

1. About the data set

Site name (AsiaFlux three letter code)	Fujiyoshida forest meteorology research site (FJY)	
Period of registered data	From January 1,2009 to December 31, 2009	
This document file name	FJY_2009_001a.pdf	
Corresponding data file name	FJY_2009_001.csv	
Revision information		
Date	Details of revision	Renewed file name
27 April 2017	First registration	FJY_2009_001.csv FJY_2009_001a.pdf
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Data provider	Yuichiro Nakai	

2. Site description

Hour line (Time difference from UTC)	Japan Standard Time(JST) (9 hours ahead of UTC)
Location (address)	Kenmarubi, Kamiyoshida, Fujiyoshida 403-0005, Yamanashi, Japan (on the premises of Yamanashi Institute of Environment Science)
Position	35.45454N, 138.76225E (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Elevation	1030m above sea level (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Terrain type	Gentle slope
Slope	3.5 degrees
Area	36km ²
Fetch	150-3000m
Climate	Cool temperate (Köppen climate classification: Cfb)
Mean annual air temperature	9.5 degreeC ,2000-2008 (Mizoguchi <i>et.al.</i> , 2011)
Mean annual precipitation	1955 mm, 2000-2007 (Mizoguchi <i>et.al.</i> , 2011)
Vegetation Type	Secondary natural evergreen needle-leaf forest
Dominant Species (Overstory)	Japanese red pine (<i>Pinus densiflora</i>)
Dominant Species (Understory)	Longstalk holly (<i>Ilex pedunculosa</i>)
Canopy height	Approx. 19m (measurement date: Apr. 2000)
Breast high diameter	23.5cm: japanese red pine (Otsuka <i>et.al.</i> 2003)
Age	approx. 90years: japanese red pine (Otsuka <i>et.al.</i> 2003)
LAI	Max. 5.0 m ² m ⁻²
Soil Type	Immature (litter and organic matter with partially exposed volcanic lava) Im
Other information	Highly disturbed until 90 years ago (Otsuka <i>et.al.</i> , 2003)

References

OTSUKA Toshiyuki, GOTO Takehiro, SUGITA Mikio, NAKAJIMA Takafumi, IKEGUCHI Hitoshi (2003) The origin of pine forest on Ken-marubi lava flow on the lower slopes of Mt.Fuji. Vegetation Science, 20:43-54 (in Japanese with English abstract)
MIZOGUCHI Yasuko, OHATNI Yoshikazu, NAKAI Yuichiro, IWATA Hiroki, TAKANASHI Satoru,, YASUDA Yukio, NAKANO Takashi, YASUDA Taisuke, WATANABE Tsutomu (2011) Climatic characteristics of the Fujiyoshida forest meteorology research site. Mount Fuji Research, 5:1-6.

3. Registered data

Observation items	Symbol	Unit	Height(s) Depth(s)	Instruments	Note
Date	DATE	-	****	****	yyyymmdd
Time	TIME	-	****	****	hhmm
Precipitation	PPT	mm	1.5m	B071-00 (YOKOGAWA)	(Mizoguchi <i>et al.</i> , 2011)
Air temperature	Ta	degrees C	22.7m	HMP45D (VAISALA)	
Relative humidity	Rh	%	22.7m	HMP45D (VAISALA)	
Wind speed	U	$\text{m} \cdot \text{s}^{-1}$	27.2m	DA600-3T (KAIJO)	
Wind direction	WD	degrees	27.2m	DA600-3T (KAIJO)	
Global solar radiation (incoming / downward)	Sd	$\text{W} \cdot \text{m}^{-2}$	32.0m	CM6F (Kipp & Zonen)	See Note [3] (Mizoguchi <i>et al.</i> , 2011)
Reflected solar radiation (upward)	Su	$\text{W} \cdot \text{m}^{-2}$	28.6m	[from the initiation to 2011-08-30] CM6B (Kipp & Zonen) [from 2011-08-30 to 2012-06-05] PCM03 (Prede) [from 2012-06-05 to the present] CMP6 (Kipp & Zonen)	See Note [3]
Photosynthetic active photon flux density (downward)	Pd	$\text{micromol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$	32.0m	LI190 (LI-COR)	See Note [3] (Mizoguchi <i>et al.</i> , 2012)
Reflected PAR (upward)	Pu	$\text{micromol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$	28.6m	LI190 (LI-COR)	See Note [3],[5]
Net radiation	Rn	$\text{W} \cdot \text{m}^{-2}$	32.0m / 28.6m	CM6F, CM6B (Kipp & Zonen), PIR (Eppley)	See Note [4]
Soil heat flux	G	$\text{W} \cdot \text{m}^{-2}$	-0.02m	MF-81 (EKO)	
Sensible heat flux	H	$\text{W} \cdot \text{m}^{-2}$	27.2m	DA600-3T (KAIJO)	See Section 4
Latent heat flux	IE	$\text{W} \cdot \text{m}^{-2}$	27.2m	LI-7500 (LI-COR)	See Section 4
Friction velocity	Ust	$\text{m} \cdot \text{s}^{-1}$	27.2m	DA600-3T (KAIJO)	See Section 4
CO ₂ flux	Fc	$\text{micromol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$	27.2m	LI-6262 (LI-COR)	Closed-path system See Section 4 (Ohtani <i>et al.</i> , 2005, Mizoguchi <i>et al.</i> , 2012)

Storage change in canopy air layer	Sc	micromol·m ⁻² ·s ⁻¹	[from the initiation to 2010-07-08] 22.7, 18.9, 13.2, 9.4, 3.2m [from 2010-07-08 to the present] 26.5, 22.7, 18.9, 13.2, 9.4, 1.9m	LI-6262 (LI-COR)	See Section 4 (Ohtani <i>et al.</i> , 2005, Mizoguchi <i>et al.</i> , 2012)
Net ecosystem exchange	NEE	micromol·m ⁻² ·s ⁻¹			Ust screening (Ust >= 0.12), Gap filled
Ecosystem respiration	Re	micromol·m ⁻² ·s ⁻¹			Gap filled
Gross primary production	GPP	micromol·m ⁻² ·s ⁻¹			GPP=-NEE+Re

Note

- [2] snow cover influence is eliminated.
 [3] value in night time is replaced by 0.0.
 [4] $R_n = S_d - S_u + L_d - L_u$ (L_d : downward longwave radiation, L_u : upward longwave radiation)
 [5] instrumental error is corrected

Gap filling

NEE	$-F_{NEE,day} = \frac{\phi \cdot Pd + (-F_{NEE})_{sat} - \sqrt{(\phi \cdot Pd + (-F_{NEE})_{sat})^2 - 4 \cdot \phi \cdot Pd \cdot \theta \cdot (-F_{NEE})_{sat}}}{2 \cdot \theta} + Re$ Parameters were derived daily, using the 15-day moving window.
Re	$F_{NEE,night} = F_{Ta=25^{\circ}C} \times \exp\left(Ha \frac{(Ta + 273) - 298.0}{298.0 \times 8.31 \times (Ta + 273)}\right)$ Parameters were derived daily using the 15-day moving window.

References

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- MIZOGUCHI Yasuko, OHATNI Yoshikazu, NAKAI Yuichiro, IWATA Hiroki, TAKANASHI Satoru,, YASUDA Yukio, NAKANO Takashi, YASUDA Taisuke, WATANABE Tsutomu (2011) Climatic characteristics of the Fujiyoshida forest meteorology research site. *Mount Fuji Research*, 5:1-6.
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Data format

Data consists of fixed length (8 digits) comma separated format. Missing data is labeled as "-9999.0" or "-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

Date, Time, yyyymmdd, hhmm,	PPT, mm,	Ta, degC,	Rh, %,	U, ms-1,	WD, deg,	Sd, Wm-2,	Su, Wm-2,	Pd, (#1),	Pu, (#1),	
File= KWG_2000_001.CSV; Created: 20100326; Gap= -9999.0; (*1): micro-mol m-2 s-1										
20000101, 0015,	0.0,	3.34,	87.13,	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	DA600-3T (Probe TR-61C) (KAIJO)
Type of IRGA	LI-6262, LI-COR
Sampling rate	5Hz (from the initiation to 2010-05-18), 10Hz (from 2010-05-18 to the present)
Averaging time	30min
Flux measurement height #1	27.2m
Zero-plane displacement	
Roughness length	
Calibration information	CO ₂ /H ₂ O gas analyzer was calibrated once a day by flowing standard gases that were automatically controlled.
Other information	

4-2. Flux calculation

Calculation methods		Note
Flow attenuation ^{*4-6}	Not applied	
Coordinate rotation ^{*1-3}	Applied	double rotation
Lag removal ^{*2, 7, 8}	Applied	automatic

4-3. Flux corrections

Correction methods		Target flux	Note
Cross wind correction ^{*9, 10}		sensible heat flux (H), latent head flux (IE)	
Vapor correction		sensible heat flux (H)	
High frequency loss	Band-pass covariance method ^{*12}	CO ₂ flux (Fc)	
	Experimental approach ^{*2}		
Low frequency loss (Detrending)	Linear detrend ^{*16}	sensible heat flux (H), latent head flux (IE), friction velocity (Ust), CO ₂ flux (Fc)	
WPL Correction ^{*17-21}		latent head flux (IE), CO ₂ flux (Fc)	
Others ^{*22-24}	Temperature dependency for latent heat Humidity dependency for specific heat 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			Not applied	
Others			Data with $|\Psi| > 5\text{deg}$ is eliminated	

4-5. Storage term

Target storage		Note
CO ₂	[from the initiation to 2010-07-08] CO ₂ profile data (22.7, 18.9, 13.2, 9.4, 3.2m) Sampling interval: 5 minute at each height [from 2010-07-08 to the present] CO ₂ profile data (26.5, 22.7, 18.9, 13.2, 9.4, 1.9m) Sampling interval: 1 minute at each height	(Ohtani <i>et al.</i> , 2005, Mizoguchi <i>et al.</i> , 2012)

References

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5. Important events

Date	Events

6. Publications relating to this site

- OHTANI Yoshikazu, MIZOGUCHI Yasuko, WATANABE Tsutomu, YASUDA Yukio (2005): Parameterization of NEP for gap filling in a cool-temperate coniferous forest in Fujiyoshida, Japan. *Journal of Agricultural Meteorology*, 60(5):769-772
- OHTANI Yoshikazu, SAIGUSA Nobuko, YAMAMOTO Susumu, MIZOGUCHI Yasuko, WATANABE Tsutomu, YASUDA Yukio, MURAYAMA Shohei (2005): Characteristics of CO₂ fluxes in cool-temperate coniferous and deciduous broadleaf forests in Japan. *Phyton*, 45(4):73-80
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- MIZOGUCHI Yasuko, YASUDA Yukio, OHTANI Yoshikazu, WATANABE Tsutomu, KOMINAMI Yuji, YAMANOI Katsumi (2014): A practical model to estimate photosynthetically active radiation using general meteorological elements in a temperate humid area and comparison among models. *Theoretical and Applied Climatology* 115(3-4): 583-589.
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