Overview of parameters (flags) for controlling 4C

The following table gives an overview of parameters (flags) which are read from the control file <name>.sim (external) or are set internally.

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
flag_adapm	flag for adaptive management; (carried out last time step)	0/1		in	Set in adap_manag
flag_bc	flag for application of biochar	0	no application of biochar	in	set in readsoil
		1	application of biochar; information comes from file (recommended appendix *.bc); set if if flag_decomp>100		
flag_bc_add	internal flag; controls output to file xxx_soil.ini for changes of soil parameters after addition of biochar	0	no output	in	set in year_ini, used in soil_ini
		1	output of new soil parameters		
flag_clim	climate data for each site	0	set for flag_multi = 2,3,5,6	in	set in readsim, used in prepare_site, control_file
		1	set for flag_multi = 1,4,7,8,9,10		
flag_climnam	kind of generation of climate scenario names (flag_multi=8)	1	scenarios for Brandenburg (code in sim-file:BRB)	in	set in readsim, used in readsim
		2	scenarios for Baden-Würtemberg (code in sim-file:BAWUE)		
		3	scenarios for Germany (code in sim-file:DEU)		
		4	scenarios from REMO (code in sim-file: REMO)		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		5	scenarios from WETTREG (code in sim-file: WETTREG)		
flag_climtyp	defines structure of climate data file	1	suffix 'cli' of name of climate file (*.cli)	in, derived from file or file name resp.	set in prepare_climate, used in read_cli
		2	first line starts with N		
		3	first line starts with T		
		4	suffix 'txt' of name of climate file (*.txt)		
		5	any suffix of name of climate file (*.*) (formerly flag_cli_dwd)		
flag_co2	choice of atmospheric CO2 scenario	22 options	See http://www.pik-potsdam.de/4c/web_4c/guide/user_sim01.html	ex	used in co2_annual,
flag_cohout	flag for cohort output	0	No output	ex	used in outtest_coh
		1	Yes		
		2	Yes, also with tree files		
flag_cohoutd	flag for cohort output daily	0/1	http://www.pik-potsdam.de/4c/web_4c/guide/user_sim01.html	ex	used in outtest_coh
flag_cohouty	flag for cohort output yearly	0/1		ex	used in outtest_coh
flag_cond	choice of heat conductance function	20 options	http://www.pik-potsdam.de/4c/web_4c/guide/user_sim01.html	ex	used in daily, finish_simul
flag_cum	calculation of cumulative values (summation output monthly values,…)	0/1		in	Set in readsim, used in stand_balance
flag_dayout	flag of daily output	0/1	no/yes	ex	Different locations

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
flag_decomp	decomposition model	0	uniform decomposition model of all litter fractions (incl. stem wood and coarse roots)	ex	used in n_upt
		1	stem wood and coarse root decay in a separate model with no direct N mineralisation and input into the humus layer according to N release		
		10	like 0; N uptake distribution controlled by N-supply of cohorts		
		11	like 1; N uptake distribution controlled by N-supply of cohorts		
		20	like 0; read litter input		
		21	like 1; read litter input		
		30	like 0; no litter input		
		31	like 1; no litter input		
		40	like 0; N uptake controlled by C/N-ratio of non-heartwood		
		41	like 1; N uptake controlled by C/N-ratio of non-heartwood		
		1xx	application of biochar; xx: choice like above; flag_bc will be set with this information		
flag_depo	deposition (set after reading file)	1	daily N deposition mg N/m²	in	set in readdepo, used in readdepo, humlay
		2	input of concentration in mg N/l; first row starts with „Concentration"; used in con-file for flag_multi=8,9,10		set in readcon

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flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		3	input of yearly constant deposition as daily value in mg N/m²; first row starts with „Yearly …."		
flag_dis	disturbance	0/1	Input of disturbance data with management file, flag_mg=10	ex	Used Prepsite, prepstand, simulation_4c
flag_end	stop of simulation of the actual site	0	default	in	used in stand_daily, partition, sim_control, simulation_4C
		1	no solution of quadratic equation in calc_dbh		set in calc_dbh
		2	stand identificator not found		set in prepare_stand
		3	maximal tree height of 125 m reached by actual cohort		set in calc_la, used in stand_daily, finish_simul, out_comp
		4	climate ID number not found		set in readsim
		5	soil ID not found		set in readsoil, used in prepare_site
flag_eva	choice of evapotranspiration function	0	Turc / Ivanov; calculation of transpiration demand after deduction of soil evaporation and interception with BIOME3 approach	ex	set in readsim, used in evapo, intercep, prepare_site, upt_wat
		1	Priestley / Taylor		
		2	Priestley / Taylor for each cohort		
		3	Penman / Monteith		
		4	Penman / Monteith for each cohort		
		5	Haude		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		6	Turc / Ivanov; calculation of transpiration demand with BIOME3 approach (without consideration of soil evaporation and interception)		
		7	Turc / Ivanov; transpiration demand from potential evapotranspiration after deduction of soil evaporation and interception		
flag_folhei	choice of foliage-height relationship	0	old (linear)	ex	set in readsim, used in partition
		1	new (nonlinear)		
flag_growth	choice of growth modus (determinate or indeterminate)	0	only yearly allocation	ex	set in readsim, used in readsim
		1	weekly allocation		
flag_hum	internal flag for recalculation of field capcity etc. depending on humus	0	no recalculation	in	set in readsoil, used in s_year
		1	new calculation of soil parameter every year; with flag_cond >= 40		
flag_int	choice of interception function	0	total interception of canopy and ground vegetation (with total crown storage capacity)	ex	set in readsim, used in intercep, prepare_site
		1	interception for each cohort (with storage capacity in each crown layer and with distribution of precipitation over all canopy layers)		
		2	interception for each cohort (with storage capacity for each cohort); precipitation distributed according to foliage		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		3	pine interception from Anders (storage capacity = 2.9 mm)		
		4	fit for Level II Brandenburg, pine (20% of precipitation)		
		5	30% of precipitation (for spruce); faster evaporation		
		6	no interception		
		10xx	like 0; reduction of throughfall to xx %		
		11xx	like 1; reduction of throughfall to xx %		
		12xx	like 2; reduction of throughfall to xx %		
		16xx	like 6; reduction of throughfall to xx %		
flag_inth	internal flag for choice of interception function	0	total interception of canopy and ground vegetation (with total crown storage capacity)	in	set in prepare_site, used in intercep
		1	interception for each cohort (with storage capacity in each crown layer and with distribution of precipitation over all canopy layers)		
		2	interception for each cohort (with storage capacity for each cohort); precipitation distributed according to foliage		
		3	pine interception from Anders (storage capacity = 2.9 mm)		
		4	fit for Level II Brandenburg, pine (20% of precipitation)		
		5	30% of precipitation (for spruce); faster evaporation		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		6	no interception		
flag_light	flag for light absorption algorithm	1	classical gap model approach	ex	set in readsim, used in canopy, growth_seed, growth_seed_week, store_para, cetbl_4C, gener_seed
		2	cohorts with crown projection area, light is averaged after each layer		
		3	cohorts with crown projection area, light is absorbed per layer and cohort		
		4	cohorts with crown projection area, light is absorbed per layer and cohort and modified by average yearly sun inclination		
flag_limi	choice of limitations taken into account	0	no limitation	ex	Readsim, year_ini, npp
		1	only drought limitation		
		2	only nitrogen limitation		
		3	drought and nitrogen limitation		
		4	nitrogen dynamic, only nitrogen limitation		
		5	nitrogen dynamic, drought and nitrogen limitation		
		6	nitrogen dynamic from mineralisation, only nitrogen limitation		
		7	nitrogen dynamic from mineralisation, drought and nitrogen limitation		
		8	only nitrogen limitation, age-dependent		
		9	drought and age-dependent nitrogen limitation		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		10	drought and nitrogen limitation; no N-limitation at 120 kg/ha anorganic N, below it decreases depending on N demand and N mineralisation		
		11	reduction of photosynthesis by ratio of cumulated N uptake and N demand of each species; daily calculation		
		12	exponential reduction of photosynthesis by ratio of cumulated N uptake and N demand of each species; daily calculation		
		13	reduction of photosynthesis by modfied ratio of cumulated N uptake and N demand of each species; daily calculation		
		14	N limitation as 13; no drought limitation		
		15	like 13; pine:		
flag_lit	input of litter initialisation	0/1	without or with litter input	in	used in readlit
flag_mess	values of measurements available	.FALSE.	No measurements within the simulation period	in	set in prep_simout, used in prep_simout
		.TRUE.	yes, measurements within the simulation period		
flag_mg	choice of management	0	without	ex	readsim, used in target_manag, aspen_manag
		1	Simple management		
		2	Adaptive management		
		3	Target management with target stem numbers		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		33	Target management with biomass reduction factors		
		4	Seeding one in simulation time		
		5	Thinning of dead trees (no litter input)		
		8	SRC management		
		9	Austrian management		
		10	Disturbance management		
flag_mort	mortality on/off	0	without	ex	readsim, used in stand_mort
		1	Stress mortality		
		2	Stress and intrinsic mortality		
flag_multi	Multiple run choice	1	multi run with complete file set	ex	control_file, error_mess, finish_all, finish_simul, out_comp, prepare_site, prepare_stand, readdepo, readlit, readredN, readsim, readsoil, sim_control, year_ini, simulation_4C
		2	sens. analysis with modified climate data		
		6	single run with the same initialization for every year		
		7	multi run with a list of control files for climate, soil, management, stand initializations, deposition, litter initialization, CO_2 flag		
		8	multi run; multi run with different data sets		
		9	multi run with different data sets similar flag_multi = 8; allows simulation with divers climate scenarios (0 - 3K) and a set of its realisations		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		10	multi run with different data sets similar flag_multi = 9; allows simulation with divers climate scenarios (RCP) and a set of its realisations		
flag_mult9		.TRUE.	first run with flag_multi=9	in	prepare_site
flag_mult910		.TRUE.	with flag_multi=9 or flag_multi=10	in	readsim
flag_mult8910		.TRUE.	with flag_multi=8, 9 or 10 and site_nr > 5	in	readsim
flag_redn		.FALSE.	Redn<0 for at least one species	in	readredn
flag_reg	Regeneration and planting on/off	0	Without regeneration	ex	readsim, used in adap_manag, planting
		1	With regeneration		
		3	Generation of several seedling cohorts at one time step		
		10	Planting Scots pine saplings		
		11	Planting beech saplings		
		12	Planting oak saplings		
		13	Planting Norway spruce saplings		
		14	Planting birch saplings		
		15	Planting aspen saplings		
		16	Planting Aleppo pine saplings		
		17	Planting Douglas fir saplings		
		18	Planting Black locust saplings		
flag_resp	choice of respiration modelling	0	tree respiration equals 0.52*NPP	ex	set in readsim, used in npp
		1	tree respiration modeled with organ specific respiration rates		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
flag_sign	choice of mode of calculation for subroutine partition	0	calculation of sigman with drought stress (drIndAl) only; determination of λ_i taking into account actual state of compartments and growthrates	ex	readsim, used in partition
		1	dynamic calculation of sigman with drought stress (drIndAl) and crown area; determination of λ_i taking into account actual state of compartments and growthrates		
		10	calculation of sigman with drought stress (drIndAl) only; determination of λ_i taking into account only growthrates		
		11	dynamic calculation of sigman with drought stress (drIndAl) and crown area; determination of λ_i taking into account only growthrates		
flag_soilin	flag for soil input version	0	flag_multi=1, 2, 3, 4, 6, 7; alte Variante	in, derived from file	Used in prepsite.f
		1	flag_multi=1, 2, 3, 4, 6, 7; New Version		
		2	flag_multi=5, 8, 9; alte Variante		
		3	flag_multi=5, 8, 9;		
		4	flag_multi=5, 8, 9; Second Version		
flag_stand	choice of initialization	0	Without *.ini file	ex	readsim, used in prepsite
		1	With *.ini.file		
		2	Generation of *.ini file		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
flag_standup	stand structure changed	1	removal of trees	in	used in stand_regen, stand_balance
		2	new trees		
flag_stat	flag for comparison with measurements	0	No analysis	ex	readsim, used in mess_stat
		1	comparison with measurements and statistical analysis		
		2	additional to 1 output of the triples of measurement , simulation value and residual		
flag_surf	flag for calculation of soil surface temperature	0	set for flag_cond = 0,1,2,3; soil surface temperature equals temperature of 1. layer	in	set in readsoil, used in surf_t
		1	set for flag_cond = 10,11,12,13; real soil surface temperature (additional to the soil profile)		
		2	set for flag_cond = 20,21,22,23; reading soil surface temperature after request		
		3	set for flag_cond = 30,31,32,33; daily correction factor cof and damping coefficient =1 (constant)		
flag_sum	flag for summation output	0	No output	ex	readsim, used in daily
		1	Daily output		
		2	Output with time step of photosynthesis		
		3	monthly		
		4	annual		
flag_sveg	flag for soil vegetation	0/1	Without/ with ground vegetation	ex	readsim, used in prepsite, root, intercep

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
flag_trace	controls the output of the …trace.log	.FALSE.		in	prepsite, outputut
		.TRUE.	output of …trace.log with the sequence of calls of subroutines		
flag_tree	Flag for tree cohort	.TRUE.	all cohorts are trees	in	daily, year_ini
		.FALSE.	not all cohorts are trees		
flag_volfunc	choice of volume function for trunc	0	Two sapwood cones	ex	
		1	Sapwood cylinder below crown, above cone		
flag_wred	choice of soil water uptake function	1	function with uptake inhibition near wilting point and field capcity	ex	
		2	uptake restrict to 4%		
		3	reduction along a profile		
		4	specific reduction function for Beerenbusch		
		5	no reduction		
		6	uptake restrict to 50%		
		7	uptake restrict to 25%		
		8	ArcEGMO, fred6		
		9	not activated (MG)		
		10	function with uptake exponential inhibition near wilting point and field capcity, fred7		
flag_wurz	choice of root distribution function	10	Function from Jackson with calculation of root depth (Jackson et al. 1996)equally distributed over all layers	ex	set in readsim

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		1	Function from Jackson with calculation of root depth (Jackson et al. 1996)		
		2	input of given distribution		
		7	Function from Jackson (1996) with fixed root depth from soil data		
flag_wpm	Wood product model	0	without	ex	readsim, used in timsort, wpm
		1	WPM		
		2	SEA		
		3	SEA + WPM		
kmint	kind of reduction function of mineralisation for soil temperature	1	Stanford approach	in	set in data_soil_cn, used in soil_cn
		2	van't Hoff (derived from Arrhenius approach)		
		4	no reduction		
kminw	kind of reduction function of mineralisation for soil water content		nicht genutzt	in	set in data_soil_cn, used in soil_cn
knitt	kind of reduction function of nitrification for soil temperature	1	Stanford approach	in	set in data_soil_cn, used in soil_cn
		2	van't Hoff (derived from Arrhenius approach)		
		3	SWAT approach		
		4	no reduction		
knitw	kind of reduction function of nitrification for soil water content	1	Franco approach	in	set in data_soil_cn, used in soil_cn
		2	SWAT approach		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
repflag	Filling of climate data records	0	If not enough data records in climate file, the simulation will be continued with less data records	in	set in read_dwd, used in read_dwd
		1	If not enough data records in climate file, next values will be filled with the same data		
flag_sap	Cohort flag, indicates sapling	0	Cohort is tree cohort	in	amod_stand, used in growth_seed_week
		1	Cohort is sapling cohort		
flag_sprout	Indicates sprouting of species in short rotation coppice	0	No sprouts (aspen, black locust)	in	Used in asp_manag
		1	Sprouting took place		
flag_sort	Different timber sorting schemes	0	Sorting with stemwood	in	Used in timsort
		1	Sorting without stemwood		
		2	only LAS 3m + Industrial +Fuelwood		
		3	only LAS 4m + Industrial + Fuel		
kmint	kind of reduction function of mineralisation for soil temperature	1	Stanford approach	in	set in data_soil_cn, use in soil_cn
		2	van't Hoff (derived from Arrhenius approach)		
		4	no reduction		
kminw	kind of reduction function of mineralisation for soil water content		nicht genutzt	in	set in data_soil_cn, used in soil_cn
knitt	kind of reduction function of nitrification for soil temperature	1	Stanford approach	in	set in data_soil_cn, used in soil_cn
		2	van't Hoff (derived from Arrhenius approach)		
		3	SWAT approach		

flag	Meaning	Value	Interpretation	Control internal / external	Subroutine
		4	no reduction		
knitw	kind of reduction function of nitrification for soil water content	1	Franco approach	in	set in data_soil_cn, used in soil_cn
		2	SWAT approach		
lint_snow	interception of snow possible (Precipitation as snow)	TRUE	yes	in	set in intercep, used in evapo
		FALSE	no		
out_flag_light	output flag for light -file …_ light.res	0	no output of light -file	in	set in outtest_year, used in old_out, finish_simul, canopy
		1	output of light –file, set if all yearly output files are selected (time_out>0, nyvar=1)		
phen_flag	Indicates changes in phenology	0		in	set in data_stand; used in stand_daily, pheno_ini, pheno_begin, pheno_shed
		1	After bud burst, canopy changes due to phenological events		
repflag	Filling of climate data records	0	If not enough data records in climate file, the simulation will be continued with less data records	in	set in read_dwd, used in read_dwd
		1	If not enough data records in climate file, next values will be filled with the same data		
thinflag	Indicates if management was undertaken	0	default	in	tending
		1	Management realised		

Jackson RB, Canadell J, Ehleringer JR, Mooney HA, Sala OE, Schulze ED (1996) A global analysis of root distributions for terrestrial biomes Oecologia 108:389-411