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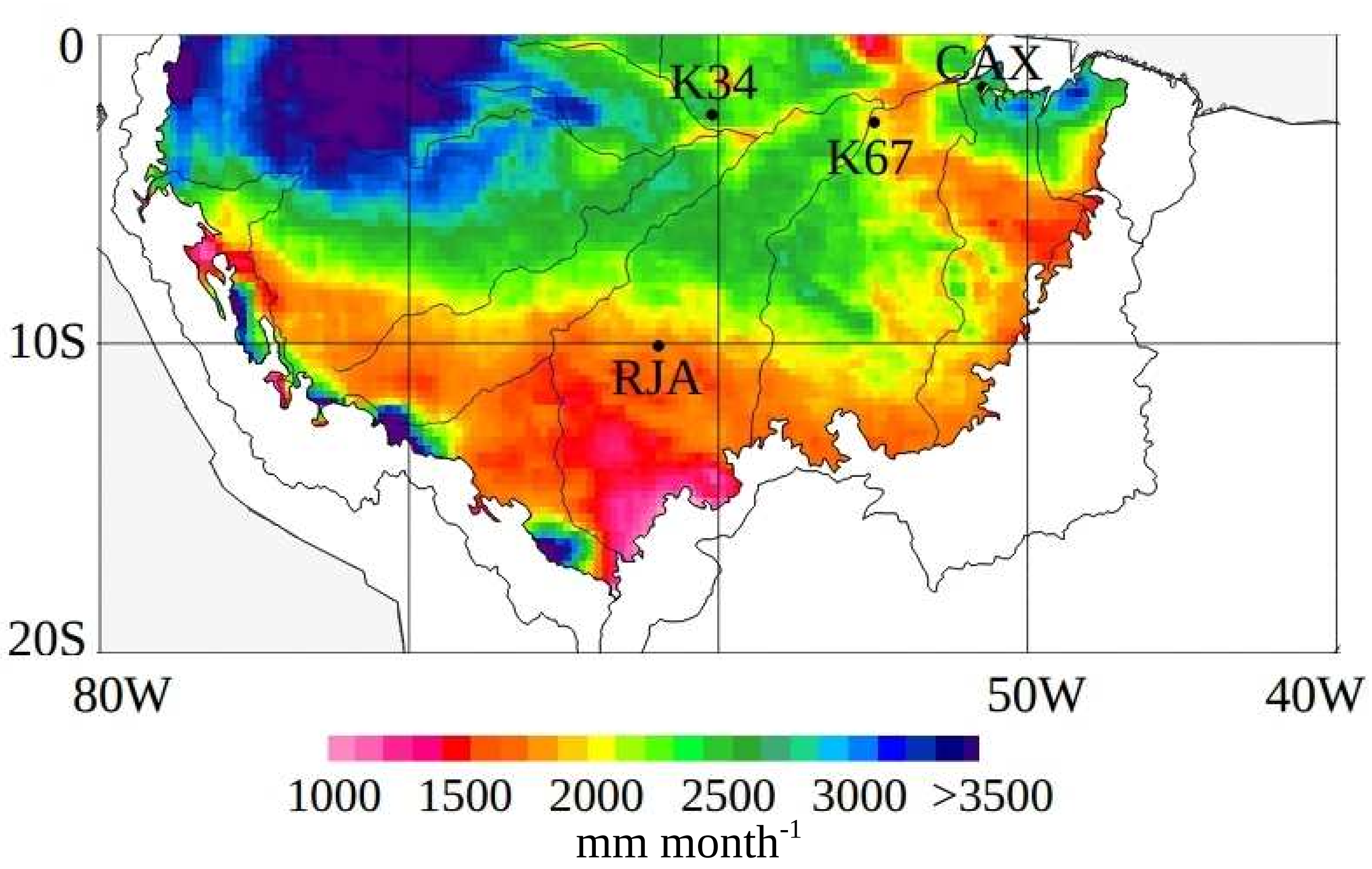


Figure S1. Locations of eddy covariance tower study sites at the Amazon Basin *sensu-stricto* (Eva and Huber (eds), 2005). Mean annual precipitation (mm $month^{-1}$) from the Tropical Rainfall Measuring Mission (TRMM) (NASA, 2014) for the years 1998 to 2013.

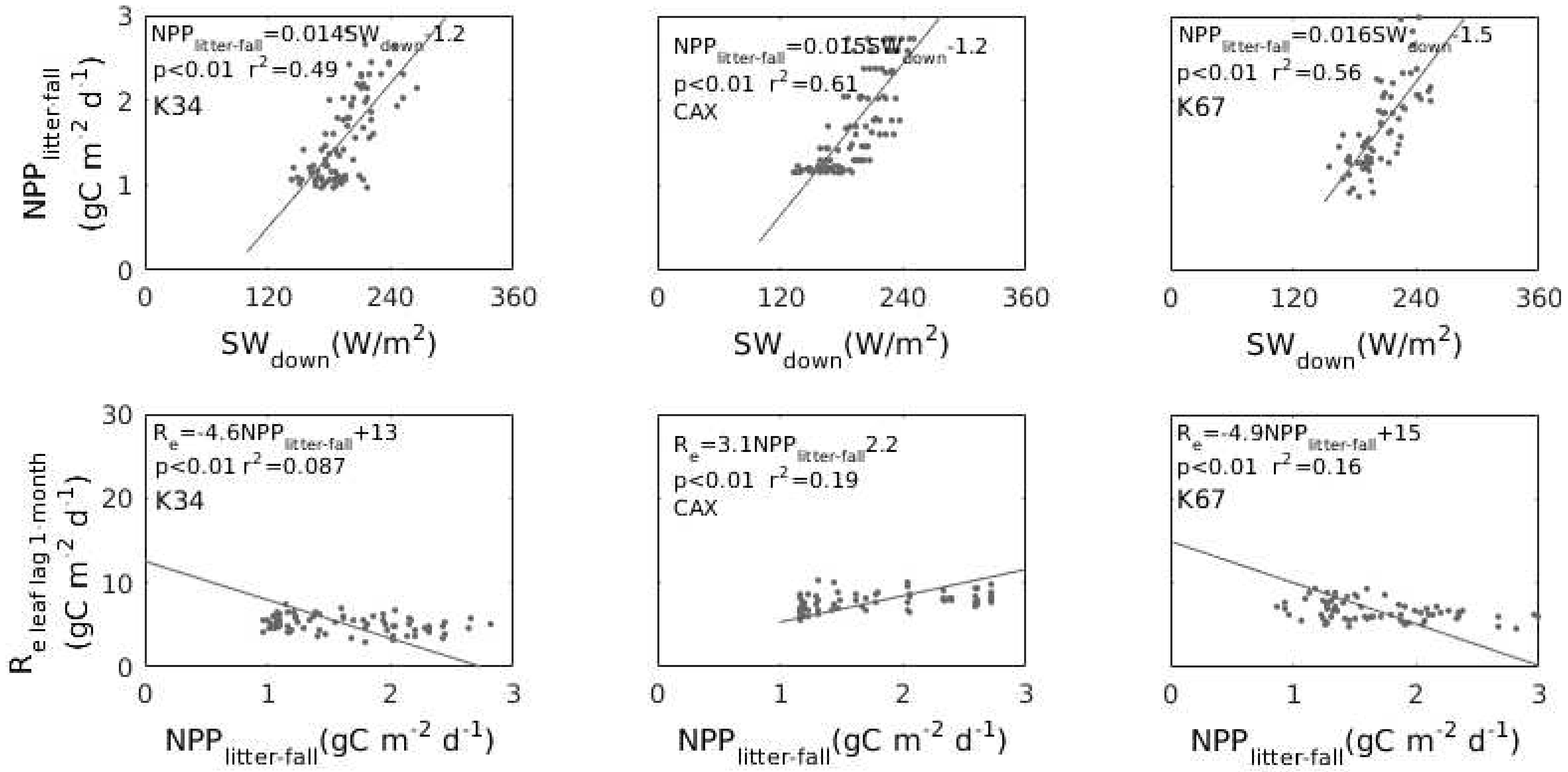
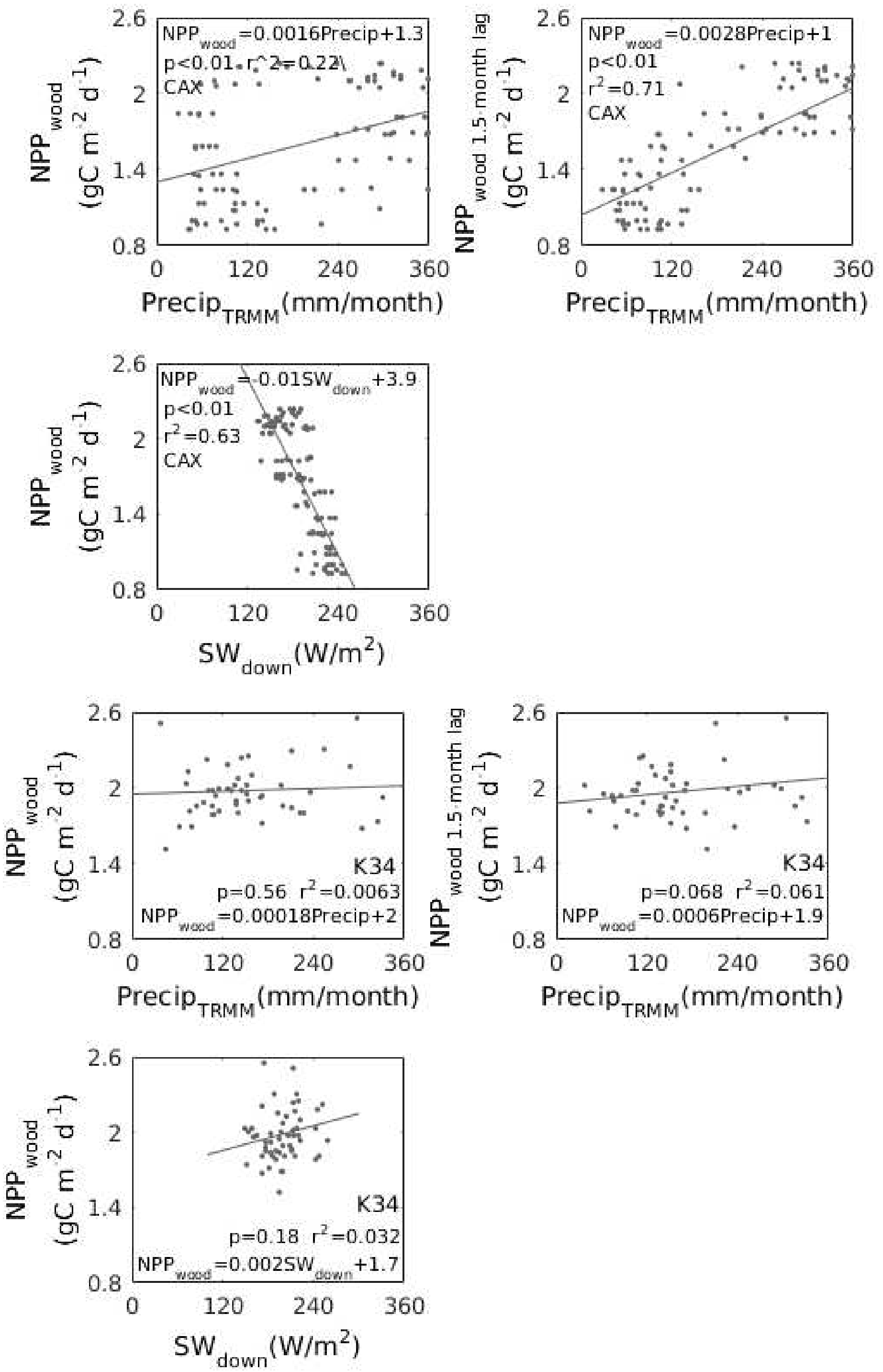


Figure S2. Type II linear regression between 16-day time series of net primary productivity allocated to litter–fall (*$NPP_{litter\text{-}fall}$*; gC m^{-2} d^{-1}) and incoming solar radiation (*SW_{down}*) at upper panels. Lower panels: regression between ecosystem respiration (R_e; gC m^{-2} d^{-1}) and *$NPP_{litter\text{-}fall}$*. From left to right Manaus forest (K34), Caxiuanã forest (CAX), and Santarém forest (K67), all sites at equatorial Amazon.



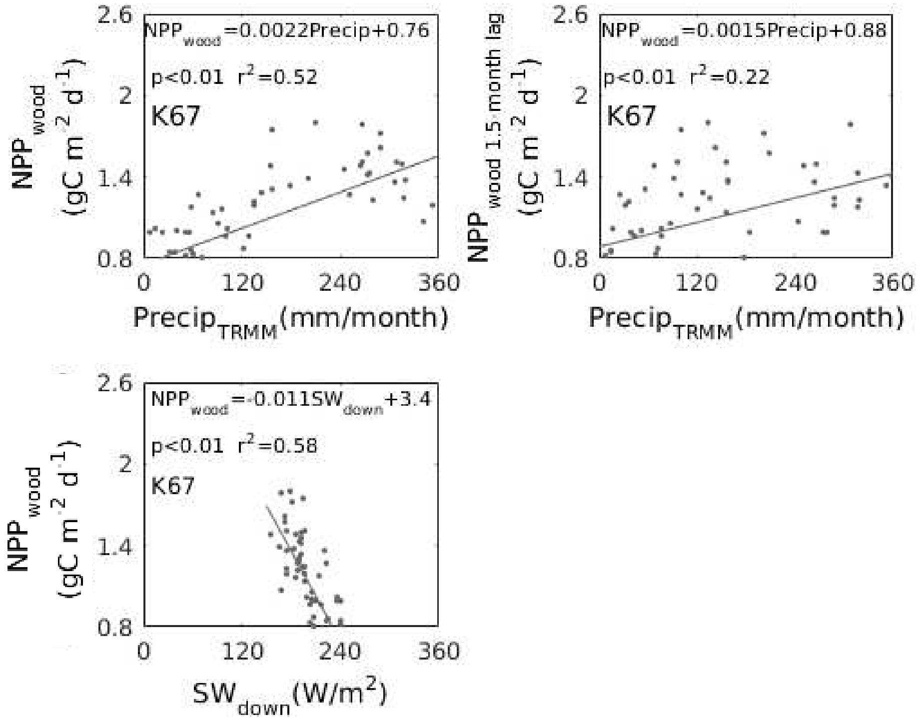


Figure S3. Type II linear regression between 16-day time series for each site: lagged (1.5 month) and non-lagged net primary productivity allocated to wood (NPP_{wood}; gC m^{-2} d^{-1}) and precipitation ($Precip_{TRMM}$; mm $month^{-1}$) at upper panels. Lower panels: Regression between NPP_{wood} and short wave incoming radiation (SW_{down}; W m^{-2}). From left to right upper box: Caxiuanã forest (CAX), and Santarém forest (K67). Lower box Manaus forest (K34), all sites at equatorial Amazon.

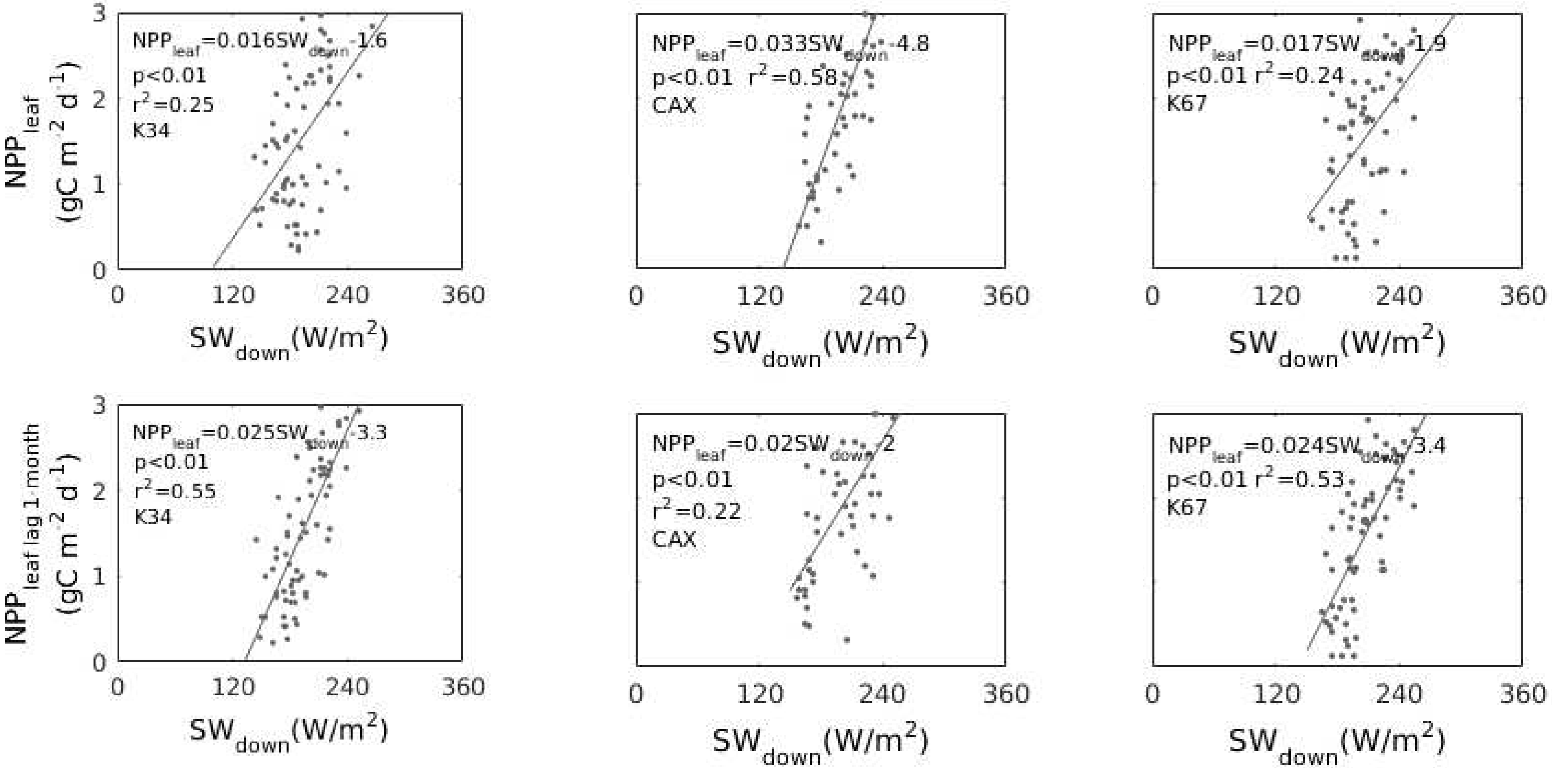
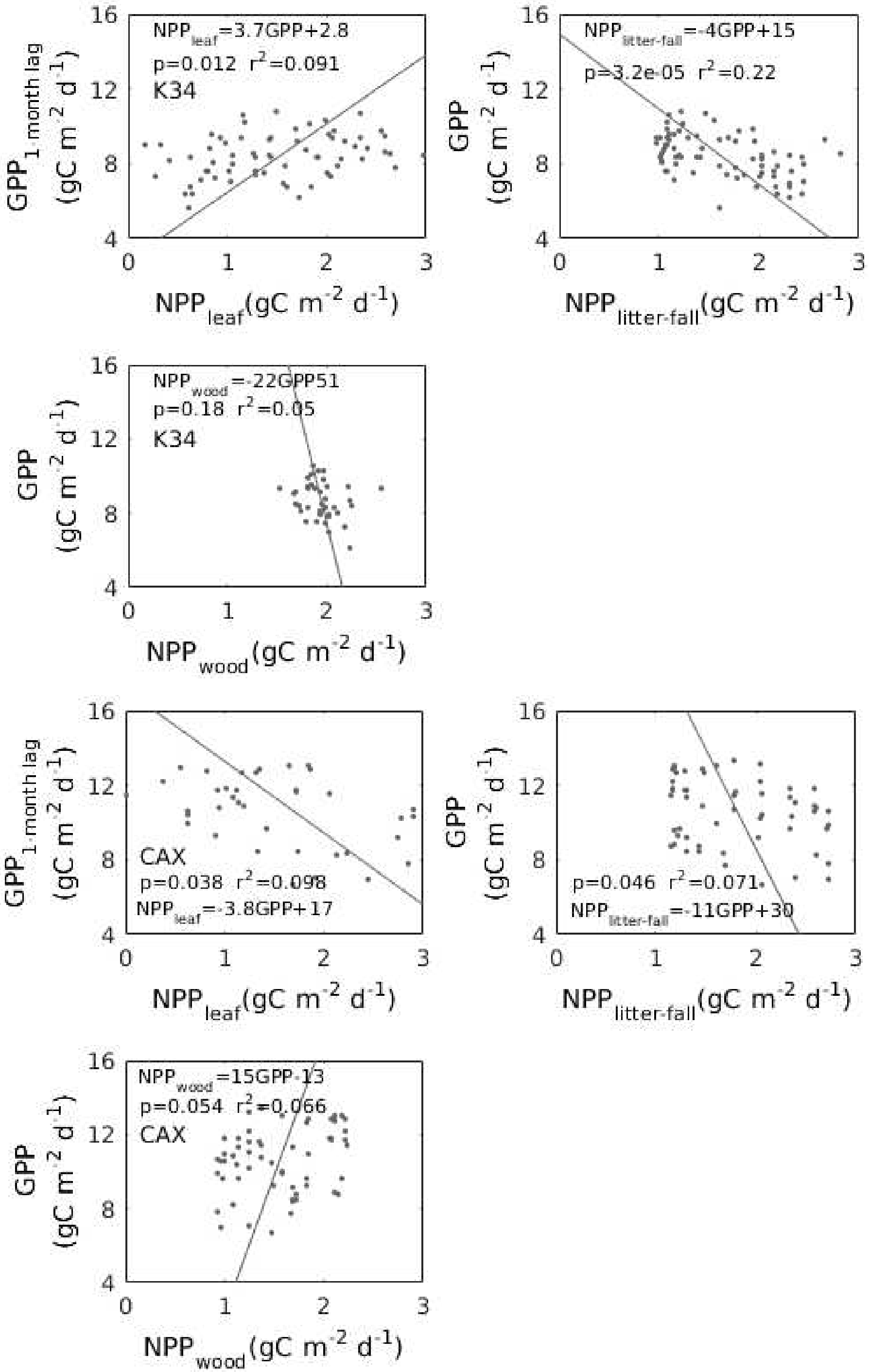


Figure S4. Type II linear regression between 16-day time series of net primary productivity allocated to leaves (NPP_{leaf}; gC m^{-2} d^{-1}) and incoming solar radiation (SW_{down}; W m^{-2}) at upper panels. Lower panels: Regression between 1 month lagged NPP_{leaf} and SW_{down}. From left to right Manaus forest (K34), Caxiuanã forest (CAX), and Santarém forest (K67) -all sites at equatorial Amazon.



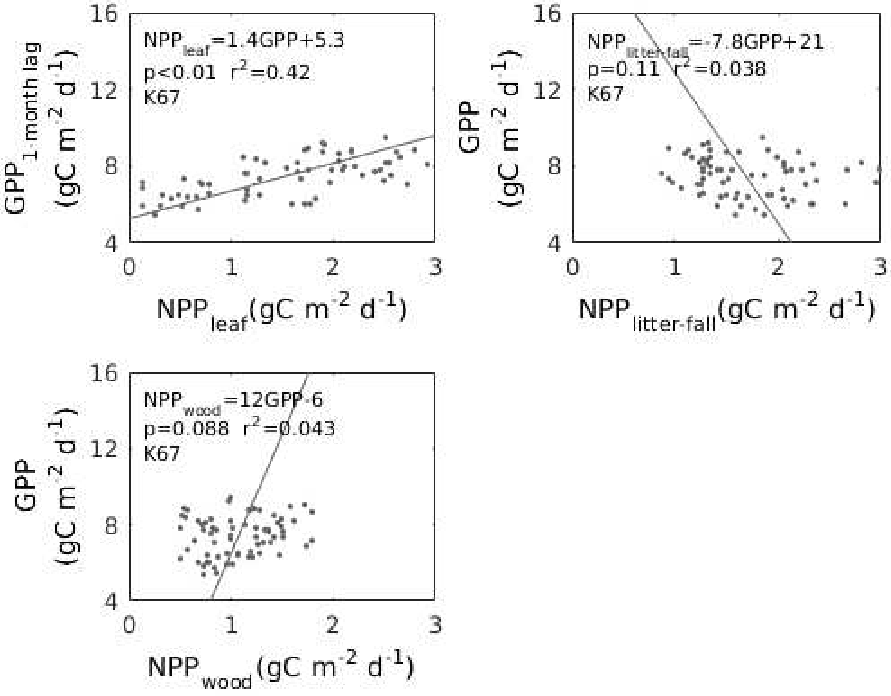


Figure S5. Type II linear regression between 16-day time series of gross ecosystem productivity (*GPP; gC* m^{-2} d^{-1}) and net primary productivity allocated to leaves (NPP_{leaf}; gC m^{-2} d^{-1}), and *GPP* and *NPP* allocated to litter-fall *(*$NPP_{litter\text{-}fall}$*; gC* m^{-2} d^{-1}) at upper panels. Lower panels: Regression between *GPP* and *NPP* allocated to wood *(*NPP_{wood}*; gC* m^{-2} d^{-1}*).* From left to right upper box: Caxiuanã forest (CAX), and Santarém forest (K67). Lower box Manaus forest (K34) -all sites at equatorial Amazon

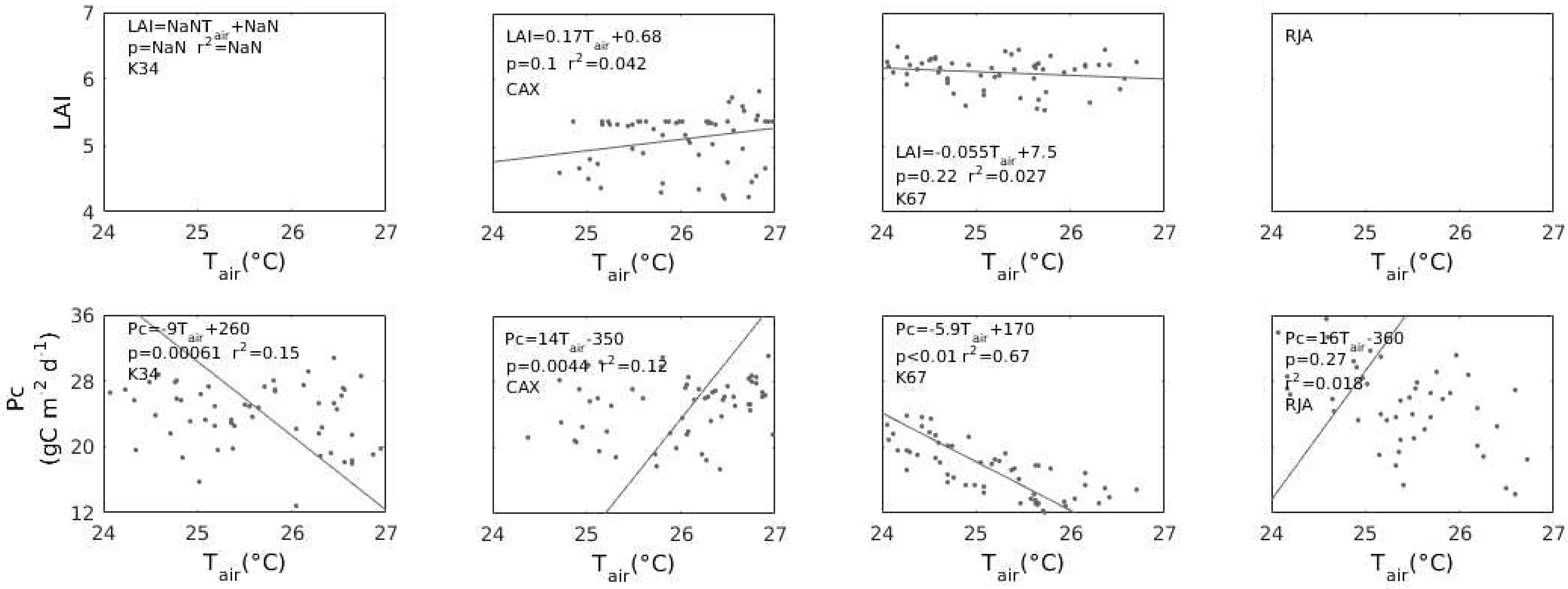


Figure S6. Type II linear regression between 16-day time series of leaf area index (*LAI; m*^{2} *m*$^{-2}$) and air temperature (T_{airr}; °C) at the top row. Lower low: regression between 16-day time series of ecosystem photosynthetic capacity (*Pc; gC m*$^{-2}$ *d*$^{-1}$) and air temperature (T_{air}; °C). From left to right study sites (from wet to dry) near Manaus (K34), Caxiuanã (CAX), Santarém (K67), and Reserva Jarú southern (RJA) forests.

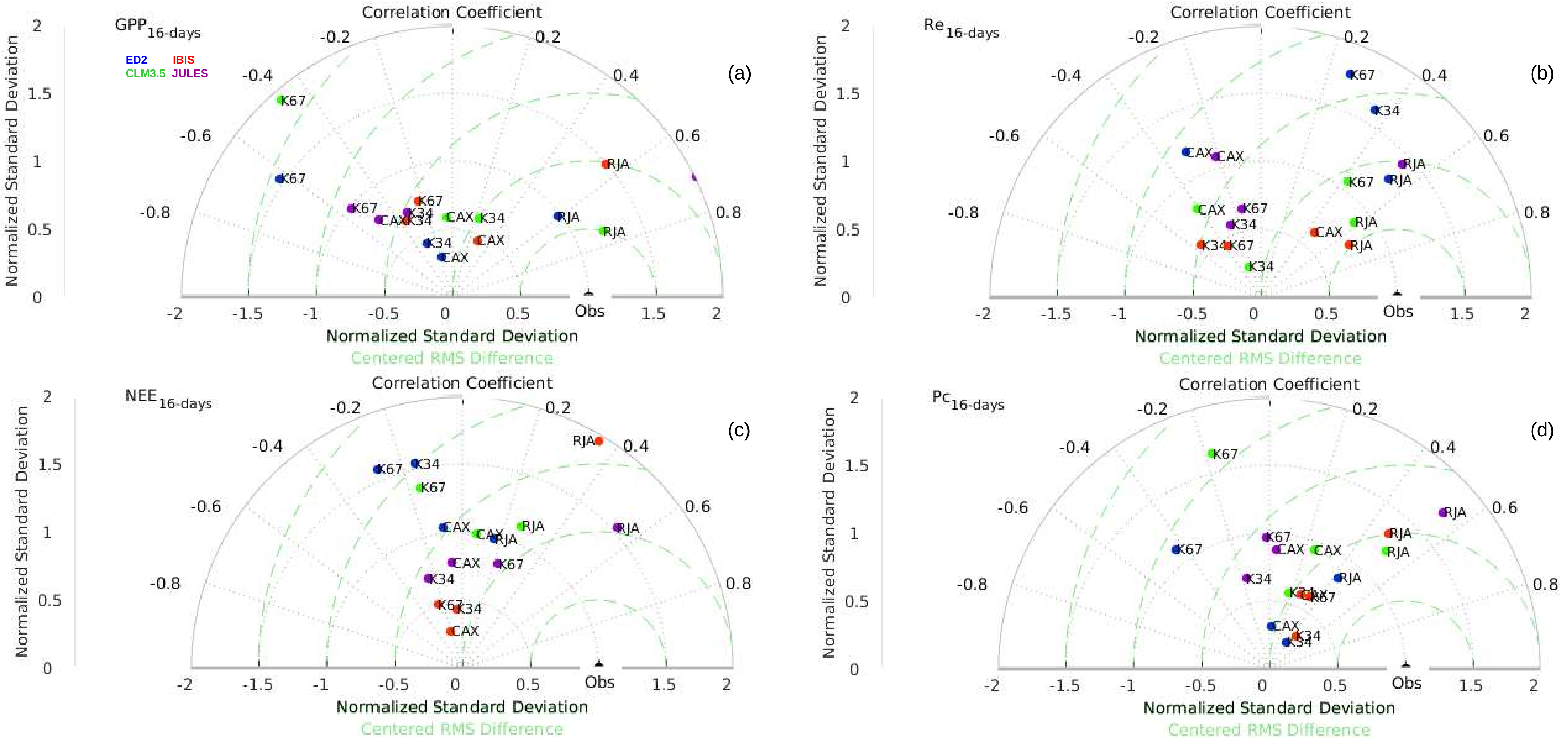


Figure S7. Taylor diagrams for a statistical summary of model (color coded) fluxes compared to observations at Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA). Missing sites indicate that the model greatly overestimates the seasonality of observations -model standard deviation (σ) normalized by observation σ is >2. Seasonal fluxes (16-day) of (a) ecosystem-scale photosynthesis (*GPP*; gC m^{-2} d^{-1}), (b) ecosystem respiration (R_e; gC m^{-2} d^{-1}), (c) net ecosystem exchange (*NEE*; gC m^{-2} d^{-1}) and (d) ecosystem photosynthetic capacity (*Pc;* gC m^{-2} d^{-1}) defined as *GPP* at a fixed *PAR* range of annual daily mean ± 100 μmol m^{-2} s^{-1}, and cloudiness index (*CI*), air temperature (T_{air}), and vapor pressure deficit (*VPD)* range of mean ± 1 standard deviation). Simulations from ED2 (blue), IBIS (red), CLM3.5 (green), and JULES (purple). Observations from the Brasil flux network. For the interpretation of Taylor plots see Supplement Figure 9.

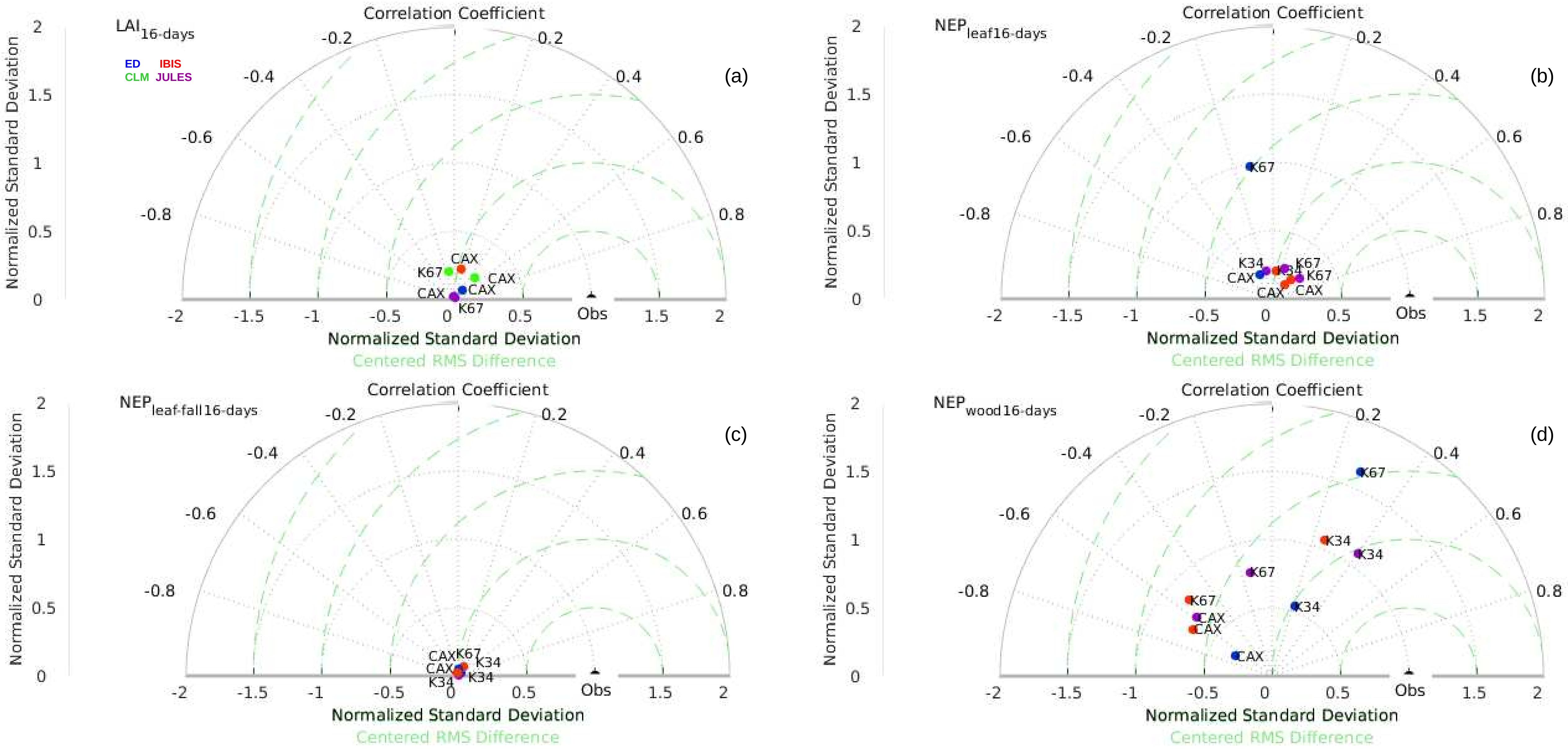


Figure S8. Taylor diagrams for a statistical summary of model (color coded) fluxes compared to observations at Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA). Missing sites indicate that the model overestimates the seasonality of observations -model standard deviation (σ) normalized by observation σ is >2. Seasonal fluxes (16-day) of (a) leaf area index (*LAI; m m*$^{-1}$), (b) net primary productivity (*NPP;* gC m^{-2} d^{-1}) allocated to leaves -leaf flush (NPP_{leaf}; gC m^{-2} d^{-1}), *NPP* allocated to litter-fall ($NPP_{litter\text{-}fall}$; gC m^{-2} d^{-1}), and (d) *NPP* allocated to wood (NPP_{wood}; gC m^{-2} d^{-1}). Simulations from ED2 (blue), IBIS (red), CLM3.5 (green), and JULES (purple). Observations from the Brasil flux network. For the interpretation of Taylor plots see Supplement Figure 9.

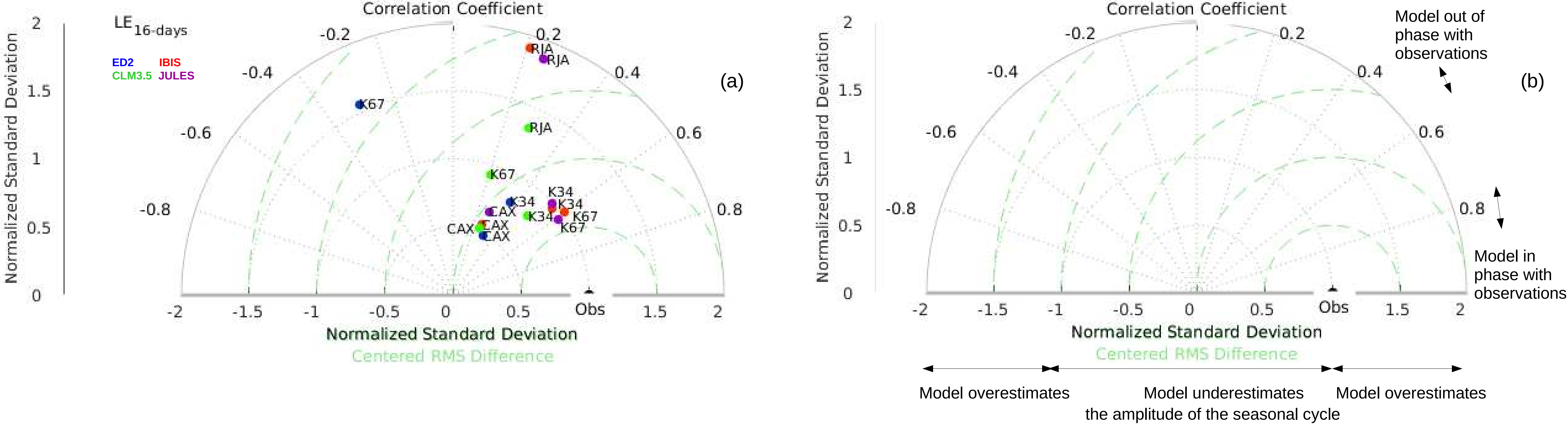


Figure S9. Taylor diagrams for a statistical summary of model (color coded) fluxes compared to observations at Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA). Missing sites indicate that the model overestimates the seasonality of observations -model standard deviation (σ) normalized by observation σ is >2. Seasonal fluxes (16-day) of (a) latent heat flux (LE; W m-2). Simulations from ED2 (blue), IBIS (red), CLM3.5 (green), and JULES (purple). Observations from the Brasil flux network. For the interpretation of Taylor plots see (b).

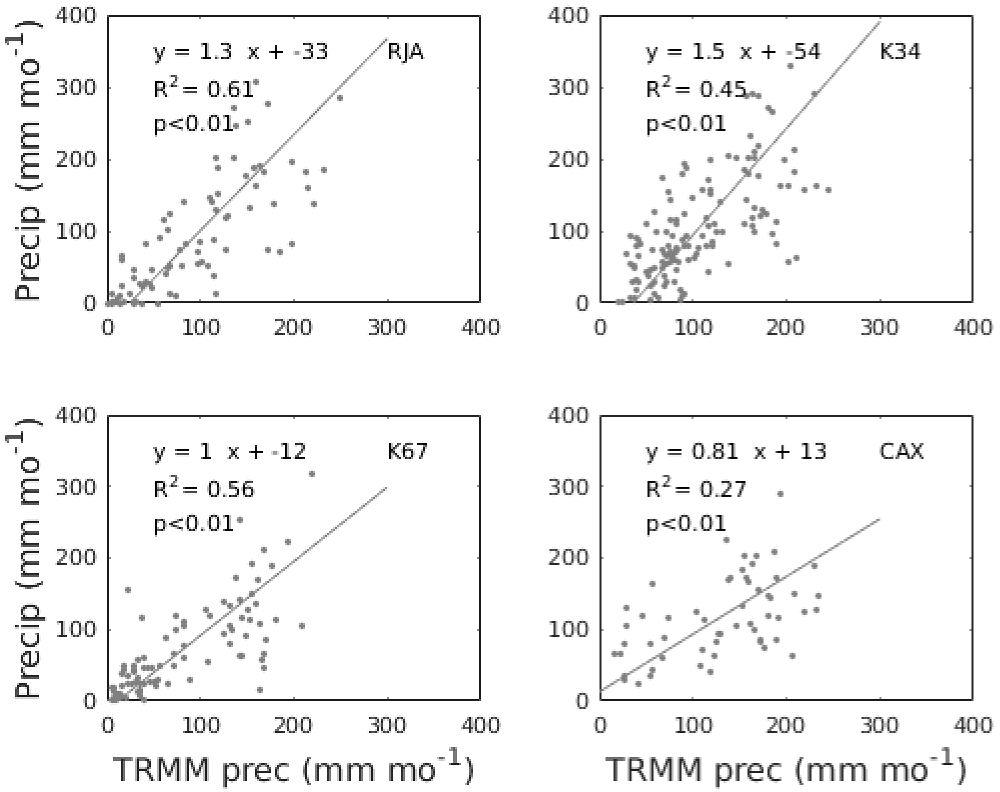


Figure S10. Linear regression 16-day average Tropical Rainfall Measuring Mission (TRMM) data product from 1998-2013 (TRMM prec) and site-specific measurements of rainfall (Precip) in mm $month^{-1}$. Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA).

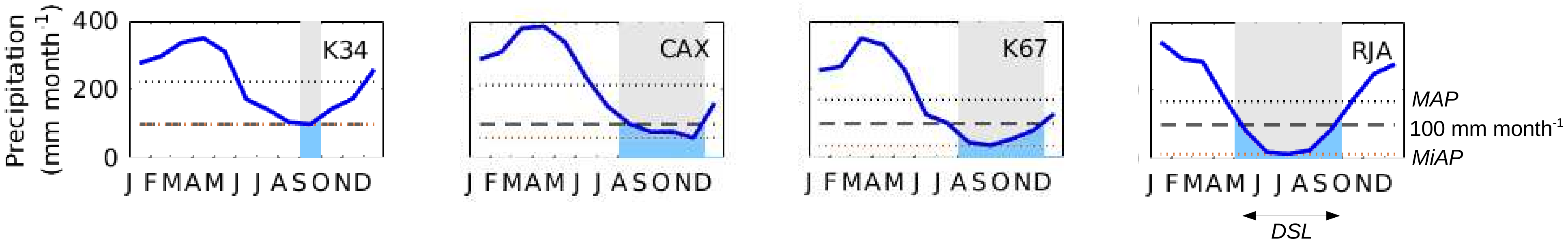


Figure S11. Annual cycle of monthly average precipitation (*Precipitation*; mm month^{-1}) from the Tropical Rainfall Measuring Mission (TRMM) (NASA, 2014) based on an annual composite for the years 1998 to 2013. Gray shaded area is dry season as defined by Precipitation <100 mm month^{-1} (dry season length, *DSL*), black doted line is mean annual precipitation (*MAP*) and orange doted line is average monthly minimum precipitation (*MiAP*). From left to right study sites (from wet to dry forest) near Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA).

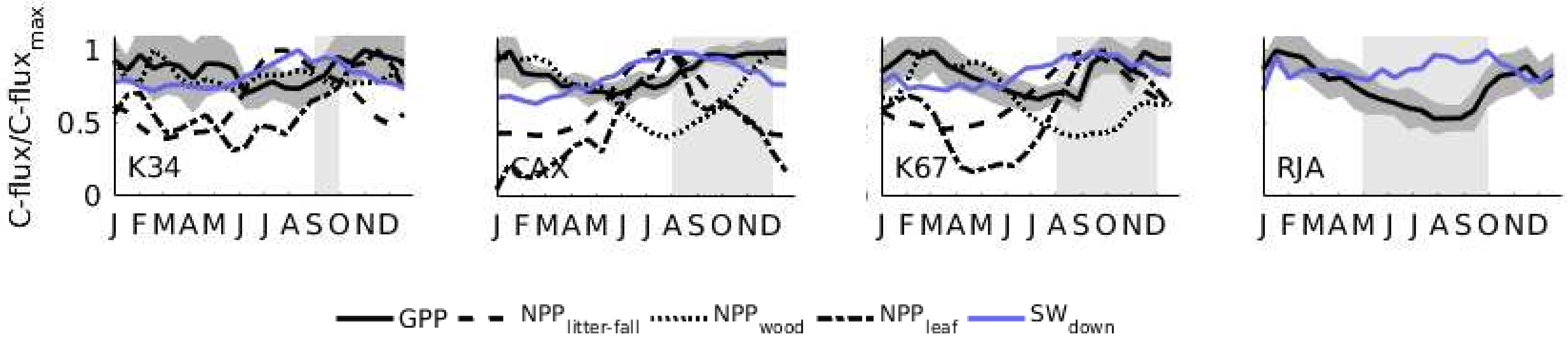


Figure S12. From left to right study sites (from wet to dry forest) near Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67), and Reserva Jarú southern forest (RJA). From top to bottom, annual cycle observed (black). Normalized (by its seasonal maximum) annual cycle of daily average ecosystem-scale photosynthesis (GPP/GPP_{max}) (continuous line), net primary productivity (*NPP*) allocated to leaves -leaf flush ($NPP_{leaf}/NPP_{leaf\ max}$), *NPP* allocated to litter-fall ($NPP_{litter\text{-}fall}/NPP_{litter\text{-}fall\ max}$), *NPP* allocated to wood ($NPP_{wood}/NPP_{wood\ max}$) and blue line is the incoming short wave radiation ($SW_{down}/SW_{down\ max}$). Gray shaded area is dry season as defined using satellite derived measures of precipitation (TRMM: 1998-2013).

	PAR μ μmol m^{-2} s^{-1}	PAR σ μmol m^{-2} s^{-1}	T_{air} μ degK	T_{air} σ degK	VPD μ kPa	VPD σ kPa	CI μ	CI σ
K34	752.15	467.08	300.18	2.23	0.88	0.50	0.45	0.19
CAX	736.48	427.31	300.68	2.13	0.67	0.40	0.39	0.20
K67	812.83	496.21	299.70	1.78	0.67	0.37	0.38	0.28
RJA	838.94	526.80	299.71	2.87	0.85	0.61	0.40	0.22

μ: annual day-time mean

σ: annual day-time standard deviation

Table S1. Site specific annual day-time mean and standard deviation of photosynthetic active radiation *(PAR,* μmol m^{-2} s^{-1}*)* , vapour pressure deficit *(VPD, kPa)*, air temperature (T_{air} degK), and cloudiness index (*CI).* Manaus forest (K34), Caxiuanã forest (CAX), Santarém forest (K67) and Reserva Jaru (RJA).

Dynamic vegetation model (DVGM)				ED2	CLM3.4	IBIS	JULES
Carbon Cycle							
Gross Photosynthesis Production (GPP)	Does model simulate GPP?		Yes/No/NA	Yes	Yes	Yes	Yes
	Does model consider C3 photosynthesis pathway?		Yes/No/NA	Yes	Yes	Yes	Yes
	Does model consider C4 photosynthesis pathway?		Yes/No/NA	Yes	Yes	Yes	Yes
	Does water stress limit photosynthesis?		Yes/No/NA	Yes	Yes	Yes	Yes
	Does temperature limit photosynthesis?		Yes/No/NA	Yes	Yes	Yes	Yes
	Does light limit photosynthesis?		Yes/No/NA	Yes	Yes	Yes	Yes
Autotrophic respiration (Ra)	Does model simulate autotrophic respiration?		Prognostic/Constant	Prognostic	Constant	Prognostic	Prognostic
	Does model simulate maintenance respiration?		Yes/No/NA	Yes	No	Yes	Yes
	Does model simulate growth respiration?		Yes/No/NA	Yes	No	Yes	Yes
Net Primary Productivity (NPP)	Is NPP calculated from GPP and Ra?		Yes/No/NA	Yes	No	Yes	Yes
Live carbon pools	Does model have separate carbon pools?		Yes/No/NA	Yes	No	Yes	Yes
	Which biomass pools?	aboveground heartwood	Yes/No/NA	Yes	No	Yes	Yes
		leaves	Yes/No/NA	Yes	No	Yes	Yes
		generic roots	Yes/No/NA	No	No	No	Yes
		coarse/fine roots	Yes/No/NA	Yes	No	Yes	No
		sapwood above ground	Yes/No/NA	Yes	No	No	No
		sapwood below ground	Yes/No/NA	No	No	No	No
		fruits (fruits and flowers)	Yes/No/NA	Yes	No	No	No
		carbohydrate reserve	Yes/No/NA	Yes	No	No	No
		other (please specify)		NA	NA	No	No
Allocation of NPP to live carbon pools	Is the carbon allocation fixed or dynamic in time?		[hour]/[day]/[year]/NA	Dynamic	NA	Fixed	Dynamic (based on allometry)
	If fixed, which fraction (0-1) is allocated to each pool? (should be consistent with answer above)	aboveground heartwood	[fraction]	NA	NA	0.5	NA
		leaves	[fraction]	NA	NA	0.3	NA
		generic roots	[fraction]	NA	NA	NA	NA
		coarse/fine roots	[fraction]	NA	NA	0.2	NA
		sapwood above ground	[fraction]	NA	NA	NA	NA
		sapwood below ground	[fraction]	NA	NA	NA	NA
		fruits (fruits and flowers)	[fraction]	NA	NA	NA	NA
		carbohydrate reserve	[fraction]	NA	NA	NA	NA
		other (please specify)	[fraction]	NA	NA	NA	NA
Turnover times of live carbon pools	What is the typical turnover time of each live carbon pool. Please specify unit [days/years]	aboveground heartwood	[days]/[years]	NA	NA	25	200
		leaves	[days]/[years]	1, 0.5, 0.333 for PFT early, mid and late successional	NA	1	1 year
		generic roots	[days]/[years]	NA	NA	NA	1 year
		coarse/fine roots	[days]/[years]	Fine roots: 1, 0.5, 0.333 for PFT early, mid and late successional	NA	1	NA
		sapwood above ground	[days]/[years]	NA	NA	NA	NA
		sapwood below ground	[days]/[years]	NA	NA	NA	NA
		fruits (fruits and flowers)	[days]/[years]	NA	NA	NA	NA
		carbohydrate reserve	[days]/[years]	NA	NA	NA	NA
Other carbon pools	Does model include litter pool?		Yes/No/NA	Yes	No	Yes	Yes
	Which litter pools are included in model?	structural	Yes/No/NA	Yes	No	Yes	Yes
		metabolic	Yes/No/NA	No	No	Yes	Yes
		above surface	Yes/No/NA	Yes	No	Yes	Yes
		below surface	Yes/No/NA	Yes	No	No	No
	Does model include soil carbon pool?		Yes/No/NA	Yes	No	Yes	Yes
	What is the typical turnover time of each soil carbon pool.	active (fast)	[days]/[years]/[NA]	Yes	NA	Yes	Yes
		slow	[days]/[years]/[NA]	Yes	NA	Yes	Yes
		passive	[days]/[years]/[NA]	No	NA	Yes	NA
	What is depth of the soil carbon pool, in m?		[m]/NA		NA	NA	NA
Heterotrophic respiration	Which variables influence soil/heterotrophic respiration?	Moisture	Yes/No/NA	NA	NA	Yes	Yes
		Temp	Yes/No/NA	NA	NA	Yes	Yes
		Other		NA	NA	NA	NA
Time step	What is the time step of the carbon cycle?	Gross Photosynthetic Production, GPP	[hour]/[day]/[year]/[NA]	hour	0.5 [hour]	hour	0.5 hours
		Autotrophic Respiration, Ra	[hour]/[day]/[year]/[NA]	NA	NA	hour	0.5 hours
		Net Primary Production, NPP	[hour]/[day]/[year]/[NA]	NA	NA	hour	0.5 hours
		Other	[hour]/[day]/[year]/[NA]	Variable: >1 second	NA	NA	NA

Table S2. Model description: Carbon dynamics, as from LBA-DMIP. Special thanks to Dr. Luis Gustavo Goncalves de Goncalves and Dr. Ian Baker.

Dynamic vegetation model (DVGM)				ED2	CLM3.4	IBIS	JULES
Vegetation Dynamics							
Disturbance	Does the model include disturbance?		Yes/No/NA	Yes	No	Yes	Yes
	Which types of disturbance model includes?	Fires	Yes/No/NA	Yes	NA	No	No
		Land use change	Yes/No/NA	Yes	NA	Yes	Yes
		Blowdowns	Yes/No/NA	Yes	NA	No	No
		Other	Yes/No/NA	na	NA	NA	Yes
Vegetation Dynamics Processes	Does the model include tree mortality?		Yes/No/NA	Yes	No	Yes	No
	Does the model include senescence?		Yes/No/NA	Yes	No	Yes	No
	Do different vegetation types compete for light?		Yes/No/NA	Yes	No	Yes	Yes
	Do different vegetation types compete for water?		Yes/No/NA	Yes	No	Yes	Yes
LAI	Is LAI fixed in time (annual mean value)?		Yes/No/NA	No	No	No	No
	Is LAI fixed in time, but presenting a seasonal cycle?		Yes/No/NA	No	Yes	No	No
	Is LAI dynamically calculated?		Yes/No/NA	Yes	No	Yes	Yes
	Is LAI assimilated from remote sensing?		Yes/No/NA	No	No	No	No
	What is the LAI time step, in days?		[days]/NA	1	1 [days]	1 day	10 days
Plant functional types	Total number of possible plant functional types			4 for the tropics	Up to 15	12	5
	Relevant plant functional types used in here presented simulations			4	1: Evergreen broadleaf	2: Tropical evergreen forest, Woodland	1: Broadleaf evergreen
Parametrization of plant functional types	Vcmax, opt: Opt max rubisco-limited potential photosynthetic capacity		Used: Yes/No	Yes	Yes	Yes	Yes
	Topt: Optimum photosynthetic temperature		Used: Yes/No	Yes	No	Yes	Yes
	lmax: Maximum LAI beyond which there is no allocation of biomass to leaves		Used: Yes/No	No	No	No	NA
	Is an exponential root distribution explicitly specified?		Yes/No/NA	No	Yes	Yes	Yes
	Maximum rooting depth (m)		Yes/No/NA	No	No	Yes	NA
	aleaf: prescribed leaf albedo		Used: Yes/No	No	Yes	Yes	NA
	h: prescribed height of vegetation		Used: Yes/No	No	No	Yes	No, dynamic
	Ac: critical leaf age for leaf senescence		Used: Yes/No	No	No	No	No
	Are there temperature thresholds which determine leaf shedding (Ts)?		Yes/No	No	No	Yes	No
	Are there moisture thresholds which determine leaf shedding?		Yes/No	Yes	No	Yes	No
	Is there a nonzero threshold (SW or PAR) above which photosynthesis starts?		Yes/No	NA	NA	Yes	NA
	Other			Reference respiration	NA	NA	NA
Time step DVGM	What is the time step of DGVM?			10 minutes	1hour	LAI -biomass: 1-day Veg. Map: 1-year	10 days
Other	Number of canopy layers			Varies per number of plant cohorts	1	2	10 days

Table S3. Model description: Vegetation dynamics, as from LBA-DMIP. Special thanks to Dr. Luis Gustavo Goncalves de Goncalves and Dr. Ian Baker.