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 simultanouely 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)	water content
`wcwp`	-	soil type	wilting point as a fraction, same for all soil layers (used if `wcwp1` not given)	water content
`wcep`	-	soil type	effective porosity as a fraction, same for all soil layers (used if `wcep1` not given)	water content
`wcfc1`	-	soil type	fraction of soil available for evapotranspiration but not for runoff, for uppermost soil layer	water content
`wcwp1`	-	soil type	wilting point as a fraction, for uppermost soil layer	water content
`wcep1`	-	soil type	effective porosity as a fraction, for uppermost soil layer	water content
`wcfc2`	-	soil type	fraction of soil available for evapotranspiration but not for runoff, for second soil layer	water content
`wcwp2`	-	soil type	wilting point as a fraction, for second soil layer	water content
`wcep2`	-	soil type	effective porosity as a fraction, for second soil layer	water content
`wcfc3`	-	soil type	fraction of soil available for evapotranspiration but not for runoff, for lowest soil layer	water content
`wcwp3`	-	soil type	wilting point as a fraction, for lowest soil layer	water content
`wcep3`	-	soil type	effective porosity as a fraction, for lowest soil layer	water content
`mperc1`	$mm\ ts^{-1}$	soil type	maximum percolation capacity from soil layer 1 to soil layer 2	perc
`mperc2`	$mm\ ts^{-1}$	soil type	maximum percolation capacity from soil layer 2 to soil layer 3	perc
`cmlt`	$mm\ °C^{-1}\ ts^{-1}$	land use	melting parameter for snow	snow melt
`ttmp`	$°C$	land use	threshold temperature for snow melt, snow density and evapotranspiration	snow melt snowfall PET

Name	Unit	Dependency	Description	Link
ttpd	*°C*	general	deviation from ttmp for threshold temperature for snow-/rainfall	snowfall
ttpi	*°C*	general	half of temperature interval with mixed snow- and rainfall. Interval is (ttmp+ttpd) +/- ttpi.	snow melt snowfall
cevp	*mm °C*$^{-1}$ *ts*$^{-1}$	land use	evapotranspiration parameter	PET
t1evap	-	general	evaporation factor for substance T1 (0-1), default is 0, if 1 the substance evaporates with the water	tracer T1
frost	*cm °C*$^{-1}$ *or -*	land use	frost depth parameter (both frost and sfrost must be >0 for simulation to occur)	frost
sfrost	*- or cm °C*$^{-1}$	soil type	frost depth parameter (both frost and sfrost must be >0 for simulation to occur)	frost
deepmem	*d*	general	deep soil temperature memory	soil temp
surfmem	*d*	land use	upper soil layer soil temperature memory	soil temp
depthrel	*m*$^{-1}$	land use	depth relation for soil temperature memory	soil temp
rrcs1	*ts*$^{-1}$	soil type	recession coefficient for uppermost soil layer	runoff
rrcs2	*ts*$^{-1}$	soil type	recession coefficient for lowest soil layer	runoff
rrcs3	*ts*$^{-1}$ *%*$^{-1}$	general	recession coefficient for slope dependence (upper layer)	runoff
srrcs	*ts*$^{-1}$	land use	recession coefficient for surface runoff (fraction), should be set to 1 for lake and riverclasses with floodplains	surface runoff
trrcs	*ts*$^{-1}$	soil type	recession coefficient for tile drains	tile runoff
rrcscorr	-	parreg	correction factor for recession rrcs=rrcs(1+rrcscorr) for rrcs1,rrcs2,trrcs and srrcs	runoff tile runoff surface runoff
cevpam	-	general	amplitude of sinus function (about 1) that corrects potential evapotranspiration.	PET
cevpph	*d*	general	phase of sinus function that corrects potential evapotranspiration	PET
cevpcorr	-	parreg	correction factor for evapotranspiration cevap=evap(1+cevpcorr)	PET
lp	-	general	factor for calculating the soil water limit for potential evapotranspiration	evap
gratk	-	general	parameter of rating curve for lake outflow $Q = gratk \times \left(w - wo\right)^{gratp}$	rating curve
gratp	-	general	parameter of rating curve for lake outflow $Q = gratk \times \left(w - wo\right)^{gratp}$	rating curve
grata	-	general	upstream area dependence of discharge curve for lake, if grata>0 and uparea>0 $Q = \left(gratk \times \left(uparea\right)^{grata}\right) \times \left(w - wo\right)^{gratp}$	rating curve

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 LakeData.txt)	
`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)	river
`damp`	-	general	fraction of delay in the watercourse which also causes damping	river
`deadl`	$m^2\ km^{-2}$	general	parameter to calculate the dead volume in the local watercourse	river
`deadm`	$m^2\ km^{-2}$	general	parameter to calculate the dead volume in the main watercourse	river
`tcalt`	$°C\ (100m)^{-1}$	general	parameter for temperature's elevation dependence, uses SLC's deviation from subbasin mean height (=0.6°C/100m)	temp
`tempcorr`	$°C$	parreg	correction parameter for temperature	temp
`tcelevadd`	$°C\ (100m)^{-1}$	general	parameter for temperature's elevation dependence, uses subbasin mean height	temp
`tcobselev`	$°C\ (100m)^{-1}$	general	parameter for temperature correction due to observation elevation deviation from subbasin elevation	temp
`monthlapse`	$°C\ (100m)^{-1}$	month	alternative parameter for temperature correction with elevation, monthly temperature lapse rate (positive when decresasing with elevation, same as `tcalt` and `tcelevadd`)	temp
`pcaddg`	-	general	correction parameter for precipitation	prec
`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 prec=prec(1-pcluse)	prec
`pcelevadd`	$(100m)^{-1}$	general	correction parameter for precipitation (per 100 m elevation > pcelevth)	prec
`pcelevth`	m	general	elevation above which the precipitation correction pcelevadd is used	prec
`pcelevmax`	-	general	maximum for height dependent precipitation correction	prec
`pcelevstd`	$(100m)^{-1}$	general	correction parameter for precipitation (per 100 m of elevation standard deviation)	prec

Name	Unit	Dependency	Description	Link
`preccorr`	-	parreg	correction factor for precipitation $prec = prec\left(1 + preccorr\right)$	prec
`gldepi`	*m*	general	depth for all ilakes	lake
`denitrlu`	d^{-1}	land use	parameter for denitrification rate in soil	denitrif
`denitrlu3`	d^{-1}	land use	denitrification rate in third soil layer, replaces `denitrlu` if set to >= *0*. If only used for some land use classes, set to *-1* for all other.	denitrif
`degradhp`	d^{-1}	land use	decay of humus to fastP	NP soil
`degradhn`	d^{-1}	land use	decay of humus to fastN	NP soil
`minerfn`	d^{-1}	land use	mineralisation of fastN to inorganic N	NP soil
`minerfp`	d^{-1}	land use	mineralisation of fastP to SRP	NP soil
`dissolfp`	d^{-1}	land use	decay of fastP to dissolved PP	NP soil
`dissolfn`	d^{-1}	land use	decay of fastN to dissolved organic N	NP soil
`dissolhp`	d^{-1}	land use	decay of humusP to dissolved PP	NP soil
`dissolhn`	d^{-1}	land use	decay of humusN to dissolved organic N	NP soil
`wprodn`	$kg\ m^{-3}\ d^{-1}$	general	production/decay of N in water (can also be defined in LakeData.txt)	NP river lake
`wprodp`	$kg\ m^{-3}\ d^{-1}$	general	production/decay of P in water (can also be defined in LakeData.txt)	NP river lake
`wprodc`	$kg\ m^{-3}\ d^{-1}$	general	production/decay of OC in water (can also be defined in LakeData.txt)	C river lake
`hsatTP`	$mg\ L^{-1}$	general	half saturation concentration of TP for production and mineralisation in surface water	NP river lake C river lake
`hsatINs`	$mg\ L^{-1}$	general	half saturation concentration of IN for denitrification in soil	denitrif
`hsatINw`	$mg\ L^{-1}$	general	half saturation concentration of IN for denitrification in surface water	denitrif
`denitwrl`	$kg\ m^{-2}\ d^{-1}$	general	parameter for denitrification in local watercourse	denitrif
`denitwrm`	$kg\ m^{-2}\ d^{-1}$	general	parameter for denitrification in main watercourse	denitrif
`denitwl`	$kg\ m^{-2}\ d^{-1}$	general	parameter for denitrification in lakes (can also be defined in LakeData.txt)	denitrif
`sedon`	$m\ ts^{-1}$	general	sedimentation rate of ON in lakes (can also be defined in LakeData.txt)	NP lake
`sedpp`	$m\ ts^{-1}$	general	sedimentation rate of PP in lakes (can also be defined in LakeData.txt)	NP lake
`sedexp`	-	general	parameter for sedimentation/resuspension in watercourses	P river
`limsedON`	$mg\ L^{-1}$	general	concentration of ON deducted from conc in water when sedimentation is calculated. This should represent the dissolved organic nitrogen.	NP lake

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.	NP lake NP lake C river lake
muptn	*kg m^{-2} d^{-1}*	general	macrophyte uptake of IN in lake water (can also be defined in LakeData.txt)	NP lake
muptp	*kg m^{-2} d^{-1}*	general	macrophyte uptake of SP in lake water (can also be defined in LakeData.txt)	NP lake
muptdep	*m*	general	macrophyte uptake production depth	NP lake
humusN0	*mg m^{-3}*	land use	starting concentration of humusN soil pool	NP soil
humusP0	*mg m^{-3}*	land use	starting concentration of humusP soil pool	NP soil
fastN0	*mg m^{-3}*	general	starting concentration of fastN soil pool	NP soil
partP0	*mg m^{-3}*	land use	starting concentration of partP soil pool	NP soil
fastP0	*mg m^{-3}*	general	starting concentration of fastP soil pool	NP soil
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	NP soil
ppconc0	*mg L^{-1}*	land use	starting value, particulate phosphorus concentration in soil	NP soil
onpercred	-	land use	reduction of ON concentration during percolation	NP perc
pppercred	-	land use	reduction of PP concentration during percolation	NP perc
pPhalf	*m*	land use	half depth for partP soil pool	NP soil
hPhalf	*m*	land use	half depth for humusP soil pool	NP soil
hNhalf	*m*	land use	half depth for humusN soil pool	NP soil
iniT1	*µU L^{-1}*	general	starting value in soil, concentration T1	tracer T1
iniT1sw	*µU L^{-1}*	general	starting value in surface water, concentration T1	tracer T1
iniT2	*°C*	general	starting value in soil, T2 (temperature)	tracer T2
freuc	*kg^{-1}*	soil type	parameter in Freundlich equation (coefficient)	P soil
freuexp	-	soil type	parameter in Freundlich equation (exponent)	P soil
freurate	*d^{-1}*	soil type	parameter that steers adsorption/desorption speed	P soil
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)	rural
drydeppp	*kg km^{-2} ts^{-1}*	land use	dry deposition of PP	deposition
wetdepsp	*µg L^{-1}*	general	wet deposition of SP	deposition
wetdepspl	*kg km^{-2} ts^{-1}*	general	wet deposition of SP on water surfaces	deposition
aloadconst	-	general	status to keep wet deposition load constant if precipitation is corrected (if set to 1, 0 is default)	deposition
ponatm	-	land use	correction factor for atmospheric deposition of IN, fraction that goes to fastN-pool instead	deposition
srrate	-	soil type	fraction for surface runoff	surface runoff

Name	Unit	Dependency	Description	Link
macrate	-	soil type	fraction for macro-pore flow	macropore
mactrinf	*mm ts*$^{-1}$	soil type	threshold for macro-pore flow	macropore
mactrsm	-	soil type	threshold soil water for macro-pore flow and surface runoff (fraction of wcwp+wcfc i uppermost layer)	macropore and surface runoff
soilcoh	*kPa*	soil type	characteristic of soil for calculation of soil erosion (cohesion)	erosion
soilerod	*g J*$^{-1}$	soil type	characteristic of soil for calculation of soil erosion (erodibility)	erosion
epotdist	*m*$^{-1}$	general	coefficient in exponential function for potential evapotranspiration's depth dependency	PET
qmean	*mm yr*$^{-1}$	general	initial value for calculation of mean flow (can also be defined in LakeData.txt)	
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 LakeData.txt	NP lake
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 LakeData.txt	
rivvel1	-	lake region	parameter for calculation of velocity of the water in the watercourse	river
rivvel2	-	lake region	parameter for calculation of velocity of the water in the watercourse	river
rivvel3	-	lake region	parameter for calculation of velocity of the water in the watercourse	river
rivwidth1	-	lake region	parameter for calculation of the width of the watercourse	river
rivwidth2	-	lake region	parameter for calculation of the width of the watercourse	river
rivwidth3	-	lake region	parameter for calculation of the width of the watercourse	river
maxwidth	*m*	general	parameter for limitation of width of the watercourse	river
sreroexp	-	general	exponent in the equation for calculation of soil erosion caused by surface runoff	erosion
pprelmax	*mm ts*$^{-1}$	general	parameter for delay of SS and PP from surface runoff and tile drains	erosion
pprelexp	-	general	parameter for delay of SS and PP from surface runoff and tile drains	erosion
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	erosion
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	erosion

Name	Unit	Dependency	Description	Link
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	erosion
macrofilt	-	soil type	filtration (retention) of PartP with macropore flow (fraction)	erosion
sdnsnew	$g\ cm^{-3}$	general	density of new-fallen snow (former snowdens0)	snow snow melt
snowdensdt	$g\ cm^{-3}\ ts^{-1}$	general	increase of snow density per day	snow
sdnsmax	$g\ cm^{-3}$	general	maximum snow density	snow
sdnsrate	ts^{-1}	general	increase of snow density per timestep	snow
sdnsradd	ts^{-1}	general	additional increase of snow density per timestep for warm days	snow
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.	snow melt
whcsnow		general	water holding capacity of snow, typical value 0.08.	snow
fertdays	d	general	number of days that fertiliser applications occur counting from application day 1 and forward using the same amount every day	fertilizer
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	C soil
fastc1	$mg\ m^{-3}$	land use	starting concentration for fastC pool in soil's uppermost soil layer	C soil
humusc2	$mg\ m^{-3}$	land use	starting concentration for humusC pool in soil's second soil layer	C soil
fastc2	$mg\ m^{-3}$	land use	starting concentration for fastC pool in soil's second soil layer	C soil
humusc3	$mg\ m^{-3}$	land use	starting concentration for humusC pool in soil lowest soil layer	C soil
fastc3	$mg\ m^{-3}$	land use	starting concentration for fastC pool in soil lowest soil layer	C soil
klh	d^{-1}	general	parameter for speed of transformation from litter to humus	C soil
klo	d^{-1}	general	parameter for speed of transformation from litter to DOC	C soil
kho	d^{-1}	general	parameter for speed of transformation from humus to DOC	C soil
kof	d^{-1}	general	parameter for speed of transformation from DOC to fastC	C soil
koflim	-	general	parameter for threshold for wetness for transformation DOC to fastC	C soil
koc	-	general	parameter for DOC-concentrations reduction for percolation	C soil

Name	Unit	Dependency	Description	Link
kcgwreg	-	general	parameter for DOC-concentrations reduction with flow out to regional groundwater	C soil
sedoc	$m\ ts^{-1}$	general	sedimentation rate OC in lakes. Can also be defined in LakeData.txt.	C lake
ripz	-	land use	parameter for OC processes in riparian zone	C riparian
ripe	m^{-1}	general	exponent for groundwater depth dependence of OC processes in riparian zones	C riparian
rips	-	general	seasonal factor for OC processes in riparian zones	C riparian
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 LakeData.txt)	
minc	-	general	fraction of transformation mineralised to DIC	C soil
ocsoimsat	-	land use	saturation in soil moisture function for degradation of soil organic carbon	C soil
ocsoimslp	%	land use	slope in soil moisture function for degradation of soil organic carbon	C soil
deeplake	-	general	part of the lake's initial volume which is considered as slow (SLP). 0 means that the lake is not divided into a slow and a fast part. Value larger than 1 means the initial volume is all slow part, but a fast part may form at high water levels. Can also be defined in LakeData.txt. Use deeplake=0 if floodplains are simulated	lake
fastlake	-	general	parameter determining the fraction of lake outflow from the different lake parts (FLP, SLP). Varies between 0 (default, no outflow from FLP) to 1 (outflow fractions proportional to FLP and SLP volumes). Can also be defined in LakeData.txt.	lake
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	$J\ m^{-2}\ s^{-1}\ °C^{-1}$	general	heat transfer parameter for water temperature T2 of river	
t2trlake	$J\ m^{-2}\ s^{-1}\ °C^{-1}$	general	heat transfer parameter for water temperature T2 of lake	
upper2deep	$J\ m^{-2}\ s^{-1}\ °C^{-1}$	general	heat transfer parameter for water temperature T2 between lake parts	
tcfriver	$J\ m^{-2}\ s^{-1}\ °C^{-1}$	general	air-riverwater heat flow, temperature difference coefficient	water - atmosphere T2 exchange
scfriver		general	air-riverwater heat flow, solar radiation coefficient	water - atmosphere T2 exchange

Name	Unit	Dependency	Description	Link
ccfriver		general	air-riverwater heat flow, constant coefficient	water - atmosphere T2 exchange
lcfriver		general	air-riverwater heat flow, linear coefficient	water - atmosphere T2 exchange
tcflake	$J\ m^{-2}\ s^{-1}\ °C^{-1}$	general	air-lakewater heat flow, temperature difference coefficient	water - atmosphere T2 exchange
scflake		general	air-lakewater heat flow, solar radiation coefficient	water - atmosphere T2 exchange
ccflake		general	air-lakewater heat flow, constant coefficient	water - atmosphere T2 exchange
lcflake		general	air-lakewater heat flow, linear coefficient	water - atmosphere T2 exchange
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	
licetf	*°C*	general	lake ice model, freezing temperature	
licesndens	$g\ cm^{-3}\ ts^{-1}$	general	lake ice model, snow compaction parameter	
licekika	*cm*	general	lake ice model, ratio between thermal conductivity of ice and heat exchange coefficient in air	
licekexp	-	general	lake ice model, water temperature threshold for freeze-up	
licetmelt	$cm\ °C^{-1}$	general	lake ice model, melt factor for ice	
licewcorr	-	general	lake ice model, snowfall reduction for wind drift	
ricettf	*°C*	general	river ice model, water temperature threshold for freeze-up	
ricetf	*°C*	general	river ice model, freezing temperature	
ricesndens	$g\ cm^{-3}\ ts^{-1}$	general	river ice model, snow compaction parameter	
ricekika	*cm*	general	river ice model, ratio between thermal conductivity of ice and heat exchange coefficient in air	
ricekexp	-	general	river ice model, water temperature threshold for freeze-up	
ricetmelt	$cm\ °C^{-1}$	general	river ice model, melt factor for ice	
fscmax	-	general	maximum fractional snow cover area	snow cover
fscmin	-	general	minimum fractional snow cover area	snow cover
fsclim	-	general	limit of fractional snow cover area for onset of snowmax	snow cover
fscdistmax	-	land use	maximum snow distribution factor	snow cover
fscdist0	-	land use	minimum snow distribution factor	snow cover
fscdist1	m^{-1}	land use	std coefficient for snow distribution factor	snow cover
fsck1	-	general	parameter for snowmax	snow cover
fsckexp	s^{-1}	general	parameter for snowmax	snow cover

Name	Unit	Dependency	Description	Link
`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	PET input data
`jhtadd`		general	parameter for petmodel 2 - Modified Jensen-Haise/McGuiness	PET
`jhtscale`		general	parameter for petmodel 2 - Modified Jensen-Haise/McGuiness	PET
`alfapt`		general	parameter for petmodel 4 - Priestly-Taylor	PET
`mwind`	$m\ s^{-1}$	general	average wind speed, used for petmodel 5 when no wind forcing is available	wind
`zwind`	*m*	general	wind observation height, typical value is 10	wind
`zwish`	*m*	general	wanted wind height, typical value is 2	wind
`zpdh`	*m*	general	zero plane displacement height	wind
`roughness`	-	general	surface roughness (for observed wind)	wind
`kc`	-	land use	crop coefficient for petmodels, default parameter	PET
`kc2`	-	land use	crop coefficient for petmodel 2, if not set kc is used	PET
`kc3`	-	land use	crop coefficient for petmodel 3, if not set kc is used	PET
`kc4`	-	land use	crop coefficient for petmodel 4, if not set kc is used	PET
`kc5`	-	land use	crop coefficient for petmodel 5, if not set kc is used	PET
`alb`	-	land use	albedo for petmodels	net downward radiation
`incorr`	-	wqparreg	*super-parameter*, regional correction factor for parameter governing inorganic nitrogen: $par = par \times \left(1 + incorr\right)$ for `degradhn` and $par = par \times \left(1 - incorr\right)$ for `denitrlu`, `denitwl`, `denitwrm`, and `denitwrl` **Note**: `denitwl` in LakeData.txt will also be affected by this correction factor	

Name	Unit	Dependency	Description	Link
`oncorr`	-	wqparreg	*super-parameter*, regional correction factor for parameter governing organic nitrogen: $par = par \times \left(1 + oncorr\right)$ for `dissolhn` and $par = par \times \left(1 - oncorr\right)$ for `sedon` **Note**: `sedon` in LakeData.txt will also be affected by this correction factor	
`phoscorr`	-	wqparreg	*super-parameter*, regional correction factor for parameter governing phosphorus: $par = par \times \left(1 + phoscorr\right)$ for `soilerod`, `dissolhP`, `fastP0`, `humusP0`, and `partP0`	
`ratcorr`	-	parreg	correction factor for discharge gratk=gratk(1+ratcorr)	rating curve
`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.	irrigation abstraction
`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.	irrigation abstraction
`sswcorr`	-	general	rescaling factor for the soil water stress irrigation threshold. sswcorr=1 implies no rescaling. sswcorr=0 if not set.	irrigation demand
`iwdfrac`	-	general	fraction of the irrigation threshold which constitutes irrigation water demand. Note iwdfrac can be >1. Only used if demandtype=3.	irrigation demand
`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	irrigation abstraction
`irrdemand`	*mm* ts^{-1}	general	the irrigation water demand for subbasins with demandtype=1	irrigation demand
`immdepth`	*mm*	general	target submergence depth for submerged irrigated crops	irrigation demand
`cirrsink`	-	parreg	concentration reduction fraction in settlement tanks at irrigation abstraction points	irrigation abstraction
`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.	irrigation abstraction
`glacdens`	m^3 *water* $(m^3\ ice)^{-1}$	general	density of glacier ice (default value=0.85)	
`glac2arlim`	m^2	general	area limit for determine glacier type	glacier

Name	Unit	Dependency	Description	Link
`glacvcoef`	*m*	general	coefficient of glacier area-volume relationship for glacier of type 0 (default), (default value=0.205)	glacier
`glacvexp`	-	general	exponent of glacier area-volume relationship for glacier of type 0 (default), (default value=1.375)	glacier
`glacvcoef1`	*m*	general	coefficient of glacier area-volume relationship for glacier of type 1, (default value=1.701)	glacier
`glacvexp1`	-	general	exponent of glacier area-volume relationship for glacier of type 1, (default value=1.25)	glacier
`glaccmlt`	$mm\ °C^{-1}\ ts^{-1}$	general	melting parameter for glacier	glacier
`glacttmp`	*°C*	general	threshold temperature for glacier melt	glacier
`glaccmrad`	$mm\ m^2\ MJ^{-1}$	general	coefficient for radiation glacier melt, parameter for snowmelt model 2	glacier
`glaccmrefr`	-	general	refreeze efficiency compared to the degree-day glacier melt factor, parameter for snow meltmodel 2	glacier
`glacalb`	-	general	albedo for glacier ice	glacier
`fepotglac`	-	general	fraction of snow-free potential evapotranspiration, used for calculation of glacier evaporation (snowevaporation model 1).	glacier
`rcgrw`	-	general	recession coefficient for regional groundwater outflow from soil layers (deepground=1 (and 2))	deep flow or aquifer
`rcgrwst`	-	soil type	recession coefficient for deep percolation flow out of soil layers (deepground=2)	aquifer
`aqretcor`	-	parreg (of aquifer)	adjustment of recession coefficients newpar=oldpar(1+aqcor) for aquifer return flow	aquifer
`aqdelcor`	-	parreg (of aquifer)	adjustment of deep percolation delay to aquifers newpar=oldpar(1+aqcor) for aquifer return flow	aquifer
`aqpercor`	-	parreg (of subbasin)	adjustment of deep percolation to aquifers newpar=oldpar(1+aqcor) for aquifer return flow	aquifer
`optonoff`	-	general	switch (0/1) for using general parameters op1-opt8 instead of flooding data of FloodData.txt (1=use `opt1`-`opt8`)	
`opt1`	*m*	general	parameter replacing FloodData.txt values of `floll`	floodplain
`opt2`	*m*	general	parameter replacing FloodData.txt values of `flolp`	floodplain
`opt3`	*m*	general	parameter replacing FloodData.txt values of `flmrr`	floodplain
`opt4`	*m*	general	parameter replacing FloodData.txt values of `flmrp`	floodplain
`opt5`	-	general	parameter replacing FloodData.txt values of `rclfp` and `rcrfp`	floodplain

Name	Unit	Dependency	Description	Link
`opt6`	*m*	general	parameter replacing FloodData.txt values of `fymol`	floodplain
`opt7`	*m*	general	parameter replacing FloodData.txt values of `fymmr`	floodplain
`opt8`	-	general	parameter replacing FloodData.txt values of `rcfpl` and `rcfpr`	floodplain
`limT2exch`	*m*	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 LakeData.txt)	lake outflow
`T1expdec`	*days*	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.	tracer T1
`T1freuc`	*L/kg soil or ((U/kg soil)/(U/L))*	general	freundlich adsorption isoterm coefficient for adsorption/desorption of T1 to soil.	tracer T1
`T1rel`	mm^{-1}	general	release of T1 from above soil pool. Typically the pool consist of manure.	tracer T1
`T1sedexp`	-	general	parameter for sedimentation/resuspension of T1 in watercourses	tracer T1
`T1sedvel`	*m/timestep*	general	sedimentation rate of T1 in lakes	tracer T1
`T1leakluse`	*µU/L or -*	land use	typical leakage concentration of T1 depending on land use or a scaling factor to typical leakage concentration depending on soil type	tracer T1
`T1leaksoil`	*µU/L or -*	soil type	typical leakage concentration of T1 depending onsoil type or a scaling factor to typical leakage concentration depending on land use	tracer T1
`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`	*degree Celsius*	land use	temperature threshold for soil temperature control on soil evapotranspiration	evaporation
`treda`	-	land use	soil temperature control on soil evapotranspiration	evaporation
`tredb`	-	land use	soil temperature control on soil evapotranspiration	evaporation
`gldepo`	*m*	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`	*m*	ilakeregion	depth for ilakes	

Name	Unit	Dependency	Description	Link
`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`	*m*	olakeregion	depth for outlet lakes, replaces lake_depth in GeoData if zero or negative	
`glacannmb`	*mm/yr*	general	annual mass balance for correction of initial glacier volume	glacier
`denit3reg`	d^{-1}	wqparreg	parameter for denitrification rate in soil layer 3, replaces other denitrification rate parameter (`denitrlu` or `denitrlu3`) in third soil layer if >0	
`erodluse`	-	land use	erosion model 1 landuse erosion factor	erosion
`erodsoil`	-	soil type	erosion model 1 soil type erosion factor	erosion
`erodslope`	-	general	erosion model 1 slope erosion factor (exponent)	erosion
`erodexp`	-	general	erosion model 1 erosion precipitation dependent factor (exponent)	erosion
`erodindex`	-	general	erosion model 1 scaling of subbasin erosion index	erosion
`ppenrmax`	-	soil type	maximum enrichment of PP in transport of soil erosion	erosion
`ppenrstab`	-	general	minimum enrichment (stable level) of PP in transport of soil erosion	erosion
`ppenrflow`	$mm\ ts^{-1}$	general	flow at which stable level of enrichment of PP in transport of soil erosion is reached	erosion
`sedss`	$m\ ts^{-1}$	general	sedimentation velocity of suspended sediments in lakes	sedimentation
`limsedss`	$mg\ L^{-1}$	general	concentration of SS deducted from concentration in water when sedimentation is calculated	sedimentation
`sedae`	$m\ ts^{-1}$	general	sedimentation velocity of algae in lakes	sedimentation
`fraxe`	*m*	general	mean river depth (m) where fractional river area = 1	evaporation
`fraxm`	*m*	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`)	evaporation
`wetrate`	-	general	parameter of rating curve of iwet and owet	wetlands
`wetexp`	-	general	parameter of rating curve of iwet and owet	wetlands
`iwetw0`	*m*	general	outflow threshold for iwet (meter above land surface)	wetlands
`owetw0`	*m*	general	outflow threshold for owet (meter above land surface)	wetlands
`wlsed`	*m/d*	general	sedimentation velocity ON,PP,SS for iwet and owet	wetlands
`wlpartfrac`	-	general	fraction of settled PP to partP soil component (the rest to fast) for iwet and owet	wetlands

Name	Unit	Dependency	Description	Link
wlproddep	*m*	general	production depth for area extent dependence of macrophype nutrient uptake IN,SP for iwet and owet	wetlands
wlmphuptin	-	general	coefficient for macrophype nutrient uptake IN for iwet and owet	wetlands
wlmphuptsp	-	general	coefficient for macrophype nutrient uptake SP for iwet and owet	wetlands
wlfastfrac	-	general	fraction macrophyte residuals to fast soil component (the rest to humus) for iwet and owet	wetlands
wltmpexp	-	general	exponent in temperature dependence of macrophype nutrient uptake IN,SP for iwet and owet	wetlands
hygeomf	-	general	exponent to calculate river depth with hydraulic geometry	main river
hygeomc	-	general	rate to calculate river depth with hydraulic geometry	main river
hygeomk	-	general	exponent to calculate river velocity with hydraulic geometry	main river
hygeomm	-	general	rate to calculate river velocity with hydraulic geometry	main river
wsfluse	-	land use	Winstral coefficient for snowfall distribution model	snowfall
wsfscale	-	general	Winstral coefficient for snowfall distribution model	snowfall
wsfbias	-	general	Winstral coefficient for snowfall distribution model	snowfall
sfdmax	-	general	maximum allowed snowfall distribution (0-1)	snowfall
sfdlim	-	general	fraction of subbasin area with snowfall for snowfall distribution to be applied	snowfall
numdir	-	general	number of wind directions used for snowfall distribution model (4 or 8)	snowfall