

Supplement

Table S1. The used average values of soil texture and hydraulic properties at different depths

Soil depth (cm)	Clay (%)	Sand (%)	K_s (10^{-6} m s^{-1})	θ_s ($\text{cm}^3 \text{ cm}^{-3}$)	VG model		
					θ_r ($\text{cm}^3 \text{ cm}^{-3}$)	α (m^{-1})	n
5-10	10.00	27.00	1.05	0.55	0.050	0.015	1.35
10-40	8.00	28.00	1.94	0.55	0.050	0.008	1.45
40-80	8.00	47.00	5.61	0.50	0.052	0.008	1.50

Note: VG, Van Genuchten (Van Genuchten, 1980)

5 Table S2. The used vegetation parameters for a Tibetan meadow ecosystem

Parameter	Symbol	Unit	Value
Root depth that contains 95% of fine root biomass	$Z_{R,95}$	m	0.3
Water use efficiency parameter, which connects the stomatal aperture and net assimilation	a_1	-	5
Specific leaf area	S_{LAI}	$\text{m}^2 \text{ LAI g C}^{-1}$	0.0225
Maximum rubisco capacity	V_{\max}	-	60
Temperature for leaf onset	T_{10}	$^{\circ}\text{C}$	0.2
Daylight threshold for senescence	$L_{\text{day_cr}}$	h	11.4
Cold control on leaf shedding	T_{cold}	$^{\circ}\text{C}$	0
Water potential at 2% loss stomatal conductivity	$\psi_{S,00}$	MPa	0
Water potential at 50% loss stomatal conductivity	$\psi_{S,50}$	MPa	-2.8
Critical leaf age	A_{cr}	d	180
Leaf onset water stress	β_R	-	0.99

Table S3. A short summary of annual average GPP and NEE of grassland over the Tibetan Plateau, with records of mean annual temperature (MAT) and precipitation (APT)

Site	Location	Elevation (m)	Type	MAT (°C)	APT (mm)	GPP (gC m ⁻² yr ⁻¹)	NEE (gC m ⁻² yr ⁻¹)	Reference
Arou	38°3'N, 100°27'36"E	3033	grassland	0.6	464.1	818.3	-198.7	Sun et al. 2019
Damxung ^a	30°28'08.50" N, 91°03'44.50"E	4286	swamp meadow	-	-	755-935	-	Bai et al. 2011
Damxung ^a	30°28'08.50" N, 91°03'44.50"E	4286	swamp meadow	1.8	475.6	835.29 (755.02-901.37)	-	Niu et al. 2016
Damxung ^a	30°28'08.50" N, 91°03'44.50"E	4286	swamp meadow	1.3	335	-	-161.85	Niu et al. 2017
Haibei ^a	38°37'N, 101°18'E	3250	shrub meadow	-1	566	634 (575-681)	-121(-193 ~ -79)	Kato et al. 2006
Haibei ^a	37°35'N, 101°20'E	3250	alpine wetland meadow	-1.1	510.367	629.87 (575.7-682.9)	106.1 (44-173.2)	Zhao et al. 2010
Lijiang	27°100' N, 100°140' E	3560	alpine meadow	6.1	1180	600 (522-669)	-161 (-213 ~ -114)	Wang et al. 2017
Zoige ^a	33°56' N, 102°52' E	3430	swamp meadow	-	-	589.8-672.1	-	Tian et al. 2003
Zoige ^a	33°56' N, 102°52' E	3430	swamp meadow	1.1	650	-	-79.7~-47.1	Hao et al., 2011
10 sites	-	3033-4730	alpine grassland	-	-	300-400	-	He et al. 2014

Note: ^a indicates same site with different years