

Article Supplementary information

Table S1

Combination of Parameterization Schemes for Four Physical Processes.

Scheme	RAD	BTR	TUB	RUN	Scheme	RAD	BTR	TUB	RUN
S01	1	1	1	1	S25	2	1	1	1
S02	1	1	1	2	S26	2	1	1	2
S03	1	1	1	3	S27	2	1	1	3
S04	1	1	1	4	S28	2	1	1	4
S05	1	1	2	1	S29	2	1	2	1
S06	1	1	2	2	S30	2	1	2	2
S07	1	1	2	3	S31	2	1	2	3
S08	1	1	2	4	S32	2	1	2	4
S09	1	2	1	1	S33	2	2	1	1
S10	1	2	1	2	S34	2	2	1	2
S11	1	2	1	3	S35	2	2	1	3
S12	1	2	1	4	S36	2	2	1	4
S13	1	2	2	1	S37	2	2	2	1
S14	1	2	2	2	S38	2	2	2	2
S15	1	2	2	3	S39	2	2	2	3
S16	1	2	2	4	S40	2	2	2	4
S17	1	3	1	1	S41	2	3	1	1
S18	1	3	1	2	S42	2	3	1	2
S19	1	3	1	3	S43	2	3	1	3
S20	1	3	1	4	S44	2	3	1	4
S21	1	3	2	1	S45	2	3	2	1
S22	1	3	2	2	S46	2	3	2	2
S23	1	3	2	3	S47	2	3	2	3
S24	1	3	2	4	S48	2	3	2	4

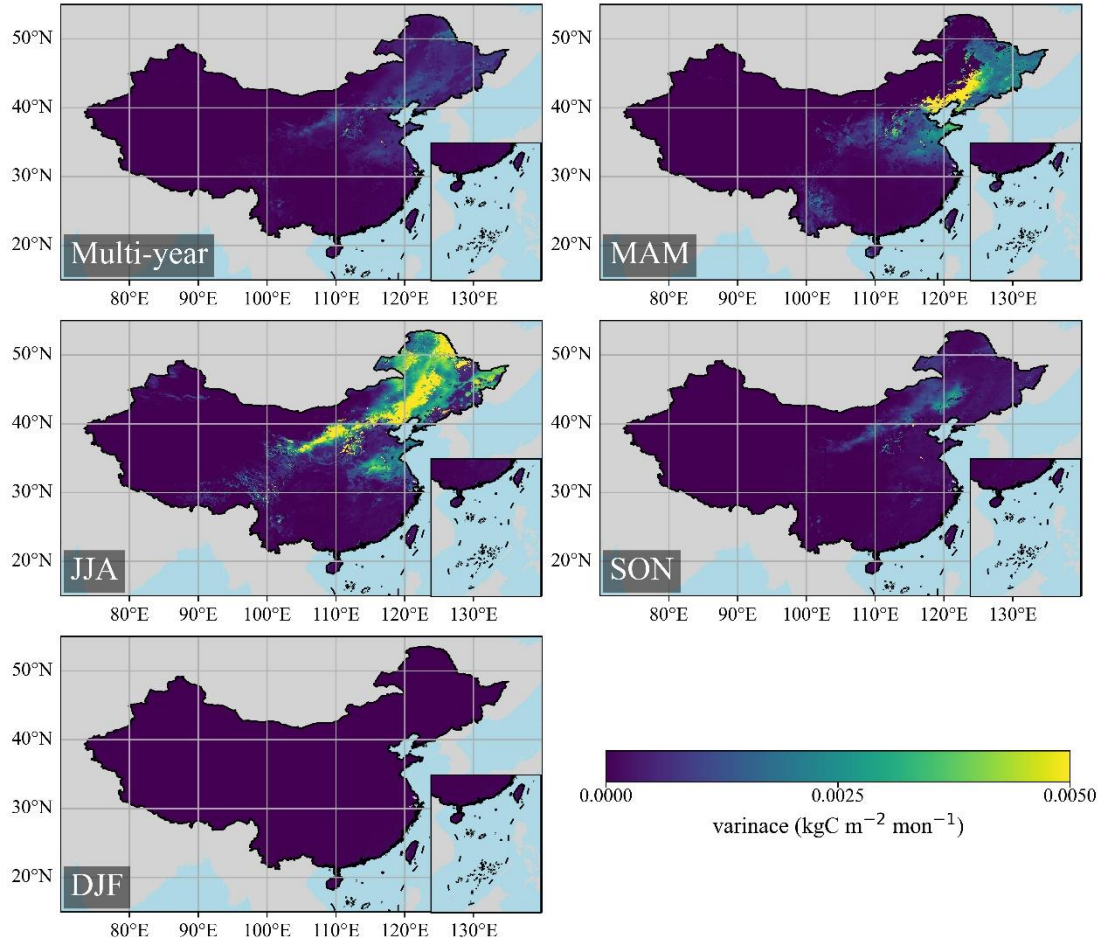


Figure S1. Multi-ensemble variance of GPP for the multi-year average and four seasons.

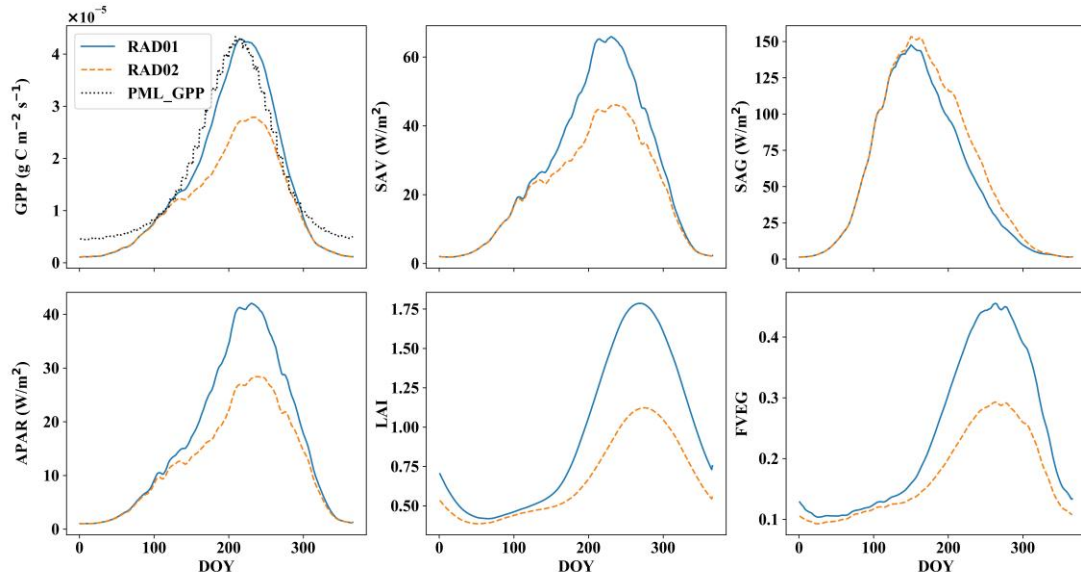


Figure S2. Interannual variations of (a) Gross primary production (GPP), (b) vegetation-absorbed solar radiation (SAV), (c) ground-absorbed solar radiation (SAG), (d) absorbed photosynthetically active radiation (APAR), (e) leaf area index (LAI), and (f) fraction of vegetated area (FVEG) under different RAD parameterization schemes in the Tibetan Plateau and northeastern Inner Mongolia.

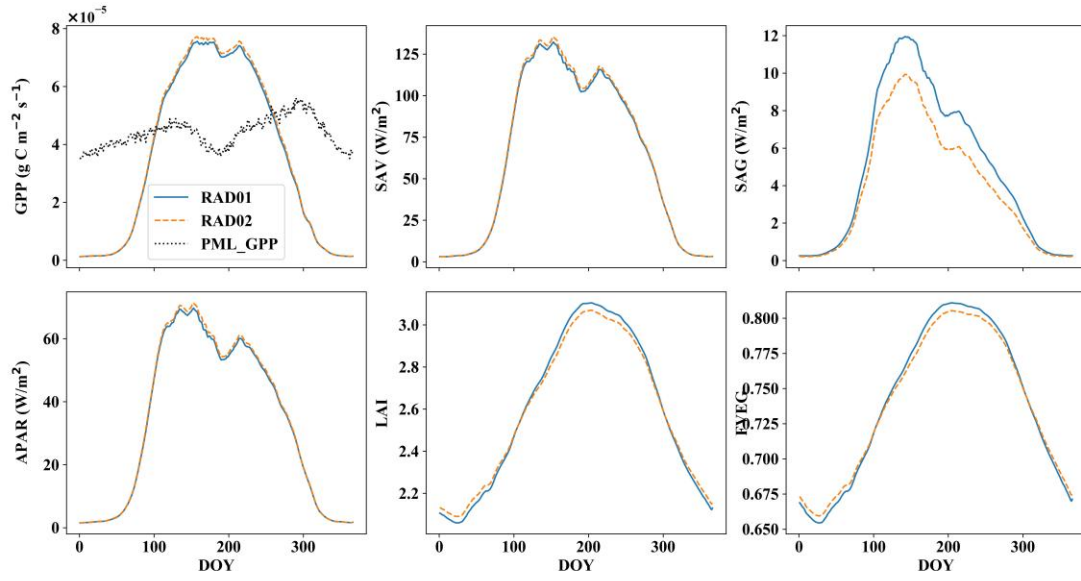


Figure S3. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in ENF ecosystems.

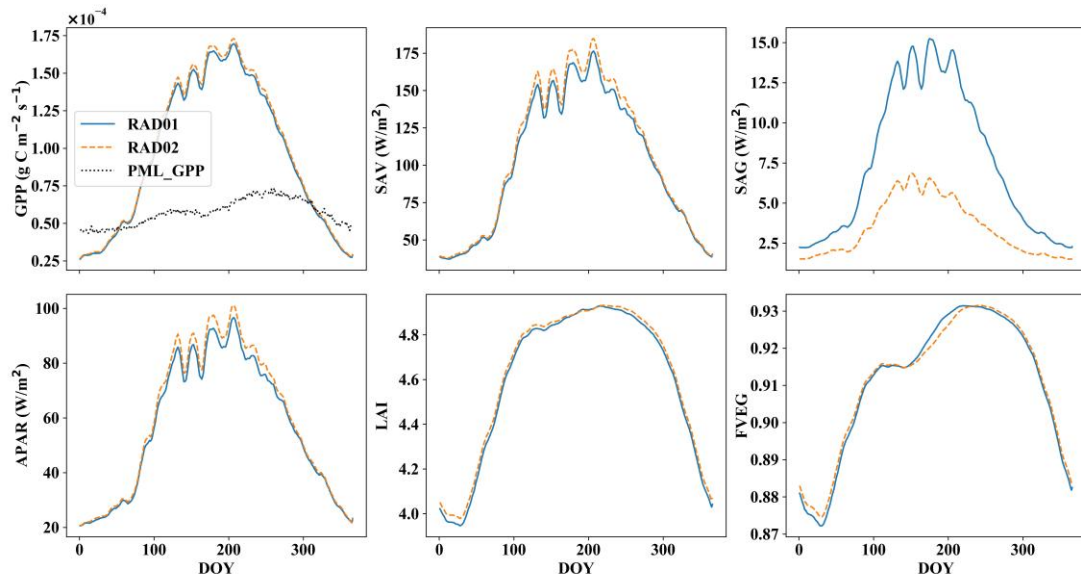


Figure S4. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in EBF ecosystems.

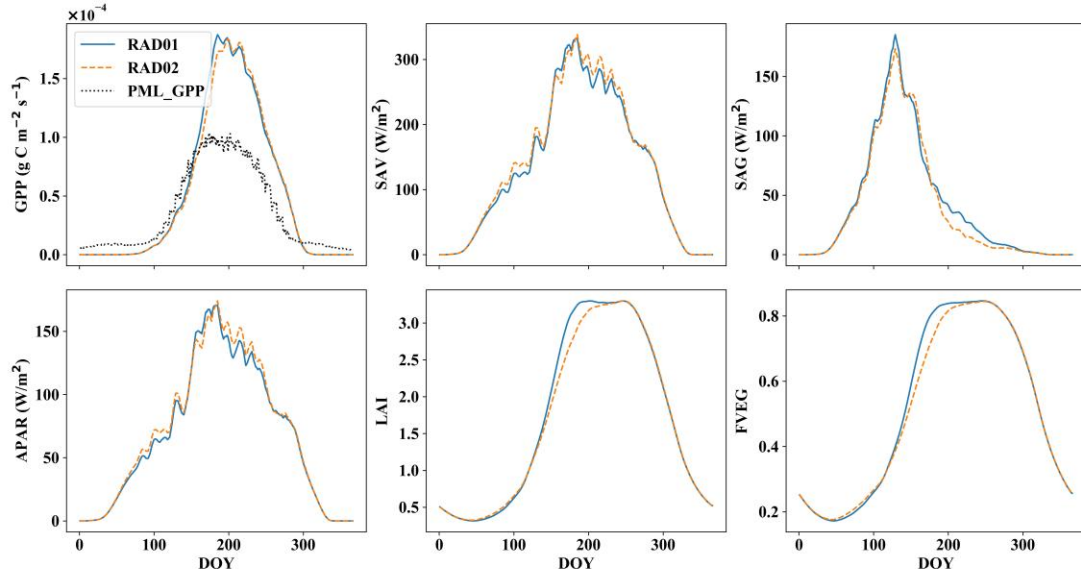


Figure S5. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in DNF ecosystems.

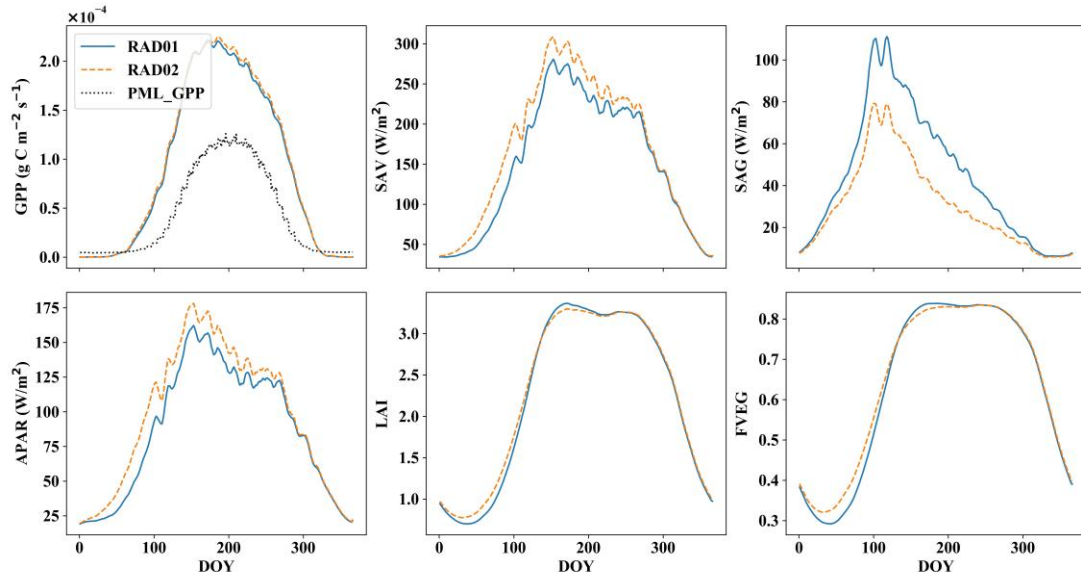


Figure S6. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in DBF ecosystems.

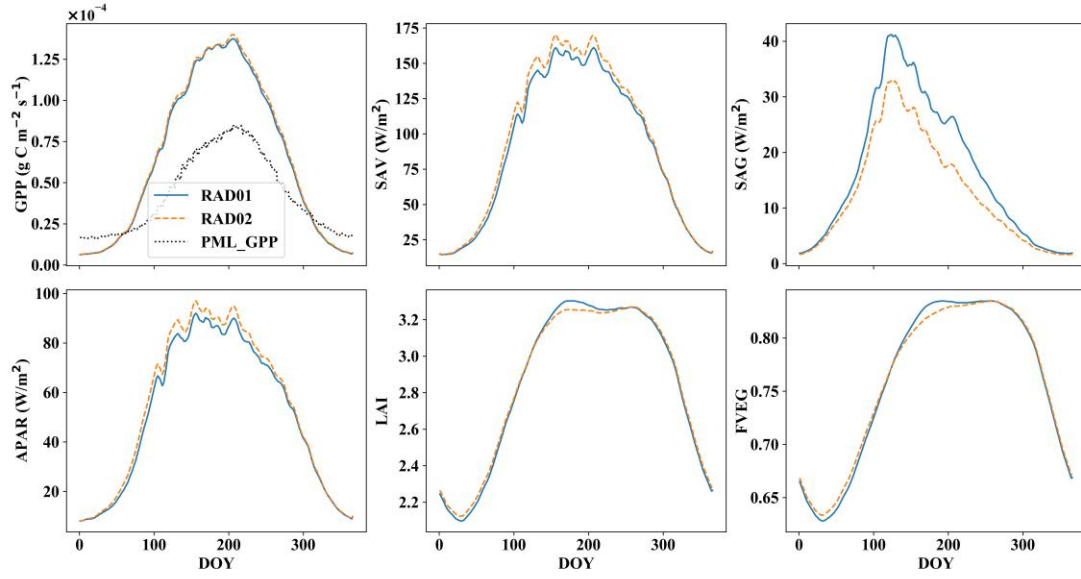


Figure S7. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in MF ecosystems.

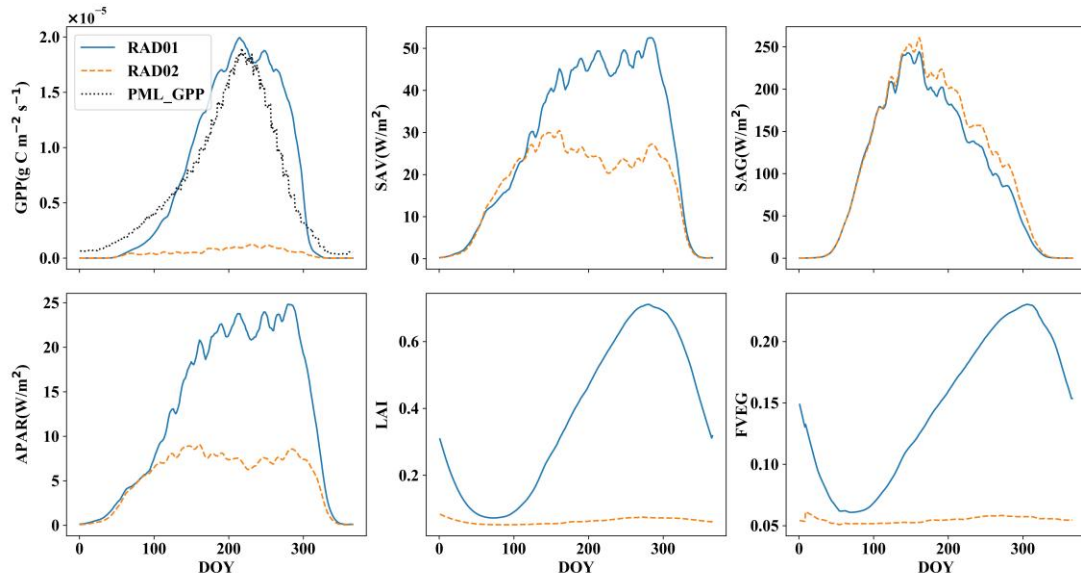


Figure S8. Same as Figure S2, showing interannual variations of (a) GPP, (b) SAV, (c) SAG, (d) APAR, (e) LAI, and (f) FVEG under different RAD parameterization schemes in shrubland ecosystems.

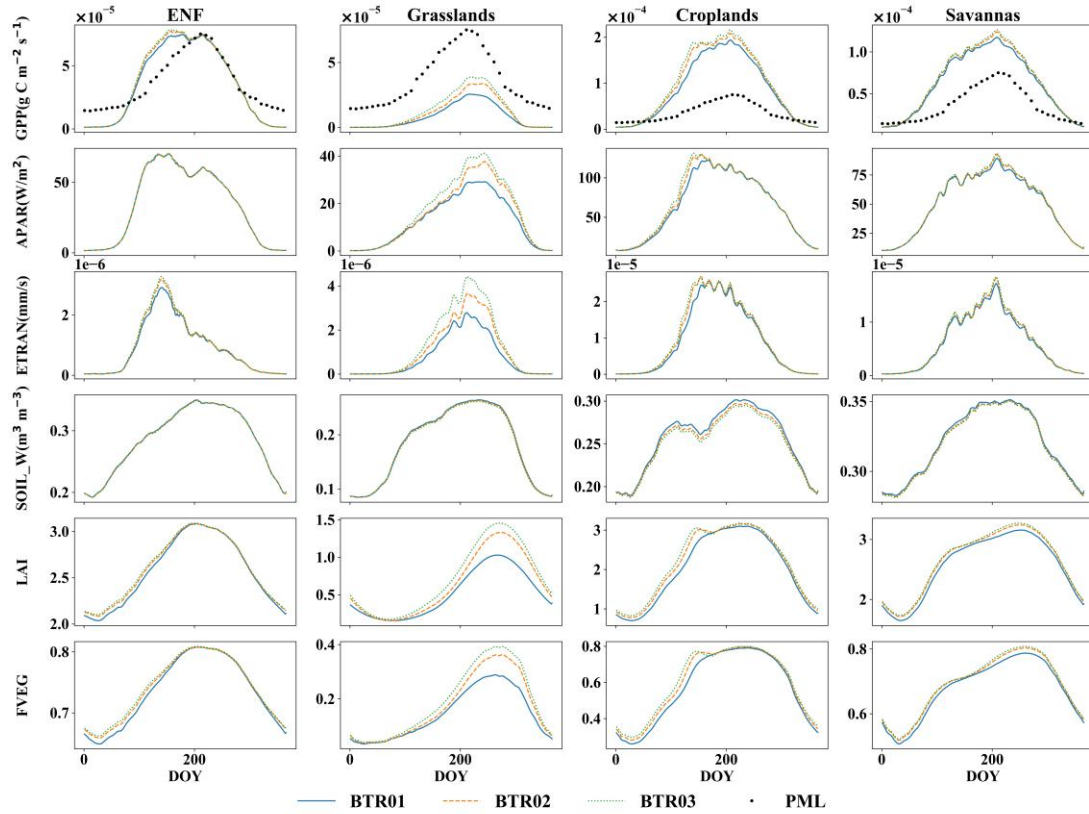


Figure S9. (a) Gross primary production (GPP), (b) absorbed photosynthetically active radiation (APAR), (c) transpiration rate (ETRAN), (d) liquid volumetric soil moisture (SOIL_W), (e) leaf area index (LAI), and (f) fraction of vegetated area (FVEG) under different BTR parameterization schemes in ENF, Croplands, Savannas, Shrublands ecosystems.

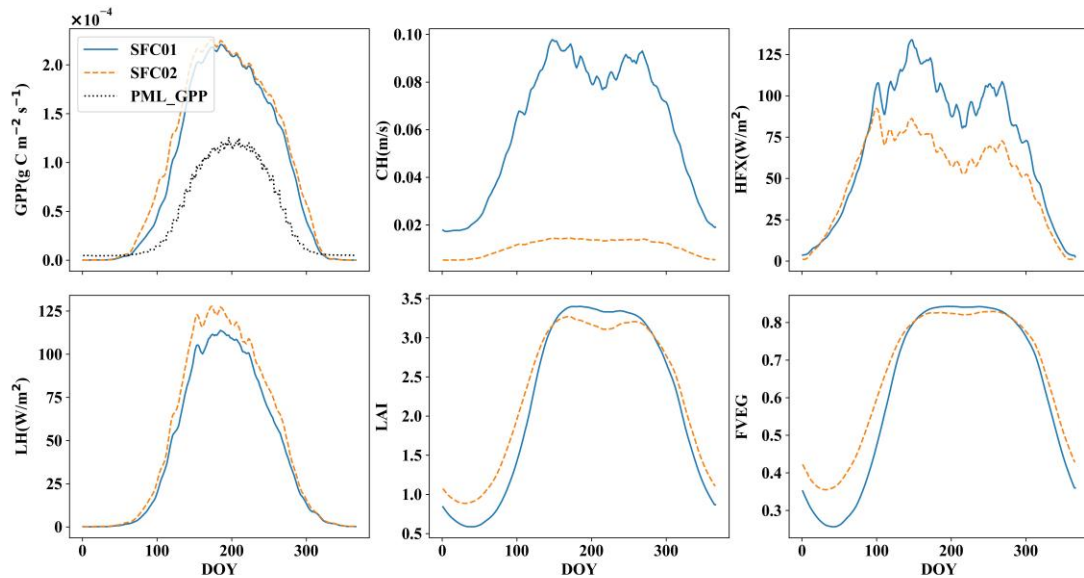


Figure S10. (a) Gross primary production (GPP), (b) sensible heat exchange coefficient (CH), (c) sensible heat flux (HFX), (d) latent heat flux (LH), (e) leaf area index (LAI), and (f) fraction of vegetated area (FVEG) under different SFC parameterization schemes in DBF ecosystems.

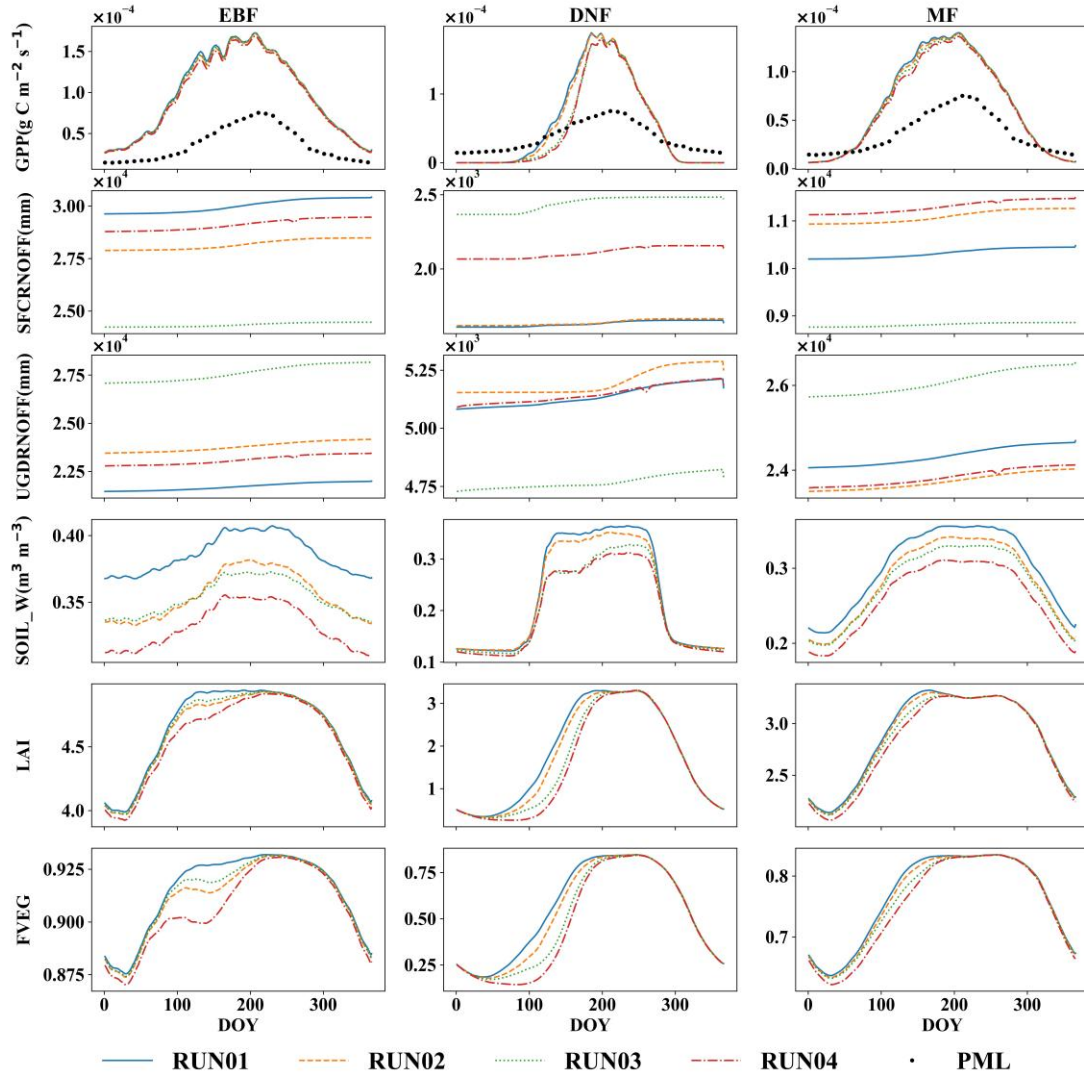


Figure S11. (a) Gross primary production (GPP), (b) accumulated surface runoff (SFCRNOFF), (c) accumulated underground runoff (UGDRNOFF), (d) liquid volumetric soil moisture (SOIL_W), (e) leaf area index (LAI), and (f) fraction of vegetated area (FVEG) under different RUN parameterization schemes in EBF, DNF, MF ecosystems.

Table S2

The average performance (measured by TSS) of GPP simulations using different parameterization schemes for the four physical processes across various vegetation types.

Process	Scheme	ENF	EBF	DNF	DBF	MF	Grasslands	Croplands	Savannas	Shrublands
RAD	1	0.15	0.12	0.66	0.67	0.64	0.96	0.74	0.70	0.80
	2	0.14	0.12	0.66	0.65	0.63	0.91	0.73	0.71	0.26
BTR	1	0.15	0.12	0.69	0.69	0.65	0.91	0.78	0.73	0.93
	2	0.14	0.12	0.66	0.65	0.64	0.96	0.72	0.70	0.77
	3	0.14	0.12	0.63	0.64	0.63	0.95	0.70	0.69	0.85
SFC	1	0.15	0.12	0.67	0.67	0.65	0.97	0.74	0.69	0.89
	2	0.14	0.12	0.66	0.65	0.63	0.95	0.73	0.72	0.79

RUN	1	0.14	0.12	0.64	0.64	0.62	0.97	0.69	0.69	0.90
	2	0.14	0.12	0.64	0.65	0.63	0.97	0.74	0.70	0.84
	3	0.14	0.12	0.67	0.66	0.64	0.97	0.73	0.71	0.86
	4	0.15	0.13	0.68	0.69	0.66	0.94	0.78	0.73	0.78

Table S3

As in Table 4, but measured by R^2 .

Process	Scheme	ENF	EBF	DNF	DBF	MF	Grasslands	Croplands	Savannas	Shrublands
RAD	1	0.02	0.36	0.87	0.93	0.93	0.91	0.83	0.89	0.65
	2	0.02	0.36	0.83	0.93	0.93	0.84	0.84	0.87	0.11
BTR	1	0.02	0.35	0.91	0.94	0.93	0.90	0.85	0.88	0.83
	2	0.02	0.36	0.79	0.93	0.93	0.85	0.83	0.88	0.38
	3	0.02	0.36	0.83	0.91	0.92	0.89	0.82	0.88	0.48
SFC	1	0.02	0.35	0.83	0.95	0.93	0.90	0.84	0.90	0.63
	2	0.02	0.36	0.87	0.91	0.92	0.87	0.83	0.87	0.56
RUN	1	0.02	0.35	0.89	0.92	0.92	0.91	0.82	0.88	0.64
	2	0.02	0.36	0.87	0.92	0.92	0.88	0.84	0.89	0.59
	3	0.02	0.35	0.80	0.93	0.93	0.88	0.83	0.88	0.61
	4	0.02	0.36	0.80	0.94	0.93	0.85	0.85	0.89	0.55