Supplemental material to “Skill assessment of the PELAGOS model over the period 1980-2000”

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Biogeochemical Discussions

Tables of parameter values and descriptions

Changes with respect to Vichi et al. (2007b,a) are highlighted in bold.

<i>Symbol</i>	$P^{(1)}$	$P^{(2)}$	$P^{(3)}$	Description	Reference
r_{0p}	2.00	2.50	3.00	Maximum specific photosynthetic rate (d^{-1})	Baretta-Bekker et al. (1997)
Q_{10p}	2.00	2.00	2.00	Characteristic Q10 coefficient	Baretta-Bekker et al. (1997)
$h_{p^{(1)}}^s$	1.00	-	-	Half saturation value for Si-limitation ($mmolSi\ m^{-3}$)	Sarthou et al. (2005)
b_p	0.01	0.05	0.10	Basal specific respiration rate (d^{-1})	Set
γ_p	0.10	0.20	0.25	Activity respiration fraction (-)	Baretta-Bekker et al. (1997)
β_p	0.05	0.20	0.20	Excreted fraction of primary production (-)	Baretta-Bekker et al. (1997)
$h_p^{p,n,s}$	0.10	0.10	0.10	Nutrient stress threshold (-)	Baretta-Bekker et al. (1997)
d_{0p}	0.50	0.50	0.50	Maximum specific lysis rate (d^{-1})	Baretta-Bekker et al. (1997)
a_1	$2.50\ 10^{-2}$	$2.50\ 10^{-2}$	$2.50\ 10^{-1}$	Specific affinity constant for P ($m^{-3}\ mg\ C^{-1}\ d^{-1}$)	Baretta-Bekker et al. (1997)
a_3	$2.50\ 10^{-2}$	$2.50\ 10^{-2}$	0.00	Specific affinity constant for N-NO ₃ ($m^{-3}\ mg\ C^{-1}\ d^{-1}$)	Baretta-Bekker et al. (1997)
a_4	$2.50\ 10^{-2}$	$2.50\ 10^{-2}$	$2.50\ 10^{-1}$	Specific affinity constant for N-NH ₄ ($m^{-3}\ mg\ C^{-1}\ d^{-1}$)	Baretta-Bekker et al. (1997)
a_7	$2.00\ 10^{-4}$	$2.00\ 10^{-4}$	$2.00\ 10^{-4}$	Specific affinity constant for Fe ($m^{-3}\ mg\ C^{-1}\ d^{-1}$)	Sunda and Huntsman (1995)
$s_{p^{(1)}}^{opt}$	0.01	-	-	Standard Si:C ratio in diatoms ($mmolSi\ mg\ C^{-1}$)	Brzezinski (1985)
$\omega_{p^{(1)}}^{sink}$	5.00	-	-	Maximum sedimentation rate ($m\ d^{-1}$)	Baretta-Bekker et al. (1997)
$l_{p^{(1)}}^{sink}$	0.10	-	-	Nutrient stress threshold for sedimentation (-)	Set
$n_p^{min}, r_p^{opt}, n_p^{max}$	$1.26\ 10^{-2} \times (0.3, 1, 2)$	$1.26\ 10^{-2} \times (0.3, 1, 2)$	$1.26\ 10^{-2} \times (0.3, 1, 2)$	Minimum, optimal and maximum nitrogen quota ($mmolN\ mgC^{-1}$)	Baretta-Bekker et al. (1997); Bertilsson et al. (2003); Timmermans et al. (2004, 2005)
$p_p^{min}, p_p^{opt}, p_p^{max}$	$7.86\ 10^{-4} \times (0.25, 1, 2)$	$7.86\ 10^{-4} \times (0.25, 1, 2)$	$7.86\ 10^{-4} \times (0.25, 1, 2)$	Minimum, optimal and maximum phosphorus quota ($mmolP\ mgC^{-1}$)	Baretta-Bekker et al. (1997); Bertilsson et al. (2003); Timmermans et al. (2004, 2005)
$\phi_p^{min}, \phi_p^{opt}, \phi_p^{max}$	$0.30\ 10^{-3} \times (0.3, 1, 1)$	$0.30\ 10^{-3} \times (0.3, 1, 1)$	$0.18\ 10^{-4} \times (-0, 1, 1)$	Minimum, optimal and maximum iron quota ($\mu mol\ Fe\ mgC^{-1}$)	Sunda and Huntsman (1997); Timmermans et al. (2004, 2005)
α_{chl}^0	$1.38\ 10^{-5}$	$0.46\ 10^{-5}$	$1.52\ 10^{-5}$	Maximum light utilization coefficient ($mgC\ (mg\ chl)^{-1}\ \mu E^{-1}\ m^2\ s$)	MacIntyre et al. (2002)
θ_{chl}^0	0.025	0.015	0.020	Optimal chl:C quotient ($mg\ chl\ mg\ C^{-1}$)	MacIntyre et al. (2002)
c_p	0.03	0.03	0.03	Chl-specific light absorption coefficient ($m^2\ (mg\ chl)^{-1}$)	Set

Table 1: Symbols, standard values and description of the phytoplankton parameters. $P^{(1)}$ = diatoms; $P^{(2)}$ = nanoflagellates; $P^{(3)}$ = picophytoplankton.

<i>Symbol</i>	$Z^{(4)}$	$Z^{(5)}$	$Z^{(6)}$	Description	Reference
Q_{10_Z}	3.00	2.00	2.00	Characteristic Q10 coefficient (-)	Baretta-Bekker et al. (1995)
h_z^F	$r_{0_z} \setminus v_z$	20.0	20	Michaelis constant for total food ingestion (mg C m^{-3})	Set
μ_z	0.00	20.0	20.0	Feeding threshold (mg C m^{-3})	Set
r_{0_z}	2.00	2.00	10.0	Potential specific growth rate (d^{-1})	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
v_z	0.025	-	-	Specific search volume ($\text{m}^3 \text{ mg C}^{-1}$)	Broekhuizen et al. (1995)
b_z	0.02	0.02	0.02	Basal specific respiration rate (d^{-1})	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
η_z	0.60	0.60	0.50	Assimilation efficiency (-)	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
β_z	0.55	0.40	0.30	Excreted fraction of uptake (-)	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
ε_z^c	0.00	0.50	1.00	Partition between dissolved and particulate excretion of C (-)	Set
ε_z^n	0.00	0.84	1.00	Partition between dissolved and particulate excretion of N (-)	Set
ε_z^p	0.00	0.96	1.00	Partition between dissolved and particulate excretion of P (-)	Set
n_z^{opt}, p_z^{opt}	0.015, 0.00167	0.0167, 0.00185	0.0167, 0.00185	Maximum nutrient quota (mmolN mgC^{-1} , mmolP mgC^{-1})	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
v_z	1.00	1.00	1.00	Specific rate of nutrients and carbon excretion (d^{-1})	Set
d_{0_z}	0.02	0.05	0.05	Specific mortality rate (d^{-1})	Broekhuizen et al. (1995); Baretta-Bekker et al. (1995)
d_z^{diss}	0.02	0.00	0.00	Density-dependent specific mortality rate ($\text{m}^3 \text{ mgC}^{-1} \text{ d}^{-1}$)	Broekhuizen et al. (1995)
γ_z	2.50	-	-	Exponent for density dependent mortality (-)	Broekhuizen et al. (1995)

Table 2: Symbols, standard values and description of the zooplankton parameters. $Z^{(4)}$ = mesozooplankton; $Z^{(5)}$ = microzooplankton; $Z^{(6)}$ = heterotrophic nanoflagellates.

<i>Symbol</i>	<i>Value</i>	<i>Description</i>
Q_{10_B}	2.95	Characteristic Q10 coefficient
h_B^O	30.0	Half saturation value for oxygen limitation ($\text{mmolO}_2 \text{ m}^{-3}$)
r_{0_B}	8.38	Potential specific growth rate (d^{-1})
b_B	0.01	Basal specific respiration rate (d^{-1})
η_B	0.40	Assimilation efficiency (-)
η_B^O	0.20	Decrease in assimilation efficiency under anoxic conditions (-)
d_{0_B}	0.00	Specific mortality rate (d^{-1})
v_B^1	0.30	Specific potential $R^{(1)}$ uptake (d^{-1})
v_B^6	0.01	Specific potential $R^{(6)}$ uptake (d^{-1})
$v_B^n = v_B^p$	1.00	Specific rate of uptake or remineralization (d^{-1})
n_B^{opt}, p_B^{opt}	0.0167, 0.00185	Optimal nutrient quota (mmolN mgC^{-1} , mmolP mgC^{-1})
h_B^n, h_B^p	5.00, 1.00	Half saturation for nutrient uptake (mmolN mgC^{-1} , mmolP mgC^{-1})

Table 3: Symbols, standard values and description of the bacterioplankton parameters.

<i>Symbol</i>	<i>Value</i>	<i>Description</i>
Ω_c^o	$\frac{1}{12}$	Unit conversion factor and stoichiometric coefficient (mmolO ₂ mgC ⁻¹)
Ω_n^o	2.00	Stoichiometric coefficient nitrification reaction (mmolO ₂ mmolN ⁻¹)
$\tilde{\Omega}_n^o$	1.25	Stoichiometric coefficient denitrification reaction (mmolO ₂ mmolN ⁻¹)
Ω_o^r	0.5	Stoichiometric coefficient (mmolHS ⁻ mmolO ₂ ⁻¹)
Ω_n^r	0.625	Stoichiometric coefficient (mmolHS ⁻ mmolN ⁻¹)
Λ_{N4}^{nit}	0.00	Specific nitrification rate (d⁻¹)
Q_{10N4}	2.37	Q10 factor for nitrification reaction.
Q_{10N3}	2.37	Q10 factor for denitrification reaction.
h_{N4}^o, h_{N6}^o	10.0	Half saturation oxygen concentration for chemical processes (mmolO ₂ m ⁻³)
Λ_{N3}^{denit}	0.35	Specific denitrification rate (d ⁻¹)
$\mathcal{M}_o^*$	1.00	Reference anoxic mineralization rate (mmol O ₂ m ⁻³ d ⁻¹)
Λ_{N6}^{reox}	0.05	Specific reoxidation rate of reduction equivalents (d ⁻¹)
Q_{10N5}	1.49	Q10 factor for dissolution of biogenic silica
Λ_s^{rmn}	0.001	Specific dissolution rate of biogenic silica (d ⁻¹)
Λ_f^{rmn}	0.001	Specific remineralization rate of biogenic iron (d ⁻¹)
Λ_f^{dep}	0.005	Specific dissolution fraction of dust iron (-)
Λ_f^{scv}	$0.7 \cdot 10^{-4}$	Specific scavenging rate for iron (d ⁻¹)
ϵ_{PAR}	0.4	Fraction of Photosynthetically Available Radiation (-)
λ_w	0.041	Optical extinction coefficient for pure water (m ⁻¹)
$c_{R(6)}$		C-specific extinction coefficient of particulate detritus (m ² mg C ⁻¹)
v_{R6}^{sed}	10.00	Settling velocity of particulate detritus (m d⁻¹)

Table 4: Chemical stoichiometric coefficients and general parameters involving pelagic components.

		Preys						
		$P_i^{(1)}$	$P_i^{(2)}$	$P_i^{(3)}$	$Z_i^{(4)}$	$Z_i^{(5)}$	$Z_i^{(6)}$	B_i
Predators	$Z_i^{(3)}$	0	0	0	1.0	0	0	0
	$Z_i^{(4)}$	1.0	0	0	1.0	1.0	0	0
	$Z_i^{(5)}$	0.2	1.0	0.1	0	1.0	0.8	0.1
	$Z_i^{(6)}$	0	0	0.9	0	0	0.2	0.9

Table 5: Availability $\delta_{Z,X}$ (non-dimensional) of prey X_i to predator Z_i

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