



CarboEastAsia Workshop 2009

*"Toward Integration of Field Observations, Remote Sensing,
and Modeling"*

February 18-19, 2009 in Tsukuba, Japan

1. Workshop Objectives and Topics

This workshop is a progress meeting for:

1. [SP2] Networking flux measurements (inter-site comparison)
2. [SP3] Model development, parameterization and validation, up-scaling, and integration efforts

Topics:

- Inter-site comparison of flux observation
- Scaling-up from point to area
- Modeling, Remote Sensing, Inversion etc

2. Date and Time

February 18 (Wed) to 20 (Fri), 2009

3. Venue and Accommodation

Hotel Grand Shinonome, Tsukuba, Japan

Address: 488-1 Onozaki, Tsukuba, Ibaraki 305-0034, Japan

Phone +81-29-856-2211

<http://www.hg-shinonome.co.jp/>

<http://www.hg-shinonome.co.jp/top/access/>

4. Organizers

Workshop Host: JapanFlux, Hokkaido University

Sponsor: A3 Foresight Program supported by JSPS, NSFC, and KOSEF

Organizing committee Chair: Kazuhito Ichii

Local organizing committee: Takashi Hirano, Nobuko Saigusa, Ryuichi Hirata, Yoshiyuki Takahashi, Masahito Ueyama, Naishen Liang, Akiko Ogawa

5. Contact

Akiko Ogawa: (office) 029-850-2971 (cell phone between Feb 17 to 20) 090-3040-0497

Nobuko Saigusa: (office): 029-850-2517

6. About tutorial

To do the tutorial exercise, participants are recommended to bring their own notebook computers and install software provided by the lecturer in them. Recommended operating system is Windows (XP or Vista) or Mac OS.

7. Program

February 17**PM**

Arrival of participants (Hotel Grand Shinonome)
Dinner at the hotel individually (dinner coupon will be provided)

February 18**AM****General Session (Forest room)**

9:30-9:40	Opening/General Announcement		
	Opening remark	Kazuhito Ichii	
	Welcome address from JapanFlux	Koji Tamai	
	Greeting from ChinaFlux delegates	Guirui Yu	
9:40-10:20	Special Talk	Joon Kim	G01
10:20-10:30	Break		

Session 2. SP-2 Networking flux measurements (Forest room)

10:30-11:45	SP2 Presentations (25 min each)	Chair: Sinkyu Kang	
		Presenters:	
		Jinkyu Hong	O01-SP2
		Hyojung Kwon	O02-SP2
		Naishen Liang	O03-SP2
11:45-13:00	Lunch (Forest room)		

PM

13:00-13:25	SP2 Presentations (continued)	Presenters:	
		Nobuko Saigusa	O04-SP2
13:25-13:50	SP2 Discussion		
13:50-14:00	Break		

Session 3. SP-2 Model development, parameterization and validation, up-scaling, and integration efforts (Forest room)

14:00-15:40	SP3 Presentations (25 min each)	Chair: Nobuko Saigusa	
		Presenters:	
		Weimin Ju	O05-SP3
		Kazuhito Ichii	O06-SP3
		Sinkyu Kang	O07-SP3
		Mei Huang	O08-SP3
15:40-16:05	SP3 Discussion		
16:05-16:15	Break		

Poster Session (Forest room)

16:15-18:00	Poster presentation		
	Presenters:		

Yuling Fu	P01	Jaeill Yoo	P02
Ryuichi Hirata	P03	Eun hye Lee,	P04
Leiming Zhang	P05	Minseok Kang	P06
Shaoqiang Wang	P07	Bindu Malla Thakuri	P08
Takashi Suzuki	P09	Nayoung Do	P10
Kazuhito Ichii	P11	Kazuhito Ichii	P12
Li Zhang	P13	Jihyeon Jang	P14
Tomohiro Oda	P15		

18:00- 20:00 Welcome dinner at the hotel (Aoi room)

February 19 (Thu)

AM

Session 4. Group Meeting (Forest room, Aoi room)

08:30-11:30 Group Meetings
SP2 Group (Forest room)
SP3 Group (Aoi room)

Break (Coffee and tea are prepared in Forest room)

11:30-11:50 Summary of Group Meetings and Future directions or A3 Program (Forest room)
Chair: Joon Kim

Closing Session (Forest room)

11:50-12:00 Closing remark Kazuhito Ichii

12:00-13:00 Lunch (Forest room)

PM

Tutorial (Forest room)

13:00-17:00 Tutorial Session Lecturer: Kazuhito Ichii

Break

18:00-20:00 Dinner at a restaurant in town

February 20 (Fri)

AM

9:00-12:00 PI Meeting
Departure of participants

Oral Presentations

G-01

On Using Flux Data for Model Validation and Algorithm Development: Priorities, Questions, Execution and Resources

*Joon Kim (Yonsei Univ.)

The overview and the summary of the recent Asilomar FLUXNET workshop will be provided. In this presentation, the following key questions are addressed: (1) How flux data and models work together to improve knowledge on the carbon cycle, land surface modeling and remote sensing? (2) How FLUXNET data and models can improve knowledge on the energy, water and carbon cycles at tower, grid, watershed and continental scales? (3) Coupled carbon, water, ecosystem climate models: reality or overreaching? and (4) What new science can modelers and experimentalists do together?

O01-SP2

Standardization of Eddy-covariance Data Processing in KoFlux

*Jinkyu Hong, Hyojung Kwon, Joon Kim (Yonsei Univ.)

It is inevitable to standardize eddy-covariance data processing in synthesizing and analyzing huge amount of data observed at many flux stations. End users eventually benefit from the standardization by clear and open understanding of final products. In this presentation, we briefly introduce standardized method used in processing data measured at KoFlux sites. Also presented are the comparison between the previous approaches and the proposed strategies in KoFlux.

O02-SP2

Interannual Variability of Net Ecosystem Carbon Exchange in a Deciduous Forest in Korea

*Hyojung Kwon, Jinkyu Hong, and Joon Kim (Yonsei Univ.)

Terrestrial ecosystem is an essential component to influence global carbon balance and climate changes. However, studies on intra- and inter-annual variations in carbon balance on a longer-term basis are in paucity in Asia. In this paper, we examine the eddy covariance CO₂ fluxes observed from 2004 to 2008 in a deciduous forest in Korea. The purposes of this study are to quantify the net ecosystem CO₂ exchange (FNEE), ecosystem respiration (FRE), and gross primary production (FGPP), and examine the influence of interannual variations in climatology and ecohydrology on FNEE, FRE, and FGPP.

O03- SP2

Different Responses of Soil CO₂ Efflux to Global Warming among Japanese Forest Ecosystems

*Naishen Liang (National Institute for Environmental Studies), Kentaro Takagi (Hokkaido Univ.), Sachinobu Ishida (Hirosaki Univ.), Masahiro Takagi (Miyazaki Univ.), Yoshitaka Kakubari (Shizuoka Univ.), Kaneyuki Nakane (Hiroshima Univ.), Yoshiyuki Takahashi (National Institute for Environmental Studies), and Hitoshi Mukai (National Institute for Environmental Studies)

Most of the carbon cycle models apply the exponential functions to predict the future global heterotrophic respiration with a Q₁₀ of 2.0. In their models, global heterotrophic respiration increases exponentially with climate warms at an average rate of 6.2% per °C, and resulting that

the current carbon sink of terrestrial ecosystem will convert to a carbon source after 2050. IPCC2007 predicted that global mean temperature will increase about 4°C (ranging 1.1~6.4°C). The ultimate objective of this project is to estimate the carbon emission rate of whole Japanese forest soils under the climate change by using multi-approaches, including the field soil warming experiment, open-top chamber facility, cross-country soil incubation and model simulation.

O04- SP2

Impact of Meteorological Anomalies in Summer, 2003 on Gross Primary Productivity in East Asia

*Nobuko Saigusa (National Institute for Environmental Studies), Ryuichi Hirata (National Institute for Agro-Environmental Sciences), Kazuhito Ichii (Fukushima Univ.), Takahiro Sasai (Nagoya Univ.), Reiko Ide (National Institute for Environmental Studies), Shao-Fen Tian (Academic Express Co.), Jun Asanuma (Univ. of Tsukuba), Shi-Jie Han (Institute of Applied Ecology, Chinese Academy of Sciences), Shen-Gong Li (Institute of Geographic Sciences and Natural Resources Research, CAS), Takeshi Ohta (Nagoya Univ.), Shao-Qiang Wang (Institute of Geographic Sciences and Natural Resources Research, CAS), and Guirui Yu (Institute of Geographic Sciences and Natural Resources Research, CAS)

We examined how forest ecosystems responded to the meteorological anomalies in the 2003 summer based on the dataset collected at flux monitoring sites in Asia. From June to August in 2003, the rainy season was prolonged in an area within latitudinal range of 35-40°N and longitude range of 80-150°E, an area extending from China, the main island of Japan through South Korea. During the anomaly period, we compared the GPP data obtained from various flux sites with the meteorological pattern. Our study illustrated that integration of flux data from wide range of areas can help us gain understandings in ecosystem responses to large-scale meteorological phenomena.

O05-SP3

Optimization of the Parameters Controlling Biospheric CO₂ and Energy Fluxes over East Asia Using Eddy Covariance Fluxes Measurements and an Ensemble Kalman Filter Approach

*Weimin Ju (Nanjing Univ.), Shaoqiang Wang, and Guirui Yu (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences)

Parameters controlling CO₂ and energy fluxes between the atmosphere and terrestrial ecosystems were optimized using eddy covariance flux observations over East Asia and an ensemble Kalman filter approach. We found model that parameters show different seasonality and interannual variations in different ecosystems. The parameter optimization significantly improves the simulations of carbon and energy fluxes.

O06- SP3

Multi-model Analysis of Terrestrial Water and Carbon Cycles in Japan: Japan-MIP

*Kazuhito Ichii (Fukushima Univ.), Takashi Suzuki (Fukushima Univ.), Tomomichi Kato (Frontier Research Center for Global Change), Akihiko Ito (National Institute for Environmental Studies, Frontier Research Center for Global Change), Takahiro Sasai (Nagoya Univ.), Tomohiro Hajima (Frontier Research Center for Global Change), Hirofumi Hashimoto (California State Univ., Monterey Bay & NASA Ames Research Center), Masahito Ueyama (Osaka Prefecture Univ.), Ryuichi Hirata (National Institute for Agro-Environmental Sciences), Nobuko Saigusa (National Institute for Environmental Studies), Yoshikazu Ohtani (Forestry and Forest Products Research Institute), and Kentaro Takagi (Hokkaido Univ.)

We conducted a terrestrial biosphere model intercomparison study in Japan. By running 9 ecosystem models for entire Japan, we found that the original model settings generally underestimate GPP and RE with large inter-model differences. Model improvement using flux observations reduces uncertainties among different ecosystem model outputs.

O07-SP3

Scaling of Vegetation Productivity from Plot to Landscape Scales Using RHESSys: Intercomparison among ASIAFLUX Sites

*Sinkyu Kang (Kangwon National Univ.), Nayoung Do (Kangwon National Univ.), Eunsook Kim (Seoul National Univ.), and Taehee Hwang (Univ. of North Carolina)

An eco-hydrological modeling system, RHESSys, was applied to simulate vegetation productivity and hydrological process in a complex terrain landscape with heterogeneous landcover. The modeling efforts include validation of MODIS GPP and ET products, explicit considerations on paddy field irrigation, and future change of water and carbon fluxes with A1B climate change scenario. As well, an inter-site RHESSys modeling activity in A3 framework will be introduced.

O08-SP3

The Responses of Vegetation NPP to East-Asian Monsoon Climate over 1981-2000

*Mei Huang (Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences)

In this study, the atmosphere-vegetation interaction model (AVIM2) was used to simulate the vegetation NPP over 1981-2000 in China-wide region and the responses of vegetation NPP to the variations of East-Asian Monsoon were analyzed. The results show that the vegetation NPP is highly influenced by the behavior of the East-Asian Monsoon.

Poster Presentations

P01

Temperature regulation of ecosystem carbon balance in Northern China

*Yuling Fu (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences), Guirui Yu (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences)

The main objectives of this study are to investigate the geographic distribution of ecosystem seasonal switching temperature between carbon source and carbon sink in northern China; to interpret the biological and environmental controlling mechanism of the difference in the seasonal switching temperature between carbon source and carbon sink for different ecosystems or vegetations; and to assess the effects the seasonal switching temperature on net ecosystem carbon budget in northern China.

P02

An Estimation of Carbon Flux in Forest During Non-rainy Season Using an Aerodynamic Variance Method

*Jaeill Yoo, Jinkyu Hong, Hyojung Kwon, and Joon Kim (Yonsei Univ.)

Eddy covariance system is world-widely used to measure carbon flux of ecosystem. But it suffers from lack of data during rainy events, especially monsoon season, due to poor performance of open path infrared gas analyzer. An approach of carbon flux measurements during rainy season using an aerodynamic variance method has been proposed during CarboEastAsia Workshop in Seoul in 2008. In this presentation, we will estimate carbon flux using aerodynamic variance method during non-rainy period in Gwangneung KoFlux site before testing this method in rainy season.

P03

Carbon dioxide exchange at four grassland sites across Japan and influence of manure application on ecosystem carbon budget

*Ryuichi Hirata (National Institute for Agro-Environmental Sciences), Akira Miyata, Masayoshi Mano, Takatoshi Akira, Hiroyoshi Kouda, Mariko Shimizu, Shoji Matsuura, Mitsuhiro Niimi, and Ryusuke Hatano

Japanese stock farming depends on imported stock feed, but compost application is not so popular in grassland in Japan. Consequently, excrements of domestic animals produce environmental contamination such as water pollution. Composting grassland is expected to increase organic carbon stock in the soil although N₂O emission possibly increases. The purpose of this study is to clarify the effect of manure application on carbon balance of grassland in Japan.

Grassland at chemical fertilizer plots functions almost carbon neutral ecosystem except for warm temperate region. Composted grassland ecosystem in cool temperate region stocks carbon because manure is not easily decomposed. In warm temperate region, however, grassland ecosystem accumulates carbon because of high plant productivity although manure is relatively easy to be decomposed.

P04

Measuring of Soil Respiration in Fuji Hokuroku Using AOCC(Automatic Open and Closing Chamber System)

*Eun hye LEE, Young ju YOO, and Jae seok LEE (Konkuk Univ.)

We measured Soil respiration in Fuji Hokuroku flux site during A3 field campaign in 2008. We used open flow method by automatic open and closing chamber system. The data from Fuji Hokuroku flux site were compared with those from Gwangneung Koflux site. Specific characteristics and variations between two sites were also discussed.

P05

Responses of Ecosystem Carbon Exchange of Forest to East Asian Monsoon Climate during Summer Period

*Leiming Zhang, Guirui Yu, Shenggong Li, Xuefa Wen, and Yuling Fu (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences)

Using the ecosystem flux measurement from JapanFlux, KoFlux and ChinaFLUX, the response of ecosystem carbon flux to monsoon climate was evaluated across different forests along the forest transect in East Asia. The results showed that ecosystem carbon budget was mainly influenced by precipitation during summer period.

P06

Estimation of Soil Evaporation by Low Level Eddy Covariance System in Deciduous and Coniferous Forests

*Minseok Kang, Hyojung Kwon, Jinkyu Hong, and Joon Kim (Yonsei Univ.)

Water use efficiency (WUE) is an important indicator of carbon cycle due to its strong link with water cycle during photosynthetic activity. Evapotranspiration (ET) measured by eddy-covariance technique above the plant canopy includes not only transpiration but also evaporation. In order to evaluate the contribution of soil evaporation to ET, we conducted soil evaporation measurements using low level eddy covariance towers at two different forest types (i.e., deciduous and coniferous forests) in Korea. In the presentation, we will present the magnitudes of soil evaporation and examine the patterns of soil evaporation at the different forests.

P07

Comparison on the Relationship of Light Use Efficiency and Climatic Factors among Typical Forests in East Asia

Weixing Wu, *Shaoqiang Wang, Guirui Yu, and Lei Zhou (Institute of Geographical Sciences and Natural Resources Research)

In this study, we used 15 site-year nearly instantaneously eddy covariance measured carbon fluxes (mainly gross primary productivity, GPP) and climatic variables to analysis daily and monthly LUE variability and relevant climatic factors among typical forests in East Asia region. The effects of air temperature (T_a), and saturation vapor pressure deficit (VPD) on LUE were revealed by linear or nonlinear fits basing on daily data during the growing seasons. LUE of the investigating ecosystems have distinct seasonal dynamics.

P08

Preliminary Study of Energy Balance Closure at Two Different Forest Ecosystems

*Bindu Malla Thakuri, Minseok Kang, Hyojung Kwon, Jinkyu Hong, and Joon kim (Yonsei Univ.)

Evaluation of surface energy balance closure is an importance prerequisite in assessing data quality of carbon and water fluxes. Energy balance components were measured using eddy-covariance systems at deciduous and coniferous forest ecosystems in Gwangneung, Korea.

We analyzed the energy balance closure at various temporal scales for each ecosystem. In this study, we will present our findings and discuss potential issues that one should consider in an examination of the closure of surface energy balance.

P09

Evaluation and Improvements of a Terrestrial Ecosystem Model Included in an Earth System Model Using Flux Observations.

*Takashi Suzuki, and Kazuhito Ichii (Fukushima Univ.)

We evaluated a terrestrial ecosystem model included in UVic Earth System Climate Model using flux observations from Ameriflux, CarboEurope and CarboEastAsia. We found the terrestrial ecosystem model (TRIFFID) is immature and model refinements using flux data greatly helped to improve the seasonal carbon/water cycle simulations.

P10

Simulating Carbon and Water Fluxes Using A Climate Change Scenario in a Complex Terrain

*Nayoung Do, and Sinkyu Kang (Kangwon National Univ.)

We applied a Regional Hydro-Ecologic Simulation System (RHESSys) that can simulate both vegetation growth and watershed hydrological processes simultaneously. In this simulation, A1B climate change scenario from 1971 to 2100 was applied as input daily meteorological data. In this presentation, relationships between changes in forest functions and geographic locations are carefully investigated in relation with change of climate seasonality for the 130 years.

P11

Simulating Carbon and Water Cycle at Larch Forests in East Asia by the BIOME-BGC Model with AsiaFlux Data

Masahito Ueyama (Osaka Prefecture Univ.), *Kazuhito Ichii (Fukushima Univ.), Ryuichi Hirata (National Institute for Agro-Environmental Sciences), Kentaro Takagi (Hokkaido Univ.), Jun Asanuma (Univ. of Tsukuba), Takashi Machimura (Osaka Univ.), Yuichiro Nakai (Forestry and Forest Products Research Institute), Takeshi Ohta (Nagoya Univ.), Nobuko Saigusa (National Institute for Environmental Studies), Yoshiyuki Takahashi (National Institute for Environmental Studies), and Takashi Hirano (Hokkaido Univ.)

A process-based terrestrial biosphere model, BIOME-BGC, was tested to larch forests at six AsiaFlux sites, and used to identify important environmental factors on the carbon and water cycle in both temporal and spatial scale. The model calibration using the AsiaFlux data significantly improved the model performance. Simulated annual GPP, RE, NEE, and ET by the calibrated model were highly consistent with observed ones. The sensitivity study indicated that spring warming enhanced the carbon sink, whereas summer warming decreased it across the six sites.

P12

Interannual Variations in Vegetation Activities Detected by Multiple Satellite-based Vegetation Indices in Asia

Kazuho Takahashi, Yoshinori Nemoto, Takashi Suzuki (Fukushima Univ.), Masahito Ueyama (Osaka Prefecture Univ.), and *Kazuhito Ichii (Fukushima Univ.)

We analyzed seasonal and interannual variations in vegetation indices from four satellite-based products; NOAA/AVHRR, Terra/MODIS, SPOT/VEGETATION and SEAWIFS. Although

each satellite data products has its own noises, we have successfully detected the reliable interannual variations by taking four products. We generated 8km Asia satellite data products and detected anomalies mainly characterized by temperature and precipitations.

P13

Estimation of Carbon Fluxes by Synthesis of Flux Observations and a Terrestrial Ecosystem Model

*Li Zhang (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy Sciences), Yiqi Luo (Univ. of Oklahoma), Guirui Yu (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy Sciences), and Leiming Zhang (Institute of Geographic Sciences and Natural Resources Research, Chinese Academy Sciences)

We conducted a Bayesian probabilistic inversion to estimate the key parameter (carbon transfer coefficient) of a terrestrial ecosystem model (TECO) by using biometric and NEE measurements, and then estimated carbon flux using the optimized parameters. This method can be used to improve the forecast of carbon flux and evaluate its uncertainty.

P14

Preliminary Evaluation of TRIFFID-MOSES Coupled Dynamic Global Vegetation Model Using Eddy-covariance Measurements in a Hilly KoFlux Forest Catchment

*Jihyeon Jang, Jinkyu Hong, Hyojung Kwon, and Joon Kim (Yonsei Univ.)

Dynamic global vegetation model can provide useful information on the climate-vegetation interactions related to future climate changes. The TRIFFID dynamic global vegetation model was evaluated against eddy-covariance data observed at the Gwangneung forest KoFlux site. For this evaluation, the TRIFFID model incorporated with MOSES land surface model was simulated in the off-line mode and the model performance will be discussed in our presentation.

P15

Application of "Top-down" Approach to East Asia for Estimation of CO₂ Source/sink

Takashi Machimura (Osaka Univ.), *Tomohiro Oda (National Institute for Environmental Studies), and Takahiro Sasai (Nagoya Univ.)

Estimation of surface CO₂ source/sink was performed over East Asia, especially focused on Japan, using "top-down" approach (inverse calculation). Our calculation was performed using atmospheric CO₂ data coming from continuous CO₂ monitoring sites and flux tower sites. Our preliminary result was compared with estimate coming from "bottom-up" (process-based) model for evaluation. In our poster, some issues associated with application of "top-down" approach will be discussed and future development will be proposed.