(Date: 30 Sept. 2013)

Contact Address

Akira Miyata (amiyat@niaes.affrc.go.jp)
Masayoshi Mano (mano@chiba-u.jp)
Keisuke Ono (onok@affrc.go.jp)

1. General Information

Site name (three letter code)	Mase paddy flux site (MSE)
Researcher #1 (e-mail)	Akira Miyata (amiyat@niaes.affrc.go.jp)
Contact Address#1	Agro-Meteorology Division, National Institute for Agro-Environmental Sciences (NIAES) 3-1-3, Kannondai, Tsukuba, Ibaraki 305-8604, Japan TEL: + 81-29-838-8207 FAX: + 81-29-838-8211
Researcher #2 (e-mail)	Masayoshi Mano (mano@chiba-u.jp)
Contact Address#2	Agro-Meteorology Division, Chiba University Graduate School of Horticulture, Faculty of Horticulture 648 Matsudo Matsudo-shi Chiba 271-8510 Japan TEL: + 81-47-308-8904
Researcher #3 (e-mail)	Keisuke Ono (onok@affrc.go.jp)
Contact Address#3	Agro-Meteorology Division, National Institute for Agro-Environmental Sciences (NIAES) 3-1-3, Kannondai, Tsukuba, Ibaraki 305-8604, Japan TEL: + 81-29-838-8239 FAX: + 81-29-838-8211
Other Researchers (e-mail)	
Observation period	August 1999 to present
Measurement frequency	Continuous
Infrastructure	Tower :Yes, Top of tower : 4.0 m, Climbable : No Electrical power : AC, Facilities for communication : - Accommodation : None
Research fund #1	Global Warming Initiative Program (FY2002-2005; FY 2006-2009; FY2010-2014) by the Ministry of Agriculture, Forestry and Fisheries of Japan
Research fund #2	Global Environment Research Coordination System (FY 2007-2011) by the Ministry of the Environment, Japan
Research fund #3	Global Environmental Research Fund B-3 (FY2000-2002) and S-1 (FY2003-2006) by the Ministry of the Environment, Japan
URL	http://ecomdb.niaes5.affrc.go.jp/
Other information	

2. Site description

Site name (three letter code)	Mase paddy flux site (MSE)
Country	Japan
Location	Tsukuba, Ibaraki
Latitude and Longitude (first decimal of second precision), Elevation (geographic coordinates, surveying method)	36°03'14.3''N, 140°01'36.9"E, 11 m above sea level (GPS locator-equipped receiver, GPSmap 76CSx (GARMIN))
Slope	Almost flat
Terrain Type	Agricultural field (cropland)
Area	About 200 ha (2 km by 1 km)
Fetch	700 m (Easterly wind) – 1000 m (southerly wind) (Easterly wind prevails in most of the growing period except in mid-summer when the southerly wind prevails.)
Climate (Köppen Climate Classification)	Warm and humid climate (Cfa)
Mean annual air temperature	13.8 degC (the 30-year average (1981-2010) at Tateno Observatory of Japan Meteorological Agency; 5 km west of the study site)
Mean annual precipitation	1282.9 mm (the 30-year average (1981-2010) at Tateno Observatory of Japan Meteorological Agency; 5 km west of the study site)
Vegetation Type	Irrigated rice paddy field
Dominant Species (Overstory)	rice (*Oryza sativa L.*; cultivar Koshihikari)
Dominant Species (Understory)	
Canopy height	Variable with season with the maximum of about 1.2 m.
Age	Annual plant
LAI	Variable with season with the maximum of about 5.0 m^2 m^{-2}.
Soil type	Grayed lowland paddy soil (Cultivated Soil Classification Committee, 1995); Typic Endoaquepts in Soil Taxonomy (Soil Survey Staff, 1992)

3. Measurement Item
3-1. Meteorology

Observation items	Levels / Depth	Instrument
Global solar radiation (incoming)	2.5 m	4 component net radiometer, CNR1 (Kipp&Zonen, The Netherlands) (August 1999 – April 2009). 4 component net radiometer, MR-40 (Eko, Tokyo, Japan) (May 2009 - present).
Global solar radiation (outgoing)	2.5 m	The same as global solar radiation.
Long-wave radiation (incoming)	2.5 m	The same as global solar radiation.
Long-wave radiation (outgoing)	2.5 m	The same as global solar radiation.
Net radiation	2.5 m	The same as global solar radiation.
PPFD (incoming)	2.6 m	Quantum sensor, LI190SB (LI-COR, Lincoln, NE, USA) (August 1999 - March 2008). Quantum sensor, LI190SL (LI-COR) (April 2008 - present).
PPFD (outgoing)	2.6 m	Quantum sensor, LI190SB (LI-COR, Lincoln, NE, USA) (April 2001 - March 2008). Quantum sensor, LI190SL (LI-COR) (April 2008 - present).
Direct/diffuse radiation	-	-
Direct/diffuse PPFD	2.5 m	Quantum sensor, LI190SL (LI-COR) equipped with a shadow blade (Eko) (2005-2006). Quantum sensor, LI190SL (LI-COR) equipped with a rotating shadow blade PRB-100 (Prede, Tokyo, Japan) (July 2009 - present).
Air temperature	3.8 m and 1.4 m	Platinum resistance thermometer (100 ohm) equipped with a home-made ventilator (August 1999 – 15 November 2000). Platinum resistance thermometer, HMP45A (Vaisala, Helsinki, Finland) equipped with a home-made ventilator (16 November 2000 –present).
Humidity	3.8 m and 1.4 m	Wet-bulb temperature was measured with a platinum resistance thermometer (100 ohm) equipped with a home-made ventilator (August 1999 – 15 November 2000). Relative humidity was measured with a capacitive moisture sensor, HMP45A (Vaisala) equipped with a home-made ventilator (16 November 2000 –present).
Soil temperature	1, 5, 10, 20 and 40cm below the ground	T-type thermocouple, home-made.
Soil heat flux	1 cm below the ground	Thermopile-type heat flux plate, MF-81 (Eko) (August 1999 – April 2008). Thermopile-type heat flux plate, MF-180M (Eko) (May 2008 – present).

Soil water content	0-15 cm below the ground (April 2000 – April 2002). 0-2.5 cm, 0-5 cm, 0–10 cm, 0-20 cm and 0-30 cm below the ground (May 2002 – present).	Soil moisture probe, CS-615 (Campbell Scientific Inc., Logan, UT, USA) (April 2000 – April 2002). Time-domain reflectometory, TDR-100 (Campbell) (May 2002-present)
Wind speed	3.75 m, 2.55 m, 1.95 m, 1.35 m and 0.75 m. The measurement heights were changed with rice growth.	Cup anemometer, AF-750 (Makino, Tokyo, Japan) (August 1999 – April 2011).
Wind direction	4.4 m	Wind vane, VF016 (Makino) (August 1999 – April 2011).
Barometric pressure	1.5 m	Capacitive pressure transducer, PTA427 (Vaisala) (August 1999 – March 2008). Capacitive pressure transducer, PTB210 (Vaisala) (April 2008 - present).
Precipitation	1.5 m	Tipping-bucket rain gauge, TE525MM (Campbell) (September 1999 – present).
CO_2 concentration	3.85 m and 1.25 m (August 1999 – September 2003. The measurement heights were changed with rice growth.) 3.8 m and several lower heights (May 2004 – present).	Non-dispersive infrared gas analyzer, ZFU (Fuji Electric, Tokyo, Japan) (August 1999 – September 2003). Non-dispersive infrared gas analyzer, LI-6262 (LI-COR) (May 2004 – present)
Water depth	-	Sonic-type displacement sensor, UD-310 (Keyence, Osaka, Japan)

3-2. Eddy correlation method

System	Open-path method (August 1999 – present) Closed-path method (2004 – present)
Wind speed	Sonic anemometer-thermometer, DA600-62AX (KAIJO)
Air temperature	The same as wind speed.
Water vapor	E009B (Advanet, Okayama, Japan (August 1999 – November 2001) LI7500 (LI-COR) (December 2001 - present) LI7000 (LI-COR) (2004 – present)
CO_2	The same as water vapor.
Measurement height	3.1 m above the ground
Sampling frequency	10 Hz
Averaging time	30 min
Data logger	DRM3 (TEAC, Tokyo, Japan) (August 1999 - April 2008) CR3000 (Campbell) (May 2008 - present)
Data storage	Magneto-optical disc (August 1999 - April 2008) Compact flash memory card (May 2008 - present)
Original data (Raw data or statistics)	Raw data

3-3. Other

Soil respiration	Heterotrophic respiration was measured during the 2004 and 2005 growing season by using the flow-through steady stare chamber method.
Photosynthesis	
Ecological Investigation	Plant height, leaf area index and dry matter including roots were measured every two weeks during the rice growing season.

4. Note (e. g. calibration information, Publications)

Calibration information

The open-path analyzers were calibrated in laboratory at least twice a year, before and after the rice growing season, with zero gas and standard CO_2 gas from cylinders and a dew point generator, LI-610 (LI-COR).

The closed-path gas analyzer was calibrated in situ once a day with zero gas and standard CO_2 gas from cylinders.

Publications

1) Zukemura, C., T. Motohka, K. N. Nasahara, 2011. Detection of abandoned rice paddies with satellite remote sensing. Journal of The Remote Sensing Society of Japan, 31(1), 55-62.
2) Harazono, Y., K. Chikamoto, S. Kikkawa, T. Iwata, N. Nishida, M. Ueyama, Y. Kitaya, M. Mano, A. Miyata, 2009. Applications of MODIS-visible bands index, Greenery Ratio to estimate CO_2 budget of a rice paddy in Japan. J. Agric. Meteorol., 65, 365-374.
3) Nishida, K. N., 2009. Simple algorithm for estimation of Photosynthetically active radiation (PAR) using satellite data. SOLA, 5, 037-040. doi:10.2151/sola.2009-010.
4) Motohka, T., K. Nishida, A. Miyata, M. Mano, S. Tsuchida, 2009. Validation of satellite remote sensing for rice paddy phenology using continuously ground observed hyper-spectral data. International Journal of Remote Sensing, 30(17), 4343–4357.
5) Saito, M., J. Asanuma, 2008. Eddy covariance calculation revisited with wavelet cospectra. SOLA, 4, 049-052.

doi:10.2151/sola.2008-013.
6) Ono, K., M. Mano, A. Miyata, Y. Inoue, 2008. Applicability of the planar fit technique in estimating surface fluxes over flat terrain using eddy covariance. J. Agric. Meteorol. 64(3), 121-130.
7) Ono, K., A. Miyata, T. Yamada, 2008. Apparent downward CO2 flux observed with open-path eddy covariance over a non-vegetated surface. Theoretical and Applied Climatology, 92, 195-208, doi:10.1007/s00704-007-0323-3.
8) Inoue, Y., J. Peñuelas, A. Miyata, M. Mano, 2008. Normalized difference spectral indices for estimating photosynthetic efficiency and capacity at a canopy scale derived from hyperspectral and CO_2 flux measurements in rice. Remote Sensing of Environment, 112, 156-172.
9) Yada, S., T. Arao, A. Kawasaki, T. Saito, H. Nagai, M. Mano, Y. Hamada, 2008. Natural cadmium loading and balance in a non-polluted rice paddy field in Japan. Water Science & Technology, 58(11), 2243-2249.
10) Ono, K., R. Hirata, M. Mano, A. Miyata, N. Saigusa, Y. Inoue, 2007. Systematic differences in CO_2 fluxes measured by open- and closed-path eddy covariance systems: influence of air density fluctuations resulting from temperature and water vapor transfer. J. Agric. Meteorol., 63(3), 139-155. (in Japanese)
11) Mano, M., A. Miyata, Y. Yasuda, H. Nagai, T. Yamada, K. Ono, M. Saito, Y. Kobayashi, 2007. Quality control for the open-path eddy covariance data. J. Agric. Meteorol., 63(3), 125-138. (in Japanese)
12) Mano, M., A. Miyata, H. Nagai, T. Yamada, K. Ono, M. Saito, Y. Kobayashi, 2007. Random Sampling errors in CO_2 fluxes measured by the open-path eddy covariance method and their influence on estimating annual carbon budget. J. Agric. Meteorol., 63(2), 67-79. (in Japanese)
13) Inoue, Y., J. Peñuelas, A. Miyata, M. Mano, 2007. Relationship of reflectance spectra with light use efficiency and CO_2 flux at canopy scale in irrigated rice. Proceeding Book of the second International Symposium on Recent Advances in Quantitative Remote Sensing, pp.455-460.
14) Saito, M., J. Asanuma, A. Miyata, 2007. Dual-scale transport of sensible heat and water vapor over a short canopy under unstable conditions. Water Resources Research, 43, W05413, doi:10.1029/2006WR005136.
15) Han, G.H., H. Yoshikoshi, H. Nagai, T. Yamada, K. Ono, M. Mano, A. Miyata, 2007. Isotopic disequilibrium between carbon assimilated and respired in a rice paddy as influenced by methanogenesis from CO_2. Journal of Geophysical Research, 112, G02016, doi:10.1029/2006JG000219.
16) Saito, M, A. Miyata, H. Nagai, T. Yamada, 2005. Seasonal variation of carbon dioxide exchange in rice paddy field in Japan. Agric. Forest Meteorol. 135, 93-109.
17) Miyata, A., T. Iwata, H. Nagai, T. Yamada, H. Yoshikoshi, M. Mano, K. Ono, G. H. Han, Y. Harazono, E. Ohtaki, Md. A. Baten, S. Inohara, T. Takimoto, M. Saito, 2005. Seasonal variation of carbon dioxide and methane fluxes at single cropping paddy fields in central and western Japan. Phyton, 45(4), 89-97.
18) Han, G.H., H. Yoshikoshi, H. Nagai, T. Yamada, M. Saito, A. Miyata, Y. Harazono, 2005. Concentration and carbon isotope profiles of CH_4 in paddy rice canopy: Isotopic evidence for changes in CH4 emission pathways upon drainage. Chemical Geology, 218, 25-40.
19) Han, G.H., H. Yoshikoshi, H. Nagai, T. Yamada, M. Saito, A. Miyata, Y. Harazono, 2005. Late growing-season CH_4 budget in a rice paddy determined by stable isotope, emission flux, and soil storage measurements. Organic Geochemistry, 36, 789-801.
20) Y. Hamada, S. Yabusaki, N. Tase, I.Taniyama, 2004. Stable isotope ratios of hydrogen and ozygen in paddy water affected by evaporation. Journal of Japanese Association of Hydrological Sciences, 34(4), 209-216. (in Japanese)