

(Date: 11. June. 2021)

1. General Information

Site name (three letter code)	Tomakomai Flux Research Site (TMK)
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Other Researchers (e-mail)	[Soil respiration] Naishen Liang (liang@nies.go.jp), CGER/NIES
Observation period	September 2000 to September 2004
Measurement frequency	Continuous
Infrastructure	Tower, Electrical power (AC), Facilities for communication (none), Accommodation (none)
Research fund #1	
Research fund #2	
Research fund #3	
URL	https://db.cger.nies.go.jp/gem/en/flux/
Other information	When this data set is referred to in publications, it should be cited in the following format. Hirata, R. (2021), Micrometeorological CO ₂ Flux Data at Tomakomai Flux Research Site (TMK), Ver.x.x *1, NIES, DOI:10.17595/20210611.001, (Reference date*2: YYYY/MM/DD) *1 The version number is indicated in the name of each data file. *2 As the reference date, please indicate the date you downloaded the files.

2. Site description

Site name (three letter code)	Tomakomai Flux Research Site (TMK)
Country	Japan
Location	Tomakomai, Hokkaido
Latitude and Longitude (first decimal of second precision), Elevation (geographic coordinates, surveying method)	42°44'13.1"N, 141°31'7.1"E (140 m above sea level) ((World Geodetic System 1984, Triangular surveying)
Slope	1-2 deg
Terrain Type	Flat
Area	117 ha
Fetch	300-800 m
Climate (Köppen Climate Classification)	Cool temperate – fully humid – warm summer (Dfb)
Mean annual air temperature	6.2 deg C (2001-2003)
Mean annual precipitation	1043 mm (2001-2003)
Vegetation Type	Japanese larch plantation, deciduous needle-leaf forest
Dominant Species (Overstory)	Japanese larch (<i>Larix Kaempferi</i> Sarg.), Birch (<i>Betula ermanii</i> and <i>Betula platyphylla</i>), Japanese elm (<i>Ulmus japonica</i>), Spruce (<i>Picea jezoensis</i>)
Dominant Species (Understory)	Fern (<i>Dryopteris crassirhizoma</i> , <i>Dryopteris austriaca</i>) and <i>Pachysandra terminalis</i>
Canopy height	About 15 m
Age	About 45 years old (Larch trees were planted in 1955–1959.)
LAI	9.2 m ² m ⁻² (Overstory: 5.6 m ² m ⁻² , Understory: 3.6 m ² m ⁻²) (maximum)
Soil type	Volcanogenous regosol

3. Measurement Item

3-1. Meteorology

Observation items	Levels / Depth	Instrument
Global solar radiation (incoming)	41, 18, 14, 5, 2 (six points) m 40, 18, 2 m	Pyranometer (MS-601, Eko, Japan) Radiometer (MR40, Eko, Japan)
Global solar radiation (outgoing)	40, 18, 2 m	Radiometer (MR40, Eko, Japan)
Long-wave radiation (incoming)	40, 18, 2 m	Radiometer (MR40, Eko, Japan)
Long-wave radiation (outgoing)	40, 18, 2 m	Radiometer (MR40, Eko, Japan)
Net radiation	40, 18, 2 m	Radiometer (MR40, Eko, Japan)
PPFD (incoming)	40, 18, 5, 2 (three points) m	Quantum sensor (LI-190S, LI-COR)
PPFD (outgoing)	40 m	Quantum sensor (LI-190S, LI-COR)
Direct/diffuse radiation	-	-
Direct/diffuse PPFD	-	-
Air temperature	40, 27, 22, 18, 14, 8, 5, 1.5 m	Platinum resistance thermometer and capacitive hygrometer (HMP45D, Vaisala)
Humidity	40, 27, 22, 18, 14, 8, 5, 1.5 m	Platinum resistance thermometer and capacitive hygrometer (HMP45D, Vaisala)
Soil temperature	0, 0.05, 0.1, 0.2, 0.5 m (three points)	Platinum resistance thermometer
Soil heat flux	0.05 m (five points)	Heat flux plate (MF-81, Eko, Japan)
Soil water content	0.05 (three points), 0.1 (two points) m	TDR sensor (CS615, Campbell)
Wind speed	40, 27, 23, 18, 14, 8.0, 5.0, 1.5 m	Sonic anemometer (MA-130A, Eko, Japan)
Wind direction	40, 27, 23, 18, 14, 8.0, 5.0, 1.5 m	Sonic anemometer (MA-130A, Eko, Japan)
Barometric pressure	40, 18, 8, 5 m	Barometer (PTB100, Vaisala)
Precipitation	41, 1.5 (three points) m	Tipping-bucket rainguage with heater (52 202, R. M. Young)
CO ₂ concentration	41, 38, 32, 26, 22, 16, 12, 6, 3, 1 m	Closed-path CO ₂ /H ₂ O analyzer (LI-6262, LI-COR)

3-2. Eddy covariance method (CO₂)

System	Open- and closed-path system (CO ₂ flux, latent heat flux)
Wind speed	Three-dimensional sonic anemometer-thermometer (DA600-3TV (Probe TR-61C), KAIJO)

Air temperature	Three-dimensional sonic anemometer-thermometer (DA600-3TV (Probe TR-61C), KAIJO) Platinum resistance thermometer and capacitive hygrometer (HMP45D, Vaisala)
Water vapor	Open- and Closed-path CO ₂ /H ₂ O analyzers (LI-7500 and LI-6262, LI-COR) Platinum resistance thermometer and capacitive hygrometer (HMP45D, Vaisala)
CO ₂	Open- and Closed-path CO ₂ /H ₂ O analyzers (LI-7500 and LI-6262, LI-COR)
Measurement height	27 and 42 m
Sampling frequency	10 Hz
Averaging time	30 min
Data logger	DRM3a, TEAC, Japan
Data storage	MO
Original data (Raw data or statistics)	Raw data

3-3. Other

Soil respiration	Continuous (automated chambers)
Photosynthesis	Occasionally
Ecological Investigation	Tree heights, stand density, diameter, biomass, LAI (1999, 2001, 2003)

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

<p>Calibration information</p> <p>Open-path analyzers were calibrated approximately every two months with standard CO₂ gases and a dew point generator (LI610, LI-COR).</p> <p>The gain of CO₂ of the closed-path analyzers was checked once a day by flowing two standard CO₂ gases of 320 ppmv and 420 ppmv that were automatically controlled using a CR23X (Campbell).</p> <p>Publications</p> <p>2008</p> <p>Flux/Synthesis analysis</p> <p>Hirata, R., Saigusa, N., Yamamoto, S., Ohtani, Y., Ide, R., Asanuma, J., Gamo, M., Hirano, T., Kondo, H., Kosugi, Y., Li, S-G., Nakai, Y., Takagi, K., Tani, M., Wang, H. 2008 Spatial distribution of carbon balance in forest ecosystems across East Asia, <i>Agricultural and Forest Meteorology</i>, doi:10.1016/j.agrformet.2007.11.016</p> <p>Saigusa, N., Yamamoto, S., Hirata, R., Ohtani, Y., Ide, R., Asanuma, J., Gamo, M., Hirano, T., Kondo, H., Kosugi, Y., Li, S-G., Nakai, Y., Takagi, K., Tani, M., Wang, H. 2008, Temporal and spatial variations in the seasonal patterns of CO₂ flux in boreal, temperate, and tropical forests in East Asia, <i>Agricultural and Forest Meteorology</i>, doi:10.1016/j.agrformet.2007.12.006</p> <p>Soil respiration/Isotope</p> <p>Takahashi, Y., Liang, N. 2008. Development of chamber-based sampling technique for determination of carbon stable isotope ratio of soil respired CO₂ and evaluation of influence of CO₂ enrichment in chamber headspace, <i>Geochemical</i></p>

Journal. (accepted)

Takahashi, Y., Liang, N., Hirata, R., Machida, T., Fujinuma, Y. 2008. Variability in carbon stable isotope ratio of heterotrophic respiration in a deciduous needle-leaf forest, *Journal of Geophysical Research- Biogeosciences*. (accepted)

Proximal Remote Sensing

Nakaji, T., Ide, R., Takagi, K., Kosugi, Y., Ohkubo, S., Nishida, K., Saigusa, N., Oguma, H. 2008. Utility of spectral vegetation indices for estimation of light conversion efficiency in coniferous forests in Japan. *Agricultural and Forest Meteorology*, doi:10.1016/j.agrformet.2007.11.006

Takeda, T., Oguma, H., Sano, T., Yone, Y., Fujinuma, Y. 2008. Estimating the plant area density of a Japanese larch (*Larix kaempferi* Sarg.) plantation using a ground-based laser scanner, *Agricultural and Forest Meteorology*, doi:10.1016/j.agrformet.2007.10.004

2007

Flux

Hirata, R., Hirano, T., Saigusa, N., Fujinuma, Y., Inukai, K., Kitamori, Y., Yamamoto, S. 2007. Seasonal and interannual variations in carbon dioxide exchange of a temperate larch forest, *Agricultural and Forest Meteorology*, 147: 110–124.

Kobayashi, N., Hiyama, T., Fukushima, Y., Lopez, M.L., Fujinuma, Y. 2007. Nighttime transpiration observed over a larch forest in Hokkaido, Japan, *Water Resources Research*, 43: W03407, doi:10.1029/2006WR005556.

Ono, K., Hirata, R., Mano, M., Miyata, A., Saigusa, N., Inoue, Y. 2007. Systematic differences in CO₂ fluxes measured by open- and closed-path eddy covariance systems: Influence of air density fluctuations resulting from temperature and water vapor transfer, *Journal of Agricultural Meteorology*, 63: 139–155. (in Japanese with English summary)

Proximal Remote Sensing

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2006

Trace gas

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Flux/Modeling

Kishihara, Y., Ueyama, M., Hamotani, K., Monji, N. 2006. Vertical distribution of CO₂ flux within and above a larch forest –Experimental and numerical approach–, *Journal of Agricultural Meteorology*, 62: 9-14.

Flux/Modeling/Gap filling

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Proximal Remote Sensing

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Hirata, R., Hirano, T., Mogami, J., Fujinuma, Y., Inukai, K., Saigusa, N., Yamamoto, S. 2005. CO₂ flux measured by an open-path system over a larch forest during snow-covered season. *Phyton–Annales Rei Botanicae*, 45: 347–351.

Hirata, R., Hirano, T., Okada, K., Fujinuma, Y., Inukai, K., Saigusa, N., Yamamoto, S. 2005. Effects of wind speed and direction on eddy fluxes over a larch plantation, *Journal of Agricultural Meteorology*, 60, 741–744.

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Photosynthesis

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Wood respiration

Liang, N., Fujinuma, Y., Inoue, G. 2005. Measurement of wood CO₂ efflux using a multichannel automated chamber system. *Phyton–Annales Rei Botanicae*, 45: 109–115.

Leaf litter decomposition

Kim, H., Hirano, T., Koike, T., Urano, S. 2005. Contribution of litter CO₂ production to total soil respiration in two different deciduous forests. *Phyton–Annales Rei Botanicae*, 45: 385–388.

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Proximal Remote Sensing

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Meteorology

Mogami, J., Hirano, T., Hirata, R., Kitaoka, S., Koike, T., Fujinuma, Y. 2005. Variation in Photosynthetic Photon Flux Density on a Larch Forest, *Journal of Agricultural and Forest Meteorology*, 60: 1161–1163.

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Flux

Wang, H., Saigusa, N., Yamamoto, S., Kondo, H., Hirano, T., Toriyama, A., Fujinuma, F. 2004. Net ecosystem

CO₂ exchange over a larch forest in Hokkaido, Japan. *Atmospheric Environment*, 38: 7021–7032.

Soil respiration

Liang, N., Nakadai, T., Hirano, T., Qu, L., Koike, T., Fujinuma, Y., Inoue, G. 2004. In situ comparison of four approaches to estimating soil CO₂ efflux in a northern larch (*Larix kaempferi* Sarg.). *Agricultural and Forest Metrology*, 123: 97–117.

2003

Flux

Hirano, T., Hirata, R., Fujinuma, Y., Saigusa, N., Yamamoto, S., Harazono, Y., Takada, M., Inukai, K., Inoue, G. 2003. CO₂ and water vapor exchange of a larch forest in northern Japan. *Tellus*. 55B: 244–257.

Miura, M., Hirano, T., Hirata, R., Mogami, J., Inukai, K., Fujinuma, Y. 2003. Effect of heat storage flux on energy balance in a Larch Forest. *Journal of Agricultural Meteorology*, 59: 245–250. (in Japanese with English summary)

2002

Flux

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Proximal Remote Sensing

Oguma, H., Tsuchida, S., Fujinuma, Y. 2002. The development of a hyper-spectral camera system for the forest monitoring, *Journal of the Remote Sensing Society of Japan*, 22(5): 588–597 (in Japanese)

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estimation of diameter at breast height (DBH) and biomass of the trees using range data measured by a portable scanning lidar, *Journal of the Remote Sensing Society of Japan*, 22(5): 550–557. (in Japanese)

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