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Supporting Information for

[Informing the SWAT model with remote sensing detected vegetation phenology for improved modeling of ecohydrological processes]

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Contents of this file

Introduction

The supporting information include 3 tables.

The Table S1-S3 are the parameters of LAI calibration, sensitivity analysis and runoff calibration process.

Table S1. Summary of the LAI-related parameters for each land cover type that control vegetation growth, and the LAI with initial and calibrated values.

Parameter	Definition (unit)	Calibration values (initial values)		
		FRST	ORCD	AGRL
ALAI_MIN	Minimum leaf area index (m2/m2)	0.643 (0.750)	0.861(0.750)	0.895(0.000)
BLAI	Maximum potential leaf area index (m2/m2)	6.3(5.00)	4.49(4.00)	7.27(3.00)
DLAI	Fraction of PHU when LAI beings to decline	0.818(0.99)	0.77(0.99)	0.937(0.64)
FRGRW1	Fraction of PHU corresponding to the 1st point on the leaf area development curve	0.021(0.05)	0.012(0.10)	0.282(0.150)
FRGRW2	Fraction of PHU corresponding to the 2nd point on the leaf area development curve	0.727(0.40)	0.091(0.50)	0.479(0.50)
LAIMX1	Fraction of BLAI corresponding to the 1st point on the optimal leaf area development curve	0.279(0.05)	0.017(0.15)	0.278(0.05)
LAIMX2	Fraction of BLAI corresponding to the 2nd point on the optimal leaf area development curve	0.708(0.95)	0.923(0.75)	0.895(0.95)
T_BASE	Minimum temperature for plant growth (℃)	2.41(10.00)	0.77(7.00)	2.62(11.00)
PHU_PLT[1]	Total number of heat units or growing degree days needed to bring plant to maturity	dynamic	dynamic	dynamic

FRST: forests, ORCD: orchards, AGRL, farmland. [1]PHU_PLT: obtained by the dynamic accumulated heat unit module calculation.

Table S2. Global sensitivity analysis of the default and modified SWAT models. Sensitivity is indicated by a high t-statistic value (in absolute terms) and a low p-value. Parameters are listed from high to low sensitivity in relation to the modified SWAT model.

Parameter	Definition (unit)	Scaling type[1]	Default SWAT model		Modified SWAT model	
			t-statistic	p-value	t-statistic	p-value
ALPHA_BF	Baseflow alpha factor (days)	v	27.70	0.00	33.78	0.00
CN2	Initial SCS runoff curve number for moisture condition II	R	3.04	0.00	25.18	0.00
GW_DELAY	Groundwater delay time (days)	v	5.36	0.00	5.92	0.00
CH_K2	Effective hydraulic conductivity in main channel alluvium (mm/hr)	v	-5.98	0.00	-6.22	0.00
SLSUBBSN	Average slope length (m)	R	1.79	0.07	2.12	0.03
CH_N2	Manning's "n" value for the main channel	v	-5.51	0.00	-3.80	0.00
CANMX	Maximum canopy storage	v	-3.20	0.00	-2.47	0.01
REVAPMN	Threshold depth of water in the shallow aquifer for "revap" to occur (mm)	V	2.73	0.00	2.43	0.02
SOL_AWC ()	Available water capacity of the soil layer (mm H2O/mm soil)	R	-1.36	0.17	1.33	0.18
TLAPS	Temperature lapse rate (°C/km)	V	0.37	0.71	1.50	0.13
SMFMN	Melt factor for snow on December 21 (mm H2O/°C-day)	V	3.52	0.00	1.76	0.08
SOL_Z ()	Depth from soil surface to bottom of layer (mm)	R	1.36	0.17	2.23	0.03
SMTMP	Snow melt base temperature (°C)	V	-0.88	0.38	-1.52	0.13
SURLAG	Surface runoff lag coefficient	V	0.39	0.70	1.04	0.30
BIOMIX	Biological mixing efficie	R	0.41	0.68	0.75	0.45
SOL_K ()	Saturated hydraulic conductivity (mm/hr)	R	-0.39	0.70	0.10	0.92
ESCO	Soil evaporation compensation factor	V	0.72	0.47	1.25	0.21
GWQMN	Threshold depth of water in the shallow aquifer required for return flow to occur (mmm H20)	V	8.02	0.000	-2.97	0.00
SFTMP	Snowfall temperature (°C)	V	-0.37	0.71	-0.13	0.90
TIMP	Snow pack temperature lag factor (°C)	V	-0.70	0.49	-0.68	0.50
EPCO	Plant uptake compensation factor	V	-0.94	0.35	-0.59	0.55
SMFMX	Melt factor for snow on June 21 (mm H2O/°C-day)	V	0.47	0.64	0.52	0.60
SOL_ALB ()	Moist soil albedo	R	0.45	0.65	0.59	0.56
GW_REVAP	Groundwater "revap" coefficient	V	1.65	0.10	-0.56	0.57

[1]Scaling type: v (absolute) indicates that the parameter is replaced by the given value, R(relative) indicates that the parameter is multiplied by [1 + (given value)].

Table S3. Summary of the SWAT parameters that control vegetation growth and LAI with default and calibrated values.

Parameter	Definition (unit)	Scaling type[1]	Range	Default model	Modified model
ALPHA_BF	Baseflow recession constant (day)	replace	0 - 1	0.38	0.35
CANMX	Maximum canopy storage	replace	0 - 100	18.34	23.42
CH_K2	Effective hydraulic conductivity in main channel alluvium (mm/hr)	replace	-0.01 - 500	68.54	52.73
CN2	Initial SCS runoff curve number for moisture condition II	relative	-0.3 – 0.3	-0.002	0.21
GW_DELAY	Groundwater delay time (days)	replace	0 - 500	331.01	327.48
GW_REVAP	Groundwater "revap" coefficient	replace	0.02 - 0.2	0.12	0.17
GWQMN	Threshold depth of water in the shallow aquifer required for return flow to occur (mmm H_20)	replace	0 - 5000	3296.93	4551.50
SLSUBBSN	Average slope length (m)	relative	-1 - 1	-0.92	-0.46
SMFMN	Melt factor for snow on December 21 (mm H_2O/°C-day)	replace	0 - 20	14.45	16.01
CH_N2	Manning's "n" value for the main channel	replace	-0.01 - 0.3	0.02	0.04
REVAPMN	Threshold depth of water in the shallow aquifer for "revap" to occur (mm)	replace	0 - 500	28.38	315.27
TLAPS	Temperature lapse rate (°C/km)	replace	-10 - 10	6.72	4.46

[1]Scaling type: v (absolute) indicates that the parameter is replaced by the given value, r (relative) indicates that the parameter is multiplied by [1 + (given value)].