

1. About the data set

Site name (AsiaFlux three letter code)	Yamashiro forest hydrology research site (YMS)	
Period of registered data	From January 1, 2001 to December 31, 2001	
This document file name	YMS_2001_002c.pdf	
Corresponding data file name	YMS_2001_002.csv	
	YMS_2001P_002.csv (Hourly precipitation data)	
Revision information		
Date	Details of revision	Renewed file name
1 April 2010	First registration	YMS_2001_001.pdf YMS_2001_001.csv YMS_2001P_001.csv
8 June 2010	Document file is updated: p.9, line19: Publication list URL	YMS_2001_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)	YMS_2001_001b.pdf
29 February 2012	Second registration: Radiation data is corrected: Sd, Su, Pd (Eliminate negative value in daytime and replace nighttime value by zero) Document file are updated: New format is applied.	YMS_2001_002a.pdf YMS_2001_002.csv YMS_2001P_002.csv
15 May 2012	Document file is updated: p.9, line21: Publication information is updated.	YMS_2001_002b.pdf
31 July 2012	Document file is updated: p.1: Details in each revision are added.	YMS_2001_002c.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)	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: > 10km ² 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 <i>et al.</i> 2008)
Mean annual precipitation	1449 mm (1994-2003, Kominami <i>et al.</i> 2008)
Vegetation Type	Warm temperate deciduous broadleaf forest
Dominant Species (Overstory)	<i>Quercus serrata</i> (Konara oak), <i>Ilex pedunculosa</i> (japanese holly), <i>Lyonia elliptica</i> (tree Lyonia), <i>Alnus Sieboldiana</i> (alder), <i>Clethra barbinervis</i> (japanese sweetspire), <i>Eurya japonica</i> (japanese eurya), <i>Pinus densiflora</i> (japanese red pine), <i>Robinia Pseudo-acacia</i> (locust tree). (Goto <i>et al.</i> 2003)
Dominant Species (Understory)	<i>Rhododendron reticulatum</i> , <i>Rhododendron macrosepalum</i> (Goto <i>et al.</i> 2003)
Canopy height	6m-20m, approx. 12m in average (1994-2005) (Goto <i>et al.</i> 2003)
Breast High Diameter	7.4cm in average, 50.2cm in Max. (Hinoki cypress) (Goto <i>et al.</i> 2003)
Age	Identified to be oldest red pine: 119years (BHD 34.8cm, investigated in 2000) Dominant species (<i>Quercus serrata</i>): mean age is about 60years (Goto <i>et al.</i> 2003)
LAI	4.42 in summer and 2.70 in winter (LAI-2000) (Goto <i>et al.</i> 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 <i>et al.</i> 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 CO₂ 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	$\text{m}\cdot\text{s}^{-1}$	26.2.	AG-750 (MAKINO)	Gap filled, see Note [1]
Wind direction	WD	NA	NA	NA	
Global solar radiation (incoming / downward)	Sd	$\text{W}\cdot\text{m}^{-2}$	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	$\text{W}\cdot\text{m}^{-2}$	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	$\text{micromol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$	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	$\text{W}\cdot\text{m}^{-2}$	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	IE	NA	NA	NA	Kominami <i>et al.</i> , 2005
Friction velocity	Ust	$\text{m}\cdot\text{s}^{-1}$	25.7m	DA-600(KAIJO)	
CO ₂ flux	Fc	$\text{micromol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$	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 <i>et al.</i> , 2008
Ecosystem respiration	Re	micromol·m ⁻² ·s ⁻¹	-	-	Gap filled Kominami <i>et al.</i> , 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 CO₂ 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

:

Data example

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 <i>et al.</i> , 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
	none

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]
- KOMINAMI Yuji, MIYAMA Takafumi, TAMAI Koji, NOBUHIRO Tatsuhiko, GOTO Yoshiaki (2003) Characteristics of CO₂ flux over a forest on complex topography. *Tellus B*, 55(3):313-321
- KOMINAMI Yuji, MIYATA Takafumi, TAMAI Koji, JOMURA Mayuko, DANNOURA Masako, GOTO Yoshiaki (2005) Evaluation of Nighttime Eddy CO₂ Flux using Automated Chamber Measurements. *Journal of Agricultural Meteorology*, 60(5):745-748.
- MIYAMA Takafumi, KOMINAMI Yuji, TAMAI Koji, GOTO Yoshiaki, Teruhiko Kawahara, JOMURA Mayuko, DANNOURA Masako (2006): Components and seasonal variation of nighttime total ecosystem respiration in a Japanese broadleaved secondary forest. *Tellus B*, 58(5):550-559
- 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
- TAMAI Koji, KOMINAMI Yuji, MIYAMA Takafumi, GOTO Yoshiaki, OHTANI Yoshikazu (2008) Topographical Effects on Soil Respiration in a Deciduous Forest -The Case of Weathered Granite Region in Southern Kyoto Prefecture-. *Journal of Agricultural Meteorology*, 64(4):215-222
- KOMINAMI Yuji, JOMURA Mayuko, ATAKA Mioko, TAMAI Koji, MIYAMA Takafumi (2012) Heterotrophic respiration causes seasonal hysteresis in soil respiration in a warm-temperate forest. *Journal of Forest Research*, 17(3):296-304.

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

References cited

Flux calculation

- *1 McMillen, R.T., 1988. *Boundary-Layer Meteorology*, 43: 231-245.
- *2 Aubinet M. et al., 2000. *Advances in Ecological Research*, 30: 113-175.
- *3 Wilczak, J.M., Oncley, S.P. and Stage, S.A., 2001. *Boundary-Layer Meteorology*, 99: 127-150.
- *4 Wyngaard, J. C. and Zhang, S. F., 1985. *J. Atmos. Oceanic Tech.*, 2: 548-558.
- *5 Kaimal, J.C. et al., 1990. *Boundary-Layer Meteorol.*, 53: 103-115.
- *6 Shimizu, T. et al., 1999. *Boundary-Layer Meteorol.*, 64: 227-236.
- *7 Leuning, R. and Judd M.J., 1996. *Global Change Biology*, 2: 241-254.
- *8 Information from Li-Cor

Flux correction

- *9 Schotanus, P. et al., 1983. *Boundary-Layer Meteorology*, 26: 81-93.
- *10 Liu, H., Peters, G. and Foken, T., 2001. *Boundary-Layer Meteorology*, 100: 459-468.
- *11 Kaimal J.C. and Gaynor, J.E., 1991. *Boundary-Layer Meteorology*, 56: 401-410.
- *12 Watanabe et al., 2000. *Boundary-Layer Meteorol.* 96, 743-491.
- *13 Massman, W. J., 2000. *Agric. For. Meteorol.* 104, 185-198
- *14 Massman, W. J., 2001. *Agric. For. Meteorol.* 107, 247-251
- *15 Moore, C.J., 1986. *Boundary-Layer Meteorology*, 37: 17-35.
- *16 Moncrieff, J. et al., 2004. Averaging, detrending and filtering of eddy covariance time series. In: X. Lee (Editor), *Handbook of Micrometeorology: A guide for surface Flux Measurements*. Kluwer, Dordrecht, pp. 7-31.
- *17 Webb, E. K., Pearman, G.I. and Leuning, R., 1980. *Quarterly Journal of the Royal Meteorological Society*, 106: 85-100.
- *18 Fuehrer, P.L. and Friehe, C.A., 2002. *Boundary-Layer Meteorology*, 102: 415-457.
- *19 Liebethal, C. and Foken, T., 2003. *Boundary-Layer Meteorology*, 109: 99-106.
- *20 Leuning, R. 2004. Measurements of trace gas fluxes in the atmosphere using eddy covariance: WPL corrections revisited. In: X. Lee (Editor), *Handbook of Micrometeorology: A guide for surface Flux Measurements*. Kluwer, Dordrecht, pp. 119-132.
- *21 Massman, W. 2004. Concerning the measurement of atmospheric trace gas fluxes with open- and closed-path eddy covariance system: The WPL terms and spectral attenuation. In: X. Lee (Editor), *Handbook of Micrometeorology: A guide for surface Flux Measurements*. Kluwer, Dordrecht, pp. 133-160.
- *22 Fischer, G (Editor), 1988. *Landolt-Börnstein, Numerical data and functional relationships in science and technology, Group V: Geophysics and space research, Volume 4: Meteorology Subvolume b: Physical and chemical properties of the air*. Springer, Berlin, Heidelberg, 570pp.
- *23 Stull, R.B., 1988. *An Introduction to Boundary Layer meteorology*. Kluwer Acad. Publ., Dordrecht, Boston, London, 666pp.
- *24 Cohen, E. R. and Taylor, B. N., 1986. The 1986 adjustment of the fundamental physical constants. International Council of Scientific Unions (ICSU), Committee on Data for Science and Technology (CODATA). CODATA-Bulletin, No. 63: 36pp.

Quality control

- *25 Vickers, D. and Mahrt, L., 1997. *Journal of Atmospheric and Oceanic Technology*, 14: 512-526.
- *26 Foken, T. and Wichura, B., 1996. *Agricultural and Forest Meteorology*, 78: 83-105.
- *27 Hojstrup, J., 1993. *Measuring Science Technology*, 4: 153-157.
- *28 Schmid, H. P., 1994. *Boundary-Layer Meteorology*, 67: 293-318.
- *29 Korman, R. and Meixner, F.X., 1990. . *Boundary-Layer Meteorology*, 99: 207-224.