CEOP/Semi-arid Region Study (SRS)

-overview and activities in the last year

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and many other contributors

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Chinese Academy of Sciences

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Why semi-arid region?

- **The region, most vulnerable due to dry climate, low vegetation cover and nutrition content and low capacity of the water conservation;**
- **A transitional zone, most sensitive in response to both human perturbation and climate change.**

  e.g. significant aridity trend and increasing dust storms due to both land use and climate variation, with potential impacts on the hydrological cycle, as well as climate.
- **A region having less knowledge in land surface process and their modeling.**

Objectives of CEOP Semi-arid Region Study

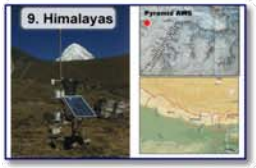
- **Contributions to understanding the water and energy cycles of semi-arid regions and their role in climate system by globally integrated analysis of CEOP reference sites data, satellite observations and the model outputs**
- **Assist in better prediction of climate and water resources and their management in semi-arid regions where the shortage of water supply is crucial**

Research Agenda

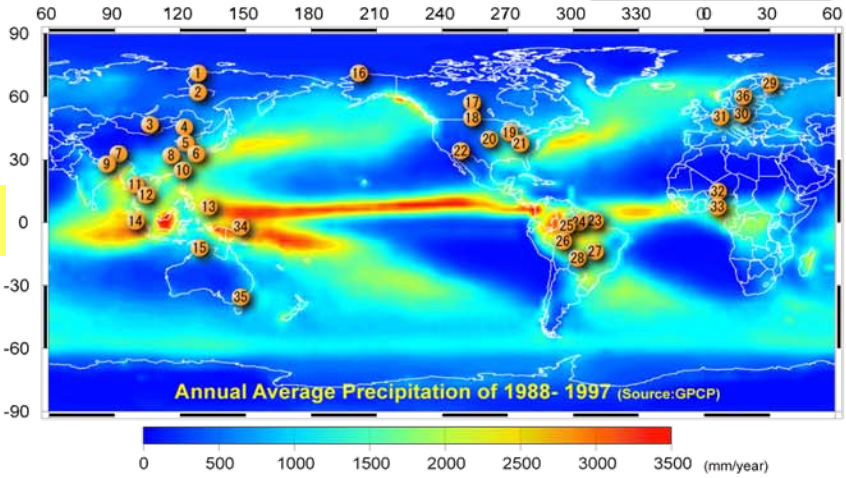
- Atmospheric boundary layer physics and dynamics of semi-arid regions;
- Water and energy cycle of air-soil-vegetation system in semi-arid regions;
- Improvement of parameterization of land surface process for semi-arid region to be coupled in climate models;
- Impacts of dust aerosols on hydrological cycle and climate at regional and global scales.

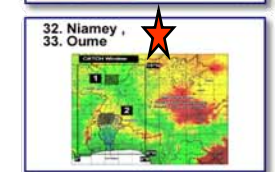
Potential reference sites for Semi-arid CEOP study

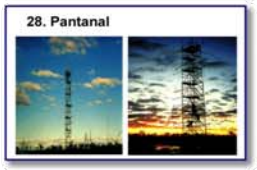
International Cooperation for the Global Coverage



Tongyu







Past year activities (Aug. 2007-Aug. 2008)

- International workshop on Semi-arid Land Surface-Atmosphere Interaction, Lanzhou, China, 9-13 August, 2007;
- The first CEOP/SRS working group meeting and the establishment of 4 task forces;
- An international joint research project "A Comparative Study on the Interactions of Atmosphere-Land-Water in the Semi-arid Regions of Asia and North America" is approved by National Natural Science Foundation of China;
- An initiative and pilot experiment of coordinated observation in arid/semi-arid regions of China.

International Workshop on Semi-Arid Land Surface-Atmosphere Interaction

Aug. 9-13, 2007 , Lanzhou, China

Key issues discussed：

- **Land surface-atmosphere interactions**
- **Dust aerosol effect on hydrological cycle**
- **Climate change monitoring in semi-arid environment**
- **International cooperative field campaign over Northwest China**

Scientific Committee:

Prof. Congbin Fu（Chair）
Institute of Atmospheric Physics,
Chinese Academy of Sciences
E-mail: fcb@tea.ac.cn

Local Host:

Prof. Jianping Huang ,
College of Atmospheric Sciences
Lanzhou University
E-mail: hjp@lzu.edu.cn

Over 80 scientists from Asia, US and EU attended the workshop.

First Semi-arid Region Study Working Group meeting

Establishment of 4 task forces :

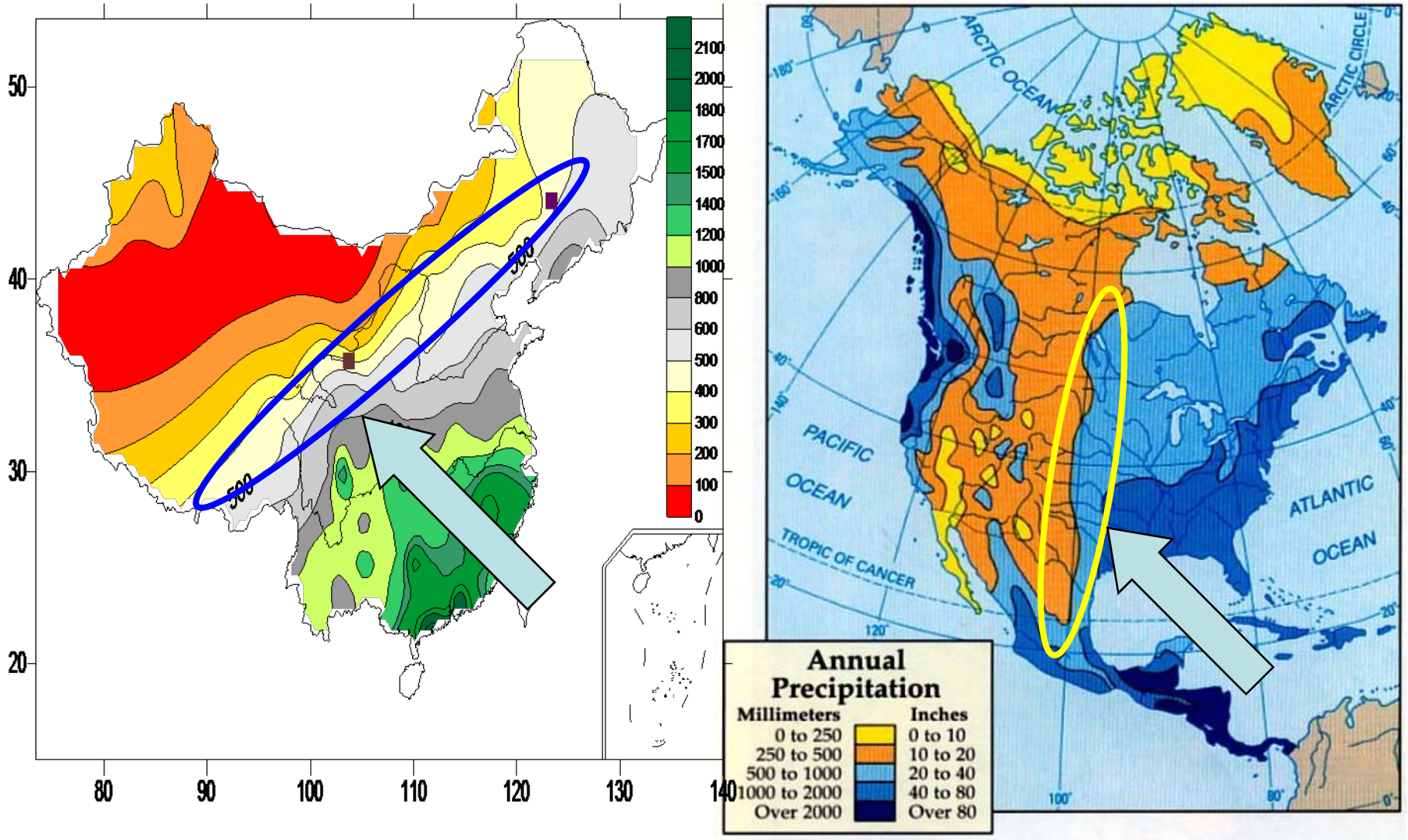
- **Observation standards and data quality control;**
- **Application of remote sensing information;**
- **Intercomparison of land surface models;**
- **Feedback mechanism between aerosol-cloud-precipitation.**

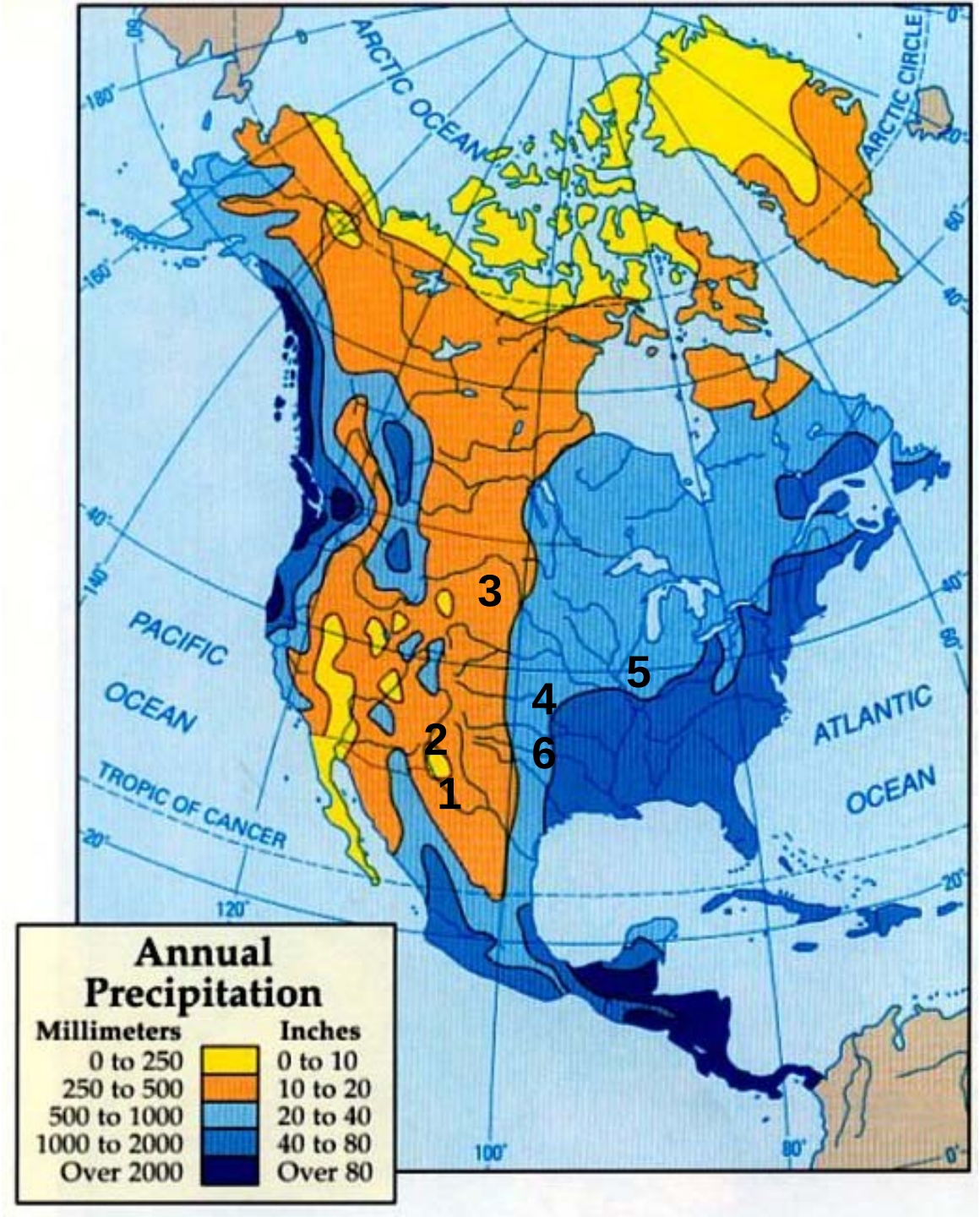
Approval of Sino-Us joint research project “A Comparative Study on the Interactions of Atmosphere-Land-Water in the Semi-arid Regions of Asia and North America”

The project is jointly led by Prof. Congbin Fu in Chinese and Prof. Robert E. Dickinson in the US side with participation of 9 Chinese and 6 US members.

The research period of the project is from January 2009 to December 2011.

Selected study regions and the Reference Sites (2 in China and 6 in the US)





1. **Audubon Research Ranch, Arizona**
2. **Santa Rita Mesquite, Arizona**
3. **Fort Peck, Montana**
4. **Walnut River Watershed, Kansas**
5. **Bondville, Illinois**
6. **Southern Great Plains, Oklahoma**

Rationales for developing collaborative research in China and North American semi-arid regions

- **Both China and North American semi-arid regions are influenced greatly by annual and decadal variability in monsoon climate and dominated by distinct aridity trend;**
- **Different land use/cover types and intensities of human impacts;**
- **Relatively distributed stations and observations available for several years (even longer);**
- **Advantages in the US side in data quality control and remote sensing applications**
- **Existed collaboration over past years.**

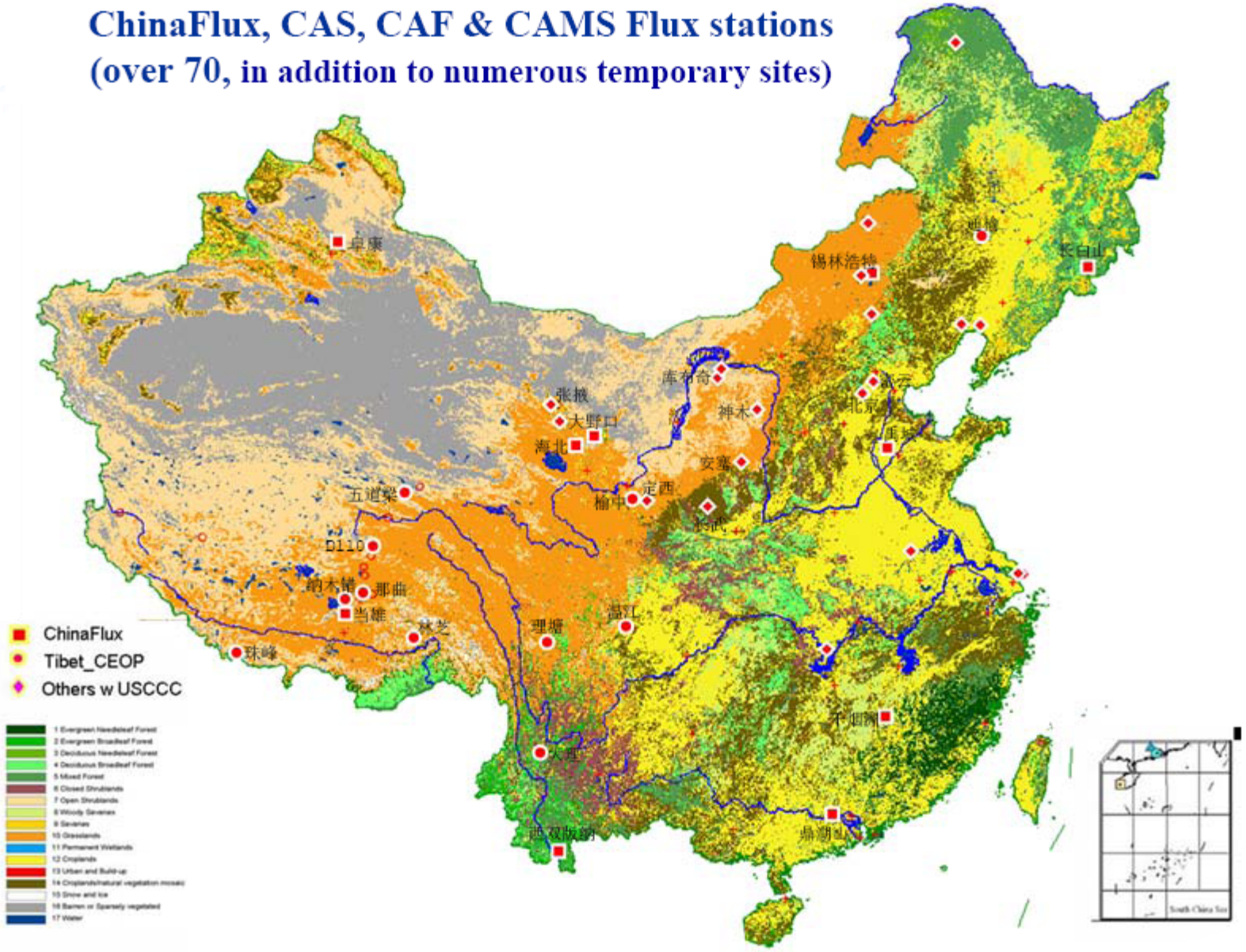
Objectives of the collaborative research

To investigate the characteristics of the water cycle and the energy budget in different semi-arid regions, and their role in the climate system through integrated data analysis and numerical model simulation, to understand the mechanisms of aridity processes and try to distinguish the potential human contributions to aridity trend which may help for better prediction of climate and water resources change in the semi-arid regions.

An initiative and pilot experiment of coordinated observation in arid/semi-arid regions of China

Flux Stations in China

ChinaFlux, CAS, CAF & CAMS Flux stations
(over 70, in addition to numerous temporary sites)



J Wang, 080627

Observations in flux stations

- All the stations are with measurements :
  - Tower (wind, temperature & humidity profiles);
  - Radiation components;
  - **Eddy-covariance fluxes (momentum, heat, water vapor, CO_2, etc.)**
  - Soil (temperature, water content, heat flux, etc.);
  - Precipitation;
  - **Hydrological, Ecological, & Aerosol observations in specific stations.**

What do we get from these stations?















Coordination of the flux networks

- **Coordination** of various stations, **data exchange** & **synthetic analysis** are essential issues.
- Quality assurance & data comparability (*accuracy* & *representability*) are vital for flux networks.
  - Eddy-covariance flux calculation. A standard method is necessary for all flux sites.
  - Data Quality Control / Quality Assurance. A data assessment system is needed for synthetic analysis.
  - Flux data Gap-Filling Interpolate data gaps produced in unfavorable conditions with proper models.
- Especially in difficult conditions…

Initiation of a coordinated observation in arid & semi-arid regions

Organization meetings & Training Course

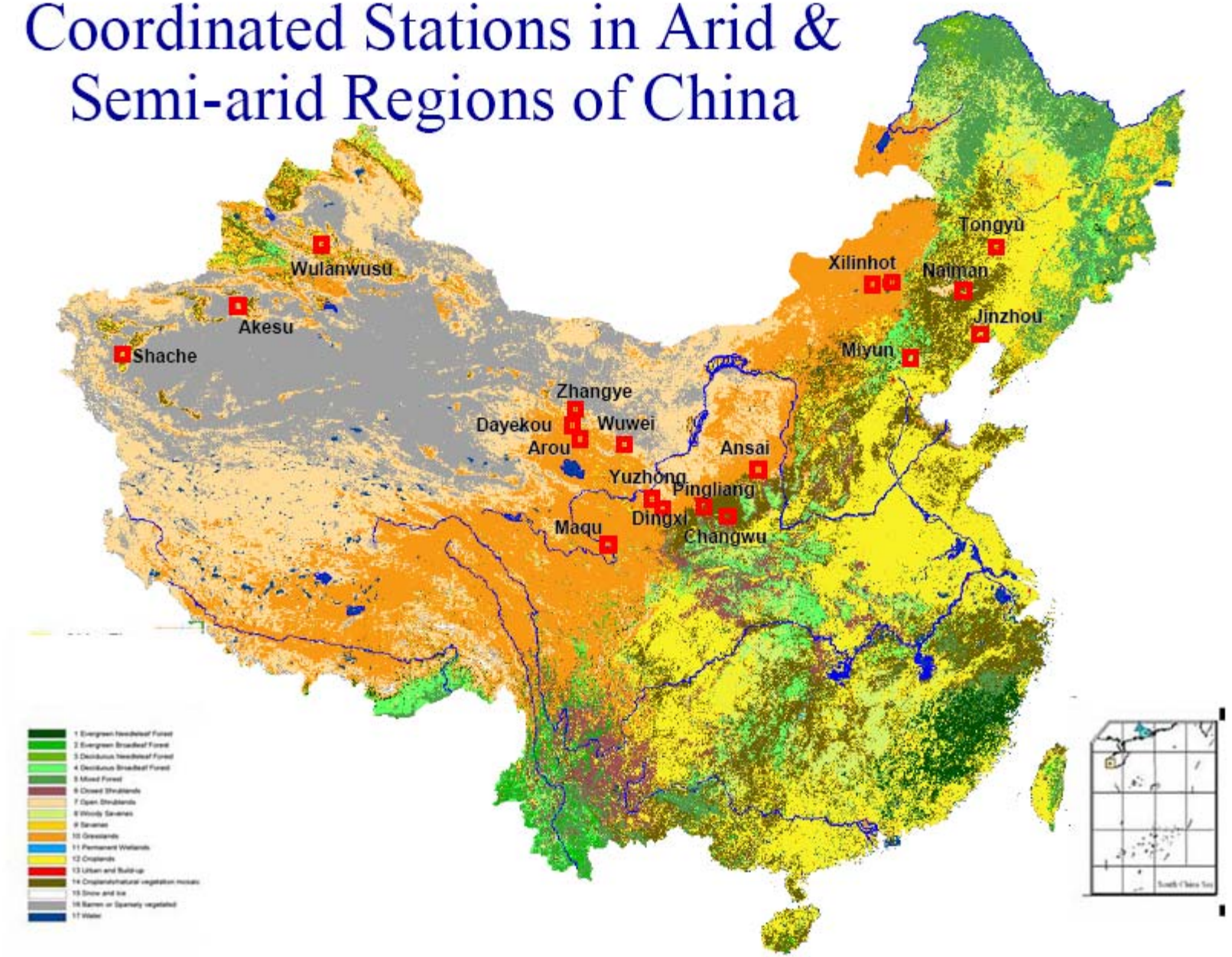
- June 27-29, 2007, "Forum on land surface processes in arid & semi-arid regions"
- Aug 9-11, 2007, "International conference on arid climate"
- Dec 12-13, 2007, "Training course on micrometeorology"
- May 17, 2008, "Kick-off meeting of pilot observation"

Participating Institutes & Steering Committee

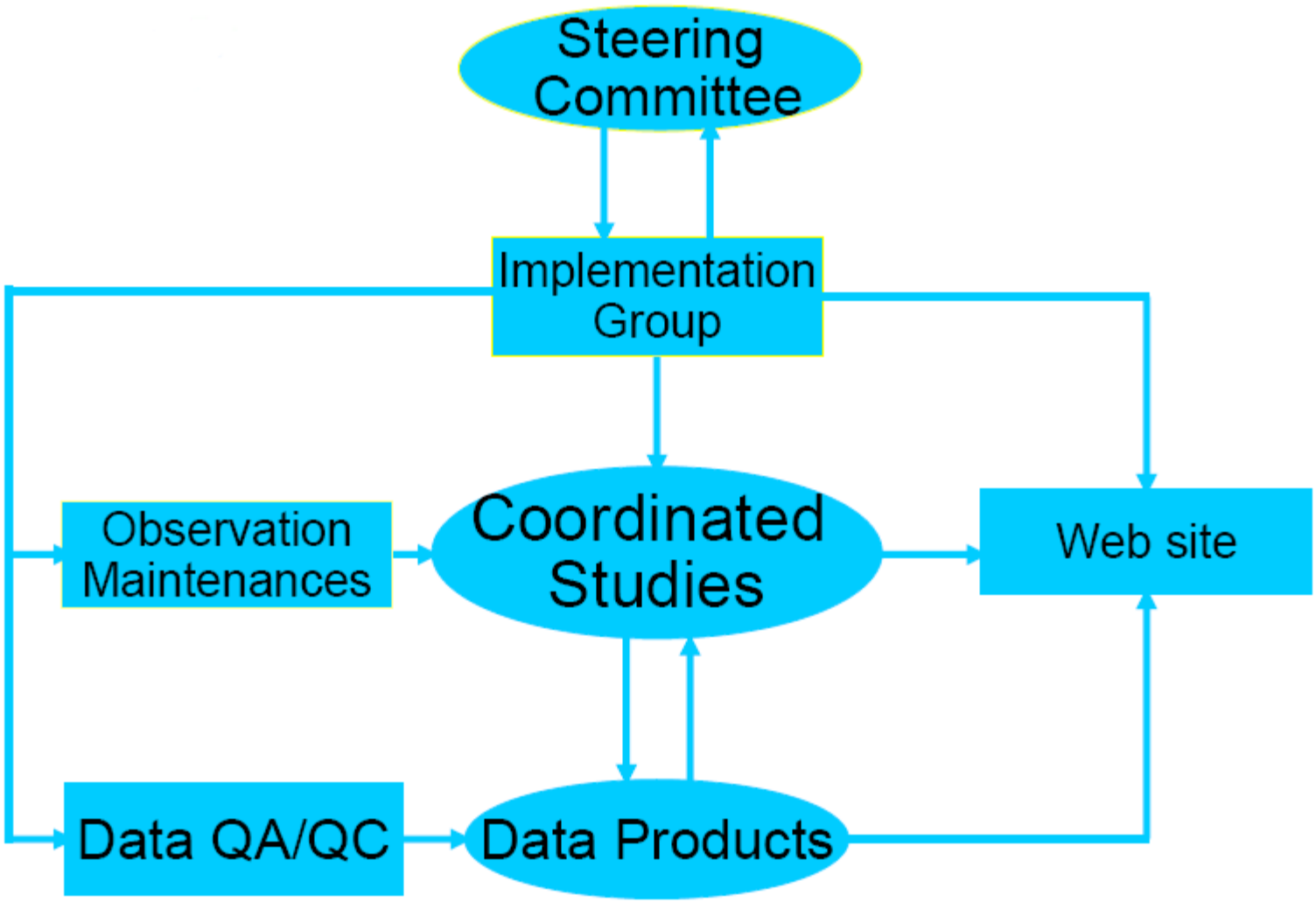
- IAP/CAS, ***Congbin Fu***, *Zhuguo Ma, Weidong Guo, Huizhi Liu, Renjian Zhang*
- CAREERI/CAS, *Jiemin Wang, Xin Li, Jun Wen, Zeyong Hu, Xueyong Zhao*
- Lanzhou University, *Jianping Huang*
- IAM/CMA, *Qiang Zhang, Runyuan Wang*
- ISWC/CAS, *Wenzhao Liu, Guobin Liu*
- IB/CAS, *Guangsheng Zhou*
- Beijing Normal University, *Shaomin Liu*
- IDM/CMA (Xinjiang Met. Adm.)

Specific financial support from MOST.

Coordinated Stations in Arid & Semi-arid Regions of China



	Precipitation Surface Pressure	Wind, temp. & humidity profiles	Radiation components	Energy, H_2O & CO_2 fluxes	Soil temp. & moiture	Ecology	Aerosol
Dingxi	√	√	√	√	√	√	×
Pingliang	√	√	√	√	√	×	×
Shache	√	√			√		
Wulanwusu	√	√			√		
Akesu	√	√	√	√	√	×	×
Changwu	√	√	√	√	√	×	×
Ansai	√	√	√	×	√	×	×
Guantan	√	√	√	√	√	×	×
Miyun	√	√	√	√	√		
Xilinhot	√	√	√	√	√	×	√
Naiman	√	√	√	×	√	√	×
Xilin	√	√	√	√	√	√	×
Yuzhong	√	√	√	√	√	√	√
Tongyu	√	√	√	√	√	√	√
Wuwei	√	√	√	√	×	√	×
Zhangye	√	√	√	√	√	√	×
Jinzhou	√	√	√	√	√	√	×
Maqu	√	√	√	√	√	×	×
Arou	√	√	√	√	√	×	×


Steering Committee
Implementation Group
Observation Maintenances
Coordinated Studies
Web site
Data QA/QC
Data Products

A coordinated observational study in arid & semi-arid regions of China

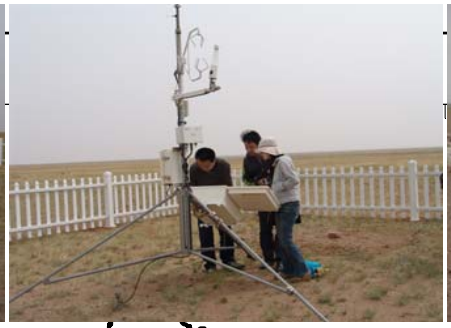
- Land surface processes, esp. surface-atmosphere exchanges of energy, H_2O & CO_2, and related characteristics of ASL on different surface of Arid & semi-arid regions;
- Scaling methods (point observation to regional scale, assimilation & spatial interpolation) in land surface studies of arid & semi-arid areas;
- Parameters ascertainment and parameterization methods in land surface models; comparison study in regional models。

Coordination & Cooperation…

✓**The period of the pilot experiment is from July 1st to September 30th, 2008.**

✓**Before the start of the pilot observation, we had conducted the calibration of Li-7500 sensors for CO_2 and H_2O fluxes measurements at 12 stations and upgraded on-line processing software.**

Li 7500 sensor calibration (in East

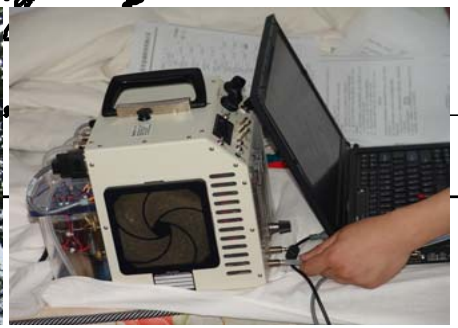







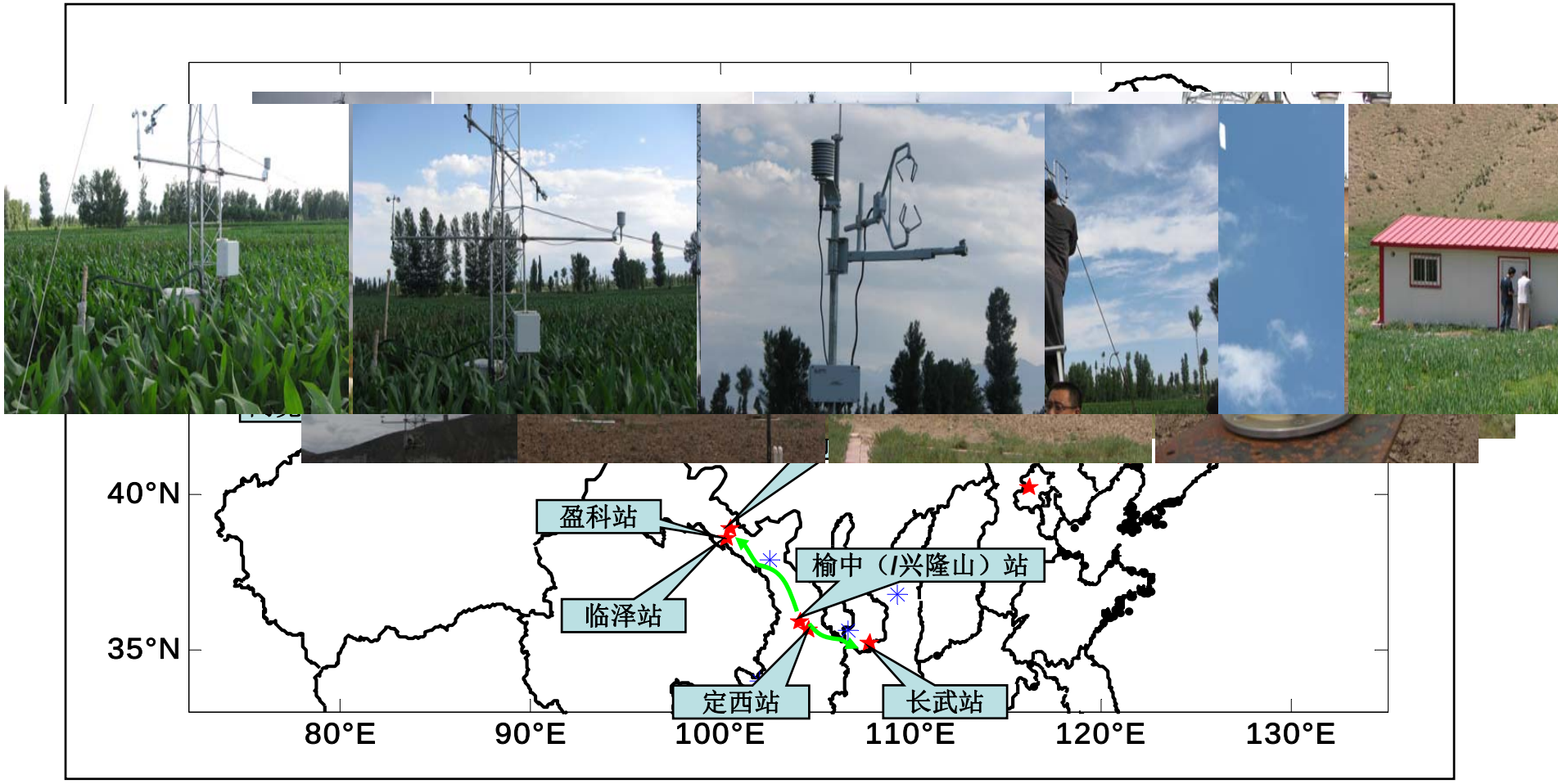






35°N

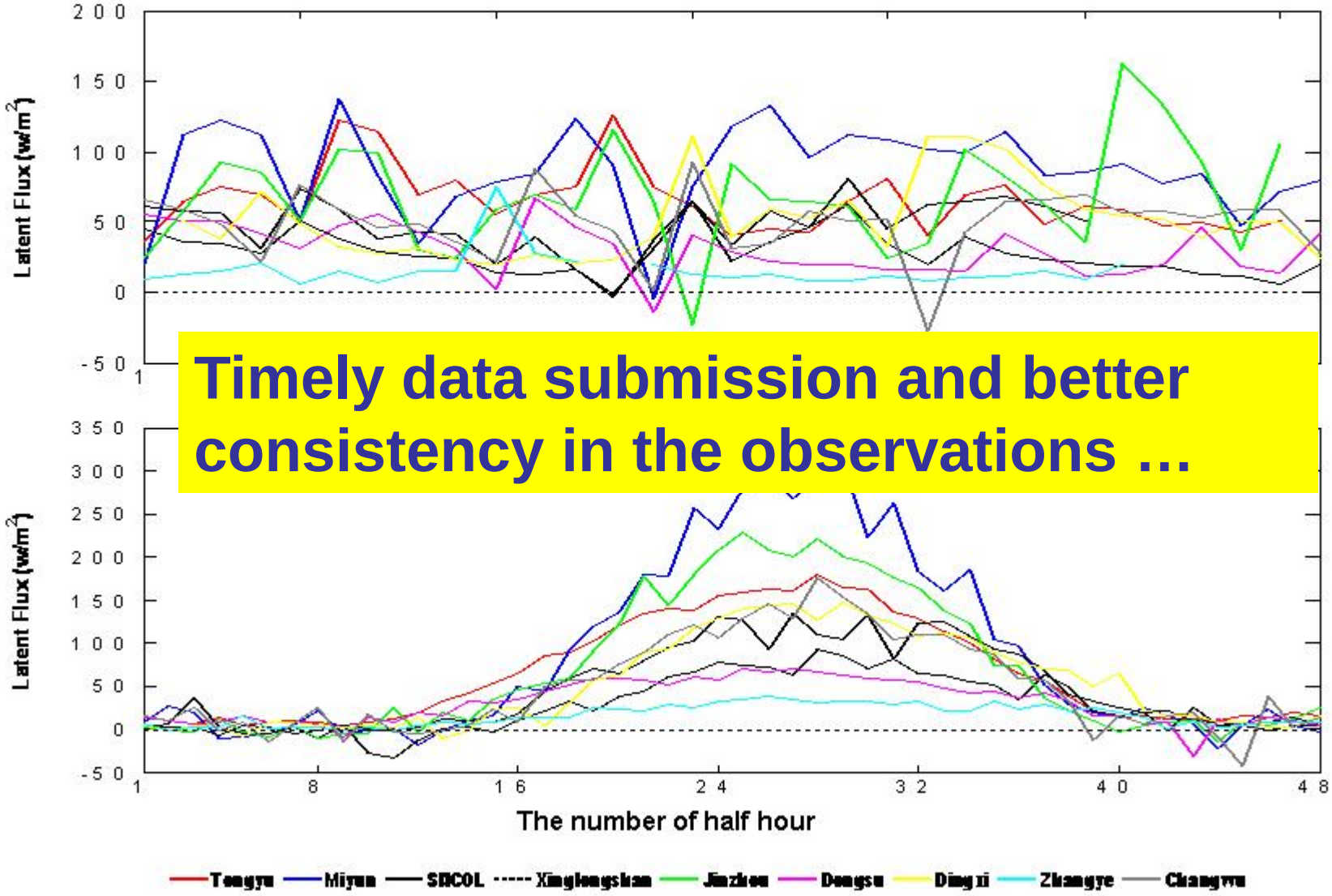
Li 7500 sensor calibration (in West



Training course on the EC flux measurements and post-processing of turbulent fluxes (Xi`an, July 17-19).

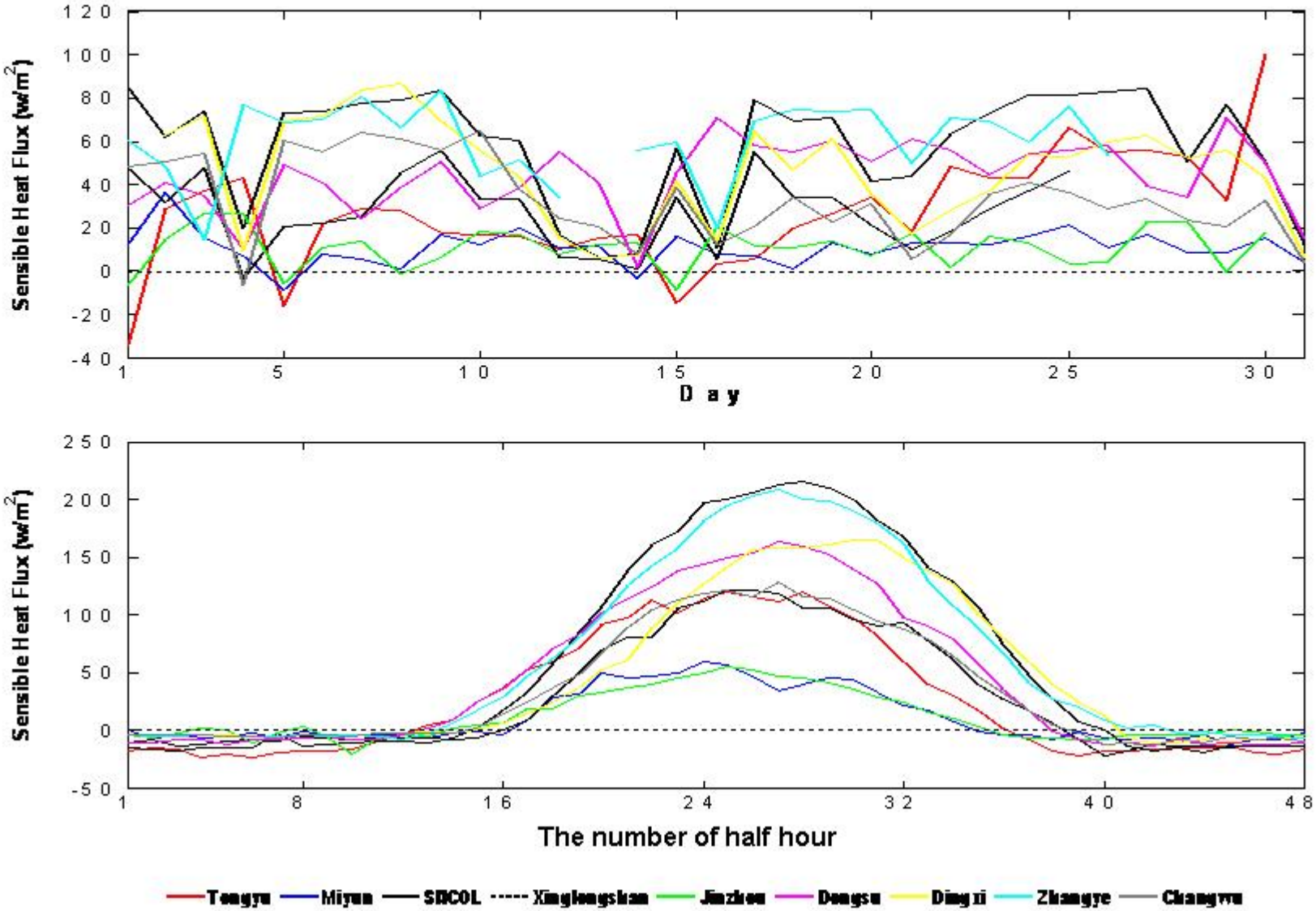
The guidelines and software were distributed to the members of stations who is in charge of observation and data processing.

Daily and diurnal variations of Latent Heat Flux at the coordinated sites in July,2008



Timely data submission and better consistency in the observations …

Daily and diurnal variations of Sensible Heat Flux at the coordinated sites in July,2008



✓A wide range of data products are going to be released to all participants in this November including field observations, products of land surface assimilation and related regional models' output, Satellite data, etc.

✓After evaluation of this pilot experiment, this coordinated observation will remain for a longer period.

Accomplishments

- Evaluation of data from Tongyu and Lanzhou station, including diurnal, seasonal variation of basic variables, fluxes, near surface layer profiles, etc.
- Some preliminary inter-comparison of Asia and America sites;
- Validation of several land surface models by using data from Tongyu and Lanzhou stations;
- Parameter sensitivity identification and optimization of Land Surface Model in semi-arid area;
- Observations of dust storm and mechanism study on the feedback between dust storm, cloud , and precipitation.

List of key publications:

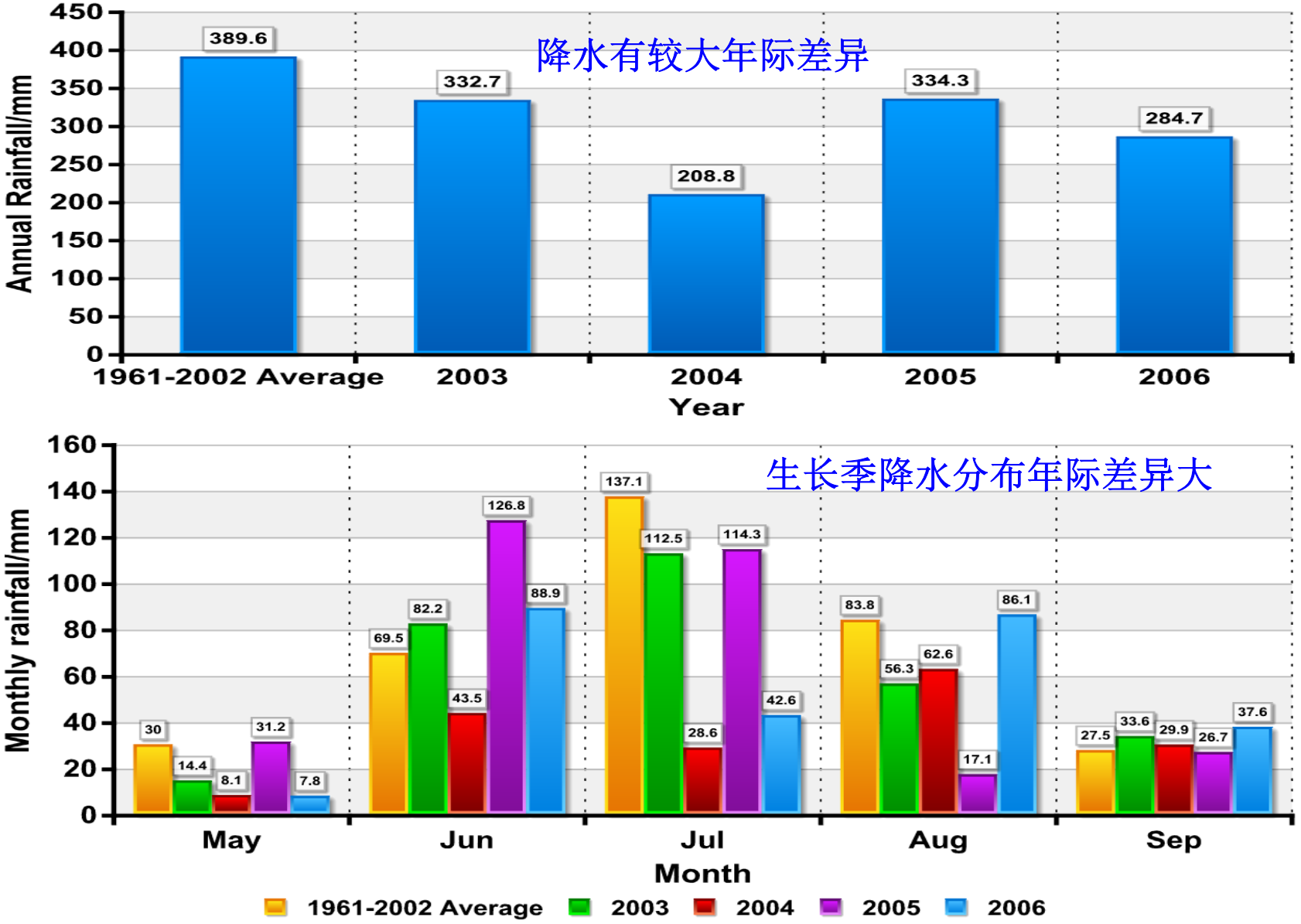
- **Congbin Fu · Zhihong Jiang Zhaoyong Guan · Jinhai He · Zhongfeng Xu (Eds.), Regional Climate Studies of China. 474pp (With 164 Figures and 42 Tables). Regional Climate Studies. Series Editors: H.-J. Bolle, M. Menenti, I. Rasool. *Springer Publishing House, in press***
- **FU Congbin and MA Zhuguo. Global Change and Regional Aridification[J]. *Chinese Journal of Atmospheric Sciences,* 2008,32(4):752-760**
- **Ma Zhuguo,2007, The interdecadal dry/wet trend and shift of North China and their relationship to the Pacific Decadal Oscillation (PDO), *Chinese Science Bulletin*， 52（15）: 2130~2139**
- **Ma Zhuguo, Fu Congbin, 2007, Evidences of Drying Trend in the Global During the later Half of 20th Century and Their Relationship with Large-Scale Climate Background, *Science in China (Series D-Earth Sciences),* 50(5): 776~788**
- **Huang Jianping, et al., Development of the semi-arid climate and**

List of key publications (Contd.):

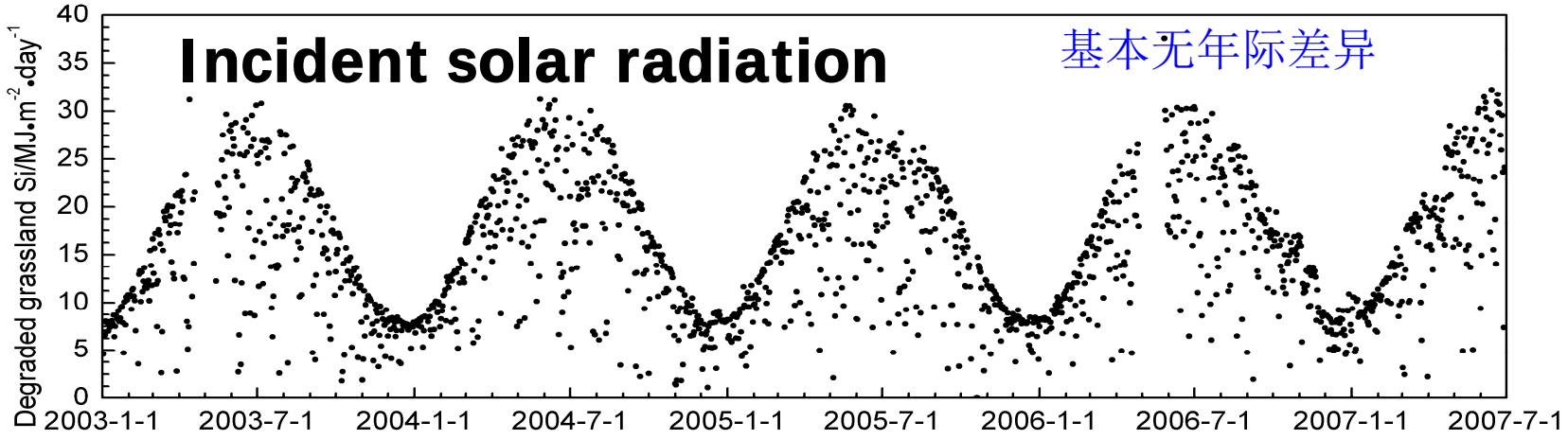
- Liu Huizhi, et al., Water, energy and fluxes over cropland and degraded grassland surfaces in a semi-arid area of Tongyu, Northeastern China. *Advances in Atmospheric Sciences*, in press
- Zhang Renjian, et al., Characteristics of elemental composition of PM2.5 in spring period in Tongyu, semi-arid region in Northeast China, *Advances in Atmospheric Sciences*, in press
- Guo Weidong, et al., Modeling the soil temperature/wetness and land surface fluxes over Loess Plateau with different land surface schemes. To be submitted.
- Tianbao Zhao, Weidong Guo, and Congbin Fu, 2008. Calibrating and Evaluating Reanalysis Surface Temperature Error by Topographic Correction. *Journal of Climate*, 1440-1446
- SONG Yaoming, GUO Weidong. Numerical Study of Impacts of Soil Moisture on the Diurnal and Seasonal Cycles of

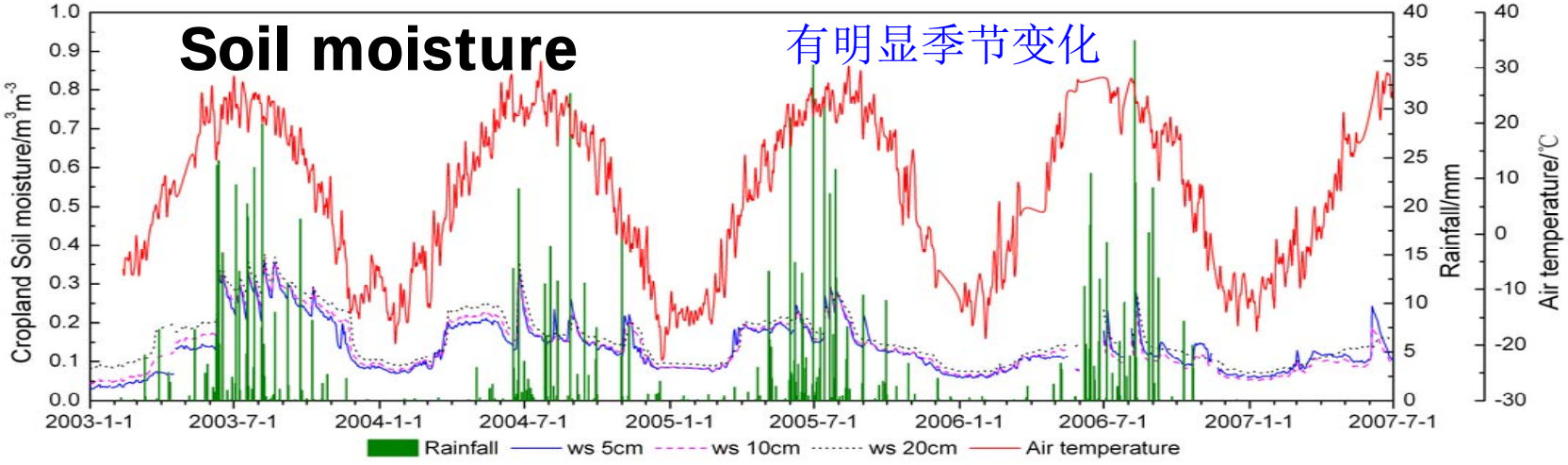
- **Diurnal, seasonal variation of surface fluxes from several reference sites of China and North America**

TongYu Reference site



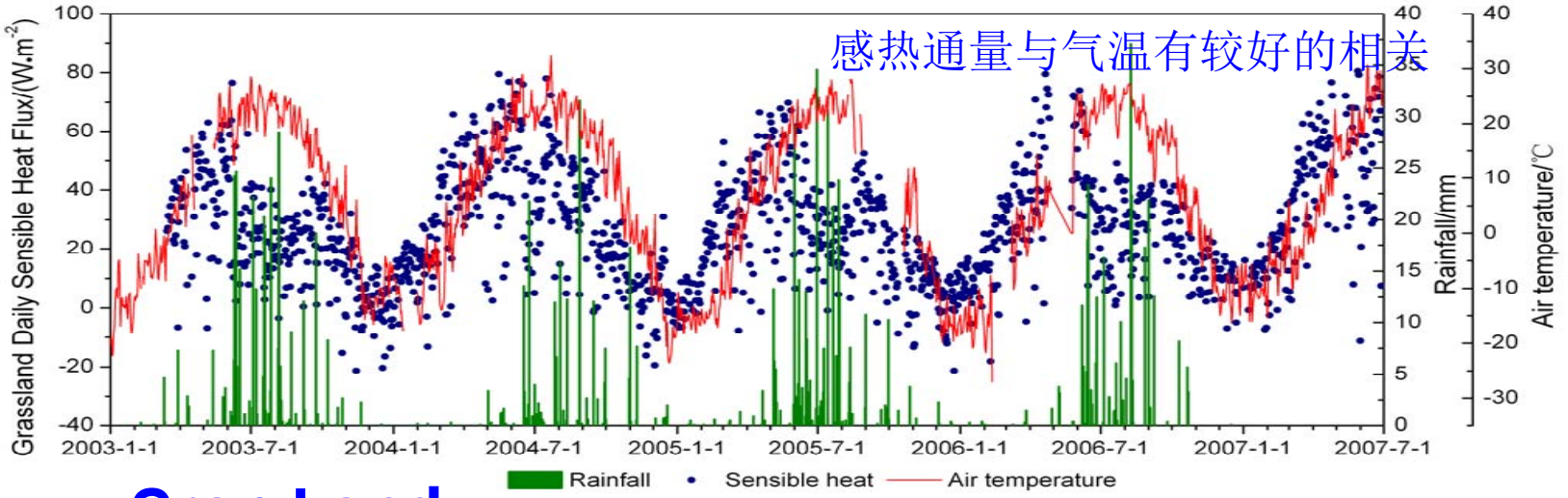
Tongyu, 2003-2007



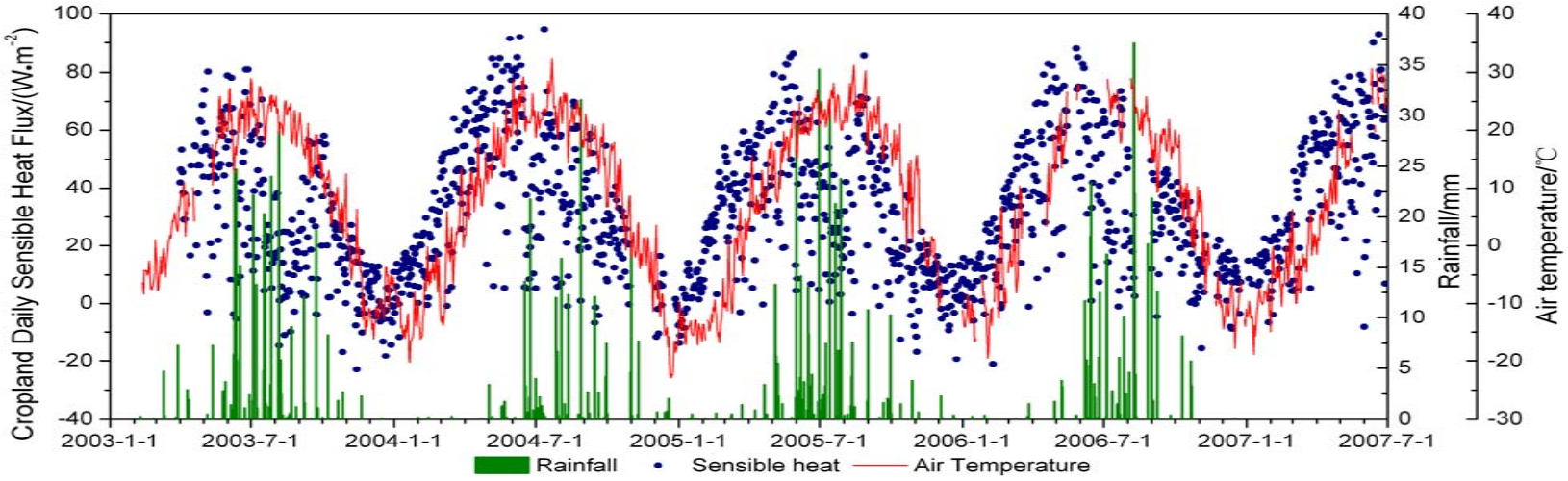


Tongyu, interannual variation of sensible heat flux at two sites

Grass land

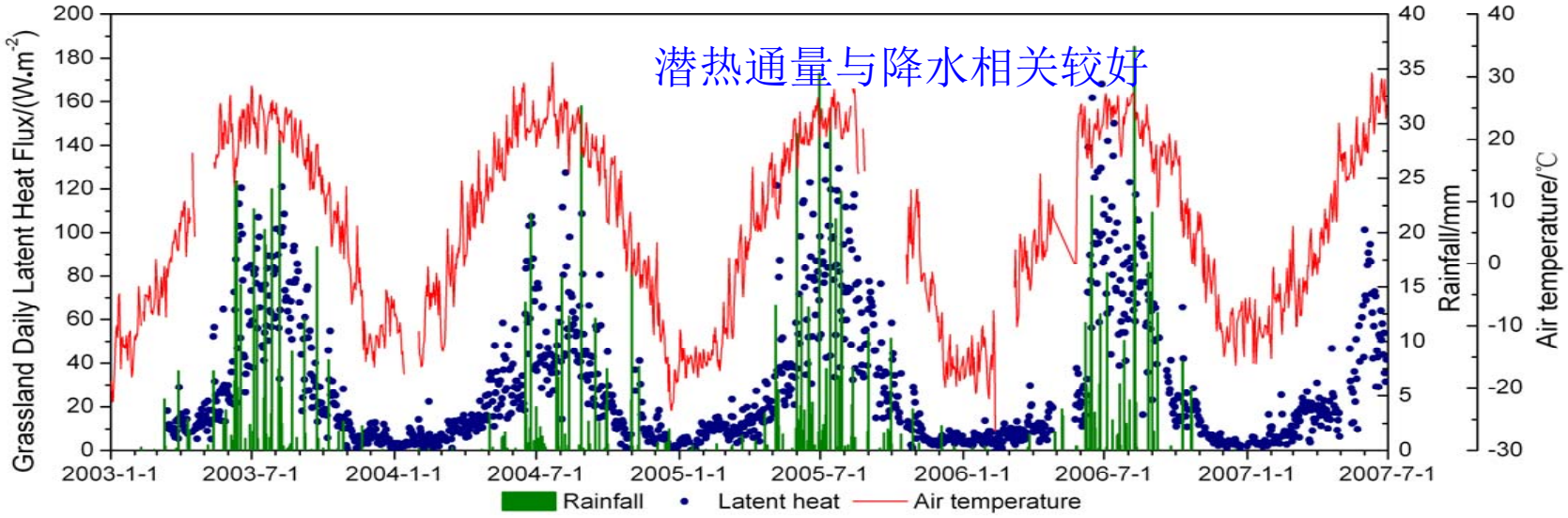


Crop Land

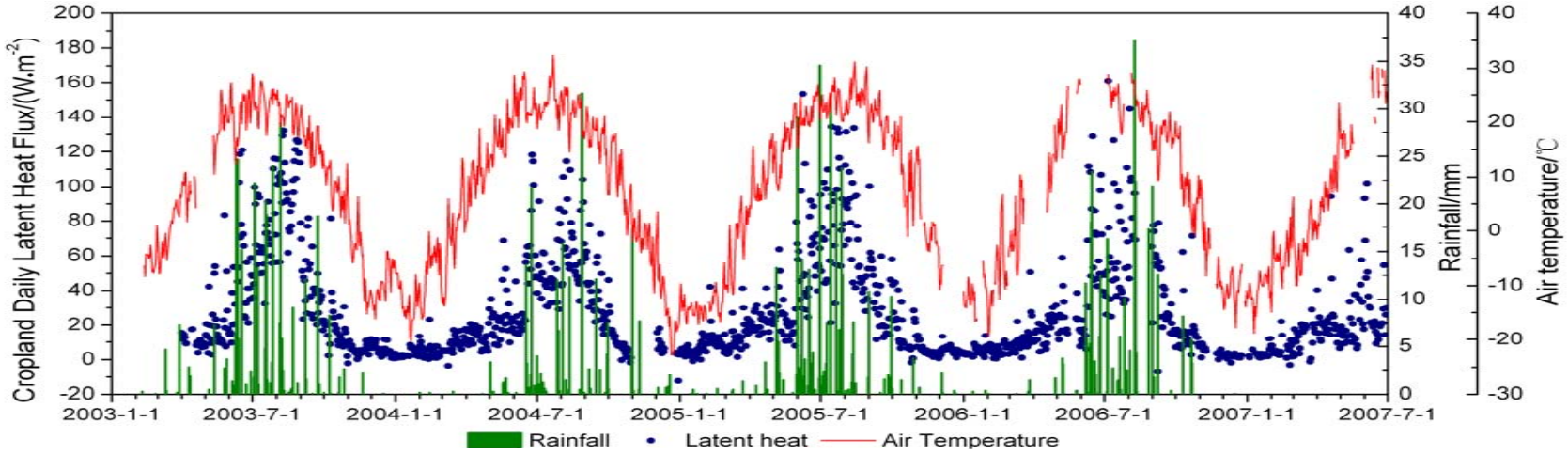


通榆观测站潜热通量年变化

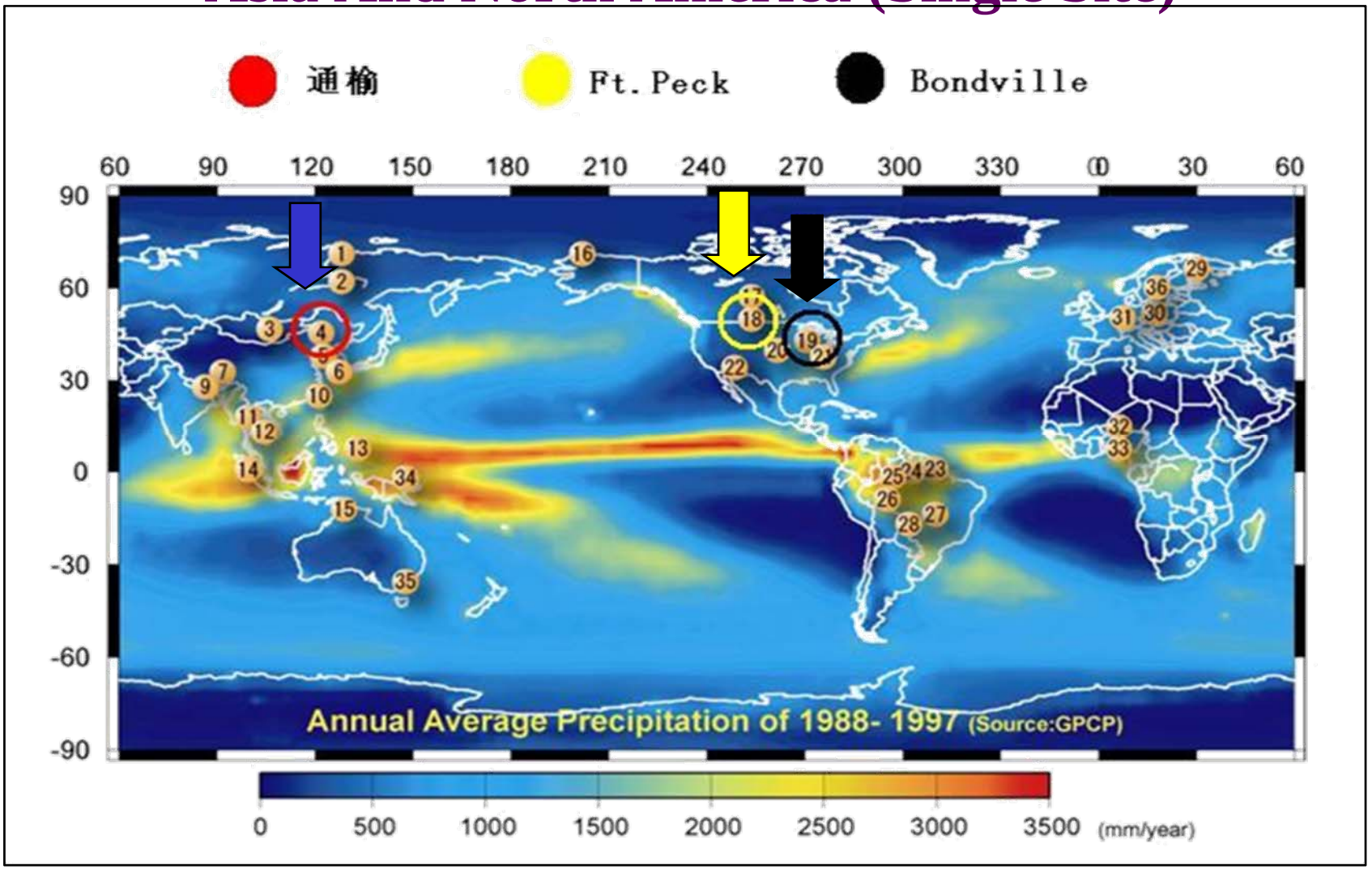
草地



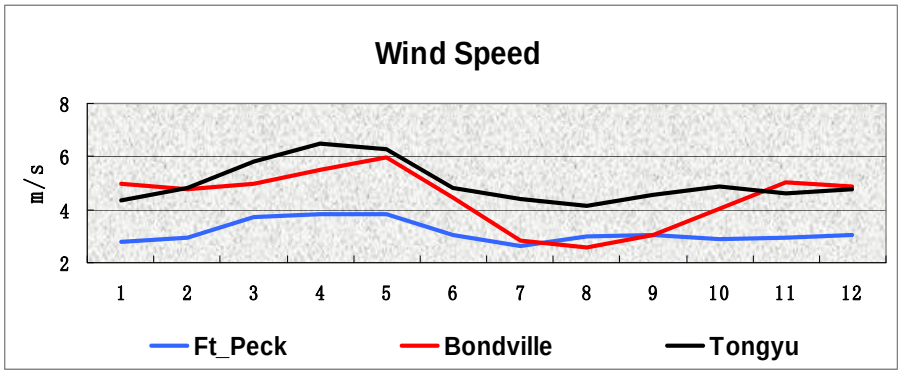
农田

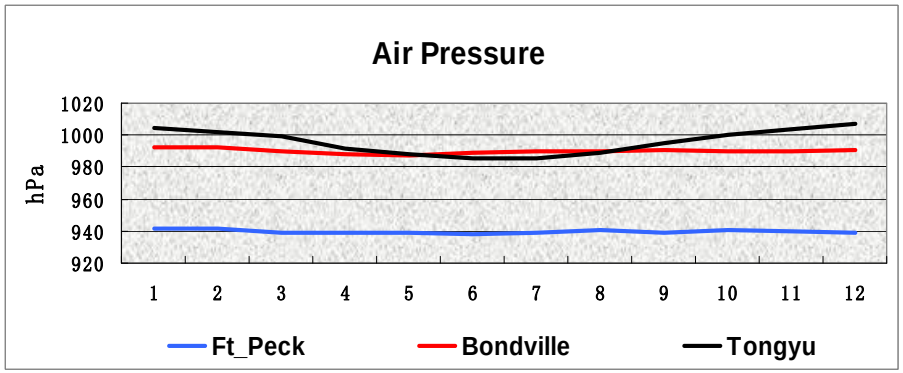


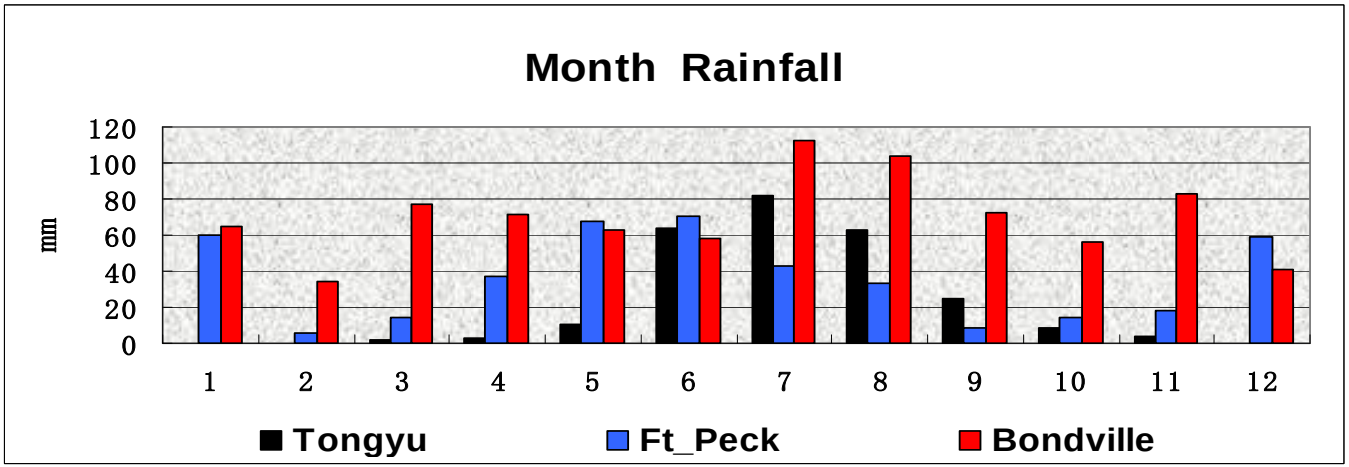
Comparison Of Two Different Semi-arid Areas In Asia And North America (Single Site)

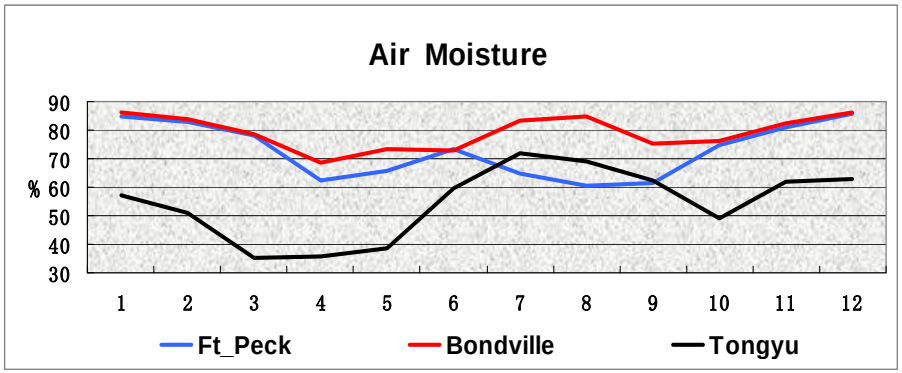


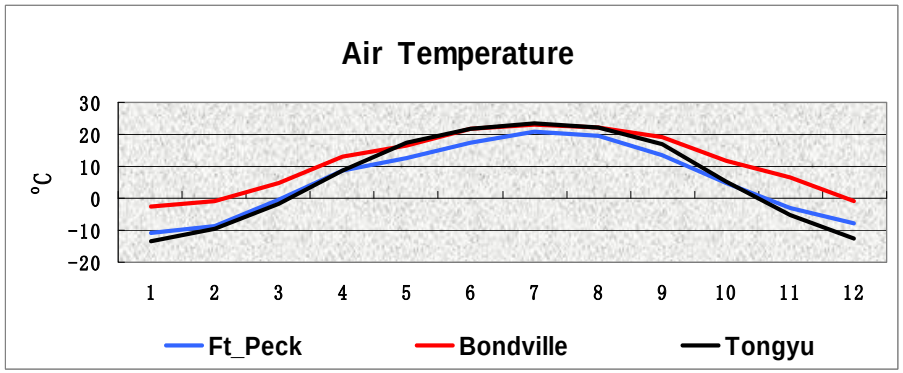
The background of these three sites





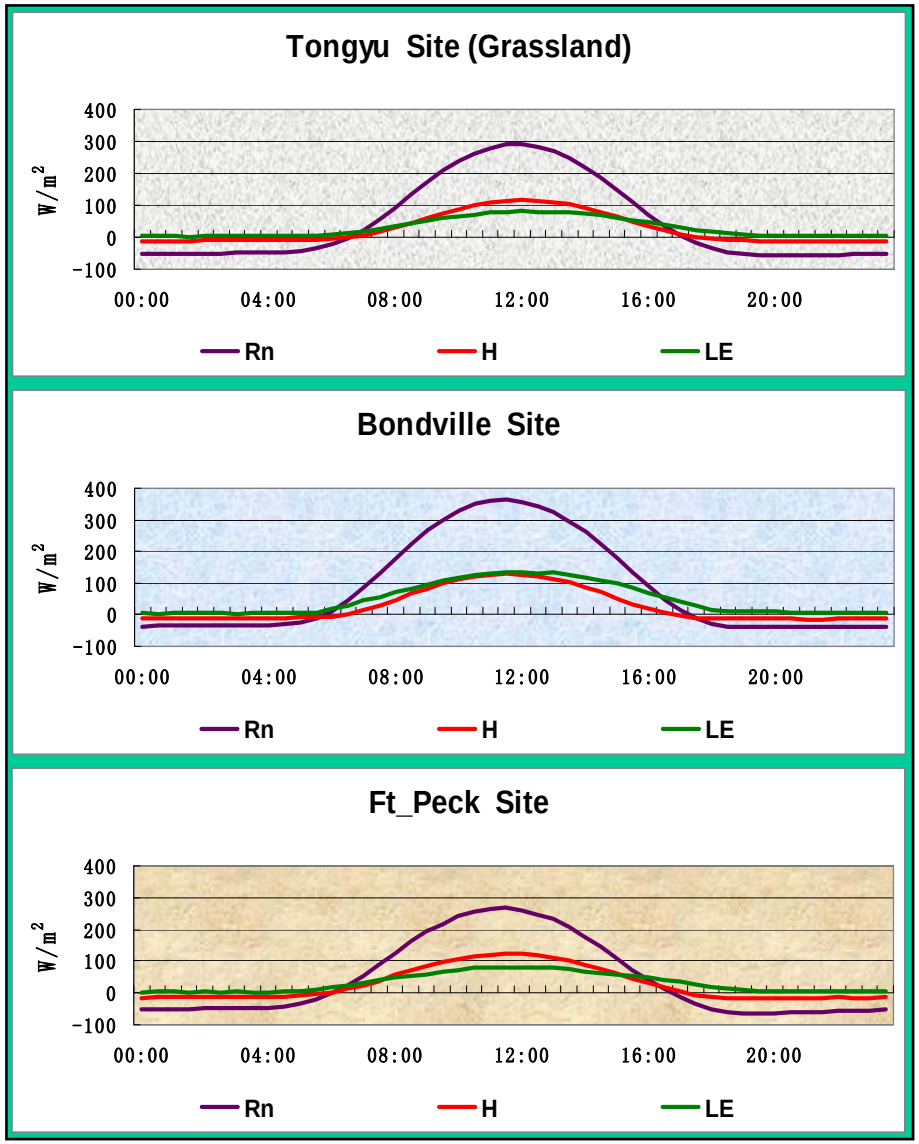




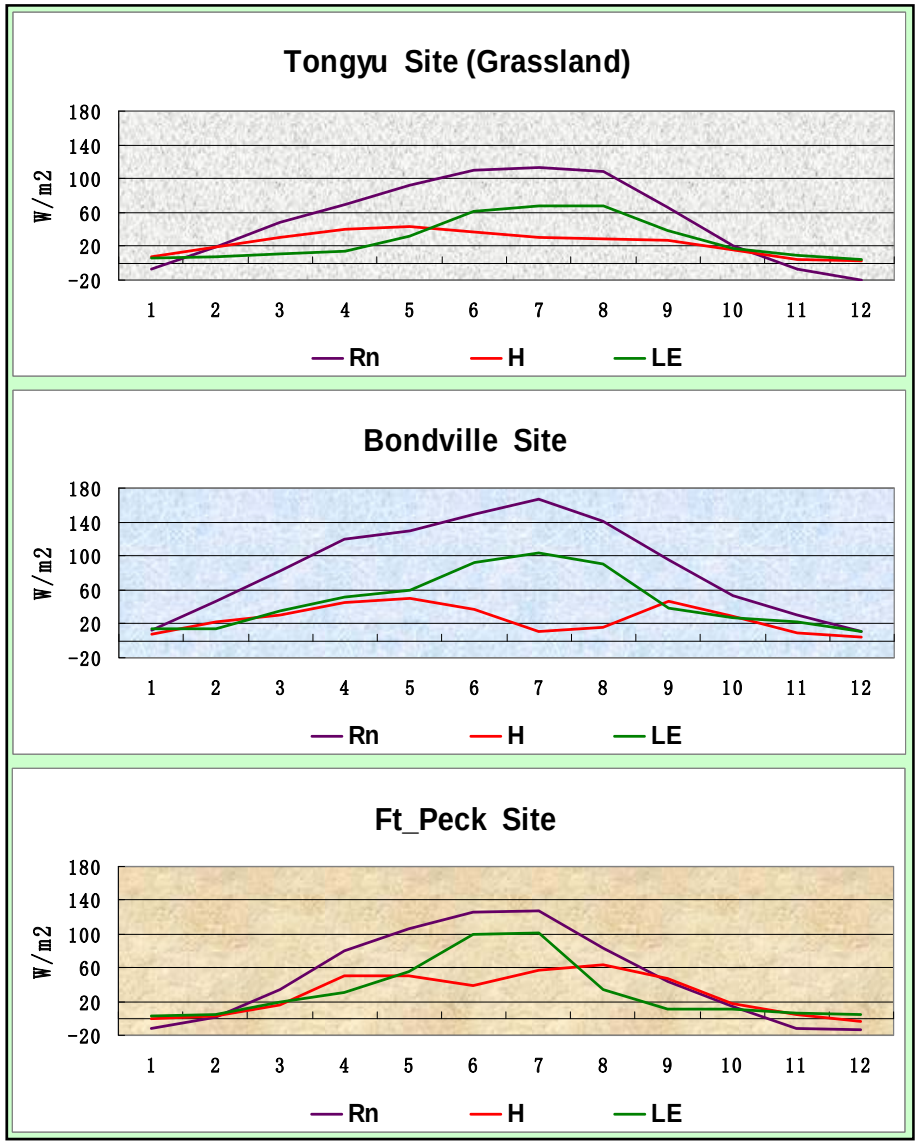


The Energy Flux In Different Semi-arid Areas

- **The diurnal variation**

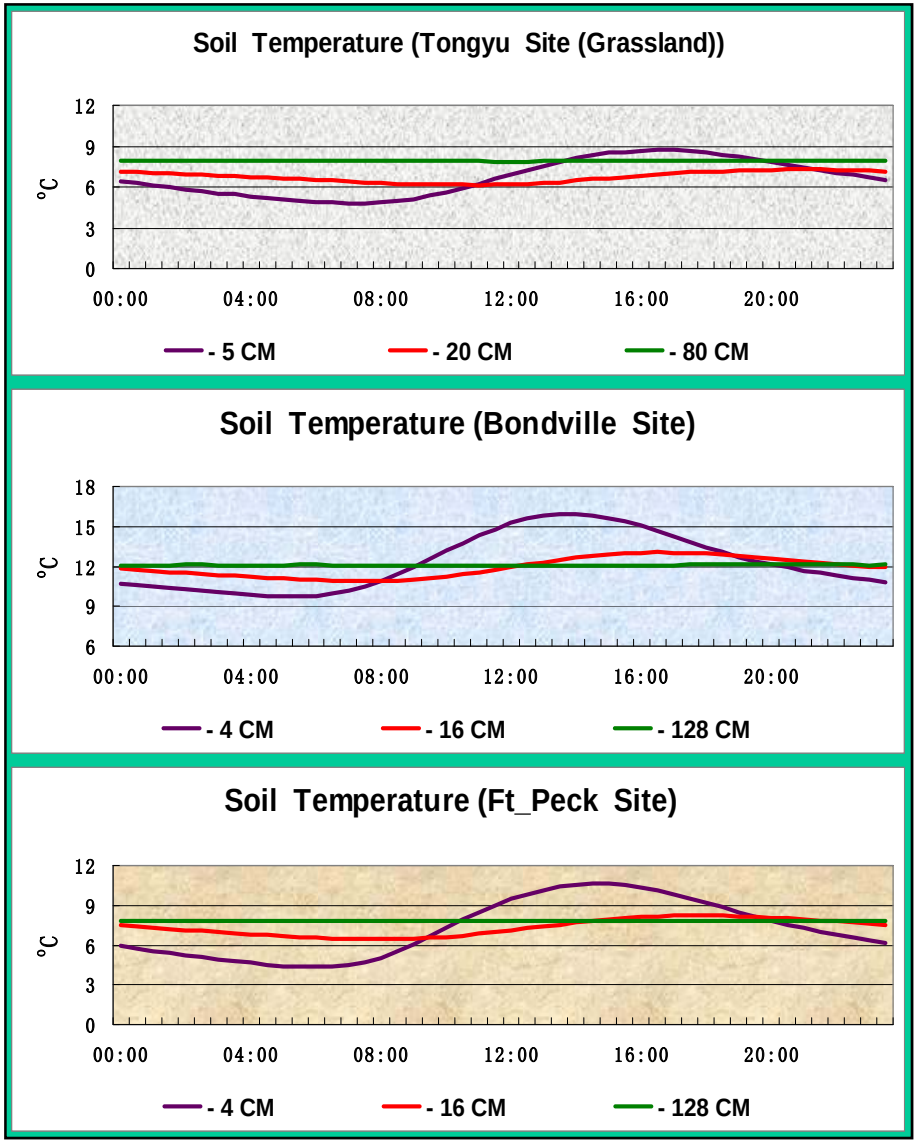


- **The seasonal variation**

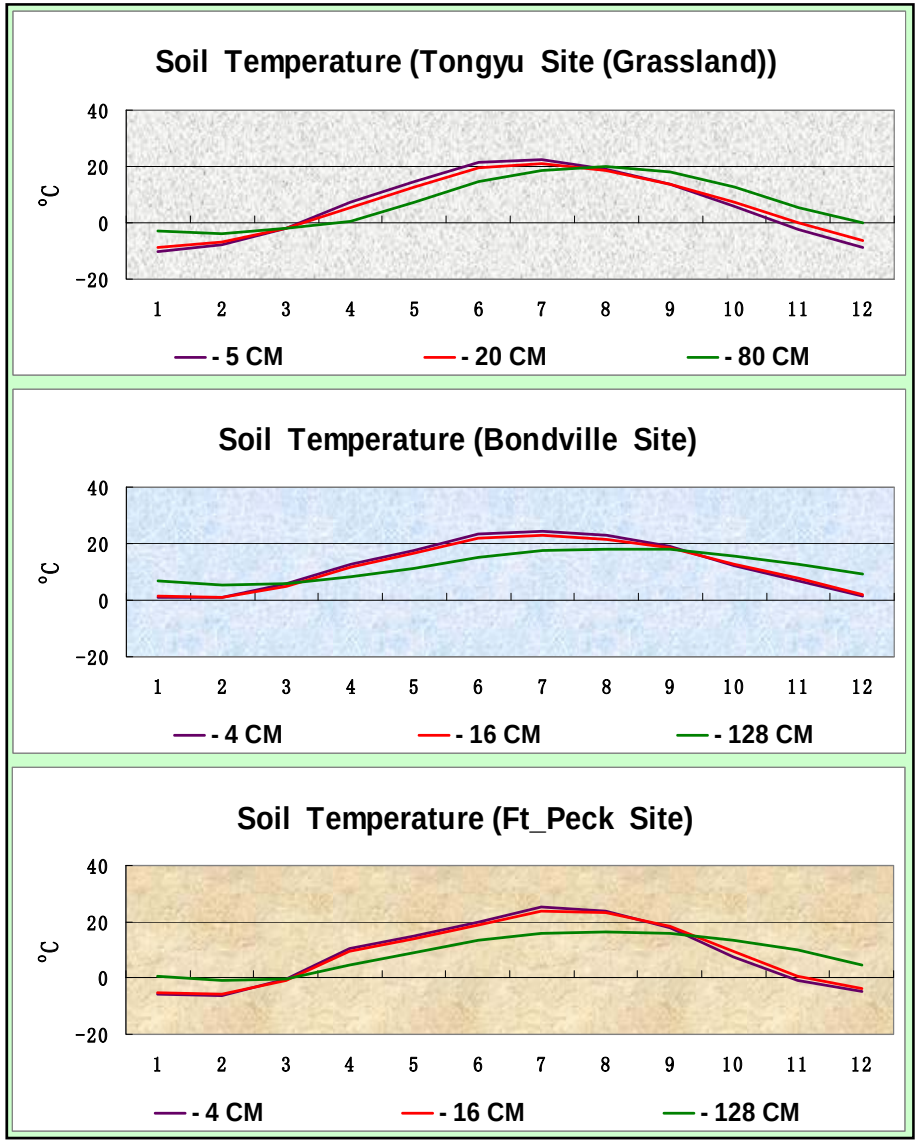


The Soil Temperature In Different Semi-arid Areas

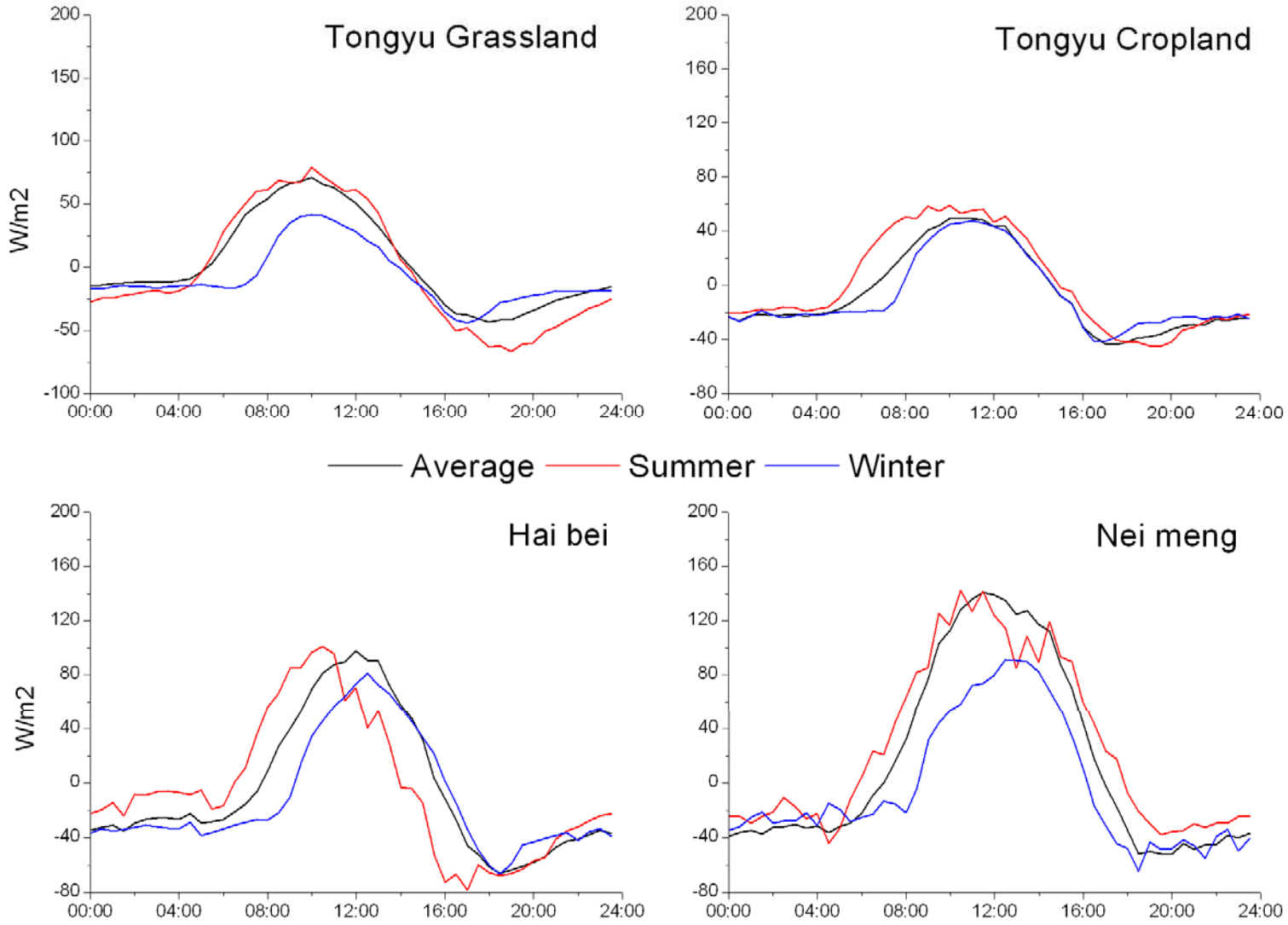
- The diurnal variation



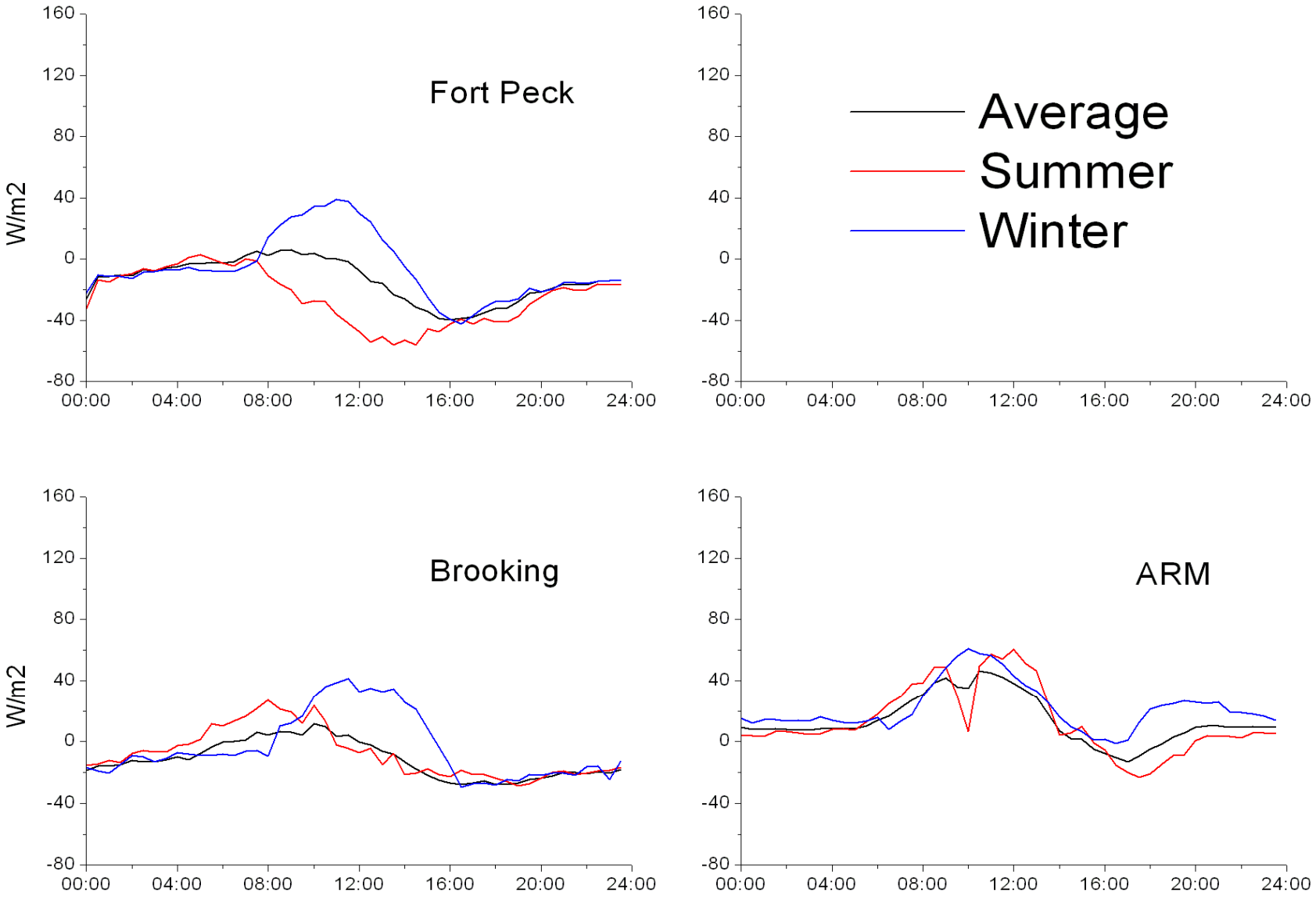
- The seasonal variation



Energy Unbalance Diurnal Variation (China)



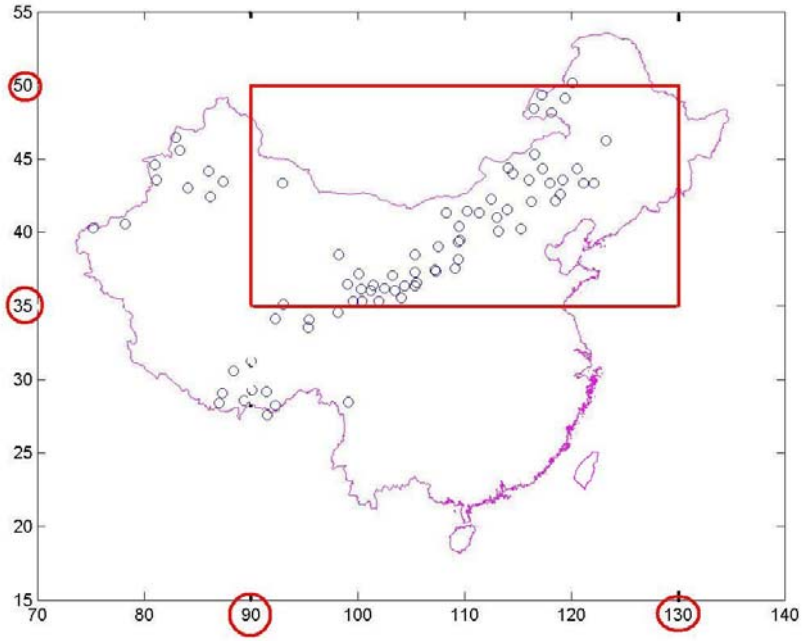
Energy Unbalance Diurnal Variatio **(North America)**



Comparison Of Two Different Semi-arid Areas In Asia And North America (Region)

Make research regions and compare two regions.

(the work is under way)



In Asia ***(35N-50N,90E-130E)***

Base on the Data from

1: the CEOP phase 2,

2: the China-Flux Station

3: the satellite data

4: the Weather Station in semi-arid region (left cycle)

In North America ***(35N-50N,)***

Base on the Data from

1: the CEOP phase 2,

2: the Ameri-Flux Station

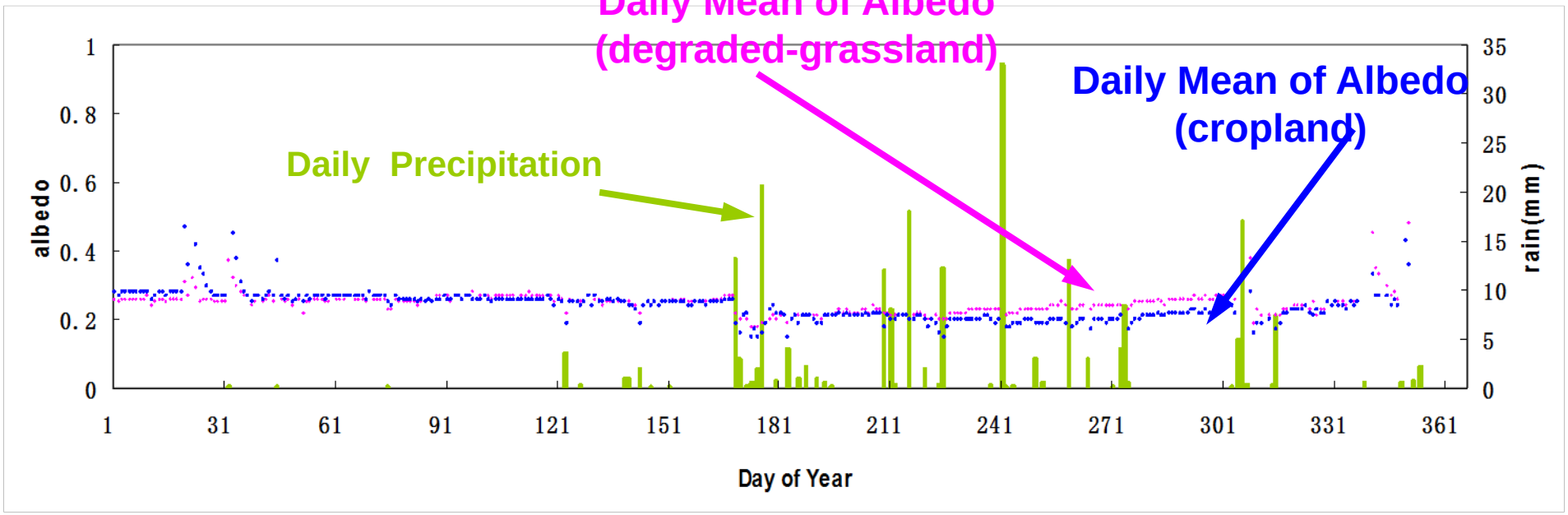
3: the satellite data

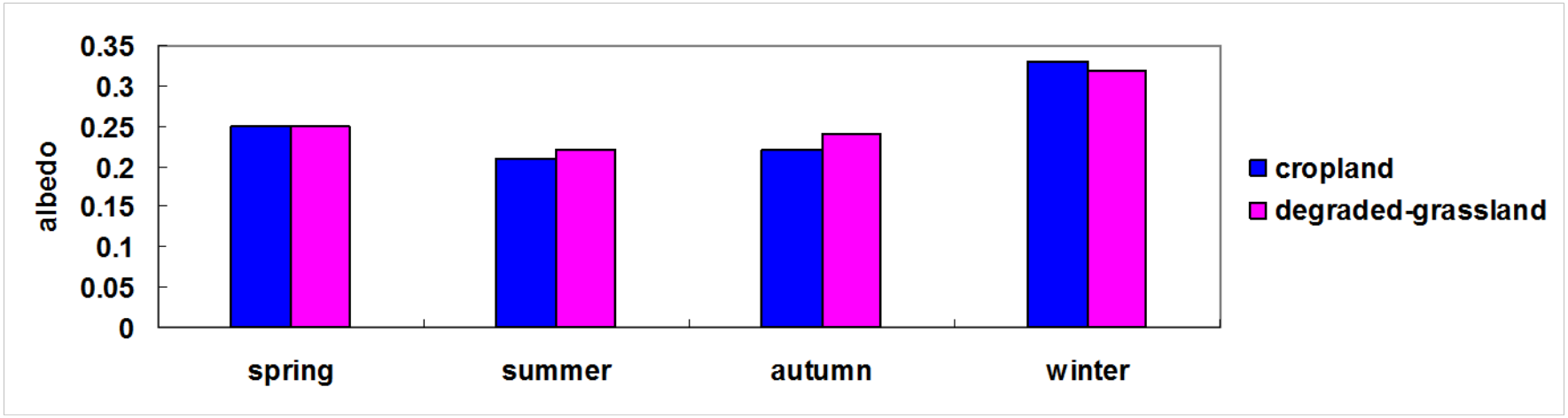
4: the Weather Station in semi-arid region

- **Evaluation of some key land surface parameters based on CEOP observations at Tongyu station over year 2003－2005**

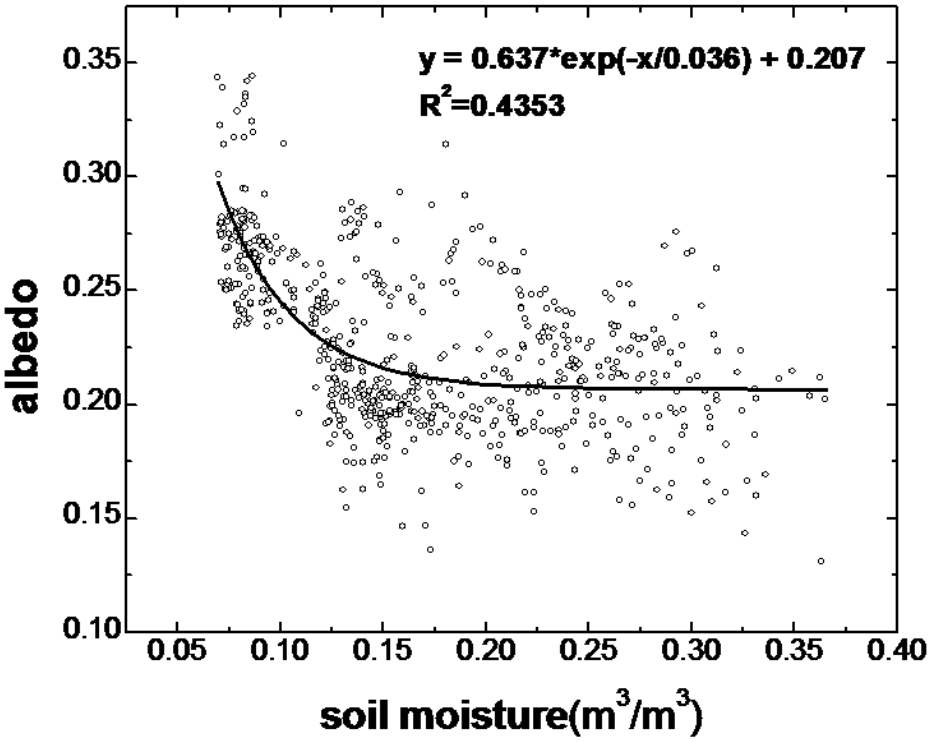
(Evaluation of daily albedo is only for year 2004 and the snow days in winter have been excluded)

Surface Albedo

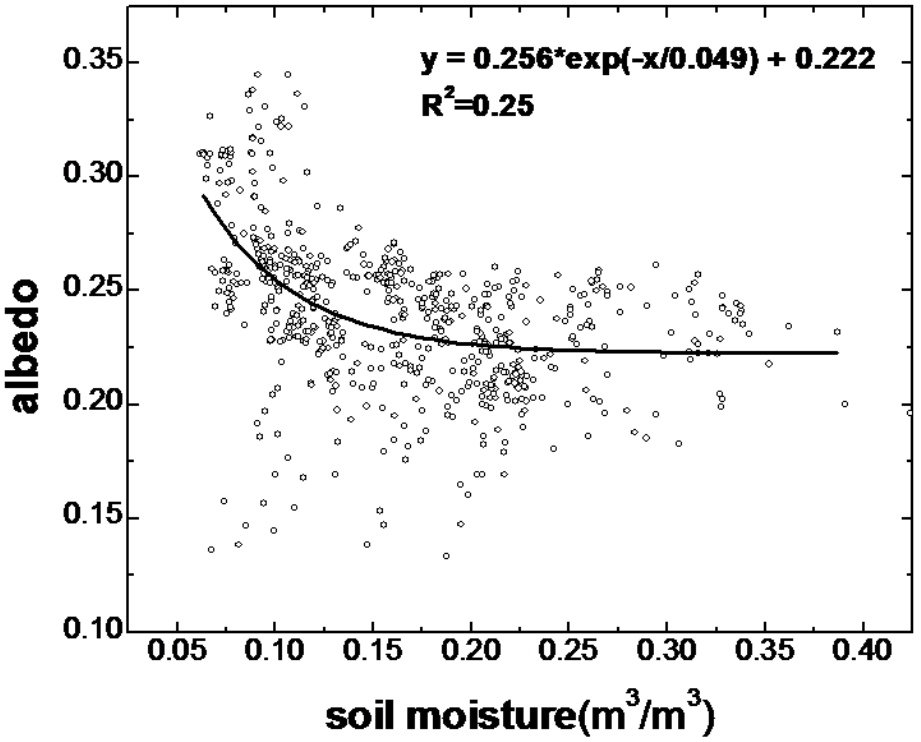




Fitting of Surface Albedo to Soil Moisture



cropland



degraded-grassland

aerodynamic roughness length ($Z_{0\,m}$)

Relationship of Wind Profile

neutral stratified layer:

$$\ln\frac{z-d}{z_{0m}}=\frac{\kappa u(z)}{u_*}$$

unneutral stratified layer:

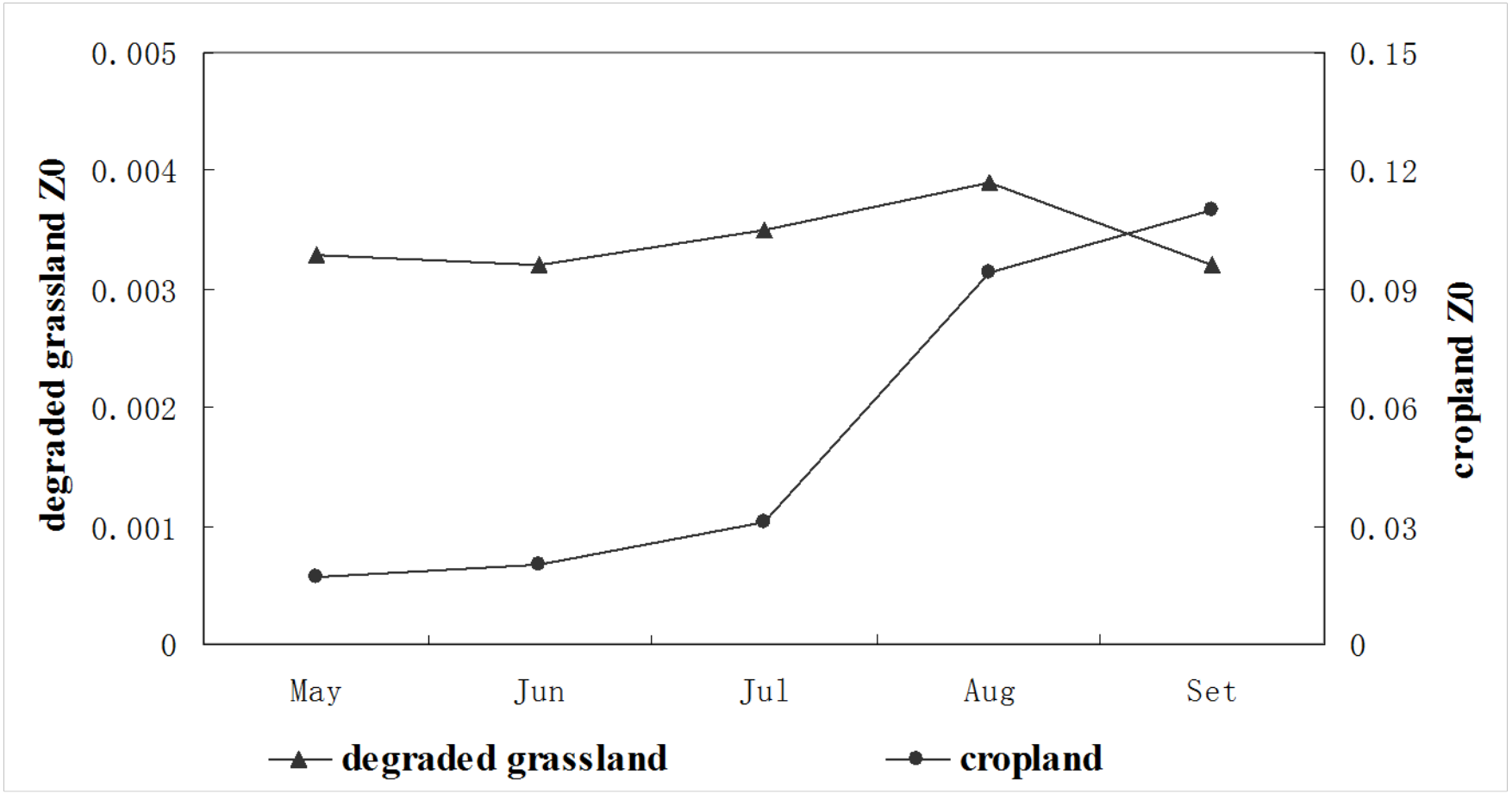
$$\ln\frac{z-d}{z_{0m}}=\frac{\kappa u(z)}{u_*}+\psi_m(\zeta)$$

$$\zeta = z/L$$

$$L=-\frac{\rho c_p\cdot u_*^3 T_a}{\kappa g H}$$

(Monin—Obukhov lenghth)

aerodynamic roughness length (Z_0, Unit: m)



Bulk Transfer Coefficients

$$\tau = \rho C_D U^2$$

$$H = -\rho c_p C_H (\theta_a - \theta_s) U$$

Neutral Bulk Coefficients:

cropland: $C_{DN} = (4.9 \pm 2.1) \times 10^{-3}$

$C_{HN} = (3.59 \pm 1.9) \times 10^{-3}$

degraded grassland: $C_{DN} = (2.6 \pm 1.4) \times 10^{-3}$

$C_{HN} = (2.62 \pm 1.6) \times 10^{-3}$

- **Validation of land surface models (NCAR CLM3, Common Land Model, SiB2, LSM and BATS) by using observed data from Tongyu stations**

Structure of the Common Land Model (Dai, et al., 2001; 2003)

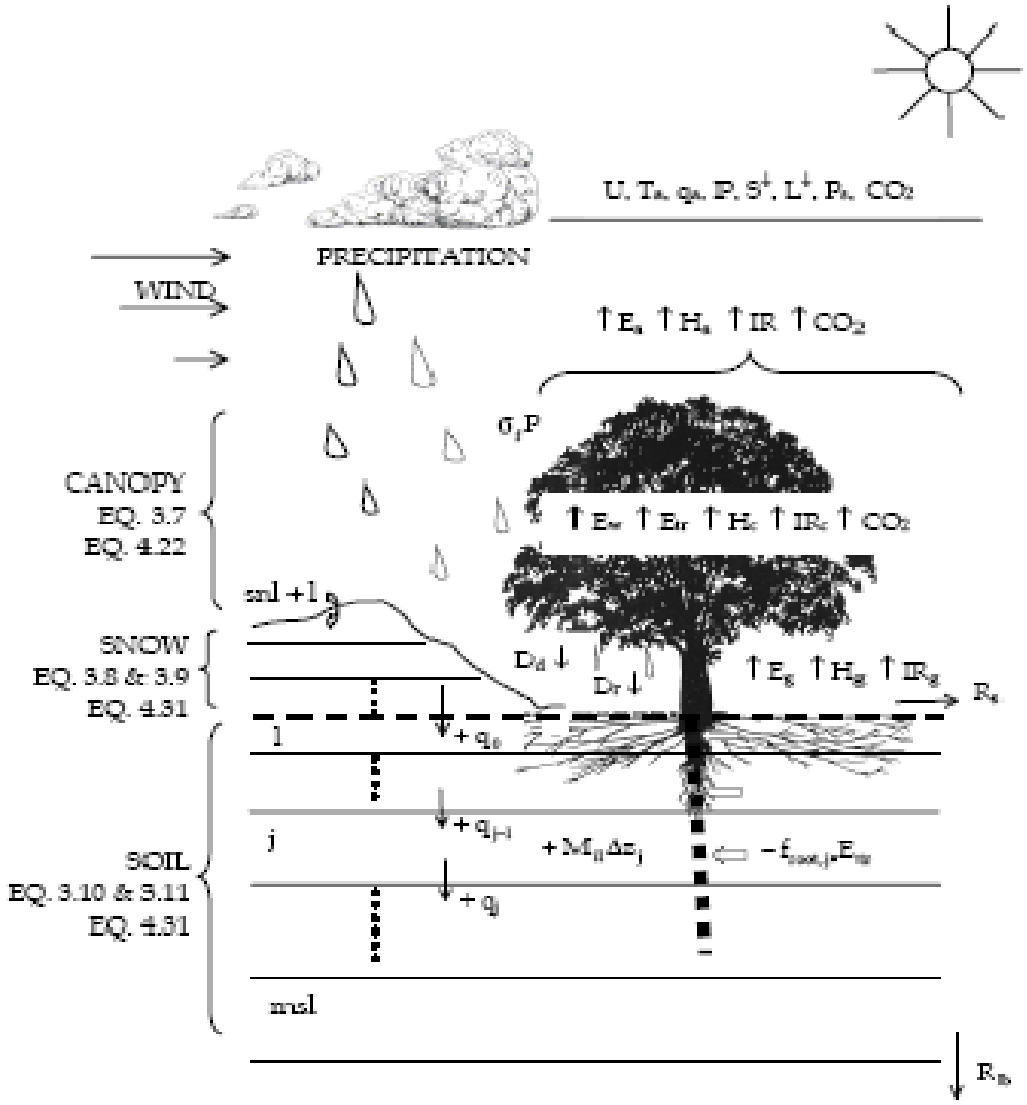
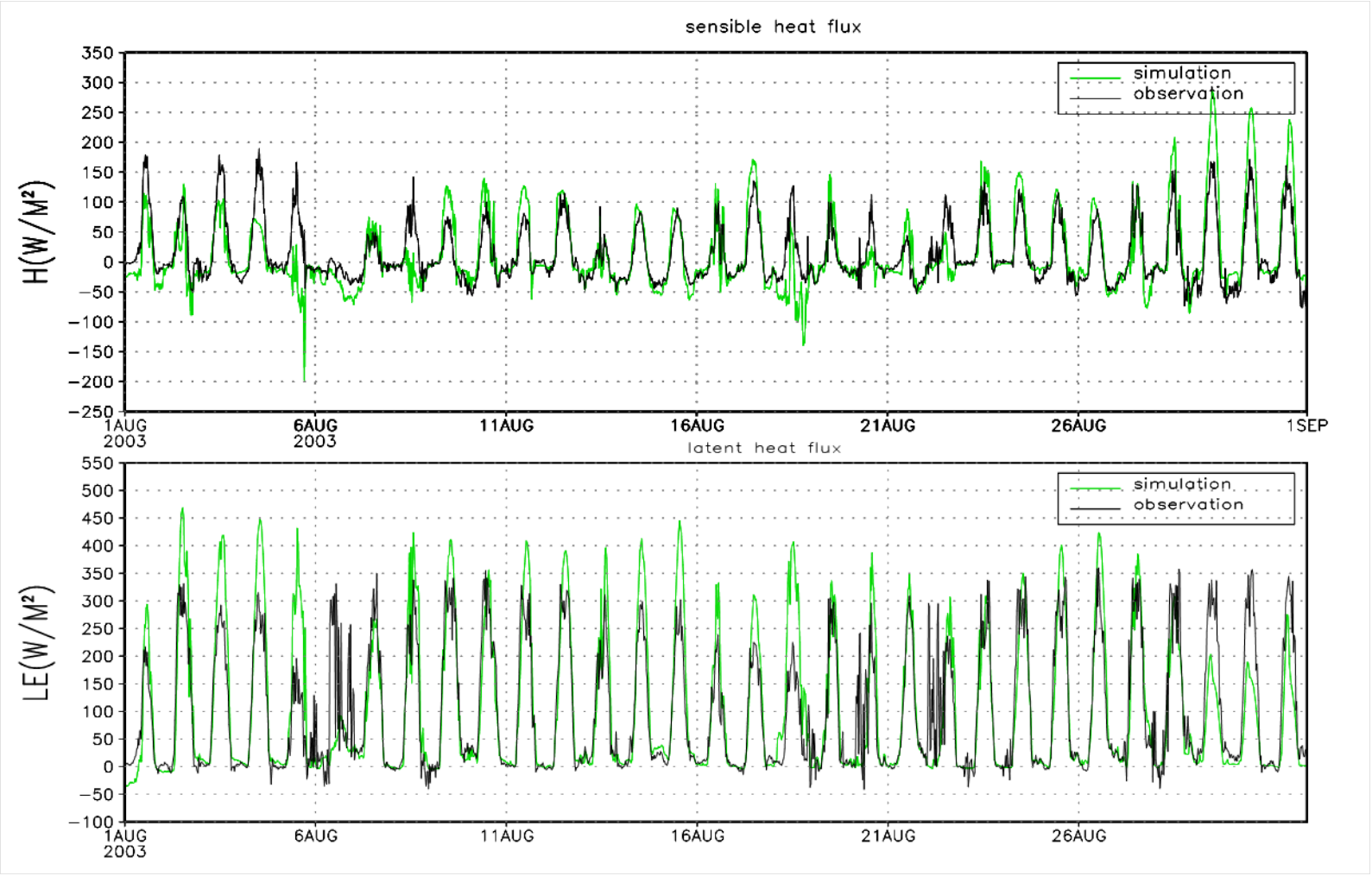


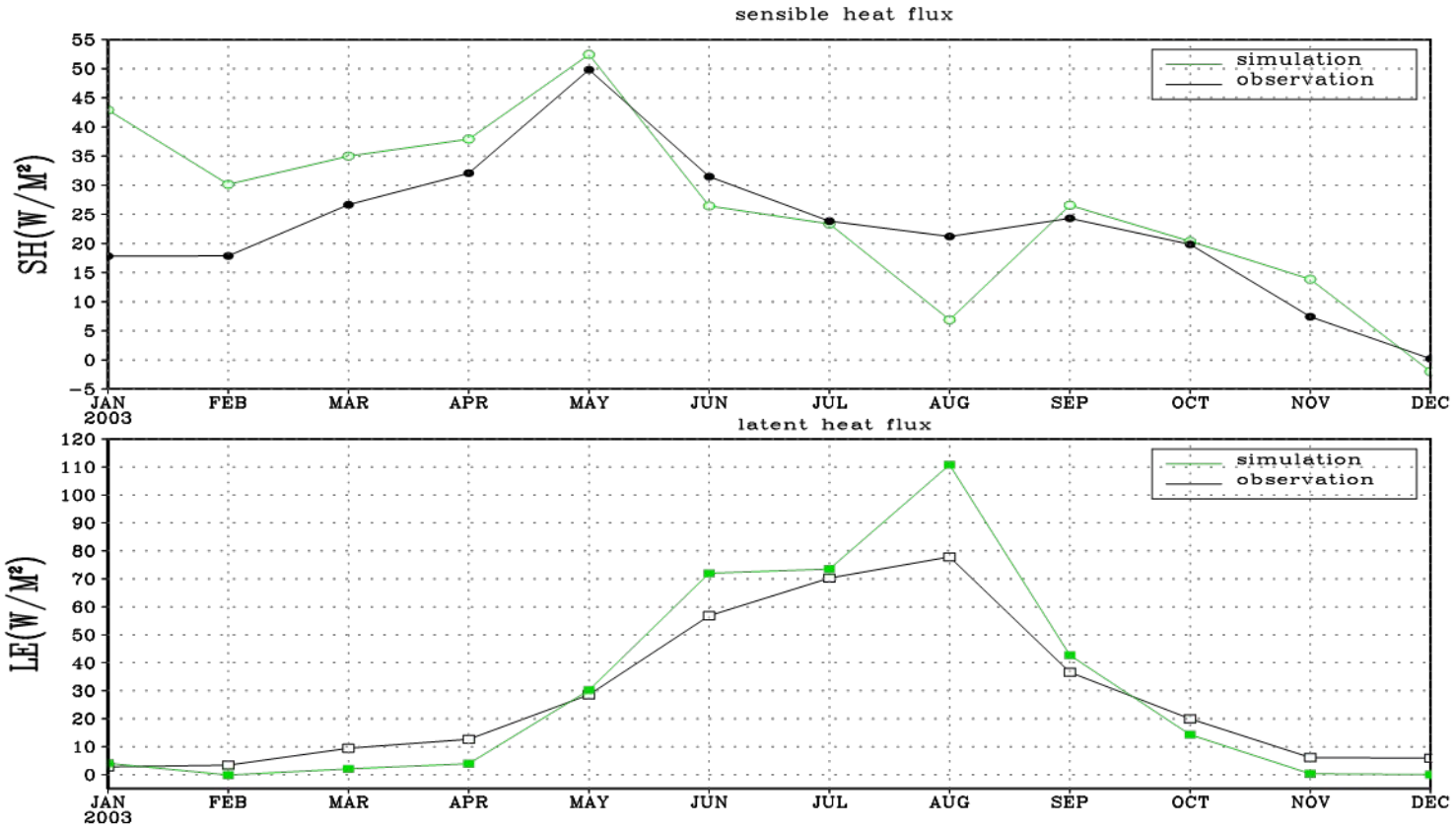
Figure 2.2. Structure of the CLM model. CLM has one vegetation layer, ten soil layers and up to 5 snow layers depending on the snow depth.

(Expect to be filled or re-shaped, especially, expect the contributions from the guys who have talent sense on such kind of figuring – BONAN, HOUSER and DIRMEYER…)

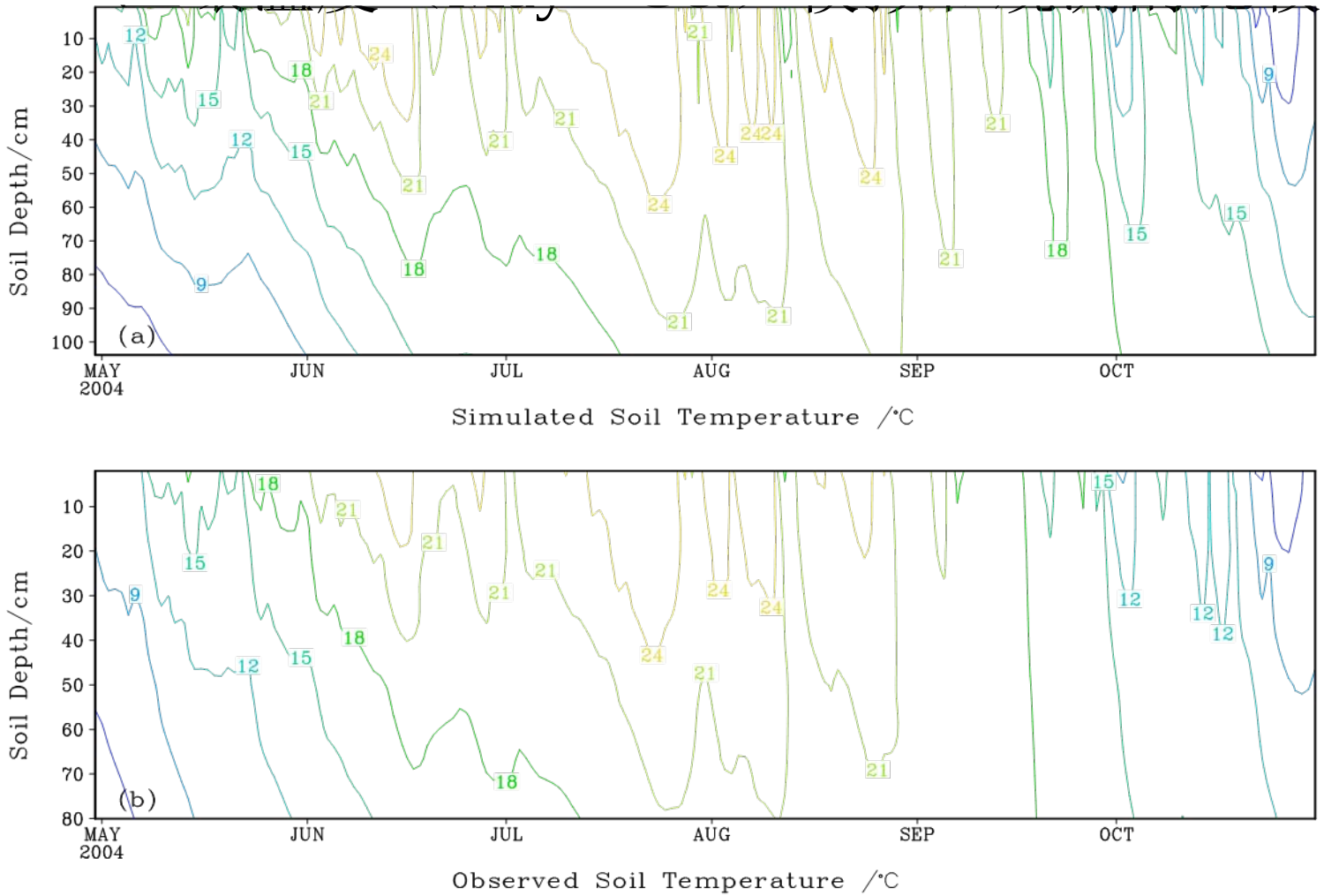
Simulation of the diurnal cycle of sensible/latent heat fluxes during Aug.2003 at cropland



Simulation of the seasonal variation of the heat fluxes during year 2003 at degraded grassland

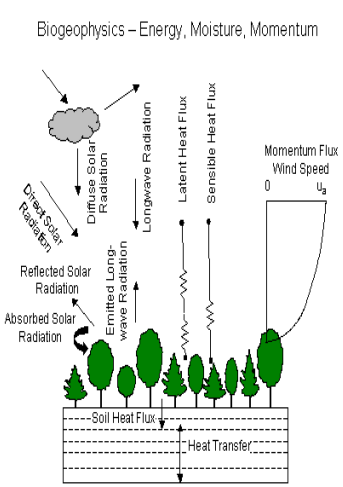


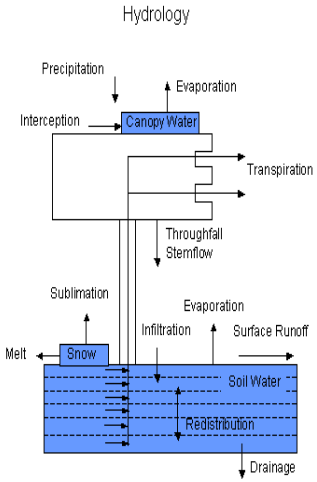
Comparison of the soil temperature profile in 2004 (May～Oct.) at degraded grassland

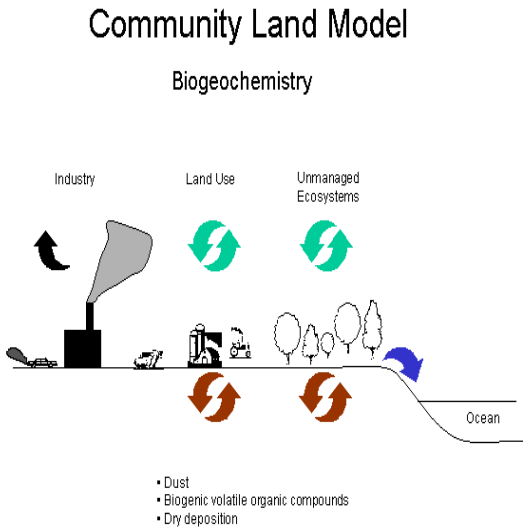


- **Modeling the soil temp./wetness and land surface fluxes over Loess Plateau with different land surface schemes**

(1) Simulation based on NCAR Community Land Model 3.0 (NCAR_CLM3.0)





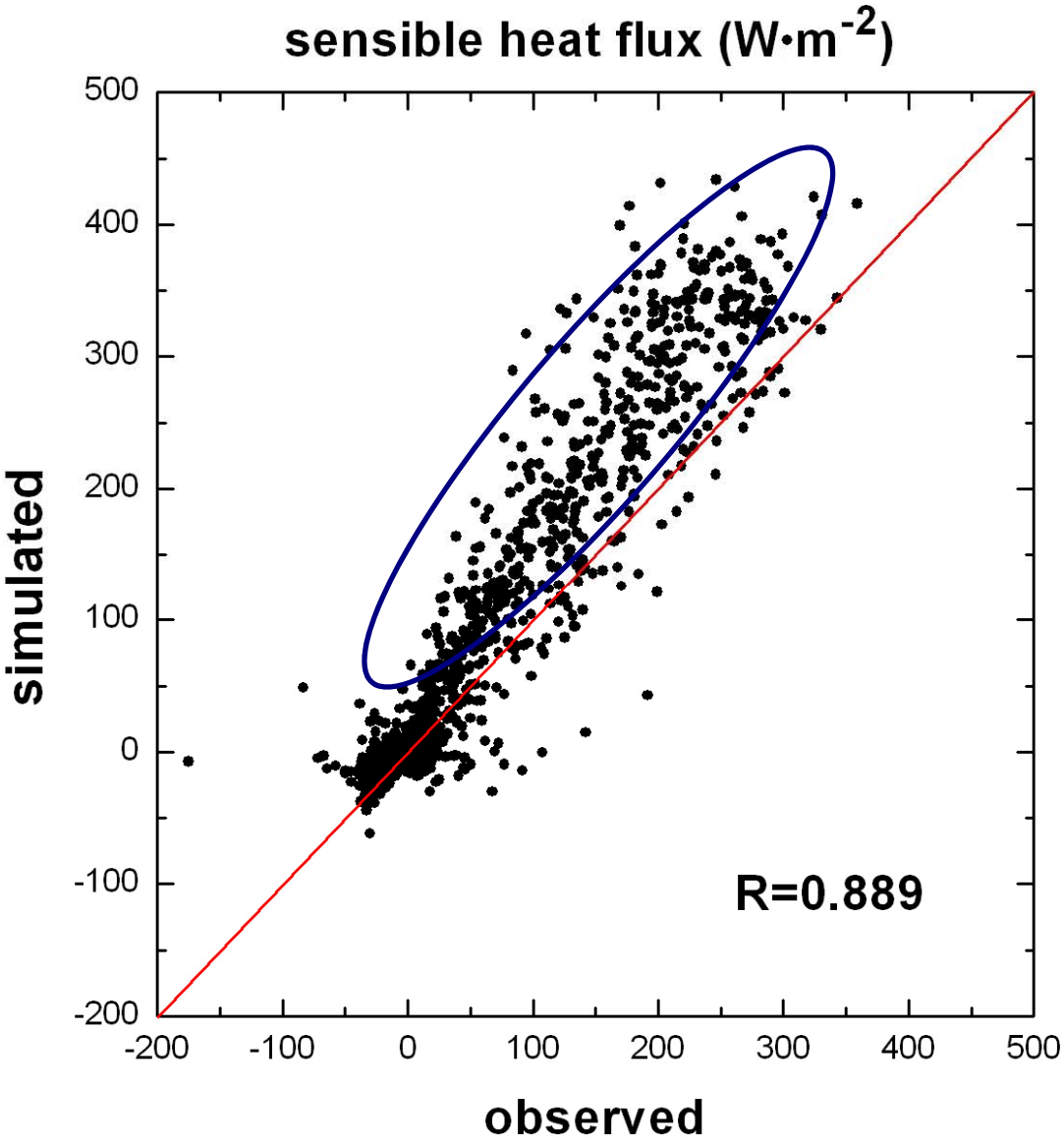


Structure of NCAR Community Land Model (NCAR/CLM3)

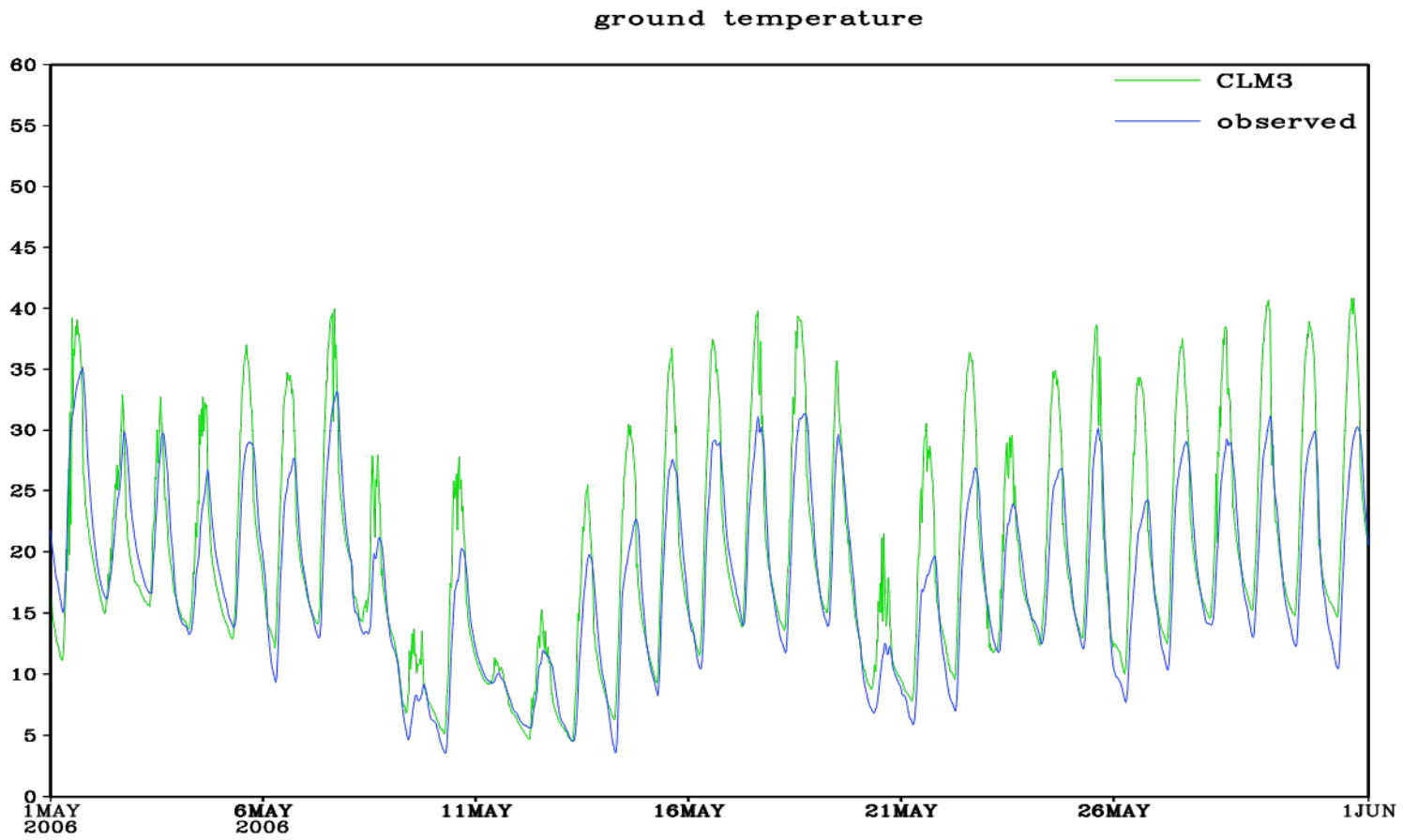
(*Bonan et al., 2002, 2004; Dickinson et al., 2005*)

- Soil texture type: **sandy loam**
- **Specified soil parameters** (Jason Beringer et al., *Journal of Climate*, 2001)

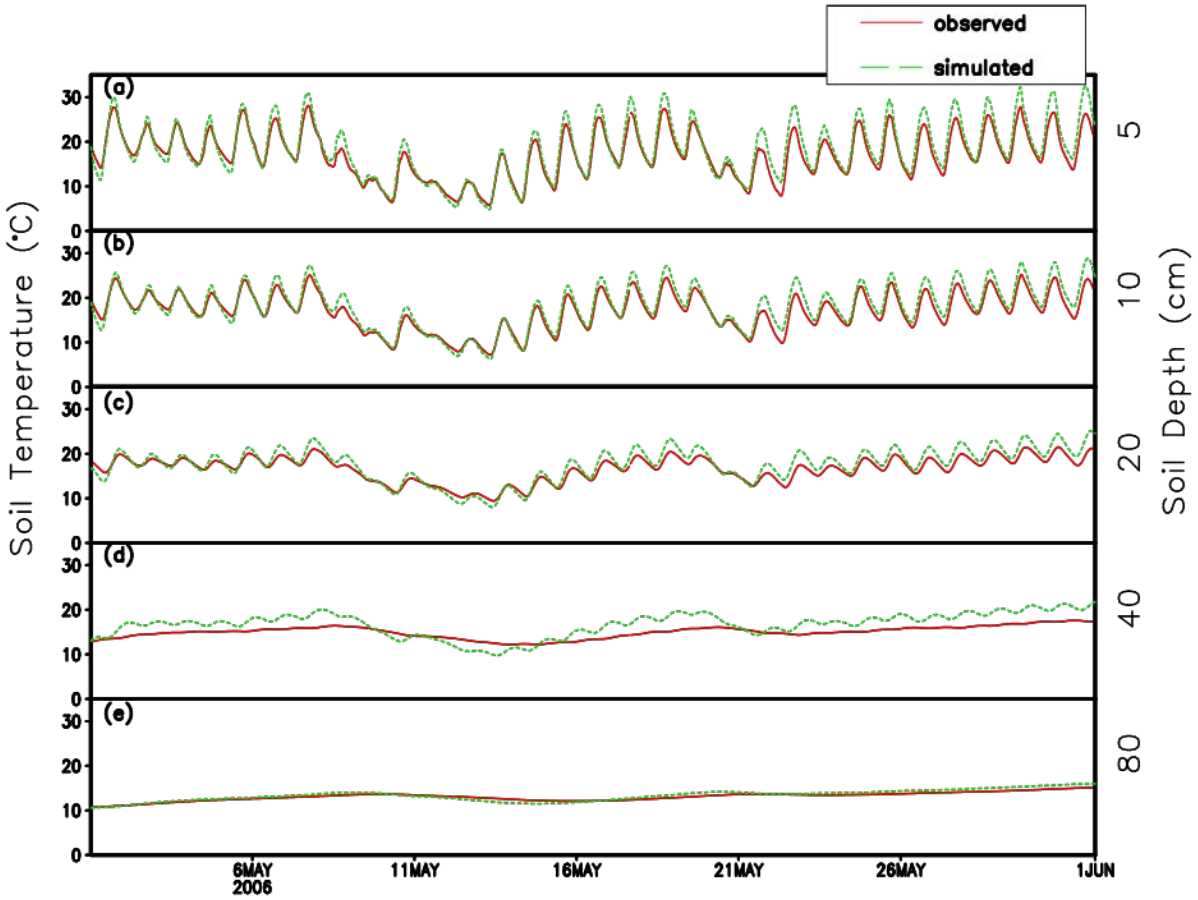
Soil porosity	0.4159
Saturation soil suction (m)	-0.131
Saturation conductivity (m s^{-1})	7.1×10^{-6}
Clapp and Hornberger parameter b	4.50
Roughness length (m)	0.01
Albedo	0.25


sensible heat flux (W·m-2)
simulated
observed
R=0.889
500
400
300
200
100
0
-100
-200
-200
-100
0
100
200
300
400
500

Ground temperature



Variation of soil temperature at all levels



(2) Simulation based on a thermal/hydraulic coupled model *(zhang and Sun,2004)*

Interactions between soil thermal and hydraulic processes

- Water vapor transport and phase change driven by the gradient of saturated water vapor pressure should result in the adjustments of water and energy balance among soil layers;
- Soil hydraulic/thermal conductivity and matric potential are the functions of soil temperature;
- ……

Currently, a bare Soil Model

- **Governing equations**

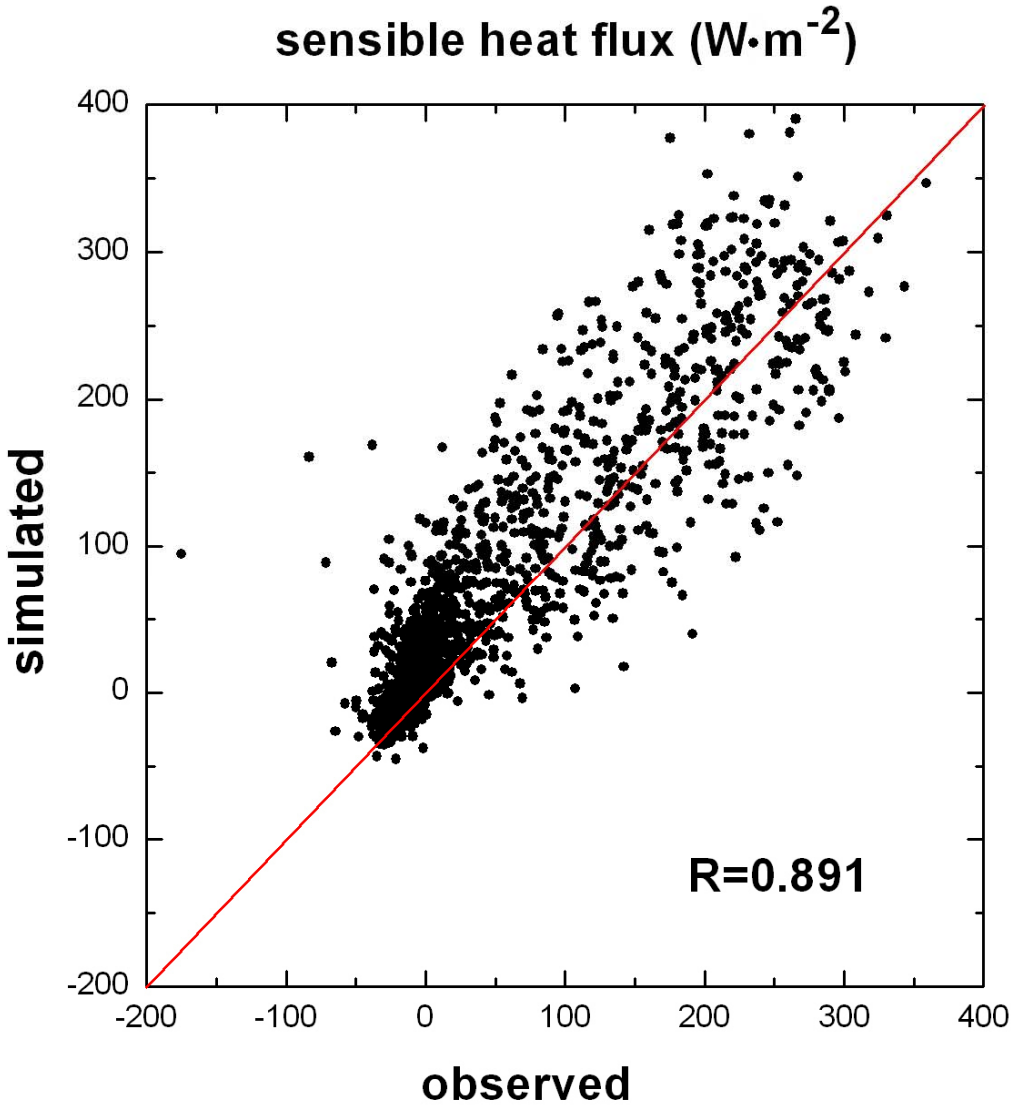
Water mass balance equation:

$$\rho_l \frac{\partial \theta_l}{\partial t} = -\rho_i \frac{\partial \theta_i}{\partial t} - \rho_l \frac{\partial}{\partial Z}\left(-k_l \frac{\partial \psi}{\partial Z} + k_l\right) + \frac{\partial}{\partial Z}\left(D_{TV} \frac{\partial T}{\partial Z} + D_{\psi V} \frac{\partial \psi}{\partial Z}\right)$$

Heat balance equation:

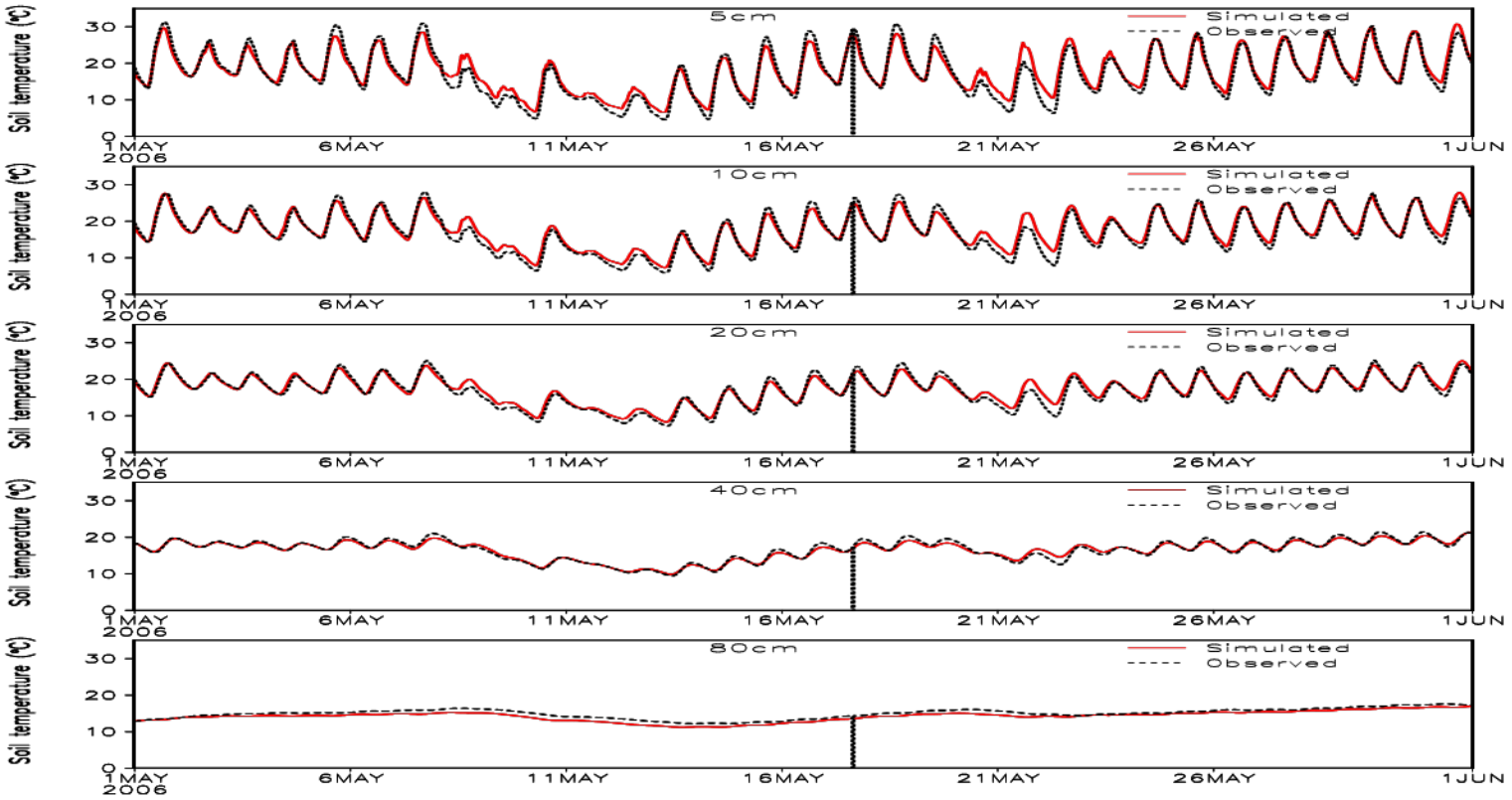
$$\frac{\partial}{\partial t}(C_t T) = \frac{\partial}{\partial Z}\left(\lambda \frac{\partial T}{\partial Z}\right) + L_{il} \rho_i . \frac{\partial \theta_i}{\partial t}$$

Not neglectable in case of a dry Soil in which the contribution of Water vapor accounts for the soil Water/energy balance.



Scatter map of sensible/latent heat fluxes (correlation coefficient exceeds the confidence level of 99%)

Comparison of simulated and observed soil temperature at all levels



Model inter-comparison with the observations

	Hs_ave (W/m^2)	Hs_bias (W/m^2)	Tg_ave (℃)	Tg_bias (℃)	Ts_40cm_ave (℃)	Ts_40cm_bias (℃)
NCAR CLM3	78.1	25.5	19.2	1.4	16.7	1.7
Coupled model	74.3	21.7	18.7	1.0	16.5	1.5
Observation	52.5		17.7		14.9	

Better performances are found in soil thermal/hydraulic coupled model by comparing its output with the observations. The simulation of the coupled model is relatively satisfactory in this study in that not only its average values are closer to the observation, but also its simulation biases are lower than those of its counterpart.

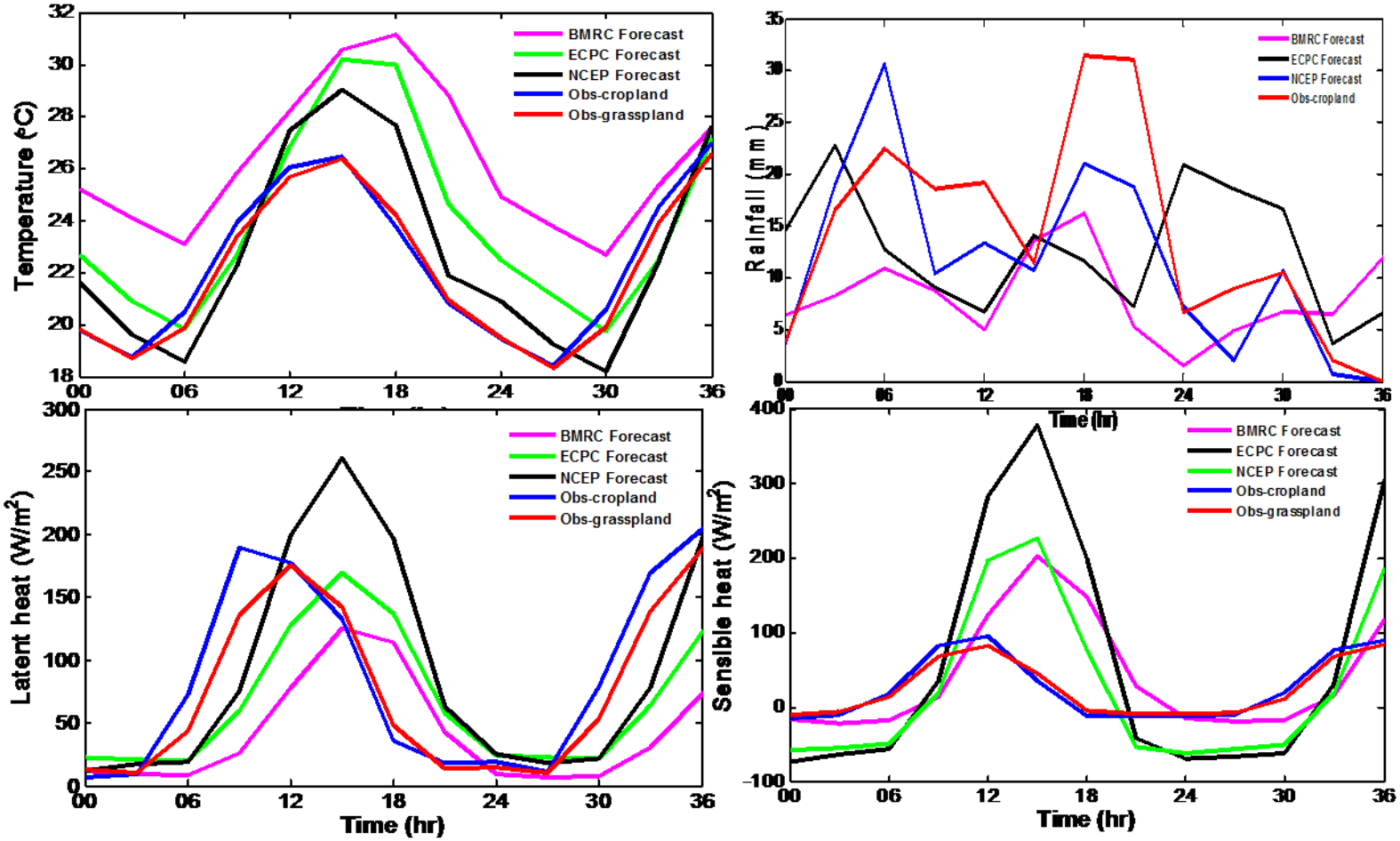
- Verification and Intercomparison of NWP Global Models against CEOP Reference Site Data at Tongyu

MOLTS from three global models

INSTITUTION	Model Name	Model Resolution	LSM	BC at the Surface
BMRC	OGMRPM	T239L29		3 layers bucket hydrology
ECPC	S FM	T62L28	OSU2	16 soil types 12 vegetation classes
NCEP	GFS	T254L64	SiB	9 soil types 13 vegetation classes

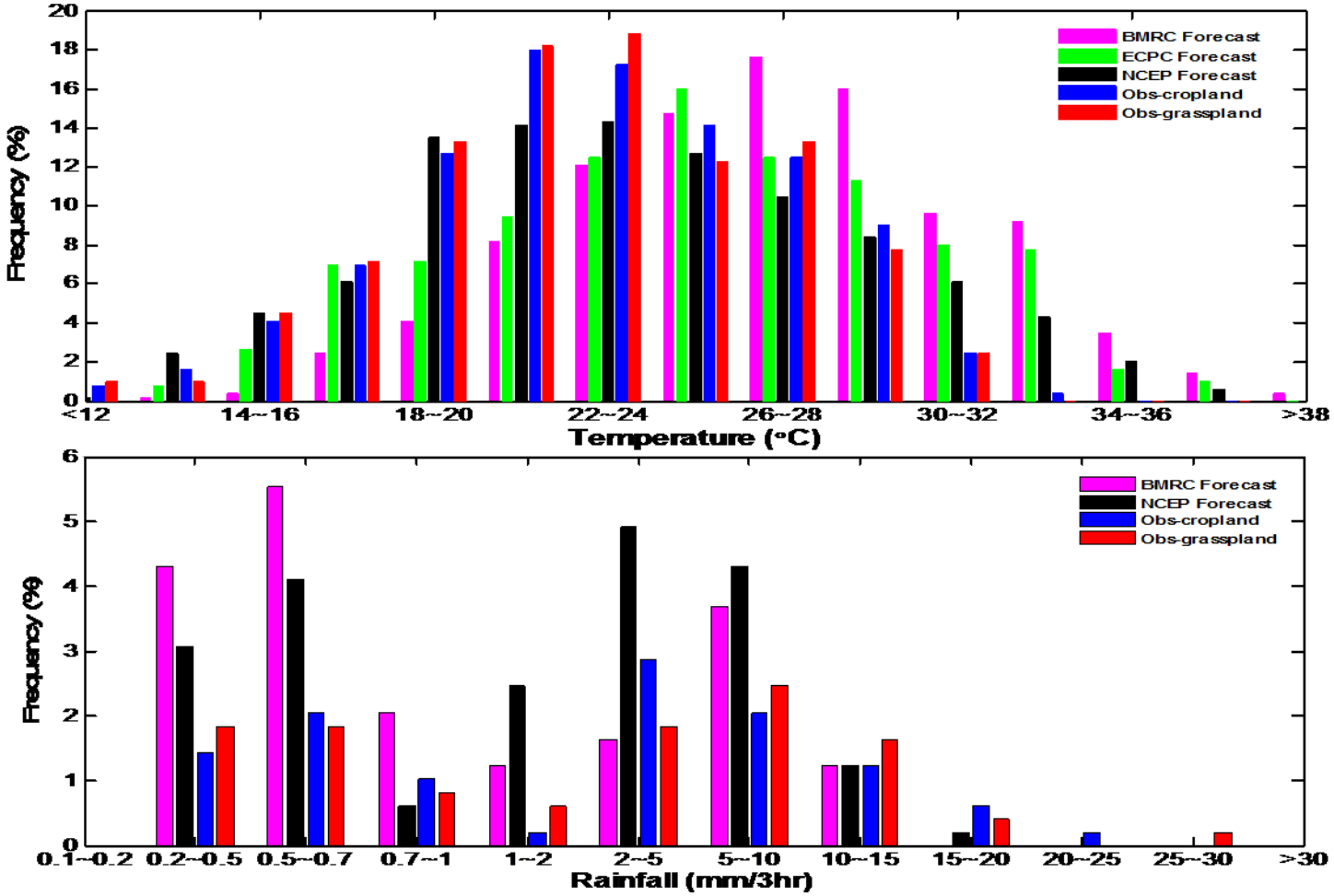
The period investigated is July 2 to Sep 2, 2003.

Diurnal Cycles



Diurnal cycle of temperature, precipitation, and latent/sensible heat fluxes from the NWP models output and the observations.

Frequency Distribution Characteristics



Distribution frequency of the temperature and precipitation from the NWP models output and the observations.

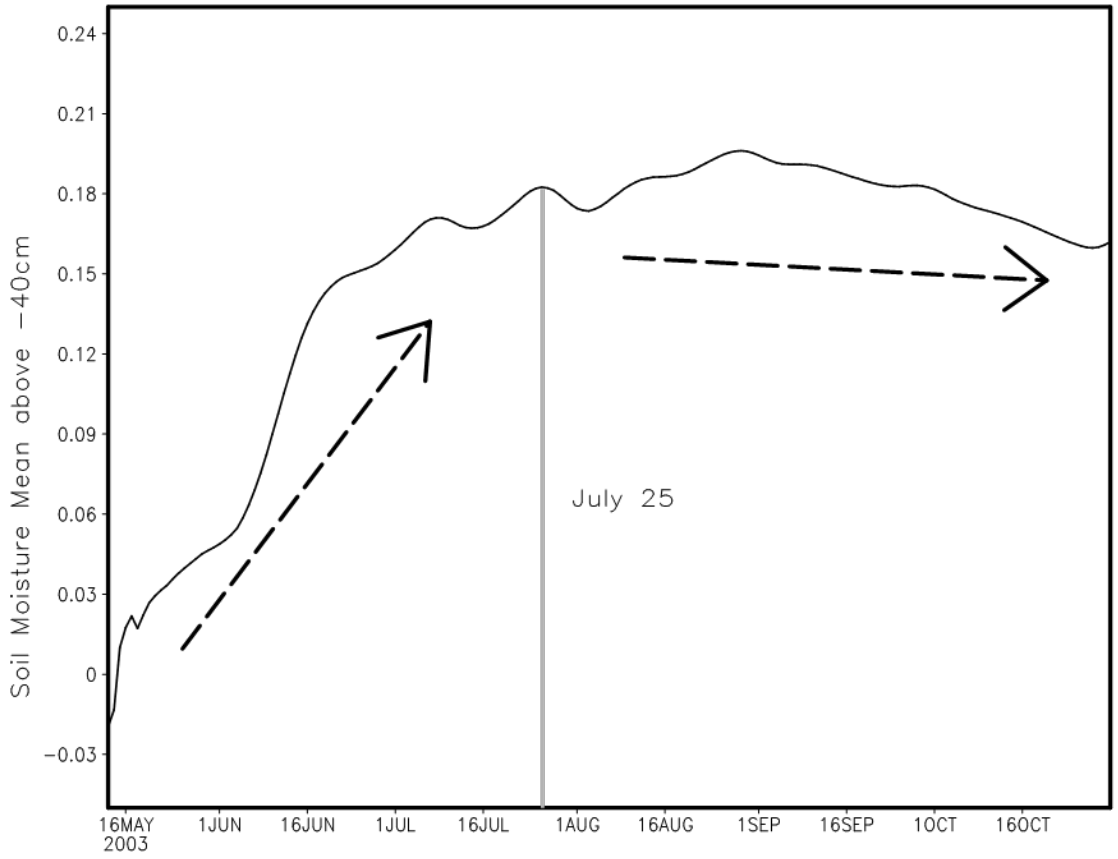
- **Impacts of Soil Moisture on the Diurnal and Seasonal Cycles of Sensible/Latent Heat Fluxes over Semi-arid Region**

Experiment Design

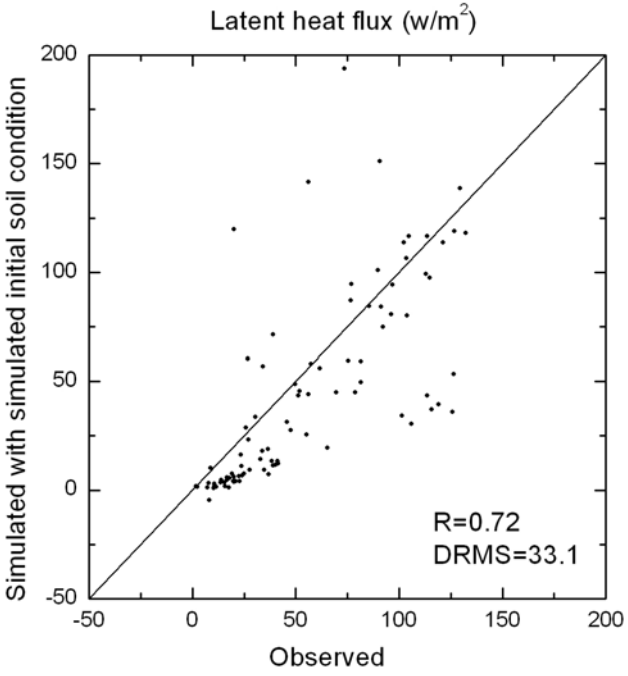
Two sets of experiments were conducted:

- In control run, the simulation integrates from May 13, 2003 to Oct 31, 2003 continuously, using observed soil moisture and temperature in May 13, 2003 as soil initial conditions.
- In the contrast run, the experiment design remain unchanged, but a restart is conducted on Jul 25, simply with observed soil moisture as updated “initial values”.

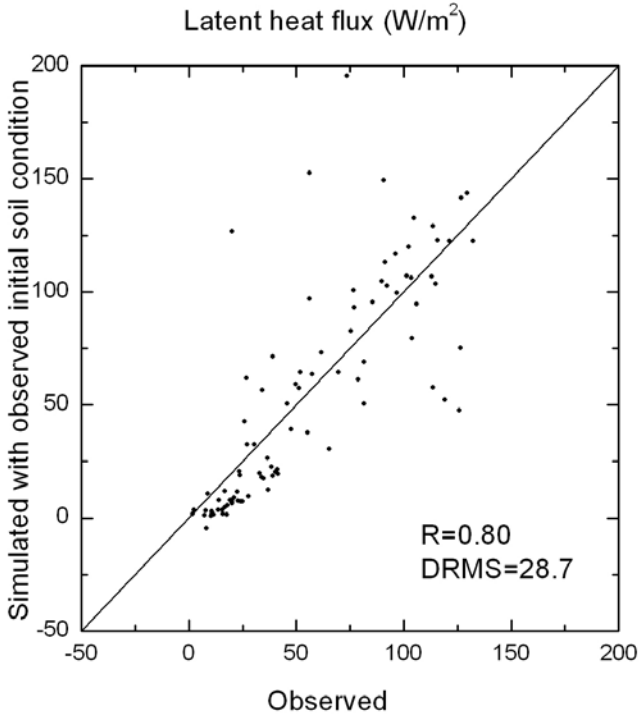
The difference between the observed and simulated soil moisture averaged from 0 to 40 cm in control run from May 13th to October 31st, 2003.



Scatter map of observed and simulated daily average latent heat flux from Aug.1st to October.31st, 2003



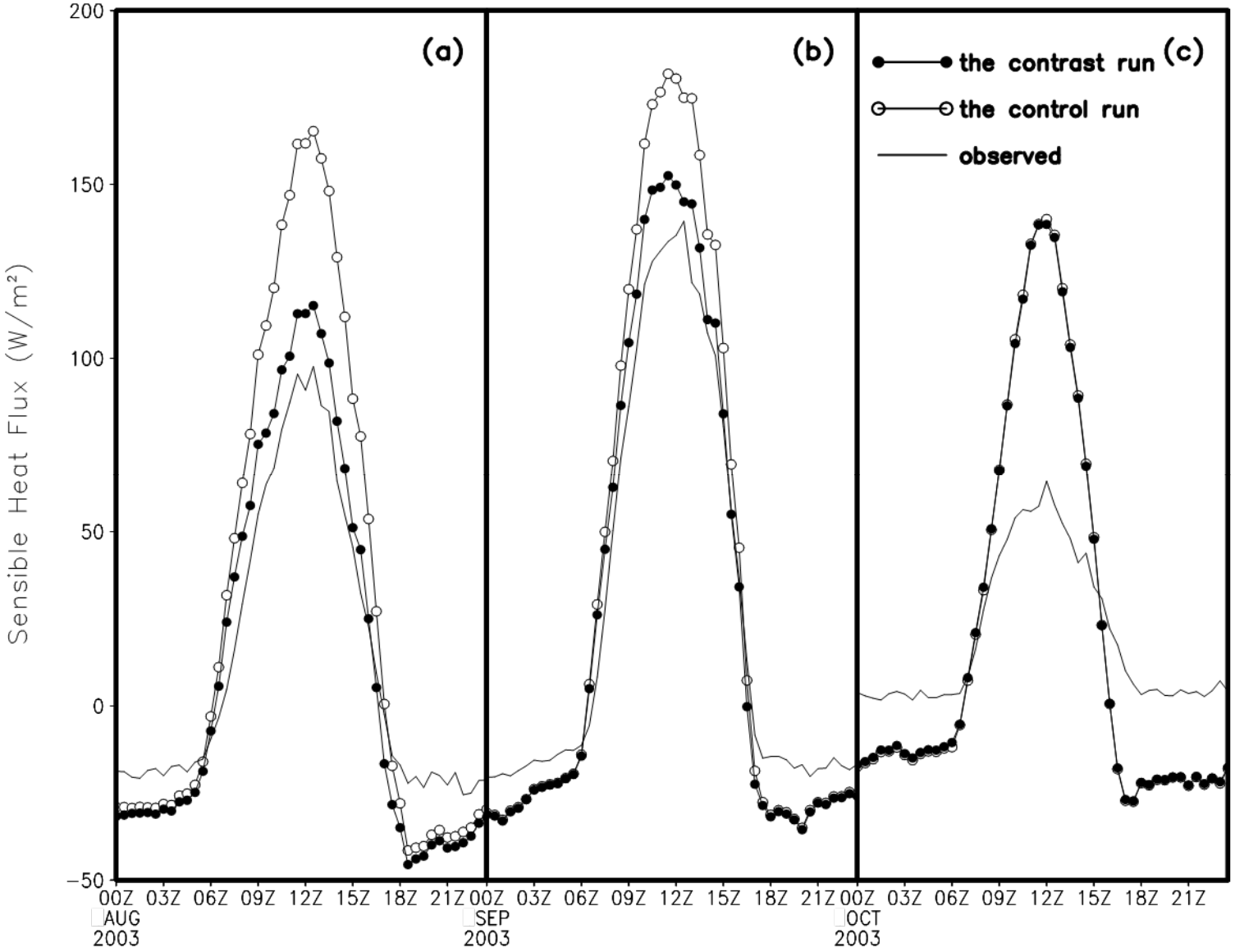
(a) for control run;

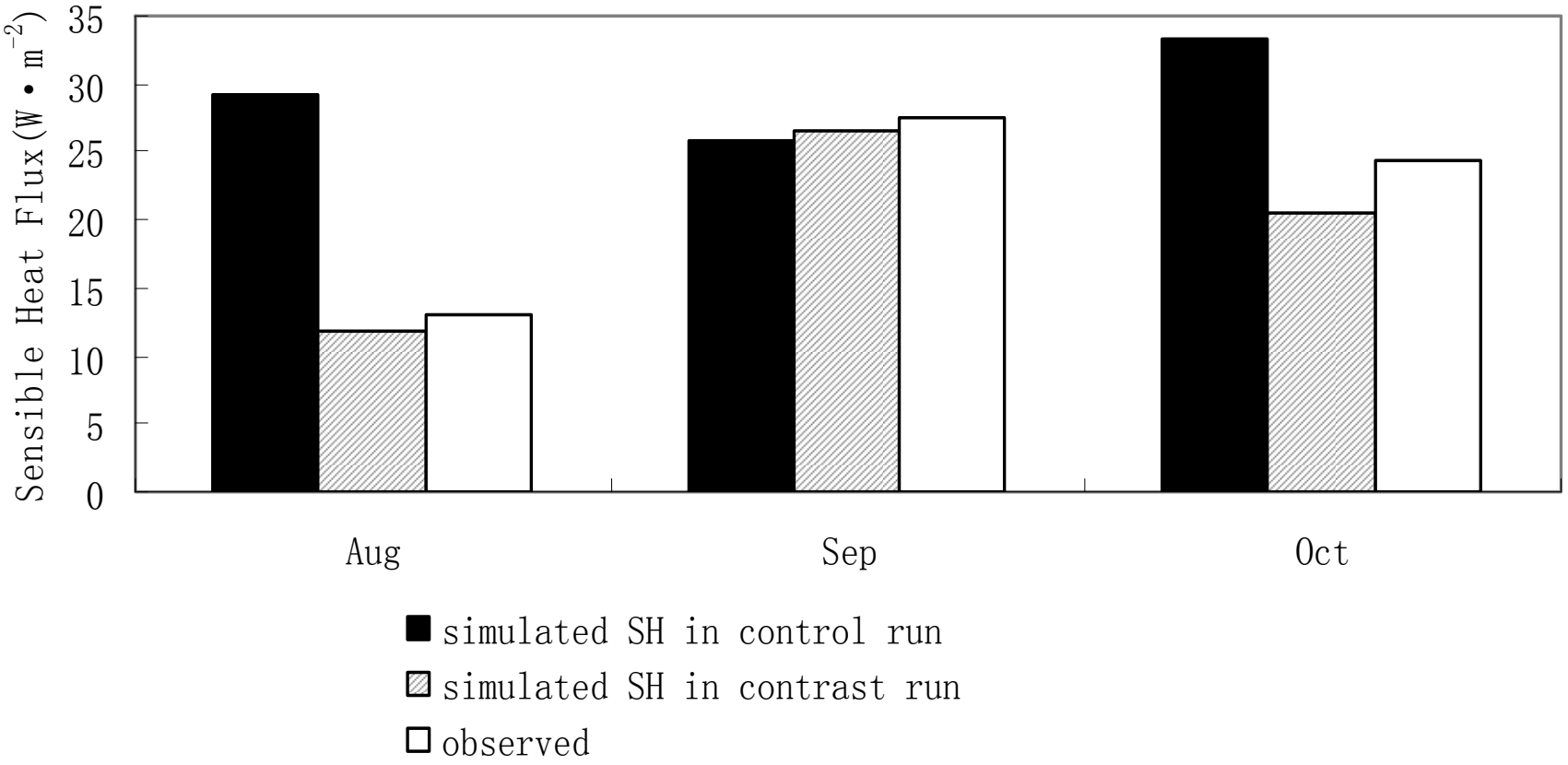


(b) for contrast run.

Diurnal cycles of HS of the observation and simulations in two experiments

(a) in August, (b) in September, (c) in October.





Seasonal evolution of the observed and simulated HS in August, September and October, 2003.

The Parameter Sensitivity and Optimization experiments of a Land Surface Model (CoLM) in Semi-arid China

Background

The land surface has complex properties, to which the climate is very sensitive.

- However, some parameterization schemes and corresponding parameters in the existing land surface models are not suitable for all the land surface patterns.
- If more suitable parameters are adopted by observations or by other ways, it can be anticipated that regional climate simulations will be improved.

Research Contents

- By the sensitivity experiments, it is studied that the sensitivity of different land surface parameters to land-atmosphere interaction and the interaction among the parameters.

- By the parameter optimization experiments, the relative appropriate ranges of land surface parameters can be gotten, and to investigate the characteristic of the land surface on different climatic conditions and underlying surface patterns.

Methods

Model：CoLM（Common Land Model）

Data： enhanced long term observations

- **The sensitivity experiments of the parameters：**

  Method: MOGSA（Bastidas et al.,1999）

  Sites: Tongyu degraded grassland site，

  Xilingol grassland site

- **The optimization experiments of the parameters：**

  Methods: MOCOM-UA（Yapo et al.,1997）

  Site: Tongyu degraded grassland site

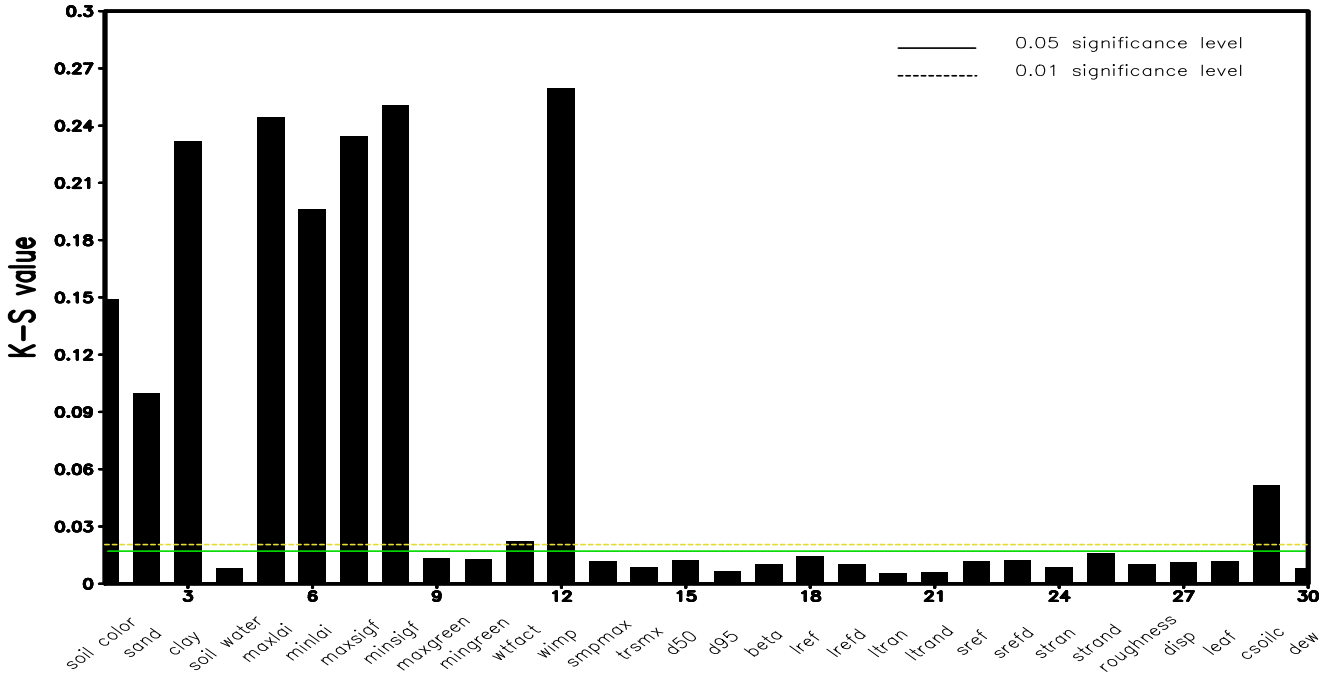
Problems

- Due to the observation, the simulation time is too short.
- the incomplete observation and the quality of data
- how to define simulation performance
- the representativeness of the selected sites
- the influence of the parameterization schemes

The sensitivity experiments at TongYu degraded grassland site

experiment times: 25200

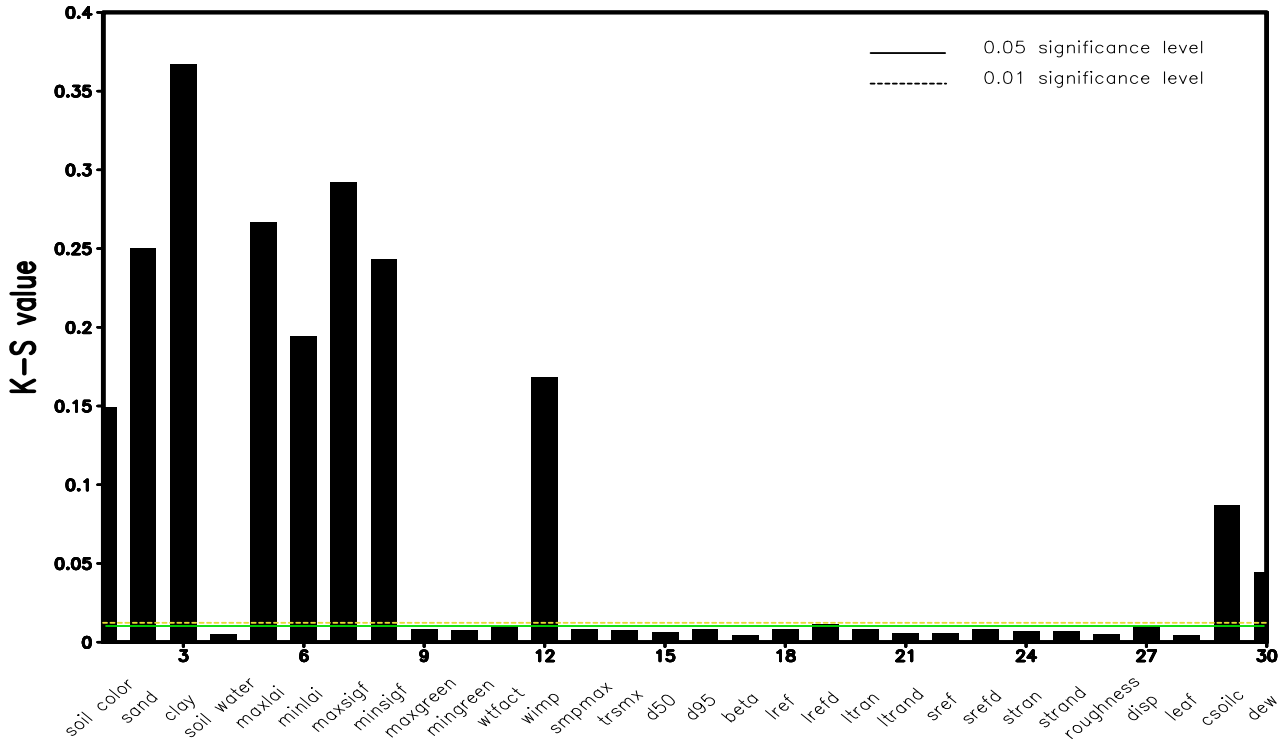
- **sensitive parameters：** soil color, soil sand and clay content, leaf area index, vegetation fraction, the drag coefficient for soil under canopy, water-impermeable soil porosity.



The sensitivity experiments at Xilingol grassland site

experiment times: 69900

- **senstivitive parameters：** soil color, soil sand and clay content, leaf area index, vegetation fraction, water-impermeable soil porosity, maximum allowed water on canopy.



The sensitivity experiments at TongYu degraded grassland site and Xilingol grassland site

- **The interaction among the parameters:**

Soil color has the more important effect on other parameters.

There are also the interactions among other parameters, for example, drag coefficient for soil under canopy is influenced by leaf area index, vegetation fraction, and water-impermeable soil porosity is influenced by soil sand and clay content.

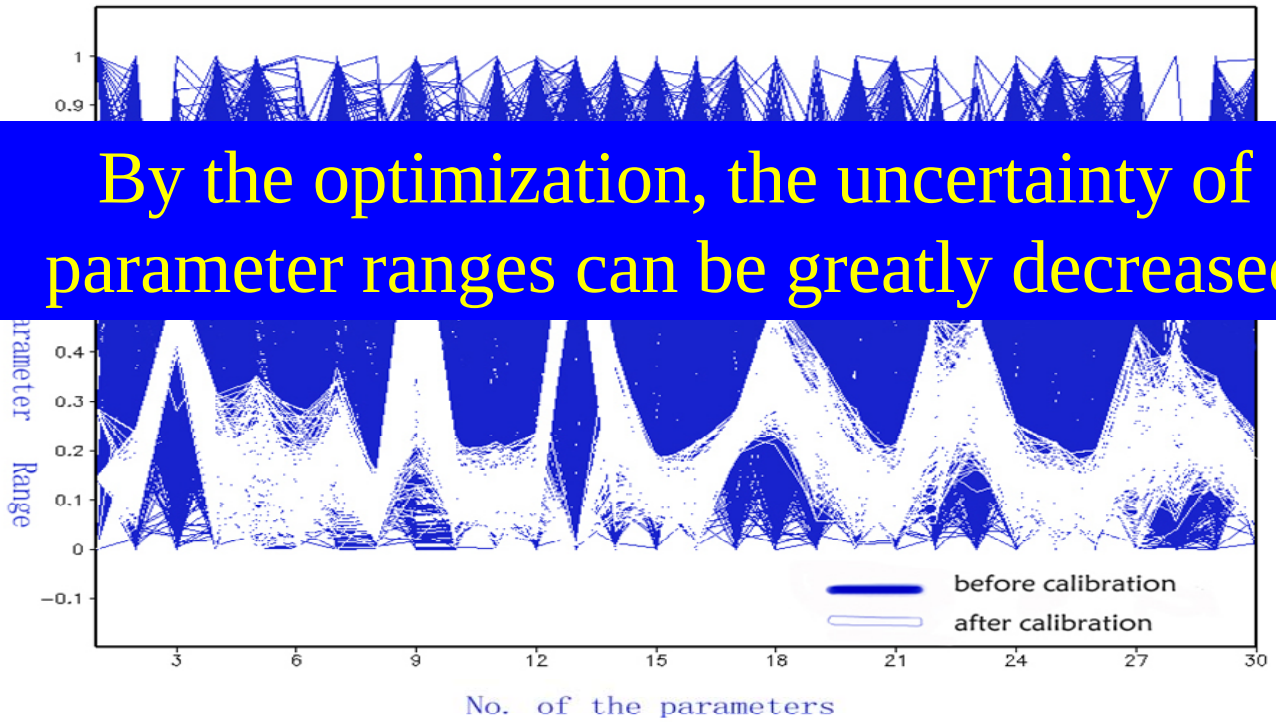
The optimization experiments at TongYu degraded grassland site (1)

Parameter sets: 500

Experiment times:22065

Optimization times:4413

Between pre and post optimization, the comparison of the ranges of 500 parameter sets

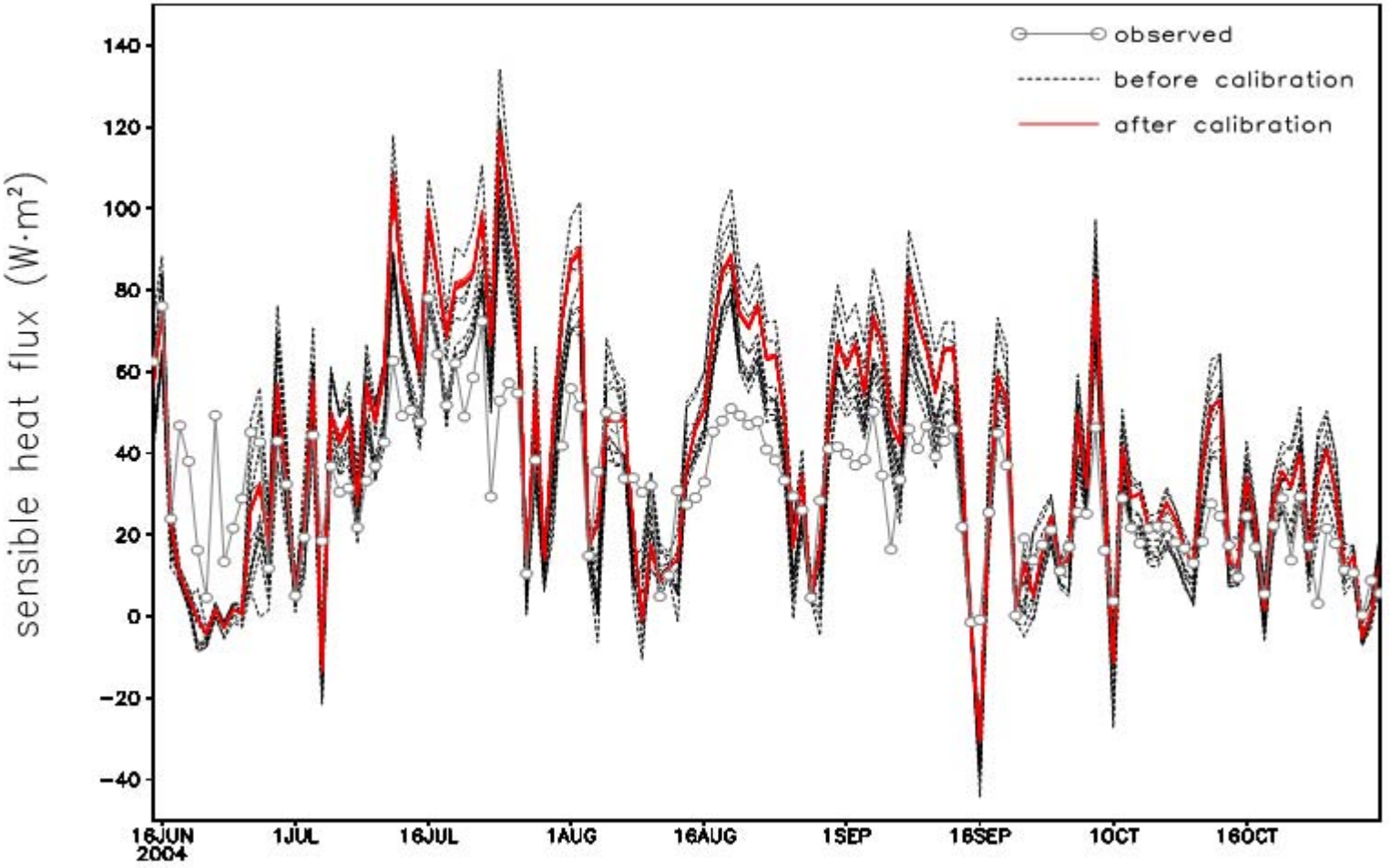


Comparison of simulation performance using 10 best parameter sets from pre and post optimized 500 parameter sets

By optimization experiments, the more appropriate ranges of parameters can be gotten to decrease the errors from parameter values to some extent.

The simulation errors, which can’t be removed by the parameter optimization, are from the parameterization schemes in a great degree.

sensible heat flux:

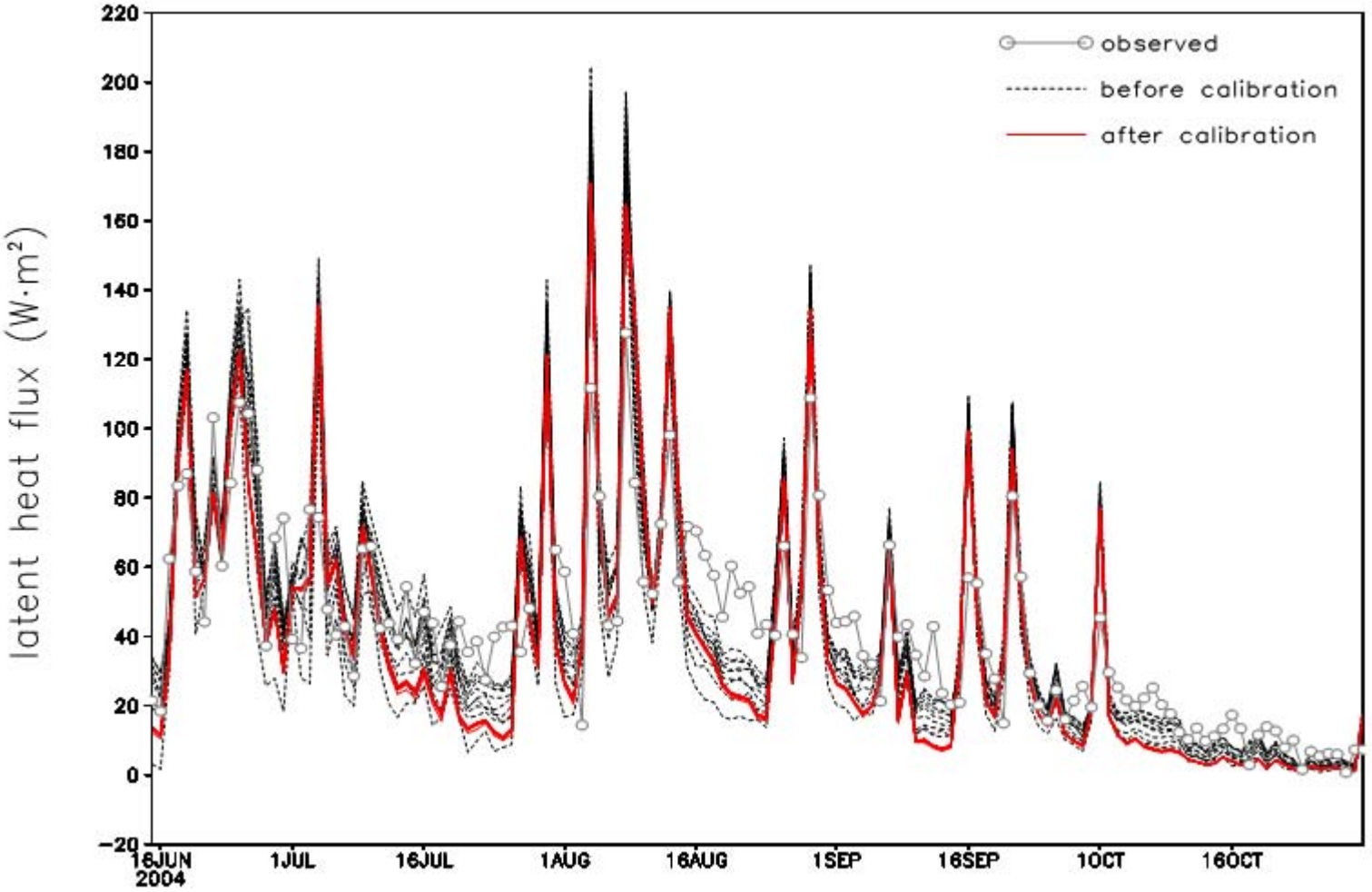


cc=0.56 (before parameter optimization)

=0.69 (after …)

cc: correlation coefficient (simulated Vs obs.)

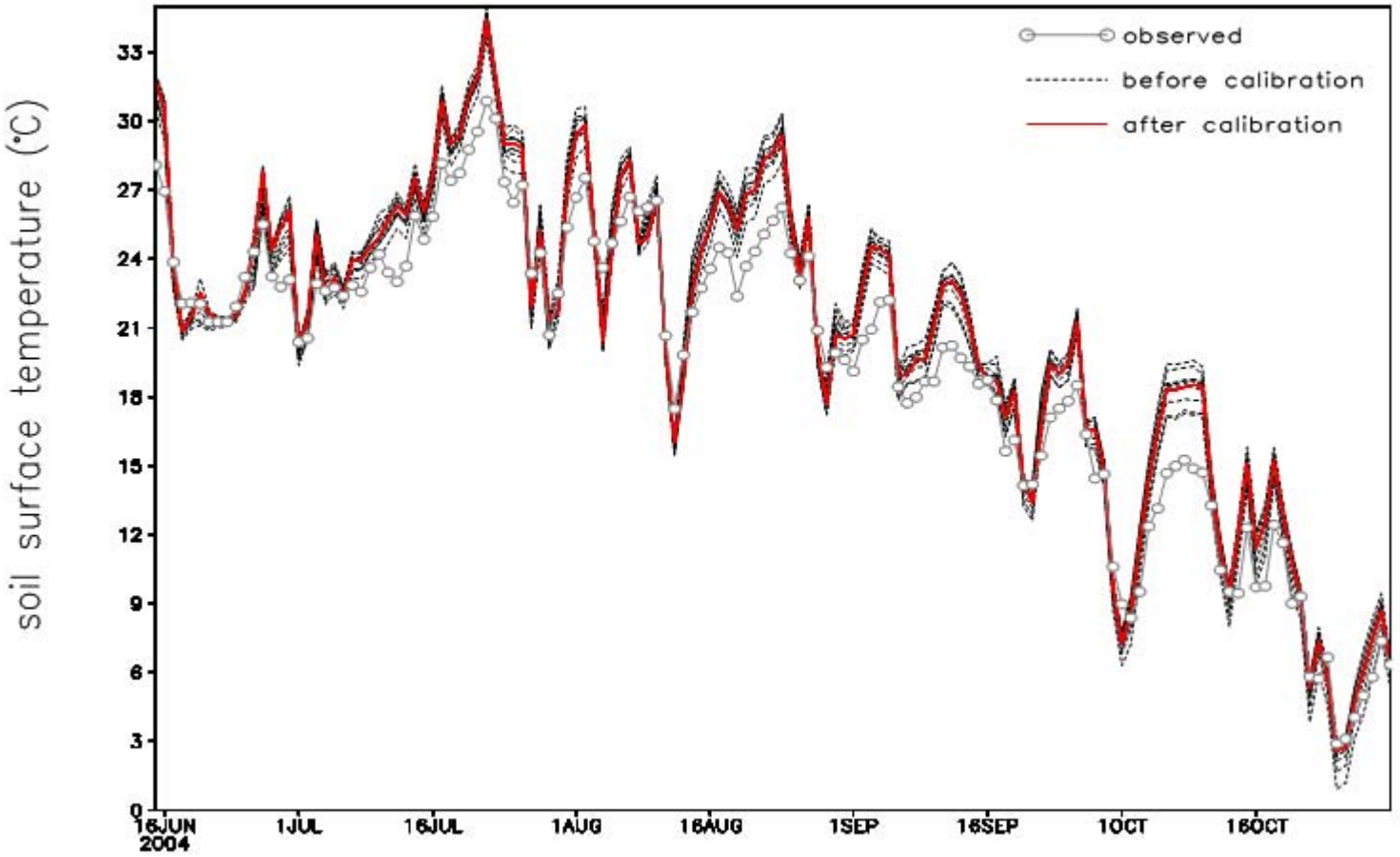
latent heat flux:



cc=0.74 (before parameter optimization)

=0.83 (after …)

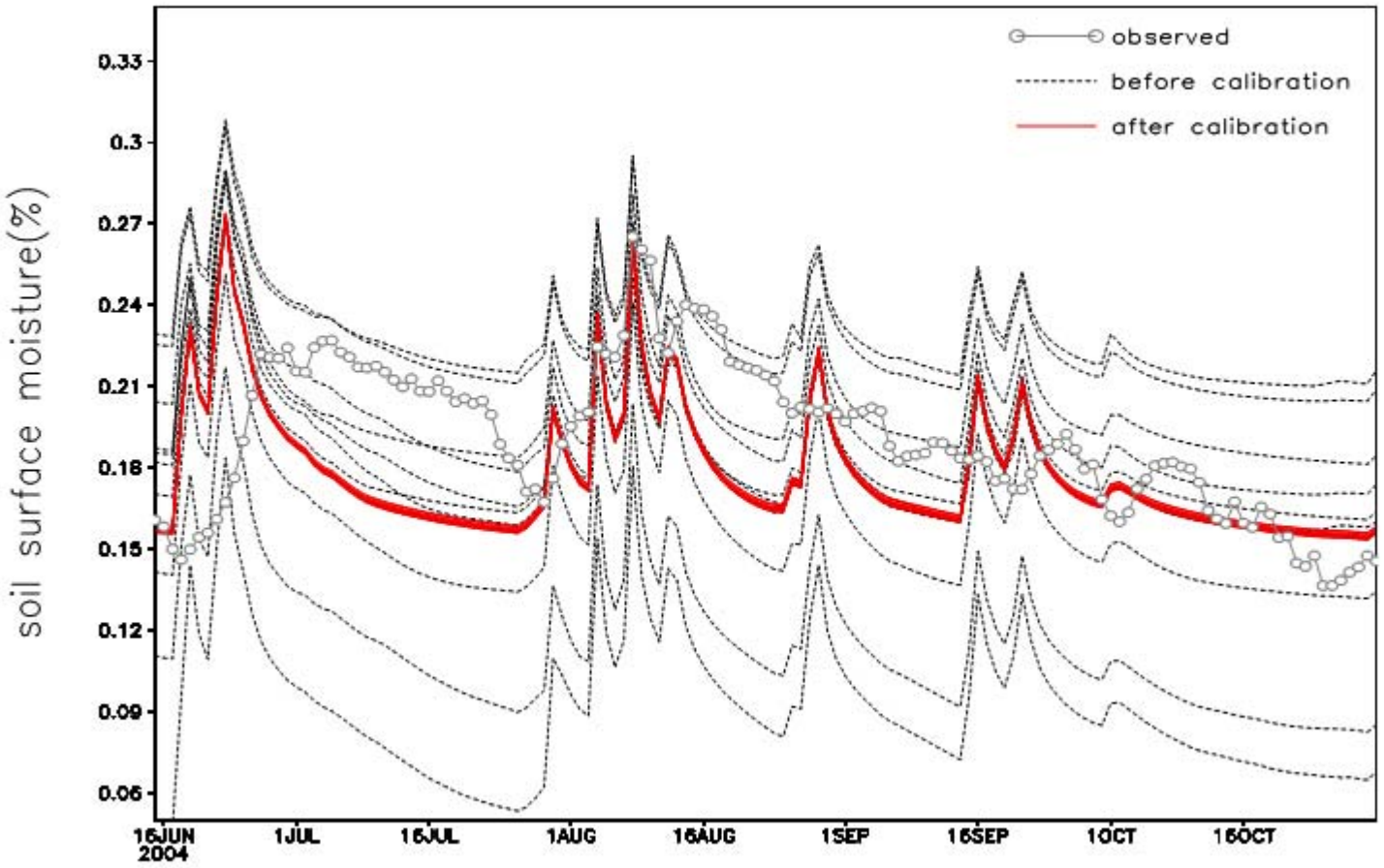
soil surface temperature:



cc=0.96 (before parameter optimization)

=0.96 (after …)

soil surface moisture:



cc=0.09 (before parameter optimization)

=0.33 (after …)

To acquire a set of optimized parameters for land surface model over different underlying surfaces in semi-arid region by taking advantage of the coordinated observations, and further improve the performance of the regional model by coupling it with the optimized land surface model …

Contributions to the CEOP objectives

- Produce consistent research quality data sets for use in climate system analysis and model development and evaluation;
- Understanding and quantify the contributions of water and energy cycle in climate feedback.

Contributions to GEWEX Roadmap

- Improve predictive capability for key water and energy variables through improved parameterization of hydro-meteorological processes;
- Determine geographical and seasonal characteristics of predictability of climate;
- Undertake joint activities with operational services, related ESSP projects, and to demonstrate the value of researches.

Next 1 – 3 yeas foreseen activities

To expand its collaboration with RHPs at global scale. Meanwhile, data exchange and availability under the framework of CEOP is in urgent need, validation of land surface models and RCMs, development of a land surface model for semi-arid region, with particularly a new scheme of eco-hydrological process, and impacts of dust aerosols on radiation, cloud micro-physics and hydrological process as well as the regional climate.

Coordination and collaborative connections with the Pan-WCRP Foci-Monsoons

- semi-arid region is located in the transitional zone of moist monsoon climate and arid continental climate and very sensitive to monsoon variability.
- At the same time, these are regions where land use change occurs most frequently. One of the most important objective for CEOP/SRS is to understand the water cycle and energy cycle processes over different land use/cover type in semi-arid region and their role in the climate system, in order to improve the predictability of changes in monsoon climate and water resources in these region.

Coordination and collaborative connections with the Pan-WCRP Foci-Extremes

- Current research has indicated that the most dramatic changes in severe aridity trend have not occured in the typical arid regions, but in semi-arid regions. The semi-arid region could be selected as the ideal place to carry out the studies of the characteristics of extreme droughs and its formation mechanism.


Thank you