

Energy-conservation datasets of global land surface radiation and heat fluxes from 2000-2020 generated by CoSEB

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Table S1 Basic information of the 258 sites from AmeriFlux (2000–2020), FLUXNET (2000–2014), ChinaFLUX (2006–2020), OzFlux (2007–2014), EuroFlux (2000–2020), and TPDC (2008–2021) involved in this study.

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
CA-Ca1	49.8673	-125.334	ENF	332.1652	1996-2010	AmeriFlux
CA-Ca3	49.5346	-124.9	ENF	163.1065	1999-2010	AmeriFlux
CA-DBB	49.1293	-122.985	WET	4.035627	2017-2018	AmeriFlux
CA-LP1	55.1119	-122.841	ENF	745.9454	2007-2019	AmeriFlux
CA-Na1	46.4722	-67.1	ENF	324.1952	2003-2005	AmeriFlux
CA-Ojp	53.9163	-104.692	ENF	514.7642	1996-2010	AmeriFlux
CA-Qcu	49.2671	-74.0365	ENF	415.4742	2005-2010	AmeriFlux
CA-SJ1	53.908	-104.656	ENF	514.5374	2000-2010	AmeriFlux
CA-SJ2	53.945	-104.649	ENF	519.4546	2002-2010	AmeriFlux
CA-SJ3	53.8758	-104.645	ENF	495.2588	2002-2010	AmeriFlux
MX-PMm	20.8462	-86.8992	EBF	8.983506	2017-2018	AmeriFlux
US-Aud	31.5907	-110.51	GRA	1469.768	2002-2011	AmeriFlux
US-Bi1	38.0992	-121.499	CRO	-2.33282	2016-2019	AmeriFlux
US-Bi2	38.1091	-121.535	CRO	-4.94422	2017-2019	AmeriFlux
US-Bkg	44.3453	-96.8362	GRA	494.5422	2004-2010	AmeriFlux
US-Blk	44.158	-103.65	ENF	1761.067	2004-2008	AmeriFlux
US-BMM	45.783	-110.778	GRA	2363.876	2016-2019	AmeriFlux
US-Bo1	40.0062	-88.2904	CRO	219.81	2000-2008	AmeriFlux
US-Bo2	40.009	-88.29	CRO	220.2599	2000-2007	AmeriFlux
US-Br1	41.9749	-93.6906	CRO	313.6844	2005-2011	AmeriFlux
US-Br3	41.9747	-93.6936	CRO	313.6844	2005-2011	AmeriFlux
US-CaV	39.0633	-79.4208	GRA	982.3821	2004-2008	AmeriFlux

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
US-ChR	35.9311	-84.3324	DBF	337.6009	2005-2010	AmeriFlux
US-CMW	31.6637	-110.178	DBF	1204.17	2000-2021	AmeriFlux
US-CPk	41.068	-106.119	ENF	2756.3	2009-2013	AmeriFlux
US-Ctn	43.95	-101.847	GRA	740.8826	2006-2009	AmeriFlux
US-Cwt	35.0592	-83.4275	DBF	725.8897	2011-2015	AmeriFlux
US-DFC	43.3448	-89.7117	CRO	259.042	2018-2022	AmeriFlux
US-Dia	37.6773	-121.53	GRA	305.8099	2010-2012	AmeriFlux
US-Fmf	35.1426	-111.727	ENF	2199.074	2005-2010	AmeriFlux
US-FPe	48.3077	-105.102	GRA	628.9181	2000-2008	AmeriFlux
US-FR3	29.94	-97.99	CSH	251.2874	2004-2012	AmeriFlux
US-Fuf	35.089	-111.762	ENF	2227.838	2005-2010	AmeriFlux
US-Fwf	35.4454	-111.772	GRA	2313.586	2005-2010	AmeriFlux
US-HB2	33.3242	-79.244	ENF	13.22842	2019	AmeriFlux
US-HB3	33.3482	-79.2322	ENF	10.78539	2019-2020	AmeriFlux
US-HBK	43.9397	-71.7181	DBF	407.8452	2016-2020	AmeriFlux
US-Hn3	46.6878	-119.461	OSH	117.1368	2017-2018	AmeriFlux
US-Jo1	32.582	-106.635	OSH	1391.373	2010-2020	AmeriFlux
US-KLS	38.7745	-97.5684	GRA	383.6021	2012-2019	AmeriFlux
US-KS4	28.6	-80.7207	WET	1.837979	2017-2019	AmeriFlux
US-KUT	44.995	-93.1863	GRA	296.5206	2007-2009	AmeriFlux
US-MC1	48.1873	-114.155	CRO	899.9223	2015	AmeriFlux
US-MH1	45.9206	-108.241	CRO	918.4681	2015	AmeriFlux
US-Mj1	46.9948	-109.614	CRO	1284.585	2013-2014	AmeriFlux
US-Mj2	46.9957	-109.63	CRO	1273.864	2014	AmeriFlux

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
US-MOz	38.7441	-92.2	DBF	232.2463	2004-2021	AmeriFlux
US-MSR	47.4758	-111.721	CRO	1112.128	2016	AmeriFlux
US-MtB	32.4167	-110.726	ENF	2494.819	2009-2021	AmeriFlux
US-NC2	35.803	-76.6685	ENF	9.417845	2005-2023	AmeriFlux
US-NC3	35.799	-76.656	ENF	14.08011	2013-2021	AmeriFlux
US-NC4	35.7879	-75.9038	WET	12.65566	2013-2021	AmeriFlux
US-NGC	64.8614	-163.701	GRA	41.80324	2017-2022	AmeriFlux
US-ONA	27.3836	-81.9509	GRA	27.96069	2016-2019	AmeriFlux
US-PFb	45.972	-90.3232	ENF	473.8129	2019	AmeriFlux
US-PFc	45.9677	-90.3088	DBF	471.2139	2019	AmeriFlux
US-PFd	45.9689	-90.301	WET	465.6382	2019	AmeriFlux
US-PFe	45.9793	-90.3004	WAT	469.6138	2019	AmeriFlux
US-PFg	45.9735	-90.2723	ENF	477.9019	2019	AmeriFlux
US-PFh	45.9557	-90.2406	ENF	478.4359	2019	AmeriFlux
US-PFi	45.9749	-90.2327	DBF	483.0373	2019	AmeriFlux
US-PFj	45.9619	-90.227	DBF	484.2585	2019	AmeriFlux
US-PFk	45.9149	-90.3425	DBF	465.8293	2019	AmeriFlux
US-PFL	45.9409	-90.3177	DBF	464.702	2019	AmeriFlux
US-PFm	45.9207	-90.3099	DBF	467.6597	2019	AmeriFlux
US-PFn	45.9392	-90.2823	DBF	471.1355	2019	AmeriFlux
US-PFp	45.9365	-90.2641	DBF	479.097	2019	AmeriFlux
US-PFq	45.9271	-90.2475	DBF	471.9663	2019	AmeriFlux
US-PFr	45.9245	-90.2475	WET	466.4052	2019	AmeriFlux
US-PFs	45.9381	-90.2382	DBF	476.5846	2019	AmeriFlux

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
US-PFt	45.9197	-90.2288	ENF	473.7249	2019	AmeriFlux
US-Rls	43.1439	-116.736	CSH	1612.881	2014-2022	AmeriFlux
US-Rms	43.0645	-116.749	CSH	2105.924	2015-2018	AmeriFlux
US-Ro1	44.7143	-93.0898	CRO	283.5414	2004-2016	AmeriFlux
US-Ro2	44.7288	-93.0888	CRO	283.0575	2008-2016	AmeriFlux
US-Ro4	44.6781	-93.0723	GRA	266.9744	2015-2019	AmeriFlux
US-Ro5	44.691	-93.0576	CRO	278.8473	2017-2019	AmeriFlux
US-Ro6	44.6946	-93.0578	CRO	279.5565	2017-2019	AmeriFlux
US-Rwe	43.0653	-116.759	CSH	2068.225	2003-2007	AmeriFlux
US-Rwf	43.1207	-116.723	CSH	1882.902	2014-2018	AmeriFlux
US-Rws	43.1675	-116.713	OSH	1448.506	2014-2018	AmeriFlux
US-SFP	43.2408	-96.902	CRO	384.8312	2007-2009	AmeriFlux
US-Skr	25.3629	-81.0776	EBF	15.9983	2006-2011	AmeriFlux
US-Slt	39.9138	-74.596	DBF	38.99984	2006-2014	AmeriFlux
US-Sne	38.0369	-121.755	GRA	-3.19868	2016-2019	AmeriFlux
US-Snf	38.0402	-121.727	GRA	-3.05857	2018-2020	AmeriFlux
US-Srr	38.2006	-122.026	WET	3.862484	2014-2017	AmeriFlux
US-UiA	40.0646	-88.1961	CRO	222.2545	2008-2016	AmeriFlux
US-WBW	35.9588	-84.2874	DBF	329.9287	1980-2002; 2002-2019	AmeriFlux
US-Wdn	40.7838	-106.262	OSH	2473.114	2006-2008	AmeriFlux
US-xAE	35.4106	-99.0588	GRA	519.8651	2017-2020	AmeriFlux
US-xBR	44.0639	-71.2873	DBF	275.7319	2017-2020	AmeriFlux
US-xCL	33.4012	-97.57	GRA	277.1757	2017-2020	AmeriFlux

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
US-xDC	47.1617	-99.1066	GRA	559.4308	2017-2020	AmeriFlux
US-xDJ	63.8811	-145.751	ENF	503.6363	2017-2020	AmeriFlux
US-xDS	28.125	-81.4362	CVM	20.77257	2017-2020	AmeriFlux
US-xHE	63.8757	-149.213	OSH	681.4483	2017-2020	AmeriFlux
US-xJE	31.1948	-84.4686	ENF	48.89666	2017-2020	AmeriFlux
US-xKA	39.1104	-96.6129	GRA	326.1032	2017-2020	AmeriFlux
US-xKZ	39.1008	-96.5631	GRA	408.9859	2017-2020	AmeriFlux
US-xML	37.3783	-80.5248	DBF	1175.641	2017-2020	AmeriFlux
US-xNG	46.7697	-100.915	GRA	585.6992	2017-2022	AmeriFlux
US-xRN	35.9641	-84.2826	DBF	330.898	2017-2020	AmeriFlux
US-xSE	38.8901	-76.56	DBF	22.44424	2017-2020	AmeriFlux
US-xST	45.5089	-89.5864	DBF	480.5691	2017-2020	AmeriFlux
US-xTA	32.9505	-87.3933	ENF	147.4779	2017-2020	AmeriFlux
US-xUN	46.2339	-89.5373	MF	520.9883	2017-2020	AmeriFlux
US-xWD	47.1282	-99.2414	GRA	583.3211	2017-2020	AmeriFlux
BR-Sa3	-3.01803	-54.9714	EBF	182.4924	2000-2004	AmeriFlux, FLUXNET
CA-Gro	48.2167	-82.1556	MF	346.4042	2003-2014	AmeriFlux, FLUXNET
CA-Obs	53.98717	-105.118	ENF	593.5317	2000-2010	AmeriFlux, FLUXNET
CA-Qfo	49.6925	-74.3421	ENF	389.1389	2003-2010	AmeriFlux, FLUXNET
CA-SF1	54.48503	-105.818	ENF	567.924	2003-2016	AmeriFlux, FLUXNET
CA-SF2	54.25392	-105.878	ENF	513.2608	2001-2015	AmeriFlux, FLUXNET
CA-SF3	54.09156	-106.005	OSH	543.9281	2001-2006	AmeriFlux, FLUXNET
CA-TP4	42.71016	-80.3574	ENF	232.4888	2002-2016; 2016-2019	AmeriFlux, FLUXNET

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
CA-TPD	42.63533	-80.5577	DBF	213.9574	2012-2017	AmeriFlux, FLUXNET
US-AR1	36.4267	-99.42	GRA	616.3783	2009-2012	AmeriFlux, FLUXNET
US-AR2	36.6358	-99.5975	GRA	650.0313	2009-2012	AmeriFlux, FLUXNET
US-ARM	36.6058	-97.4888	CRO	315.6375	2003-2012	AmeriFlux, FLUXNET
US-CRT	41.6285	-83.3471	CRO	178.2366	2011-2013	AmeriFlux, FLUXNET
US-GBT	41.36579	-106.24	ENF	3183.434	2001-2005	AmeriFlux, FLUXNET
US-GLE	41.36653	-106.24	ENF	3183.434	2005-2014	AmeriFlux, FLUXNET
US-Goo	34.2547	-89.8735	GRA	91.67505	2002-2006	AmeriFlux, FLUXNET
US-Ivo	68.4865	-155.75	WET	580.1469	2004-2007	AmeriFlux, FLUXNET
US-Me2	44.4523	-121.557	ENF	1255.822	2002-2014	AmeriFlux, FLUXNET
US-Me6	44.32328	-121.608	ENF	999.7321	2010-2014	AmeriFlux, FLUXNET
US-MMS	39.3232	-86.4131	DBF	279.0861	1999-2014	AmeriFlux, FLUXNET
US-Ne1	41.16506	-96.4766	CRO	354.9172	2001-2013	AmeriFlux, FLUXNET
US-Ne2	41.16487	-96.4701	CRO	354.4763	2001-2013	AmeriFlux, FLUXNET
US-Ne3	41.17967	-96.4397	CRO	356.9478	2001-2013	AmeriFlux, FLUXNET
US-NR1	40.0329	-105.546	ENF	3046.277	2000-2014	AmeriFlux, FLUXNET
US-Oho	41.5545	-83.8438	DBF	213.95	2004-2009; 2009-2019	AmeriFlux, FLUXNET
US-Prr	65.12367	-147.488	ENF	209.6657	2010-2013	AmeriFlux, FLUXNET
US-SRC	31.9083	-110.84	MF	988.2855	2008-2014	AmeriFlux, FLUXNET
US-SRG	31.78938	-110.828	GRA	1293.582	2008-2014	AmeriFlux, FLUXNET
US-SRM	31.8214	-110.866	WSA	1115.434	2004-2014	AmeriFlux, FLUXNET
US-Syv	46.242	-89.3477	MF	548.2922	2001-2014	AmeriFlux, FLUXNET
US-Tw2	38.1047	-121.643	CRO	-4.55806	2012-2013	AmeriFlux, FLUXNET

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
US-Tw3	38.1159	-121.647	CRO	-2.10492	2013-2014	AmeriFlux, FLUXNET
US-Tw4	38.10298	-121.641	WET	-4.55806	2014-2015; 2015-2019	AmeriFlux, FLUXNET
US-Var	38.4133	-120.951	GRA	159.533	2001-2019	AmeriFlux, FLUXNET
US-WCr	45.8059	-90.0799	DBF	519.5778	2000-2014	AmeriFlux, FLUXNET
US-Whs	31.7438	-110.052	OSH	1372.312	2007-2014	AmeriFlux, FLUXNET
US-Wkg	31.7365	-109.942	GRA	1514.289	2004-2014	AmeriFlux, FLUXNET
Baiyinxile	43.5544	116.6714	GRA	1258.533	2006-2015	ChinaFLUX
Duolun	42.0467	116.2836	GRA	1318.744	2006-2015	ChinaFLUX
Jinzhou	41.1481	121.2017	CRO	19.17814	2005-2014	ChinaFLUX
Jurong	31.8068	119.2173	CRO	16	2015-2020	ChinaFLUX
Panjindaotian	40.9414	121.9603	CRO	2	2018-2020	ChinaFLUX
AT-Rtz	47.39472	11.80472	GRA	547.6171	2008-2012	EuroFlux
CZ-KrP	49.57326	15.07877	CRO	524.0347	2014-2020	EuroFlux
CZ-RAJ	49.44372	16.69651	ENF	637.0834	2012-2020	EuroFlux
DE-HoH	52.08656	11.22235	DBF	209.2388	2015-2020	EuroFlux
DE-Me2	51.27537	10.65555	GRA	284.2861	2004-2006	EuroFlux
DE-Meh	51.27531	10.65547	MF	284.2861	2003-2006	EuroFlux
DE-Msr	47.80918	11.45617	ENF	607.8965	2020	EuroFlux
DE-Wet	50.4535	11.45753	ENF	786.0023	2002-2008	EuroFlux
DK-Ris	55.53028	12.09722	CRO	18.73956	2004-2008	EuroFlux
ES-Abr	38.70184	-6.78588	SAV	281.3872	2016-2020	EuroFlux
ES-Cnd	37.915	-3.22766	WSA	365.1301	2014-2020	EuroFlux
ES-ES2	39.27438	-0.31641	CRO	0	2004-2008	EuroFlux

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
ES-LM1	39.94269	-5.77868	SAV	264.1469	2014-2020	EuroFlux
ES-LM2	39.93459	-5.77588	SAV	268.9989	2014-2020	EuroFlux
ES-LMa	39.94033	-5.77465	SAV	267.0455	2004-2011	EuroFlux
ES-VDA	42.15111	1.44738	GRA	1775.869	2004-2008	EuroFlux
FR-Hes	48.6741	7.06465	DBF	313.1134	1997-2010	EuroFlux
FR-Mau	43.38528	1.292222	GRA	190.9938	2005-2007	EuroFlux
IE-Dri	51.98669	-8.75181	GRA	196.3475	2002-2012	EuroFlux
IE-Kil	51.96836	-9.90031	WET	147.4867	2002-2012	EuroFlux
IL-Yat	31.34504	35.05199	ENF	643.8403	2000-2018	EuroFlux
PL-Brd	52.43418	16.29952	CRO	94.74407	2011-2012	EuroFlux
RU-Fy2	56.4476	32.90188	ENF	273.9275	2015-2020	EuroFlux
RU-Fy3	56.4435	33.0478	ENF	269.1536	2016-2018	EuroFlux
AT-Neu	47.11667	11.3175	GRA	1046.595	2002-2012	EuroFlux, FLUXNET
BE-Bra	51.30761	4.51984	MF	19.54127	2000-2014	EuroFlux, FLUXNET
BE-Lon	50.55162	4.74623	CRO	166.9129	2004-2014	EuroFlux, FLUXNET
BE-Vie	50.30493	5.99812	MF	494.6324	2000-2014	EuroFlux, FLUXNET
CH-Cha	47.21022	8.41044	GRA	392.4003	2006-2012	EuroFlux, FLUXNET
CH-Dav	46.81533	9.85591	ENF	1665.292	2000-2011	EuroFlux, FLUXNET
CH-Fru	47.11583	8.53778	GRA	978.7588	2006-2012	EuroFlux, FLUXNET
CZ-wet	49.02465	14.77035	WET	425.2172	2006-2014	EuroFlux, FLUXNET
DE-Geb	51.09973	10.91463	CRO	157.4446	2001-2014	EuroFlux, FLUXNET
DE-Gri	50.94947	13.51253	GRA	378.4147	2014	EuroFlux, FLUXNET
DE-Hai	51.07921	10.45217	DBF	449.4347	2000-2012	EuroFlux, FLUXNET
DE-Kli	50.89306	13.52238	CRO	475.6852	2004-2017	EuroFlux, FLUXNET

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
DE-Lkb	49.09962	13.30467	ENF	1290.676	2009-2013	EuroFlux, FLUXNET
DE-Lnf	51.32822	10.3678	DBF	470.7628	2002-2012	EuroFlux, FLUXNET
DE-Obe	50.78666	13.72129	ENF	739.407	2008-2014	EuroFlux, FLUXNET
DE-RuR	50.62191	6.30413	GRA	510.6434	2011-2014	EuroFlux, FLUXNET
DE-RuS	50.86591	6.44717	CRO	101.84	2011-2014	EuroFlux, FLUXNET
DE-SfN	47.80639	11.3275	WET	593.6301	2012-2014	EuroFlux, FLUXNET
DE-Tha	50.96256	13.56515	ENF	383.1516	2000-2018	EuroFlux, FLUXNET
DE-Zrk	53.87594	12.88901	WET	0	2013-2017	EuroFlux, FLUXNET
DK-Sor	55.48587	11.64464	DBF	45.00622	2000-2014	EuroFlux, FLUXNET
FI-Hyy	61.84741	24.29477	ENF	181.4199	2005-2014	EuroFlux, FLUXNET
FI-Lom	67.99724	24.20918	WET	272.1427	2007-2009	EuroFlux, FLUXNET
FR-Gri	48.84422	1.95191	CRO	121.3056	2004-2007	EuroFlux, FLUXNET
FR-LBr	44.71711	-0.7693	ENF	66.94761	2000-2008	EuroFlux, FLUXNET
FR-Pue	43.7413	3.5957	EBF	262.8136	2000-2014	EuroFlux, FLUXNET
GH-Ank	5.26854	-2.69421	EBF	97.95021	2011-2014	EuroFlux, FLUXNET
IT-BCi	40.52375	14.95744	CRO	8.639963	2004-2014	EuroFlux, FLUXNET
IT-CA1	42.38041	12.02656	DBF	202.5322	2011-2014	EuroFlux, FLUXNET
IT-CA2	42.37722	12.02604	CRO	197.3609	2011-2012	EuroFlux, FLUXNET
IT-CA3	42.38	12.0222	DBF	196.5162	2011-2014	EuroFlux, FLUXNET
IT-Col	41.84936	13.58814	DBF	1574.159	2000-2014	EuroFlux, FLUXNET
IT-Cp2	41.70427	12.35729	EBF	10.76524	2012-2014	EuroFlux, FLUXNET
IT-Isp	45.81264	8.63358	DBF	223.2504	2013-2014	EuroFlux, FLUXNET
IT-Lav	45.9562	11.28132	ENF	1368.359	2004-2013	EuroFlux, FLUXNET
IT-MBo	46.01468	11.04583	GRA	1552.588	2003-2014	EuroFlux, FLUXNET

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
IT-Ren	46.58686	11.43369	ENF	1758.296	2011-2013	EuroFlux, FLUXNET
IT-Ro2	42.39026	11.92093	DBF	160.5363	2002-2011	EuroFlux, FLUXNET
IT-SR2	43.73202	10.29091	ENF	12	2013-2014	EuroFlux, FLUXNET
IT-SRo	43.72786	10.28444	ENF	9.013709	2000-2012	EuroFlux, FLUXNET
IT-Tor	45.84444	7.57806	GRA	2153.661	2008-2014	EuroFlux, FLUXNET
NL-Hor	52.24035	5.0713	GRA	-0.73628	2004-2011	EuroFlux, FLUXNET
NL-Loo	52.16658	5.74356	ENF	32.84047	2000-2014	EuroFlux, FLUXNET
RU-Cok	70.82914	147.4943	OSH	5	2003-2012	EuroFlux, FLUXNET
RU-Fyo	56.46153	32.92208	ENF	273.4177	2000-2014	EuroFlux, FLUXNET
RU-SkP	62.255	129.168	DNF	205.5664	2012-2014	EuroFlux, FLUXNET
ZA-Kru	-25.0197	31.4969	SAV	357.9457	2000-2010	EuroFlux, FLUXNET
ZM-Mon	-15.4391	23.2525	DBF	1085.43	2000-2009	EuroFlux, FLUXNET
AU-Cpr	-34.0021	140.5891	SAV	62.10091	2010-2014	FLUXNET
AU-Cum	-33.6152	150.7236	EBF	32.76765	2012-2014	FLUXNET
AU-DaP	-14.0633	131.3181	GRA	68.98811	2008-2014	FLUXNET
AU-Dry	-15.2588	132.3706	SAV	173.4906	2008-2014	FLUXNET
AU-Emr	-23.8587	148.4746	GRA	173.8074	2011-2013	FLUXNET
AU-Fog	-12.5452	131.3072	WET	4	2006-2008	FLUXNET
AU-Gin	-31.3764	115.7138	WSA	50.91777	2011-2014	FLUXNET
AU-GWW	-30.1913	120.6541	SAV	447.3401	2013-2014	FLUXNET
AU-How	-12.4943	131.1523	WSA	38.89426	2001-2014	FLUXNET
AU-Lox	-34.4704	140.6551	DBF	43.50616	2008-2009	FLUXNET
AU-RDF	-14.5636	132.4776	WSA	186.4187	2011-2013	FLUXNET
AU-Rig	-36.6499	145.5759	GRA	153.4382	2011-2014	FLUXNET

site	Latitude (°)	Longitude (°)	IGBP	DEM (m)	Temporal Coverage	Networks
AU-Rob	-17.1175	145.6301	EBF	713.7575	2014-2015	FLUXNET
AU-Whr	-36.6732	145.0294	EBF	150.1855	2011-2014	FLUXNET
AU-Wom	-37.4222	144.0944	EBF	712.2723	2010-2012	FLUXNET
AU-Ync	-34.9893	146.2907	GRA	125.4918	2012-2014	FLUXNET
CN-Cng	44.5934	123.5092	GRA	140.932	2007-2010	FLUXNET
MY-PSO	2.973	102.3062	EBF	140.1725	2003-2009	FLUXNET
AU-Ade	-13.0769	131.1178	WSA	76.846	2007-2009	OZFlux, FLUXNET
AU-ASM	-22.283	133.249	SAV	606.2923	2010-2014	OZFlux, FLUXNET
AU-DaS	-14.1593	131.3881	SAV	78.64063	2008-2014	OZFlux, FLUXNET
AU-Stp	-17.1507	133.3502	GRA	227.7105	2008-2014	OZFlux, FLUXNET
AU-TTE	-22.287	133.64	GRA	551.6757	2014-2014	OZFlux, FLUXNET
Arou	38.0473	100.4643	GRA	3024.387	2012-2019	TPDC
Cropland	41.99	101.12	CRO	936.0195	2013-2015	TPDC
Daman	38.85551	100.3722	CRO	1561.311	2012-2019	TPDC
Gaohancaodian	37.70319	98.59489	GRA	3721.163	2019	TPDC
Guantao	36.515	115.1274	CRO	43.33562	2008-2010	TPDC
Mixed forest	41.99	101.13	MF	936.9081	2013-2020	TPDC
Miyun	40.6308	117.3233	CRO	362.5396	2008-2010	TPDC
Sidalong	38.428	99.926	DBF	3114.211	2020	TPDC
Suganhu	38.99	94.12	WET	2813.418	2019-2020	TPDC
Wenxingcaoyuan	37.24694	100.2358	GRA	3208.458	2019	TPDC
Xiyinghe	37.561	101.855	GRA	3606.162	2019-2020	TPDC
Yagaoshan	37.52102	100.101	OSH	3521.231	2019	TPDC
Zhangye wetland	38.98	100.45	WET	1457.197	2012-2020	TPDC

Table S2 Basic information of the 9 sites from SURFRAD involved in this study.

Site	Latitude (°)	Longitude (°)	Temporal coverage	DEM (m)	Surface Type at Station
Alamosa_CO	37.7	-105.92	2014-2016	2317	Grassland
Bondville_IL	40.05	-88.37	1995-2023	213	Grassland
Boulder_CO	40.13	-105.24	1995-2023	1689	Sparse grassland
Desert_Rock_NV	36.62	-116.02	1998-2023	1007	Arid shrubland
Fort_Peck_MT	48.31	-105.1	1995-2023	634	Grassland
Goodwin_Creek_MS	34.25	-89.87	1995-2023	98	Grassland
Penn_State_PA	40.72	-77.93	1998-2023	376	Cropland
Rutland_VT	43.64	-72.97	2014-2015	184	Grassland
Sioux_Falls_SD	43.73	-96.62	2003-2023	473	Grassland

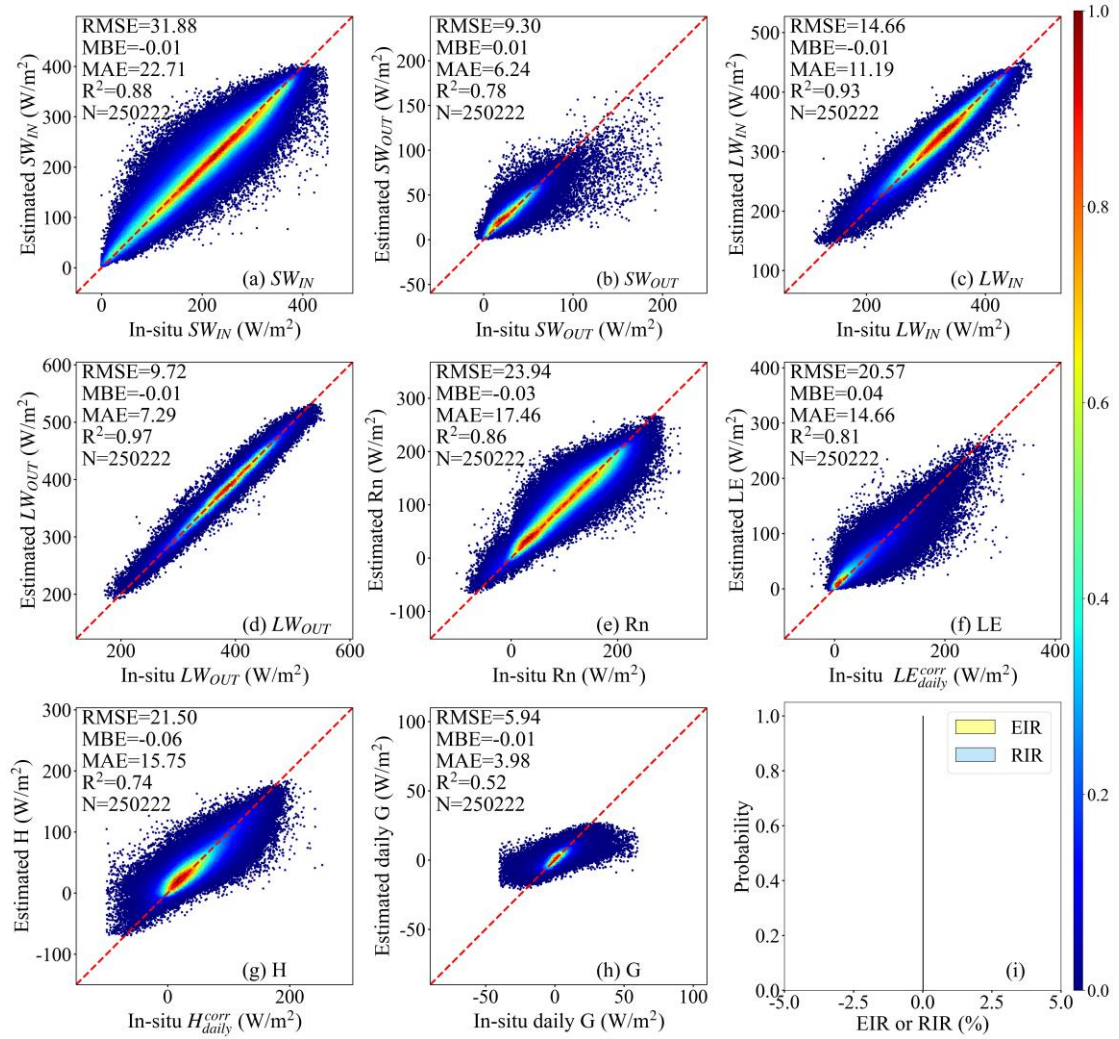


Fig. S1 Scatter density plots of the sample-based 10-fold cross-validation of daily downward shortwave and longwave radiation (SW_{IN} and LW_{IN}), upward shortwave and longwave radiation (SW_{OUT} and LW_{OUT}), net radiation (Rn), soil heat flux (G), latent heat flux (LE) and sensible heat flux (H) derived by the CoSEB model against in-situ observed SW_{IN} , LW_{IN} , SW_{OUT} , LW_{OUT} , Rn , G , and energy imbalance-corrected LE (LE_{daily}^{corr}) and H (H_{daily}^{corr}), where the sample-based 10-fold cross-validation was employed by randomly dividing all sample data into ten folds. The EIR and RIR in the subfigure (i) represent the energy imbalance ratio and radiation imbalance ratio, which are defined as $100\% \times (Rn - G - LE - H) / Rn$ and $100\% \times (SW_{IN} + LW_{IN} - SW_{OUT} - LW_{OUT} - Rn) / Rn$, respectively. The colorbar represents the normalized density of data points.

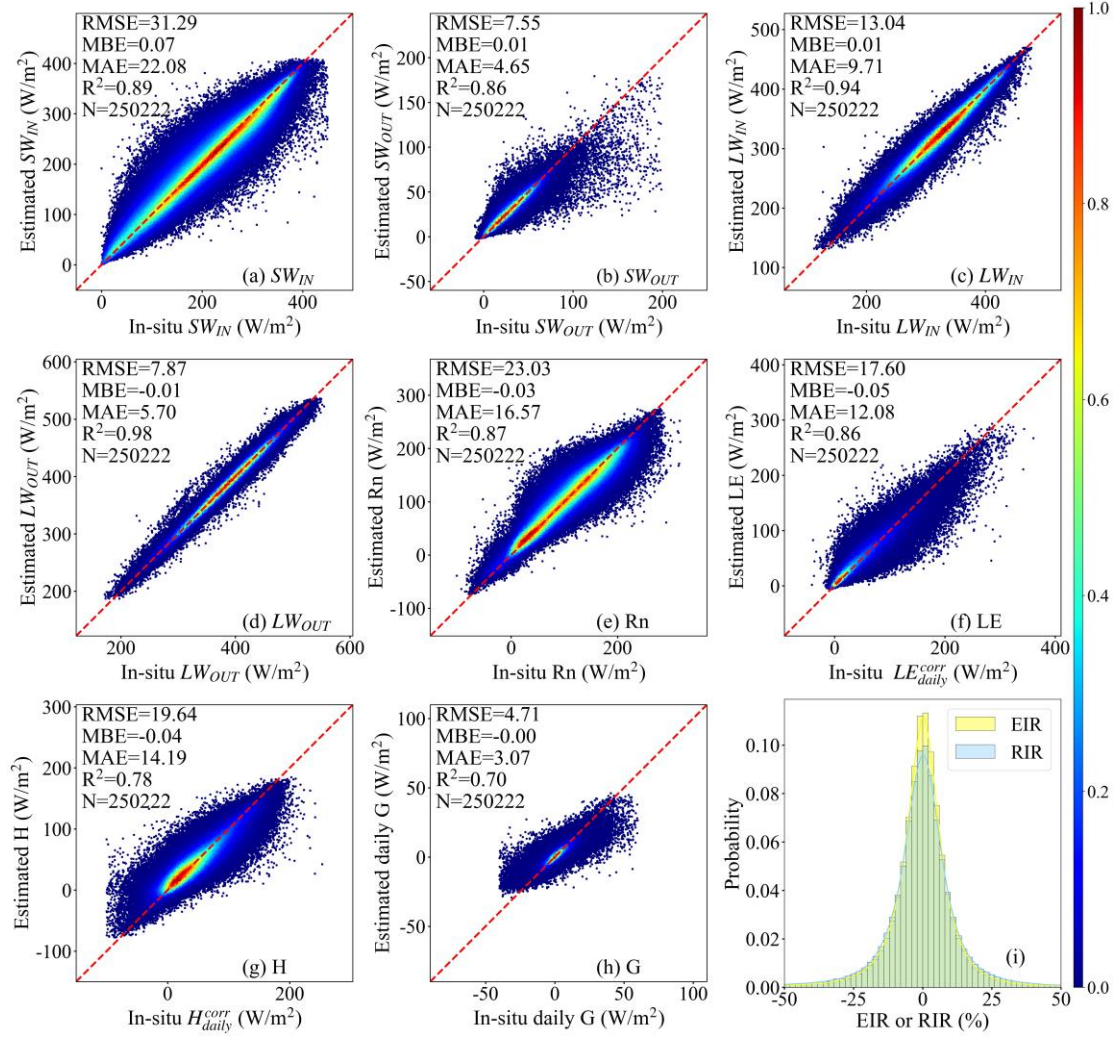


Fig. S2 Scatter density plots of the sample-based 10-fold cross-validation of daily downward shortwave and longwave radiation (SW_{IN} and LW_{IN}), upward shortwave and longwave radiation (SW_{OUT} and LW_{OUT}), net radiation (Rn), soil heat flux (G), latent heat flux (LE) and sensible heat flux (H) derived by the RF-based uncoordinated models against in-situ observed SW_{IN} , LW_{IN} , SW_{OUT} , LW_{OUT} , Rn , G , and energy imbalance-corrected LE (LE_{daily}^{corr}) and H

(H_{daily}^{corr}), where the sample-based 10-fold cross-validation was employed by randomly dividing

all sample data into ten folds.. The EIR and RIR in the subfigure (i) represent the energy imbalance ratio and radiation imbalance ratio, which are defined as

$$100\% \times (Rn - G - LE - H) / Rn \quad \text{and} \quad 100\% \times (SW_{IN} + LW_{IN} - SW_{OUT} - LW_{OUT} - Rn) / Rn ,$$

respectively. The colorbar represents the normalized density of data points.

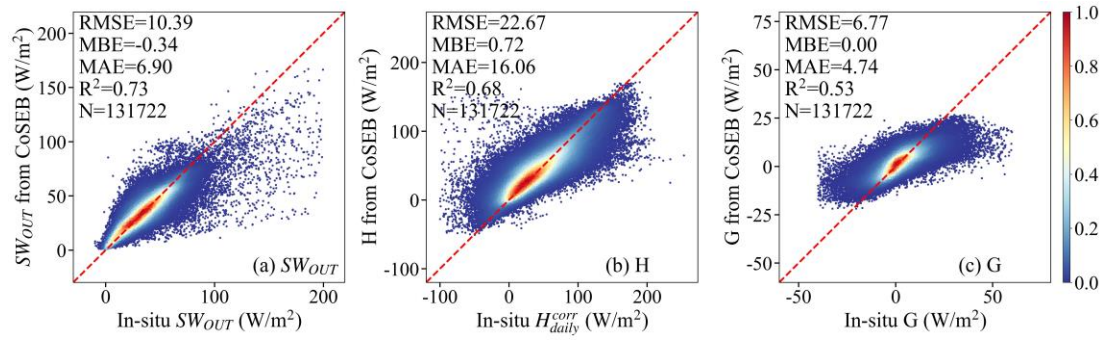


Fig. S3 Scatter density plots of the validation of daily upward shortwave radiation (SW_{OUT}), soil heat flux (G) and sensible heat flux (H) from the CoSEB-based datasets against in situ observed SW_{OUT} , G and energy imbalance-corrected H (H_{daily}^{corr}) at 134 eddy covariance sites. The colorbar represents the normalized density of data points.

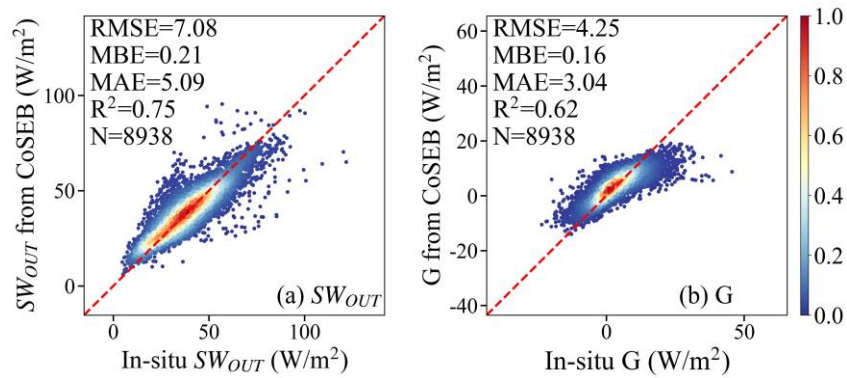


Fig. S4 Scatter density plots of the validation of 8-day upward shortwave radiation (SW_{OUT}) and soil heat flux (G) from the CoSEB-based datasets against in situ observed SW_{OUT} and G at 134 eddy covariance sites. The colorbar represents the normalized density of data points.