Supplementary Materials: Assessing the Multi-Source Evapotranspiration Products over China with Eddy Covariance Observations at 12 Sites

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Table S1. Members of Eearth2Observe-En ET product, with their PET schemes and references.

Full (Abbreviated) Name	PET Schemes	References
Hydrology Tiled ECMWF Scheme for Surface Exchanges over Land-Catchment-based Macro-scale Floodplain model (HTESSEL-CaMa)	Penman–Monteith	*Balsamo et al.* [1] and *Yamazaki et al.* [2]
the Joint UK Land Environment Simulator (JULES)	Penman–Monteith	*Best et al.* [3] and *Clark et al.* [4]
LISFLOOD	Penman–Monteith	*Van Der Knijff et al.* [5]
ORCHIDEE	Bulck ETP [6]	*d'Orgeval et al.* [7]
PCRaster GLOBal Water Balance model (PCR-GLOBWB)	Hamon (tier 1) or imposed as forcing	*Sutanudjaja et al.* [8] and *van Beek et al.* [9]
SURFEX-TRIP	Penman-Monteith	*Decharme et al.* [10,11]
Hydrologiska Byråns Vattenbalansavdelning model (HBV)-SIMREG	Penman-1948	*Beck et al.* [12]
Simple Water Balance Model (SWBM)	Inferred from net radiation	*Orth* and *Seneviratne* [13]
Water Resources Assessment (W3RA)	Penman-Monteith	*Lindström et al.* [14] and *van Dijk et al.* [15]
Water-Global Assessment and Prognosis (WaterGAP3)	Priestley–Taylor	*Verzano* [16] and *Flörke et al.* [17]

Table S2. Monthly comparisons of the estimated EC ET with the constant and the variable λ at 11 sites.

Name	*ME* (mm)	*RME* (%)	*RMSE* (mm)	*RRMSE* (%)	*R*
Cbs	0.25	0.6%	0.86	2.3%	0.99
Qyz	0.86	1.6%	1.43	2.7%	0.99
Dhs	0.82	1.5%	1.33	2.5%	0.99
Xsbn	0.87	1.6%	1.45	2.7%	0.99
Yc	0.14	0.2%	0.95	2.0%	0.99
Haa	-0.04	-0.1%	0.61	2.0%	0.99
Has	-0.91	-0.2%	0.92	2.0%	0.99
Nmg	0.20	0.8%	0.51	2.1%	0.99
Dx	0.10	0.2%	1.11	2.2%	0.99
Cl	0.30	0.8%	0.86	2.3%	0.99
Dl	0.15	0.5%	0.67	2.1%	0.99

Note: The constant λ is equal to 2.45 MJ/kg, while the variable λ is a function of temperature, such as $\lambda = 1.91846 \cdot \left(\frac{\text{temperature}+273.15}{\text{temperature}+273.15-33.91}\right)^2$ [18]. Here, the observed temperature at 11 EC sites is collected from FLUXNET and ChinaFlux, which has the same time span as the measured EC latent heat flux. Notably, temperature at Sx site is unavailable now. Moreover, this temperature dataset has been postprocessed using the standardized procedures [19] and gap-filled method [20], and ERA-Interim reanalysis data. The computations of *ME*, *RME*, *RMSE*, *RRMSE* and *R* are shown in equations (2-7) of the maintext.

Table S3. Comparisons of LUC types used by the four ET products at EC sites.

Name	IGBP Biomes at EC sites	GLEAM3.0a and W3RA within EartH2Observe	MERRA-LAND	GLDAS2.0-Noah	EartH2Observe-En		
					HTESSEL-CaMa JULES and PCR-GLOBWB	LISFLOOD and HBV-SIMREG	WaterGAP3
Cbs	MF	Tall vegetation	Broadleaf and Needleleaf Trees	MF	MF	Mosaic grassland (50-70%)/forest or shrubland (20-50%)	ENF
Qyz	ENF	Low vegetation	Agriculture or C3 Grassland	MF	CRO	Closed (>40%) needleleaved evergreen forest (>5m)	ENF
Dhs	EBF	Tall vegetation	Broadleaf and Needleleaf Trees	EBF	CRO	Closed to open (>15%) broadleaved evergreen or semi-deciduous forest (>5m)	EBF
Xsbn	EBF	Low vegetation	Broadleaf Evergreen Trees	Deciduous Broadleaf Forest	EBF	Closed to open (>15%) (broadleaved or needleleaved, evergreen or deciduous) shrubland (<5m)	EBF
Yc	CRO	Low vegetation	Agriculture or C3 Grassland	CRO	CRO	Rainfed croplands	CRO
Haa	GRA	Low vegetation	Agriculture or C3 Grassland	GRA	GRA	Rainfed croplands	Open Shrublands
Has	WET	Low vegetation	Agriculture or C3 Grassland	GRA	GRA	Mosaic vegetation (grassland/shrubland/forest) (50-70%)/cropland (20-50%)	GRA
Nmg	GRA	Low vegetation	Agriculture or C3 Grassland	GRA	GRA	Sparse (<15%) vegetation	GRA
Dx	GRA	Bare soil	Agriculture or C3 Grassland	GRA	GRA	Mosaic vegetation (grassland/shrubland/forest) (50-70%) / cropland (20-50%)	GRA
Cl	GRA	Low vegetation	Agriculture or C3 Grassland	WET	CRO	Mosaic vegetation (grassland/shrubland/forest) (50-70%)/cropland (20-50%)	CRO
Dl	GRA	Low vegetation	Broadleaf and Needleleaf Trees	GRA	CRO	Rainfed croplands	GRA
Sx	CRO	Low vegetation	Agriculture or C3 Grassland	Savannas	CRO	Post-flooding or irrigated croplands (or aquatic)	CRO

Note: For GLEAM3.0a, MERRA-LAND and GLDAS2.0-Noah, the corresponding LUC datasets can found. However, regarding EartH2Observe-En, the LUC datasets used by seven (in this table) and two models (i.e., ORCHIDEE and SURFEX-TRIP) are available and unavailable, respectively; the LUC is not the necessary input for SWBM. These LUC maps are from different sources and produced based on different classifications, i.e., GLEAM3.0a and W3RA model within EartH2Observe-En: the MODIS MOD44B product with a spatial resolution of 250 m and a classification legend including three types [tall (e.g., trees) and low vegetations (e.g., grasslands and croplands), and bare soil [21]]; MERRA-Land: the 1 km Global Land Cover Characterization (GLCC) Version 2 based on Simple Biosphere 2 Model classification; GLDAS2.0-Noah: the 500 m MODIS MCD12Q1 product with IGBP legend; HTESSEL-CaMa, JULES and PCR-GLOBWB, the 1 km GLCC Version 2 with IGBP legend; LISFLOOD and HBV-SIMREG: the 300 m GlobCover2009 v2.3 with GlobCover classification system; WaterGAP3: the 1 km MODIS MOD12Q1 product with IGBP legend. Notably, the LUC type shown in this table is the dominant one (corresponding to the largest fraction) within the $0.25^{o}\times0.25^{o}$ grid of the ET products.

Table S4. Comparisons of elevations from several popular digital elevation model (DEM) datasets at EC sites, with their spatial variability within the 0.25°×0.25° grid.

Name	Altitude at EC sites (m)	Means over the 0.25°×0.25° grid				Spatial variability within the 0.25°×0.25° grid			
		SRTM3 (m)	GTOPO30 (m)	HYDRO1k (m)	GMTED2010 (m)	SRTM3 (m)	GTOPO30 (m)	HYDRO1k (m)	GMTED2010 (m)
Cbs	738	761.9	756.4	775.9	764.4	68.3	70.3	107.3	73.2
Qyz	110.8	106.1	90.6	103	111.2	47.3	38	50.6	54.31
Dhs	300	211.4	207.1	174	201.9	180.6	179.9	168.9	179.6
Xsbn	750	825.5	810.3	905.9	824.2	193.6	195.3	218.3	191.6
Yc	28	23.7	18.9	19.3	24.2	1.4	8.9	7.7	1.5
Haa	3250	3660.4	3652.5	3653	3647.7	267.1	268.8	303.2	265.3
Has	3160	3323.5	3317.1	3406	3321.7	233.8	232.5	367.4	241.2
Nmg	1189	994.6	1012.1	1017.3	997.2	32.5	33.6	42.4	33.6
Dx	4333	4703	4703.7	4794.3	4697.5	390.9	391.4	417.9	383.5
Cl	171	143	128.4	137	143.7	3.8	8.2	5	4.1
Dl	1350	1373.3	1376.2	1405.3	1377.3	64	64.4	80.4	68.9
Sx	24	23	17.4	21.8	23.1	3.5	8.0	5.2	4

Note: Here, four popular DEM datasets are collected, i.e., Shuttle Radar Topography Mission (SRTM) Version 3 (SRTM3) from http://srtm.csi.cgiar.org/Index.asp, Global 30 Arc-Second Elevation (GOTOP30) from https://lta.cr.usgs.gov/GTOPO30, HYDRO1k from https://lta.cr.usgs.gov/HYDRO1K and Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010) from https://topotools.cr.usgs.gov/gmted_viewer/, which has the same spatial resolution of 1 km. The grid mean elevations are obtained by averaging the 1 km grid elevations within the 0.25°×0.25° grid. The grid spatial variability is represented by the standard deviation of the 1 km grid elevations within the 0.25°×0.25° grid.

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