1. About the data set

Site name (AsiaFlux three letter code)	Yamashiro forest hydrology research site (YMS)	
Period of registered data	From January 1, 2009 to December 31, 2009	
This document file name	YMS_2009_001a.pdf	
Corresponding data file name	YMS_2009_001.csv	
Revision information		
Date	Details of revision	Renewed file name
01 May 2017	First registration	YMS_2009_001a.pdf YMS_2009_001.csv
Contact person#1	[Flux & Meteorology] Yuji KOMINAMI (kominy@ffpri.affrc.go.jp)	
Contact person#2		
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	34.7940252N, 135.840884E (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	NA	NA	NA	
Air temperature	Ta	degrees C	26.2m	HMP-45D (VAISALA)	
Relative humidity	Rh	NA	NA	NA	
Wind speed	U	NA	NA	NA	
Wind direction	WD	NA	NA	NA	
Global solar radiation (incoming / downward)	Sd	$W \cdot m^{-2}$	26.2m	MR-20 (EKO)	See Note [4]
Reflected solar radiation (upward)	Su	$W \cdot m^{-2}$	26.2m	MR-20 (EKO)	See Note [4]
Photosynthetic active photon flux density (downward)	Pd	NA	NA	NA	
Reflected PAR (upward)	Pu	NA	NA	NA	
Net radiation	Rn	$W \cdot m^{-2}$	26.2m	MR-20 (EKO)	See Note [5]
Soil heat flux	G	NA	NA	NA	
Sensible heat flux	H	NA	NA	NA	
Latent heat flux	lE	NA	NA	NA	
Friction velocity	Ust	NA	NA	NA	
CO_2 flux	Fc	NA	NA	NA	
Storage change in canopy air layer	Sc	NA	NA	NA	
Net ecosystem exchange	NEE	micromol$\cdot m^{-2} \cdot s^{-1}$	-	-	NEE=Fc+Sc Ust screening (Ust >= 0.4m s-1) Gap filled Kominami *et al.*, 2008
Ecosystem respiration	Re	micromol$\cdot m^{-2} \cdot s^{-1}$	-	-	Gap filled Kominami *et al.*, 2008
Gross primary production	GPP	micromol$\cdot m^{-2} \cdot s^{-1}$	-	-	GPP=-NEE+Re

Note

[4] night time data is replaced by 0.0.
[5] Summation of 4 elements (Sd, Su, Longwave radiation_downward and Longwave radiation_upward).

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" or “-9999.0”.

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
Sampling rate	10Hz
Averaging time	0
Flux measurement height #1	25.7m
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

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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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 Decious 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.

ATAKA Mioko, KOMINAMI Yuji, JOMURA Mayuko, YOSHIMURA Kenichi, MIYAMA Takafumi, KOSUGI Yoshiko, TANI Makoto (2015) CO_2 efflux from decomposing leaf litter stacks is influenced by the vertical distribution of leaf litter water content and its temporal variation. Journal of Agricultural Meterology 71(4): 263-270.

KOMATSU Masabumi, YOSHIMURA Kenichi, FUJII Saori, YAZAKI Kenichi, TOBITA Hiroyuki, MIZOGUCHI Yasuko, MIYAMA Takafumi, KOMINAMI Yuji, YASUDA Yukio, YAMANOI Katsumi, KITAO Mitsutoshi (2015) Estimation of ozone concentrations above forests using atmospheric observations at urban air pollution monitoring stations. Journal of Agricultural Meteorology 71(3): 202-210.

KITAO Mitsutoshi, YASUDA Yukio, KOMINAMI Yuji, YAMANOI Katsumi, KOMATSU Masabumi, MIYAMA Takafumi, MIZOGUCHI Yasuko, KITAOKA Satoshi, YAZAKI Kenichi, TOBITA Hiroyuki, YOSHIMURA Kenichi, KOIKE Takayoshi, IZUTA Takeshi (2016) Increased phytotoxic O_3 dose accelerates autumn senescence in an O_3-sensitive beech forest even under the present-level O_3. Scientific Reports 6: 32549 (DOI: 10.1038/srep32549).

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, Dirdrecht, 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, Dirdrecht, 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, Dirdrecht, 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.