

Dynamic Satellite-Derived Vegetation and Radiation Inputs Advance Continental-Scale Hydrological Simulation Across China

Tab. S1. Attributes of the 50 hydrological stations and their controlled basins within the nine major river basins. In the 'River basin' field, the abbreviations are: Yz. RB for Yangtze River Basin, Ye. RB for Yellow River Basin, Huai. RB for Huai River Basin, Hai. RB for Hai River Basin, Pe. RB for Pearl River Basin, SL RB for Songliao River Basin, SE RB for Southeast Rivers Basin, In. RB for Interior Rivers Basin, and SW RB for Southwest Rivers Basin. The 'Area' field represents the drainage area controlled by the hydrological station. For the 'Source' field, CRSB indicates data from the *China River Sediment Bulletin*, AHR indicates data from the *Annual Hydrological Report for P.R.C.*, and Center indicates data from the National Earth System Science Data Center – Loess Plateau Sub-center. In the 'Application' field, Validation denotes use for VIC model parameter calibration and validation, while Transfer denotes use for validating the parameter transfer process.

FID	River basin	Hydrological station	Lon. (°)	Lat. (°)	Area (10 ⁴ km ²)	Data period (Monthly)	Source	Application
1	Yz. RB	Zhimenda	97.25	32.99	13.77	2000–2011, 2013–2020	CRSB	Validation
2		Gaochang	104.42	28.80	13.54	2003–2020	CRSB	Transfer
3		Beibei	106.42	29.85	15.67	2001–2020	CRSB	Validation
4		Wulong	107.73	29.33	8.30	2001–2020	CRSB	Validation
5		Huangzhuang	112.56	31.19	14.21	2001–2020	CRSB	Validation
6		Tongzilin	101.84	26.69	12.84	2013–2020	CRSB	Validation
7		Xiangtan	112.93	27.87	8.16	2002–2020	CRSB	Validation
8		Taoyuan	111.48	28.90	8.52	2003–2020	CRSB	Transfer
9		Waizhou	115.84	28.63	8.09	2002–2020	CRSB	Validation
10		Lijiadu	116.16	28.22	1.58	2000–2013	AHR	Validation
11		Meigang	116.82	28.44	1.55	2003–2020	CRSB	Transfer
12		Hushan	117.27	28.92	0.64	2000–2013	CRSB	Validation
13		Wanjiabu	115.65	28.85	0.35	2000–2008	AHR	Validation
14		Dufengkeng	117.20	29.27	0.50	2000–2013	AHR	Validation
15	Ye. RB	Tangnaihai	100.15	35.50	12.20	2001–2020	CRSB	Validation
16		Zhangjiashan	108.59	34.64	4.32	2007–2019	Center	Validation
17		Zhuangtou	109.84	35.00	2.56	2007–2019	Center	Validation
18		Huaxian	109.76	34.58	10.65	2009–2019	Center	Validation
19		Heishiguan	112.93	34.72	1.86	2009–2019	Center	Transfer
20		Wuzhi	113.27	35.07	1.29	2013–2018	Center	Validation
21		Baimasi	112.58	34.71	1.19	2007–2019	Center	Validation
22		Xianyang	108.70	34.32	4.68	2009–2019	Center	Validation
23	Huai. RB	Linyi	118.40	35.02	1.03	2002–2020	CRSB	Validation
24		Bengbu	117.37	32.95	12.13	2002–2020	CRSB	Validation
25		Xixian	114.73	32.33	1.02	2002–2020	CRSB	Transfer
26		Fuyang	115.83	32.90	3.52	2002–2020	CRSB	Validation

27	Hai. RB	Xiahui	117.17	40.62	0.53	2003–2020	CRSB	Validation
28		Zhangjiafen	116.77	40.62	0.85	2003–2020	CRSB	Validation
29		Guantai	114.08	36.33	1.78	2016–2020	CRSB	Validation
30		Yuancunji	115.06	36.11	1.43	2016–2020	CRSB	Validation
31	Pe. RB	Qianjiang	108.97	23.62	12.89	2003–2020	CRSB	Validation
32		Liuzhou	109.40	24.33	4.54	2003–2020	CRSB	Transfer
33		Nanning	108.24	22.83	7.27	2003–2020	CRSB	Validation
34		Shijiao	112.95	23.57	3.84	2002–2020	CRSB	Validation
35		Boluo	114.30	23.17	2.53	2002–2020	CRSB	Validation
36		Xiaolongtan	103.19	23.81	1.54	2003–2020	CRSB	Validation
37	SL RB	Jiangqiao	123.69	46.79	16.26	2003–2020	CRSB	Transfer
38		Fuyu	124.81	45.17	7.18	2002–2020	CRSB	Validation
39		Jiamusi	130.37	46.82	52.83	2003–2020	CRSB	Validation
40		Tieling	123.84	42.33	12.08	2002–2017	CRSB	Validation
41	SE RB	Quxian	118.87	28.97	0.54	2004–2006, 2010–2020	CRSB	Validation
42		Lanxi	119.47	29.22	1.82	2002–2020	CRSB	Transfer
43		Huashan	120.83	29.70	0.30	2004–2009, 2012–2020	CRSB	Validation
44		Zhuji	120.22	29.68	0.17	2004–2020	CRSB	Validation
45		Zhuqi	119.10	26.15	5.45	2002–2020	CRSB	Validation
46	In. RB	Yingluoxia	100.18	38.80	1.00	2003–2020	CRSB	Validation
47		Buhahekou	99.74	37.04	1.43	2013–2020	CRSB	Validation
48		Gangcha	100.13	37.32	0.14	2013–2020	CRSB	Validation
49	SW RB	Changdu	97.18	31.18	5.44	2000–2009	AHR	Transfer
50		Nuxia	94.57	29.45	21.71	2000–2009	AHR	Validation

Table S2. Basic information of ET observation stations. ENF is evergreen needleleaf forest, EBF is evergreen broadleaf forest, DNF is deciduous needleleaf forest, DBF is deciduous broadleaf forest, Mix is mixed forest, OSH is open shrubland, ARG is agriculture land, and GRA is grassland.

FID	Flux station	Lat (°)	Lon (°)	Year (month)	Vegetation type	Source
1	Arou	42.40	128.10	2008 (1–12), 2009 (1–12)	GRA	ChinaFLUX
2	Changbaishan mountain1	45.28	127.58	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	ENF	ChinaFLUX
3	Changwu	23.17	112.53	2008 (7–9), 2009 (7–9)	GRA	ChinaFLUX
4	Dinghushan mountain1	26.74	115.06	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	EBF	ChinaFLUX
5	Haibei alpine Tibet	36.83	116.57	2002 (1–12), 2003 (1–12), 2004 (1–12)	GRA	ChinaFLUX

6	Haibei shrubland	43.53	116.67	2002 (1–12), 2003 (1–12), 2004 (1–12)	OSH	ChinaFLUX
7	Laoshan1	21.92	101.27	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	DNF	ChinaFLUX
8	Qianyanzhou	38.05	100.46	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	ENF	ChinaFLUX
9	Xilin Gol league	42.40	128.10	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	GRA	ChinaFLUX
10	Xishuangbanna	24.58	121.40	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	DBF	ChinaFLUX
11	Yucheng	23.17	112.54	2002 (1–12), 2003 (1–12), 2004 (1–12), 2005 (1–12), 2006 (1–12), 2007 (1–12)	ARG	ChinaFLUX
12	Yuzhong	31.58	121.90	2008 (7–9), 2009 (7–9)	GRA	ChinaFLUX
13	Changbaishan Mountain2	44.09	113.57	2003 (1–12)	ENF	FLUXNET
14	Chilanmountain research site	42.05	116.67	2007 (1–12), 2008 (1–12), 2009 (1–12)	EBF	FLUXNET
15	Dinghushan mountain2	42.05	116.28	2003 (1–12)	EBF	FLUXNET
16	Dongtan2	44.28	87.92	2005 (1–12)	EBF	FLUXNET
17	Duolun cropland	36.52	115.13	2006 (1–12)	ARG	FLUXNET
18	Duolun grassland	40.54	108.69	2006 (1–12)	GRA	FLUXNET
19	Fukang	45.28	127.58	2006 (1–12), 2007 (1–12)	OSH	FLUXNET
20	Guantao	40.63	117.32	2009 (1–12)	ARG	FLUXNET
21	Kubuqi populus forest	42.93	120.70	2005 (1–12), 2006 (1–12)	DBF	FLUXNET
22	Laoshan2	37.53	105.80	2002 (1–12)	DNF	FLUXNET
23	Miyun	32.56	116.78	2008 (1–12), 2009 (1–12)	DBF	FLUXNET
24	Naiman	44.13	116.33	2008 (1–12)	GRA	FLUXNET
25	Shapotou	43.55	116.67	2009 (1–12)	OSH	FLUXNET
26	Shouxian	39.09	100.30	2005 (1–12)	EBF	FLUXNET
27	Xilindongsu	38.05	100.46	2008 (1–12)	GRA	FLUXNET
28	Xilinhot grassland site	38.92	100.30	2006 (1–12)	GRA	FLUXNET

29	Xilinhot Inner Mongolia fenced typical steppe	38.86	100.37	2004 (1–12), 2005 (1–12), 2006 (1–12)	GRA	FLUXNET
30	Zhangye	38.84	98.94	2008 (1–12)	OSH	FLUXNET
31	Arou superstation	41.99	101.12	2013 (1–11)	GRA	HiWATER
32	Bajitan	38.77	100.32	2012 (10–12), 2013 (1–12)	OSH	HiWATER
33	Daman superstation	41.99	101.13	2012 (10–12), 2013 (1–12)	ARG	HiWATER
34	Dashalong	42.00	101.13	2013 (9–12)	GRA	HiWATER
35	Huazhaizi	38.79	100.49	2012 (10–12), 2013 (1–12)	OSH	HiWATER
36	Hunhelin	42.00	101.14	2013 (8–12)	DBF	HiWATER
37	Huyanglin	38.98	100.45	2013 (8–12)	DBF	HiWATER
38	Luodi	37.61	101.32	2013 (8–12)	BAR	HiWATER
39	Shenshawo	37.37	101.18	2013 (10–12)	OSH	HiWATER
40	Sidaoqiao superstation	35.25	107.68	2013 (7–12)	DNF	HiWATER
41	Zhangye	35.95	104.13	2012 (7–12), 2013(1–11)	GRA	HiWATER

Tab. S3. Comparison of monthly observed runoff and VIC-simulated runoff across the nine major river basins. Due to shorter observation periods, the Guantai and Yuancunji stations are used only for parameter calibration.

FID	River basin	Hydrological station	Calibration period				Validation period			
			<i>R</i>	<i>NSE</i>	<i>KGE</i>	<i>Bias</i>	<i>R</i>	<i>NSE</i>	<i>KGE</i>	<i>Bias</i>
1	Yz. RB	Beibei	0.93	0.84	0.76	0.48%	0.90	0.56	0.58	-32.93%
		Dufengkeng	0.90	0.80	0.76	9.36%	0.96	0.89	0.78	-2.16%
		Huangzhuang	0.87	0.75	0.80	-0.56%	0.82	0.66	0.81	5.40%
		Hushan	0.94	0.86	0.80	-3.52%	0.96	0.83	0.81	-6.22%
		Lijiadu	0.91	0.81	0.74	7.65%	0.97	0.86	0.69	8.13%
		Tongzilin	0.82	0.67	0.72	-6.56%	0.76	0.42	0.70	-17.25%
		Waizhou	0.90	0.79	0.89	-0.53%	0.88	0.76	0.83	-9.27%
		Wanjiabu	0.94	0.88	0.86	2.92%	0.88	0.76	0.80	8.19%
		Wulong	0.92	0.83	0.77	-0.64%	0.86	0.73	0.83	-6.45%
		Xiangtan	0.92	0.82	0.85	-9.98%	0.91	0.79	0.78	-13.68%
		Zhimenda	0.89	0.63	0.58	40.31%	0.85	0.60	0.65	31.68%
Basin mean	0.90	0.79	0.78	3.54%	0.89	0.71	0.75	-3.14%		
2	Ye. RB	Baimasi	0.83	0.61	0.56	-23.41%	0.89	0.75	0.69	-17.59%
		Huaxian	0.93	0.84	0.82	16.14%	0.87	0.72	0.73	17.57%
		Tangnaihαι	0.89	0.71	0.77	19.58%	0.81	0.62	0.80	7.60%
		Wuzhi	0.92	0.84	0.86	5.60%	0.80	0.63	0.65	-5.31%
		Xianyang	0.89	0.74	0.72	24.55%	0.85	0.68	0.60	17.27%
		Zhangjiashan	0.86	0.73	0.75	2.35%	0.86	0.62	0.74	12.46%

		Zhuangtou	0.78	0.58	0.64	-19.27%	0.84	0.56	0.73	-0.05%
		Basin mean	0.87	0.72	0.73	3.65%	0.85	0.65	0.71	4.56%
3	Huai. RB	Bengbu	0.94	0.83	0.69	6.88%	0.84	0.68	0.65	3.09%
		Fuyang	0.90	0.66	0.42	56.37%	0.90	0.64	0.46	51.69%
		Linyi	0.94	0.83	0.68	14.40%	0.97	0.89	0.60	33.76%
		Basin mean	0.93	0.77	0.60	25.88%	0.90	0.74	0.57	29.51%
4	Hai. RB	Guantai	0.80	0.62	0.64	30.16%	/	/	/	/
		Xiahui	0.60	0.34	0.48	8.81%	0.69	0.47	0.60	-6.67%
		Yuancunji	0.87	0.69	0.62	32.32%	/	/	/	/
		Zhangjiafen	0.59	0.32	0.50	3.44%	0.70	0.40	0.67	14.55%
		Basin mean	0.72	0.49	0.56	18.68%	0.70	0.44	0.64	3.94%
5	Pe. RB	Boluo	0.88	0.77	0.81	7.80%	0.87	0.76	0.78	0.93%
		Nanning	0.94	0.78	0.72	27.74%	0.92	0.80	0.83	14.71%
		Qianjiang	0.89	0.78	0.77	7.73%	0.80	0.60	0.80	-4.48%
		Shijiao	0.97	0.95	0.85	-0.08%	0.97	0.94	0.91	-2.46%
		Xiaolongtan	0.89	0.77	0.74	8.10%	0.89	0.76	0.68	4.63%
		Basin mean	0.91	0.81	0.78	10.26%	0.89	0.77	0.80	2.67%
6	SL RB	Fuyu	0.74	0.49	0.58	-20.69%	0.81	0.62	0.81	-2.99%
		Jiamusi	0.81	0.61	0.81	2.63%	0.87	0.74	0.87	-2.87%
		Tieling	0.82	0.52	0.37	25.61%	0.46	0.09	0.42	9.32%
		Basin mean	0.79	0.54	0.59	2.52%	0.71	0.48	0.70	1.15%
7	SE RB	Huashan	0.90	0.78	0.74	5.19%	0.88	0.76	0.73	4.33%
		Quxian	0.97	0.83	0.65	-9.03%	0.96	0.83	0.66	-13.05%
		Zhuji	0.94	0.82	0.70	1.72%	0.93	0.82	0.74	12.42%
		Zhuqi	0.92	0.84	0.85	3.54%	0.90	0.81	0.88	1.51%
		Basin mean	0.93	0.82	0.74	0.36%	0.92	0.81	0.75	1.30%
8	In. RB	Buhahekou	0.80	0.64	0.73	5.34%	0.92	0.80	0.72	-14.76%
		Gangcha	0.97	0.92	0.89	-9.82%	0.88	0.61	0.50	-40.77%
		Yingluoxia	0.96	0.77	0.70	-29.67%	0.97	0.71	0.63	-36.53%
		Basin mean	0.91	0.78	0.77	-11.38%	0.92	0.71	0.62	-30.69%
9	SW RB	Nuxia	0.83	0.53	0.51	-35.83%	0.80	0.54	0.63	-26.87%
		Basin mean	0.83	0.53	0.51	-35.83%	0.80	0.54	0.63	-26.87%
10	Overall mean		0.88	0.73	0.71	5.05%	0.86	0.68	0.71	-0.08%