

A brief guide to GENIE-1 namelists

Parameters in the model are controlled via 'namelists'. The default namelist parameter values are listed in the following Tables. To effect a change in parameter value, the parameter name is simply assigned the new value, typically in the *user config* file. Namelist settings can simply be edited in the *user config* file if they are already present, or a namelist assignment can be added (either under a relevant heading, or at the bottom of the file - it does not matter).

The assignment takes the form:

```
namelist = value
```

Note that where the value is a string, the syntax is:

```
namelist = 'string'
```

The syntax for logical (true/false) assignments is:

```
namelist = .true.
```

(or `namelist = .false.`)

For selecting (or de-selecting) atmospheric tracers, the syntax is:

```
gm_atm_select_n = .true.
```

where *n* is the index of the tracer as detailed in the Tables. For ocean and sediment (particulate) tracers, the namlist names take the same form except with 'ocn' or 'sed' in the namlist parameter name.

NOTE: If the number of selected tracers in the ocean is changed, so to must the value of GOLDSTEINNTRACSOPTS, which sets the array dimensions in the ocean and the number of tracers that must be advected, convected, and diffused in the ocean. For example, for 16 selected ocean tracers (including temperature and salinity), add the line:

```
GOLDSTEINNTRACSOPTS = '$ (DEFINE) GOLDSTEINNTRACS=16'
```

For setting initial values of atmospheric tracers, the syntax is:

```
gm_atm_init_n = 278.0E-6
```

where again, *n* is the index of the tracer (detailed below). Ocean tracers are initialized similarly.

NOTE: There is no user-configurable initialization of deep-sea sediment composition (in SEDGEM).

TRACER MNEMONIC	INDEX <i>n</i>	SELECTION <code>gm_atm_select_n</code>		INITIALIZATION <code>ac_atm_init_n</code>		TRACER DESCRIPTION
		DEFAULT VALUE	UNITS	DEFAULT VALUE	UNITS	
ATMOSPHERE (GASEOUS) TRACERS						
ia_temp	1	.true.	logical	n/a (0.0)	K	surface air temperature
ia_humidity	2	.true.	logical	n/a (0.0)		specific humidity
ia_pCO2	3	.false.	logical	0.0	atm	carbon dioxide (CO ₂)
ia_pCO2_13C	4	.false.	logical	0.0	‰	δ ¹³ C of CO ₂
ia_pCO2_14C	5	.false.	logical	0.0	‰	δ ¹⁴ C of CO ₂
ia_pO2	6	.false.	logical	0.0	atm	oxygen (O ₂)
ia_pO2_18O	7	.false.	logical	0.0	‰	δ ¹⁸ O of O ₂
ia_pN2	8	.false.	logical	0.0	atm	nitrogen (N ₂)
ia_pN2_15N	9	.false.	logical	0.0	‰	δ ¹⁵ N of N ₂
ia_pCH4	10	.false.	logical	0.0	atm	methane (CH ₄)
ia_pCH4_13C	11	.false.	logical	0.0	‰	δ ¹³ C of CH ₄
ia_pCH4_14C	12	.false.	logical	0.0	‰	δ ¹⁴ C of CH ₄
ia_pSF6	13	.false.	logical	0.0	atm	sulphur hexafluoride (SF ₆)
ia_pN2O	14	.false.	logical	0.0	atm	nitrous oxide (N ₂ O)
ia_pN2O_15N	15	.false.	logical	0.0	‰	δ ¹⁵ N of N ₂ O
ia_pH2S	16	.false.	logical	0.0	atm	hydrogen sulphide (H ₂ S)
ia_pH2S_34S	17	.false.	logical	0.0	‰	δ ³² S of H ₂ S
ia_pCFC11	18	.false.	logical	0.0	atm	CFC-11
ia_pCFC12	19	.false.	logical	0.0	atm	CFC-12

TRACER MNEMONIC	INDEX "n"	SELECTION gm_ocn_select_n		INITIALIZATION bg_ocn_init_n		TRACER DESCRIPTION
		DEFAULT VALUE	UNITS	DEFAULT VALUE	UNITS	
OCEAN (DISSOLVED) TRACERS						
io_temp	1	.true.	logical	n/a (0.0)	K	temperature
io_sal	2	.true.	logical	n/a (0.0)	PSU	salinity
io_DIC	3	.false.	logical	0.0	mol kg ⁻¹	dissolved inorganic carbon (DIC)
io_DIC_13C	4	.false.	logical	0.0	‰	δ ¹³ C of DIC
io_DIC_14C	5	.false.	logical	0.0	‰	δ ¹⁴ C of DIC
io_NO3	6	.false.	logical	0.0	mol kg ⁻¹	dissolved nitrate (NO ₃)
io_NO3_15N	7	.false.	logical	0.0	‰	δ ¹⁵ N of NO ₃
io_PO4	8	.false.	logical	0.0	mol kg ⁻¹	dissolved phosphate (PO ₄)
io_Fe	9	.false.	logical	0.0	mol kg ⁻¹	dissolved iron (Fe)
io_O2	10	.false.	logical	0.0	mol kg ⁻¹	dissolved oxygen (O ₂)
io_O2_18O	11	.false.	logical	0.0	‰	δ ¹⁸ O of O ₂
io_ALK	12	.false.	logical	0.0	mol kg ⁻¹	alkalinity (ALK)
io_SiO2	13	.false.	logical	0.0	mol kg ⁻¹	aqueous silicic acid (H ₄ SiO ₄)
io_SiO2_30Si	14	.false.	logical	0.0	‰	δ ³⁰ Si of H ₄ SiO ₄
io_DOM_C	15	.false.	logical	0.0	mol kg ⁻¹	dissolved organic matter (DOM); C
io_DOM_C_13C	16	.false.	logical	0.0	‰	δ ¹³ C of DOM-C
io_DOM_C_14C	17	.false.	logical	0.0	‰	δ ¹⁴ C of DOM-C
io_DOM_N	18	.false.	logical	0.0	mol kg ⁻¹	dissolved organic matter; nitrogen
io_DOM_N_15N	19	.false.	logical	0.0	‰	δ ¹⁵ N of DOM-N
io_DOM_P	20	.false.	logical	0.0	mol kg ⁻¹	dissolved organic matter; P
io_DOM_Cd	21	.false.	logical	0.0	mol kg ⁻¹	dissolved organic matter; cadmium
io_DOM_Fe	22	.false.	logical	0.0	mol kg ⁻¹	dissolved organic matter; iron
io_FeL	23	.false.	logical	0.0	mol kg ⁻¹	ligand-bound Fe
io_L	24	.false.	logical	0.0	mol kg ⁻¹	free ligand (iron binding)
io_CH4	25	.false.	logical	0.0	mol kg ⁻¹	dissolved methane (CH ₄)
io_CH4_13C	26	.false.	logical	0.0	‰	δ ¹³ C of CH ₄
io_CH4_14C	27	.false.	logical	0.0	‰	δ ¹⁴ C of CH ₄
io_NH4	28	.false.	logical	0.0	mol kg ⁻¹	dissolved ammonium (NH ₄)
io_NH4_15N	29	.false.	logical	0.0	‰	δ ¹⁵ N of NH ₄
io_N2	30	.false.	logical	0.0	mol kg ⁻¹	dissolved nitrogen (N ₂)
io_N2_15N	31	.false.	logical	0.0	‰	δ ¹⁵ N of N ₂
io_N2O	32	.false.	logical	0.0	mol kg ⁻¹	dissolved nitrous oxide (N ₂ O)
io_N2O_15N	33	.false.	logical	0.0	‰	δ ¹⁵ N of N ₂ O
io_Cd	34	.false.	logical	0.0	mol kg ⁻¹	dissolved cadmium (Cd)
io_Ca	35	.false.	logical	0.0	mol kg ⁻¹	dissolved calcium (Ca)
io_B	36	.false.	logical	0.0	mol kg ⁻¹	dissolved boron (B)
io_F	37	.false.	logical	0.0	mol kg ⁻¹	dissolved fluorine (F)
io_SO4	38	.false.	logical	0.0	mol kg ⁻¹	dissolved sulphate (SO ₄)
io_SO4_34S	39	.false.	logical	0.0	‰	δ ³⁴ S of SO ₄
io_H2S	40	.false.	logical	0.0	mol kg ⁻¹	dissolved hydrogen sulphide (H ₂ S)
io_H2S_34S	41	.false.	logical	0.0	‰	δ ³⁴ S of H ₂ S
io_Ge	42	.false.	logical	0.0	mol kg ⁻¹	dissolved germanium
io_231Pa	43	.false.	logical	0.0	mol kg ⁻¹	²³¹ Pa
io_230Th	44	.false.	logical	0.0	mol kg ⁻¹	²³⁰ Th
io_CFC11	45	.false.	logical	0.0	mol kg ⁻¹	dissolved CFC-11
io_CFC12	46	.false.	logical	0.0	mol kg ⁻¹	dissolved CFC-12
io_SF6	47	.false.	logical	0.0	mol kg ⁻¹	dissolved sulphur hexafluoride (SF ₆)
io_colr	48	.false.	logical	0.0	n/a	RED numerical (color) tracer
io_colb	49	.false.	logical	0.0	n/a	BLUE numerical (color) tracer
io_Mg	50	.false.	logical	0.0	mol kg ⁻¹	dissolved Magnesium (Mg)

TRACER MNEMONIC	INDEX <i>n</i>	SELECTION gm_sed_select_ <i>n</i>		(INITIALIZATION) ¹		TRACER DESCRIPTION
		DEFAULT VALUE	UNITS	DEFAULT VALUE ¹	UNITS ²	
SEDIMENT (SOLID, PARTICULATE) TRACERS						
is_NULL1	1	.false.	logical	n/a	n/a	dummy index
is_NULL2	2	.false.	logical	n/a	n/a	dummy index
is_POC	3	.false.	logical	0.0	wt%	particulate organic carbon (POC)
is_POC_13C	4	.false.	logical	0.0	‰	$\delta^{13}\text{C}$ of POC
is_POC_14C	5	.false.	logical	0.0	‰	$\delta^{14}\text{C}$ of POC
is_PON	6	.false.	logical	0.0	(wt%)	particulate organic nitrogen (PON)
is_PON_15N	7	.false.	logical	0.0	‰	$\delta^{15}\text{N}$ of PON
is_POP	8	.false.	logical	0.0	(wt%)	particulate organic phosphate (POP)
is_POCd	9	.false.	logical	0.0	(wt%)	particulate organic cadmium (POCd)
is_POFe	10	.false.	logical	0.0	(wt%)	particulate organic iron (POFe)
is_POM_231Pa	11	.false.	logical	0.0	(wt%)	POM scavenged ^{231}Pa
is_POM_230Th	12	.false.	logical	0.0	(wt%)	POM scavenged ^{230}Th
is_POM_Fe	13	.false.	logical	0.0	(wt%)	POM scavenged Fe
is_CaCO3	14	.false.	logical	0.0	wt%	calcium carbonate (CaCO_3)
is_CaCO3_13C	15	.false.	logical	0.0	‰	$\delta^{13}\text{C}$ of CaCO_3
is_CaCO3_14C	16	.false.	logical	0.0	‰	$\delta^{14}\text{C}$ of CaCO_3
is_CaCO3_18O	17	.false.	logical	0.0	‰	$\delta^{18}\text{O}$ of CaCO_3
is_CaCO3_Cd	18	.false.	logical	0.0	(wt%)	CaCO_3 incorporated cadmium
is_CaCO3_231Pa	19	.false.	logical	0.0	(wt%)	CaCO_3 scavenged ^{231}Pa
is_CaCO3_230Th	20	.false.	logical	0.0	(wt%)	CaCO_3 scavenged ^{230}Th
is_CaCO3_Fe	21	.false.	logical	0.0	(wt%)	CaCO_3 scavenged Fe
is_det	22	.false.	logical	0.0	(wt%)	detrital (refractory) material
is_det_231Pa	23	.false.	logical	0.0	(wt%)	detrital scavenged ^{231}Pa
is_det_230Th	24	.false.	logical	0.0	(wt%)	detrital scavenged ^{230}Th
is_det_Fe	25	.false.	logical	0.0	(wt%)	detrital scavenged Fe
is_opal	26	.false.	logical	0.0	wt%	opal
is_opal_30Si	27	.false.	logical	0.0	‰	$\delta^{30}\text{Si}$ of opal
is_opal_Ge	28	.false.	logical	0.0	(wt%)	opal incorporated germanium
is_opal_231Pa	29	.false.	logical	0.0	(wt%)	opal scavenged ^{231}Pa
is_opal_230Th	30	.false.	logical	0.0	(wt%)	opal scavenged ^{230}Th
is_opal_Fe	31	.false.	logical	0.0	(wt%)	opal scavenged Fe
is_ash	32	.false.	logical	0.0	wt%	ash
is_POC_frac2	33	.false.	logical	0.0	(ratio)	
is_CaCO3_frac2	34	.false.	logical	0.0	(ratio)	
is_opal_frac2	35	.false.	logical	0.0	(ratio)	
is_CaCO3_age	36	.false.	logical	0.0		CaCO_3 numerical age tracer
is_foram_p_13C	37	.false.	logical	0.0	‰	planktic foraminiferal CaCO_3 $\delta^{13}\text{C}$
is_foram_p_14C	38	.false.	logical	0.0	‰	planktic foraminiferal CaCO_3 $\delta^{14}\text{C}$
is_foram_p_18O	39	.false.	logical	0.0	‰	planktic foraminiferal CaCO_3 $\delta^{18}\text{O}$
is_foram_b_13C	40	.false.	logical	0.0	‰	benthic foraminiferal CaCO_3 $\delta^{13}\text{C}$
is_foram_b_14C	41	.false.	logical	0.0	‰	benthic foraminiferal CaCO_3 $\delta^{14}\text{C}$
is_foram_b_18O	42	.false.	logical	0.0	‰	benthic foraminiferal CaCO_3 $\delta^{18}\text{O}$

¹ The ocean is initialized with no particulates in the ocean. Sediment composition is initialized with 100 wt% ash in the surface sediment layer and 100 wt% detrital material in the underlying stack layers, so as to enable the construction of a constant sedimentation rate chronology (based on locating the consequential ash 'peak'). These values are hard-coded (in:~/genie/genie-sedgem/src/fortran/sedgem_data.f90).

² The units are given for sediment composition. Particulate tracers in the ocean are in units of mol kg⁻¹ and per mil (‰), corresponding to sediment units of wt% and ‰, respectively.

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
TIME-STEPPING			
ma_koverall_total		(INTEGER)	overall model number of time-steps
ma_genie_timestep		s	length of each time-step ¹
bg_par_misc_t_start	0.0	years	simulation start year
bg_par_misc_t_runtime	1001.0	years	simulation run length
bg_ctrl_misc_t_BP	.false.	(LOGICAL)	simulation time scale as years Before Present
sg_par_misc_t_runtime	1001.0	yr	simulation run length ¹
ma_katm_loop	1 ³	(INTEGER)	relative frequency of updating of atmosphere
ma_ksic_loop	5	(INTEGER)	relative frequency of updating of sea-ice
ma_kocn_loop	5	(INTEGER)	relative frequency of updating of ocean
ma_conv_kocn_katchem	5	(INTEGER)	time-stepping ratio between ATCHEM and ocean
ma_conv_kocn_ksedgem	50	(INTEGER)	time-stepping ratio between SEDGEM and ocean
ma_conv_kocn_kbiogem	5	(INTEGER)	time-stepping ratio between BIOGEM and ocean
ma_conv_kocn_krokgem	5	(INTEGER)	time-stepping ratio between ROKGEM and ocean
ma_dt_write	720	(INTEGER)	default interval of output ⁴
rg_par_screen_output	200	(INTEGER)	ROKGEM reporting frequency (in ROKGEM time-steps)
ea_3	1000	(INTEGER)	frequency of 'health check' diagnostics reporting ⁵
go_3	1000	(INTEGER)	frequency of 'health check' diagnostics reporting ⁵
gs_3	1000	(INTEGER)	frequency of 'health check' diagnostics reporting ⁵
ea_5	100	(INTEGER)	'time series' frequency ⁵
go_5	100	(INTEGER)	'time series' frequency ⁵
gs_5	100	(INTEGER)	'time series' frequency ⁵
ea_6	50000	(INTEGER)	'average' frequency ⁵
go_6	50000	(INTEGER)	'average' frequency ⁵
gs_6	50000	(INTEGER)	'average' frequency ⁵

¹ This parameter sets the 'aging' of pre-existing (i.g., restart) sedimentary material consistent with the duration of a run. It must be equal to the run length of everything else. Obviously ;)

² The length of each time-step is determined by the value of *ma_genie_timestep* (seconds), and is defined in *genie_eb_go_gs_ac_bg_sg.config* by: *ma_genie_timestep* = 365.25*24.0/500 * 3600.0, i.e., *ma_genie_timestep*=63115.2, giving 500 time-steps per year.

³ This means that the atmosphere (the EMBM in this case) is updated every GENIE time-step.

⁴ In multiples of the GENIE time-step.

⁵ When set equal to *ma_genie_timestep*+1, this effectively disables this feature.

ARRAY SPECIFICATION: GRID

NAME	DEFAULT VALUE	DESCRIPTION
GENIENXOPTS	'\$(DEFINE) GENIENX=36'	x (i) direction resolution in atmosphere
GENIENYOPTS	'\$(DEFINE) GENIENY=36'	y (j) direction resolution in atmosphere
GENIENLOPTS	'\$(DEFINE) GENIENL=1'	number of levels in atmosphere
GOLDSTEINNLONSOPTS	'\$(DEFINE) GOLDSTEINNLONS=36'	x (i) direction resolution in ocean
GOLDSTEINNLATSOPTS	'\$(DEFINE) GOLDSTEINNLATS=36'	y (j) direction resolution in ocean
GOLDSTEINNLEVSOPTS	'\$(DEFINE) GOLDSTEINNLEVS=8'	number of (depth) levels in ocean
SEDGEMNLONSOPTS	'\$(DEFINE) SEDGEMNLONS=36'	x (i) direction resolution in sediments
SEDGEMNLATSOPTS	'\$(DEFINE) SEDGEMNLATS=36'	y (j) direction resolution in sediments
ROKGEMNLONSOPTS	'\$(DEFINE) ROKGEMNLONS=36'	x (i) direction resolution on land surface
ROKGEMNLATSOPTS	'\$(DEFINE) ROKGEMNLATS=36'	y (j) direction resolution on land surface
gm_par_grid_lon_offset	-260.0	assumed longitudinal offset of the grid for ATCHEM, BIOGEM, SEDGEM 2- and 3-D field data saving (units of degrees East)

ARRAYSPECIFICATION: NUMBER OF TRACERS

GOLDSTEINNTRACSOPTS	'\$(DEFINE) GOLDSTEINNTRACS=10'	number of dissolved tracers in ocean
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NAME	DEFAULT VALUE	DESCRIPTION
RUN RE-START SPECIFICATION		
ea_7	'n'	new/continuing run? (i.e., use restart?)
ea_rstidir_name	'\$RUNTIME_ROOT/genie-embm/data/input'	restart (input) directory
ea_35	'tmp.1'	input ASCII restart file name
ea_29	'spn'	output file number (restart file string)
go_7	'n'	new/continuing run? (i.e., use restart?)
go_rstidir_name	'\$RUNTIME_ROOT/genie-goldsteindata/input'	restart (input) directory
go_23	'tmp.1'	input ASCII restart file name
go_17	'spn'	output file number (restart file string)
gs_7	'n'	new/continuing run? (i.e., use restart?)
gs_rstidir_name	'\$RUNTIME_ROOT/genie-seaice/data/input'	restart (input) directory
gs_18	'tmp.1'	input ASCII restart file name
gs_12	'spn'	output file number (restart file string)
ac_ctrl_continuing	.false.	continuing ATCHEM run? (i.e., use restart?)
ac_par_rstidir_name	'\$RUNTIME_ROOT/genie-atchem/data/input'	ATCHEM restart (input) directory
ac_par_infile_name	'atchem'	input restart filename
ac_par_outfile_name	'atchem'	output restart filename
bg_ctrl_continuing	.false.	continuing BIOGEM run? (i.e., use restart?)
bg_par_rstidir_name	'\$RUNTIME_ROOT/genie-biogem/data/input'	BIOGEM restart (input) directory
bg_par_infile_name	'biogem'	input restart filename
bg_par_outfile_name	'biogem'	output restart filename
sg_ctrl_continuing	.false.	continuing SEDGEM run? (i.e., use restart?)
sg_par_rstidir_name	'\$RUNTIME_ROOT/genie-sedgem/data/input'	SEDGEM restart (input) directory
sg_par_infile_name	'sedgem'	input restart filename
sg_par_outfile_name	'sedgem'	output restart filename
rg_ctrl_continuing	.false.	continuing ROKGEM run? (i.e., use restart?)
-	-	-
rg_par_infile_name	'rokgem'	input restart filename
rg_par_outfile_name	'rokgem'	output restart filename
INPUT/OUTPUT DIRECTORY SPECIFICATION		
gm_par_gem_indir_name	'\$RUNTIME_ROOT/genie-main/data/input'	GEM data input directory
ea_1	'\$RUNTIME_ROOT/genie-embm/data/input'	data input directory
ea_2	'\$RUNTIME_OUTDIR/embm'	results output directory
go_1	'\$RUNTIME_ROOT/genie-goldstein/data/input'	data input directory
go_2	'\$RUNTIME_OUTDIR/goldstein'	results output directory
gs_1	'\$RUNTIME_ROOT/genie-seaice/data/input'	data input directory
gs_2	'\$RUNTIME_OUTDIR/seaice'	results output directory
ac_par_indir_name	'\$RUNTIME_ROOT/genie-atchem/data/input'	ATCHEM data input directory
ac_par_outdir_name	'\$RUNTIME_OUTDIR/atchem'	ATCHEM results output directory
bg_par_indir_name	'\$RUNTIME_ROOT/genie-biogem/data/input'	BIOGEM data input directory
bg_par_outdir_name	'\$RUNTIME_OUTDIR/biogem'	BIOGEM results output directory
bg_par_fordir_name	'\$RUNTIME_ROOT/genie-biogem/data/input'	BIOGEM forcings (input) directory
sg_par_indir_name	'\$RUNTIME_ROOT/genie-sedgem/data/input'	SEDGEM data input directory
sg_par_outdir_name	'\$RUNTIME_OUTDIR/sedgem'	SEDGEM results output directory
rg_par_indir_name	'\$RUNTIME_ROOT/genie-rokgem/data/input'	ROKEM data input directory
rg_par_outdir_name	'\$RUNTIME_OUTDIR/rokgem'	ROKEM results output directory

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
USEFUL(!) CLIMATE VARIABLES			
ma_genie_solar_constant	1368.0	W m ⁻²	solar constant
ea_topo	'worbe2'	(STRING)	topography name ¹
ea_dosc	.true.	(LOGICAL)	seasonal insolation forcing? ²
ea_diffa_scl	1.0	(REAL)	atmospheric diffusivity scaling factor
ea_diffa_len	0	(INTEGER)	grid point distance over which scalar is applied (j direction)
ea_36	'n'	('y'/'n')	use ATCHEM CO ₂ to calculate radioactive forcing (else climate is invariant)?
ea_delf2x	5.77	W m ⁻²	climate sensitivity; radiative forcing in W m ⁻² for a doubling of CO ₂ is calculated as: delf2x × ln(2.0)
go_topo	'worbe2'	(STRING)	topography filename ¹
go_dosc	.true.	(LOGICAL)	seasonal insolation forcing? ²
go_ocnconv	0	(INTEGER)	ocean convection scheme ³
gs_dosc	.true.	(LOGICAL)	seasonal insolation forcing? ²
¹ Note that an extension of ".k1" is added automatically. ² The three climate components modules must all include seasonal insolation forcing together or not (i.e., the 3 namelist parameter values must have the same value). ³ Current options are: 0 = original; 1 = Mueller.			
NAME	DEFAULT VALUE	UNITS	DESCRIPTION
GENERAL BIOGEOCHEMISTRY			
gm_par_carbconstset_name	"Mehrbach"	(STRING)	carbonate dissociation constants set
ATMOSPHERE BIOGEOCHEMISTRY			
-	-	-	-

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
OCEAN BIOGEOCHEMISTRY: MISC CONTROL			
bg_ctrl_misc_Snorm	.true.	(LOGICAL)	tracer update with salinity normalization
bg_ctrl_misc_noSnorm	.false.	(LOGICAL)	tracer update without salinity normalization
bg_ctrl_misc_nobioupdate	.false.	(LOGICAL)	tracer update with no biological overprint
OCEAN BIOGEOCHEMISTRY: BOUNDARY CONDITIONS			
bg_ctrl_force_sed_closedsystem	.true.	(LOGICAL)	Dissolution flux = rain flux to close system?
bg_ctrl_force_GOLDSTEInTS	.false.	(LOGICAL)	Allow temperature / salinity forcing of climate?
bg_ctrl_force_seaice	.false.	(LOGICAL)	Replace internal fractional sea-ice cover field?
bg_ctrl_force_windspeed	.true.	(LOGICAL)	Replace internal wind-speed field?
bg_ctrl_force_CaCO3toPOCrainratio	.false.	(LOGICAL)	Replace internal CaCO3:POC export rain ratio?
bg_ctrl_force_POCdtoPOCrainratio	.false.	(LOGICAL)	Replace internal POCd:POC export rain ratio?
bg_ctrl_force_Cd_alpha	.false.	(LOGICAL)	Replace internal [Cd/P]POM/[Cd/P]SW alpha?
bg_ctrl_force_solconst	.false.	(LOGICAL)	Replace solar constant (with time-varying IP)?
bg_ctrl_force_oldformat	.false.	(LOGICAL)	Use old tracer forcing file format?
bg_par_seaice_file	'seaice.dat'	(STRING)	Filename for prescribed BIOGEM seaice boundary condition
bg_par_windspeed_file	'windspeed.dat'	(STRING)	Filename for prescribed BIOGEM windspeed (air-sea gas exchange) boundary condition
bg_par_CaCO3toPOCrainratio_file	'CaCO3toPOCrainratio.dat'	(STRING)	Filename for prescribed BIOGEM CaCO3:POC rain ratio boundary condition
bg_par_POCdtoPOCrainratio_file	'POCdtoPOCrainratio.dat'	(STRING)	Filename for prescribed BIOGEM POCd:POC rain ratio boundary condition
bg_par_Cd_alpha_file	'Cd_alpha.dat'	(STRING)	Filename for prescribed Cd partition coefficient (α) field
bg_par_gastransfer_a	0.310	???	Value of <i>Wanninkhof</i> [1992] gas transfer coeff, a
OCEAN BIOGEOCHEMISTRY: BIOLOGICAL NEW PRODUCTION			
bg_par_bio_prodopt	'1N1T_P04MM'	(STRING)	biological scheme ID
bg_par_bio_k0_PO4	2.0E ⁻⁰⁶	mol kg ⁻¹ yr ⁻¹	maximum PO ₄ consumption rate
bg_par_bio_k0_NO3	32.0E ⁻⁰⁶	mol kg ⁻¹ yr ⁻¹	maximum NO ₃ consumption rate
bg_par_bio_c0_PO4	0.050E ⁻⁰⁶	mol kg ⁻¹	[PO ₄] M-M half-sat value
bg_par_bio_c0_NO3	3.200E ⁻⁰⁶	mol kg ⁻¹	[NO ₃] M-M half-sat value
bg_par_bio_c0_N	1.600E ⁻⁰⁶	mol kg ⁻¹	[NO ₃]+[NH ₄] M-M half-sat value
bg_par_bio_c0_Fe	0.030E ⁻⁰⁹	mol kg ⁻¹	[Fe] M-M half-sat value
bg_par_bio_c0_SiO2	10.0E ⁻⁰⁶	mol kg ⁻¹	[H ₄ SiO ₄] M-M half-sat value
OCEAN BIOGEOCHEMISTRY: ORGANIC MATTER UPTAKE (EXPORT) RATIOS			
bg_par_bio_red_POP_PON	16.0	n/a	N/P organic matter Redfield ratio
bg_par_bio_red_POP_POC	106.0	n/a	C/P organic matter Redfield ratio
bg_par_bio_red_POP_PO2	-138.0	n/a	O ₂ /P organic matter pseudo-Redfield ratio
bg_par_bio_red_PON_ALK	-1.00	n/a	ALK/N alkalinity correction factor
bg_par_bio_red_DOMfrac	0.66	n/a	production fraction of dissolved organic matter
OCEAN BIOGEOCHEMISTRY: REMINERALIZATION			
bg_par_bio_remin_DOMlifetime	0.5	yrs	DOC lifetime
bg_ctrl_bio_remin_POC_fixed	.true.	(LOGICAL)	fixed-profile POM remineralization?
bg_par_bio_remin_POC_frac2	0.05	n/a	initial fractional abundance of fraction #2
bg_par_bio_remin_POC_eL1	500.0	m	remineralization length: fraction #1
bg_par_bio_remin_POC_eL2	1000000.0	m	remineralization length: fraction #2
bg_ctrl_bio_remin_CaCO3_fixed	.true.	(LOGICAL)	fixed-profile CaCO3 remineralization?
bg_par_bio_remin_CaCO3_frac2	0.5	n/a	initial fractional abundance of fraction #2
bg_par_bio_remin_CaCO3_eL1	1000.0	m	remineralization length: fraction #1
bg_par_bio_remin_CaCO3_eL2	1000000.0	m	remineralization length: fraction #2
bg_ctrl_bio_remin_opal_fixed	.false.	(LOGICAL)	fixed-profile opal remineralization?
bg_par_bio_remin_opal_frac2	0.5	n/a	initial fractional abundance of fraction #2
bg_par_bio_remin_opal_eL1	1000.0	m	remineralization length: fraction #1
bg_par_bio_remin_opal_eL2	1000000.0	m	remineralization length: fraction #2
bg_par_bio_remin_sinkingrate	125.0	m d ⁻¹	prescribed particle sinking rate
bg_ctrl_bio_remin_ONtoNH4	.false.	(LOGICAL)	aerobic remineralization of ON -> NH ₄ (not NO ₃)
bg_par_bio_remin_denitrO2thresh	0.0	mol kg ⁻¹	Denitrification [O ₂] threshold (mol kg ⁻¹)
bg_ctrl_bio_remin_reminfix	.false.	(LOGICAL)	Stop rapidly-oxidizing species going < 0.0?

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
OCEAN BIOGEOCHEMISTRY: IRON			
bg_par_det_Fe_sol	1.0	n/a	fractional aeolian Fe solubility
bg_par_det_Fe_sol_exp	1.0	n/a	exponent for aeolian Fe solubility ¹
bg_ctrl_bio_red_fixedFetoC	.false.	(LOGICAL)	fixed cellular Fe:C ratio?
bg_par_bio_red_POFe_POC	250000.0	n/a	C/Fe organic matter ratio
bg_ctrl_bio_Fe_fixedKscav	.false.		fixed scavenging rate (if not: Parekh scheme)?
bg_par_scav_Fe_Ks	0.1E-3	d ⁻¹	fixed Fe scavenging rate
bg_par_scav_Fe_sf_POC	0.300	n/a	Parekh Fe scavenging rate scale factor: POC
bg_par_scav_Fe_sf_CaCO3	0.0	n/a	Parekh Fe scavenging rate scale factor: CaCO ₃
bg_par_scav_Fe_sf_opal	0.0	n/a	Parekh Fe scavenging rate scale factor: opal
bg_par_scav_Fe_sf_det	0.0	n/a	Parekh Fe scavenging rate scale factor: det
bg_par_scav_fremin	1.0	n/a	Fraction of scavenged Fe remineralizable
OCEAN BIOGEOCHEMISTRY: SILICA			
-	-	-	-
OCEAN BIOGEOCHEMISTRY: NITROGEN			
bg_par_bio_mu1	1.0	yr ⁻¹	mu-1 maximum rate of export production
bg_par_bio_mu2	0.2	yr ⁻¹	mu-2 maximum rate of export production from N ₂ -fixation
bg_par_bio_N2fixthresh	100.0E ⁻⁰⁶	mol yr ⁻¹	Threshold NO ₃ + NH ₄ to encourage N ₂ fixation
bg_par_bio_Nstar_offset	2.90E ⁻⁰⁶	mol yr ⁻¹	N-star calculation offset
OCEAN BIOGEOCHEMISTRY: TRACE METALS			
bg_par_bio_red_POC_POCd	0.0E-6	n/a	Default cellular C:Cd (Cd/C) ratio
bg_par_bio_red_POC_POCd_alpha	10.0	n/a	[Cd/P]POM/[Cd/P]SW partition coefficient (α)
bg_ctrl_bio_red_CdtoC_Felim	.true.	(LOGICAL)	Fe-limitation dependent Cd:C 'Redfield' uptake ratio?
bg_par_bio_red_CdtoC_Felim_min	3.000E-6	n/a	Minimum (Fe replete) Cd:C uptake ratio
bg_par_bio_red_CdtoC_Felim_max	6.000E-6	n/a	Maximum (Fe limited) Cd:C uptake ratio
¹ Use a value of 1.0 for uniform solubility.			

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
OCEAN BIOGEOCHEMISTRY: DATA SAVING: TIME-SLICES			
bg_ctrl_data_save_slice_ocnatm	.false.	(LOGICAL)	atmospheric (interface) composition (2D)?
bg_ctrl_data_save_slice_ocn	.true.	(LOGICAL)	ocean composition (3D)?
bg_ctrl_data_save_slice_ocnsed	.false.	(LOGICAL)	ediment (interface) composition (2D)?
bg_ctrl_data_save_slice_fairsea	.true.	(LOGICAL)	Air-sea gas exchange (2D)?
bg_ctrl_data_save_slice_focnatm	.false.	(LOGICAL)	ocean-atmosphere flux (2D)?
bg_ctrl_data_save_slice_focnsed	.false.	(LOGICAL)	ocean-sediment flux (2D)?
bg_ctrl_data_save_slice_fsedocn	.false.	(LOGICAL)	sediment-ocean flux (2D)?
bg_ctrl_data_save_slice_bio	.true.	(LOGICAL)	biological fluxes (3D)?
bg_ctrl_data_save_slice_carb	.true.	(LOGICAL)	aqueous carbonate system properties (3D)?
bg_ctrl_data_save_slice_carbconst	.false.	(LOGICAL)	aqueous carbonate system constants (3D)?
bg_ctrl_data_save_slice_phys_atm	.false.	(LOGICAL)	atmospheric physical properties (2D)?
bg_ctrl_data_save_slice_phys_ocn	.false.	(LOGICAL)	ocean physical properties (3D)?
bg_ctrl_data_save_slice_misc	.true.	(LOGICAL)	miscellaneous properties (-)?
bg_ctrl_data_save_slice_diag	.false.	(LOGICAL)	biogeochemical diagnostics?
bg_par_data_save_slice_dt	1.0	yr	integration interval
bg_par_infile_slice_name	'biogem_save_t imeslice.dat'	(STRING)	time-slice mid-point specification filename
OCEAN BIOGEOCHEMISTRY: DATA SAVING: TIME-SERIES			
bg_ctrl_data_save_sig_ocnatm	.true.	(LOGICAL)	atmospheric (interface) composition?
bg_ctrl_data_save_sig_ocn	.true.	(LOGICAL)	oceanic composition?
bg_ctrl_data_save_sig_fexport	.true.	(LOGICAL)	export flux?
bg_ctrl_data_save_sig_fairsea	.true.	(LOGICAL)	Air-sea gas exchange?
bg_ctrl_data_save_sig_ocnsed	.true.	(LOGICAL)	sediment (interface) composition?
bg_ctrl_data_save_sig_focnatm	.false.	(LOGICAL)	ocean->atmosphere flux?
bg_ctrl_data_save_sig_focnsed	.true.	(LOGICAL)	ocean->sediment flux?
bg_ctrl_data_save_sig_fsedocn	.true.	(LOGICAL)	sediment->ocean flux?
bg_ctrl_data_save_sig_ocnSS	.true.	(LOGICAL)	ocean surface tracers?
bg_ctrl_data_save_sig_carbSS	.true.	(LOGICAL)	ocean surface carbonate chemistry?
bg_ctrl_data_save_sig_misc	.true.	(LOGICAL)	miscellaneous properties?
bg_ctrl_data_save_sig_diag	.true.	(LOGICAL)	biogeochemical diagnostics?
bg_par_data_save_sig_dt	1.0	yr	integration interval
bg_par_infile_sig_name	'biogem_save_s ig.dat'	(STRING)	time-slice mid-point specification filename
OCEAN BIOGEOCHEMISTRY: DATA SAVING: MISC			
bg_ctrl_data_save_derived	.false.	(LOGICAL)	save 'derived' ¹ data?
bg_ctrl_data_save_GLOBAL	.true.	(LOGICAL)	save global diagnostics ² ?
bg_ctrl_data_save_slice_ascii	.false.	(LOGICAL)	save time-slices in ASCII format?
bg_ctrl_data_save_sig_ascii	.true.	(LOGICAL)	save time-series in ASCII format?
OCEAN BIOGEOCHEMISTRY: TRACER AUDITING AND DEBUGGING OPTIONS			
bg_ctrl_audit	.true.	(LOGICAL)	audit tracer inventory?
bg_ctrl_audit_fatal	.false.	(LOGICAL)	halt on audit fail?
bg_par_misc_audit_reterr	1.0E ⁻⁰⁸	n/a	threshold of relative inventory change to trigger audit error
bg_ctrl_debug_reportwarnings	.false.	(LOGICAL)	report all run-time warnings?
bg_ctrl_debug_lvl1	.false.	(LOGICAL)	report level #1 debug?
bg_ctrl_debug_lvl2	.false.	(LOGICAL)	report level #2 debug?
<p>¹ e.g., salinity-normalized ocean tracers, tracer inventories of each cell.</p> <p>² Saved at time-slice intervals.</p>			

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
DEEP-SEA SEDIMENTS: PHYSICAL CONFIGURATION			
sg_par_sed_top_th	1.0	cm	top ('well-mixed') sediment layer thickness
sg_par_sed_poros_det	0.880	cm ³ cm ⁻³	detrital porosity
sg_par_sed_poros_CaCO3	0.610	cm ³ cm ⁻³	carbonate porosity in top layer
DEEP-SEA SEDIMENTS: DIAGENESIS SCHEME: SELECTION			
sg_par_sed_diagen_CaCO3opt	'archer1991explicit'	(STRING)	CaCO ₃ diagenesis scheme
sg_par_sed_diagen_opalopt	'none'	(STRING)	opal diagenesis scheme
sg_par_sed_diagen_Corgopt	'none'	(STRING)	organic matter diagenesis scheme
DEEP-SEA SEDIMENTS: DIAGENESIS SCHEME: CONTROL			
sg_ctrl_sed_bioturb	.true.	(LOGICAL)	bioturbate sediment stack?
sg_ctrl_sed_bioturb_Archer	.true.	(LOGICAL)	use <i>Archer et al.</i> [2002] bioturbation scheme?
sg_par_n_sed_mix	20	n/a	maximum layer depth for bioturbation
sg_par_sed_mix_k_sur_max	0.15	cm ² yr ⁻¹	maximum surface bioturbation mixing rate
sg_par_sed_mix_k_sur_min	0.15	cm ² yr ⁻¹	minimum surface bioturbation mixing rate
sg_par_sed_fdet	0.150	g cm ⁻² kyr ⁻¹	prescribed (additional) flux of detrital material to the sed
sg_par_sed_diagen_fPOCfrac	1.0	n/a	fraction of POC rain available for driving CaCO ₃ dissolution
DEEP-SEA SEDIMENTS: MISC CONTROLS			
sg_ctrl_sed_forcedohmega_ca	.true.	(LOGICAL)	Ca-only adjustment for forced ocean saturation?
sg_par_sed_ohmegamin	0.00	n/a	forced minimum saturation (calcite Ω) anywhere
sg_par_sed_ohmegamin_flux	0.00	mol Ca cm ⁻² per time-step	imposed sed->ocn flux for saturation
DEEP-SEA SEDIMENTS: DATA FILENAMES			
sg_par_sed_topo_D	'sedgem_topo_D.36x36'	(STRING)	sediment water depth grid name
sg_par_sedcore_save_mask_name	'sedgem_save_mask.36x36'	(STRING)	sediment core save mask name
sg_par_sed_mix_k_name	'sedgem_sed_mix_k.dat'	(STRING)	biodiffusion profile name
DEEP-SEA SEDIMENTS: I/O: MISC			
sg_ctrl_data_save_ascii	.false.	(LOGICAL)	save 2-D data fields in ASCII format?
sg_ctrl_data_save_wtfrac	.true.	(LOGICAL)	report sediment data as a mass fraction?
sg_ctrl_misc_debug1	.false.	(LOGICAL)	debug level #1?
sg_ctrl_misc_debug2	.false.	(LOGICAL)	debug level #2?
sg_ctrl_misc_debug3	.false.	(LOGICAL)	debug level #3?
sg_ctrl_misc_debug4	.false.	(LOGICAL)	debug level #4?
sg_ctrl_misc_report_err	.false.	(LOGICAL)	report errors?
sg_par_misc_debug_i	1	n/a	i sediment coordinate for debug reporting
sg_par_misc_debug_j	1	n/a	j sediment coordinate for debug reporting

NAME	DEFAULT VALUE	UNITS	DESCRIPTION
TERRESTRIAL WEATHERING: RIVER ROUTING PARAMETERS			
rg_topo	'worbe2.kl'	n/a	continental config and river routing filename
TERRESTRIAL WEATHERING: WEATHERING SCHEME PARAMETER			
rg_par_weathopt	'Global avg'		weathering option
TERRESTRIAL WEATHERING: GLOBAL AVERAGE WEATHERING PARAMETERS			
rg_opt_weather_CaCO3	.FALSE.	(LOGICAL)	CaCO ₃ weathering-temperature feedback?
rg_opt_weather_CaSiO3	.FALSE.	(LOGICAL)	CaSiO ₃ weathering-temperature feedback?
rg_opt_weather_P	.FALSE.	(LOGICAL)	productivity-weathering feedback
rg_par_weather_T0	8.451890	C	weathering reference mean global land surface temperature
rg_par_weather_P0	0.716	kgC m ⁻² yr ⁻¹	weathering reference mean global land productivity
rg_par_outgas_CO2	0.0	mol C yr ⁻¹	CO ₂ outgassing rate
rg_par_outgas_CO2_13C	-5.000	‰	mean volcanic/metamorphic δ ¹³ C
rg_par_weather_CaSiO3	0.0	mol Ca ²⁺ yr ⁻¹	global silicate weathering rate
rg_par_weather_CaCO3	10.00E+12	mol Ca ²⁺ yr ⁻¹	global carbonate weathering rate
rg_par_weather_CaCO3_13C	0.000	‰	mean carbonate δ ¹³ C
TERRESTRIAL WEATHERING: DATA FILENAMES			
rg_par_output_years_file	'rokgem_output_years.dat'	(STRING)	filename of file containing the times (in years) at which output is to be generated