1. About the data set

Site name (AsiaFlux three letter code)	Kahoku Experimental Watershed (KHW)
Period of registered data	From January 1, 2000 to December 31, 2000
This document file name	KHW_2000_001d.pdf
Corresponding data file name	KHW_2000_001.csv

Revision information

Date	Details of revision	Renewed file name
31 March 2010	First registration	KHW_2000_001.pdf KHW_2000_001.csv
8 June 2010	Document file is updated: p.8, line4: Publication list URL	KHW_2000_002.pdf
28 July 2010	Document file is renamed (no change in document contents): Version management is changed: 002 → 001b (corresponding data version + alphabetical sequence)	KHW_2000_001b.pdf
31 July 2012	Document file is updated: New format is applied p.1: Details in each revision are added	KHW_2000_001c.pdf
31 July 2014	Document file is updated: Information related to data processing (p.3-4) is added.	KHW_2000_001d.pdf

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2. Site description

Hour line (Time difference from UTC)	Japan Standard Time (JST) (9 hours ahead of UTC)
Location (address)	Iwano, Kahoku-town, Yamaga-city, Kumamoto pref., Japan
Position	33.137N, 130.7095E (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Elevation	165m above sea level (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Terrain type	Rolling terrain
Slope	16 degrees (average value around the tower)
Area	approx. 12.7ha
Fetch	>300m
Climate	Warm temperate (Köppen climate classification: Cfa)
Mean annual air temperature	15.3 degrees C (2000-2007)
Mean annual precipitation	2130mm (2000-2007)
Vegetation Type	Evergreen needleleaf forest
Dominant Species (Overstory)	*Cryptomeria japonica* (Sugi cedar), *Chamaecyparis obtuse* (Hinoki cypress): plantimal *Castanopsis cuspidata*, *Fagus japonica* (japanese beech): grown in gaps
Dominant Species (Understory)	Fagus japonica Maxim., Castanopsis sieboldii, etc.
Canopy height	10-35m
Breast high diameter	50cm (max, Sugi cedar)
Age	Around 50 years (Sugi cedar), 30-60 years (Hinoki cypress)
LAI	3.6-5.2 (estimated by LAI-2000)
Soil Type	Brown forest soil B_D
Other information	

Reference

3. Registered Data

Observation items	Symbol	Unit	Height(s) Depth(s)	Instruments	Note
Date	DATE	-	-	-	yyyymmdd
Time	TIME	-	-	-	hhmm
Precipitation	PPT	mm	1.5m	RT-5 (IKEDA)	See Note [1]
Air temperature	Ta	degrees C	41.5m	ML-020L (EKO)	See Note [2]
Relative humidity	Rh	%	41.5m	ML-202L (EKO)	See Note[2], [3]
Wind speed	U	$m\cdot s^{-1}$	51.0m	DAT-600-3T (KAIJO)	
Wind direction	WD	degrees	51.0m	DAT-600-3T (KAIJO)	
Global solar radiation (incoming / downward)	Sd	$W\cdot m^{-2}$	47.2m	CM14 (Kipp & Zonen)	See Note [4]
Reflected solar radiation (upward)	Su	$W\cdot m^{-2}$	47.2m	CM14 (Kipp & Zonen)	See Note [4]
Photosynthetic active photon flux density (downward)	Pd	NA	NA	NA	
Reflected PAR (upward)	Pu	NA	NA	NA	
Net radiation	Rn	$W\cdot m^{-2}$	47.2m	CM14 (Kipp & Zonen) PIR (EPPLEY)	See Note [5], [6]
Soil heat flux	G	NA	NA	NA	
Sensible heat flux	H	$W\cdot m^{-2}$	51.0m	DAT-600-3T (KAIJO)	
Latent heat flux	lE	NA	NA	NA	
Friction velocity	Ust	$m\cdot s^{-1}$	51.0m	DA-600-3T (KAIJO)	
CO_2 flux	Fc	$micromol\cdot m^{-2}\cdot s^{-1}$	51.0m	DA600-3T (KAIJO) LI-6262 (LI-COR)	Closed-path system, QC
Storage change in canopy air layer	Sc	$micromol\cdot m^{-2}\cdot s^{-1}$	6.0, 11.5, 17.3, 24.0, 31.2, 36.5, 40.3, 46.1m	LI-6262 (LI-COR)	
Net ecosystem exchange	NEE	$micromol\cdot m^{-2}\cdot s^{-1}$	-	-	NEE=Fc+Sc
Ecosystem respiration	Re	NA	NA	NA	
Gross primary production	GPP	NA	NA	NA	

Note

[1] Data gaps were filled with data obtained using AMeDAS (weather station managed by Meteorological Agency) data.
[2] Data gaps were filled with data obtained using the backup system. When data of both observation sets were

unavailable, linear interpolation were applied. The residual gaps were filled with AMeDAS data.
[3] value of >100% is replaced by 100%
[4] value in night time is replaced by 0.0.
[5] Rn = Sd – Su + Ld - Lu (Ld: downward longwave radiation, Lu: upward longwave radiation_)
[6] Data gaps were filled with data obtained by the net radiometer; NR-LITE (Kipp&Zonen).

Reference

Data format

Data consists of fixed length (8 digits) comma separated format. Missing data is labeled as "-9999.00"

Line 1: Symbol (Date, Time, PPT, Ta, …..)

Line 2: Unit (yyyymmdd, hhmm, mm, degC, ….)

"hhmm" shows intermediate time of averaging period.

i.e. "1215" labels half-hourly average (or sum) of data from 12:00 to 12:30

Line 3: Comment

Line 4: Data

:

Data Example

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    Date, Time,     PPT,      Ta,      Rh,       U,      WD,      Sd,      Su,      Pd,      Pu, ...........
yyyymmdd, hhmm,      mm,    degC,       %,    ms-1,     deg,    Wm-2,    Wm-2,    (*1),    (*1), ...........
File= KWG_2000_001.CSV; Created: 20100326; Gap= -9999.0; (*1): micro-mol m-2 s-1                 ...........
20000101, 0015,     0.0,    3.34,   87.19,    1.58, -9999.0,     0.1, -9999.0,     0.1,     0.0, ...........
20000101, 0045,     0.0,    3.12,   88.14,    1.44, -9999.0,     0.0, -9999.0,     0.1,     0.0, ...........
20000101, 0115,     0.0,    2.36,   90.51,    1.15, -9999.0,    -0.3, -9999.0,     0.1,     0.0, ...........
20000101, 0145,     0.0,    2.14,   91.32,    0.83, -9999.0,     0.0, -9999.0,     0.1,     0.0, ...........
20000101, 0215,     0.0,    2.28,   88.96,    0.49, -9999.0,    -0.3, -9999.0,     0.1,     0.0, ...........
20000101, 0245,     0.0,    2.24,   89.82,    0.35, -9999.0,    -0.2, -9999.0,     0.2,     0.0, ...........
20000101, 0315,     0.0,    2.05,   89.49,    1.50, -9999.0,     0.1, -9999.0,     0.2,    -0.1, ...........
20000101, 0345,     0.0,    2.41,   87.25,    1.27, -9999.0,     0.0, -9999.0,     0.2,     0.0, ...........
20000101, 0415,     0.0,    2.31,   86.83,    1.12, -9999.0,    -0.2, -9999.0,     0.1,     0.0, ...........
20000101, 0445,     0.0,    2.84,   83.36,    0.54, -9999.0,    -0.6, -9999.0,     0.0,     0.0, ...........
20000101, 0515,     0.0,    2.53,   83.32,    1.23, -9999.0,     0.2, -9999.0,     0.2,     0.0, ...........
20000101, 0545,     0.0,    1.59,   87.54,    1.29, -9999.0,    -0.6, -9999.0,     0.0,     0.0, ...........
20000101, 0615,     0.0,    1.89,   85.13,    0.94, -9999.0,     0.4, -9999.0,     0.3,     0.0, ...........
20000101, 0645,     0.0,    1.77,   82.40,    0.83, -9999.0,     3.5, -9999.0,     8.5,     0.4, ...........
20000101, 0715,     0.0,    2.67,   76.83,    1.38, -9999.0,    45.8, -9999.0,    71.9,    11.6, ...........
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4. Observation and calculation

4-1. Flux observation system and data acquisition

Type of sonic anemometer	DA-600-3T (KAIJO)
Type of IRGA	LI-6262 (LI-COR)
Sampling rate	10Hz
Averaging time	0
Flux measurement height #1	51.0m
Zero-plane displacement	27.0m for southern direction from the tower
Roughness length	5.3m for southern direction from the tower
Calibration information	—
Other information	—

4-2. Flux calculation

Calculation methods		Note
Flow attenuation [*4-6]	Transducer shadow correction	Shimizu et al. (1999) Boundary-Layer Met., 93, 227-236.
Coordinate rotation [*1-3]	double rotation	
Lag removal [*2, 7, 8]	Automatic	

4-3. Flux corrections

Correction methods		Target flux	Note
Cross wind correction [*9, 10]		For sensible heat flux	
Vapor correction			
High frequency loss	Band-pass covariance method [*12]	For CO_2 flux (Fc)	Experimental approach*2
	Experimental approach [*2]		
Low frequency loss (Detrending)	Linear detrend [*16]	Block average	
WPL Correction [*17-21]		For CO_2 flux (Fc)	
Others [*22-24]	Temperature dependency for latent heat: L Humidity dependency for specific heat: Cp Temperature dependency for air density Pressure dependency for air density		

4-4. Quality control [25-26]

QC methods				Note
Raw data test [25,26]	Spike test [27]		Applied	
	Absolute limits		Applied	
	Absolute variance		Applied	
	Higher-moment statistics	skewness	Applied	
		kurtosis	Applied	
	Discontinuities	Harr mean test	Applied	
		Harr variance test	Applied	
	Visual inspection		Applied	
Non steady state test[25]			Not applied	
Absolute thresholds				
Others				

4-5. Storage term

Target storage		Note
CO_2	From CO_2 profile data (6.0, 11.5, 17.3, 24.0, 31.2, 36.5, 40.3, 46.1m) Sampling interval: 120 seconds at each height	

References

5. Important events

Date	Events
2000.8.22~	Storage CO_2 terms became continuously available from 22, Aug.

6. Publications relating to this site

SHIMIZU Takanori (2007) Practical applicability of high frequency correction theories to CO_2 flux measured by a closed-path system. Boundary-Layer Meteorology, 122(2):417-438

Publication list: http://www2.ffpri.affrc.go.jp/labs/flux/paper_e.html [KHW]

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Flux calculation

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Quality control

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