

Supplementary

The input data of the above three models includes leaf area index (LAI), net radiation (Rn), air temperature (Ta), precipitation (P), air pressure (Pa), relative humidity (RH), and land cover (LC) (Supplementary Table S1). To investigate the influences of vegetation and meteorological variables on ET estimations, three sets of LAI data and two sets of meteorological data were used in this study. A total of 18 ensembles evapotranspiration (ET) products are obtained from the three ET models with different combinations of inputs data (Supplementary Table S2).

Supplementary Table S1. Variables used as input to derive evapotranspiration (ET) in three models.

* '√' represents the forcing data used in the model.

Models	Leaf Area	Meteorological variables					Land Cover
	Index	Ta	P	Pa	RH	Rn	
SiTH	√	√	√	√		√	√
MOD16	√	√		√	√	√	√
PT-JPL	√	√		√	√	√	√

Supplementary Table S2. Details of the input datasets combinations for each ensemble members.

Models	Ensemble	Meteorological datasets		Leaf Area Index datasets			period
	No.	ERA5	MERRA2	GLOBMAP	GLASS	GIMMS	
SiTH	e1	√		√			1982-2017
	e2	√			√		1982-2015
	e3	√				√	1982-2011
	e4			√	√		1982-2017
	e5			√		√	1982-2015
	e6			√			√
MOD16	e7	√		√			1982-2017

	e8	√		√	1982-2015
	e9	√			√ 1982-2011
	e10		√	√	1982-2017
	e11		√		√ 1982-2015
	e12		√		√ 1982-2011
	e13	√		√	1982-2017
	e14	√			√ 1982-2015
	e15	√			√ 1982-2011
PT-JPL	e16		√	√	1982-2017
	e17		√		√ 1982-2015
	e18		√		√ 1982-2011

In addition, we analyze the statistical description (i.e., mean, maximum, minimum, standard deviation, skewness coefficient, and kurtosis coefficient) of the data used for the study should be provided. The statistical parameters of the observed ET data at sites were presented in Supplementary Table S3, which provided a summary of the annual mean, maximum, minimum, standard deviation (SD), skewness, and kurtosis values of ET for 43 sites. The SD values varied from 6.22 to 48.90 mm/month. The skewness values ranged from -0.11 to 1.22, within the conventional acceptable limit of ± 2 , indicating that the data were normally distributed. The kurtosis values at most sites were lower than 3. The main information and statistical parameters of the observed ET data across 32 catchments were given in Supplementary Table S4. The SD values varied from 6.65 mm/month to 36.55 mm/month. The skewness values at most catchments were within the acceptable limit of ± 2 , and the kurtosis values of most catchments were lower than 3.

Supplementary Table S3. The monthly statistical parameters of the measured ET data at flux sites.

No.	Station	Mean (mm/year)	Max (mm/year)	Min (mm/year)	SD (mm/month)	Skewness	Kurtosis
<i>ENF</i>							
1	CA-Obs	323.06	411.66	270.66	21.81	0.48	2.02
2	CA-SF2	402.23	460.97	357.98	35.72	0.98	2.63
3	DE-Lkb	446.69	476.65	398.02	23.25	0.49	1.78
4	FI-Hyy	312.00	391.78	221.14	25.11	0.81	2.26
5	FI-Let	363.00	382.96	336.25	32.39	0.85	2.26
6	IT-Ren	717.07	797.28	654.07	45.16	0.37	1.74
7	US-Blo	658.78	702.04	597.67	37.63	0.61	2.16
8	US-Me2	546.15	694.43	423.70	27.39	0.83	2.74
<i>EBF</i>							
1	AU-Cum	696.24	699.67	692.82	18.03	0.40	2.16
2	AU-Wom	755.00	860.26	637.93	29.40	0.46	2.11
3	BR-Sa1	1117.07	1128.51	1105.56	11.73	0.11	2.27
4	CN-Din	628.19	664.40	585.45	20.34	-0.08	1.69
5	MY-PSO	1252.20	1301.47	1176.77	7.56	-0.11	2.36
<i>DBF</i>							
1	DE-Hai	414.59	448.19	385.82	32.36	0.48	1.83
2	US-MMS	492.82	583.64	428.27	38.02	0.58	1.82
3	CA-Oas	362.10	383.64	341.61	36.32	0.90	2.28
4	US-Wi3	451.37	453.34	449.41	35.63	0.79	2.23
<i>MF</i>							
1	BE-Vie	299.43	344.97	260.46	22.60	0.45	1.83
2	CA-Gro	368.69	447.28	265.05	28.49	0.80	2.24
<i>GRA</i>							
1	AT-Neu	459.55	525.56	380.83	33.21	0.33	1.74
2	AU-Dap	722.84	879.87	591.29	50.24	0.48	1.97
3	AU-Emr	436.84	-	-	13.63	1.22	4.57
4	AU-Stp	574.71	811.31	438.63	35.72	0.53	1.90
5	CN-Cng	450.25	513.46	412.97	30.46	0.73	2.34
6	CN-Dan	593.57	668.20	518.95	44.65	0.73	2.20
7	CN-Du2	423.50	430.26	416.74	32.03	0.78	2.13
8	CN-HaM	364.28	411.98	318.79	26.67	0.58	1.84
9	CN-Sw2	265.75	-	-	17.84	0.76	2.76
10	DE-RuR	524.45	535.19	506.66	29.85	0.30	1.63
11	IT-Tor	449.52	524.78	393.35	36.89	0.75	2.06
12	US-AR1	642.46	716.51	568.41	38.84	0.90	2.69
13	Us-cop	142.10	154.61	129.58	6.28	0.99	3.21
<i>CRO</i>							
1	BE-Lon	341.47	423.08	247.20	24.18	0.65	2.35

2	DE-Geb	363.53	413.60	304.76	28.46	0.90	2.82
3	DE-Kli	346.41	514.07	241.63	24.79	0.72	2.53
4	FR-Gri	485.58	525.84	436.56	27.86	0.68	2.24
5	US-ARM	506.93	558.61	470.33	24.18	0.47	2.08
6	US-CRT	723.31	724.59	722.02	40.52	0.90	2.76
7	UA-Ne1	670.56	760.54	589.42	48.90	0.95	2.61
<i>OSH</i>							
1	AU-ASM	194.81	268.07	102.68	16.60	1.01	2.74
2	AU-TTE	312.58	-	-	30.75	1.03	2.58
3	ES-Amo	175.64	218.57	147.70	6.22	0.75	2.81
4	RU-Cok	210.98	257.39	157.84	17.20	0.86	2.67

* The transverse lines "--" indicate no data because the data at this sites have less than two year.

Supplementary Table S4. The main characteristics and monthly statistical parameters at the 32 catchments.

Basin	Location	Area (10 ³ km ²)	Mean (mm/year)	Max (mm/year)	Min (mm/year)	SD (mm/month)	Skewness	Kurtosis
Amazon	South America	5,854	1144.81	1191.63	1075.01	7.65	-0.18	2.54
Amur	Asia	1,755	281.97	307.10	258.02	24.85	0.72	1.89
Aral	Asia	2,148	208.81	251.20	158.26	17.08	0.50	1.91
Changjiang	Asia	1,794	378.39	416.56	334.38	20.20	0.51	2.09
Columbia	North America	732	317.64	352.33	282.47	26.30	0.52	1.83
Congo	Africa	3,699	1008.15	1100.39	916.24	11.08	0.43	2.84
Danube	Europe	788	498.29	545.49	426.63	34.89	0.38	1.67
Dnieper	Europe	500	434.77	486.80	372.45	36.55	0.47	1.64
Don	Asia	423	353.77	402.76	295.69	31.66	0.56	1.73
Huang	Asia	795	324.14	359.87	291.30	22.80	0.63	2.04
Indigirk	Asia	334	72.89	100.18	45.92	11.80	2.11	7.01
Indus	Asia	1,143	293.29	340.61	225.75	13.21	0.18	1.95
Kolyma	Asia	666	124.83	146.41	94.79	17.63	1.62	4.48
Lena	Asia	2,442	179.81	196.62	156.73	22.44	1.28	3.10
Limpopo	Africa	429	485.75	632.80	358.22	24.55	0.33	1.83
MacKenz	North America	1,695	212.09	248.53	193.30	20.62	0.99	2.41
Mekong	Asia	759	844.55	924.29	766.15	12.43	1.06	5.44
Mississippi	North America	3,203	577.51	635.71	526.43	36.11	0.28	1.55
Murray	Oceania	1,032	450.80	532.82	348.83	13.07	0.30	2.25
Ndavina	Asia	288	267.33	300.89	232.81	27.17	1.06	2.68
Niger	Africa	2,240	422.85	482.21	386.49	16.09	0.25	2.01
Nile	Africa	3,826	421.27	450.69	381.22	9.01	0.48	2.54
Ob	Asia	3,026	275.39	315.32	239.25	29.19	0.90	2.27
Olenek	Asia	223	112.64	135.48	64.65	18.22	1.83	5.20
Parana	South America	2,664	982.29	1030.64	899.70	23.04	0.07	1.67
Pechora	Asia	314	186.09	218.61	141.34	22.92	1.35	3.61

Senegal	Africa	847	283.97	335.71	230.86	20.61	1.15	3.09
Ural	Asia	296	250.52	294.89	209.96	24.00	0.73	2.08
Volga	Europe	1,476	353.82	386.45	322.64	32.53	0.71	2.00
Yenisei	Asia	2,579	226.90	244.51	205.09	26.25	1.16	2.84
Yukon	North America	856	86.01	128.71	54.92	14.54	0.92	2.53
Zhujiang	Asia	450	627.20	661.43	569.74	20.00	0.12	2.16
