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Symposium "The Carbon Balance of Forest Biomes"

Yoshiyuki TAKAHASHI

(National Institute for Environmental Studies, Japan)

The symposium "The Carbon Balance of Forest Biomes" organized by Paul Jarvis (Univ. of Edinburgh, UK) and Howard Griffiths (Univ. of Cambridge, UK) for the Plant Environmental Physiology Group of the Society of Experimental Biology (SEB) and the Physiological Ecology Group of the British Ecological Society (BES) was held on April 1-4, 2003 at the Univ. of Southampton, UK, during the annual meeting of the SEB. From AsiaFlux, Naishen Liang and I (National Institute for Environmental Studies, Japan) attended the symposium and made presentations. Unfortunately, because of circumstances that the Iraq war had just broken out, some of the delegates including Japanese scientists canceled their presentations. The conference room with about 150 seats, however, was closely packed out and intense discussion went on through the period of the symposium.

The first session "The Global and Regional Perspective" was held in the afternoon of April 1. In this session, several topics of cutting edge research on atmosphere-forest carbon balance were provided. J. Grace (Univ. of Edinburgh, UK) showed a motion picture of a field-experiment using small aircraft to evaluate spatial variability of CO₂ flux just above forest

canopy. P. Ciais (LSCE, France; because he was absent, presentation was made by J. Grace) compared estimates of Net Biomes Productivity (NBP), a newly defined measure of atmosphere-forest carbon balance in large scale, over three regions, Europe, Amazon and Siberia. B. Helliker (Carnegie Institution of Washington, USA) introduced a new approach to estimate regional scale CO₂ component flux (photosynthetic uptake and respiration efflux) using the mean gradients in CO₂ mixing ratio and stable carbon isotope ratio of atmospheric CO₂ between the atmospheric boundary layer and the free troposphere over a forest. Every last one of the presentations was highly interesting and definitely helpful for planning of future project. In the evening of the day, a convivial wine party and "electric poster session", five minutes short talk by presenters of poster session in the next day, were held.

Two sessions, "Carbon Storage at the Regional Scale" and "Sequestration in the Major Forest Biomes", were held on the second day. Presentations of ongoing challenges for scaling up of CO₂ budget evaluation and the latest results of flux measurement in various sites of the world were given in those sessions. D. Baldocchi (UC Berkeley, USA) and others provided several new



In responding to the question of P. Jarvis, on the left of the rostrum, N. Liang, in the middle, was introducing himself and his work.

research topics of various flux measurement. Nishen Liang introduced activities of AsiaFlux network and presented the schemes and the results of new chamber systems developed for the measurements of flux components; soil respiration, trunk/stem respiration and leaf respiration/photosynthesis. He showed strained look slightly, but his presentation was clear and comprehensible. Several researchers had expressed interest in the chamber systems and exchanged information with him after the presentation. The evening of the day was core hours of poster session. While enjoying "Pale Ale", specialty beer of the place, at the booth of advertisers, we discussed various subjects till late.

The sessions "Sequestration in the Major Forest Biomes" continued from the previous day and "Components of Carbon Balance" were held on the third day. P. Malhi (Univ. of Edinburgh, UK) presented their research in tropical forest biomes. From the intensive and extensive studies in the tropical forests of Amazon, many noteworthy results were obtained. P. Hogberg (SLU, Sweden) illustrated importance and difficulties in partitioning ecosystem respiration flux to autotrophic and heterotrophic respiration. In this session, I presented the results of our research on temporal variability of stable isotope ratios of respired CO₂ observed in Tomakomai Flux Research site, Japan. In the evening, the whole conference dinner was laid in the large banqueting hall of the university. We all had pleasant talk not only on scientific topics, but also on various things like that characteristics of research activi-



Y. Takahashi was presenting the research result of Tomakomai Research site.

ties in different countries, or food cultures, etc. The party went on till late with live music. Many participants enjoyed the music and dancing.

The last session "Future Potential for Forest Carbon Sequestration" was held in the morning of April 4. The potential of forest management for atmospheric carbon mitigation was discussed intensively based on various observational data. At the end of this symposium, Paul Jarvis proposed new approaches to forestry practice to embrace carbon sequestration in his presentation "Carbon Forestry", then Howard Griffiths gave synopsis and conclusions of this fruitful meeting. After the general discussion on the subjects addressed in sessions, the meeting was closed successfully.

Assessment of the carbon balance in forest biomes is pressing global environmental issue. Although many latest research developments has given a mass of valuable information on the role of the forest in global carbon balance, there are still many outstanding issues. Further development of our understanding on the forest carbon balance requires interdisciplinary collaboration across national borders. In present circumstances, observational data from Asian region is lacking. Since Asian forests have unique characteristics in vegetation types and in climatic factors, the data from this region will give valuable information about global assessment of forest carbon balance. We should encourage ourselves to attain the expected results in this current international research effort.

Web page of this symposium:

<http://www.plantsci.cam.ac.uk/forestbiomes/>



Commencement of a Project Entitled "Integrated Research on Carbon Budget Management in Terrestrial Ecosystems of Asia in the 21st Century" by the Ministry of the Environment, Japan

Takehisa OIKAWA
(University of Tsukuba, Japan)

A strategic research project entitled "Integrated research on carbon budget management in terrestrial ecosystems of Asia in the 21st century" is in progress from fiscal year (FY) 2002 and is sponsored by the Global Environment Research Fund of the Ministry of the Environment, Japan. The project has two phases; FY 2002 - 2004, and FY 2005- 2006. The main aim is to elucidate carbon dynamics between the atmosphere and terrestrial ecosystems in Asia in order to ultimately minimize the rate of increase in CO₂ concentration, one of the main causes of global warming. The four main themes and ten sub-themes of this project are listed below.

1. Analysis of carbon balance in terrestrial ecosystems using bottom-up approaches based on micrometeorological and ecological methods

Theme leader: Susumu YAMAMOTO, National Institute of Advanced Industrial Science and Technology

Quantitative analysis of carbon balance in forest ecosystems

Quantitative analysis of carbon balance in grassland and crop ecosystems

Quantitative analysis of carbon balance in soil realm

Database construction and comprehensive analysis of carbon balance in terrestrial ecosystems

2. Analysis of meso-scale terrestrial carbon balance using top-down approach based on atmospheric monitoring

Theme leader: Gen INOUE, National Institute for Environmental Studies

Analysis of meso-scale CO₂ distribution and its variation using atmospheric monitoring network

Estimation of CO₂ balance through the development of a meso-scale inverse model

3. Assessment of carbon balance dynamics and evaluation of methodologies for carbon budget management in terrestrial ecosystems of Asia in the 21st century

Theme leader: Takashi KOHYAMA, Hokkaido University

Development of a prediction model for estimating carbon absorption and emission in terrestrial ecosystems in the near future

Global comparison of carbon cycle models and monitoring systems

Data analysis and modeling for estimation of CO₂ balance

Integrated assessments of options for carbon management in terrestrial ecosystems in the 21st century and the development of an integrated model to assess carbon balance

4. Promotion of integrated research and information sharing

Theme leader: Takehisa OIKAWA, University of Tsukuba

a. Analysis of carbon balance in terrestrial ecosystems using bottom-up approaches based on micrometeorological and ecological methods

In this study, year-long observations on main processes of the carbon cycle will be conducted using unified methodologies on typical vegetation and soil realms in sub-arctic, temperate, and tropical zones extending from Siberia to Southeast Asia. The annual monitoring includes measurements of CO₂ fluxes in forest and grassland ecosystems using micrometeorological methods, and of photosynthesis and respiration of soils and vegetation using gas chamber method. Other measurements such as plant biomass, mass of plant debris, annual dry mass increase, ratios of stable isotopes of oxygen and carbon, changes in plant phenology (based



on spectral characteristics) will also be conducted at the main sites. Furthermore, characteristics of each region and typical processes in each ecosystem will be examined and new research methodologies and technologies will be developed.

b. Analysis of meso-scale terrestrial carbon balance using top-down approaches based on atmospheric monitoring

The study takes an opposite approach to the bottom-up approach that estimates carbon balance in terrestrial ecosystems using micrometeorology and ecology. Here, the study estimates CO₂ absorption and emission into the atmosphere based on atmospheric CO₂ concentration. As CO₂ distribution in the atmosphere is determined by both carbon absorption and emission from the soil surface and carbon diffusion into the air, carbon balance on the soil surface can be estimated by monitoring CO₂ distribution in the air. A comparison of estimated values with those obtained from bottom-up approaches is expected to give a more reliable estimation of CO₂ balance. Studies will also include validation of CO₂ balance models and development of an up-scaling method in forests.

c. Assessment of carbon balance dynamics and evaluation of methodologies for carbon budget management in terrestrial ecosystems of Asia in the 21st century

In this study, data on carbon balance dynamics obtained from field monitoring research in themes 1 and 2 will be used for establishing an information infrastructure in order to assess variability in carbon balance, enhance accuracy level of carbon balance model in terrestrial ecosystems, and study the influence of climate change due to anthropogenic activities on carbon balance in terrestrial ecosystems. Research on mid- to long-term methodologies for carbon budget management and on ways to utilize scientific knowledge in policymaking will be also conducted.

d. Promotion of integrated research and information sharing

In this project, a GIS database will be managed by the project leader to collect and share data from the above

themes and facilitate close and effective partnerships among researchers. A comparative evaluation of progress in different research themes and maintenance of an information infrastructure for promotion of the project are also planned.

As mentioned above, the project has two types of outcomes: implementation of field monitoring following modeling in themes 1-3, and integration of research results in theme 4. All integrated research projects on environmental sciences including this project need to elucidate the overall picture of carbon dynamics on the basis of large-scale data rather than focusing on a single study area. Consequently this project is becoming a massive association with nearly a hundred researchers from a variety of independent administrative institutions and universities. It is not enough, however, to collect only data from each researcher but it is essential to integrate them in order to generate valid scientific results. Although the importance of integrated research has long been recognized, it has been quite difficult to implement it.

A kick-off meeting of the advisory board was held on the October 2002. The Chairman of the Board, Masayuki Tanaka of Tohoku Institute of Technology, and other members pointed out the importance of integrated research comprising various research fields. As part of such integration, data disclosure was strongly suggested. Originally the principle of "Promotion of integrated research and information sharing" [discussed in the fourth theme] was to be adopted for integration of modeling and for strengthening collaborative studies on field monitoring, modeling and analysis through sharing data among participating researchers only. In our sincere response to the advice from the Board, we changed the above principle, however, and decided to provide data for any researcher, including those not involved in





this project. Specific measures to be implemented in FY 2003 were discussed in the report of the integrated working group (WG) meeting. The main contents of the report were as follows.

1. Introduction: Objectives of Sharing Integrated Data
2. Initial Time of Commencement of Data Sharing and Procedure for Data Usage
3. Varieties, Content and Format of Data, and Methodology for Generating Items and Guidelines
 - Micro-meteorology of the Tower Site, Flux Monitoring Datasets
 - Data for Photosynthesis, Plant Respiration, Soil Respiration, and Soil Classification
 - Data for Biomass Quantity and Vegetation Characteristics
 - Satellite Data of Tower Site Area
4. Data for the Model Usage, Variety and Content of Output Data
 - Terrestrial Ecosystem Model
 - Inverse Model
5. Database Supporting Systems, and Method of Database Operation
6. Current Issues and Discussion Points for the Future

If the practice of sharing data obtained through the above research themes works effectively, it will contribute greatly to our most valuable mission in this project - integrated analysis. Since this project involves many researchers and a large budget, it is a big enter-

prise rather than a single study project. Therefore, data disclosure is more crucial than in other studies. We believe data sharing must be valuable for many researchers not only for updating but also for using as a basic data for a long time.

In June 2002, Japan accepted the Kyoto Protocol of the United Nations Framework Convention on Climate Change in which Japan is required to cut greenhouse gas emissions by 6 % during the first phase of commitment from 2008 to 2012. It is the first time that there has been a unanimous agreement on climate change. The Ministry of the Environment, Japan, playing the role as a leader, has vigorously continued discussions on implementing specific measures. The environmental issue on greenhouse gases, however, is not one simple problem to be solved during the first phase only. It is a major issue for everyone around the world to deal with during the period after the second phase of commitment and even throughout this century. Effective measures based on scientific knowledge must be taken immediately, and research results from this project must contribute to resolution of problems shared by the entire human race. Accordingly, it is vital to examine the current state and the mechanism of global environmental change in Asia and suggest measures for CO₂ emission cuts to policy-makers through publishing peer-reviewed research papers. We need to publish high-quality reports such as those of IPCC, which are cited for their relevance in setting important guidelines for the global environmental policy.

Introduction and Activity of KoFlux Measurement Sites

Wonsik KIM and Joon KIM
(Yonsei University, Korea)

Since one and half years after the KoFlux launched, the various studies in regard of carbon dioxide (CO₂) flux measurement over a canopy or a soil surface at Asian vegetation types have been carried out by efforts and supports of KoFlux members. The vegetation types of KoFlux study are covered with temperate deciduous forest, paddy field and farmland in the Korean Peninsular and tropical deciduous forest with mixed cropland in

the Indochina Peninsular. Though this period is too short to understand the factors controlling the mechanisms and quantify the budget resulting photosynthesis and respiration about CO₂ exchange over the each study area through the studies, the successful and interesting results as a primary study could be obtained during the term. The aim of this report is to introduce those abstracts under KoFlux activity. For more detailed



information about those papers, please refer to the special issue of *Korean Journal of Agricultural and Forest Meteorology* (Vol. 5, No. 2, 2003) to be published in July, 2003.

Exchange of CO₂ at Kwangneung broadleaves deciduous forest during growing season in 2002 (Taejin Choi et al.) Eddy covariance measured CO₂ exchange was analyzed at Kwangneung broadleaves deciduous forest (i.e. DK site within KoFlux) during growing season (i.e. from June to August) in 2002. Although the site is located at complex terrain (i.e. valley-like shape), turbulence characteristics is not significantly different from those at simple and homogeneous terrain in the direction of $90 \pm 45^\circ$ with long fetch. CO₂ flux could be assumed to be stationary during this growing season and its magnitude was in the range of $0.5 \sim -1.0 \text{ mg m}^{-2} \text{ s}^{-1}$. Although storage term was one order of magnitude smaller than CO₂ flux, it was comparable to CO₂ flux around sun rise and sun set. Net ecosystem exchange was well fitted with Michaelis-Menten light response model at daytime with r^2 of 0.80. Parameters derived from the model at DK shows that DK site may seem less favorable for photosynthesis and more favorable for respiration, which could be attributed to old-growth of forest at DK site when compared to the age at other sites. At nighttime, if u^* is larger than 0.25 ms^{-1} , net ecosystem exchange (NEE) is not underestimated due to weak mixing.

Measurement for soil CO₂ efflux using closed dynamic chamber system (Namyi Chae and Joon Kim) Soil CO₂ efflux can be the second largest component of the carbon budget in the ecosystem. The objectives of this study are to understand soil CO₂ efflux measurement procedures that minimize error for closed dynamic chamber system and to evaluate preliminary results for forests and rice paddy. We examined by references advantage and shortcoming of closed dynamic chamber system and possible problems for measuring. One of closed dynamic chamber system is LI-COR 6400 system which is portable and has newest chamber function. Therefore, this system is possible to measure for various locations and can reduce many errors for

chamber effects although this is not easy long term periods measurement, continuously. Preliminary measurement was conducted at forests and rice paddy middle of September. Soil CO₂ efflux in forest sites was $3 \mu \text{ mol m}^{-2} \text{ s}^{-1}$ while soil temperature was $18 \sim 19^\circ \text{ C}$ and that in rice paddy was $3 \mu \text{ mol m}^{-2} \text{ s}^{-1}$ while soil temperature $20 \sim 21^\circ \text{ C}$. Because of non homogenous soil surface in forest, CV for each sampling points was 50 % and relatively homogenous soil surface in rice paddy was 20%.

Nutrient dynamics in litterfall and decomposing leaf litter at the Gwangneung deciduous broad-leaved natural forest (Choonsig Kim et al.), Litterfall and litter decomposition represent a major contribution to the carbon and nutrient inputs in forest ecosystem. We measured litterfall quantity and nutrient dynamics in decomposing litter for two years at the Gwangneung broad-leaved natural forest (DK site) in Korea. Litterfall was collected in circular littertraps (collecting area : 0.25 m^2) and mass loss rates and nutrient release patterns in decomposing litter were estimated using the litterbag technique employing $30 \text{ cm} \times 30 \text{ cm}$ nylon bags with 1.5mm mesh size. Total annual litterfall was $5,627 \text{ kg/ha/yr}$ and leaf litter account for 61% of the litterfall. The leaf litter quantity was highest in *Quercus serrata*, followed by *Carpinus laxiflora* and *C. cordata*, etc., which are dominant tree species in the site. Mass loss from decomposing leaf litter was more rapid in *C. laxiflora* and *C. cordata* than in *Q. serrata* litter. About 77% of *C. laxiflora* and 84% of *C. cordata* litter disappeared, while about 48% in *Q. serrata* litter lost for two years. Lower mass loss rates of *Q. serrata* litter may be attributed to the difference of substrate quality such as lower nutrient concentrations compared with the other litter types. Nutrient concentrations (N, P, Mg) of three litter types except for potassium (K) increased compared with initial nutrient concentrations of litter over the study period. Nutrients (N, P, K, Ca, Mg) in *C. laxiflora* and *C. cordata* litter were released rapidly compared with *Q. serrata* litter. The results suggest that litter mass loss and nutrient dynamic processes among tree species vary considerably on same site condition.

Spatial variability of soil heat fluxes in a conifer



forest (Yun-Ho Park et al.) The spatial variability of soil heat fluxes in a conifer forest was investigated by micrometeorological measurement. The maximum daily averages of R_s and R_n were about 260 Wm^{-2} and 180 Wm^{-2} . The daily average of G was typically 10% of net radiation during mid-July to mid-August. The measured soil heat flux of G_6 was suitable to calculate G within a 2% error during the study period. A time delay in the maximum flux at the depth 0.1m by heat storage was observed.

Forest stand structure, site characteristics and carbon budget of the Kwangneung natural forest in Korea (Jong-Hwan Lim et al.) The study area, Kwangneung Experiment Forest (KEF) is located at the west-central portion of Korean peninsula and belongs to cool-temperate broadleaved forest zone. At the old-growth deciduous forest near Soribong-peak (533.1m) in KEF, we have established 1ha permanent plot ($100 \times 100\text{m}$) and a flux tower, and the site was registered as a KLTER (Korean long-term ecological research network) and DK site of KoFlux. In this site, we made a stemmap of trees and analyzed forest stand structure and physical and chemical soil characteristics, and estimated carbon budgets by forest components (tree biomass, soils, litter and so on). Dominant tree species were *Quercus serrata* and *Carpinus laxiflora*, and accompanied by *Q. aliena*, *Carpinus cordata*, and so on. As a result of field survey of the plot, density of the trees larger than 2cm in DBH was 1,473 trees per ha, total biomass 261.2 tons/ha, and basal area $28.0 \text{ m}^2/\text{ha}$. Parent rock type is granite gneiss. Soil type is brown forest soil (alfisols in USDA system), and the depth is from 38 to 66cm. Soil texture is loam or sandy loam, and its pH was from 4.2 to 5.0 in surface layer, and from 4.8 to 5.2 in subsurface layer. Seasonal changes in LAI were measured by hemispherical photography at the 1.2m height, and its maximum was 3.65. And the spatial distributions of volumetric soil moisture

contents and LAIs of the plot were measured. Carbon pool in living tree biomass including below ground biomass was 136 tons C/ha, and 5.6 tons C/ha is stored litter layer, and about 92.0 tons C/ha in soil up to 30cm in depth. Totally more than about 233.6 tons C/ha was stored in DK site. These ground survey and monitoring data will give some important parameters and validation data for the forest dynamics models or biogeochemical dynamics models to predict or interpolate spatially the changes in forest ecosystem structure and function.

Tower CO_2 flux measurements in farmland at Haenam in Korea (Hee Choon Lee et al.) Tower-based CO_2 flux measurements have been executed in FK KoFlux site which is the crop field mixed with farmland and rice paddy since Jul. 2002 to understand quantitatively the interaction between terrestrial ecosystem and atmosphere and the ecosystem response on environmental change. Maintenance of eddy covariance system was focused during the early stage of measurement period to archive data stably. CO_2 half-hourly averaged density had a diurnal variation and a seasonal difference related to NEE. Daytime maximum CO_2 uptake was about $-1.0 \text{ mgCO}_2\text{m}^{-2}\text{s}^{-1}$ at Aug. and reversely, nighttime maximum CO_2 was released about $0.3 \text{ mgCO}_2\text{m}^{-2}\text{s}^{-1}$ at summer. Both the amount of CO_2 uptake and release were decreased gradually, and they were almost zero or less than $0.05 \text{ mgCO}_2\text{m}^{-2}\text{s}^{-1}$ at winter. Maximum magnitude of daily NEE was $22 \text{ gCO}_2\text{m}^{-2}\text{d}^{-1}$ at summer and averaged magnitude of daily NEE from Oct. to Dec. was $2 \text{ gCO}_2\text{m}^{-2}\text{d}^{-1}$.

CO_2 and energy exchange in a rice paddy for the growing season of 2002 in Hari, Korea (Byung-Kwan Moon et al.) Rice, which occupies about 60% of the farmland in Korea, is a staple crop in Asia. It not only absorbs CO_2 from the atmosphere, but also emits carbon in a form of CH_4 . It has a potential role in the global budget of greenhouse gases because of its relative con-





tributions of carbon absorption and emission associated with changing hydrologic cycle. To better understand its current and future role, seasonal variations of energy and CO₂ exchange in this critical ecosystem need to be quantified. The purpose of this study was to measure, document and understand the exchange of energy and CO₂ in a typical rice paddy in Korea throughout the whole growing season. Since late April of 2002, we have conducted measurements of energy and CO₂ exchange in a rural rice paddy at Hari site, one of the Korea regional network of tower flux measurement (KoFlux). After the quality control and gap-filling, the observed fluxes were analyzed in the context of micrometeorology and biophysics. CO₂ and energy exchanges varied significantly with land cover changes (e.g., plant growth stages), in addition to changes in weather and climate conditions. This study, reporting first direct measurement of energy and CO₂ exchange over a rice paddy in Korea, would serve as a useful database as one of the reference sites in AsiaFlux and FLUXNET.

Inferring regional scale surface heat flux around FK KoFlux site: From one point tower measurement to MM5 mesoscale model (Jinkyu Hong and Joon Kim) KoFlux network was launched to improve our understanding on CO₂, water and energy exchanges between atmosphere and biosphere as well as to contribute to the regional, continental, and global reference site networks of both FLUXNET and CEOP/CAMP. However, most observation towers in KoFlux are located in a non-ideal terrain, therefore we need the estimation of effects due to surface heterogeneities on a tower-based flux observation. Additionally, the demands for understanding water, CO₂ and energy cycles in regional and continental scales are growing in science community as well as in social area. We also feel some needs to examine if a tower-based estimation represents the properties around a tower appropriately. To quantify the 2 dimensional and 3 dimensional effects on flux observations in one point tower as well as to infer the regional scale heat fluxes around FK KoFlux site, we com-

pared sensible heat fluxes from a tower, CBL budget method, MM5 mesoscale model, and NCEP Reanalysis data. Each data source had a unique horizontal area. Preliminary results of our study showed that 1) the tower-based measurements revealed the surface heterogeneities, but have the possibility to capture the regional averaged properties; 2) the sensible heat fluxes of MM5 mesoscale model were very similar with those in a tower measurement; 3) it seems that the horizontal advection is not negligible around FK KoFlux site; and 4) NCEP/NCAR Reanalysis data estimates were relatively smaller than other data sets.

Soil CO₂ evolution and nitrogen availability on abandoned agricultural fields at Mt. Kumdan (Yowhan Son et al.) The influence of abandonment of agricultural fields on soil carbon and nitrogen dynamics is rarely addressed due to lack of appropriately paired sites. In this study, we identified three sites that have native forest and abandoned rice and crop fields at Mt. Kumdan near Seoul. Currently the vegetation of indigenous forest and abandoned rice field is deciduous hardwood forests while that of abandoned crop field is deciduous shrub. We measured soil CO₂ evolution and inorganic N availability for the three sites from 25 July, 2002 through 24 January, 2003. Soil CO₂ evolution tracked seasonal soil temperature. Mean soil CO₂ evolution (g CO₂/m²/hr) for the study period was 0.42 for the rice field to forest, 0.50 for the crop field to shrub, and 0.41 for the indigenous forest, respectively. Soil CO₂ evolution and soil temperature were not different among the sites, however, soil water content was significantly different. Soil water content had a very weak influences on soil CO₂ evolution. Inorganic resin N availability differed among the three sites and seemed to be related to soil moisture.

Real time monitoring and simulation system (RTMASS) for Tak flux measurement site, Thailand (Wonsik Kim et al.) The Tak flux measurement (TFM) site, one of the sites of Korean Flux Network (KoFlux) which is infrastructure of AsiaFlux, is constructed in northwest of Thailand. The eddy covariance technique



is used for measuring the energy, water and CO₂ fluxes, and a real time monitoring and simulation system (RTMASS) developed for data acquisition and processing. The RTMASS is the core structure of KoFlux-data information system (KoFlux-DIS) and is consisted of a remote and a local system. Data acquisition and transmission, and data storage, processing and publishing are functions of those systems, respectively. As primary result about the characteristics of mean flow and turbulence analysis, TFM is proper site to measure and analyze the various fluxes and those budgets on tropical deciduous forest..

Field intercomparison and calibration of net radiometers (Byung-Kwan Moon et al.) Net radiation (R_n) is one of the most fundamental components in surface energy budget. For an accurate measurement of R_n,

periodic and consistent calibrations of net radiometers are required. With a 4-month time interval, two field experiments were conducted to inter-compare and calibrate two types of net radiometers (the Q-7.1 and the CNR1), widely used in flux measurements. Differences between the Q-7.1 and the CNR1 net radiometers were within 7.7 %, and the errors after calibration against the standard net radiometer were < 3.2 %. Radiometric responses and calibration factors appeared to have changed with sky conditions, especially temperature difference with season's progress. We concluded that the periodically calibrated Q-7.1 can replace more expensive, more accurate CNR1 net radiometer for long-term field measurements, providing that field calibrations of net radiometers are performed every 4 - 6 months interval.

Tomakomai Flux Research Site

Koh INUKAI

(National Institute for Environmental Studies, Japan)

The quantitative assessment of forest carbon fluxes has become an urgent task after the Conference of the Parties to the U.N. Framework Convention on Climate Change .

With the cooperation of Hokkaido Regional Forestry Office, the Center for Global Environmental Research (CGER) in the National Institute for Environmental Studies (NIES), Japan, constructed Tomakomai Flux Research Site in a



100 ha larch plantation (about 43 years old) in Hokkaido and has been carrying out the long-term monitoring of the mechanism of greenhouse gases cycling in the forest ecosystem under certain forestry management since the summer of 2000. The surrounding of this site

is suitable for flux observation of carbon dioxide, as the fairly large forest has no artifact within 10 km and has a gentle slope of 1-2 degrees and a homogeneous forest

stand . Furthermore, publicly available record of the forestry management by the Hokkaido Regional Forestry Office contains abundant

basic information for our research.

At the end of 2003, a tree thinning will be done as a regular forestry management at this site. Therefore the change of the forest functions due to the thinning will be observed. We anticipate that the integration of results



Monitoring projects at Tomakomai flux research site in fiscal 2003

No.	Theme	Representative
R-1	Long-term measurement of soil CO ₂ efflux and trunk-space CO ₂ flux	Hokkaido University Takashi HIRANO
R-2	Measurements and estimation of ecophysiological parameters of a larch ecosystem	Hokkaido University Takayoshi KOIKE
R-3	Water balance and Carbon flow in Larch forest	Hokkaido University Kaichiro SASA
R-4	Wet and dry depositions of air pollutants in deciduous larch forest	HIES * Izumi NOGUCHI
R-7	A long-term measurement and modeling on energy, water vapor and CO ₂ fluxes over a larch forest	AIST ** Susumu YAMAMOTO
R-11	Observation of vertical profile of atmospheric CO ₂ using balloon and Kite-plane	NIES *** Gen INOUE
R-12	Development of evaluating method for CO ₂ sink on forest ecosystem using remote sensing technology	NIES *** Hiroyuki OGUMA
R-14	Study on carbon cycle in forest ecosystem using stable isotope measurement	NIES *** Yoshiyuki TAKAHASHI
R-15	Turbulent structure and methane flux inside and above the forest canopy	Osaka Prefecture University Nobutaka MONJI
R-16	Evaluation of stability of air layers and nighttime ecosystem respiration rate using microwave temperature profiler	NIES *** Gen INOUE
R-18	Development of evaluating method for sink/source of CO ₂ in a regional scale	NIES *** Yasumi FUJINUMA
R-19	Terpene flux above Japanese larch forest and its contribution to carbon budget of the ecosystem	Tokai University Akira TANI
R-20	Integrated modeling of hydrological cycle and ecosystem change aided by remote sensing technology	NIES *** Shogo MURAKAMI
R-21	Carbon balance research in Tomakomai larch forest: continuous measurements by multichannel automated chamber systems	NIES *** Naishen LIANG
R-24	Evaluation of the large-scale estimation of net primary production using ground-based data sets	Tokyo Institute of Technology Hideki KOBAYASHI
R-25	Study on ecosystem scale model of carbon cycling in northern Larix forest ecosystem	NIES *** Yoshiyuki TAKAHASHI
R-26	Observation of upper wind flow and thickness of the atmospheric boundary layer with the Doppler acoustic sounder	AIST ** Hiroaki KONDO
R-27	Relationship between wind speed and photosynthesis and transpiration rate	NIES *** Atsushi TORIYAMA
R-28	Airborne laser profiling for standing biomass estimation	Ehime University Tatsuhiko SUEDA
R-29	Study on CH ₄ , N ₂ O, CO and H ₂ sink/source strength of northern Larix forest soil	NIES *** Yoshiyuki TAKAHASHI
R-30	Measurement of sap flow rates of larch trees and energy storage flux	Hokkaido University Takashi HIRANO
R-31	Estimating subsurface carbon stocks in forest using ground-penetrating radar	The University of Tokyo Shuichi ROKUGAWA
R-32	Development of forest measurement techniques using synthetic aperture radar	NIES *** Hiroyuki OGUMA
R-33	Fundamental research on the factors regulating carbon and oxygen isotopic ratios of tree ring cellulose of Japanese larch	Hokkaido University Takeshi NAKATSUKA
R-34	Estimation of stand leaf area and LAI in a deciduous conifer forest	Kobe University Hiroaki ISHII
R-35	Monitoring of occurrence of dead branches and the death of individuals.	Hokkaido University Takayoshi KOIKE
R-36	Studies on the formation of organic aerosols in the forestal atmosphere and their hygroscopic properties	Hokkaido University Kimitaka KAWAMURA

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from the site with those from the site at Teshio CC-LaG site (bare soil and glowing larch forest, collaborated with Hokkaido University and Hokkaido Electric Power Co. Inc.) will provide a profound understanding of material cycling in this type of larch forest, which is widely

distributed in the northeast Eurasian area [1].

At Tomakomai site, we operate the long-term monitoring of carbon circulation and air pollutants with Hokkaido University and Hokkaido Institutes of Environmental Sciences. Twenty-six research projects



are being conducted by more than 50 researchers and students. As one of the key sites of AsiaFlux, it hosted Japan-U.S. international comparison measurement made by several Japanese researchers and Bob Evans, who is a specialist on measurement comparison of Ameriflux, in August 2001 [2].

The great effort to maintain such an openly collaborative research site has started to show excellent results. Many reports concerning this site have been published in journals and presented at conferences; and more than 40 reports were presented at the domestic meeting in November 2002. Our further intention is to coordinate

the collaboration among the researchers who use the site to carry out integrated researches.

The next public offering to join our research will be in December 2003. We are looking forward to your applications. If you want to start a research before the tree thinning, please let us know as soon as possible.

CGER Monitoring Office : cgermoni@nies.go.jp

[1] AsiaFlux Newsletter No.5

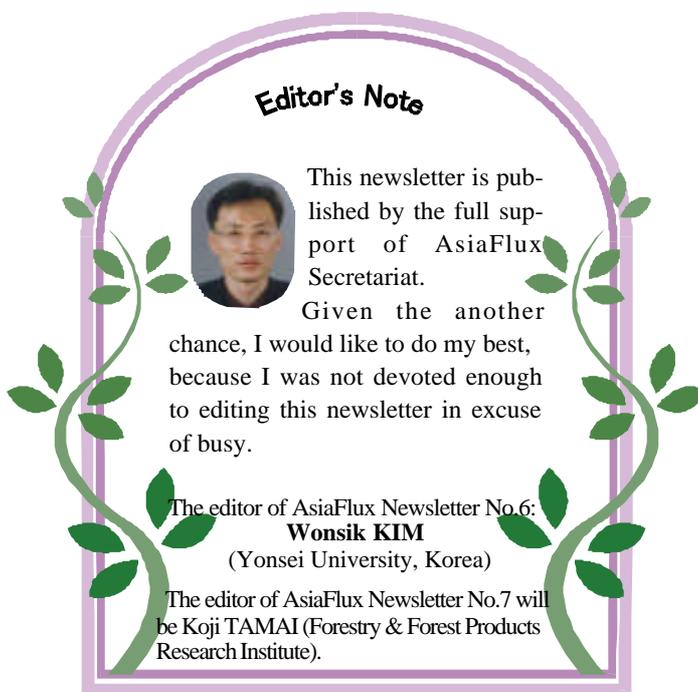
[2] AsiaFlux Newsletter No.1 and No.2

http://www-cger.nies.go.jp/~moni/flux/asia_flux/index.html



Call for Articles for AsiaFlux Newsletter

We quarterly publish the AsiaFlux Newsletter, usually on the 25th of March, June, September, and December. Kindly submit information about announcement of conference, workshops and other meetings directly to the secretariat by e-mail or floppy disk. asiaflux@nies.go.jp The text may be modified according to the requirement of the newsletter format. Your support to the newsletter will be greatly appreciated.



Editor's Note

This newsletter is published by the full support of AsiaFlux Secretariat.

Given the another chance, I would like to do my best, because I was not devoted enough to editing this newsletter in excuse of busy.

The editor of AsiaFlux Newsletter No.6:
Wonsik KIM
(Yonsei University, Korea)

The editor of AsiaFlux Newsletter No.7 will be Koji TAMAI (Forestry & Forest Products Research Institute).



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