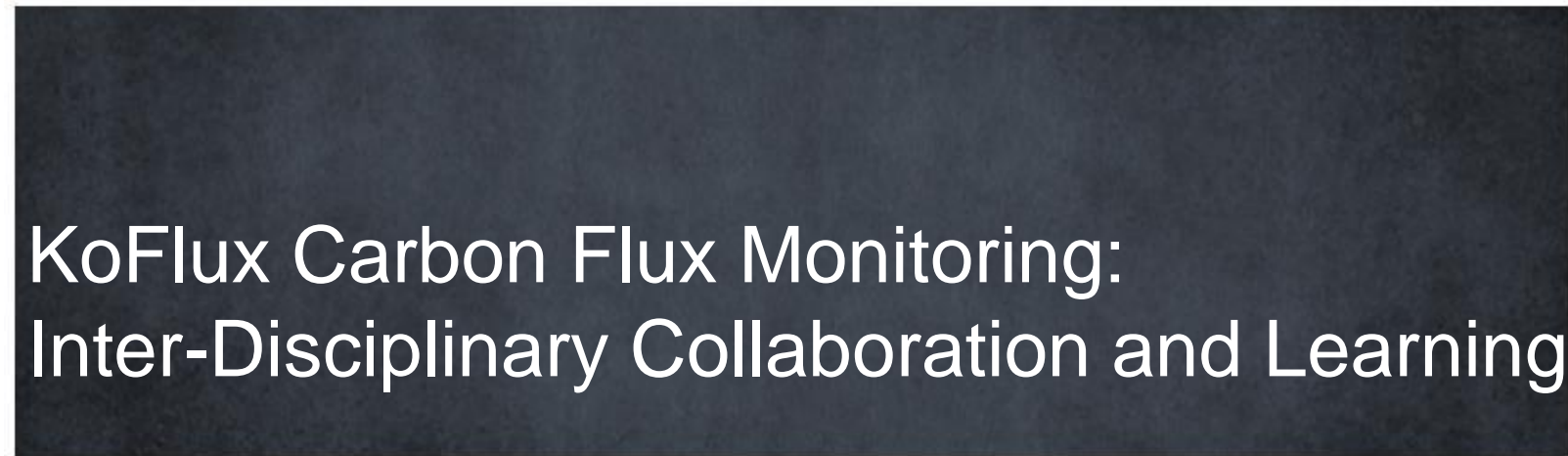





2nd International Workshop on
Atmosphere Watch in Asia 2010

JEJU KOREA 



KoFlux Carbon Flux Monitoring:
Inter-Disciplinary Collaboration and Learning



Hyojung Kwon & KoFlux Members

Endless River and Mountain



Lee, Inmoon (1745 – 1821)

SYNTHESIS of ECOSYSTEM KNOWLEDGE on CARBON CYCLE

Questions:

- (1) Can we close the carbon budgets over a complex forest catchment?
- (2) How large are the annual net ecosystem exchanges (NEE) of carbon?
- (3) What is the spatial representativeness of the estimated NEE in the context of its footprint climatology?
- (4) How is scale represented in the parameterization of ecohydrology models and remote sensing algorithms, and how are model and satellite products affected by the use of data on inappropriate scales?
- (5) How can we use the constraint of interdependency between carbon and water cycles, particularly as inferred from isotope analysis, to better understand and predict them?
- (6) What is the role of hydrology in the carbon budget of this complex forest catchment and how will changes in the hydrologic cycle in monsoon Asia influence the forest carbon budget?
- (7) What are the functions and roles of a forest catchment as a sustainable water resource and a carbon sink in the context of 'Kyoto forest'?

**MONITORING OF CARBON THROUGH THE SYNERGY OF
MEASUREMENT-MODELING-REMOTE SENSING**



KoFlux INFRASTRUCTURE

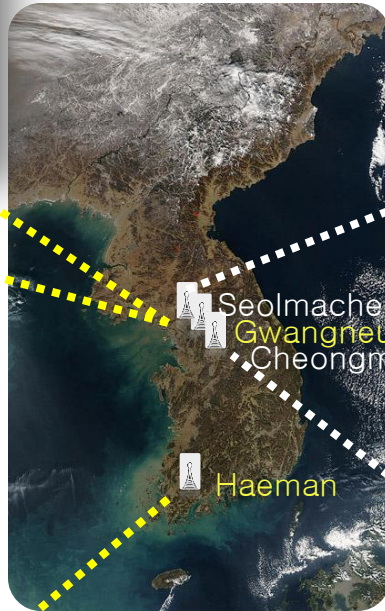
KoFlux INFRASTRUCTURE

KoFlux Sites:

Deciduous Forest



Coniferous Forest



Mixed Forest



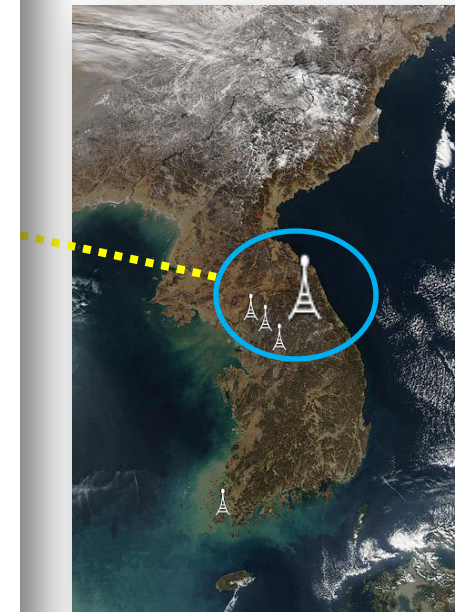
Farmland



Rice Paddy

| Site | Location | Plant functional type | Institute |
|---------------|-------------------|-----------------------------|---|
| Gwangneung | 37°45'N; 127°9'E | Deciduous/Coniferous forest | Korea Forest Research Institute/Yonsei University |
| Haeman | 34°55'N; 126°57'E | Farmland | National Institute of Meteorological Research/Yonsei University |
| Seolmachoen | 37°56'N; 126°57'E | Mixed forest | Hydrological Survey Center |
| Cheongmicheon | 37°09'N; 127°39'E | Rice paddy | Hydrological Survey Center |
| King Sejong | 62°13'S; 58°46'W | Antarctic Ocean | Korea Polar Research Institute |
| Dasan Station | 78°55'S; 11°56'E | Tundra | Korea Polar Research Institute |

Complex Terrain and Ecological Heterogeneity (TERRECO)



KoFlux Sites: Future Sites

K-Water (2011): H₂O/CO₂ Fluxes

용담댐 시험유역
Experimental Watershed in Yongdam Dam Basin
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연구현황 | 유역개요 | 관측소현황 | 기기현황 | 관측자료

연구목적 | 연구내용 및 범위 | 연구개발의 필요성 | 시험유역 연혁 | 기대성과

우리는 물로 더 행복한 세상을 만든다.
Water for the happier world

관측소 현황

주지천, 금강, 구양천, 정지천, 잔안천, 금강, 양계천, 금강

— 수위 관측소
우량 관측소
Parshall Flume

연구개발의 필요성

우리나라의 다목적댐의 관리·개발 및 각종 수문 모형의 개발시 검정 자료로 활용할 자연 유역의 신뢰도 높은 수문 기초자료의 생산 필요

용담댐 행정구역 GO • 용담댐 공간영상정보 GO • 용담댐 지질도 GO •

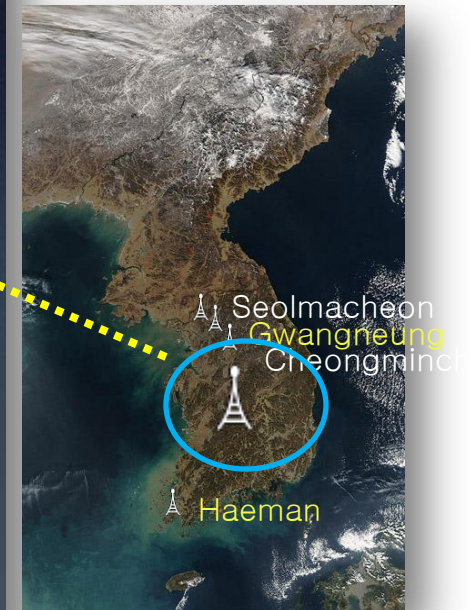
용담댐은 전북 진안군 인천면 삼학리에 위치하고 있으며, 시험유역은 창수군, 무주군, 진안군에 위치

용담댐 시험유역의 영상정보 및 관련정보(수리/수문 관측시설 포함)의 열기만 서비스로 고품질의 영상제공

용담댐 유역의 지질은 크게 선캄브리아기 변성암류와 중생대의 퇴적암류 화산암류, 그리고 실성암류 등으로 대별

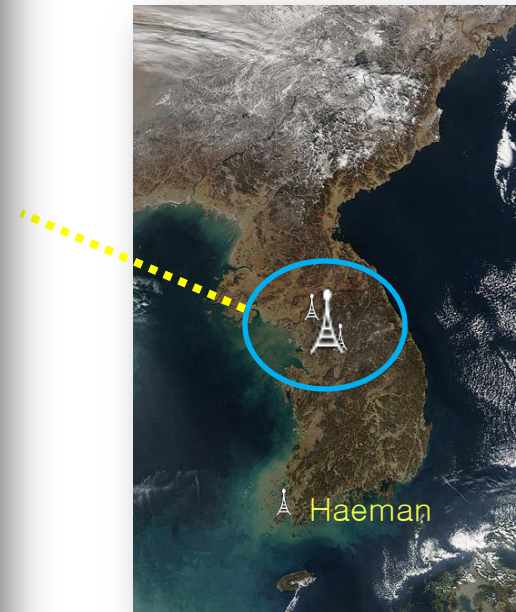
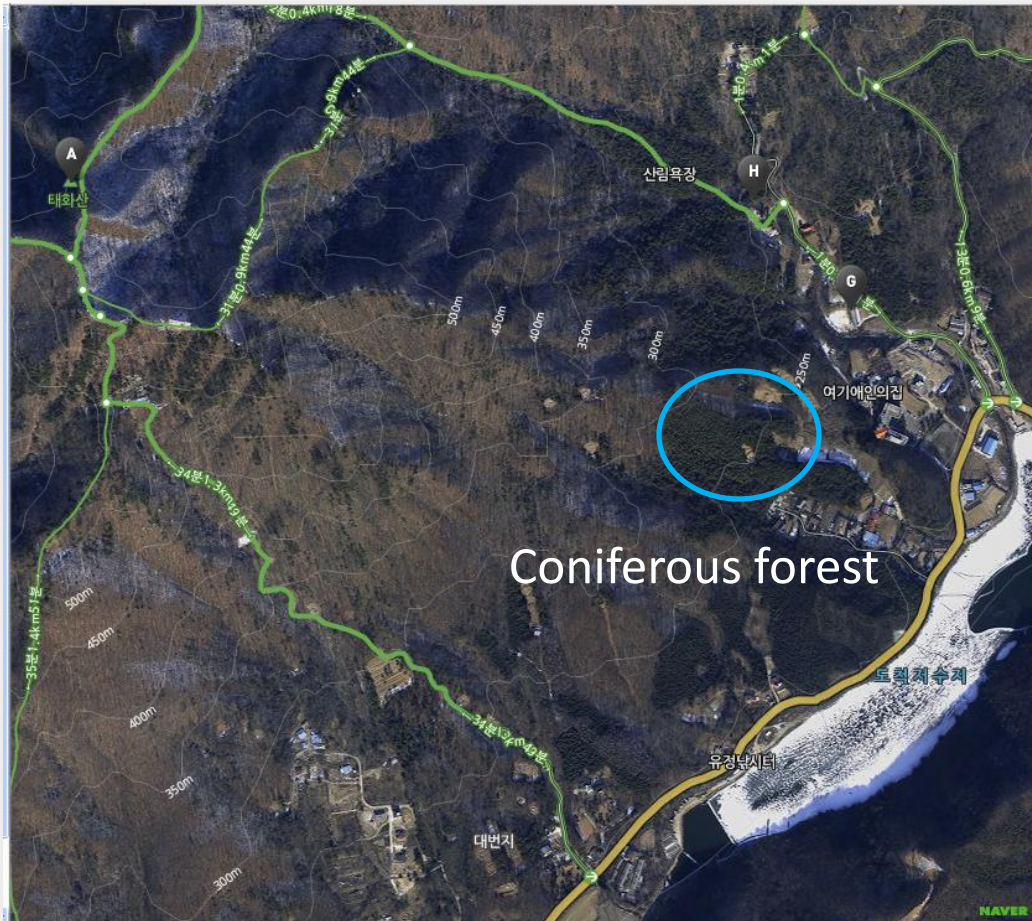
K water 수자원연구원 주소: 대전광역시 유성구 전민동 462-1 Tel: 042-870-7431
COPYRIGHT 2008 BY KOREA INSTITUTE OF WATER AND ENVIRONMENT. ALL RIGHTS RESERVED

===== 관련사이트 =====



KoFlux Sites: Future Sites

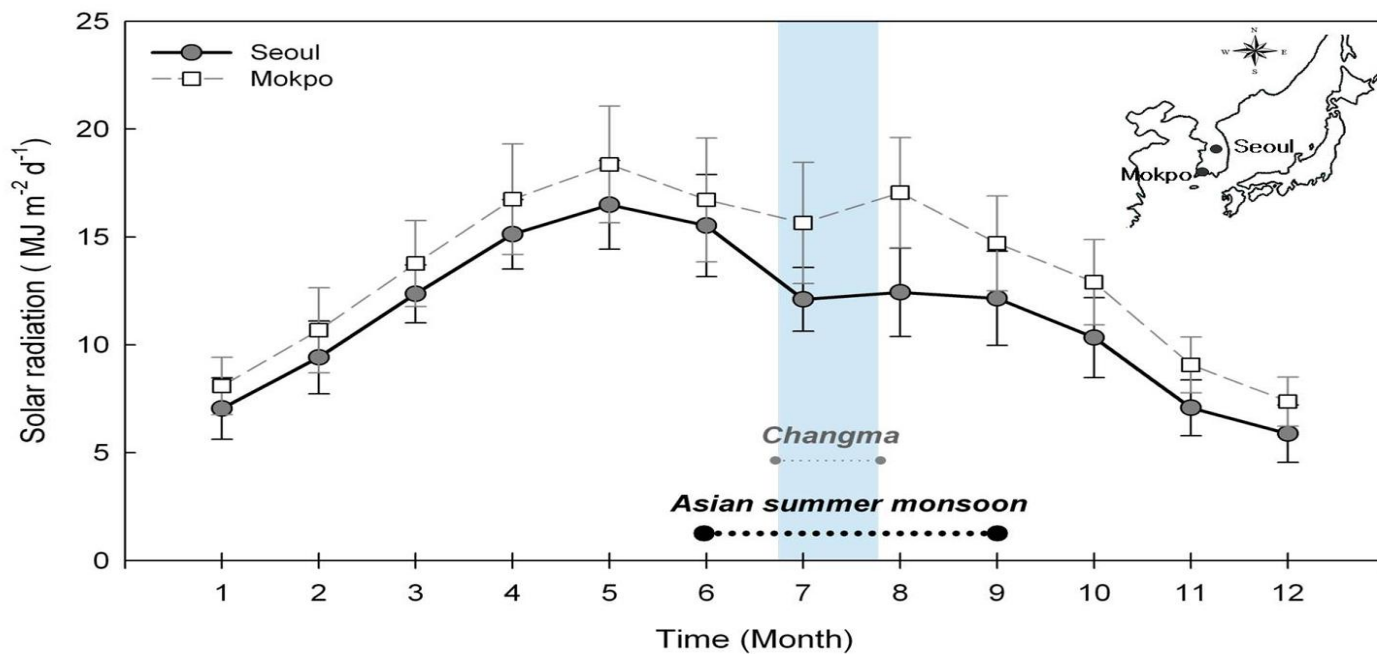
National Institute of Environmental Research (2011):
H₂O/CO₂ Fluxes; BVOC; Aerosols



RESEARCH ACTIVITY

RESEARCH ACTIVITY

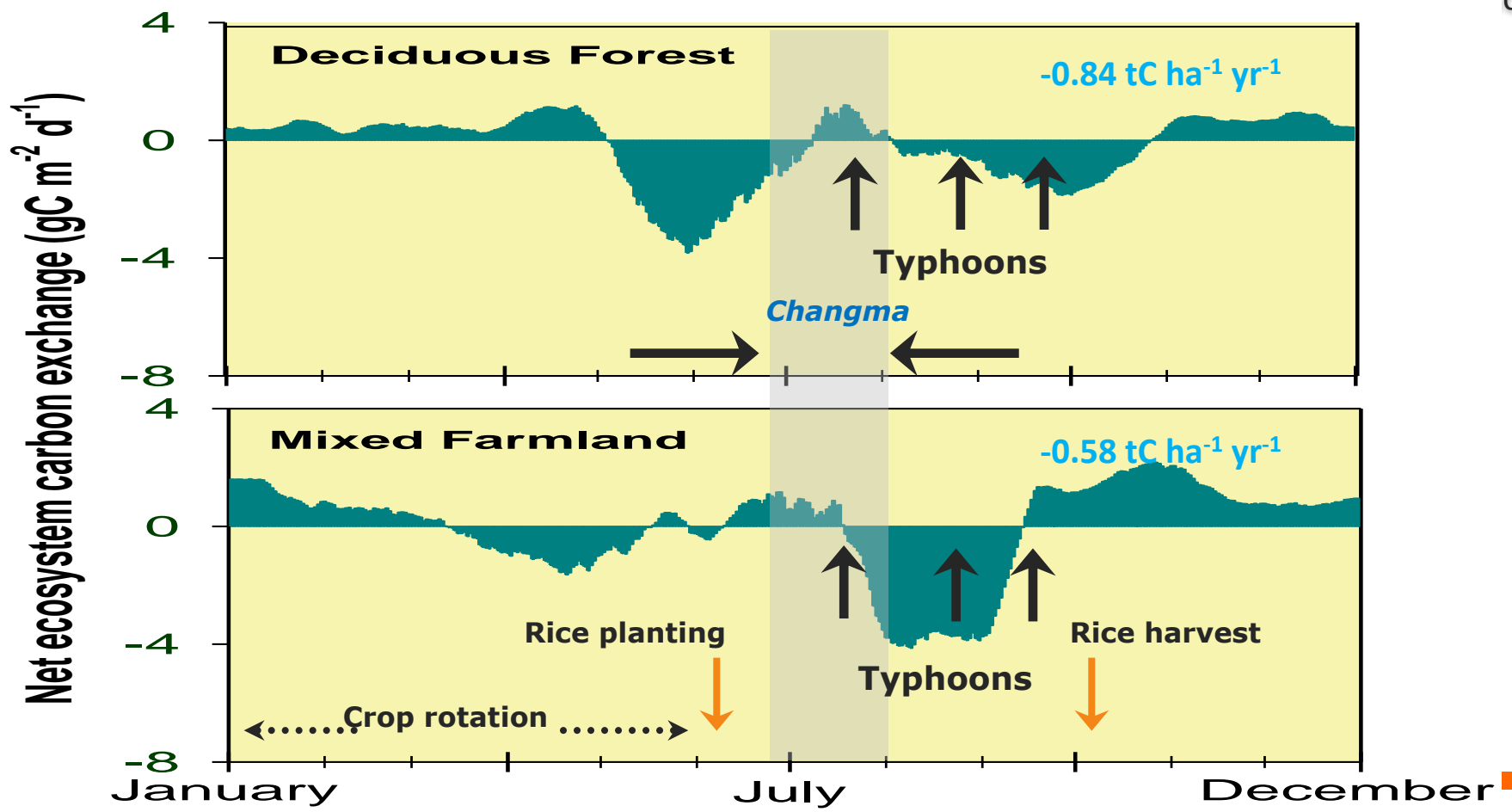
Spatiotemporal Variability of Carbon Flux – Influence of Asian monsoon



MEASUREMENTS:

Spatiotemporal Variability of Carbon Flux – Influence of Asian monsoon

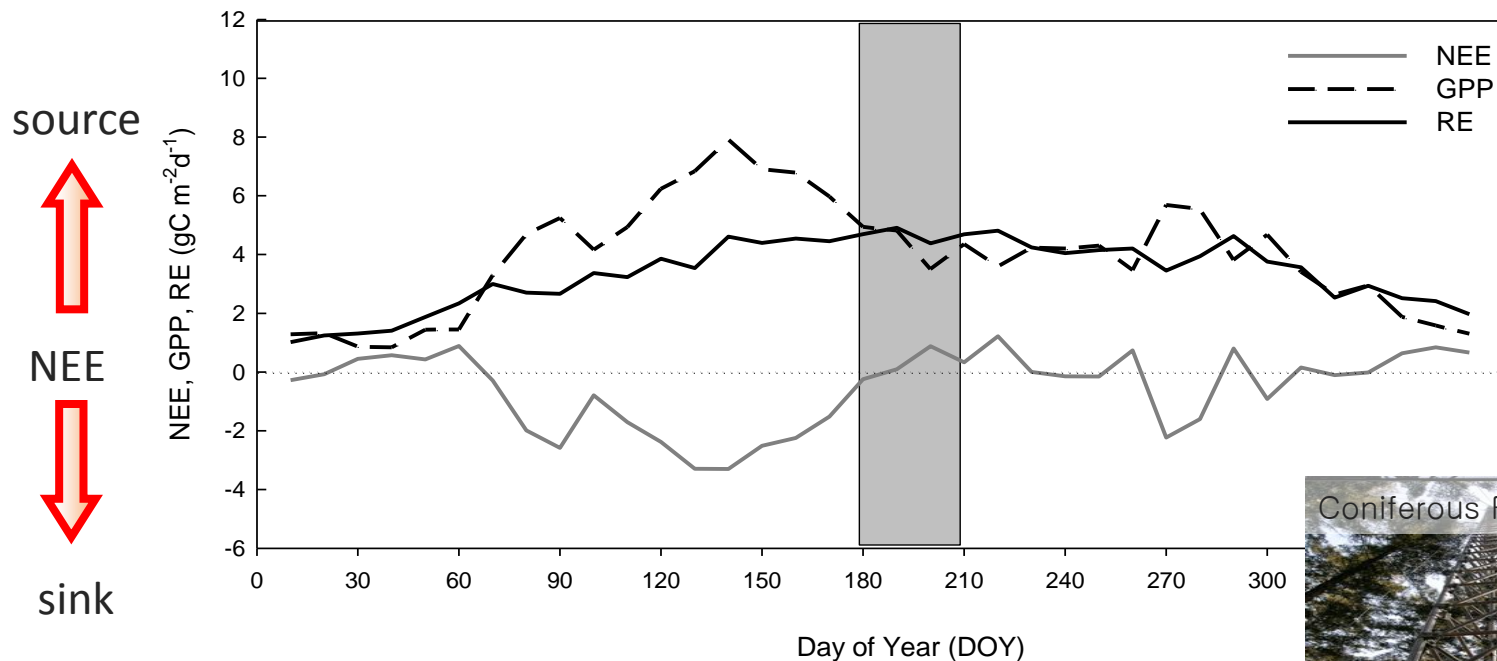
ces



- Mid-season depression of NEE associated with natural and human disturbances
- Different timing and magnitude of the mid-season depression due to different sources

Objectives:

- to assess the influence of the Asian monsoon on NEE
- to examine interannual variability of NEE and its cause and effect



Comparison of Carbon Flux among Various Ecosystems

Annual Carbon Budget:

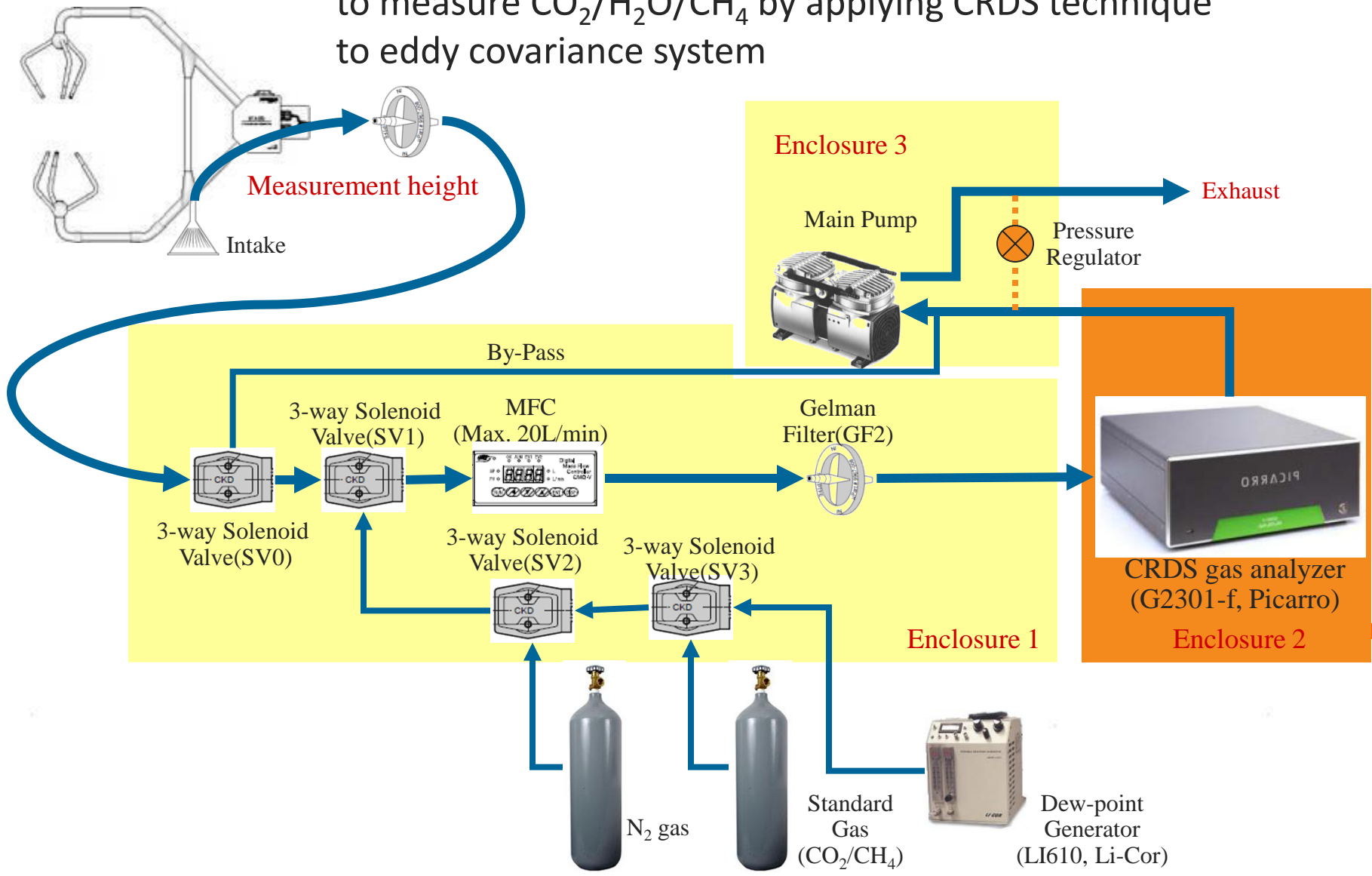
| Site | Deciduous | Coniferous | Farmland |
|---------|---------------|----------------|--------------|
| 2004 | | | -13 |
| 2006 | -73 | | 10 |
| 2007 | 66 | | |
| 2008 | -246 | -192 | -172 |
| 2009 | | -358 | |
| Average | -84 ± 156 | -275 ± 117 | -58 ± 99 |

Unit: [gC m⁻² yr⁻¹]

Cavity Ring Down Spectroscopy – Eddy Covariance System

Objectives:

to measure $\text{CO}_2/\text{H}_2\text{O}/\text{CH}_4$ by applying CRDS technique to eddy covariance system



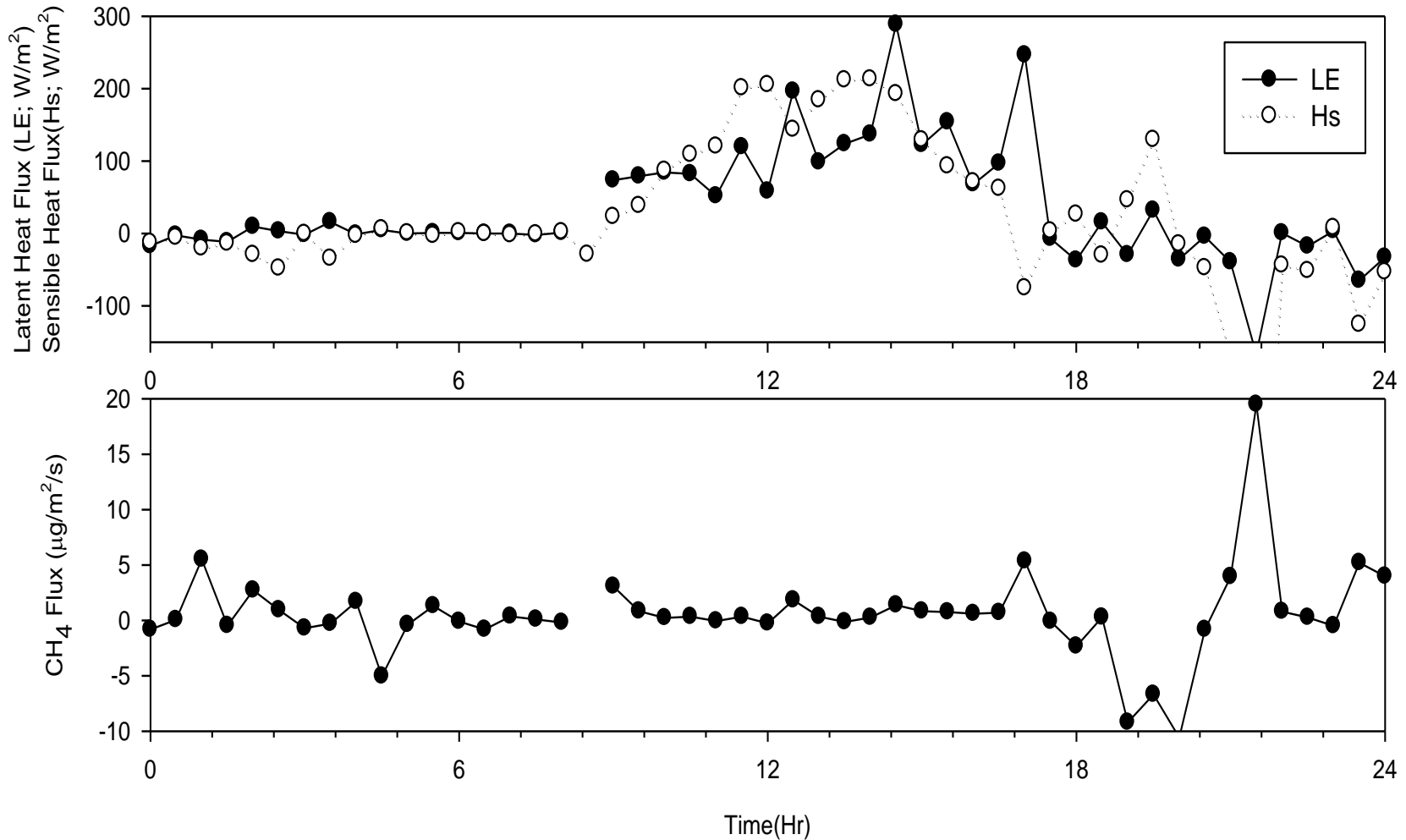
MEASUREMENTS:

Cavity Ring Down Spectroscopy – Eddy Covariance System



Preliminary Results:

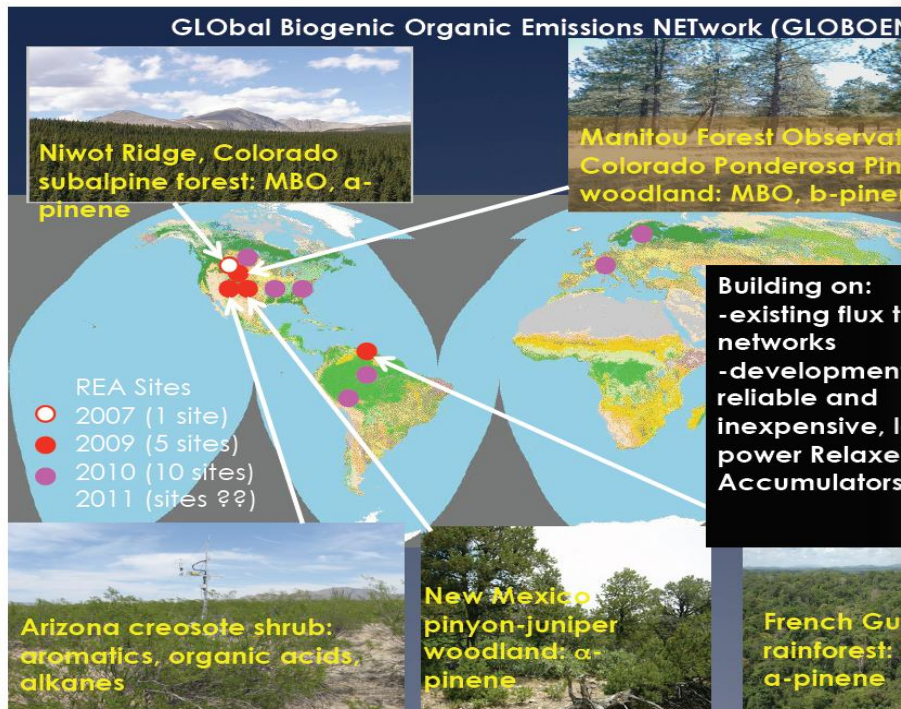
October 9, 2010



Biogenic Volatile Organic Compound

Objectives:

- to monitor BVOC (e.g., isoprene, monoterpenes) and assess the variability of BVOC source strength



NCAR Automated REA Flux Measurement System



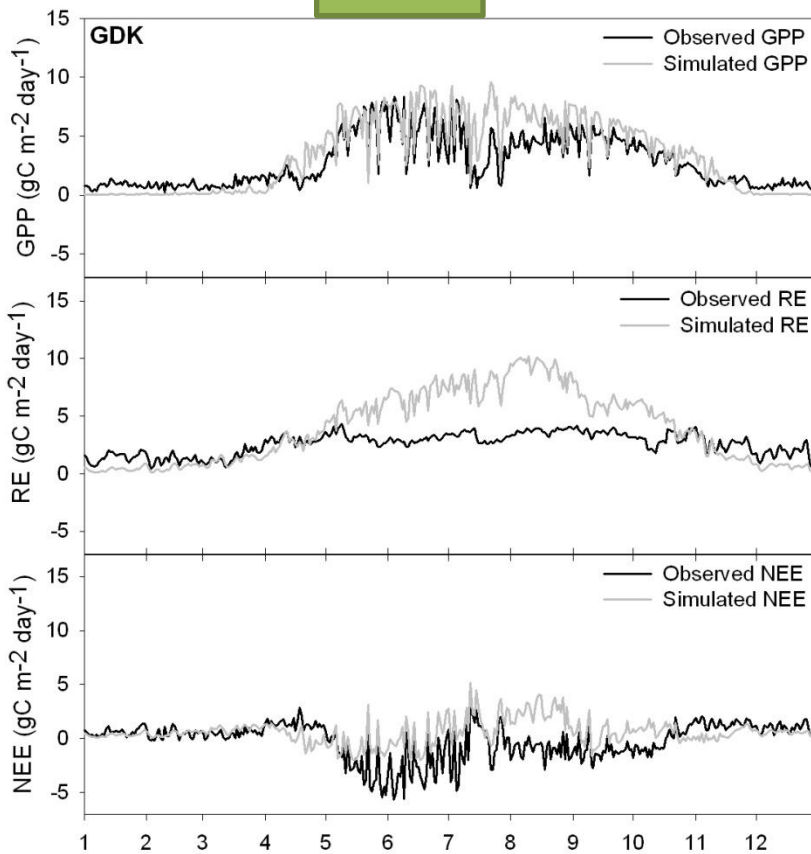
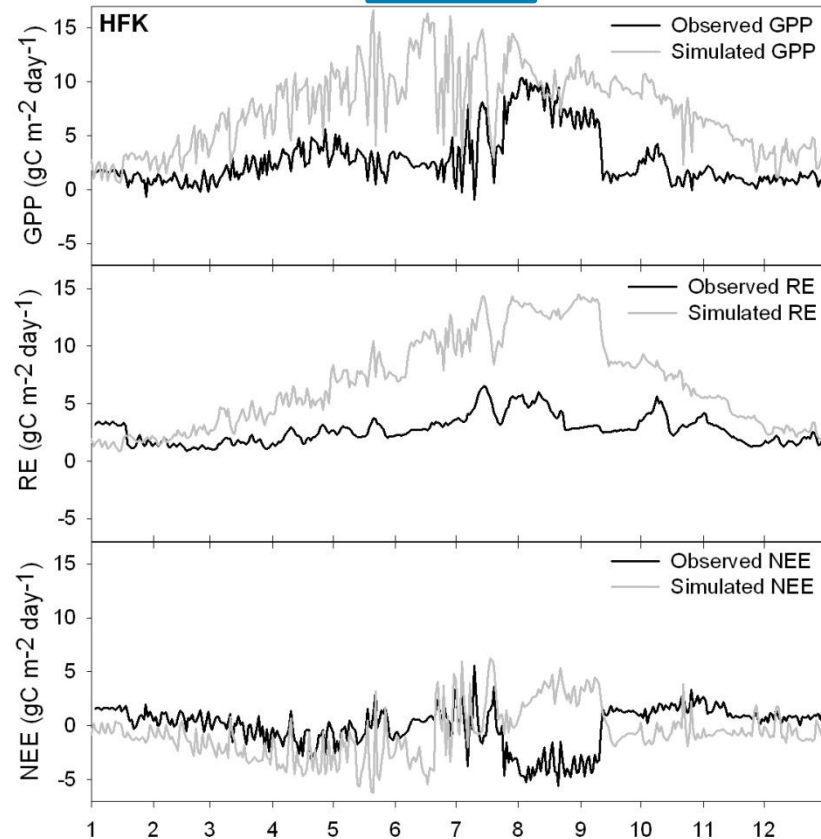
Key Questions:

- ▶ To which parameters of JULES model are gross primary productivity (GPP) and ecosystem respiration (RE) most sensitive in two major PFTs in Korea, the Gwangneung deciduous forest (GDK) site and the Haenam farmland (HFK) site?
- ▶ Can JULES model reproduce the carbon budget in these two sites?
- ▶ How does the observation-based parameter modification affect the performance of JULES?

JULES: Joint UK Land Environment Simulator

JULES— Scaling and Mapping of Carbon Flux

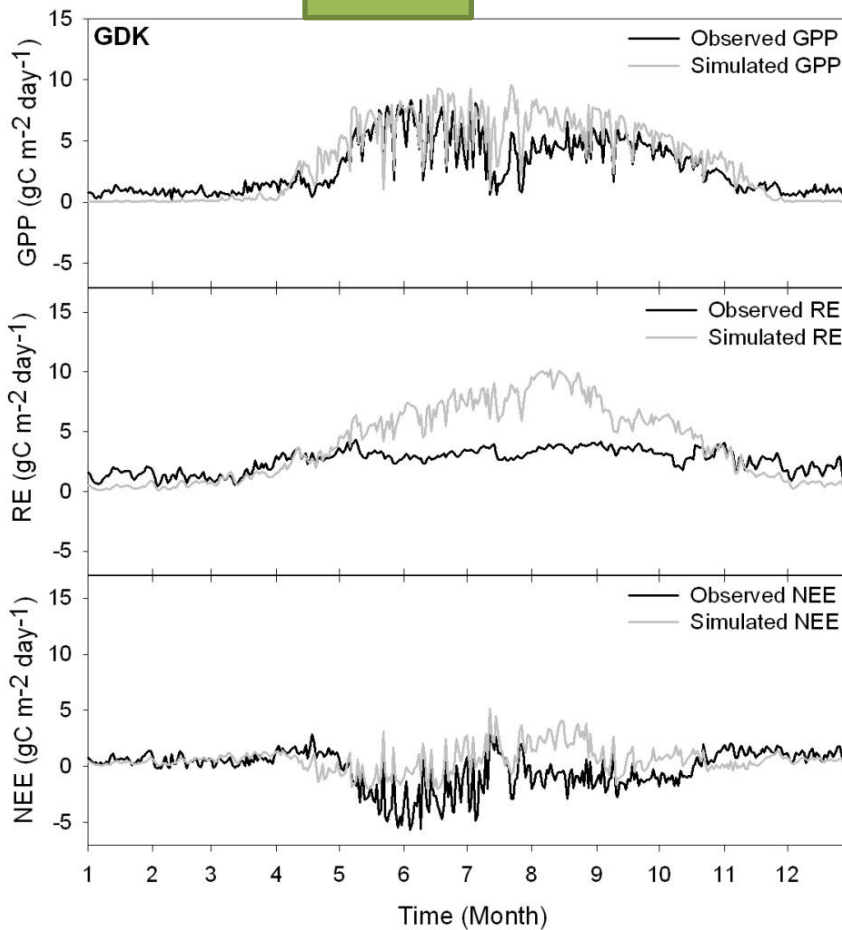
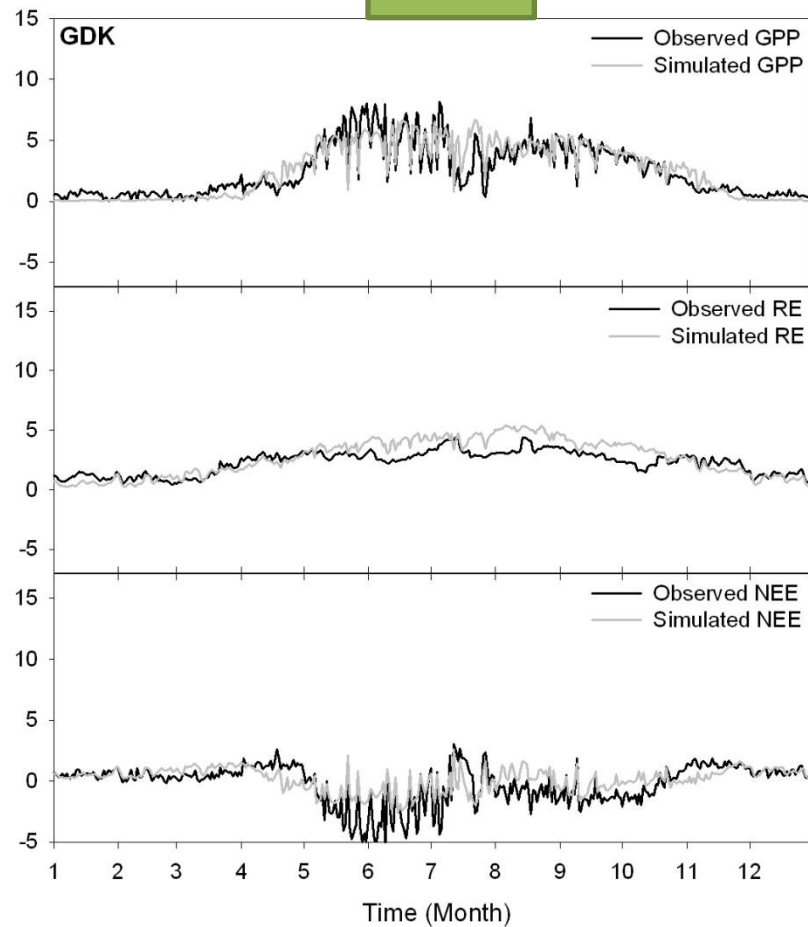
Default

GDK**HFK****GPP****RE****NEE**

Observation-based parameter modification

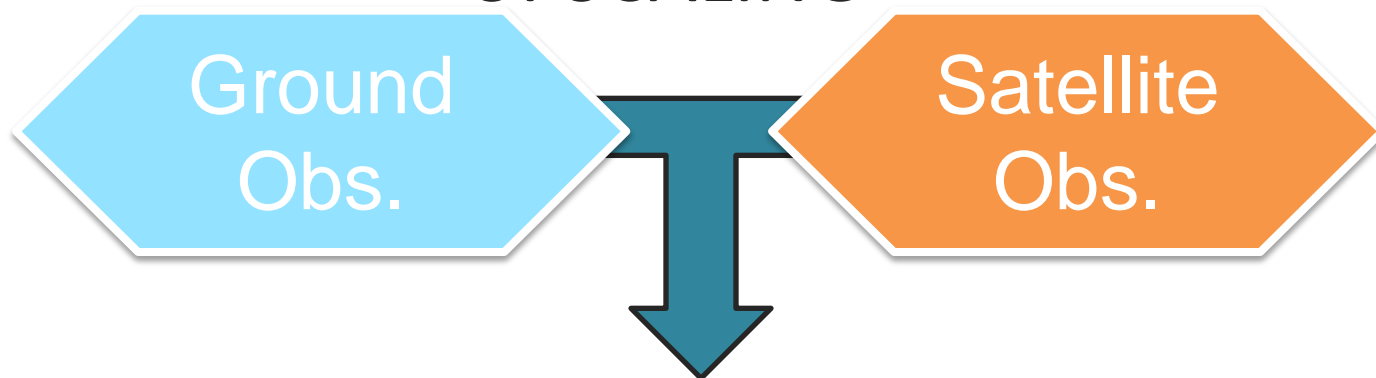
| Parameters | Unit | JULES (BL) | Observed Value | Year of Obs. | References |
|----------------|---------------------------|----------------------|------------------------|-----------------|------------------------|
| nI0 | kg N (kg C) ⁻¹ | 0.040 | 0.023 | 2003, 2005 | Chae et al. (2009) |
| K _s | s ⁻¹ | 5 × 10 ⁻⁹ | 4.6 × 10 ⁻⁹ | 2004 | Chae et al. (2008) |
| cs | kg C m ⁻² | 12.01 | 9.76 | 2003 | Lim et al. (2003) |
| r _g | - | 0.25 | 0.15 | 2006 | Alton and Bodin (2010) |
| f _d | - | 0.015 | 0.005 | 2006 | Alton and Bodin (2010) |
| q10_leaf | - | 2.0 | 1.8 | 2006 | Flux measurement |
| q10_soil | - | 2.0 | 1.5 | 2006 | Flux measurement |

JULES— Scaling and Mapping of Carbon Flux

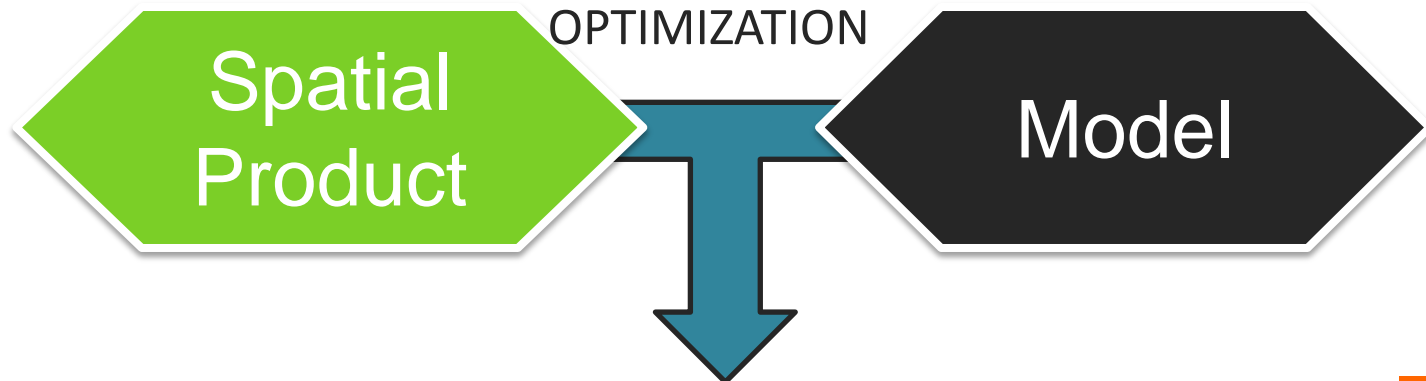
GDK**GPP****RE****NEE****GDK**

observation-based parameters

UPSCALING



CONSTRAIN OPTIMIZATION



OBJECTIVES:

To develop models, datasets, and methodologies for estimating regional surface carbon flux over East Asia



Development of Collaborative Research

A3 Foresight Program **CarboEastAsia**



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BGD - Papers in Open Discussion

Effects of grazing on leaf traits and ecosystem functioning in Inner Mongolia grasslands: scaling from species to community 16 Oct 2009

S. X. Zheng, H. Y. Ren, Z. C. Lan, W. H. Li, and Y. F. Bai
Biogeosciences Discuss., 6, 9945-9975, 2009

▣ [Abstract](#) ▣ [Discussion Paper](#) (PDF, 594 KB) ▣ [Supplement](#) (90 KB) ▣ [Interactive Discussion](#) (Open, 0 Comments)

A global model of carbon, nitrogen and phosphorus cycles for the terrestrial biosphere 14 Oct 2009

Y. P. Wang, R. M. Law, and B. Pak
Biogeosciences Discuss., 6, 9891-9944, 2009

▣ [Abstract](#) ▣ [Discussion Paper](#) (PDF, 1272 KB) ▣ [Interactive Discussion](#) (Open, 0 Comments)

Atmospheric deposition of nutrients and excess N formation in the North Atlantic 14 Oct 2009

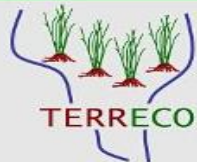
L. M. Zamora, A. Landolfi, A. Oschlies, D. Hansell, H. Dietze, and F. Dentener
Biogeosciences Discuss., 6, 9849-9889, 2009

▣ [Abstract](#) ▣ [Discussion Paper](#) (PDF, 2444 KB) ▣ [Interactive Discussion](#) (Open, 1 Comments)

Effect of CO₂ on the properties and sinking velocity of aggregates of the coccolithophore *Emiliania huxleyi* 13 Oct 2009

A. Biermann and A. Engel
Biogeosciences Discuss., 6, 9817-9848, 2009

▣ [Abstract](#) ▣ [Discussion Paper](#) (PDF, 894 KB) ▣ [Interactive Discussion](#) (Open, 0 Comments)



Complex **TERR**ain and **EC**ological Heterogeneity

International Research Training Group
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Complex **TERR**ain and **EC**ological Heterogeneity

Evaluating ecosystem services in production versus water yield and water quality in mountainous landscapes

A joint education and research activity between Germany and South Korea (DFG / KOSEF)

Ecosystem Services in Production



Services in Water Quality and Yield

Speakers:

Prof. Dr. John Tenhunen (University of Bayreuth)
Prof. Dr. Sinkyu Kang (Kangwon National University)

Bayceer



Endless River and Mountain



Lee, Inmoon (1745 – 1821)