

Table S1. The chosen physical parameters in studies of Sun and Mu [46,47].

No.	Parameter	Standard	Minimum	Maximum	Description
1	θ^*	0.7	0.2	0.996	Co-limitation shape parameter
2	α_a^*	0.5	0.3	0.7	fraction of PAR assimilated at ecosystem level relative to leaf level
3	$\lambda_{\max,C3}$	0.7	0.6	0.8	Optimal C_i/C_a for C3 plants (all PFTs except TrH)
4	α_{C3}^*	0.08	0.02	0.125	Intrinsic quantum efficiency of CO ₂ uptake in C3 plants
5	a_{C3}^*	0.015	0.01	0.021	Leaf respiration as a fraction of Rubisco capacity in C3 plants
6	$Q_{10,ko}$	1.2	1.1	1.3	q10 for temperature-sensitive parameter ko
7	$Q_{10,kc}$	2.1	1.9	2.3	q10 for temperature-sensitive parameter kc
8	$Q_{10,\tau}$	0.57	0.47	0.67	q10 for temperature-sensitive parameter tau
9	r_{growth}^*	0.25	0.15	0.4	Growth respiration per unit <i>NPP</i>
10	g_m^*	3.26	2.5	18.5	Maximum canopy conductance analogue [mm d ⁻¹]
11	α_m	1.391	1.1	1.5	Evapotranspiration parameter
12	k_{allom1}	100	75	125	Crown area= k_{allom1} *height** k_{rp}
13	k_{allom2}	40	30	50	height= k_{allom2} *diameter** k_{allom3}
14	k_{allom3}	0.67	0.5	0.8	height= k_{allom2} *diameter** k_{allom3}
15	$k_{la:sa}^*$	6000	2000	8000	leaf-to-sapwood area ratio
16	k_{rp}	1.5	1.37	1.6	Crown area= k_{allom1} *height** k_{rp}
17	k_{mort1}^*	0.01	0.005	0.1	Asymptotic maximum mortality rate [yr ⁻¹]
18	k_{mort2}	0.4	0.2	0.5	growth efficiency mortality scalar

19	est_{\max}^*	0.24	0.05	0.48	Maximum sapling establishment rate [$\text{m}^{-2} \text{yr}^{-1}$]
20	n_0	7.15	6.85	7.45	leaf N concentration (mg/g) not involved in photosynthesis
21	$dens_{\text{wood}}$	200	180	220	specific wood density [kgC m^{-3}]
22	τ_{litter}^*	0.35	0.19	0.81	litter turnover time at 10°C [yr]
23	p_t	1.32	1.12	1.52	Priestley-Taylor coefficient
24	β	0.17	0.15	0.19	global average short-wave albedo

Table S2. The chosen physical parameters in studies of Sun et al. [48].

Number of Parameters (NP)	Parameter	Standard	Minimum	Maximum	Description
1	θ^*	0.7	0.2	0.996	Co-limitation shape parameter
2	α_a^*	0.5	0.3	0.7	Fraction of PAR assimilated at ecosystem level relative to leaf level
3	$\lambda_{\max, C3}$	0.7	0.6	0.8	Optimal $ci=ca$ for C3 plants (all PFTs except TrH)
4	α_{C3}^*	0.08	0.02	0.125	Intrinsic quantum efficiency of CO_2 uptake in C3 plants
5	a_{C3}^*	0.015	0.01	0.021	Leaf respiration as a fraction of Rubisco capacity in C3 plants
6	$Q_{10, ko}$	1.2	1.1	1.3	q10 for temperature-sensitive parameter ko
7	$Q_{10, kc}$	2.1	1.9	2.3	q10 for temperature-sensitive

					parameter kc
8	$Q_{10,\tau}$	0.57	0.47	0.67	q10 for temperature-sensitive parameter tau
9	g_m^*	3.26	2.5	18.5	Maximum canopy conductance analogue [mm d ⁻¹]
10	α_m	1.391	1.1	1.5	Evapotranspiration parameter
11	k_{allom3}	0.67	0.5	0.8	Height=kallom2*diameter**kal lom3
12	k_{rp}	1.5	1.37	1.6	Crown area=kallom1*height**krp
13	k_{mort1}^*	0.01	0.005	0.1	Asymptotic maximum mortality rate [yr ⁻¹]
14	k_{mort2}	0.4	0.2	0.5	Growth efficiency mortality scalar
15	est_{max}^*	0.24	0.05	0.48	Maximum sapling establishment rate [m ⁻² yr ⁻¹]
16	n_0	7.15	6.85	7.45	Leaf N concentration (mg/g) not involved in photosynthesis
17	τ_{litter}^*	0.35	0.19	0.81	Litter turnover time at 10°C [yr]
18	p_t	1.32	1.12	1.52	Priestley-Taylor coefficient
19	β	0.17	0.15	0.19	Global average short-wave albedo
20	k_f	0.03	0.027	0.033	fast pool decomposition rate at 10 deg C
21	k_s	0.001	0.0009	0.0011	slow pool decomposition rate at 10 deg C
22	f_{inter}	0.985	0.85	0.99	fraction of soil-bound decomposed litter entering the intermediate soil pool

23	f_{air}	0.7	0.5	0.9	fraction of the decomposed litter emitted as CO ₂ to the atmosphere
24	k_1	5.0 ¹	4.5	5.5	variables in percolation equation
		4.0 ²	3.6	4.4	
		3.0 ³	2.7	3.3	
		4.5 ⁴	4.05	4.95	
		4.0 ⁵	3.6	4.4	
		3.5 ⁶	3.15	3.85	
		4.0 ⁷	3.6	4.4	
		9.0 ⁸	8.1	9.9	
		0.2 ⁹	0.18	0.22	
25	k_2	2.00	1.80	2.20	variables in percolation equation
26	f_1	0.9	0.6	1.0	Fraction of active fraction of roots uptaking water from top soil layer
27	i_{ntc}	0.02	0.005	0.08	LAI parameter, interception storage parameter
28	f_{air}	0.3	0.15	0.4	Flammability threshold

1, 2, 3, 4, 5, 6, 7, 8, 9 indicate the different soil type. 1 represents coarse loamy sand. 2 represents medium silty clay loam. 3 represents fine and non-vertisol light clay. 4 represents medium-coarse sandy loam. 5 represents fine-coarse sandy clay. 6 represents fine-medium clay loam. 7 represents fine-medium-coarse sandy clay loam. 8 is organic. 9 represents land ice and describes it as loamy sand.