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AsiaFlux Newsletter

Contents

Report from the 2nd AmeriFlux Workshop on "Standardization of Flux Analysis and Diagnostics"

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During my visit to UC-Berkeley hosted by Prof. Dennis Baldocchi, I had an opportunity to participate in AmeriFlux workshop held at Oregon State University, Corvallis, Oregon, U.S.A. during August 27 - 30, 2002. The workshop was sponsored by the Department of Energy and intended to outline and recommend better procedures for computing and correcting eddy covariance fluxes. The main goals of the workshop were (1) to minimize uncertainties in cross-site comparisons of fluxes resulting from different methods of data processing and post-processing QA/QC and (2) to highlight and explore emerging issues on influence of nighttime/stable conditions, advection, and complex terrain on measured fluxes.

The workshop dealt with 8 topics: (1) averaging and detrending (Lecturer: John Moncrieff, Discussant: Tilden Meyers), (2) coordinate rotation (Lecturer: Xuhui Lee, Discussant: Kyaw Tha Paw U), (3) low frequency corrections (Lecturer: Yadvinder Mahli, Discussant: Dennis Baldocchi), (4) high frequency corrections (Lecturer: Bill Massman, Discussant: Rob Clement), (5) flux corrections for cross contamination (Ray Leuning, Discussant: Scott Miller), (6) time series analysis (Lecturer: Gaby Katul, Discussant: Larry Mahrt), (7) post-field data quality control (Lecturer: Thomas Foken, Discussants: Brian Amiro and Bill Munger), and (8) advection and modeling (Lecturer: John Finnigan, Discussants: Bernard Heinesch and HaPe Schmid). Each topic was introduced with a one-hour lecture, followed by a one-hour discussion. Furthermore, special sessions were held to demonstrate processing/analysis software for eddy covariance data and to synthesize recommendations. The summary outlined below is based on the draft prepared by Bill

Massman who organized this workshop. More detailed information including the lecture notes are available through the AmeriFlux website (http://cdiac.esd.ornl.gov/programs/ameriflux/workshops/workshops.html).

The following is a list of workshop recommendations and discussions. It is strongly urged that the AmeriFlux network follow these recommendations when calculating fluxes for publication.

1. Fluxes should be computed by block averaging. Linear detrending or recursive filtering are not recommended for computing fluxes.

Discussion: Block averaging (acting as a high pass filter) offers better frequency response than linear detrending or recursive filtering (which ensures the loss of any low frequency contribution to the fluxes). Special care is needed (e.g., using recursive filter) during periods of nonstationarity (e.g., times of rapid atmospheric boundary layer growth/decay, frontal or cloud passage). The lack of energy balance closure (with subsequent underestimation of CO_2 flux) partly results from the inability of eddy covariance system to fully capture low frequencies (i.e., atmospheric motions with periods of 1- 4 hours). However, as the flux-averaging period increases the chance of incurring nonstationary conditions increases. Discussions on these concerns suggested the following recommendations: (1) the flux averaging periods should be no shorter than 30 minutes and no longer than 60 minutes. The recommended length still remains 30 minutes; (2) ogives should be used to diagnose the length of time necessary to capture the low frequency flux components; (3) all raw data records should be obtained and maintained; (4) scaling fluxes to close the energy balance is not recommended.

2. The planar fit coordinate system is the preferred coordinate system.

Discussion: The conventional rotation (e.g., w = 0) acts as a nonlinear high pass filter and removes some of the low frequency content of fluxes, thereby contributing to the lack of surface energy balance closure. To recover this low frequency component in the planar fit coordinate system requires including the mean vertical velocity term. Limited tests to date suggest that the fluxes in the planar fit coordinate system are 5-10% higher (in magnitude) than in the natural coordinate system. This planar fit coordinate system is defined over a long period (months) and historical data sets should be reprocessed to re-estimate fluxes in the new coordinate system. With the planar fit coordinate system it is possible to recover the mean vertical wind and the crosswind momentum flux, which should provide information on thermal circulations at the site and some measure of site heterogeneity. For investigations of spectra and cospectra, turbulence time series should be rotated into the planar fit coordinate system first.

3. High frequency spectral losses are unavoidable, but can be minimized by careful design. It is recommended that (1) all separation distances, time constants, system sensor characteristics, and deployment height be recorded and preserved and (2) such information be used to estimate high frequency spectral loss.

Discussion: All sites should estimate spectral loss using methods of Moore (1986: Boundary-Layer Meteorology), Massman (2000, 2001: Agricultural and Forest Meteorology), Massman and Lee (2002: Agricultural and Forest Meteorology). Estimating spectral loss from sonic thermometry should provide a lower bound on spectral loss associated with any scalar flux. This simple check should help decide if corrections associated with scalar fluxes are reasonable or not. The time constants associated with closed-path sensors should be determined empirically and frequent checks on time constants are important. Methods of correcting for spectral losses are different in closed- and open-path systems. All sites should determine ensemble spectra and cospectra and one specific mathematical formulation should be used for comparing results between sites. When using the analytical approach, the spectral corrections should be applied after coordinate rotation.

4. The WPL term is not an instrument related cor-

rection; it results from mass transfer associated with surface heating and evaporation.

Discussion: CO_2 instrument detects the number of absorbing CO_2 molecules within the path of its infrared beam and indirectly measures the density of CO_2 molecules in the sample with a known volume. The WPL term is not required to 'correct' the measured density, but applies to the measured fluxes. For open-path sensors spectral corrections must be applied to the raw covariances first and then the WPL terms afterward for the final estimate of the trace gas flux. In a closed-path system, the intake tube alters the sample's density by changing its temperature such that fluxes measured with this instrument do not require the heat flux portion of the WPL term. Including the WPL appropriately to a closed-path system requires careful consideration of the nature of the sampling and its associated spectral correction.

5. All post field QA/QC should be documented and reported when publishing flux estimates.

Discussion: No minimum set of QA/QC controls or tests were established. More diagnostic tests are better than fewer especially in complex terrain where comparison with flat terrain diagnostics is important. Three papers that discuss post field QA/QC are: Foken and Wichura (1996: Agricultural and Forest Meteorology, 78, 83-105), Vickers and Mahrt (1997: Journal of Atmospheric and Oceanic Technology, 14, 512-526), and Finkelstein and Sims (2001: Journal of Geophysical Research, 106, 3503-3509). The first two of these papers discuss, among other things, tests for stationarity and the third paper discusses flux sampling error. It appears now that nonstationarity results in random error and not bias error. There are also spike detecting (and interpolation) subroutines that should be used to test time series for spikes: Hojstrup (1993: Measurement Science and Technology, 4, 153-157) and Brock (1986: Journal of Atmospheric and Oceanic Technology, 3, 51-58). It is also recommended that the standard deviation of all standard micrometeorological variables be recorded. The standard deviation (or variance) of net radiation or incoming solar radiation should be useful for diagnosing periods of nonstationarity associated with the passage of clouds. Nighttime u* thresholds associated with insufficient turbulence to use eddy covariance fluxes should be determined on a site-by-site basis. These thresholds should be established during periods of stationary turbulence. Employing the new planar fit coordinate system may require the re-establishment of the u* threshold because u* is dependent upon the coordinate system used. Gap filling should be done by the researchers themselves, not by the users. The gap filling strategy depends on the goal. Synthetic data gaps are recommended to determine if there are any systematic biases associated with different gap filling methods. Some cross-site comparisons should be done with different gap filling methods.

6. It is important to be cognizant of emerging issues.

Discussion: Some emerging issues were identified and tended to be associated with the influence of advection or complex terrain on measured fluxes:

(1) Drainage flow is expected to deplete near-soil CO_2 from beneath the tower measurement height. This process still needs better understanding and quantification.

(2) Directional wind shear inside canopies makes comparison between above- and below-canopy flux measurements difficult. The above- and below-canopy flux footprints will not necessarily coincide or overlap.

(3) The u* threshold for data screening should be replaced with metrics based on the Froude or Strouhal number and the bulk Richardson number.

(4) Regions of flow separation behind even gentle hills result from the presence of canopies on the hill. This can confound the interpretation of the measured fluxes

and can result in significant biases.

(5) Stable or nighttime conditions can support different types of motions, which can impact fluxes in different ways. Ramps tend to dominate during slightly stable conditions and they will promote the vertical mixing of trace gases. For very stable highly stratified flows, gravity waves (usually confined to regions just above the canopy top) will dominate. Under these conditions turbulence is nonexistent and the gravity waves usually do not support much vertical mixing. However, their presence may bias flux measurements. Nighttime conditions can shift between these two bounding states and can display features suggesting a mixture of the two. Inspection of turbulent time series is required to begin diagnosing these issues at different sites. Intermittency and the loss of stationarity are common at night.

APEIS Meeting in Beijing

Guirui YU
(Institute of Geographic Sciences and Natural Resources (IGSNR), Chinese Academy of Sciences, China)

Asia-Pacific Environmental Innovation Strategy (APEIS) workshop, which was sponsored by National Institute of Environmental Studies (NIES), Japan, and IGSNR, CHINA, was held on 20-21 September 2002 in Beijing. Many researchers from Southeast Asia and Asia-Pacific regions took part in this workshop. The purpose is to promote the monitoring system for environmental change in Southeast Asia and Asia-Pacific regions through comprehensive activities both on MODIS and ground stations. APEIS has set up MODIS data receiving stations and other monitoring sites in China. Activities of the APEIS were reported by Masataka WATANABE from NIES and the MODIS data receiving station by Jiyuan LIU from IGSNR. Qingxue WANG from NIES presented the prime data on APEIS station and Guirui YU from SCCERN reported discussions on monitoring instruments and parameters of the monitoring sites in ChinaFlux. Other researchers from China and Korea also reported and discussed research results of flux measurements.

Sink Issues of Kyoto Protocol and Research Undertaken at Forestry and Forest Products Research Institute

—FFPRI Symposium on Study Results, 2002—

Masahiro AMANO
(Forestry and Forest Products Research Institute, Japan)

After the COP3, much discussion was conducted about the use of sinks stipulated by the Kyoto Protocol, and the COP7 held in 2001 in Marrakech, Morocco, determined how to deal with forests approved by the Protocol as carbon sinks and how to report to the UNFCCC. However, the method of measuring and assessing carbon absorption by forests that was determined at the COP7 contains many elements that cannot be addressed by conventional administrative data, and requires new scientific knowledge. The Forestry and Forest Products Research Institute (FFPRI) has examined problems facing researches on these fields, observing the trend of international debates about sinks, and FFPRI held a workshop to explain an outline of the examination as follows;

A snapshot in the FFPRI symposium

(1) The exchanges of CO_2 between main forest ecosystem types and the atmosphere have been analyzed

by the result of observation data derived from the eddy covariance method.

(2) A scheme of the process model was elaborated to factor out direct human induced changes in carbon stock from natural effects to satisfy the concept of Article 3.4 of Kyoto Protocol.

(3) The amount of carbon storage globally in soil is about 4 times of in vegetation. A model of soil carbon dynamics is developing to evaluate soil carbon changes caused by forestry activities.

(4) The study has been conducted to investigate socio-economic affects of a large-scale afforestation and reforestation as CDM sink projects.

(5) There are several key issues for National Inventory of forest carbon to the required degree of precision and accuracy. Specific problems depended on the Japanese inventory situation were proposed and discussed.

Brief Report on the International Symposium on "Response of Terrestrial Watershed Ecosystems in Monsoon Asia to Global Change"

Tetsuya HIYAMA
(Nagoya University, Japan)

The International Symposium on "Response of Terrestrial Watershed Ecosystems in Monsoon Asia to Global Change" was done during November 24-26, 2002 at Kyoto International Conference Hall, Japan. This symposium was sponsored by "Research Institute for Humanity and Nature (RIHN), Japan", "Science Council of Japan", "Ministry of Education, Culture, Sports, Science and Technology, Japan", and "IGBP-GCTE sub-working group".

The aim of this symposium was to synthesize the research project titled "Global change impacts on terrestrial ecosystems in Monsoon Asia" (TEMA) as a core research of IGBP-GCTE during 1997-2002. In this project, several focal forest sites along the latitudinal gradient were intensively investigated. Because East Asia is characterized by humid climate over a latitudinal gradient from Southeast Asia to Siberia, it provided a unique framework for the synthetic studies of terrestrial system functions and its change. Major concepts in TEMA sites were the functional scaling up from a single leaf, a tree, a forest stand, to a watershed ecosystem, and the attention to river and lake sub-systems that are reflected by the biogeochemical processes of forest sub-systems. In order to estimate carbon budget, flux monitoring systems (using towers) were established, and contributed to AsiaFlux Network community. This symposium also aimed to propose an integrated regional study in Monsoon Asia for IGBP II, through synthesis and evaluation of the present state.

Totally seven sessions, including poster session, were established in this symposium as follows.

<Session 1: Integration of Eco-physiological Processes to Stand Dynamics>

<Session 2: Latitudinal/Altitudinal Transect of East Asia>

<Session 3: Monitoring and Modeling Atmosphere-Forest-Soil Processes>

<Session 4: Forest-Lake Interface in Watershed Systems>

<Session 5: Human Activity Discharge into Watershed Systems>

<Session 6: Synthesis and Future Direction>

After an opening address by Wada (RIHN, Japan), introductory talks were presented by Pitelka (University of Maryland, USA) on the "GCTE-past and future", and by Ojima (Colorado State University, USA) on "Regional biogeochemistry and land-atmosphere interactions".

In the Session 1, proposals of methodology and some case studies in integration of eco-physiological processes of stand dynamics were presented. Leadley (Universite Paris-Sud XI, France) had presentation titled as "Links between biodiversity and ecosystem car-

bon cycles". Abaimov (V.N.Sukachev Institute of Forest, Russia) talked about forest fire and subsequent successions in larch forests of continuous permafrost area in Siberia. Hiura (Hokkaido University, Japan) has shown a case study on aboveground carbon fixation at a leaf to landscape level in a temperate deciduous broad-leaved forest (located in the experimental forest of Hokkaido University in Tomakomai) as one of the results from IGBP-GCTE-TEMA, Japan. Kubo (Hokkaido University, Japan) presented his own three dimensional "PipeTree model" to simulate response of forest structure on the global environmental change. Finally Rustad (USDA Forest Service, USA) had presentation on the response of terrestrial ecosystems to CO_2 enrichment in conjunction with steady state response of ecosystem.

A snapshot during the International Symposium on Japanese IGBP-GCTE- TEMA in Kyoto International Conference Hall, taken by Takahito Yoshioka, RIHN Japan.

In the Session 2, ecosystem transect studies in East Asia were presented. Kassim (Forest Research Institute Malaysia, Malaysia) and Marod (Kasetsart University, Thailand) presented population structures and dynamics of tropical seasonal forests in Malaysia peninsular and in western Thailand. Aiba (Kagoshima University, Japan) has shown dynamics of tropical rain forests along altitudinal gradients with contrasting soil phosphorus on Mount Kinabalu, Borneo. Takyu (Forestry and Forest Products Research Institute, Japan) talked about changes in diversity, structure and function of forest ecosystems in East Asia.

Session 3 focused on monitoring and modeling of atmosphere - forest - soil processes. At first Kim (University of California, USA) introduced FLUXNET activities in the world (EUROFLUX, Ameriflux, AsiaFlux etc.) and kickoff of KoFlux (Korean contribution to FLUXNET) to study water, energy and carbon exchange in Asian ecosystems. Hiyama (Nagoya University, Japan) introduced a case study in IGBP-GCTE-TEMA on the behavior of carbon dioxide in an urban forest using combined approach of flux measurements and carbon isotopic sampling. Lai (University of Utah, USA) also used carbon isotopic approach over a grassland ecosystem for partitioning of net ecosystem exchange in CO_2 fluxes between C3 and C4 plants. The study of Shibata (Hokkaido University, Japan) was also carried out in IGBP-GCTE-TEMA project. Their target was carbon fluxes and budgets in forest-soil-stream ecosystem in experimental forest of Tomakomai. Finally Barrett (CSIRO Plant Industry, Australia) proposed a methodology in constraining carbon cycle models using multiple sources of data.

In the Session 4, one of the main issues in IGBP-GCTE-TEMA group focusing on forest-lake interface in watershed systems was introduced. Before the introduction, Shin (Forestry Research Institute, Republic of Korea) presented long-term ecological research activities in forest ecosystem in Korea. After that three presentations were done from the IGBP-GCTE-TEMA group: Ohte (Kyoto University, Japan) about carbon discharge through hydrological processes from a temperate forest watershed in the central Japan; Konohira (Nagoya University, Japan) about water chemistry of the stream waters from the forest to the downstream; Murase (Nagoya University, Japan) about carbon dynamics in bottom sediment of Lake Biwa, especially about origins, metabolism, and impact on the lake ecosystem. After that Cole (Institute of Ecosystem Studies, USA) introduced international status about the multiple roles of freshwater ecosystems in regional to global carbon budgets.

Session 5 focused on human effect for discharge into watershed systems. Because Tanaka (RIHN, Japan) was absent, only two persons, i.e. Yachi (RIHN, Japan) and Hara (Pacific Consultants Co., Ltd., Japan) were the presenters. They introduced Japanese activities for finding basin-specific factors towards consensus - building on a comprehensive manual for assessing the human and natural environment of a river basin, and resources for basin diagnostics and the four diagnostics tools (indicator, factor diagram, model, and GIS).

Session 6 was final session for synthesis and discussion about future direction in IGBP II. Kohyama (Hokkaido University, Japan) synthesized Japanese IGBP-GCTE-TEMA activities and proposed schemes in GCTE II for the future. Pitelka (University of Maryland, USA) again proposed perspectives on IGBP II activities, and finally Canadell (Pye Laboratory, Australia) introduced overview and research agenda in the IGBP-IHDP-WCRP global carbon project.

In the poster session, 8 posters were introduced on 26 November. At the same time, core members have small meetings to focus on an integrated regional study in Monsoon Asia in IGBP II with positively discussion.

In the discussion, Japanese observational studies in several forest ecosystems were highly appreciated by foreign researchers. Especially, importance of carbon storage in soil, uniqueness of tropical rainforest in conjunction with soil organic matter (SOM) and nitrogen limit and phosphorus limit, use of isotopic approach combined with flux measurements were highlighted. These researches should be used and combined with the forthcoming new projects. New GCTE initiative includes ecological processes in urban ecosystem, biodiversity and consideration of food system. The interaction among green house gases, ecosystem properties, and biodiversity should be strongly focused. The drivers in the interaction are land use change, nitrogen deposition, CO_2 emission, and over-exploitation. "Land project" organized by IGBP-LUCC, and GCP (Global Carbon Project) are the forthcoming project. In those projects, integration schemes such as inverse models from local to regional / global scales are the most important issues, again. The URL for the GCP project is <http//:GlobalCarbonProject.org>

Circum-Pacific Workshop

Wonsik KIM
(Yonsei University, Korea)

The Circum-Pacific Workshop hosted by Walter Oechel (San Diego State University) was held on 15-17 October 2002 at the EAST-WEST Center in Honolulu, Hawaii, USA, to discuss the Interaction of the Pacific Atmosphere-Ocean Systems on Circum-Pacific Carbon Balance.

The purpose of this Workshop is to understand the carbon balance budget of land, atmosphere and ocean resulting from monitoring of carbon flux, meteorological change, and ocean circulation; from high-resolution meso-scale simulation; and from long-term monitoring of carbon flux in terrestrial ecosystem using MODES GPP and Biome BGC.

Five of the 21 participants are involved in AsiaFlux, including Gen Inoue who hosted this meeting and Susumu Yamamoto who presented a report on behalf of the AsiaFlux community. Invited speakers presented their research results. The research focus and directions in the future were discussed. Presentations on flux monitoring were mostly of AsiaFlux; Flux monitoring of OzFlux and AlaskaFlux was also presented. A special session was set for the measurement strategies to monitor carbon flux for the Pacific Rim and for the ocean systems and fluxes.

Introduction of Chinese Terrestrial Ecosystem Flux Observational Research Network

Guirui YU
(Institute of Geographic Sciences and Natural Resources (IGSNR),
Chinese Academy of Sciences, China)

Chinese Terrestrial Ecosystem Flux Observational Research Network (ChinaFlux) is a long-term network which relies on Chinese Ecosystem Research Network (CERN) and applies eddy covariance of microclimatology and chamber/GC as main research method to study flux of CO_2 and water heat between representative ecosystem and atmosphere. Now, ChinaFlux consists of six stations that apply microclimatology method and 16 stations that apply chamber method (Fig.1). ChinaFlux will carry out the synthesis study on ecosystem process of carbon and water cycle besides long-term flux observation; moreover, ChinaFlux will systematically collect related data such as vegetation, soil, hydrology and climate. Current micrometeorology observational network includes four forest stations (Changbaishan, Qianyanzhou, Dinghusan, Xisuangbanna), one grassland station (Haibei) and one agriculture station (Yucheng). 16 stations which use chamber observational method cover all of main ecosystems such as agriculture, grassland, forest, water-body, mostly measure the output of CO_2, CH_4 and N_2O in ecosystem. Meanwhile, ChinaFlux is planning to add two grassland ecosystem stations (Inner Mongolia, Lhasa) with micrometeorology flux observational method, and cooperates with other observational sites in china build by overseas research institutes, and constitutes a complete ChinaFlux observational system.

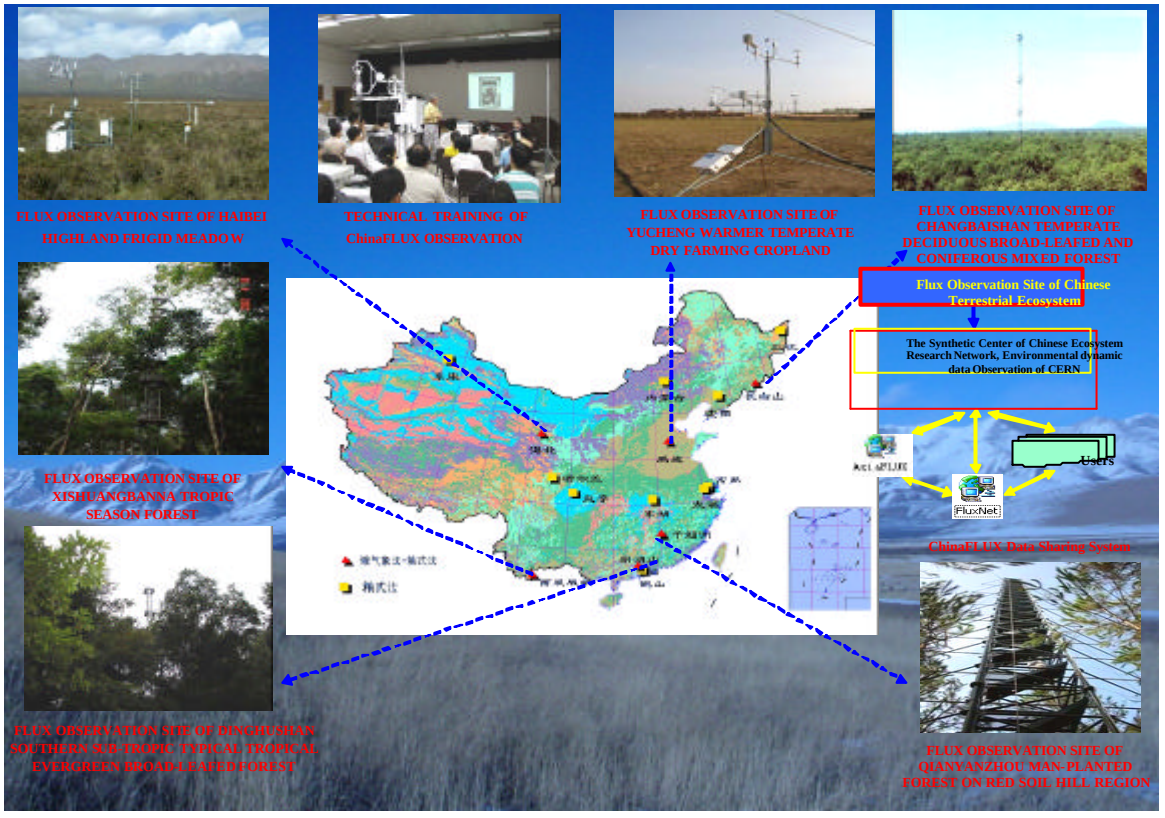


Fig.1 Chinese Terrestrial Ecosystem Flux Observational Research Network (ChinaFLUX)

The 8th AsiaFlux Steering Committee Meeting

AsiaFlux secretariat

The 8th AsiaFlux steering committee meeting was held in Kyoto on November 26,2002. Twelve committee members gathered and had a heated discussion.

The following is the key points of the discussion.

A snapshot in The 8th AsiaFlux steering committee meeting

1. Manual

The standardization of flux measurement and its data analysis is essential to enhance and to level up the monitoring activities. English and Japanese versions of manuals on them, edited by the specialists, are requested though the present methodologies of observation and the data are still in progress. It would be desirable to regularly revise the manuals to incorporate new and improve methodologies of flux measurement.

(In the 10th AsiaFlux organizer meeting held on December 26, 2002, it was decided that we issue guideline books in Japanese for the time being and will continue to discuss producing manuals for CO_2 flux measurement .)

2. AsiaFlux office

It is desirable that AsiaFlux is under the umbrella of FLUXNET as are EuroFlux and AmeriFlux now. KoFlux of Korea supports the idea that AsiaFlux works as an organizer in establishing such a frame among KoFlux, ChinaFlux and JapanFlux. JapanFlux is ready to accept such an idea. The frame of AsiaFlux would be realized with the acceptance of this idea by ChinaFlux. At present, AsiaFlux does not have any independent fund source. Publication and meeting of AsiaFlux is covered by voluntary fund and expense of CGER/NIES. It would be good idea to join APN. The construction of data base by AsiaFlux can be supported by CGER/NIES.

3. Maintenance of flux measurement

It is accepted by the all participants that the flux measurement should be continued for a long term to evaluate the yearly average and variability of NEE. The obtained data would be a key to evaluate the global terrestrial carbon budget and to investigate the cause of the future change in environmental conditions accompanied by the climate changes. However, some groups are facing to various difficulties, such as shortage of budget, reduction of budget, or shortage of staff number.

Another point of discussion is whether CO_2 flux observation is in the operational phase or in research phase. If it is in the research phase, these research activities could be supported by research fund, and acquirement would not be difficult with the present context of research. If the importance of research result was not evaluated well, it could be a matter of scientists conducting the research project.

If it is in operational observation stage, it could be funded by different source, and the research activities using the flux data or conducting precise observation should be continued as the related research activities. In any case, the flux observation will definitely get into the operational observation level where data management and analysis are essential and the data are required to be open in public. What kind of organizations can be a fund source for flux monitoring? WMO or FAO? GCOS, GTOS, GCO or so on? This is a common subject for flux network community to seriously discuss. It would be difficult to find out a fund source for a new monitoring project.

4. Data-base open in public

There is a very strong request from international community of terrestrial carbon cycle research to provide the flux data obtained in Asia. It is our obligation to offer our data to the community as collaborator. There was a discussion whether AsiaFlux should archive the data and offer to the international science community, or to introduce the research activities.

If the latter is chosen, what is the function of

AsiaFlux? Is it simply the forum of exchange the information? NO. Our intension is to get the comprehensive data to evaluate the terrestrial carbon sink in Asia, to get the reliable data that is valuable to compare each other, and to appeal the importance of our activities. If it is so, we should make proper correction of our data and offer them to the carbon cycle researchers as a highly qualified data set.

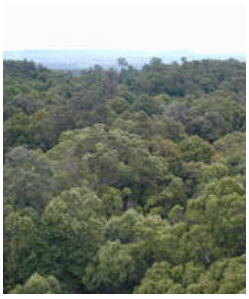
In this case, securing originality of researchers is very important issue. We should request users to include the researchers as the co-authors of the research paper using AsiaFlux data. Key point is that the data authorize by AsiaFlux network is relied upon by other users. The manual of Flux observation will be the first step of it, and the data-base of AsiaFlux should be evaluated by the experts of AsiaFlux network. The cost of this evaluation work can be covered by CGER/NIES.

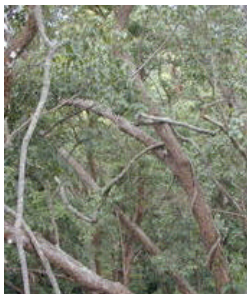
—— Two New Monitoring Sites ——

Information of the two operating sites located in Sakaerat, Nakonrachasima,Thailand, and in Teshio Experimental Forest, Toikanbetsu, Horonobe, Hokkaido, Japan, has been added to the AsiaFlux website (http://www-cger/~moni/flux/asia_flux/index.html). These monitoring sites have been set up by Gamo (National Institute of Advanced Industrial Science and Technology)) and others, and Takagi (Field Science Center for Northern Biosphere, Hokkaido University) and others, respectively.

Carbon Cycle and Larch Growth Experiment
LaG
Since 2001

Teshio, Hokkaido, Japan





Sakaerat, Nakonrachasima,Thailand

Editor's Note

A Happy New Year !!
I hope this year will be one of the fruitful year for the flux observation / research groups in Asia and the world.

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