Variable	Definition	Description	Computation method	References
Inputs: carbon cycle				
Fc	NPP	Spatially resolved model-data fusion estimates	Input	CARDAMOM; Bloom et al. (2016)
$\tau_{i=1,2,3,4,5}$	Residence time of foliage, fine roots, wood, litter, and SOM	Spatially resolved model-data fusion estimates	Input	CARDAMOM; Bloom et al. (2016)
$\gamma_{C,\,i=1,2,3}$	Fraction of NPP allocated to foliage, fine roots, and wood	Spatially resolved model-data fusion estimates	Input	CARDAMOM; Bloom et al. (2016)
$f_{\text{fireC},i=1,2,3,4,5}$	Fraction of fire to total outgoing flux from foliage, fine roots, wood, litter, and SOM	Spatially resolved model-data fusion estimates	Input	CARDAMOM; Bloom et al. (2016)
η	Fraction of litter outflux that enters SOM	Spatially resolved model-data fusion estimates	Input	CARDAMOM; Bloom et al. (2016)
Inputs: nitrogen cycle				
$\rho_{\text{N},i=1,2,3,5}$	N : C ratio in foliage, fine roots, wood and SOM	Biome-scale synthesis based on in situ measurements	Input	Zechmeister-Boltenstern et al. (2015)
f_{leach}	Fraction of inorganic N (or P) lost due to leaching (Eq. B7)	Spatially resolved reanalysis by model; Model result, scaled to match measurements	Input	Balsamo et al. (2015) Fekete et al. (2002)
$\varepsilon_{\text{N},1}$	Resorption coefficient of N in foliage	Biome-scale synthesis based on in situ measurements	Input	Zechmeister-Boltenstern et al. (2015)
N_{d}	N deposition	Spatially resolved model result, scaled to match in situ measurements	Input	Wang et al. (2017)
N_{fix}	N fixation	Spatially resolved model result, scaled to match the estimates of NPP and N : C ratios	Input	Peng et al. (2018)
f_{gas}	Fraction of denitrification to the total loss of inorganic N	Spatially resolved process-based statistical model result	Input	Goll et al. (2017b)
Inputs: phosphorus cycle				
$\rho_{\text{P},\,i=1,2,3,5}$	P : C ratio in foliage, fine roots, wood and SOM	Biome-scale synthesis based on in situ measurements	Input	Zechmeister-Boltenstern et al. (2015)
$f_{\text{dissolved}}$	Fraction of labile soil P that is dissolved in the soil water	In situ measurements, averaged based on soil order	Input	Yang and Post (2011)
f_{sorb}	Fraction of inorganic P that is transformed to strongly sorbed P	Assumed constant	Input	Goll et al. (2017a)
$\varepsilon_{\text{P},\,1}$	Resorption coefficient of P in foliage	Biome-scale synthesis based on in situ measurements	Input	Zechmeister-Boltenstern et al. (2015)
P_{d}	P deposition	Spatially resolved model result, scaled to match in situ measurements	Input	Wang et al. (2017)
P_{d}	P weathering	Spatially resolved model result, scaled to match observed data	Input	Hartmann et al. (2014)
Unknowns estimated from mass balance assuming steady state				
$C_{i=1,2,3,4,5}$	C pool of foliage, fine roots, wood, litter, and SOM	Pools	Based on steady-state assumption	
F_{N}	N uptake from inorganic-N pool by vegetation	Flux	Mass balance approach based on NPP (input) and stoichiometry ratios (input)	
$\gamma_{\text{N},\,i=1,2,3}$	Fraction of F_{N} allocated to foliage, fine roots and wood	Allocation fractions	Mass balance approach based on NPP (input) and stoichiometry ratios (input)	
$N_{i=1,2,3,4,5}$	N in foliage, fine roots, wood, litter, and SOM	Pools	Mass balance approach based on stoichiometry ratios (input) and steady-state C pools ($C_{i=1,2,3,4,5}$), assuming N : C ratios do not change over time	
N_{imob}	N immobilization flux	Pools	Based on steady-state assumption that stoichiometry ratios (input), litter C, and soil C do not change at the annual timescale	
f_{denit}	Annual denitrification rate	Rate	Mass balance approach, assuming annual mean inorganic N pool size does not change at the annual timescale	
N_{inorg}	Inorganic-N pool	Pool	Based on steady-state assumption that inorganic N does not change at the annual timescale	
F_{P}	P uptake from inorganic-P pool by vegetation	Flux	Mass balance approach based on NPP (input) and stoichiometry ratios (input)	
$\gamma_{\text{P},\,i=1,2,3}$	Fraction of Fp allocated to foliage, fine roots and wood	Allocation fractions	Mass balance approach based on NPP (input) and stoichiometry ratios (input)	
$P_{i=1,2,3,4,5}$	P in foliage, fine roots, wood, litter, and SOM	Pools	Mass balance approach based on stoichiometry ratios (input) and steady-state C pools ($C_{i=1,2,3,4,5}$)	
P_{imob}	P immobilization flux	Flux	Based on steady-state assumption that stoichiometry ratios (input), litter C, and soil C do not change at the annual timescale	
P_{inorg}	Inorganic-P pool	Pool	Based on steady-state assumption that labile P do not change at annual scale	