1. About the data set

Site name (AsiaFlux three letter code)	Sapporo forest meteorology research site (SAP)
Period of registered data	From January 1, 2004 to December 31, 2004
This document file name	SAP_2004_002e.pdf
Corresponding data file name	SAP_2004_002.csv SAP_2004P_002.csv (Hourly precipitation data)

Revision information

Date	Details of revision	Renewed file name
28 April 2011	First registration	SAP_2004_001a.pdf SAP_2004_001.csv SAP_2004P_001.csv
2 June 2011	Second registration: PPT and WD are updated. Document file are updated accordingly.	SAP_2004_002a.pdf SAP_2004_002.csv SAP_2004P_002.csv
17 August 2011	Document file is updated: p.2, 13th row on right: Name of a dominant species is corrected.	SAP_2004_002b.pdf
15 May 2012	Document file is updated: p.9, line10: Publication information is updated.	SAP_2004_002c.pdf
31 July 2012	Document file is updated: p.1: Details in each revision are added. p.2: Dominant Species (Understory): Sasa Bamboo is corrected to Dwarf bamboo	SAP_2004_002d.pdf
27 March 2013	Document file is updated: p.6: 4-1. Flux observation system and data acquisition: Unassociated details are deleted.	SAP_2004_002e.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)	Sapporo, Hokkaido, Japan
Position	42.9868N, 141.3853E (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Elevation	182m above sea level (World Geodetic System 1984, GPS: Garmin eTrex Legend and map)
Terrain type	Gentle slope
Slope	0-7 degrees
Area	130 ha
Fetch	500-1500m
Climate	Cool temperate (Köppen climate classification: Dfb)
Mean annual air temperature	7.0 degree C (Tower site, 4years (2000-2003) average)
Mean annual precipitation	980 mm (Meteorological station (FFPRI-Hokkaido, 1998; Sameshima *et al*., 2009), 4years (2000-2003) average)
Vegetation Type	Deciduous broadleaf forest
Dominant Species (Overstory)	Japanese white birch (*Betula platyphylla*), Mizunara oak (*Quercus crispula*), painted maple (*Acer mono*), aralia (*Kalopanax pictus*), Japanese linden (*Tilia japonica*), Japanese elm (*Ulmus davidiana var. japonica*)
Dominant Species (Understory)	Dwarf bamboo (*Sasa senanensis, Sasa kurilensis*)
Canopy height	Approx. 20m
Breast high diameter	approx. 25 cm (Japanese White Birch)
Age	90years (in 2002)
LAI	approx. 4 in max.
Soil Type	Black soil Bl_D (Andosol: WRB classification)
Other information	

References

Hokkaido Research Center, Forestry and Forest Products Research Institute, FFPRI-Hokkaido (1998) Hitsujigaoka experimental forest operation plan. FFPRI-Hokkaido, Sapporo, Japan. 44p

Sameshima R, Hirota T, Hamasaki T, Kato K, Iwata Y (2009) Meteorological Observation System at the National Agricultural Research Center for Hokkaido Region since 1966. Miscellaneous Publication of the National Agricultural Research Center for Hokkaido Region, 67:1-8.

3. Registered data

Observation items	Symbol	Unit	Height(s) Depth(s)	Instruments	Note
Date	DATE	-	-	-	yyyymmdd
Time	TIME	-	-	-	hhmm
Precipitation	PPT	mm	1.8m		See Note [1]
Air temperature	Ta	degrees C	29.6m	HMP45D (VAISALA)	See Note [2], [3]
Relative humidity	Rh	%	29.6m	HMP45D (VAISALA)	See Note [2], [4]
Wind speed	U	$m \cdot s^{-1}$	29.6m	WM-30P (IKEDA)	See Note [2]
Wind direction	WD	degrees	28.5m	DA600-3T (KAIJO)	Newly added in this version
Global solar radiation (incoming / downward)	Sd	$W \cdot m^{-2}$	41.3m	CM-6F (Kipp & Zonen)	See Note [3], [5]
Reflected solar radiation (upward)	Su	$W \cdot m^{-2}$	39.0m	CM-6B (Kipp & Zonen)	See Note [5]
Photosynthetic active photon flux density (downward)	Pd	$micromol \cdot m^{-2} \cdot s^{-1}$	41.2m	LI190 (LI-COR)	See Note [5]
Reflected PAR (upward)	Pu	$micromol \cdot m^{-2} \cdot s^{-1}$	39.0m	LI190 (LI-COR)	See Note [5]
Net radiation	Rn	$W \cdot m^{-2}$	41.3m / 39.0m	CM-6F and CM-6B (Kipp & Zonen), PIR (Eppley)	See Note [6]
Soil heat flux	G	$W \cdot m^{-2}$	-0.02m	MF-81 (EKO)	
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	NA	NA	NA	
Ecosystem respiration	Re	NA	NA	NA	
Gross primary production	GPP	NA	NA	NA	

Note

[1] Hourly data at Hitsujigaoka meteorological observation field (42.9950N, 141.3906E, 146.5m a.s.l.). Errors have been corrected from the previous version (001).
[2] Observation height is different from that of previous years (2000 – 2003).
[3] Data processing method is different from that of previous years (2000 – 2003).
[4] Data of >100% is replaced by 100%.
[5] Night time data is replaced by 0.0.
[6] Summation of 4 elements (Sd, Su, Longwave radiation_downward and Longwave radiation_upward).

References

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	
Type of IRGA	
Sampling rate	
Averaging time	
Flux measurement height #1	
Zero-plane displacement	
Roughness length	
Calibration information	
Other information	

4-2. Flux calculation

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

4-3. Flux corrections

Correction methods		Target flux	Note
Cross wind correction [*9, 10]			
Vapor correction			
High frequency loss	Band-pass covariance method [*12]		
	Experimental approach [*2]		
Low frequency loss (Detrending)	Linear detrend [*16]		
WPL Correction [*17-21]			
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]			
	Absolute limits			
	Absolute variance			
	Higher-moment statistics	skewness		
		kurtosis		
	Discontinuities	Harr mean test		
		Harr variance test		
	Visual inspection			
Non steady state test [*25]				
Absolute thresholds				
Others				

4-5. Storage term

Target storage		Note
CO_2		

References

5. Important events

Date	Events
08 September, 2004	Typhoon 200418 (SONGDA) has brought a serious damage in the research site and the measurements were stopped until early 2005

6. Publications relating to this site

WATANABE Tsutomu, NAKAI Yuichiro, KITAMURA Kenzo, UTSUGI Hajime, TOBITA Hiroyuki, ISHIZUKA Shigehiro (2005) Scaling energy and CO_2 fluxes from leaf to canopy using a Multilayered Implementation for Natural Canopy-Environment Relations (MINCER). Phyton, 45:353-360

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SUZUKI Satoru, ISHIZUKA Shigehiro, KITAMURA Kenzo, YAMANOI Katsumi, NAKAI Yuichiro (2006) Continuous estimation of winter carbon dioxide efflux from the snow surface in a deciduous broadleaf forest. Journal of Geophysical Research, 111:D17101

KITAMURA Kenzo, NAKAI Yuichiro, SUZUKI Satoru, OHTANI Yoshikazu, YAMANOI Katsumi, SAKAMOTO Tomoki (2012) Interannual variability of net ecosystem production for a broadleaf deciduous forest in Sapporo, northern Japan, Journal of Forest Research, 17(3):323-332.

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

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