Evolution of the long-term and estuary-scale phytoplankton patterns in the Scheldt estuary: the disappearance of net growth in the brackish region

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Supporting Information

Table S1. Parameter values used in our model experiments. If only one parameter value is presented, we used this value for all three periods.

	variable	definition	value 2004-2007	value 2008-2014	value 2015-2018	unit
Hydrodynamics	A^0	M_2 water level amplitude at x=0		1.77		m
	A^1	M_4 water level amplitude at x=0		0.14		m
	ϕ^1	M_4 water level phase relative to M_2 tide at x=0		-1.3		deg
	Q	total river discharge to resolve the phytoplankton dynamics	85	81	72	$m^3\ s^{-1}$
	$Q_{\text{upper Sea Scheldt}}$	relative contribution of the upper Sea Scheldt boundary to total river discharge	26.4 %	31.5 %	27.1 %	/
	Q_{Rupel}	relative contribution of the Rupel tributary to total river discharge	64.2 %	59.3 %	63.3 %	/
	Q_{Dender}	relative contribution of of the Dender tributary to total river discharge	9.4 %	9.2 %	9.6 %	/
	Q^{sediment}	total river discharge to resolve the sediment dynamics		180		$m^3\ s^{-1}$
Sediment	c_{sea}	depth-averaged subtidal concentration at x=0		0.06		$kg\ m^{-3}$
	$c_{\text{upper Sea Scheldt}}$	subtidal SPM concentration at the Upper Sea Scheldt boundary		0.01		$kg\ m^{-3}$
	K_h	horizontal eddy diffusivity coefficient		100		$m^2\ s^{-1}$
	K_ν^0	vertical eddy diffusivity coefficient		3.1×10^{-2}		$m^2\ s^{-1}$
	M	erosion parameter		4×10^{-3}		$s\ m^{-1}$
Turbulence	σ_ρ	Prandtl-Smidth number (=A_ν/K_ν^0 with A_ν the vertical eddy viscosity)		1		/
	sf_0	bed roughness coefficient		4.22		$mm\ s^{-1}$
Flocculation	$k_A^{\text{min.}}$	non-dimensional minimal aggregation coefficient		0.29		/
	f_s	shape factor		$\pi/6$		/
	D_p	diameter primary mud particles		25×10^{-6}		m
	μ	dynamic viscosity		0.0010518		Pa s
	ρ_s	density of sediment primary particles		2650		$kg\ m^{-3}$
	ρ_w	reference density of water		1000		$kg\ m^{-3}$
	λ^{spring}	ratio of minimal aggregation and floc break-up parameter in spring		65.9×10^{-6}		$s^{-1/2}\ m^2$
Salinity	$ssea$	salinity boundary condition at the mouth		28.9 ‰		/
	$x_c^{\text{sal, spring}}$	calibration parameter in postulated tanh salinity distribution in spring	47.5	46.4	49.0	km
	$x_L^{\text{sal, spring}}$	calibration parameter in postulated tanh salinity distribution in spring	28.8	30.7	29.9	km
Nutrients	H_N	half-saturation constant for PP dependence on N availability		0.003		mol N m^{-3}
	H_P	half-saturation constant for PP dependence on P availability		0.0002		mol P m^{-3}
	N_{sea}	nitrogen boundary concentration at the mouth		0.025		mmol N L^{-1}
	$Phos_{\text{sea}}$	phosphorous boundary concentration at the mouth		0.0011		mmol P L^{-1}
	$N_{\text{upper Sea Scheldt}}$	influx of nitrogen at the upstream boundary		3		mol N s^{-1}
	$Phos_{\text{upper Sea Scheldt}}$	influx of phosphorous at the upstream boundary		0.2		mol P s^{-1}
	N_{Rupel}	influx of nitrogen at Rupel tributary		5.1		mol N s^{-1}
	$Phos_{\text{Rupel}}$	influx of phosphorous at Rupel tributary		0.12		mol P s^{-1}
	C:N:P	ratio between carbon, nitrogen, and phosphorous (in mol)		106:16:1		/
Phytoplankton	μ_{00}	calibration parameter in postulated temperature dependence for μ_{max}	1.12×10^{-5}	1.21×10^{-5}	1.00×10^{-5}	s^{-1}
	μ_{01}	calibration parameter in postulated temperature dependence for μ_{max}	1.10	1.07	1.05	/
	$\mu_{\text{max}} : \alpha$	ratio between maximum photosynthetic rate and growth efficiency	393	381	230	μmol photons $m^{-2}\ s^{-1}$
	m_0	phytoplankton mortality rate	0.83×10^{-6}	1.19×10^{-6}	2.64×10^{-6}	s^{-1}
	g_1	calanoids grazing efficiency	1.6×10^{-7}	0.24×10^{-7}	1.6×10^{-7}	s^{-1} L
	g_2	non-calanoids grazing efficiency	0.93×10^{-7}	0.63×10^{-7}	0.93×10^{-7}	s^{-1} L
	C:Chla	carbon to chlorophyll a ratio		50		/
	E_{00}	maximum PAR		1007		μmol photons $m^{-2}\ s^{-1}$
	ω_E	angular frequency for day length		0.215		d^{-1}
	T	water temperature	14.3	14.7	14.7	° C
	P_{sea}	phytoplankton boundary concentration at the mouth	15.9	17.1	15.8	$\mu g\ L^{-1}$
	QP	influx of phytoplankton at the upstream boundary	1.5	1.8	2.5	$g\ s^{-1}$
	w_P	settling velocity of phytoplankton cells		1.15×10^{-5}		$m\ s^{-1}$
	k_{bg}	background exponential light extinction coefficient		0.095		m^{-1}
	k_P	phytoplankton-induced exponential light extinction coefficient		18		m^2 (mol N)$^{-1}$
	k_c	sediment-induced exponential light extinction coefficient	81.4	77.9	72.0	$m^2\ kg^{-1}$