1. About the data set

Site name (AsiaFlux three letter code)	Yamashiro forest hydrology research site (YMS)
Period of registered data	From January 1, 2004 to December 31, 2004
This document file name	YMS_2004_001c.pdf
Corresponding data file name	YMS_2004_001.csv YMS_2004P_001.csv (Hourly precipitation data)

Revision information

Date	Details of revision	Renewed file name
29 February 2012	First registration	YMS_2004_001a.pdf YMS_2004_001.csv YMS_2004P_001.csv
15 May 2012	Document file is updated: p.9, line21: Publication information is updated.	YMS_2004_001b.pdf
31 July 2012	Document file is updated: p.1: Details in each revision are added.	YMS_2004_001c.pdf

Contact person#1	[Flux & Meteorology] Yuji KOMINAMI (kominy@ffpri.affrc.go.jp)
Contact person#2	[Flux & Meteorology] Takafumi MIYAMA (tmiyama@affrc.go.jp)
Contact person#3	

2. Site description

Hour line (Time difference from UTC)	Japan Standard Time (JST) (9 hours ahead of UTC)
Location (address)	Yamashiro, Souraku, Kyoto, Japan
Position	34.7948N, 135.8462E (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Elevation	180-255m above sea level (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Terrain type	Complex
Slope	0-35 degrees
Area	Forest community: > 10km2 Ecosystem research area: 1.7ha, Hydrological catchment area: 1.6ha
Fetch	> 2km
Climate	Warm temperate (Köppen climate classification: Cfa)
Mean annual air temperature	15.5 degree C (1994-2003, Kominami *et al*. 2008)
Mean annual precipitation	1449 mm (1994-2003, Kominami *et al*. 2008)
Vegetation Type	Warm temperate deciduous broadleaf forest
Dominant Species (Overstory)	*Quercus serrata* (Konara oak), *Ilex pedunculosa* (japanese holly), *Lyonia elliptica* (tree Lyonia), *Alnus Sieboldiana* (alder), *Clethra barbinervis* (japanese sweetspire), *Eurya japonica* (japanese eurya), *Pinus densiflora* (japanese red pine), *Robinia Pseudo-acacia* (locust tree). (Goto *et al*. 2003)
Dominant Species (Understory)	*Rhododendron reticulatum*, *Rhododendron macrosepalum* (Goto *et al*. 2003)
Canopy height	6m-20m, approx. 12m in average (1994-2005) (Goto *et al*. 2003)
Breast High Diameter	7.4cm in average, 50.2cm in Max. (Hinoki cypress) (Goto *et al*. 2003)
Age	Identified to be oldest red pine: 119years (BHD 34.8cm, investigated in 2000) Dominant species (*Quercus serrata): mean age is about 60years* (Goto *et al*. 2003)
LAI	4.42 in summer and 2.70 in winter (LAI-2000) (Goto *et al*. 2003)
Soil Type	Immature (Im)
Other information	Having two observation towers (one on the ridge, the other in the valley). More than 2km apart from major roads and inhabitable area (Kominami *et al*. 2003)

References

KOMINAMI Yuji, JOMURA Mayuko, DANNOURA Masako, GOTO Yoshiaki, TAMAI Koji, MIYAMA Takafumi, KANAZAWA Yoichi, KANEKO Shinji, OKUMURA Motonori, MISAWA Noriko, HAMADA Shogo, SASAKI Taizo, KIMURA Hitoshi, OHTANI Yoshikazu (2008): Biometric and eddy-covariance-based estimates of carbon balance for a warm-temperate mixed forest in Japan. Agricultural and Forest Meteorology, 148(5):723-737.

GOTO Yoshiaki, KOMINAMI Yuji, MIYAMA Takafumi, TAMAI Koji, KANAZAWA Yoichi (2003): Aboveground Biomass and Net Primary Production of a Broad-leaved Secondary Forest in the Southern Part of Kyoto Prefecture, Central Japan. Bulletin of the Forestry and Forest Products Research Institute, 2(2):115-147. [in Japanese with an English abstract]

KOMINAMI Yuji, MIYAMA Takafumi, TAMAI Koji, NOBUHIRO Tatsuhiko, GOTO Yoshiaki (2003): Characteristics of CO_2 flux over a forest on complex topography. Tellus B, 55(3):313-321.

3. Registered data

Observation items	Symbol	Unit	Height(s) Depth(s)	Instruments	Note
Date	DATE	-	-	-	yyyymmdd
Time	TIME	-	-	-	hhmm
Precipitation	PPT	mm	1.5m	34-HT (Ohta Keiki)	Hourly data. Gap filled, see Note [1]
Air temperature	Ta	degrees C	25.7m	HMP-45D (VAISALA)	Gap filled, see Note [1]
Relative humidity	Rh	%	25.7m	HMP-45D (VAISALA)	Gap filled, see Note [1]. See also Note [2], [3]
Wind speed	U	$m \cdot s^{-1}$	26.2.	AG-750 (MAKINO)	Gap filled, see Note [1]
Wind direction	WD	NA	NA	NA	
Global solar radiation (incoming / downward)	Sd	$W \cdot m^{-2}$	26.2m 36.1m	MR-22 (EKO) CM-7B (Kipp & Zonen)	Gap filled, see Note [1]. See also Note [4]
Reflected solar radiation (upward)	Su	$W \cdot m^{-2}$	26.2m 36.1m	MR-22 (EKO) CM-7B (Kipp & Zonen)	Gap filled, see Note [1]. See also Note [4]
Photosynthetic active photon flux density (downward)	Pd	$micromol \cdot m^{-2} \cdot s^{-1}$	26.2m	LI190 (LI-COR)	Gap filled, see Note [1]. See also Note [3], [4]
Reflected PAR (upward)	Pu	NA	NA	NA	
Net radiation	Rn	$W \cdot m^{-2}$	26.2m	CN-11(EKO)	Gap filled, see Note [1].
Soil heat flux	G	NA	NA	NA	
Sensible heat flux	H	NA	NA	NA	
Latent heat flux	lE	NA	NA	NA	Kominami *et al.*, 2005
Friction velocity	Ust	$m \cdot s^{-1}$	25.7m	DA-600(KAIJO)	
CO_2 flux	Fc	$micromol \cdot m^{-2} \cdot s^{-1}$	25.7m	LI-6262(LICOR)	Closed path system See 4-4 for QC

Storage change in canopy air layer	Sc	micromol·m^{-2}·s^{-1}	1.1, 3.1, 5.3, 6.9, 8.9, 14.2, 20.0, 25.7m	LI-6262(LICOR)	
Net ecosystem exchange	NEE	micromol·m^{-2}·s^{-1}	-	-	NEE=Fc+Sc Ust screening (Ust >= 0.4m s-1) Gap filled Kominami *et al.*, 2008
Ecosystem respiration	Re	micromol·m^{-2}·s^{-1}	-	-	Gap filled Kominami *et al.*, 2008
Gross primary production	GPP	micromol·m^{-2}·s^{-1}	-	-	GPP=-NEE+Re

Note

[1] gaps are filled using data from observation data of another tower (correlation factor: > 0.99).
[2] data of >100% is replaced by 100%.
[3] ageing deterioration is corrected.
[4] night time data is replaced by 0.0.

Gap filling

NEE	–NEE(daytime) = Agmax* alpha*APAR/ (Agmax+alpha*APAR) : Parameters were derived monthly.
Re	Re = -NEE(nighttime) = a* exp^(b*Ts) : Parameters (a & b) were derived yearly.

References

KOMINAMI Yuji, MIYATA Takafumi, TAMAI Koji, JOMURA Mayuko, DANNOURA Masako, GOTO Yoshiaki (2005) Evaluation of Nighttime Eddy CO_2 Flux using Automated Chamber Measurements. Journal of Agricultural Meteorology, 60(5):745-748.

KOMINAMI Yuji, JOMURA Mayuko, DANNOURA Masako, GOTO Yoshiaki, TAMAI Koji, MIYAMA Takafumi, KANAZAWA Yoichi, KANEKO Shinji, OKUMURA Motonori, MISAWA Noriko, HAMADA Shogo, SASAKI Taizo, KIMURA Hitoshi, OHTANI Yoshikazu (2008) Biometric and eddy-covariance-based estimates of carbon balance for a warm-temperate mixed forest in Japan. Agricultural and Forest Meteorology, 148(5):723-737

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

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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 (ridge tower) LI-7500, LI-COR (valley tower)
Sampling rate	10Hz
Averaging time	0
Flux measurement height #1	25.7m (ridge tower) 36.1m (valley tower)
Zero-plane displacement	NA
Roughness length	NA
Calibration information	NA
Other information	

4-2. Flux calculation

Calculation methods		Note
Flow attenuation [*4-6]	NA	
Coordinate rotation [*1-3]	Applied	3d rotation
Lag removal [*2, 7, 8]	Applied	Automatic

4-3. Flux corrections

Correction methods		Target flux	Note
Cross wind correction[*9, 10]		-	
Vapor correction		-	
High frequency loss	Band-pass covariance method [*12]	NA	
	Experimental approach [*2]		
Low frequency loss (Detrending)	Linear detrend [*16]	Applied	
WPL Correction[*17-21]		(Not applied)	Dehumidification was conducted to avoid WPL correction using
Others [*22-24]			

4-4. Quality control [25-26]

QC methods				Note
Raw data test [25,26]	Spike test [27]		Applied	Koinami *et al.*, 2008
	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			Applied	Low limit 350ppm High limit 450ppm
Others				

4-5. Storage term

Target storage		Note
CO_2	1.1, 3.1, 5.3, 6.9, 8.9, 14.2, 20.0, 25.7m 8 elevations 30min interval	

References

KOMINAMI Yuji, JOMURA Mayuko, DANNOURA Masako, GOTO Yoshiaki, TAMAI Koji, MIYAMA Takafumi, KANAZAWA Yoichi, KANEKO Shinji, OKUMURA Motonori, MISAWA Noriko, HAMADA Shogo, SASAKI Taizo, KIMURA Hitoshi, OHTANI Yoshikazu (2008) Biometric and eddy-covariance-based estimates of carbon balance for a warm-temperate mixed forest in Japan. Agricultural and Forest Meteorology, 148(5):723-737

5. Important events

Date	Events
15 July 15:45 ~ 16 July 14:30	electrical power outage
17 August 21:15 ~ 20 August 14:30	electrical power outage

6. Publications relating to this site

GOTO Yoshiaki, KOMINAMI Yuji, MIYAMA Takafumi, TAMAI Koji, KANAZAWA Yoichi (2003) Aboveground Biomass and Net Primary Production of a Broad-leaved Secondary Forest in the Southern Part of Kyoto Prefecture, Central Japan. Bulletin of the Forestry and Forest Products Research Institute, 2(2):115-147 [in Japanese with an English abstract]

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Flux calculation

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Flux correction

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