | erosion model 1 slope erosion factor (exponent)                                                                                                                                                                  | <a href="#">erosion</a>       |
| erodexp   | -             | general     | erosion model 1 erosion precipitation dependent factor (exponent)                                                                                                                                                | <a href="#">erosion</a>       |
| erodindex | -             | general     | erosion model 1 scaling of subbasin erosion index                                                                                                                                                                | <a href="#">erosion</a>       |
| ppenrmax  | -             | soil type   | maximum enrichment of PP in transport of soil erosion                                                                                                                                                            | <a href="#">erosion</a>       |
| ppenrstab | -             | general     | minimum enrichment (stable level) of PP in transport of soil erosion                                                                                                                                             | <a href="#">erosion</a>       |
| ppenrflow | $mm\ ts^{-1}$ | general     | flow at which stable level of enrichment of PP in transport of soil erosion is reached                                                                                                                           | <a href="#">erosion</a>       |
| sedss     | $m\ ts^{-1}$  | general     | sedimentation velocity of suspended sediments in lakes                                                                                                                                                           | <a href="#">sedimentation</a> |
| limesdss  | $mg\ L^{-1}$  | general     | concentration of SS deducted from concentration in water when sedimentation is calculated                                                                                                                        | <a href="#">sedimentation</a> |
| sedae     | $m\ ts^{-1}$  | general     | sedimentation velocity of algae in lakes                                                                                                                                                                         | <a href="#">sedimentation</a> |
| fraxe     | <i>m</i>      | general     | mean river depth (m) where fractional river area = 1                                                                                                                                                             | <a href="#">evaporation</a>   |
| fraxm     | <i>m</i>      | general     | mean river depth (m) where the slope of the fractional river area has its maximum (must be in the range between 0 and fraxe)                                                                                     | <a href="#">evaporation</a>   |

| Name                 | Unit            | Dependency | Description                                                                                       | Link                        |
|----------------------|-----------------|------------|---------------------------------------------------------------------------------------------------|-----------------------------|
| wetrate              | -               | general    | parameter of rating curve of iwet and owet                                                        | <a href="#">wetlands</a>    |
| wetexp               | -               | general    | parameter of rating curve of iwet and owet                                                        | <a href="#">wetlands</a>    |
| iwetw0               | m               | general    | outflow threshold for iwet (meter above land surface)                                             | <a href="#">wetlands</a>    |
| owetw0               | m               | general    | outflow threshold for owet (meter above land surface)                                             | <a href="#">wetlands</a>    |
| wlsed                | m/d             | general    | sedimentation velocity ON,PP,SS for iwet and owet                                                 | <a href="#">wetlands</a>    |
| wlpartfrac           | -               | general    | fraction of settled PP to partP soil component (the rest to fast) for iwet and owet               | <a href="#">wetlands</a>    |
| wlproddep            | m               | general    | production depth for area extent dependence of macrophyte nutrient uptake IN,SP for iwet and owet | <a href="#">wetlands</a>    |
| wlmpहुptin           | -               | general    | coefficient for macrophyte nutrient uptake IN for iwet and owet                                   | <a href="#">wetlands</a>    |
| wlmpहुptsp           | -               | general    | coefficient for macrophyte nutrient uptake SP for iwet and owet                                   | <a href="#">wetlands</a>    |
| wlfastfrac           | -               | general    | fraction macrophyte residuals to fast soil component (the rest to humus) for iwet and owet        | <a href="#">wetlands</a>    |
| wltmpexp             | -               | general    | exponent in temperature dependence of macrophyte nutrient uptake IN,SP for iwet and owet          | <a href="#">wetlands</a>    |
| hygeomf              | -               | general    | exponent to calculate river depth with hydraulic geometry                                         | <a href="#">main river</a>  |
| hygeomc              | -               | general    | rate to calculate river depth with hydraulic geometry                                             | <a href="#">main river</a>  |
| hygeomk              | -               | general    | exponent to calculate river velocity with hydraulic geometry                                      | <a href="#">main river</a>  |
| hygeommm             | -               | general    | rate to calculate river velocity with hydraulic geometry                                          | <a href="#">main river</a>  |
| ricew0por, rivewlpor | <i>fraction</i> | general    | ice porosity thresholds for change between summer and winter river rating curve                   | <a href="#">main river</a>  |
| ricew0ice, ricewlice | cm              | general    | ice thickness thresholds for change between summer and winter river rating curve                  | <a href="#">main river</a>  |
| wsfluse              | -               | land use   | Winstral coefficient for snowfall distribution model                                              | <a href="#">snowfall</a>    |
| wsfscale             | -               | general    | Winstral coefficient for snowfall distribution model                                              | <a href="#">snowfall</a>    |
| wsfbias              | -               | general    | Winstral coefficient for snowfall distribution model                                              | <a href="#">snowfall</a>    |
| sfdmax               | -               | general    | maximum allowed snowfall distribution (0-1)                                                       | <a href="#">snowfall</a>    |
| sfdlim               | -               | general    | fraction of subbasin area with snowfall for snowfall distribution to be applied                   | <a href="#">snowfall</a>    |
| numdir               | -               | general    | number of wind directions used for snowfall distribution model (4 or 8)                           | <a href="#">snowfall</a>    |
| logsatmp             | -               | soil type  | coefficient in unfrozen soil water content function                                               | <a href="#">frozen soil</a> |
| bcosby               | -               | soil type  | coefficient in unfrozen soil water content function                                               | <a href="#">frozen soil</a> |

| Name      | Unit | Dependency | Description                                         | Link                        |
|-----------|------|------------|-----------------------------------------------------|-----------------------------|
| fzsexpand | -    | soil type  | frozen soil water volume expansion effect on runoff | <a href="#">frozen soil</a> |