1 Supplementary information
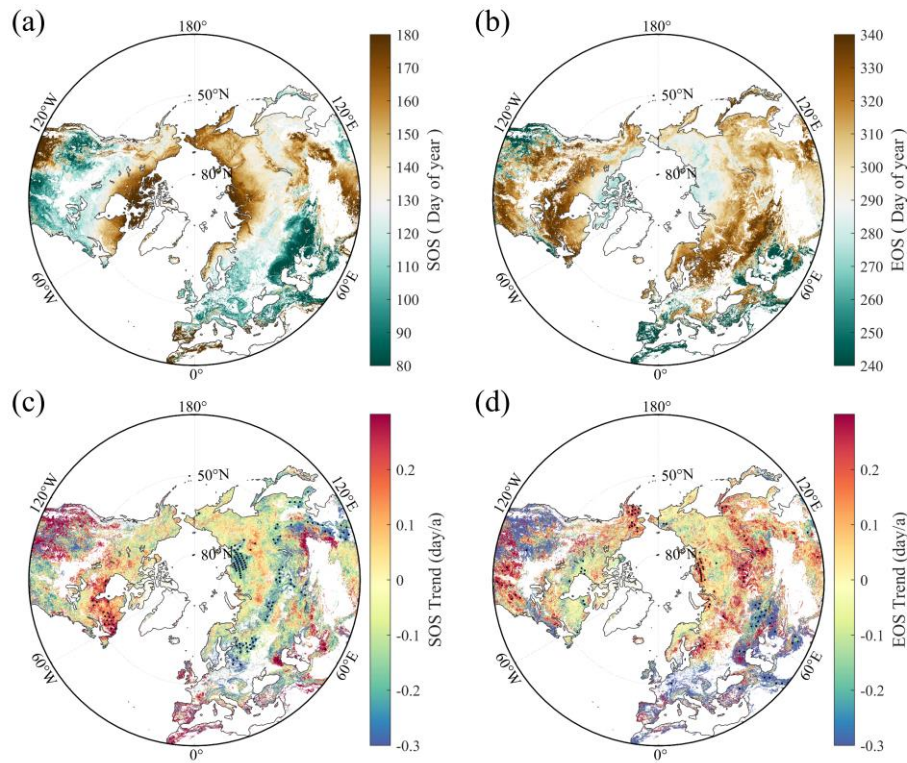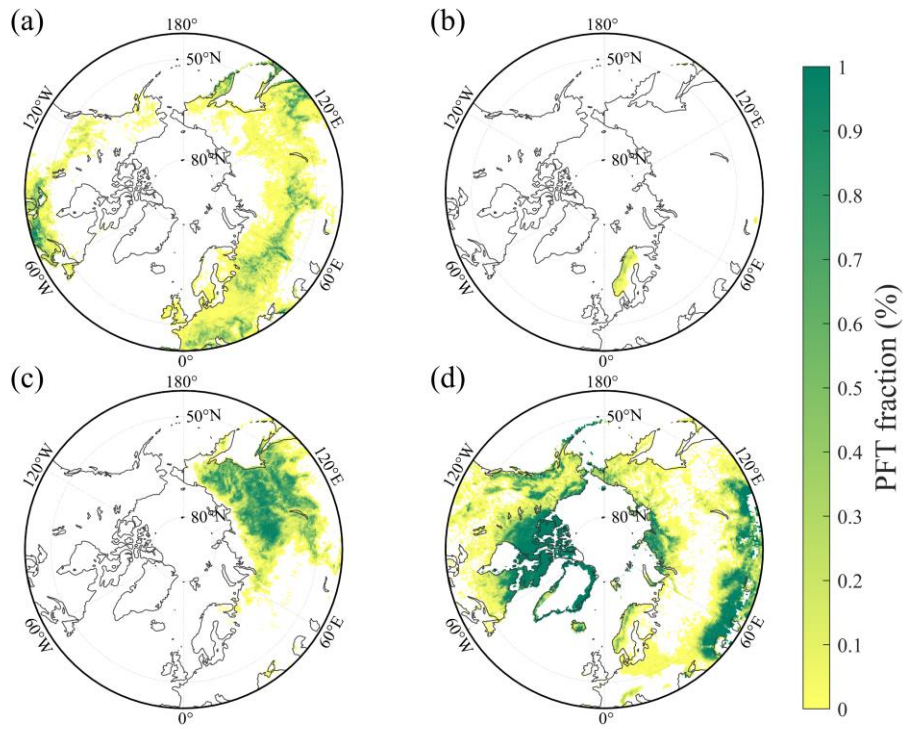
2 Figure S1 vegetation phenology based on remote sensing. (a) Spring phenology, (b)
3 autumn phenology, (c) the change trend of spring phenology (SOS), and (d) the change
4 trend of autumn phenology. The dots represent regions with significant change trend.
5

6   **Figure S2 Plant function type fraction at 0.5° spatial resolution.** (a) IBS, (b)
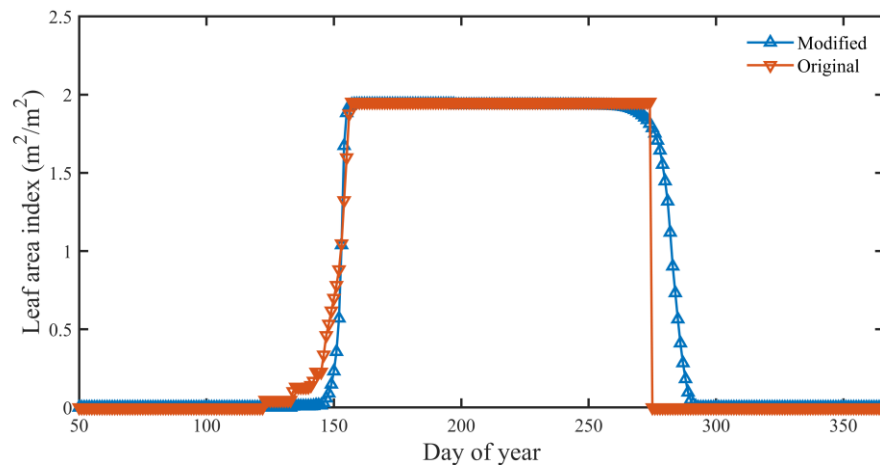
7   TeBS, (c) BNS and (d) Shrubs.

8

Figure S3 Potential nature plant distribution simulated by LPJ-GUESS during

1979-2015. (a) Simulation with original phenological module, (b) simulation with

modified phenological module.
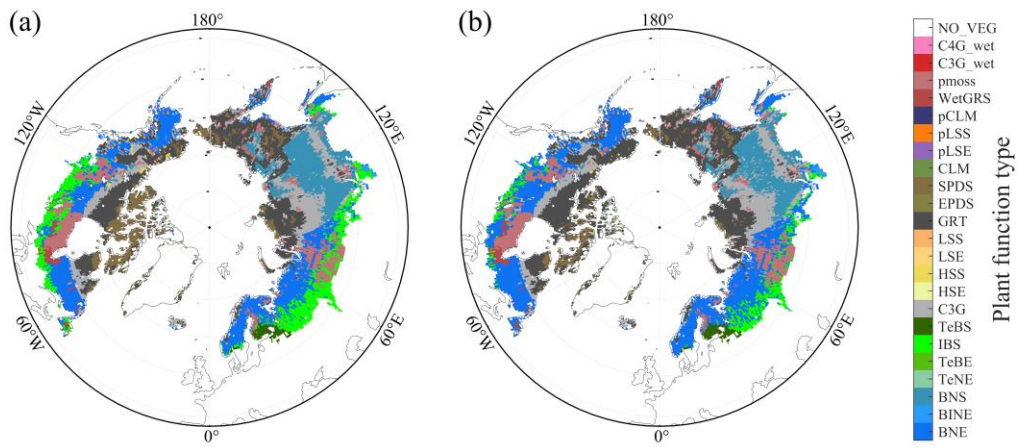
13 **Figure S4 Daily leaf area index simulation performance of LPJ-GUESS model**
14 **using original and modified phenological module.**

15
16

Figure S5 Frequency distributions of Spring (March to May) and Autumn (August
to November) gross primary productivity (GPP) of LPJ-GUESS simulation and
VPM product. (a-c) Spring GPP for BNS, IBS&TeBS and Shrubs dominant regions.
(d-f) Autumn GPP for BNS, IBS&TeBS and Shrubs dominant regions.
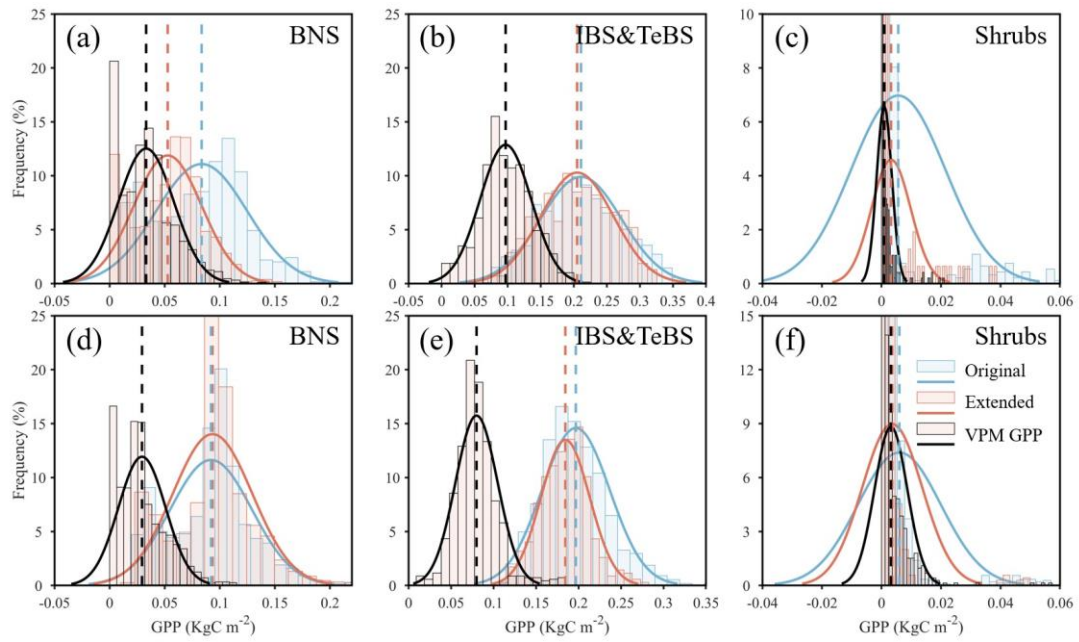
TableS1 DROMPHOT model parameters.

Plant function type	DLcrit	Dcrit	Ccrit	Fcrit	aD	bD	aC	cC	dF	gT	hDL
BNS	13.38	37.03	147.45	14.38	0.02	-11.84	-0.18	14.43	-0.28	7.86	17.57
IBS&TeBS	17.37	49.57	133.08	27.78	-0.05	-7.00	-0.11	10.62	-0.40	19.53	16.45
Shrubs	10.74	90.11	107.31	21.20	0.31	10.71	-0.36	-6.12	-0.26	17.38	16.40

TableS2 DM model parameters.

Plant function type	Tb	Pstart	Ycrit	x	y	porn
BNS	22.21	22.24	5365.79	2.15	3.09	0
IBS&TeBS	39.12	16.42	8015.66	1.29	0.53	1
Shrubs	13.20	19.76	1380.31	1.59	1.03	0