SOweb - Parameters, Energy Flows & Impacts

Andrew Constable

2023-12-30

Contents

State and environmental variables

Primary Producers

Parameter Allocation

Energy Flows and Impacts

Table 1: State and environmental forcing variables in the Steady-state Ecosystem Model

Variable	**Symbol**	**Units**
Arena		
Latitude	L	$^{\circ}$
Area	A	km^2
Depth	Z	m
State Variables		
Detritus	D	$gC.m^{-2}$
Macronutrients (Silicate)	Si	$mmol.m^{-2}$
Micronutrients (dissolved Iron)	dFe	$\mu mol.m^{-2}$
Phytoplankton	P	$gC.m^{-2}$
Higher trophic levels	B	$gC.m^{-2}$
Environmental Forcing Variables		
Mixed layer depth	MLD	m
Incident solar radiation (insolation) at surface	$I(0,t)$	$W.m^{-2}$
Sea ice concentration	SIC	%
Sea ice thickness	SIT	m
Temperature	T	$^{\circ}C$

Table 2: Parameters used for primary production in diatoms and other phytoplankton (modelled on haptophytes) in the NPZD model of Base Production

Parameter	Symbol	Units
Light		
Attenuation PAR through sea ice	k_{si}	m^{-1}
Attenuation PAR through water	k_w	m^{-1}
Proportion incident radiation photosynthetically active	PAR	$-$
Growth rate		
Photosynthesis efficiency (initial slope of P-I curve)	α	
Maximum growth rate	μ_{max}	d^{-1}
Half saturation constants for nutrient uptake		
Silicate	K_{SiO_4}	$mmol.m^{-3}$
Dissolved Iron	K_{dFe}	$\mu mol.m^{-3}$
Stoichiometry		
Algal carbon to nitrogen ratio	$R_{c:n}$	$mol.mol^{-1}$
Algal chl-a to nitrogen ratio	$R_{chla:n}$	$g.mol^{-1}$
Algal iron to nitrogen ratio	$R_{fe:n}$	$mmol.mol^{-1}$
Algal silica to nitrogen ratio	$R_{fe:n}$	$mol.mol^{-1}$

Table 3: Allocation of Parameters Part 1

Parameter	Symbol	Units	Category
J_{max} parameter	a	d^{-1}	Primary Production
	A		
Initial slope of photosynthis-irradiance curve	α	$d^(-1)/Wm^{-2}$	Primary production
J_{max} parameter	b	d^{-1}	Primary Production
Benthic inputs	be		Subscript
Carbon mass of higher trophic level	B		State variable
	β		
	c		
Phytoplankton competition coefficients	${}^{p}c$		Primary production
Circumpolar Deep Water	cdw		Subscript
	C		
	d		
Detrital concentration	D		State variable
Realised depth adjustment for incident angle of light	${}^{I}D$		Primary production
	δ		
	Δ		
	e		
	E		
	ϵ		
	ε		
	η		
	f		
	F		
	g		
Nutrient uptake by phytoplankton	gN		Primary production
Total grazing rate by zooplankton	G		
	γ		
	Γ		
	h		
	H		
	i		
Incident solar radiation at surface	I	$W.m^{-2}$	Environment
	ι		

Table 4: Allocation of Parameters Part 2

Parameter	Symbol	Units	Category
	j		
Phytoplankton growth rate	J		Primary Production
Phytoplankton - maximum growth rate	J_{max}		Primary production
Light attenuation	k	m^{-1}	Primary production
	K		
Phytoplankton nutrient uptake - half saturation	κ		Primary production
	l		
	L		
	λ		
	Λ		
	m		
Mortality rate	M		
Mixed layer depth	MLD	m	Environment
Mortality rate of phytoplankton	μ	t^{-1}	Primary production
	n		
Nutrient concentration	N		State variable
	ν		
	o		
	O		
	ω		
	Ω		
	p		
Phytoplankton concentration (carbon)	P		State variable
Proportion incident radiation photosynthetically active	PAR		Primary production
	π		
	Π		
	ϕ		
	Φ		
	q		
	Q		
	r		
	R		
	ρ		
	s		
Sea ice	si		Subscript
Nutrient Source	S		Nutrients
Sea ice thickness	SIT	m	Environment

Table 5: Allocation of Parameters Part 3

Parameter	Symbol	Units	Category
Time	t		Subscript
Terrestrial inputs	ti		Subscript
Temperature	T	$°C$	Environment
	θ		
	Θ		
	ϑ		
	τ		
	u		
	U		
	υ		
	Υ		
	v		
	V		
	w		
	W		
	x		
	X		
	ξ		
	Ξ		
	χ		
	y		
	Y		
Depth	z	m	Environment
	Z		
	ζ		

Table 6: Energy Flows

Consumed	nFeM	nFeD	nFeSI	nSiM	nSiD	nSiSI	nCaM	nCaD	nCaSI	pDi	pSm	z
Consumed												
Time	t		Subscript									
Terrestrial inputs	ti		Subscript									
Temperature	T	$^{\circ}C$	Environment									
	θ											
	Θ											
	ϑ											
	τ											
	u											
	U											
	υ											
	Υ											
	v											
	V											
	w											
	W											
	x											
	X											
	ξ											
	Ξ											
	χ											
	y											
	Y											
Depth	z	m	Environment									
	Z											
	ζ											