

Introduction

This supporting information contains nine additional figures, four tables, and one movie. Figure S1 shows a scatterplot of the TROPOMI SIF data against the AmeriFlux GPP data. Figure S2 shows scatterplots of TROPOMI SIF against AmeriFlux GPP for the various ecosystems. Figure S3 shows the impact of temporal averaging on the SIF-GPP relationship. Figure S4 shows the difference between GPP in fall (August, September, October) 2019 and 2018. Figure S5 shows a comparison of SIF and GPP at two AmeriFlux sites dominated by C3 plants and two dominated by C4 plants. Figure S6 is the same as main text Figure 4 but shows MODIS LAI instead of NIR_v . Figure S7 is the same as main text Figure 3 but shows FLUXCOM. Figure S8 is the same as main text Figure 2 but uses 3 Gaussians. Figure S9 is the same as main text Figure 2 but uses 4 Gaussians. Table 1 lists all of the eddy covariance sites used in this work. Table 2 lists the ecosystem weighting for each Gaussian in the 2-component model. Table 3 lists the ecosystem weighting for each Gaussian in the 3-component model. Table 4 lists the ecosystem weighting for each Gaussian in the 4-component model.

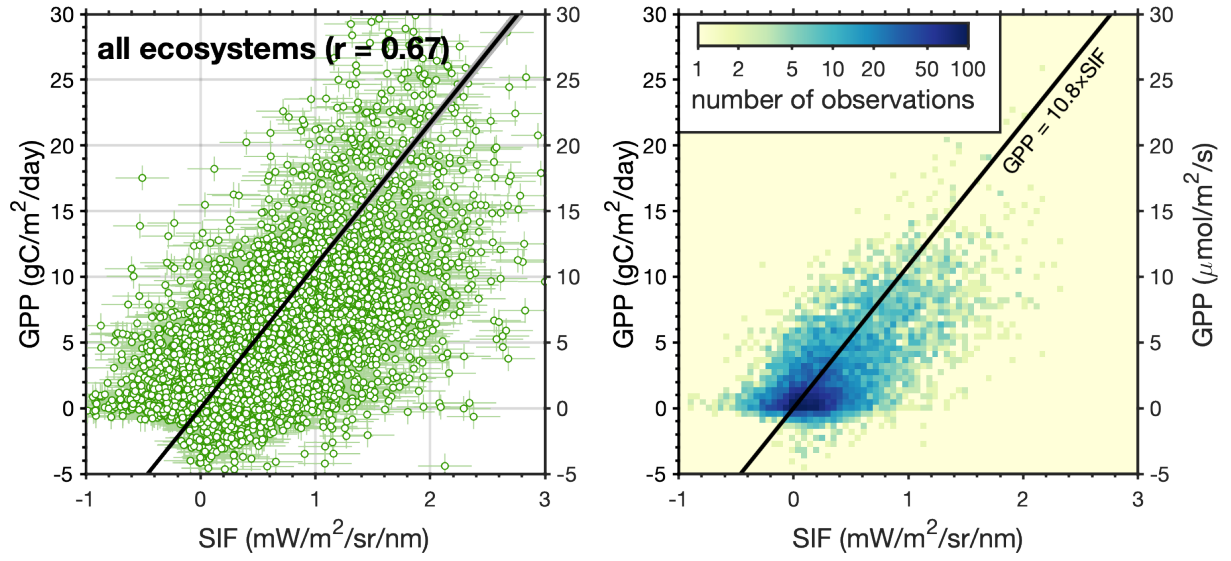


Figure S1: **Comparison of TROPOMI SIF and AmeriFlux GPP.** Scatterplot comparison of TROPOMI SIF (x-axis) and AmeriFlux GPP (y-axis) using all observations. Solid line is fitted using a bisquare regression. Light gray lines are bootstrap of the fit. (Left panel) All points plotted. (Right panel) Log-scale density map.

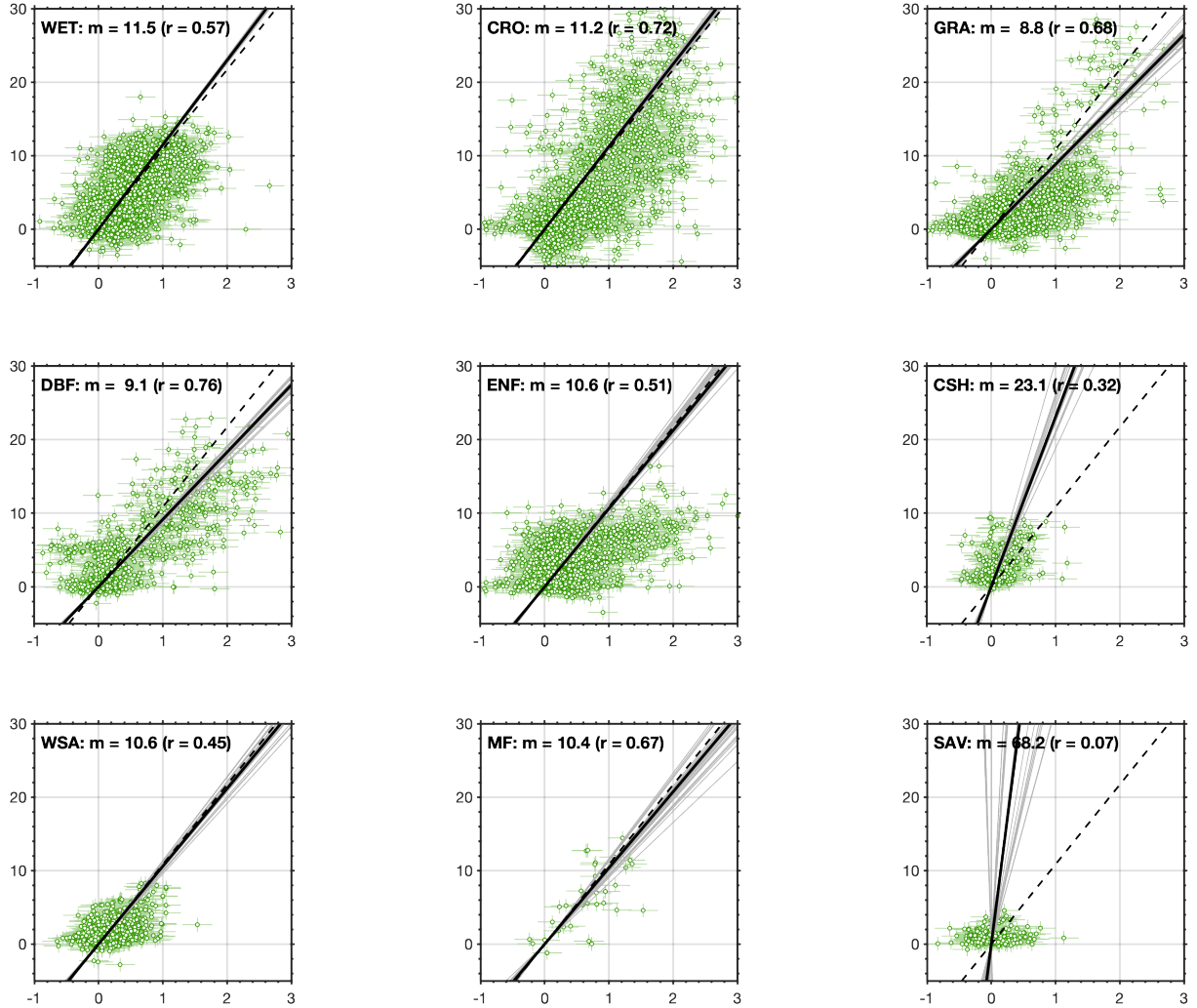


Figure S2: **Comparison of TROPOMI SIF and AmeriFlux GPP by ecosystem.** Same as left panel of Fig. S1 except broken down by ecosystem. x-axis is TROPOMI SIF ($\text{mW/m}^2/\text{sr/s}$) and y-axis is AmeriFlux GPP ($\mu\text{mol/m}^2/\text{s}$). WET = wetlands, CRO = croplands, GRA = grasslands, DBF = deciduous broadleaf forest, ENF = evergreen needleleaf forest, CSH = closed shrubland, WSA = woody savanna, MF = mixed forest, SAV = savanna. Open shrubland is not shown.

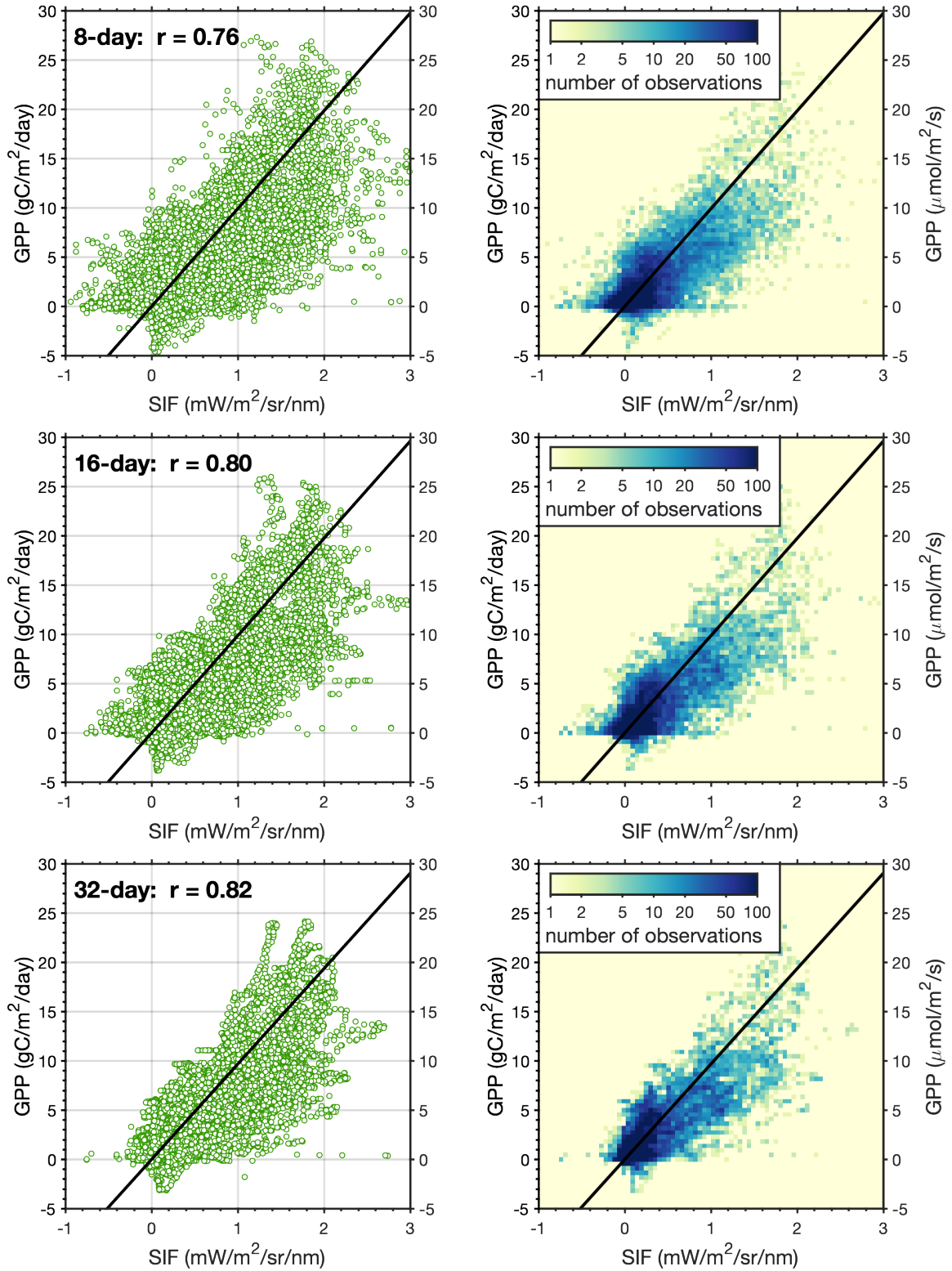


Figure S3: **Impact of temporal averaging on SIF-GPP relationship.** Same as Fig. S2 but using averaged data. Top row uses an 8-day moving window, middle row uses a 16-day moving window, and bottom row uses a 32-day moving window.

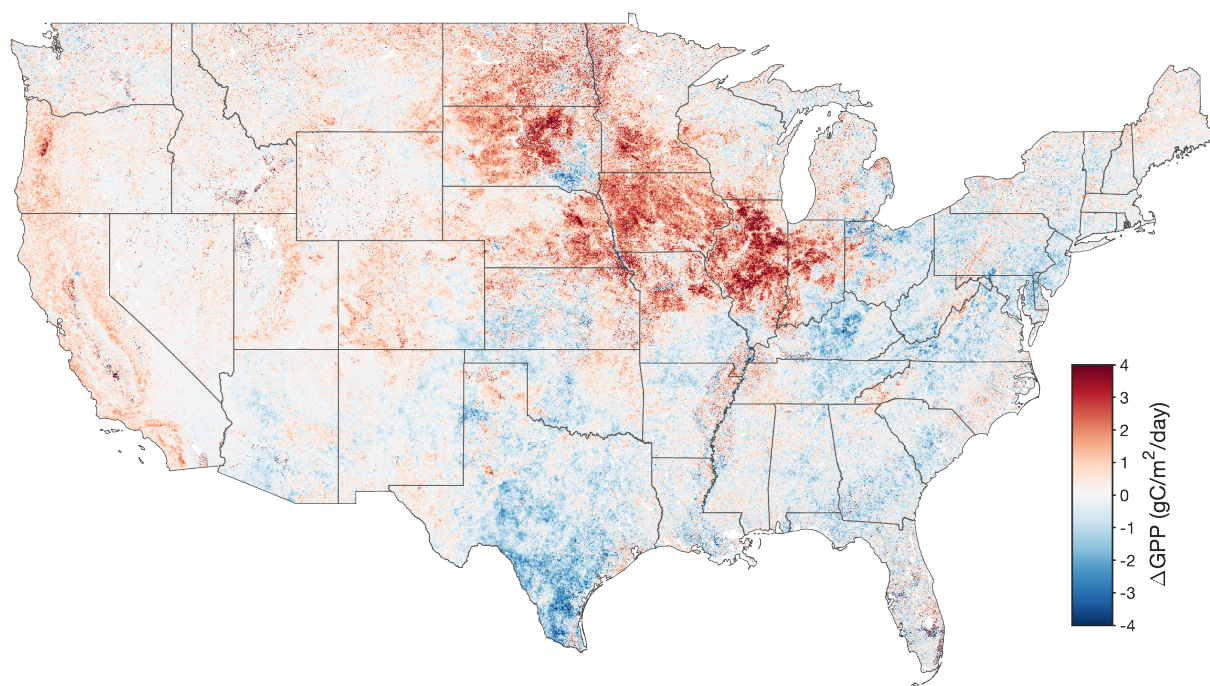


Figure S4: **Difference in GPP between Fall 2019 and Fall 2018.** Same as main text Fig. 3c but for August, September, and October.

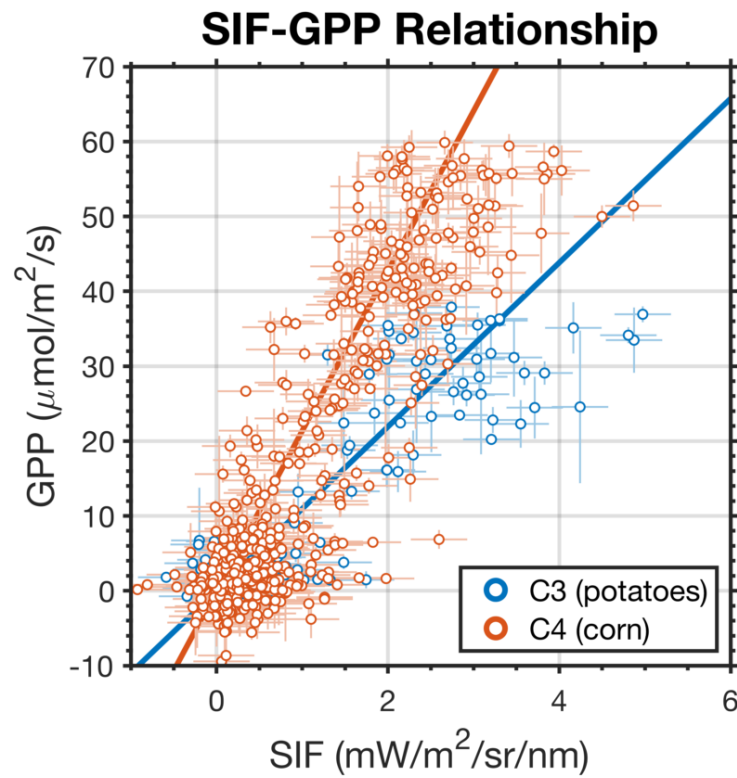


Figure S5: **Comparison of the SIF-GPP relationship for C3 and C4 plants.** Comparison of TROPOMI SIF and AmeriFlux GPP for C3 (blue) and C4 (red) plants at four AmeriFlux sites: US-CS1, US-CS3, US-Bi2, and US-KL1..

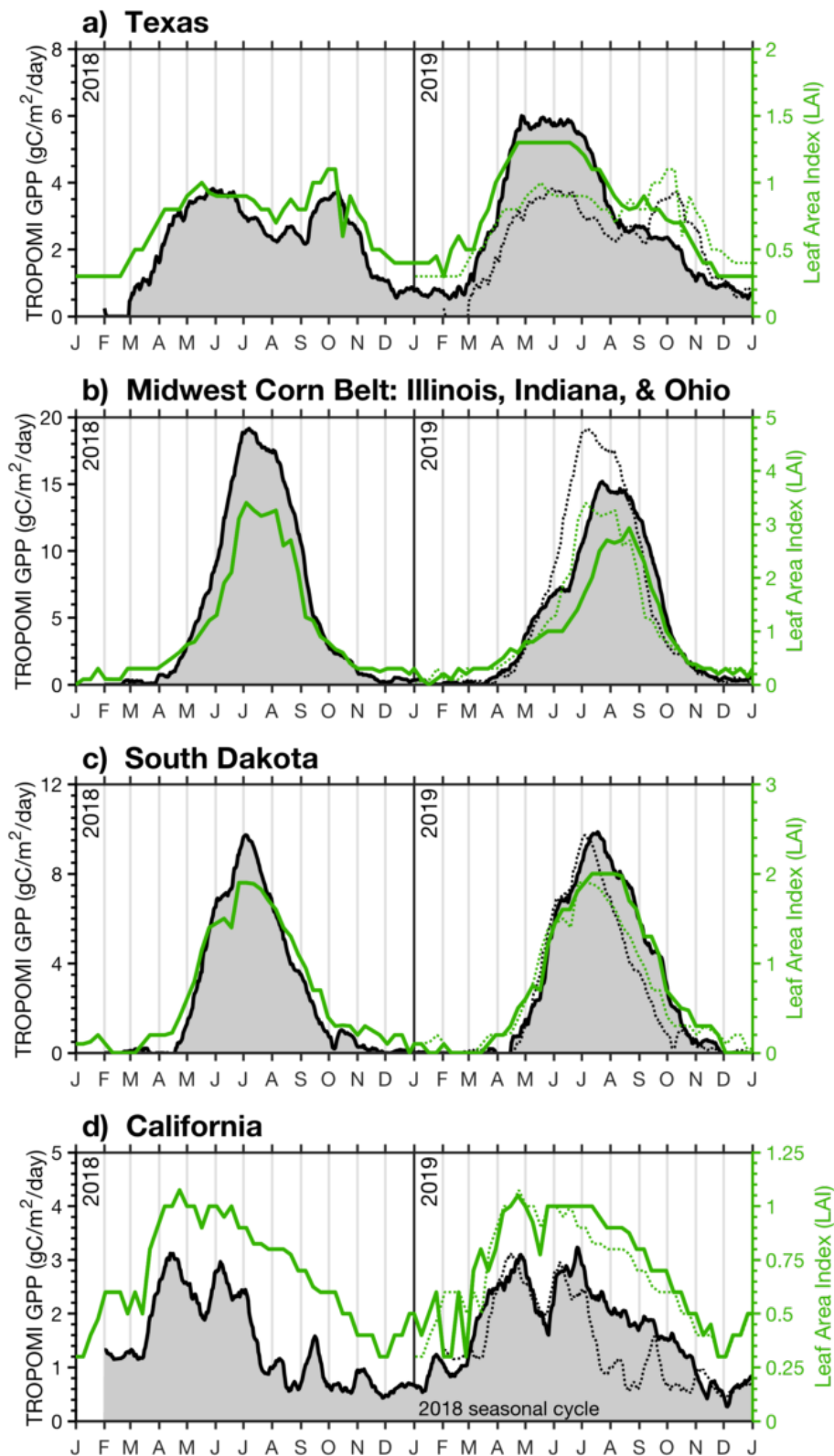


Figure S6: **Major drivers of interannual variability in CONUS GPP.** Same as main text Fig. 4 but show MODIS LAI instead of NIR_v. Here we use the MCD15A2H MODIS LAI product that was available at a coarser time resolution.

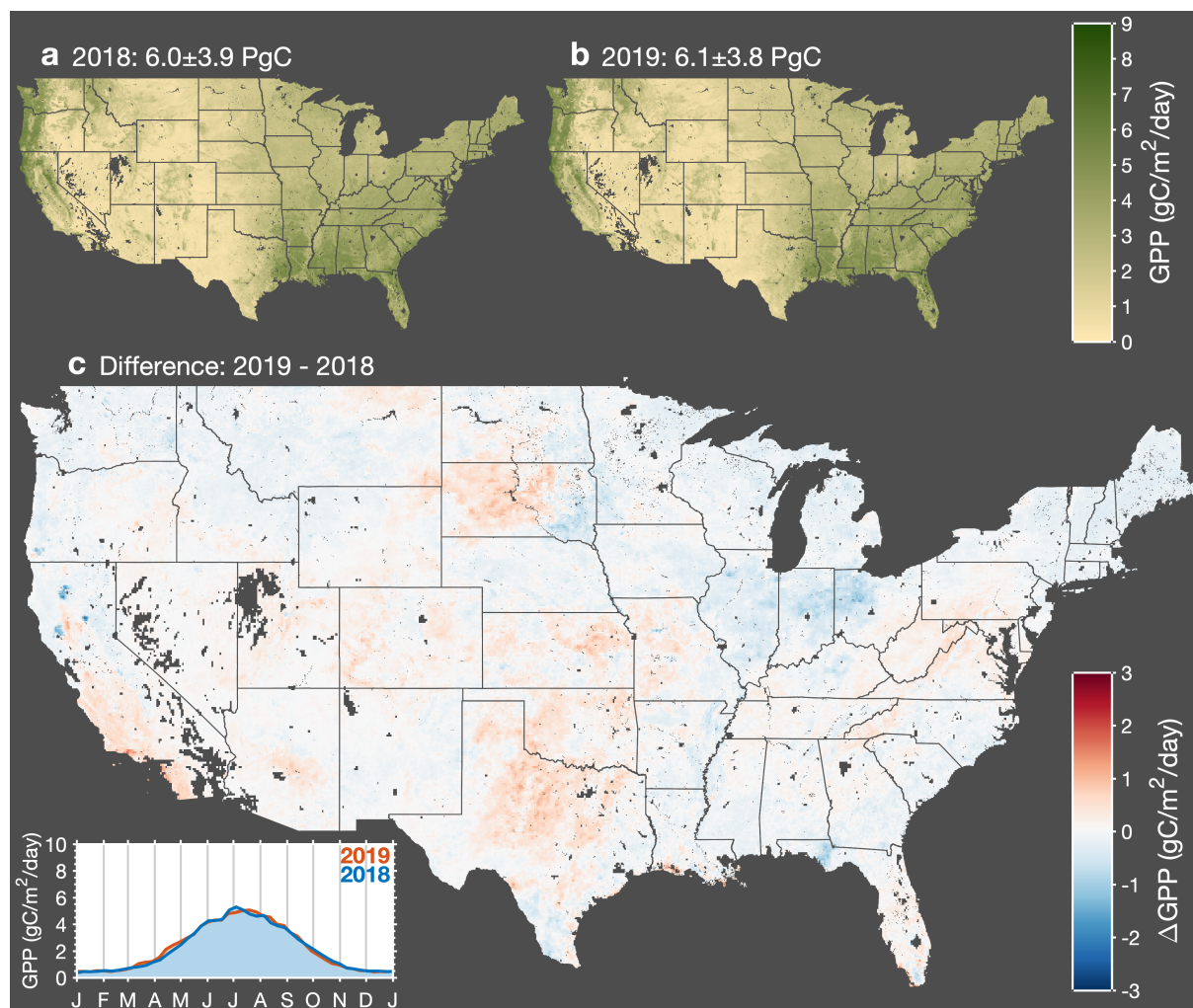


Figure S7: Same as main text Fig 3 but for FLUXCOM.

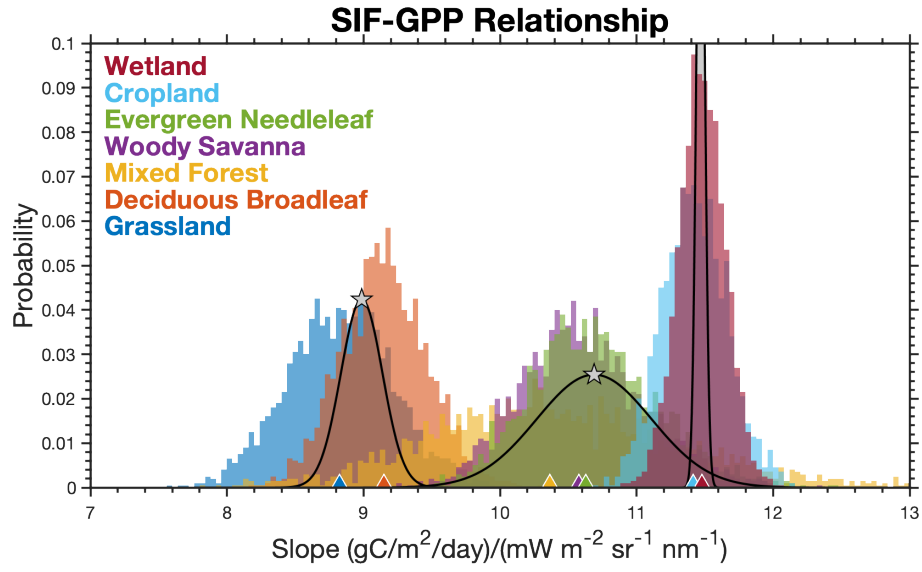


Figure S8: Same as main text Fig 2 but with 3 Gaussians.

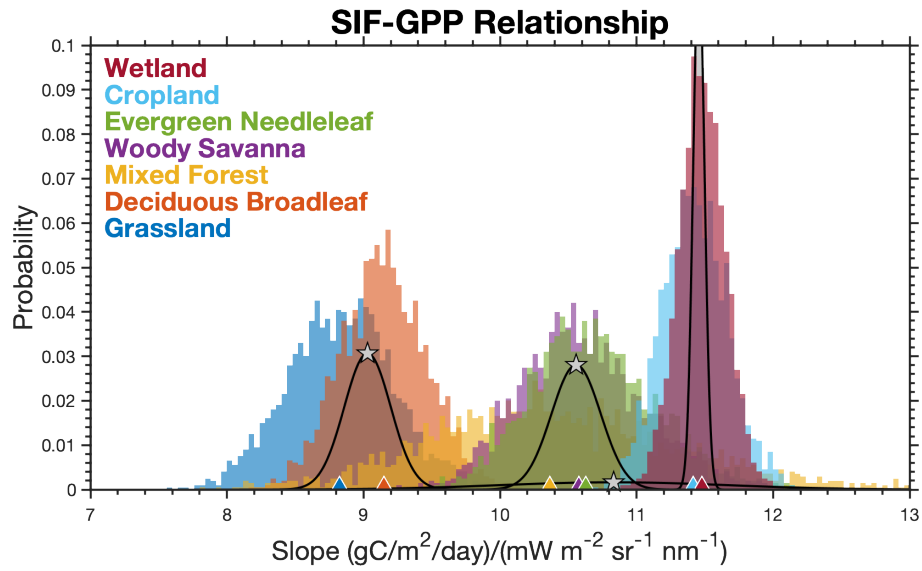


Figure S9: Same as main text Fig 2 but with 4 Gaussians.

Table 1: Eddy covariance sites used in this work.

Station	Code ^a	Lat.	Long.	IGBP Classification
Allequash Creek Site	ALQ	46°N	90°W	Wetland
ARM Southern Great Plains site- Lamont	ARM	37°N	97°W	Cropland
Bangtail Mountain Meadow	BMM	46°N	111°W	Grassland
Bartlett Experimental Forest	Bar	44°N	71°W	Deciduous Broadleaf
Bouldin Island Alfalfa	Bi1	38°N	121°W	Cropland
Bouldin Island corn	Bi2	38°N	122°W	Cropland
CAF-LTAR Cook East	CF1	47°N	117°W	Cropland
CAF-LTAR Cook West	CF2	47°N	117°W	Cropland
CAF-LTAR Boyd North	CF3	47°N	117°W	Cropland
CAF-LTAR Boyd South	CF4	47°N	117°W	Cropland
Charleston Mesquite Woodland	CMW	32°N	110°W	Deciduous Broadleaf
Central Sands Irrigated Agricultural Field	CS1	44°N	90°W	Cropland
Tri county school Pine Forest	CS2	44°N	90°W	Evergreen Needleleaf
Central Sands Irrigated Agricultural Field	CS3	44°N	90°W	Cropland
US Dairy Forage Research Center, Prairie du S	DFC	43°N	90°W	Cropland
Eden Landing Ecological Reserve	EDN	38°N	122°W	Wetland
GLEES	GLE	41°N	106°W	Evergreen Needleleaf
North Inlet Crab Haul Creek	HB1	33°N	79°W	Wetland
Hobcaw Barony Mature Longleaf Pine	HB2	33°N	79°W	Evergreen Needleleaf
Hobcaw Barony Longleaf Pine Restoration	HB3	33°N	79°W	Evergreen Needleleaf
Hubbard Brook Experimental Forest	HBK	44°N	72°W	Deciduous Broadleaf
Hanford 100H grassland	Hn2	47°N	119°W	Grassland
Hanford 100H sagebrush	Hn3	47°N	119°W	Open Shrubland
Howland Forest (main tower)	Ho1	45°N	69°W	Evergreen Needleleaf
WV Jacks Run	JRn	40°N	80°W	Grassland
Jornada Experimental Range Mixed Shrubland	Jo2	33°N	107°W	Open Shrubland
Kansas Field Station	KFS	39°N	95°W	Grassland
KBS Lux Arbor Reserve Corn	KL1	42°N	85°W	Cropland
KBS Lux Arbor Reserve Switchgrass	KL2	42°N	85°W	Cropland
KBS Lux Arbor Reserve Prairie	KL3	42°N	85°W	Cropland
KBS Marshall Farms Corn	KM1	42°N	85°W	Grassland
KBS Marshall Farms Prairie	KM2	42°N	85°W	Grassland
KBS Marshall Farms Switchgrass	KM3	42°N	85°W	Grassland
KBS Marshall Farms Smooth Brome Grass (Ref)	KM4	42°N	85°W	Cropland
Kennedy Space Center (salt marsh)	KS3	29°N	81°W	Wetland
Lost Creek	Los	46°N	90°W	Wetland
Missouri Ozark Site	MOz	39°N	92°W	Deciduous Broadleaf
Metolius mature ponderosa pine	Me2	44°N	122°W	Evergreen Needleleaf
Metolius Young Pine Burn	Me6	44°N	122°W	Evergreen Needleleaf
Lake Mendota, Center for Limnology Site	Men	43°N	89°W	Water
Mountainair Pinyon-Juniper Woodland	Mpj	34°N	106°W	Open Shrubland
Mt Bigelow	MtB	32°N	111°W	Evergreen Needleleaf
Mayberry Wetland	Myb	38°N	122°W	Wetland
NC Loblolly Plantation	NC2	36°N	77°W	Evergreen Needleleaf
NC Clearcut#3	NC3	36°N	77°W	Evergreen Needleleaf
NC AlligatorRiver	NC4	36°N	76°W	Wetland
Niwot Ridge Forest (LTER NWT1)	NR1	40°N	106°W	Evergreen Needleleaf
Florida pine flatwoods	ONA	27°N	82°W	Grassland
RCEW Low Sagebrush	Rls	43°N	117°W	Closed Shrubland
RCEW Mountain Big Sagebrush	Rms	43°N	117°W	Closed Shrubland
Rosemount Prairie	Ro4	45°N	93°W	Grassland
Rosemount I18 South	Ro5	45°N	93°W	Cropland
Rosemount I18 North	Ro6	45°N	93°W	Cropland
RCEW Upper Sheep Prescribed Fire	Rwf	43°N	117°W	Closed Shrubland

^aThree letter codes beginning with an “x” are part of NEON.

Table 1 continued.

Station	Code ^a	Lat.	Long.	IGBP Classification
RCEW Mountain Big Sagebrush	Rms	43°N	117°W	Closed Shrubland
Rosemount Prairie	Ro4	45°N	93°W	Grassland
Rosemount I18 South	Ro5	45°N	93°W	Cropland
Rosemount I18 North	Ro6	45°N	93°W	Cropland
RCEW Upper Sheep Prescribed Fire	Rwf	43°N	117°W	Closed Shrubland
Reynolds Creek Wyoming big sagebrush	Rws	43°N	117°W	Open Shrubland
Santa Rita Grassland	SRG	32°N	111°W	Grassland
Santa Rita Mesquite	SRM	32°N	111°W	Woody Savanna
Santa Rita Experimental Range Mesquite Savann	SRS	32°N	111°W	Woody Savanna
Sevilleta grassland	Seg	34°N	107°W	Grassland
Sevilleta shrubland	Ses	34°N	107°W	Open Shrubland
Sherman Island Restored Wetland	Sne	38°N	122°W	Grassland
Sherman Barn	Snf	38°N	122°W	Grassland
St Jones Reserve	StJ	39°N	75°W	Wetland
Sylvania Wilderness Area	Syv	46°N	89°W	Mixed Forest
Tonzi Ranch	Ton	38°N	121°W	Woody Savanna
Twitchell Wetland West Pond	Tw1	38°N	122°W	Wetland
Twitchell East End Wetland	Tw4	38°N	122°W	Wetland
East Pond Wetland	Tw5	38°N	122°W	Wetland
UMBS Disturbance	UMd	46°N	85°W	Deciduous Broadleaf
Vaira Ranch- Ione	Var	38°N	121°W	Grassland
Valles Caldera Mixed Conifer	Vcm	36°N	107°W	Evergreen Needleleaf
Valles Caldera Ponderosa Pine	Vcp	36°N	107°W	Evergreen Needleleaf
Willow Creek	WCr	46°N	90°W	Deciduous Broadleaf
Walnut Gulch Lucky Hills Shrub	Whs	32°N	110°W	Open Shrubland
Willard Juniper Savannah	Wjs	34°N	106°W	Savanna
Walnut Gulch Kendall Grasslands	Wkg	32°N	110°W	Grassland
NEON Abby Road (ABBY)	xAB	46°N	122°W	Evergreen Needleleaf
NEON Bartlett Experimental Forest (BART)	xBR	44°N	71°W	Deciduous Broadleaf
NEON Central Plains Experimental Range (CPER)	xCP	41°N	105°W	Grassland
NEON Dakota Coteau Field School (DCFS)	xDC	47°N	99°W	Grassland
NEON Dead Lake (DELA)	xDL	33°N	88°W	Mixed Forest
NEON Great Smoky Mountains National Park, Twi	xGR	36°N	84°W	Deciduous Broadleaf
NEON Harvard Forest (HARV)	xHA	43°N	72°W	Deciduous Broadleaf
NEON Jones Ecological Research Center (JERC)	xJE	31°N	84°W	Evergreen Needleleaf
NEON Jornada LTER (JORN)	xJR	33°N	107°W	Open Shrubland
NEON Konza Prairie Biological Station - Reloc	xKA	39°N	97°W	Grassland
NEON Konza Prairie Biological Station (KONZ)	xKZ	39°N	97°W	Grassland
NEON Northern Great Plains Research Laborator	xNG	47°N	101°W	Grassland
NEON Onaqui-Ault (ONAQ)	xNQ	40°N	112°W	Open Shrubland
NEON Rocky Mountain National Park, CASTNET (R	xRM	40°N	106°W	Evergreen Needleleaf
NEON Smithsonian Environmental Research Cente	xSE	39°N	77°W	Deciduous Broadleaf
NEON North Sterling, CO (STER)	xSL	40°N	103°W	Cropland
NEON Soaproot Saddle (SOAP)	xSP	37°N	119°W	Evergreen Needleleaf
NEON Santa Rita Experimental Range (SRER)	xSR	32°N	111°W	Open Shrubland
NEON Steigerwaldt Land Services (STEI)	xST	46°N	90°W	Deciduous Broadleaf
NEON Lower Teakettle (TEAK)	xTE	37°N	119°W	Evergreen Needleleaf
NEON Treehaven (TREE)	xTR	45°N	90°W	Deciduous Broadleaf
NEON The University of Kansas Field Station (xUK	39°N	95°W	Deciduous Broadleaf
NEON University of Notre Dame Environmental R	xUN	46°N	90°W	Mixed Forest
NEON Woodworth (WOOD)	xWD	47°N	99°W	Grassland
NEON Wind River Experimental Forest (WREF)	xWR	46°N	122°W	Evergreen Needleleaf
NEON Yellowstone Northern Range (Frog Rock) (xYE	45°N	111°W	Evergreen Needleleaf

^aThree letter codes beginning with an “x” are part of NEON.

Table 2: Ecosystem weighting with 2 Gaussians.

Ecosystem	Gaussian 1 (9.06 ± 0.21)	Gaussian 2 (11.03 ± 0.34)
CRO	0.00	1.00
WET	0.00	1.00
WSA	0.03	0.97
MF	0.18	0.82
GRA	0.99	0.01
DBF	0.96	0.04
ENF	0.01	0.99

Table 3: Ecosystem weighting with 3 Gaussians.

Ecosystem	Gaussian 1 (8.99 ± 0.15)	Gaussian 2 (11.47 ± 0.03)	Gaussian 3 (10.69 ± 0.42)
CRO	0.00	0.34	0.66
WET	0.00	0.41	0.59
WSA	0.01	0.04	0.95
MF	0.13	0.06	0.81
GRA	0.91	0.00	0.09
DBF	0.83	0.00	0.17
ENF	0.01	0.05	0.94

Table 4: Ecosystem weighting with 4 Gaussians.

Ecosystem	Gaussian 1 (9.03 ± 0.17)	Gaussian 2 (11.46 ± 0.04)	Gaussian 3 (10.56 ± 0.18)	Gaussian 4 (10.83 ± 0.84)
CRO	0.00	0.62	0.17	0.21
WET	0.00	0.69	0.11	0.19
WSA	0.02	0.09	0.66	0.23
MF	0.20	0.12	0.48	0.21
GRA	0.95	0.00	0.01	0.04
DBF	0.91	0.00	0.03	0.06
ENF	0.01	0.11	0.65	0.23