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Contents

Report on the AsiaFlux Training Course 2006

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The very first AsiaFlux Training Course 2006 was held on 21- 30 August 2006, in Tsukuba, Japan. It was organized by AsiaFlux Short Training Course Sub-workgroup and its aim was to diffuse the basic theory and observation techniques to flux researchers in Asia.

Twenty participants from nine countries (Bangladesh, China, India, Indonesia, Malaysia, Philippines, Taiwan, Thailand and Viet Nam) learned together about observation theory, observation techniques such as instrumentation and its maintenance and data analysis in ten days.

This training course consisted of four parts, and the first part was a series of lectures to learn basic theories. Front-line researchers from USA, Canada, China and Japan led graduate-level lectures and participants learned some essential knowledge on micrometeorological observation.

The second part was practical training. First section was NDIR (Non-Dispersive InfraRed gas analyzer) calibration practice using standard gas. Then, in-field practice was held to try equipments assembling, actual observation and data acquisitions. All participants and some AsiaFlux members joined for field trip and visited paddy field observation site in Mase and forest observation sites in Fujiyoshida to see on-going observation on tower, soil respiration and photosynthesis observation. Researchers who are actually carrying out the observation at the site explained practical approaches for long term observation including electrical power securing and precaution against lightning strike.

The third part was an analysis practice to calculate flux from data obtained in the field. A vast amount of data is usually handled in eddy covariance method, since in every second, it requires ten measurements of wind speed and CO_2 concentration data. Participants have experienced the multiple steps of data processing individually, using PC to obtain mean value of CO_2 absorption in 30min ~

60min.

Last part of the course was an open seminar. The first lecture was given by Prof. Roger H. Shaw, who has taught meteorology for long time in UC Davis, USA. He introduced his study on vortical structure in the roughness sublayer. He explained with very detailed diagrams, that how he clarified, based on LES (Large Eddy Simulation), the mechanism of vortex in plant community and its influence on energy and material transportation. The second lecture was given by vice-chair of AsiaFlux, Prof. Kim Joon, Yonsei University, Korea. He emphasized that we should concern and respond sincerely to the global environmental issues. He also evocatively introduced a new orientation of flux study network in Korea, which they are going to inject research resources intensively to a super site to promote the integrated study. At the same time, local sites are going to enhance the coordination between researches on carbon and water cycle.

This training course was especially for young Asian researchers who are about to start CO_2 flux observation. In every class, the participants had very energetic discussion and communed with each other even after classes. By the time that the course was over, participants and staffs developed strong friendships with each other and it was quite hard to say good bye.

The followings are some of the comments from the participants:

・ *I have studied micrometeorology long time ago and I have never had a chance to apply the knowledge to real measurement. This is the first time I jump into this field. It is quite enjoyable to me. Here, we are measuring the micro-quantity on the earth and this quantity ends up controibuting to the global warming. It is a little suprising for me!*

・ *It was a exiting training course to me. Everyday I learned new stuffs through lecturers and discussions. This is a lifetime experience in my proffesional career. I also would like to devote my experience to the future training course and flux studies. We shall work as hard as we can to repay the help we got from this community.*

・ *This course improved my view that Asian countries have capabilities and chance to contribute idea, technology knowledge and human resource for analysis of global change. We have chance to establish flux measurement and capacity building for our countires in terms of global change. This idea should be suported by AsiaFlux.*

Activities like this training course are expected to contribute greatly to the improvement of data quality, fostering leading researchers and strengthening cooperation between research institutions in Asia. AsiaFlux Short Training Course Sub-workgroup is planning to hold the socond training course in 2007 based on feedbacks from participants, lecturers and staffs. Training Course Sub-workgroup will start announcing for next year's program soon, so all potential participants should pay some attentions to AsiaFlux website.

Report on the ChinaFLUX Training Course 2006

—Theory and Practice of CO_2 Flux Data Analysis and Modeling

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The Chinese Terrestrial Ecosystem Flux Research Network (ChinaFLUX) relies on the existing Chinese Ecosystem Research Network (CERN) of Chinese Academy of Sciences (CAS), fills an important regional gap and increases the number of ecosystem types in FLUXNET. Since the establishment of ChinaFLUX in 2002, many new flux sites have been established by some funding agencies (e.g. Chinese Academy of Forestry (CAF), Chinese Academy of Meteorological Sciences (CAMS), etc.), which have greatly promoted the rapid development of flux observation and research in China.

The symposium on "the Formation and Development of Regional Flux Research Network in China" was held successfully in Beijing on November 30 in 2005. ChinaFLUX promised to hold a training course on the theory and practice of CO_2 flux data analysis and modeling in 2006. More importantly, it has been realized that close collaboration with colleagues in China were first launched ensures rapid technological transfer, and will likely avoid reinventing the wheel and identify critical needs to improve further the eddy covariance method.

Opening Ceremony by Prof. Guirui Yu

The "Theory and Practice of CO_2 Flux Data Analysis and Modeling" training course (ChinaFLUX Training Course 2006) was held successfully during July 21-27, 2006, in Beijing, China. The ChinaFLUX Training Course 2006 was organized by ChinaFLUX, as the important part of the "2004~2010 Programme of National Ecosystem Observational and Research Network". The objectives of this training course and networking activity are the followings: (a) to provide training in flux data analysis methods that have been developed within CO_2 flux networks, demonstrating progress that has been made as well as difficulties that are encountered in the search for general methodologies; (b) to provide professional training for the young scientists in flux observation and research field; (c) to ensure and promote the long-term development of flux observation and research in China; and (d) to share experiences with respect to network data management and data sharing that may help improve the international science communication at global levels along with broader understanding at global ecosystem carbon exchange processes.

The topics of this training course are the followings: (1) basic theories and hypothesis of eddy covariance flux measurement; (2) principles of flux data analysis and quality control; (3) flux measurements, gap filling and flux partitioning; (4) model inversions and parameter estimation; (5) process-based flux tower data analysis and simulation; (6) satellite-based flux tower data analysis and simulation and (7) scientific papers writing. The lecturers of this training course come from Australia, USA, Germany and Japan, They are the followings: Dr. Ray Leuning and Dr. Yingping Wang (CSIRO Marine and Atmospheric Research, Australia), Prof. John Tenhunen and Ms. Katherine Elizabeth Owen (Department of Plant Ecology, University of Bayreuth, Germany), Dr. Xiangming Xiao

(Institute for the Study of Earth Oceans and Space, University of New Hampshire, USA), Dr. Liukang Xu (LI-COR Biosciences, USA) and Dr. Nobuko Saigusa (National Institute of Advanced Industrial Science and Technology, Japan).

More than 110 participants attended the training course, including scientists and students from over 20 institutes and universities in China. Through 7-days training course, all participants benefited from the theory and practice of CO_2 flux data analysis and modeling lectures significantly. It has been recognized that it is fruitful for the ChinaFLUX Training Course 2006. For additional information about the training course, please refer to the news or notice at ChinaFLUX website (http://www.chinaflux.org).

A Snapshot of Lecture by Dr. Ray Leuning

Response Characteristics of VAISALA CO_2 Sensors and its Correction for the Accurate Estimation of Soil CO_2 Efflux

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Introduction

Portable infrared CO_2 sensors such as GMM222 and GMP343 (VAISALA) are often used to measure soil CO_2 efflux (Tamai *et al*., 2005 among others). Although these sensors are portable and easy to use, the response time of the sensors is inadequate when measuring the CO_2 efflux with an increasing rate of carbon dioxide concentration in the chamber. The output signals of these CO_2 sensors are delayed as a result of both diffusion processes in the sample cell and internal averaging calculations that ensure a stable data output. We conducted experiments to determine the response characteristics of several portable sensors and developed a backward estimation method for recovering the actual increase in CO_2 concentration (Mizoguchi and Ohtani, 2005). In the present paper we provide an outline of the response experiments and its applications.

Response Experiments

Laboratory experiments were conducted using calibration tubes to determine the response characteristics of sensors under two different conditions: flow-through and diffusion. First, the sensor was placed in a calibration tube filled with a low concentration of standard gas (353ppm). A high concentration of gas (950ppm) was then introduced to the tube by switching the flow using the solenoid valve under the flow-through condition (Fig. 1). The experiments were conducted using three different flow rates: 0.3, 0.75, and 1.2 $Lmin^{-1}$. Another high concentration of gas (1938ppm) was injected into the tube containing gas of 353ppm concentration using a syringe after the airflow was cut off by a solenoid valve under the diffusion condition (Fig. 2). A small hole was kept open while introducing the gas to maintain constant pressure in the tube. The averaging time of the outputs of GMP343, which can select the averaging time of the outputs, was set to zero.

Sensor Response

Figure 3 shows the predicted changes in CO_2 concentration in the calibration tube and

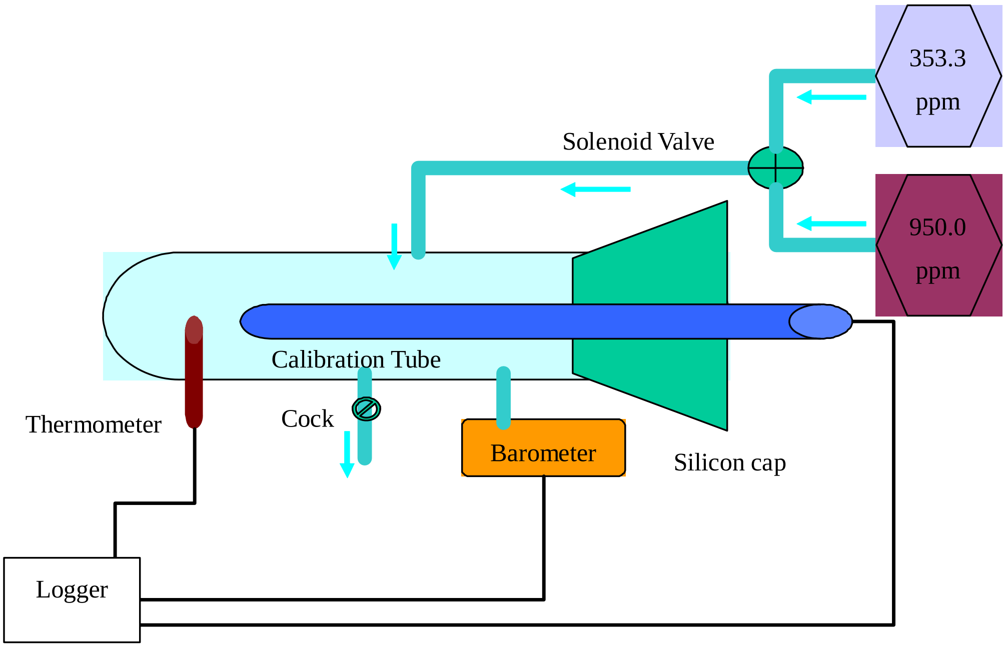

Fig. 1 Schematic diagram of the CO_2 sensor response experiment under the flow-through condition.

Fig. 2 Photograph of the CO_2 sensor response experiment under the diffusion condition.

changes in sensor outputs from the portable CO_2 sensor (GMP343 diffusion-type sensor) in the response experiments under the flow-through condition (flow rates: 0.3 and 1.2Lmin^{-1}). The predicted CO_2 concentrations were calculated using input and output flow rates and the concentrations of the standard gases. Although GMP343 without internal averaging calculation shows a superior performance to earlier VAISALA sensors such as GMT222, output was still delayed.

The sensor outputs obtained in the response experiments were normalized by Equation (1):

$$k_t = (C_t - C_0) / (C_1 - C_0) \qquad (1)$$

where C_0 is the initial concentration (ppm), C_1 is the final CO_2 concentration (ppm), and C_t is the sensor output (ppm) at time t (s). Figures 4 and 5 show the normalized CO_2 concentration (k_t) obtained in the response experiments under the flow-through (flow rate: 0.75Lmin^{-1}) and diffusion conditions, respectively. The results indicate that the attachment of a dust filter acts to substantially slow the sensor response. Furthermore, the response time of the sensor under the diffusion condition was longer than that under the flow-through condition.

Assuming that the relationship between k_t and k_t' (normalized predicted CO_2 concentration) is expressed as described in the following equation, we calculated the values of the constants α and τ, for each sensor using the least squares regression method.

$$k_t = k_t' \exp(-\alpha t)$$

$$k_t = (C_{t+\tau} - C_0) / (C_1 - C_0)$$

$$k_t' = (C_t' - C_0) / (C_1 - C_0) \qquad (2)$$

where $C_{t+\tau}$ is the sensor output (ppm) at t+τ (s), and C_t ' is the predicted CO_2 concentration (ppm) at t (s) if sensor output is not delayed. The values of the constants α and τ for each sensor under the flow-through condition are clearly different to those under the diffusion condition; however, the values showed no systematic differences under each flow rate for the flow-through condition. We then took the average values obtained for each sensor in the response experiments under each condition as the constants for each sensor. We regarded the time when k_t / k_t' was equal to 0.9 to be the 90% response time (Table 1).

Correction of the Sensor Response

We can expand Eq. (2) to the following equation:

$$C_t' = C_0 + (C_{t+\tau} - C_0) / (1-\exp(-\alpha t)) \qquad (3)$$

This equation makes it possible to estimate the predicted CO_2 concentration using the initial CO_2 concentration (C_0) and the sensor output (C_t). Figure 6 shows the output of the GMP343 diffusion-type sensor, the predicted CO_2 concentration calculated using input and output flow rates and the concentrations of the standard gases, and the predicted CO_2 concentration estimated by substituting sensor output for Eq. (3). The CO_2 concentration estimated using Eq. (3) is in good agreement with the predicted CO_2 concentration calculated using the flow rates and the concentrations.

Errors in the Measurement of Soil CO_2 Efflux

The change in CO_2 concentration within a static closed chamber was calculated using the diffusion model (Fig. 7: solid line). The diffusion model was run under the following

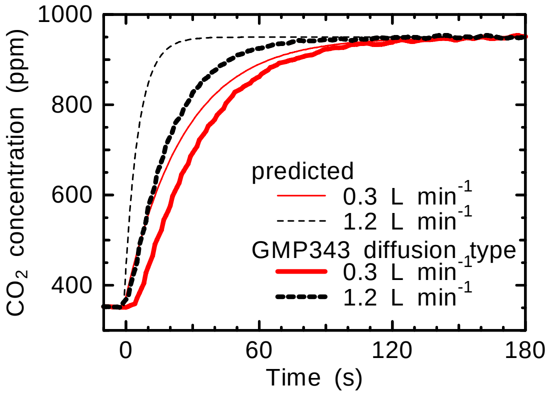

Fig. 3 CO_2 concentrations measured in the response experiments under the flow-through condition (flow rates: 0.3 and 1.2 L min^{-1})

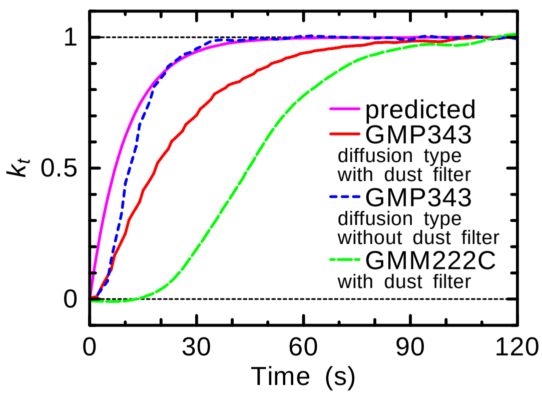

Fig. 4 Normalized CO_2 concentrations (kt) obtained in the response experiments under the flow-through condition.

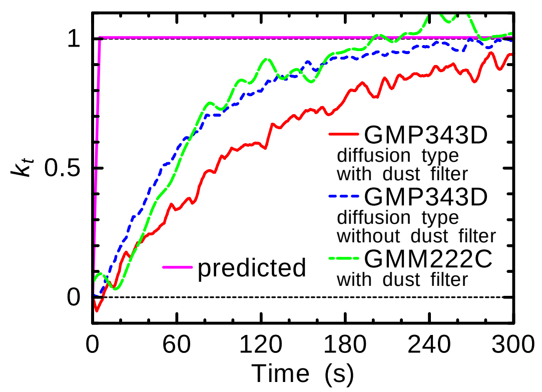

Fig. 5 Normalized CO_2 concentrations (kt) obtained in the response experiments under the diffusion condition.

conditions: initial CO_2 concentration in the chamber = 400ppm; CO_2 concentration at a soil depth of 0.02 m = 1500ppm; diffusion coefficient of the soil surface = 2.0 × 10^{-6} m^2 s^{-1}; air pressure = 101.3 kPa; air temperature = 20°C. We ignored the rate of CO_2 production and storage at the soil surface and depths down to 0.02 m. The CO_2 concentration in the chamber was treated as uniform. Soil CO_2 efflux was calculated using the nonlinear method according to the following equation:

$$F = \frac{V}{A} \frac{\left(C_{t_0+dt} - C_{t_0}\right)^2}{dt\left(2C_{t_0+dt} - C_{t_0+2dt} - C_{t_0}\right)} \ln\left(\frac{C_{t_0+dt} - C_{t_0}}{C_{t_0+2dt} - C_{t_0+dt}}\right) \tag{4}$$

where F is the soil CO_2 efflux ($gm^{-2}\,s^{-1}$), V is the volume of the chamber (m^3), A is the basal area of the chamber (m^2), dt is the sampling interval (s), t_0 is the starting time of the measurement (s), and C_{t0}, C_{t0+dt}, and C_{t0+2dt} represent CO_2 concentrations (gm^{-3}) at t_0, t_0+dt, and t_0+2dt (s), respectively. CO_2 efflux under the above condition was 0.2 × 10^{-3} $gm^{-2}s^{-1}$ (F_{model}). CO_2 sensor (GMP343 diffusion-type with dust filter) outputs were then estimated using Eq. (3) (Fig. 7: dashed line and symbols). Soil CO_2 effluxes (F_{cal}) were also calculated using the nonlinear method for the following data intervals (dt): 120 sec (Fig. 7: * symbol), 300 sec (Fig. 7: Δ symbol), 600 sec (Fig. 7: + symbol), 1200 sec, and 1800 sec. The ratios of the effluxes (F_{cal} / F_{model}) were 0.4351, 0.8088, 0.9766 and 0.9997 at dt = 120, 300, 600 and 1200 sec, respectively. The ratio finally reached 1 at dt = 1800 sec. These results suggest that soil CO_2 efflux is potentially underestimated for shorter sampling intervals.

Measurements of Soil CO_2 Efflux Using Portable Sensors

Most VAISALA-made CO_2 sensors including the GMP343 diffusion-type sensor do not need to draw air into the sample cell because the cell is set in the open air. Undertaking direct measurements without drawing the sample from the chamber has the advantages of both portability and minimizing the risk of measurements being influenced by the pressure changes that occur when sample air is drawn with a pump for the measurement of porous soil or snow. Correction for the delayed outputs of small CO_2 sensors increases the range of CO_2 sensors that are suitable for measurements of soil CO_2 efflux.

References

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Mizoguchi, Y. and Ohtani, Y. 2005, Comparison of Response Characteristics of Small CO_2 Sensors and an Improved Method Based on the Sensor Response. Journal of Agricultural Meteorology 61(4), 217-228. (in Japanese with English Summary)

Table 1 Response time of each CO_2 sensor under the flow-through and diffusion conditions.

Condition	Sensor	90% response time(s)	α	τ
Flow-through	GMM222C with dust filter	77	0.0421	21
Flow-through	GMP343D with dust filter	46	0.0510	0
Flow-through	GMP343D without dust filter	16	0.1532	0
Diffusion	GMM222C with dust filter	151	0.0182	23
Diffusion	GMP343D with dust filter	304	0.0076	0
Diffusion	GMP343D without dust filter	173	0.0133	0

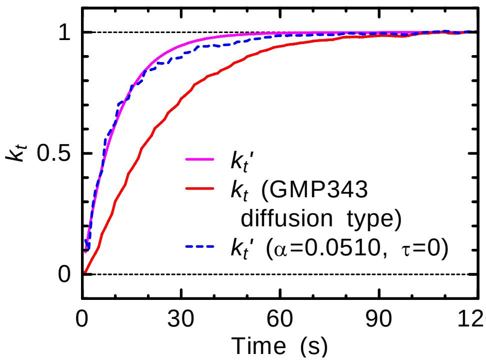

Fig. 6 Comparison of the output of the GMP343 diffusion-type sensor in the response experiments, the predicted CO_2 concentration calculated using input and output flow rates of the standard gases and their concentration in the response experiment, and the predicted CO_2 concentration estimated from Eq. (3).

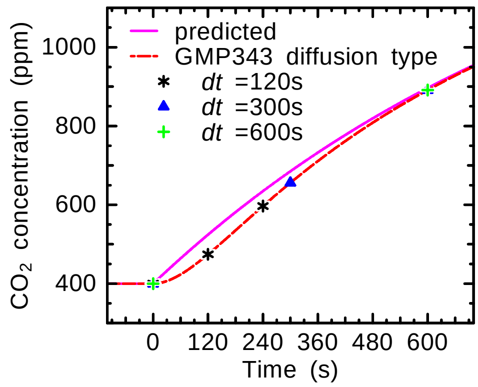

Fig. 7 CO_2 concentration in a static closed chamber calculated using the diffusion model and the CO_2 sensor output estimated using Eq. (3) and based on the response characteristics of the GMP343 diffusion-type sensor.

Site Info

Introduction to the Research at Kog-Ma Watershed, Northern Thailand

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This article 1) introduces hydro-meteorological studies at a tropical monsoon forest in northern Thailand, 2) reviews notable findings related to the site with references to those derived at an adjacent research site covered by other forest type, and 3) presents our next research targets.

Site description

Sequences of mountain ranges and intra-mountain basins characterize the topography of northern Thailand (Fig.1). Forest types in the region vary greatly with the variations in topography and subsequent climatological features (Santisuk 1988). Ecologically, two types of evergreen forest exist in this region: hill evergreen forests in upland areas with altitudes >1,000 m and dry evergreen forests in lowland areas with altitudes <1,000 m. These two types of evergreen forest have distinct floristic compositions; *Fagaceae* and *Lauraceae* dominate the hill evergreen forests, while *Depterocarpaceae* dominate the dry evergreen forests. Our study focused on hill evergreen forests (*lauro–fagaceous* forests), which are widespread throughout Southeast Asia in mountainous areas >1,000 m in altitude (Ohsawa 1993). Our study site, the Kog-Ma watershed (18°48' N, 98°54' E; 1,268 m asl), is located within Doi Suthep-Pui National Park, on the eastward facing slope of Mount Pui, northern Thailand (Fig.1). Soils of the watershed are derived from granitic materials and have a sandy clay loam texture; these soils are classified as Tropohumults Ultisols (Chunkao *et al.* 1981) or reddish-brown lateritic soils. An ecological survey investigating canopy structures of hill evergreen forests on Mount Pui along the altitude showed that trees around the watershed (altitudinal range of 1,200–1,300 m) have a canopy height of 25 to 40 m, basal area of 29.1

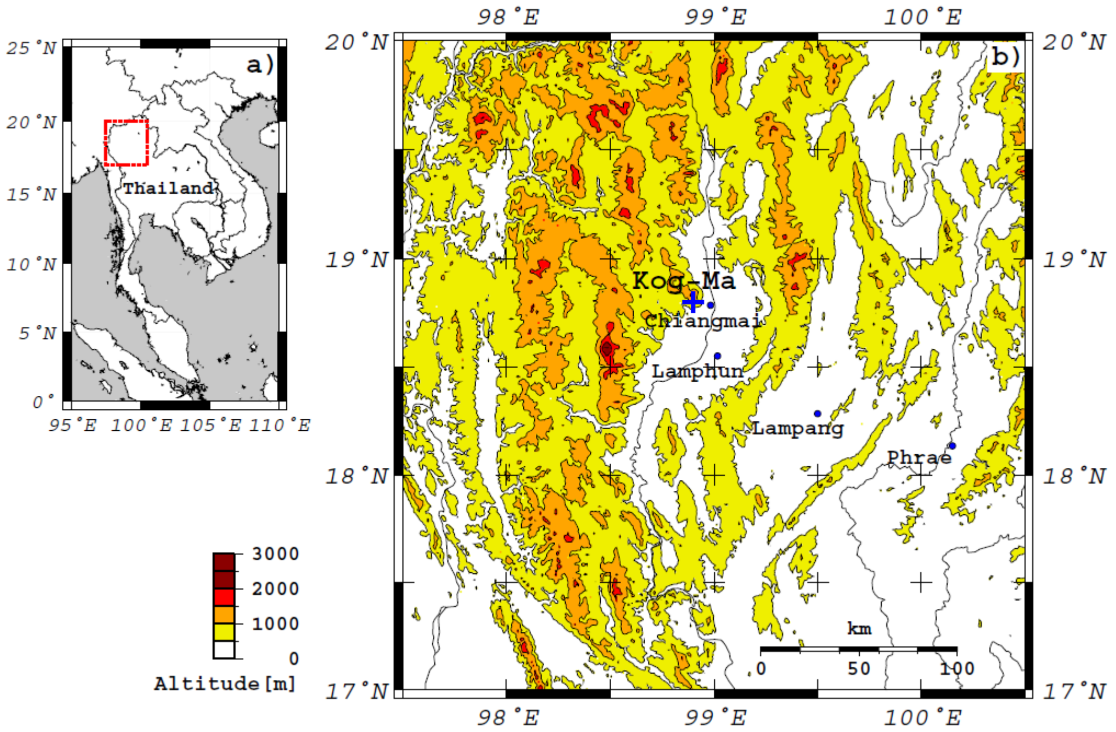

Fig.1 a) Map of Thailand, and b) locations of Kog-Ma watershed (+) and major cities (●) with a topographic map of northern Thailand. The enlarged area is encompassed by a dashed red line in Fig.1a).

to 38.1 m^2 ha^{-1}, and stem density of 567 to 1,119 trees ha^{-1} (trees with DBH > 5 cm) (Aksornkaoe and Boonyawat 1977). The leaf area index in this watershed ranges between 3.5 and 4.5, with slight seasonal changes (Takizawa *et al*. 2001). The regional climate is largely affected by annual cycles of the Asian monsoon regime, with defined dry months from November to April and rainy months from May to October. Mean annual rainfall during the 15 years from 1966 to 1980 was 2,084 mm, most of which (ca. 90 %) was observed during the rainy seasons (Chunkao *et al*. 1981). Based on long-term runoff measurements in the watershed from 1966 to 1978, mean annual evapotranspiration (ET) from the watershed was estimated to be 734 mm (Chunkao *et al*. 1981). Annual mean air temperature at the study site is 20.0ºC. April and December are the warmest and coldest months, with monthly mean temperatures of 23.3º and 16.7ºC, respectively. The seasonal change in humidity is large with a mean humidity of 87 % during the 6-month rainy season and 70 % during the 6-month dry season (Chunkao *et al*. 1981). Besides our studies in a hill evergreen forest, flux observations as part of the AsiaFlux project are ongoing at a dry evergreen forest, another evergreen forest in this region, as described by Gamo and Panuthai (2005) in the previous AsiaFlux newsletter.

Pioneer studies in Kog-Ma watershed

In 1964, forest hydrologists of the Department of Conservation, Faculty of Forestry, Kasetsart University, established the first research sites in the Kog-Ma watershed. These sites included three small sub-watersheds with weirs and several experimental plots. The watershed researches focused on investigating the hydro-ecological roles of the upland forest ecosystem. Data from these pioneer studies have archived in the *Kog-Ma Watershed Research Bulletin* series, which include information on spatial distribution of rainfall within the watersheds, hillslope hydrology, water budget and rainfall–runoff processes, nutrient cycling, partitioning of rainfall by the canopy, sediment productivity, and tree species distributions within the watersheds. That long-term project ended in 1980; Chunkao *et al*. (1981) provided a summary of project results and listed all published literature related to the project.

Recent findings and next targets

Our hydro-meteorological observations in Kog-Ma initiated in 1997, with the construction of a 50-m meteorological observation tower (Fig.2), as part of the Global Energy Water Cycle Experiment (GEWEX)/Asian Monsoon Experiment (GAME). The main purpose of the project was to understand seasonal variations in energy and water exchanges between the forest ecosystem and the atmosphere. One of the noteworthy findings is that ET for the hill evergreen forest reaches a maximum of ca. 3 to 4 mm d^{-1} in the late dry season (Fig.3), despite a significant decrease in moisture in the shallow soil layer (< 0.5 m) during this period (Tanaka *et al.* 2003). Although this finding was derived from numerical simulations using an ecosystem process model with observed physiological parameters, the simulated results agreed well with observed above-canopy net radiation, observed seasonality in sap flow velocities of predominant trees, heat and carbon exchanges for several days in representative seasons measured directly by eddy covariance methods, and measured rainfall interception (Tanaka *et al*. 2005). Furthermore, on an annual basis, the mean simulated ET was close both to ET derived from stream water gauging records (812 mm y^{-1}), and to the above-mentioned historical figure (734 mm y^{-1}) shown by Chunkao *et al*. (1981). The result implies that ET for hill evergreen forests increases as the evaporative demand of the atmosphere increases. Interestingly, the seasonal trend in ET of the hill evergreen forest was profoundly different from that of a dry evergreen forest in central Thailand. Using a gradient method, Pinker *et al*. (1980) concluded that the ET in a dry evergreen forest was higher in the rainy season (ca. 3.3 mm d^{-1}) than during the dry season (ca. 0.6 mm d^{-1}). Their finding on the seasonality of ET for the dry evergreen forest was consistent with physiological features of the same forest (Ishida *et al*. 2006), which indicated the lowered stomatal conductance during the dry season for a dominant tree (*Hopea ferrea*) in the forest. However, such stomatal control of the uppermost trees was not identified in the hill evergreen forest (Tanaka *et al*. 2003). This suggests the presence of available water in the soil at depths below 0.5 m in Kog-Ma watershed. Tanaka *et al*. (2004), using a soil–plant–atmosphere continuum (SPAC) model with observed soil hydraulic parameters, calculated the possible soil depth with roots (rooting depth) in a hill evergreen forest, with which the seasonal trend in ET of Kog-Ma site could be reproduced. Consequently, Tanaka *et al*. (2004) showed that rooting depths of 4 to 5 m were needed to explain the ET seasonality in the Kog-Ma watershed. A direct measurement of soil depth using a cone penetrometer supported the calculated rooting depth. A watershed-scale (8.9 ha) investigation of soil depths is now

Fig.2 50-m meteorological observation tower in Kog-Ma watershed, northern Thailand

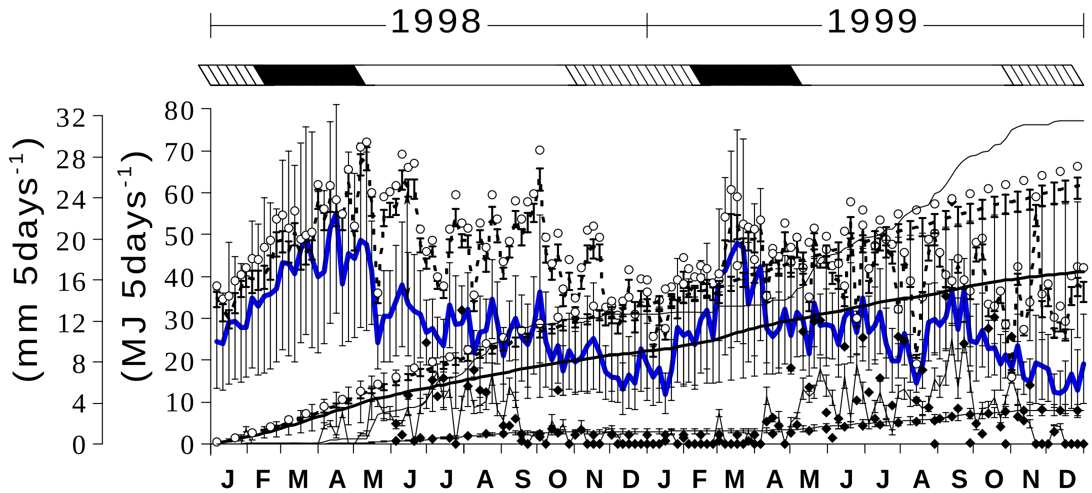

Fig.3 Simulated results of the seasonal variation in the net radiation (*Rn*) and latent heat (*LHF*) over a hill evergreen forest in 1998 and 1999 (modified from Tanaka *et al*. 2003).

Simulated ranges of net radiation and latent heat are indicated by thick error bars and thin error bars, respectively. Mean of the simulated latent heat is shown by a thick solid blue line. Simulated interception and its mean are indicated by a thin error bars with a thin solid line. Observed net radiation and interception evaporation are expressed by blank circles (○) and solid diamonds (♦), respectively.

conducted in Kog-Ma watershed, being expected to serve as general information on the distribution of rooting depths in Kog-Ma.

With respect to wet-canopy hydrological processes, cloud/fog water interception by the canopy might also play an important role in the hill evergreen forest because the forest is occasionally immersed in cloud (Fig.4). Cloud water (CW) is thought to provide additional moisture to the ecosystem beyond that brought by precipitation. Based on a 3-year observation of above-canopy cloud/fog occurrence using a well-calibrated fog gauge on the tower, Tanaka *et al*. (in press) found that the cloud/fog occurred over 1,346 h in Kog-Ma watershed. This number of hours is comparable to the total hours with records of rainfall (1,731 h) during the same period. Furthermore, the fog at the site tended to occur in association with rainfall events, i.e., before, during, and after rainfall events in the rainy seasons, implying the importance of CW in analysis of the wet-canopy hydrological processes. Quantitative estimation of the fog deposition rate is one of the present research subjects in this watershed.

To clarify the characteristics of momentum transfer above sloping canopy of Kog-Ma watershed, Komatsu *et al*. (2003) analyzed a 1-year data set of vertical wind profiles above the canopy, and found that 9.4 % of the data showed lower wind speed at greater heights. This difference was caused by nocturnal drainage flow on calm, clear nights. Such drainage flows might be critical for interpreting nighttime carbon dioxide and heat flux data. Thus, Komatsu *et al*. (2005), comparing several stability indices, concluded that the bulk Richardson number was a useful index to distinguish the drainage flow from shear flow for a sloping flux study site such as Kog-Ma. Based on these findings on momentum transfers within the atmospheric boundary layer, continuous observations of heat flux and net ecosystem exchanges using eddy covariance methods started in 2005 at Kog-Ma.

Soil respiration (SR) is one of major components when considering carbon cycling in forest ecosystems. Hashimoto *et al*. (2004) examined seasonality in SR in Kog-Ma watershed, and indicated that SR was relatively high in the rainy season than during the dry

Fig.4 Kog-Ma watershed immersed in fog

season. The seasonal changes might be caused by changes in soil moisture, while effects of soil temperature on the SR rates remained unclear because of small seasonal variations in soil temperature. Hashimoto (2005) thus investigated temperature sensitivity of SR using a large soil sample collected from the watershed, and delineated strong temperature sensitivity of SR flux from the soil sample, implying the possibility that a small increase in temperature might enhance carbon release from the hill evergreen forest ecosystem.

Our first goal of clarifying the seasonality of water and heat exchanges in a hill evergreen forest has been completed as a whole. However, large interannual variations in regional climate, such as delays in the onsets of rainy seasons associated with the El Ninõ/Southern Oscillation (ENSO) events (Zhang *et al*. 2002), and decreased rainfall during these events (Malhi and Wright 2004), have been demonstrated in this region. These anomalies in climate may lead to severe soil drought especially during the late dry season, and to unexpected ecological and hydrological responses of the hill evergreen forest. Kume *et al*. (unpublished data) inferred one of these responses of the Kog-Ma forest to the severe droughts. They demonstrated that sap flow velocities of only a small-sized tree declined in the late dry season when the soils underwent a severe drought, even though such decline was not observed for the uppermost trees during the same period. Our next research target is to comprehensively elucidate the effects of climate-induced severe droughts on the hydrology and ecology of the hill evergreen forest based on long-term flux observations.

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Announcement

AmeriFlux Science Team Meeting in Boulder, USA.

The “AmeriFlux Science Team Meeting” will be held in Boulder, CO, USA in October 16-18, 2006. The themes are as follows.

1. Carbon Fluxes at Multiple Scales
   - Bottom-up approaches
   - Top-down, complementary approaches
   - Ecosystem processes and interannual variation in fluxes
2. Disturbance/Climate/Vegetation gradients

For more details, please see: http://public.ornl.gov/ameriflux/

AsiaFlux Newsletter Special Issue

National report from TC2006-participants

Participants in AsiaFlux Training Course 2006 have contributed their national reports of carbon cycle research. AsiaFlux Editorial SWG is preparing to publish them in three volumes of AsiaFlux Newsletter Special Issue. The first volume will be released in late October 2006.

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Editor's Note

AsiaFlux workshop 2006 will be held in Chiang Mai, Thailand. The field trip is planed to visit Kog Ma Watershed Research Station. The deadline of the abstract submission is soon coming. (15 Oct. 2006). I am looking forward to meeting you in Chiang Mai.

The editor of AsiaFlux Newsletter No.19:
Koji TAMAI
(Kyusyu Research Center, Forestry & Forest Products Research Institute)

The editor of AsiaFlux Newsletter No.20 will be Xuefa WEN (Chinese Academy of Sciences).