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MODIS vegetation products as proxies of photosynthetic potential along a gradient of meteorologically and biologically driven ecosystem productivity

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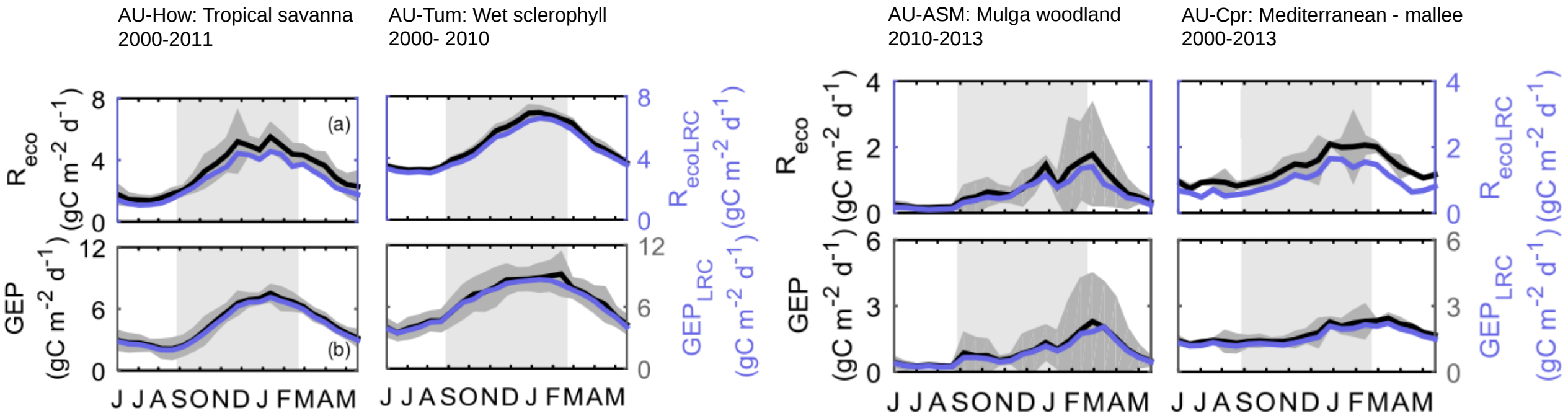

Figure S1. OZflux sites annual cycle (16-day composites) of (a) ecosystem respiration derived using a second-order Fourier regression (R_e; gC m^{-2} d-^{1}) (black line) and derived as the intercept of the rectangular hyperbola fitted to the light response curve (net ecosystem exchange (*NEE*) versus photosynthetic active radiation (*PAR*) without u$_*$ threshold correction (R_{eLUE}; gC m^{-2} d-^{1}) (blue line). (b) Gross ecosystem productivity (*GEP;* gC m^{-2} d-^{1}) derived using R_e (black line); and using $R_{e\,LRC}$, GEP_{LRC} (blue line). Grey boxes indicate Southern Hemisphere spring and summer October to April. Howard Springs savanna (AU-How), Tumbarumba wet sclerophyll forest (AU-Tum), Alice Springs mulga (AU-ASM), and Calperum-Chowilla mallee (AU-Cpr).

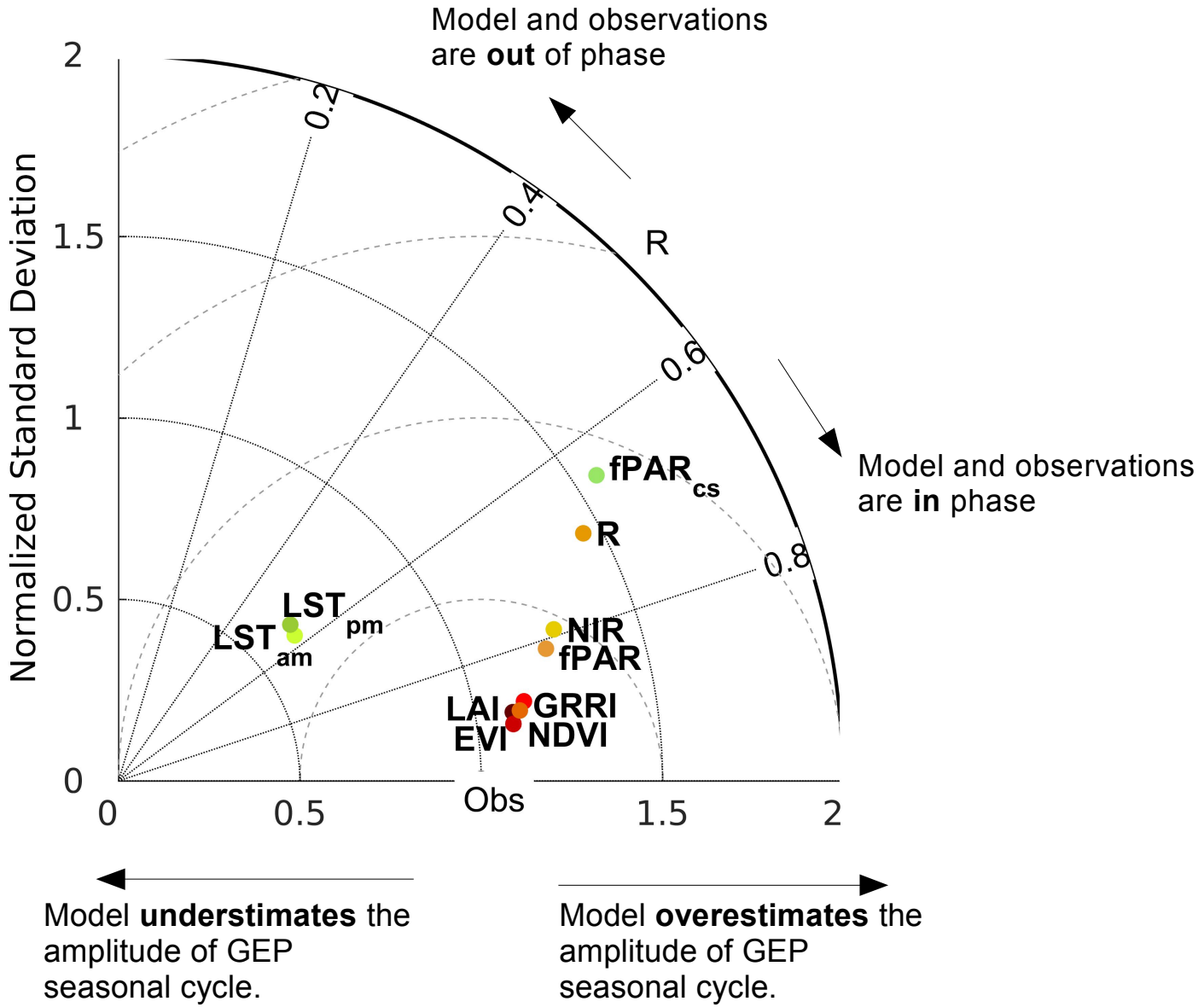

Figure S2. Taylor diagram comparing Howard Springs eddy flux tower measured gross ecosystem productivity (GEP) and GEP based on MODIS and AVHHR products (based on a Type II linear regression). Labels indicate MODIS leaf area index (LAI) and fPAR (fPAR); MODIS enhanced vegetation index (EVI), green (G), red (R43), and near-infrared (NIR) reflectances; MODIS daytime (LST_{am}) and nighttime (LST_{pm}) land surface temperature, and AVHHR total fPAR (fPARcs) (processed by CSIRO).

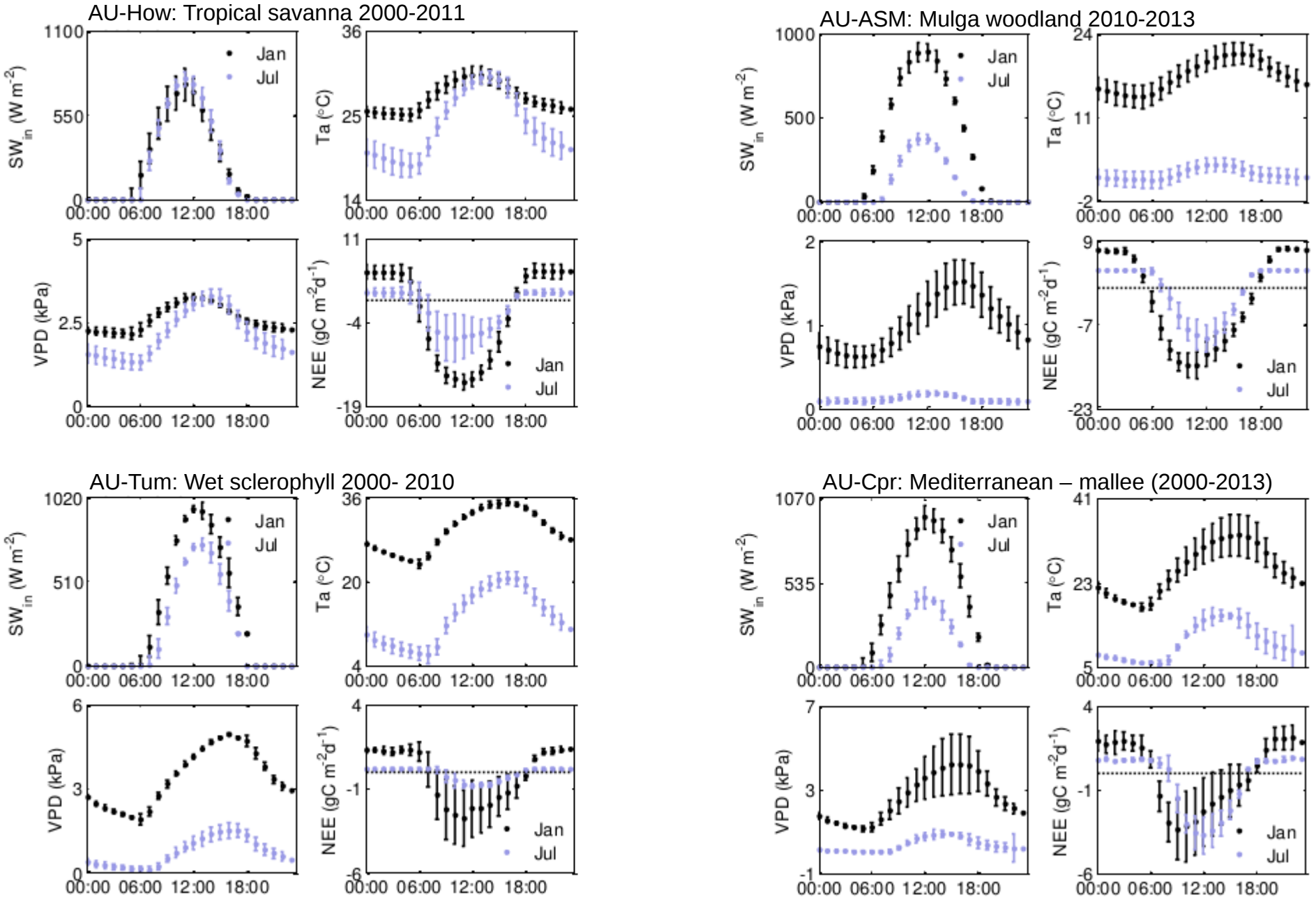

Figure S3. Average and standard deviation (error bars) diel cycle for all available years, January (Australian winter) (black dots) and July (summer) (blue dots). Four plots per site, from left to right, top to bottom: Short wave incoming radiation (SW_{in}; W m^{-2}), air temperature (T_a; °C), vapor pressure deficit (VPD; kPa), and net ecosystem exchange (NEE; gC m^{-2} d^{-1}). Howard Springs savanna (AU-How), Tumbarumba wet sclerophyll forest (AU-Tum), Alice Springs mulga (AU-ASM), and Calperum-Chowilla mallee (AU-Cpr).

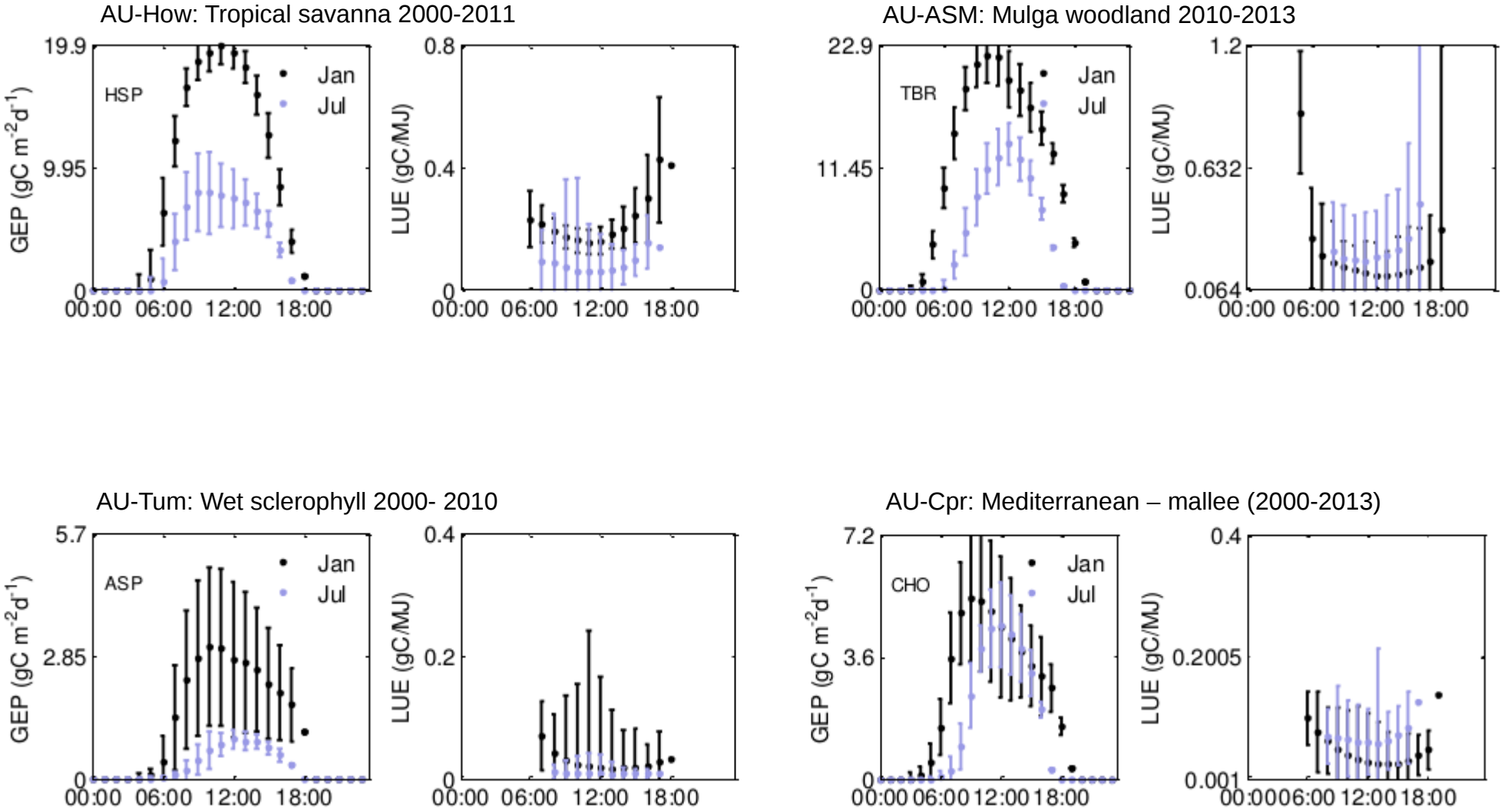

Figure S4. Average and standard deviation (error bars) diel cycle for all available years, January (Australian winter) (black dots) and July (summer) (blue dots). From left to right: Gross ecosystem productivity (GEP; gC m^{-2} d^{-1}), and light use efficiency (LUE; gC/MJ). Howard Springs savanna (AU-How), Tumbarumba wet sclerophyll forest (AU-Tum), Alice Springs mulga (AU-ASM), and Calperum-Chowilla mallee (AU-Cpr).

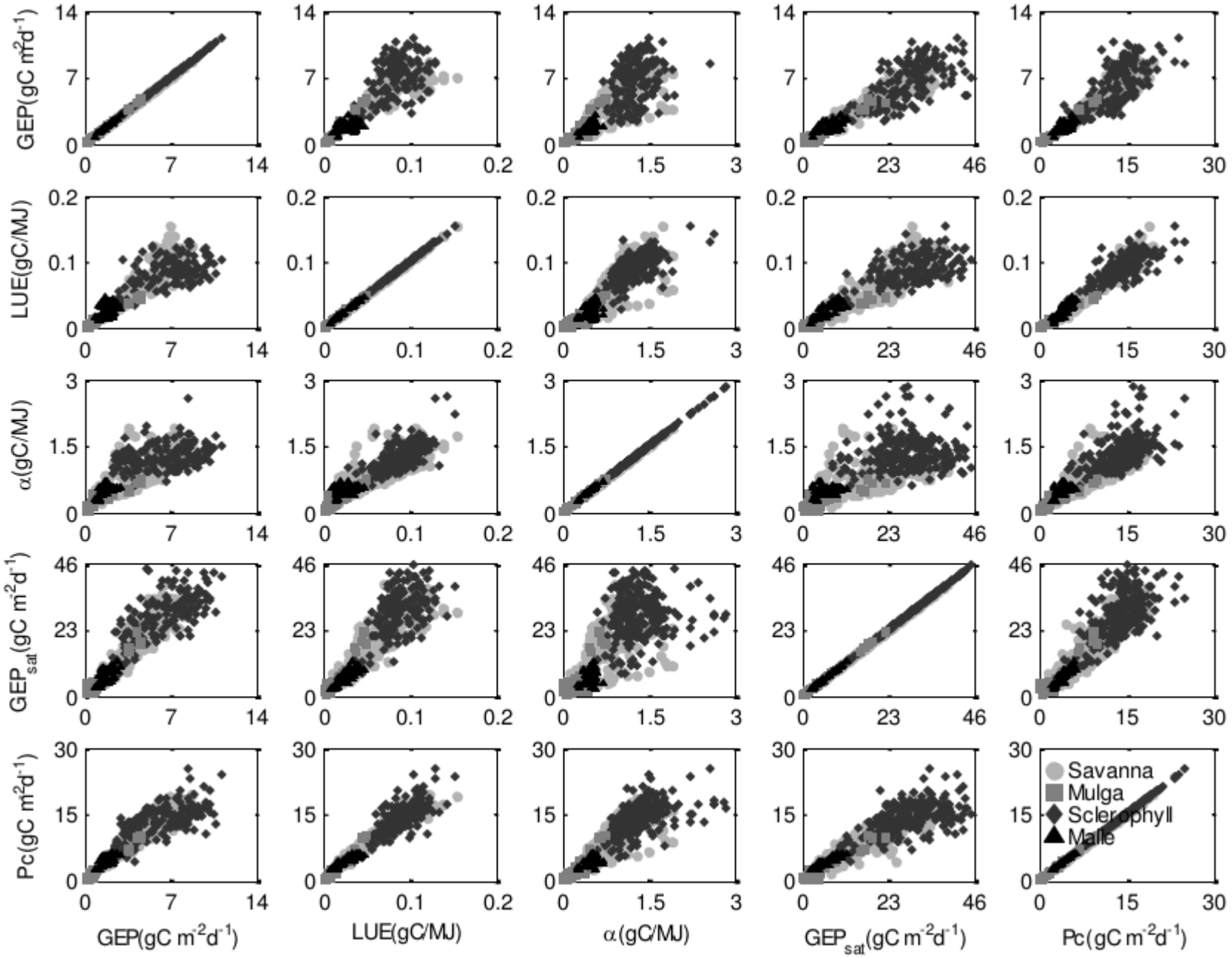

Figure S5. Multi-site regressions between different measures of ecosystem function: Gross ecosystem productivity (GEP; gC m^{-2} d^{-1}), light use efficiency (LUE; gC/MJ), ecosystem quantum yield (α; gC/MJ), GEP at saturation light (GEP_{sat}; gC m^{-2} d^{-1}), and photosynthetic capacity (Pc; gC m^{-2} d^{-1}). Howard Springs savanna (AU-How), Tumbarumba wet sclerophyll forest (AU-Tum), Alice Springs mulga (AU-ASM), and Calperum-Chowilla mallee (AU-Cpr).

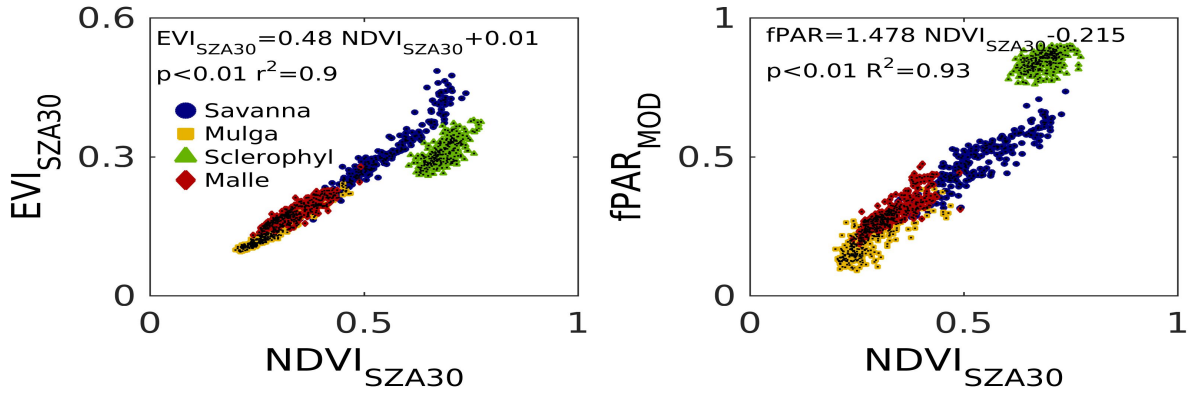

Figure S6. Multi-site regressions between MODIS normalized difference vegetation index ($NDVI_{SZA30}$) and enhanced vegetation index (EVI_{SZA30}) at fixed solar zenith angle of 30˚ (left panel) and $NDVI_{SZA30}$ and MODIS fraction of the absorbed photosynthetic active radiation (fPAR) (right panel).

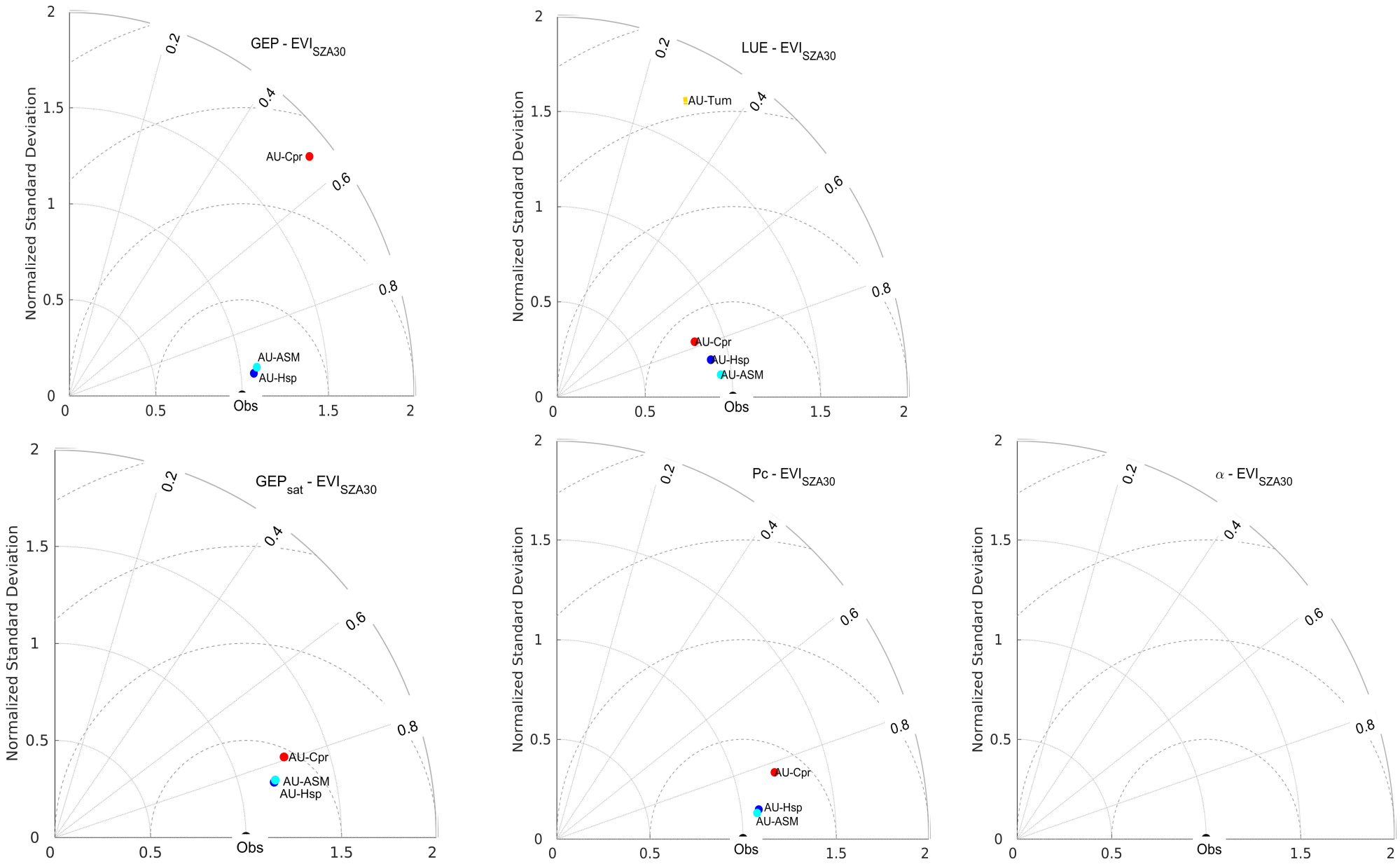

Figure S7. Taylor diagrams showing linear model results (e.g GEP=a EVI +b) for Howard Springs (AU-How), Tumbarumba (AU-Tum), Alice Springs (AU-ASM) and Calperum-Chowilla (AU-Cpr) based on site-specific linear regressions between gross ecosystem productivity (*GEP*; gC m^{-2} d^{-1}), light use efficiency (*LUE*; gC/MJ), photosynthetic capacity (*Pc*; gC m^{-2} d^{-1}), ecosystem quantum yield (α; gC/Mj), GEP at saturation light (GEP_{sat}; gC m^{-2} d^{-1}) and MODIS enhanced vegetation index at fixed solar zenith angle of 30˚ (EVI_{SZA30}). Missing sites indicate that the model overestimates the seasonality of observations -model normalized standard deviation is >2.

SDS name	Field	Value masked
Pixel reliability	N/A	-1 **(**fill/no data**)**
		2 (snow/ice)
		3 (cloudy)
VI quality	MODLAND QA	10 (produced/cloudy)
		11 (not produces)
	VI usefulness	1100 (lowest quality)
		1101 (not useful)
		1110 (data faulty)
		1111 (other)
	Mixed clouds	1 (yes)

Table S1: MODIS Pixel Reliability and VI Quality

	HSP				ASP				TMB				CHO				All			
	Coeff [a b c d]	CI	R^2	AIC	Coeff	CI	R^2	AIC	Coeff	CI	R^2	AIC	Coeff	CI	R^2	AIC	Coeff	CI	R^2	AIC
GEP = a EVI + b	**[21.94 -2.65]**	**[0.96 0.28]**	**0.82**	**263**	**[26.01 -2.48]**	**[1.69 0.2]**	**0.85**	**64**	[15.52 0.90]	[5.55 2.01]	0.03	740	**[12.74 -0.71]**	**[2.05 0.38]**	**0.36**	**49**	**[22.47 -2.19]**	**[0.51 0.1]**	**0.69**	**1323**
GEP = a NDVI	[15.03 -4.11]	[0.70 0.35]	0.78	275	[14.34 -3.10]	[0.99 0.26]	0.83	80	[19.05 -7.28]	[5.23 3.79]	0.07	733	[3.97 0.24]	[1.29 0.46]	0.09	70	**[12.62 -2.74]**	**[0.27 0.12]**	**0.72**	**1276**
GEP = a LST_{day} + b	[-0.22 70.91]	[0.02 7.70]	0.28	676	[-0.02 7.59]	[0.013 3.90]	0.03	218	**[0.26 -68.09]**	**[0.015 4.45]**	**0.58**	**656**	[0.017 -3.27]	[0.006 1.74]	0.12	69	[-0.095 32.57]	[0.01 3.13]	0.14	2279
GEP = a $Precip_{TRMM}$ + b	[0.01 3.03]	[0.001 0.11]	0.53	627	[0.01 0.38]	[0.004 0.11]	0.30	182	[-0.017 7.54]	[0.005 0.31]	0.03	799	[0.0006 1.66]	[0.003 0.097]	0.02	73	[0.009 3.60]	[0.001 0.14]	0.13	2340
GEP = a SW_{CERES} + b	[-0.012 7.30]	[0.006 1.48]	0.02	781	[0.005 -0.30]	[0.002 0.59]	0.02	209	[0.026 1.025]	[0.001 0.26]	0.60	635	[0.003 1.14]	[0.0008 0.14]	0.12	67	[0.007 2.81]	[0.0016 0.32]	0.01	2329
GEP = a EVI + b LST_{day} + c LST_{day} EVI + d	[-29.96 127.38 0.09 -0.34]	[18.42 66.60 0.06 0.22]	0.82	268	[-11.51 76.94 0.03 -0.16]	[7.81 67.35 0.03 0.22]	0.87	66	[-2.64 1.38 0.08]	[0.21 10.71 (	0.64	583	**[22.6 -145.8 -0.08 0.53]**	**[9.4 51.44 0.03 0.17]**	**0.63**	**30**	[-5.60 17.51 0.01 0.02]	[2.98 13.87 0.01 0.05]	0.70	1322
GEP = a EVI + b LST_{day} + c	[ ]	[ ]	0.82	266	[ ]	[ ]	0.87	62	[ ]	[ ]	0.63	586	[ ]	[ ]	0.57	35	[ ]	[ ]	0.70	1318
GEP = a LST_{day} + b LST_{day} EVI + c	[ ]	[ ]	0.81	266	[ ]	[ ]	0.86	65	[ ]	[ ]	0.63	586	[ ]	[ ]	0.58	33	[ ]	[ ]	0.70	1329
GEP = a EVI + b LST_{day} EVI + c	[ ]	[ ]	0.82	266	[ ]	[ ]	0.86	63	[ ]	[ ]	0.64	582	[ ]	[ ]	0.59	32	[ ]	[ ]	0.70	1319
GEP = a LST_{day} EVI + b	[ ]	[ ]	0.81	265	[ ]	[ ]	0.86	61	[ ]	[ ]	0.14	720	[ ]	[ ]	0.50	36	[ ]	[ ]	0.70	1326
GEP = a EVI + b SW_{CERES} + c SW_{CERES} EVI + d	**[-3.57 24.15 0.003 -0.004]**	**[3.45 11.26 0.01 0.05]**	**0.82**	**266**	[2.48 -21.70 -0.02 0.19]	[0.99 8.68 0.004 0.03]	0.87	54	**[7.75 -19.41 -0.05 0.21]**	**[3.25 8.84 0.017 0.05]**	**0.70**	**553**	**[1.87 -4.52 -0.01 0.095]**	**[0.83 4.41 0.005 0.025]**	**0.62**	**26**	**[-0.31 4.95 -0.009 0.079]**	**[0.35 1.45 0.001 0.007]**	**0.82**	**1154**
GEP = a EVI + b SW_{CERES} + c	[ ]	[ ]	0.82	263	[ ]	[ ]	0.87	62	[ ]	[ ]	0.67	567	[ ]	[ ]	0.56	34	[ ]	[ ]	0.76	1259
GEP = a SW_{CERES} + b SW_{CERES} EVI + c	[3.63 -0.03 0.097]	[0.73 0.003 0.004]	0.82	263	**[-0.008 -0.01 0.10]**	**[0.18 0.001 0.006]**	**0.88**	**56**	[0.69 -0.014 0.12]	[0.29 0.006 0.016]	0.69	554	**[1.023 -0.01 0.07]**	**[0.097 0.001 0.008]**	**0.62**	**23**	[0.92 -0.014 0.1]	[0.13 0.001 0.002]	0.82	1179
GEP = a EVI + b SW_{CERES} EVI + c	[ ]	[ ]	0.82	264	[-2.44 20.45 0.02]	[0.198 2.4 0.007]	0.88	60	[ ]	[ ]	0.68	559	[ ]	[ ]	0.58	30	[ ]	[ ]	0.81	1181
GEP = a SW_{CERES} EVI + b	[ ]	[ ]	0.74	297	[ ]	[ ]	0.70	105	[ ]	[ ]	0.68	558	[ ]	[ ]	0.32	52	[ ]	[ ]	0.73	1454
GEP = a EVI + b $Precip_{TRMM}$ + c $Precip_{TRMM}$ EVI + d	**[-2.13 18.93 0.01 -0.02]**	**[0.34 1.28 0.004 0.01]**	**0.84**	**253**	**[-1.32 15.09 0.019 0.18]**	**[0.25 2.19 0.005 0.04]**	**0.88**	**42**	[1.63 15.31 0.002 -0.04]	[3.78 10.29 0.06 0.16]	0.04	732	[0.21 6.96 -0.03 0.2]	[0.69 3.57 0.015 0.08]	0.52	43	[-2.35 22.48 0.008 -0.02]	[0.14 0.64 0.003 0.009]	0.66	1312
GEP = a EVI + b $Precip_{TRMM}$ + c	[ ]	[ ]	0.82	251	[-2.25 22.8 0.005]	[0.19 1.73 0.002]	0.88	59	[ ]	[ ]	0.04	729	[ ]	[ ]	0.48	45	[ ]	[ ]	0.68	1321
GEP = a TRMM + b $Precip_{TRMM}$ EVI + c	[ ]	[ ]	0.49	364	[ ]	[ ]	0.75	123	[ ]	[ ]	0.03	733	[ ]	[ ]	0.49	45	[ ]	[ ]	0.19	1848
GEP = a EVI + b $Precip_{TRMM}$ EVI + c	[ ]	[ ]	0.81	254	[-1.97 20.17 0.049]	[0.2 1.86 0.01]	0.89	51	[ ]	[ ]	0.04	728	[ ]	[ ]	0.49	43	[ ]	[ ]	0.65	1309
GEP = a $Precip_{TRMM}$ EVI + b	[ ]	[ ]	0.51	361	[ ]	[ ]	0.57	155	[ ]	[ ]	0.01	734	[ ]	[ ]	0.08	72	[ ]	[ ]	0.15	1932
GEP = a NDVI + b LST_{day} + c LST_{day} EVI + d	[-57.78 118 0.17 -0.33]	[23.79 48.54 0.08 0.16]	0.79	279	[-24.42 79.28 0.07 -0.21]	[9.19 36 0.03 0.12]	0.86	75	[231 -416.25 -0.83 1.51]	[105.9 145.1 0.37 0.50]	0.68	566	**[34.5 -119.1 -0.12 0.43]**	**[10.8 29.76 0.036 0.1]**	**0.60**	**34**	[0.43 -27.31 -0.01 0.14]	[3.17 7.05 0.01 0.024]	0.79	1226
GEP = a NDVI + b LST_{day} + c	[ ]	[ ]	0.78	278	[ ]	[ ]	0.85	74	[ ]	[ ]	0.66	572	[ ]	[ ]	0.48	45	[ ]	[ ]	0.76	1237
GEP = a LST_{day} + b LST_{day} NDVI + c	[ ]	[ ]	0.78	279	[ ]	[ ]	0.85	76	[ ]	[ ]	0.66	571	[ ]	[ ]	0.49	44	[ ]	[ ]	0.77	1235
GEP = a NDVI + b LST_{day} EVI + c	[ ]	[ ]	0.78	279	[ ]	[ ]	0.85	76	[ ]	[ ]	0.67	569	[ ]	[ ]	0.53	40	[ ]	[ ]	0.79	1215
GEP = a LST_{day} NDVI + b	[ ]	[ ]	0.78	276	[ ]	[ ]	0.84	73	[ ]	[ ]	0.34	677	[ ]	[ ]	0.21	61	[ ]	[ ]	0.75	1249
GEP = a NDVI + b SW_{CERES} + c SW_{CERES} NDVI + d	[-9.6 23.6 0.02 -0.03]	[4.76 9.06 0.02 0.04]	0.79	277	[2.77 -11.51 0.02 0.10]	[1.38 5.41 0.006 0.02]	0.87	62	**[13.58 -17.68 -0.12 0.198]**	**[6.53 8.95 0.032 0.04]**	**0.71**	**542**	**[2.74 -5.59 -0.02 0.07]**	**[0.88 2.32 0.005 0.014]**	**0.60**	**30**	**[-0.75 2.8 -0.01 0.05]**	**[0.37 0.75 0.001 0.003]**	**0.88**	**1013**
GEP = a NDVI + b SW_{CERES} + c	[ ]	[ ]	0.79	276	[ ]	[ ]	0.86	72	[ ]	[ ]	0.69	555	[ ]	[ ]	0.46	45	[ ]	[ ]	0.81	1163
GEP = a SW_{CERES} + b SW_{CERES} NDVI + c	[2.63 -0.031 0.07]	[0.79 0.004 0.003]	0.78	277	[-0.15 -0.01 0.06]	[0.19 0.001 0.004]	0.88	64	**[0.72 -0.056 0.11]**	**[0.29 0.01 0.014]**	**0.71**	**542**	[0.69 -0.01 0.04]	[0.12 0.002 0.005]	0.57	30	[0.64 -0.016 0.058]	[0.12 0.0006 0.001]	0.87	1052
GEP = a NDVI + b SW_{CERES} EVI + c	[ ]	[ ]	0.79	274	[ ]	[ ]	0.87	69	[ ]	[ ]	0.70	550	[ ]	[ ]	0.51	39	[-3.15 7.36 0.026]	[0.096 0.35 0.0015]	0.87	1052
GEP = a SW_{CERES} NDVI + b	[ ]	[ ]	0.69	313	[ ]	[ ]	0.62	120	[ ]	[ ]	0.65	568	[ ]	[ ]	0.30	53	[ ]	[ ]	0.77	1403
GEP = a NDVI + b $Precip_{TRMM}$ + c $Precip_{TRMM}$ EVI + d	[ ]	[ ]	0.82	249	[-1.56 7.74 -0.026 0.11]	[0.31 1.196 0.006 0.02]	0.88	50	[ ]	[ ]	0.08	727	[ ]	[ ]	0.26	66	[ ]	[ ]	0.72	1250
GEP = a NDVI + b $Precip_{TRMM}$ + c	[ ]	[ ]	0.82	245	[ ]	[ ]	0.86	69	[ ]	[ ]	0.07	725	[ ]	[ ]	0.21	65	[ ]	[ ]	0.72	1263
GEP = a $Precip_{TRMM}$ + b $Precip_{TRMM}$ EVI + c	[ ]	[ ]	0.51	360	[ ]	[ ]	0.76	121	[ ]	[ ]	0.08	726	[ ]	[ ]	0.25	65	[ ]	[ ]	0.35	1808
GEP = a NDVI + b $Precip_{TRMM}$ EVI + c	[ ]	[ ]	0.81	246	[-2.28 10.35 0.03]	[0.24 0.98 0.006]	0.88	60	[ ]	[ ]	0.07	725	[ ]	[ ]	0.23	64	[ ]	[ ]	0.71	1251
GEP = a $Precip_{TRMM}$ NDVI + b	[ ]	[ ]	0.52	361	[ ]	[ ]	0.54	158	[ ]	[ ]	0.01	733	[ ]	[ ]	0.06	72	[ ]	[ ]	0.19	1920

Table S2. Linear regressions obtained by a nonlinear mixed-effects regression model for gross ecosystem productivity (GEP; gC m^{-2} d^{-1}) versus combinations of 16-day average MODIS products: fixed solar zenith angle of 30˚ enhanced vegetation index (EVI), daytime land surface temperature (LST_{day}; degC), fixed solar zenith angle of 30˚ normalized difference vegetation index (NDVI), precipitation from the Tropical Rainfall Measuring Mission (TRMM; mm $month^{-1}$) data product from 1998-2013 (NASA, 2014), and surface shortwave incident radiation (W m^{-2}) from the Clouds and the Earth's Radiant Energy System (CERES) (Kato et al., 2012). Howard Springs (AU-How), Alice Springs mulga (AU-ASM), Calperum-Chowilla (AU-Cpr), and Tumbarumba (AU-Tum) and all available data (includes the four sites). EVI and NDVI labels are used instead of EVI_{SZA30} and $NDVI_{SZA30}$

	AU_How				AU_ASM				AU_Tum				AU_Cpr				All			
	Coeff [a b]	CI	R^2	RMSE	Coeff [a b]	CI	R^2	RMSE	Coeff [a b]	CI	R^2	RMSE	Coeff [a b]	CI	R^2	RMSE	Coeff [a b]	CI	R^2	RMSE
LUE = a EVI_{SZA30} + b	[0.262 -0.029]	[0.0124 0.0035]	0.77	0.0006	[0.3 -0.029]	[0.02 0.002]	0.85	0.0000	[ ]	[ ]	0.10	0.0000	[ ]	[ ]	0.44	0.0000	[ ]	[ ]	0.67	0.0000
LUE = a $NDVI_{SZA30}$ + b	[ ]	[ ]	0.73	0.0000	[ ]	[ ]	0.83	0.0000	[ ]	[ ]	0.13	0.0000	[0.18 -0.041]	[0.016 0.006]	0.69	0.0000	[ ]	[ ]	0.75	0.0000
LUE = a LAI + b	[ ]	[ ]	0.75	0.0000	[ ]	[ ]	0.68	0.0000	[ ]	[ ]	0.12	0.0000	[ ]	[ ]	0.52	0.0005	[ ]	[ ]	0.73	0.0043
LUE = a fPAR + b	[ ]	[ ]	0.74	0.0001	[ ]	[ ]	0.65	0.0000	[ ]	[ ]	0.15	0.0005	[0.13 -0.02]	[0.007 0.002]	0.85	0.0000	[ ]	[ ]	0.78	0.0000
Pc = a EVI_{SZA30} + b	[50.567 -5.758]	[2.112 0.613]	0.81	0.0912	[60.91 -5.91]	[3.42 0.41]	0.87	0.0000	[44.26 -2.34]	[7.12 2.6]	0.15	0.3144	[ ]	[ ]	0.52	0.0340	[49.43 -4.75]	[0.82 0.18]	0.81	0.0000
Pc = a $NDVI_{SZA30}$ + b	[ ]	[ ]	0.76	0.0000	[33.78 -7.40]	[1.95 0.51]	0.85	0.0000	[42.27 -17.05]	[6.72 4.9]	0.16	0.1449	[ ]	[ ]	0.49	0.0000	[27.47 -5.81]	[0.43 0.19]	0.79	0.0000
Pc = a LAI + b	[7.66 -2.57]	[0.28 0.38]	0.79	0.0000	[ ]	[ ]	0.73	0.0000	[ ]	[ ]	0.10	0.0000	[ ]	[ ]	0.68	0.0000	[ ]	[ ]	0.64	0.4318
Pc = a fPAR + b	[ ]	[ ]	0.72	0.0000	[ ]	[ ]	0.65	0.0000	[ ]	[ ]	0.03	0.0000	[ ]	[ ]	0.66	0.0000	[ ]	[ ]	0.74	0.0000
α = a EVI_{SZA30} + b	[ ]	[ ]	0.34	0.0035	[ ]	[ ]	0.75	0.0000	[ ]	[ ]	0.01	0.0000	[ ]	[ ]	0.18	0.0055	[ ]	[ ]	0.54	0.0000
α = a $NDVI_{SZA30}$ + b	[ ]	[ ]	0.29	0.0000	[ ]	[ ]	0.74	0.0000	[ ]	[ ]	0.02	0.0000	[ ]	[ ]	0.09	0.0064	[ ]	[ ]	0.58	0.0000
α = a LAI + b	[ ]	[ ]	0.32	0.0014	[ ]	[ ]	0.72	0.0000	[ ]	[ ]	0.02	0.0000	[ ]	[ ]	0.26	0.0000	[ ]	[ ]	0.54	0.0567
α = a fPAR + b	[ ]	[ ]	0.28	0.0000	[ ]	[ ]	0.55	0.0000	[ ]	[ ]	0.02	0.0000	[ ]	[ ]	0.10	0.0000	[ ]	[ ]	0.62	0.0060
GEP_{sat} = a EVI_{SZA30} + b	[ ]	[ ]	0.66	0.3131	[ ]	[ ]	0.73	0.0000	[113.95 -12.36]	[17.9 6.5]	0.14	0.1318	[ ]	[ ]	0.44	0.1384	[ ]	[ ]	0.71	0.0000
GEP_{sat} = a $NDVI_{SZA30}$ + b	[ ]	[ ]	0.69	0.2707	[ ]	[ ]	0.71	0.0000	[ ]	[ ]	0.13	0.3624	[ ]	[ ]	0.51	0.0000	[ ]	[ ]	0.74	0.0000
GEPsat = a LAI + b	[ ]	[ ]	0.69	0.3214	[ ]	[ ]	0.58	0.0000	[ ]	[ ]	0.07	0.3561	[ ]	[ ]	0.60	0.1019	[ ]	[ ]	0.63	1.5390
GEPsat = a fPAR + b	[ ]	[ ]	0.65	0.2730	[ ]	[ ]	0.55	0.0000	[ ]	[ ]	0.01	0.4973	[ ]	[ ]	0.72	0.0000	[ ]	[ ]	0.68	0.1617
GEP = a EVI_{SZA30} + b	[23.03 -2.89]	[0.96 0.28]	0.82	0.0502	[26.17 -2.49]	[1.69 0.2]	0.86	0.0000	[ ]	[ ]	0.04	0.1290	[ ]	[ ]	0.37	0.0000	[ ]	[ ]	0.68	0.0000
GEP = a $NDVI_{SZA30}$ + b	[16.27 -4.63]	[0.70 0.35]	0.77	0.0000	[14.33 -3.09]	[0.99 0.26]	0.83	0.0000	[ ]	[ ]	0.06	0.0000	[ ]	[ ]	0.10	0.0000	[ ]	[ ]	0.70	0.0000
GEP = a LAI + b	[ ]	[ ]	0.84	0.0406	[ ]	[ ]	0.74	0.0000	[ ]	[ ]	0.04	0.0901	[ ]	[ ]	0.37	0.0000	[ ]	[ ]	0.60	0.3951
GEP = a fPAR + b	[ ]	[ ]	0.71	0.0230	[ ]	[ ]	0.63	0.0000	[ ]	[ ]	0.00	0.0000	[ ]	[ ]	0.07	0.0337	[ ]	[ ]	0.65	0.0000

Table S3. Linear regressions obtained by a nonlinear mixed-effects regression model for light use efficiency (LUE; gC/MJ), photosynthetic capacity (*Pc*; gC m^{-2} d^{-1}), ecosystem quantum yield (*α;* gC/MJ), and GEP at saturation light (GEP_{sat}, gC m^{-2} d^{-1}), gross ecosystem productivity (GEP; gC m^{-2} d^{-1}), versus combinations of 16-day average MODIS products: fixed solar zenith angle of 30˚ enhanced vegetation index (EVI_{SZA30}) and normalized difference vegetation index ($NDVI_{SZA30}$), MODIS leaf area index, (LAI_{MOD}) and fraction of the absorbed photosynthetic active radiation ($fPAR_{MOD}$)