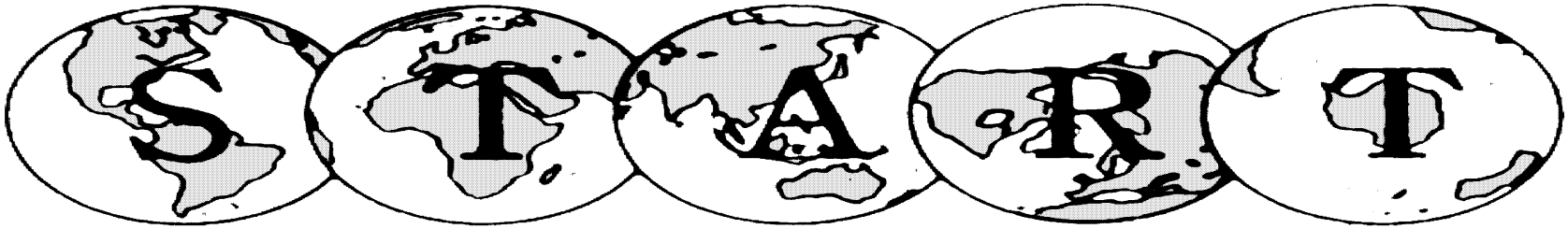


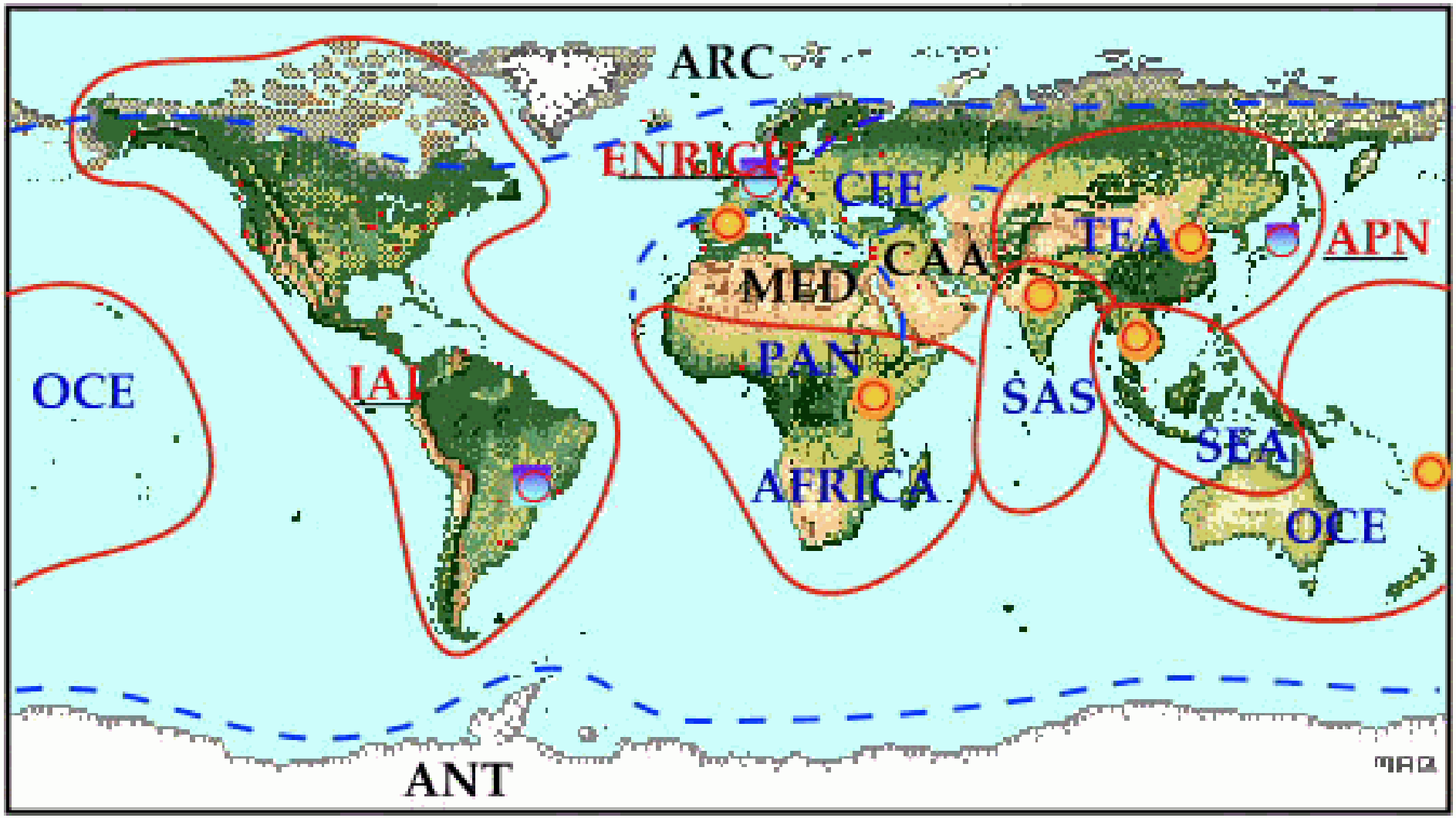
START ACTIVITIES IN ASIA RELATED TO AGENDAS OF CEOP AND IGWCO

Fu, Congbin

START Regional Center for TEA

Chinese Academy of Sciences

Global Change SysTem for Analysis,Research and Training (START) REGIONAL NETWORKS for IGBP,WCRP,IHDP and Diversitas



MISSION OF START

Regional implementation of global change research and related capacity building, including:

1. **Global Change Research at the Regional level;**
2. **Support for Policy Formulation, including assessment;**
3. **Capacity building for human resource development**
4. **Institution and Network Development**

Over 70 ongoing regional research projects on themes of

- **Land Use Change and its Impacts on terrestrial Ecosystems;**
- **Regional Climate Variability and Change;**
- **Regional Changes in Atmosphere and Hydrosphere;**
- **Coastal Zones;**
- **Assessments`of Impacts of and Adaptations to Climate Change.**

START CAPACITY BUILDING PROGRAM

- **START Fellowships;**
- **African Doctorial Dissertation Fellowship;**
- **START Young Scientist Award;**
- **Advanced Institutions on Global Change Topics with follow-on research projects of 12-18 month.**

i.e. **Climate variability,food and water security,2002**
Urbanization,emission and global carbon cycle,2003;
Assessment of vulnerability to global change,2004;
Global change and water system is under planning by START, GWSP, IHE/UNESCO.

Projects related to Agendas of CEOP and IGWCO

- The SOUTHEAST ASIA BASINS PROJECT (SEABASINS)
- VULNERABILITIES AND COPING MECHANISMS WATER RESOURCES IN SOUTH ASIA: AN ASSESSMENT OF CLIMATE CHANGE ASSOCIATED
- AFRICA GOUNDWATER INITIATIVE
- STUDY OF ARIDIFICATION IN NORTHERN CHINA

Projects related to Agendas of CEOP and IGWCO

- Regional Model Inter-comparison for Asia(RMIP);
- CEOP in semi-arid Asia.
- Monsoon Asia Integrated Regional Study (MAIRS);

The Southeast Asia Basins Project (SEABASINS)

Building a multi-scale integrated regional model of changes in water resources of Southeast Asia as a function of land use/cover change and regional climate change over river basins

GEF

UNOPS

START

SARCS

WATER RESOURCES IN SOUTH ASIA: AN ASSESSMENT OF CLIMATE CHANGE ASSOCIATED VULNERABILITIES AND COPING MECHANISMS

APN

USGCRP

START

SACOM

1. To assess the impacts of climate change and associated vulnerabilities related to the shared water resources of the Indus, Ganges and Maghna River Basins;
2. To analyze recent experience in climate variability and extreme events, and their impacts on regional water resources;
3. To determine the vulnerability of regional water resources to climate change, identify key risks to each sub-region, and prioritize adaptation responses;

AFRICA GOUNDWATER INITIATIVE

START

GWSP

PACOM

To develop a user-friendly framework for determining groundwater recharge in Southern Africa for region-wide application in groundwater management

Study of Aridification in Northern China

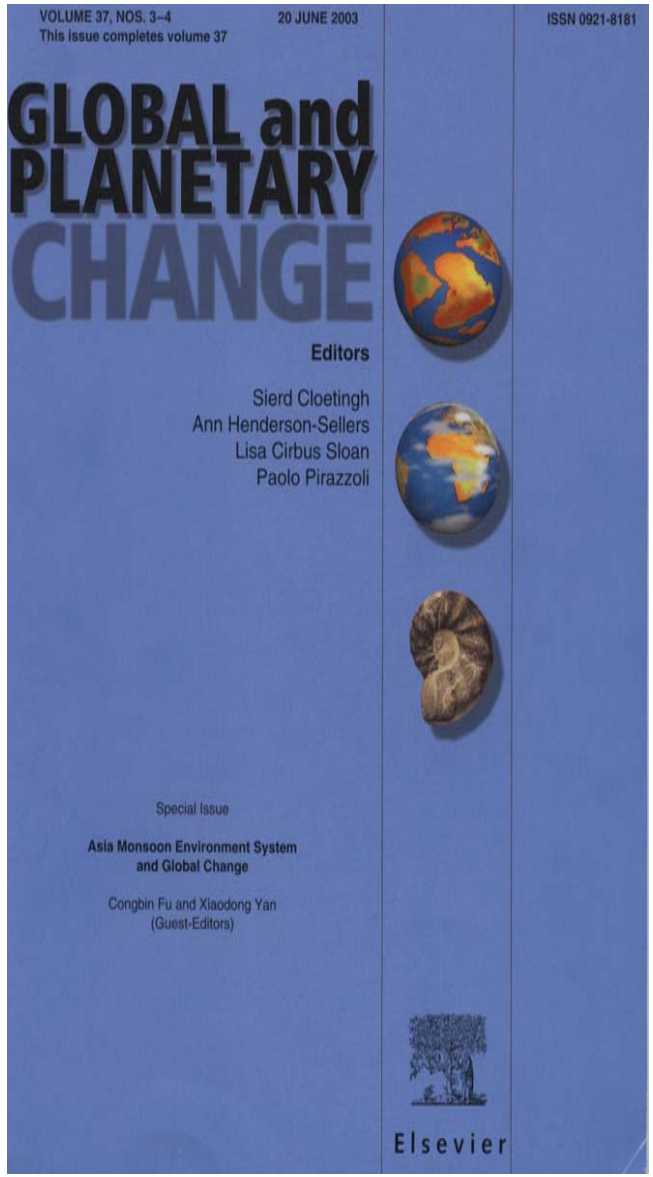
CAS

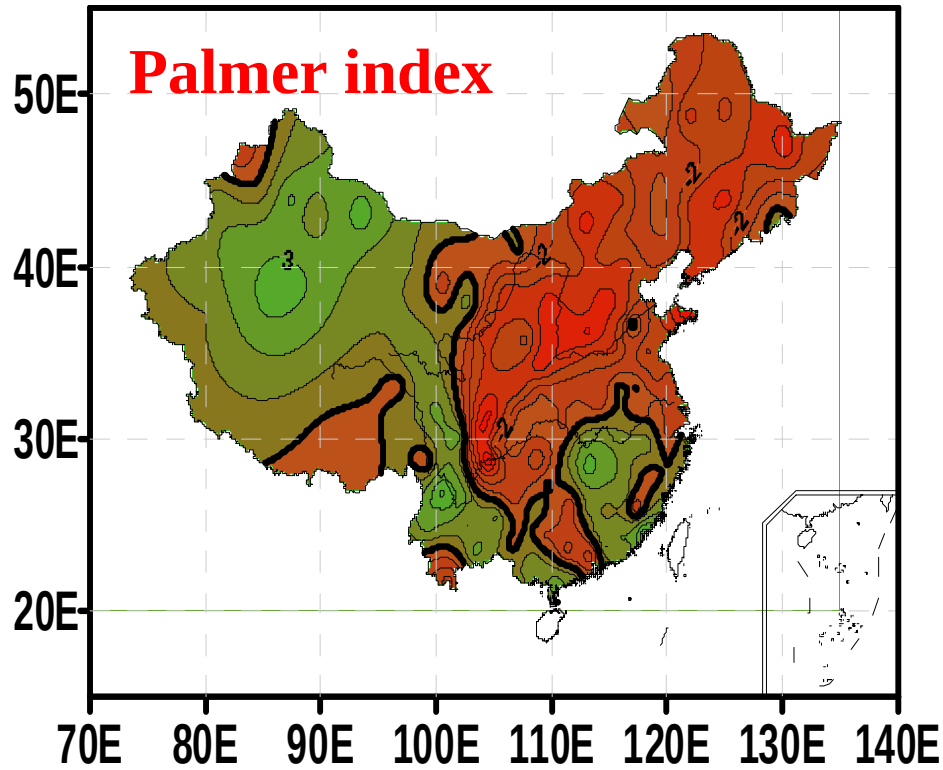
MOST, China

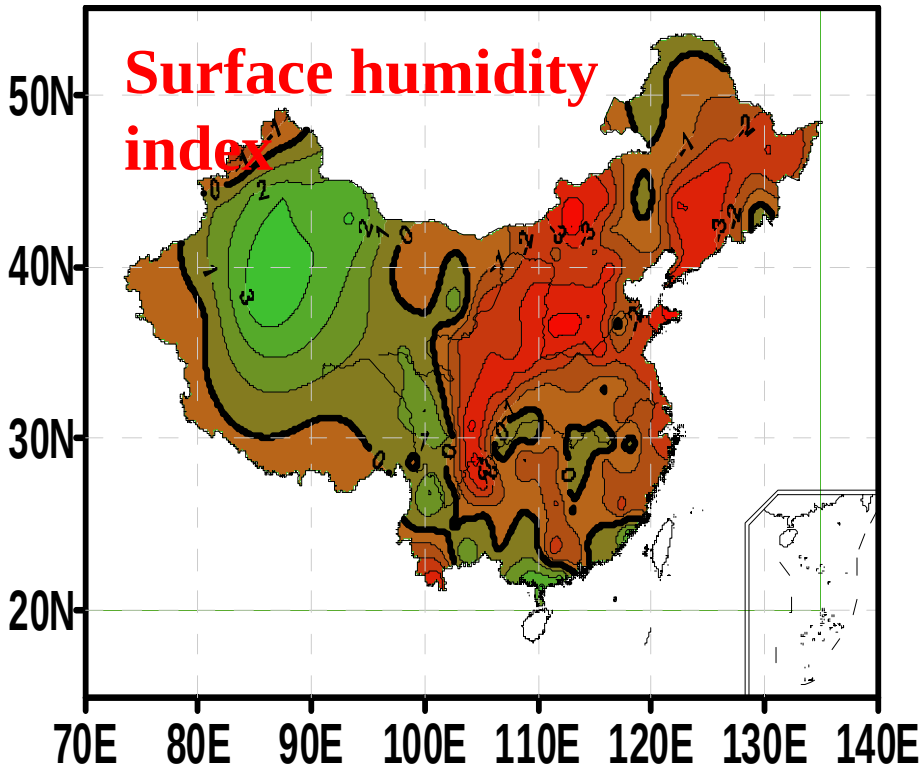
- **Predictive understanding the regulation of drying trend and their mechanism;**
- **Assess impacts on regional water resources and agriculture development;**
- **Development of scientific base for adaptation.**

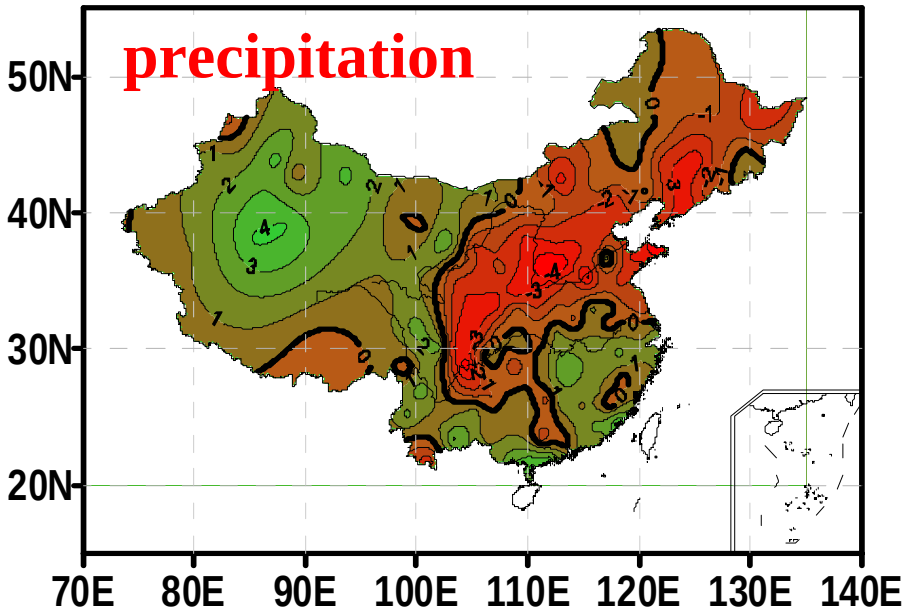
This 5-year project was accomplished and received high rank in the national review process, with products of 6 monographs, more than 200 papers in SCI or EI citations.

It is now under the review process to renew for another 5 years.

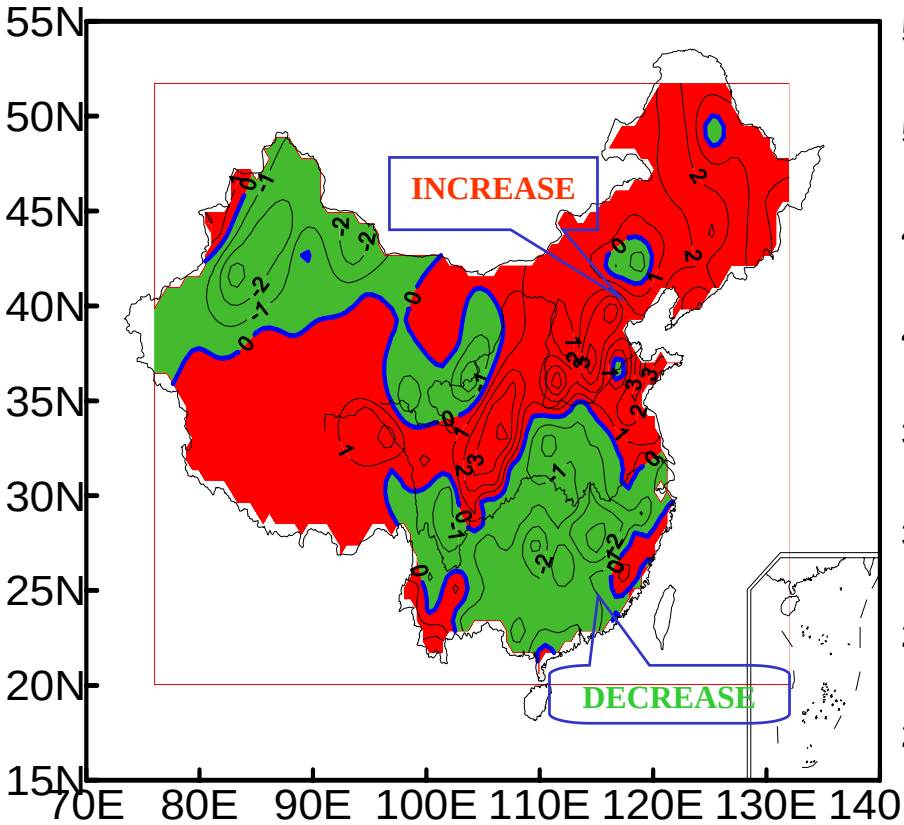


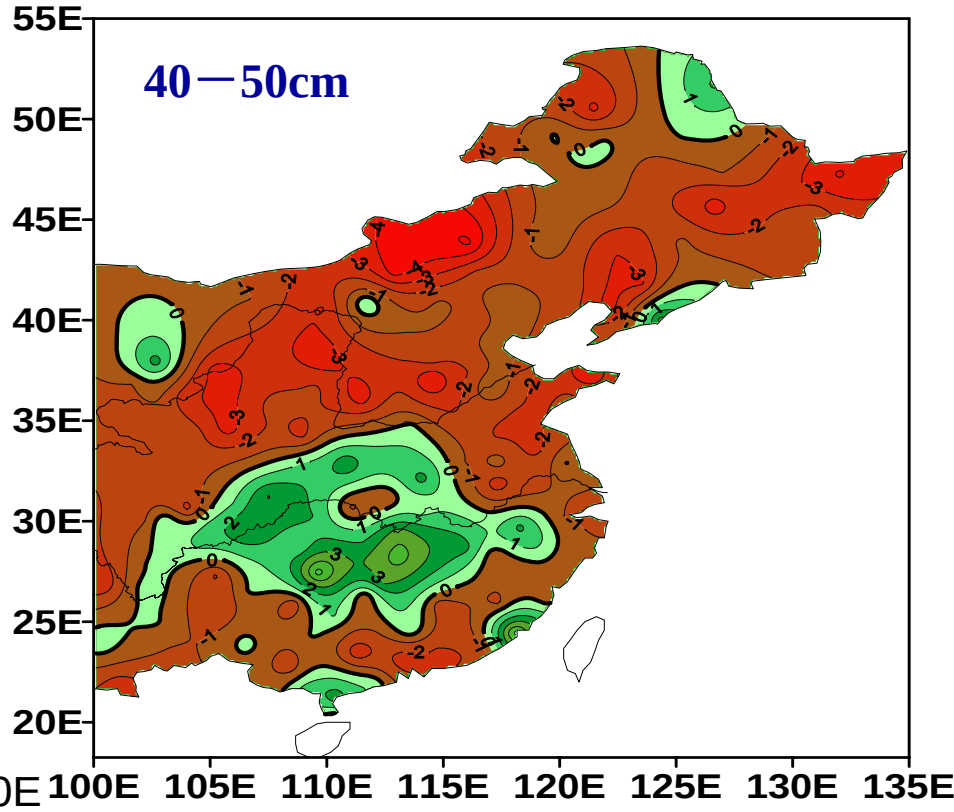






Trend of Aridity in 1951～2003, RED indicates dry trend。

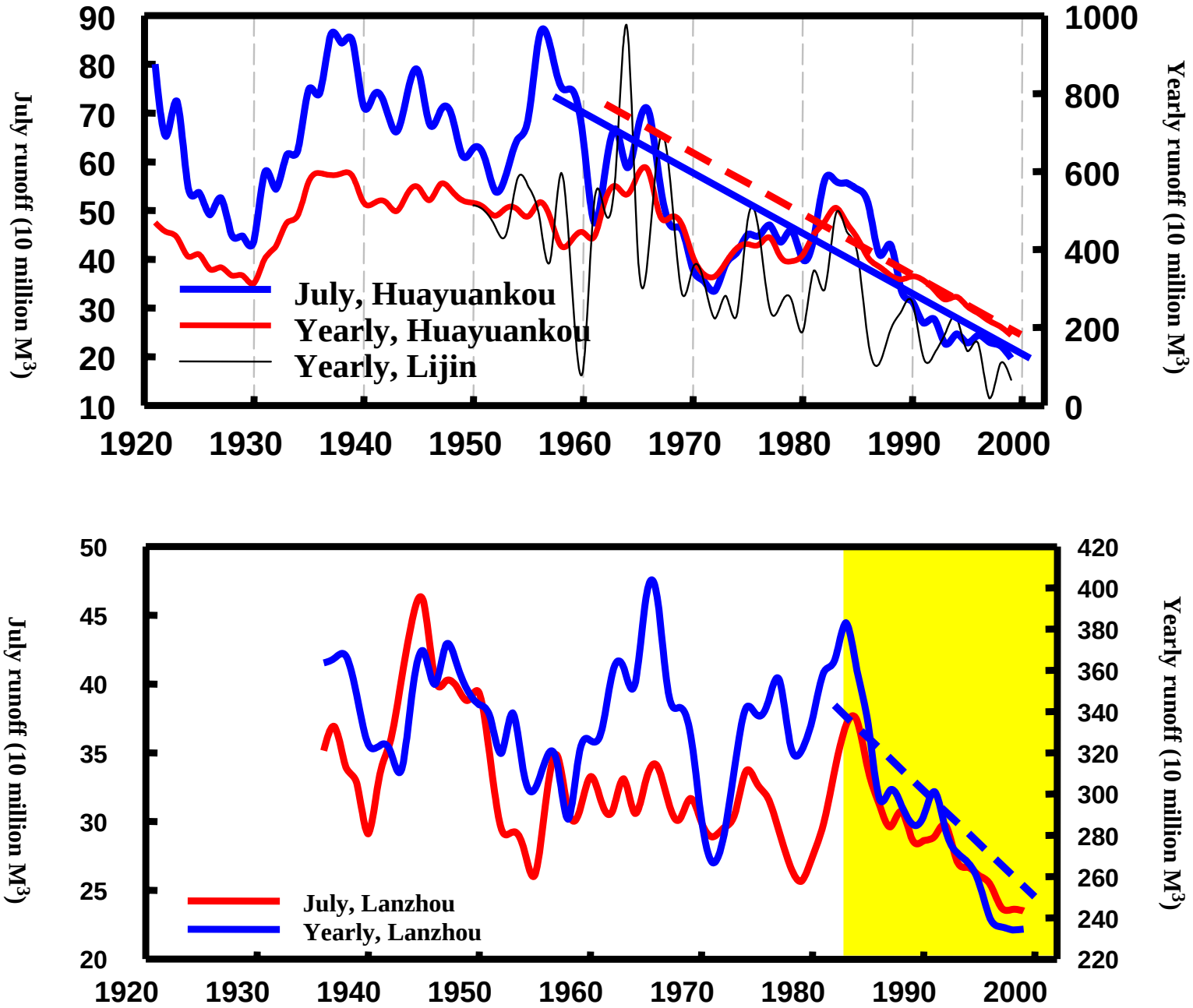




Frequency of drought events in last 50 years

Soil moisture trend

YELLOW RIVER RUNOFF



REGIONAL CLIMATE MODEL INTER-COMPARISON PROJECT FOR AISA

An APN/START-TEA Project

REGIONAL CLIMATE MODEL INTER-COMPARISON PROJECT FOR ASIA

A joint effort of 10 research groups of 5 countries (Australia, China, S.Korea, Japan and USA) with also the involvement of India, N.Korea, Italy, Mongolia and Russia under the joint support of APN, START , CAS of China and other national projects of participating countries

PARTICIPATING GROUPS

Model	Group leader	Country
DARLAM	J. MeGregor	Australia
RIEMS	C.Fu	China
NJU RCM	B. Su	China
NIES/CCSR	S. Emori	Japan
Regcm3	H. Kato	Japan
JMA-BAIM	Y.Sato	Japan
MM5/LSM, Regcm2	D. Lee	S.Korea
RegCM	J.Kim	S.Korea
MM5/LSM	W. Gutowski	U.S.A
ARCSyM	W. Wu	U.S.A

OBJECTIVES of RMIP for Asia

- **To further improve the RCMs for application in Asia through inter-comparison;**

- **To develop an ensemble of the performance from a group of RCMs;**

- **To provide scenarios of regional climate change in Asia by an ensemble of RCMs nested with GCM.**

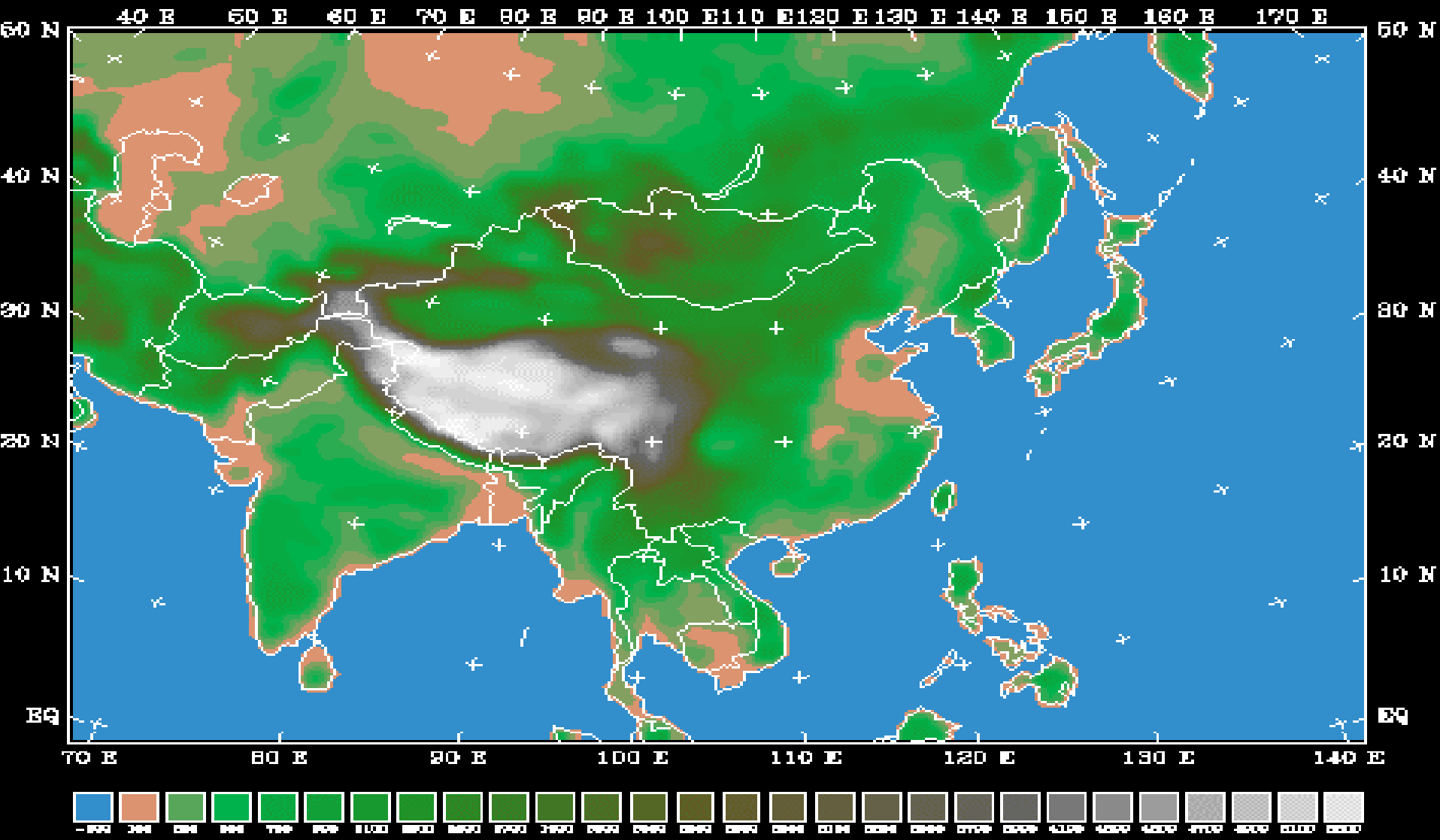
Tasks

Phase 1 18 months — **Full annual cycle and extreme**

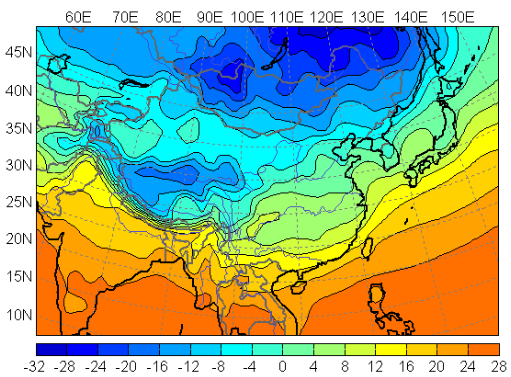
Phase 2 10 years — **Statistical behavior**

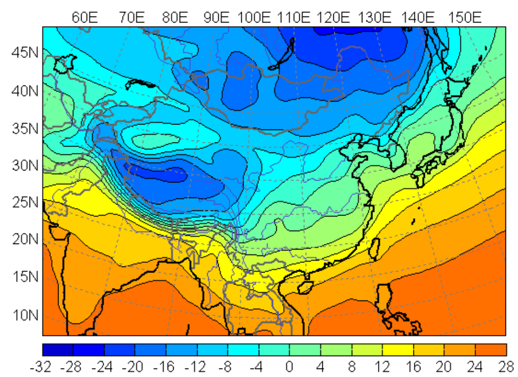
Phase 3 Scenarios for next century — **Regional climate change projection by nesting with GCM**

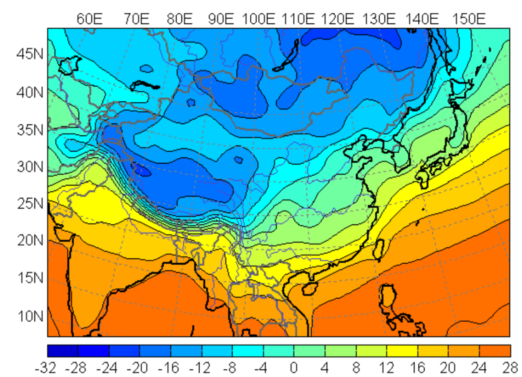
Topography in model domain



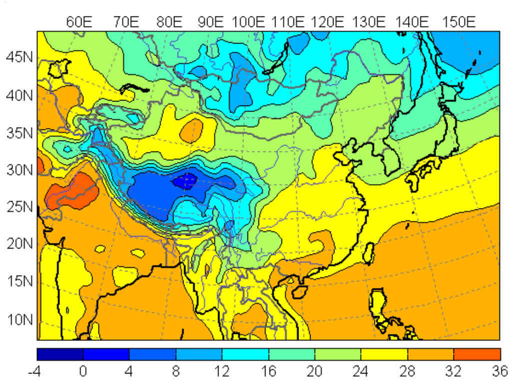
10–winters Averaged T_{surf}(℃)

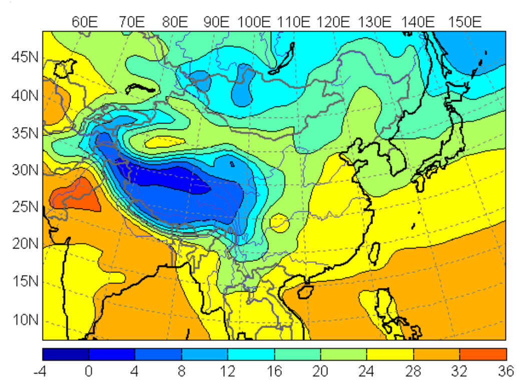


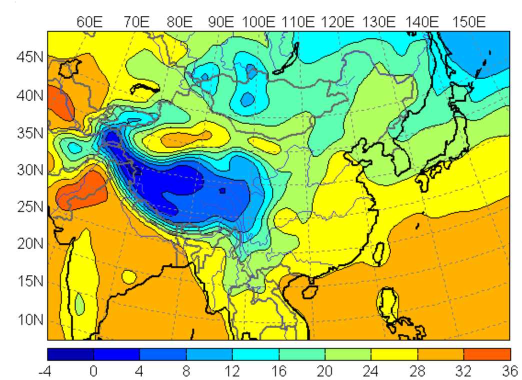




10–summers Averaged T_{surf}(℃)

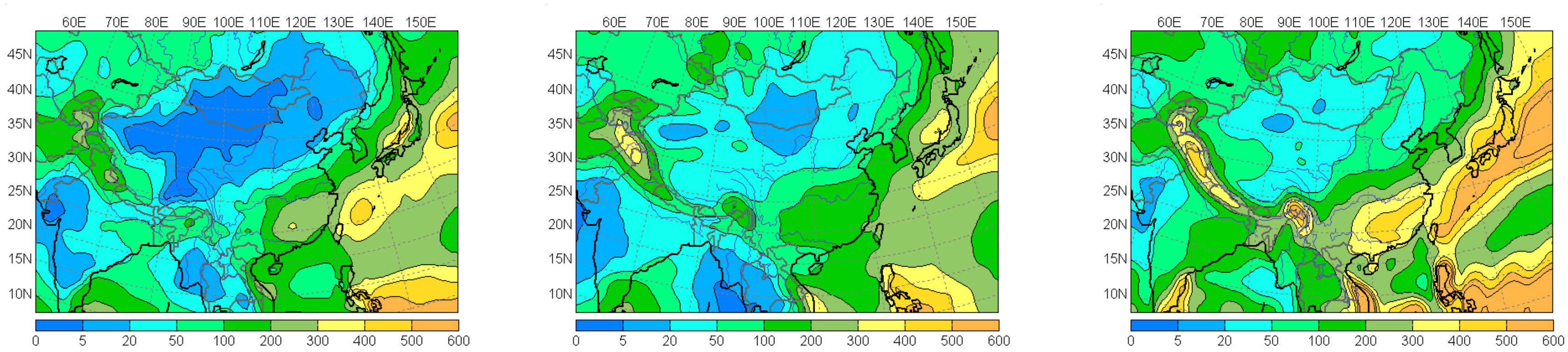




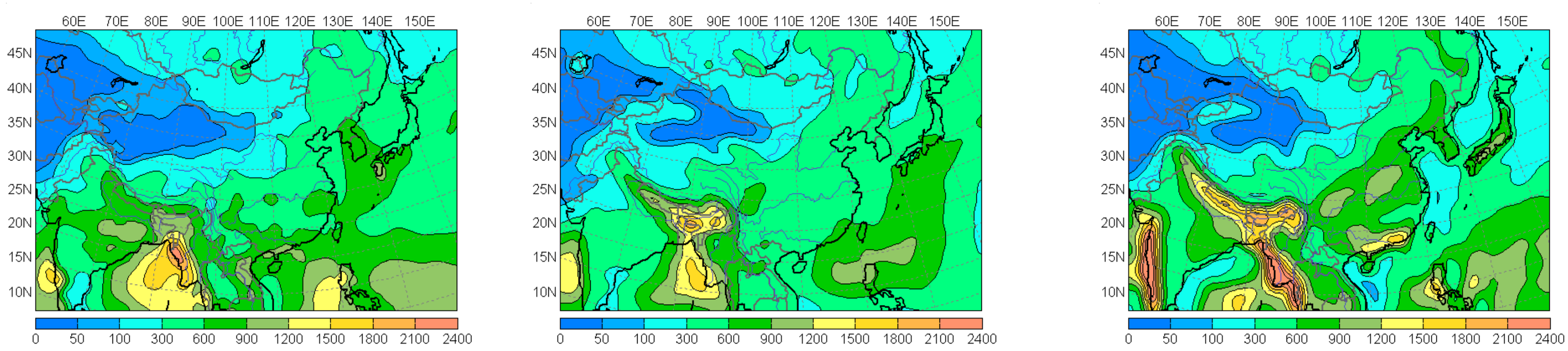


Observation **Ensemble** **CSIRO CCAM**

10–winters Averaged Total Precipitation(mm)



10–summers Averaged Total Precipitation(mm)

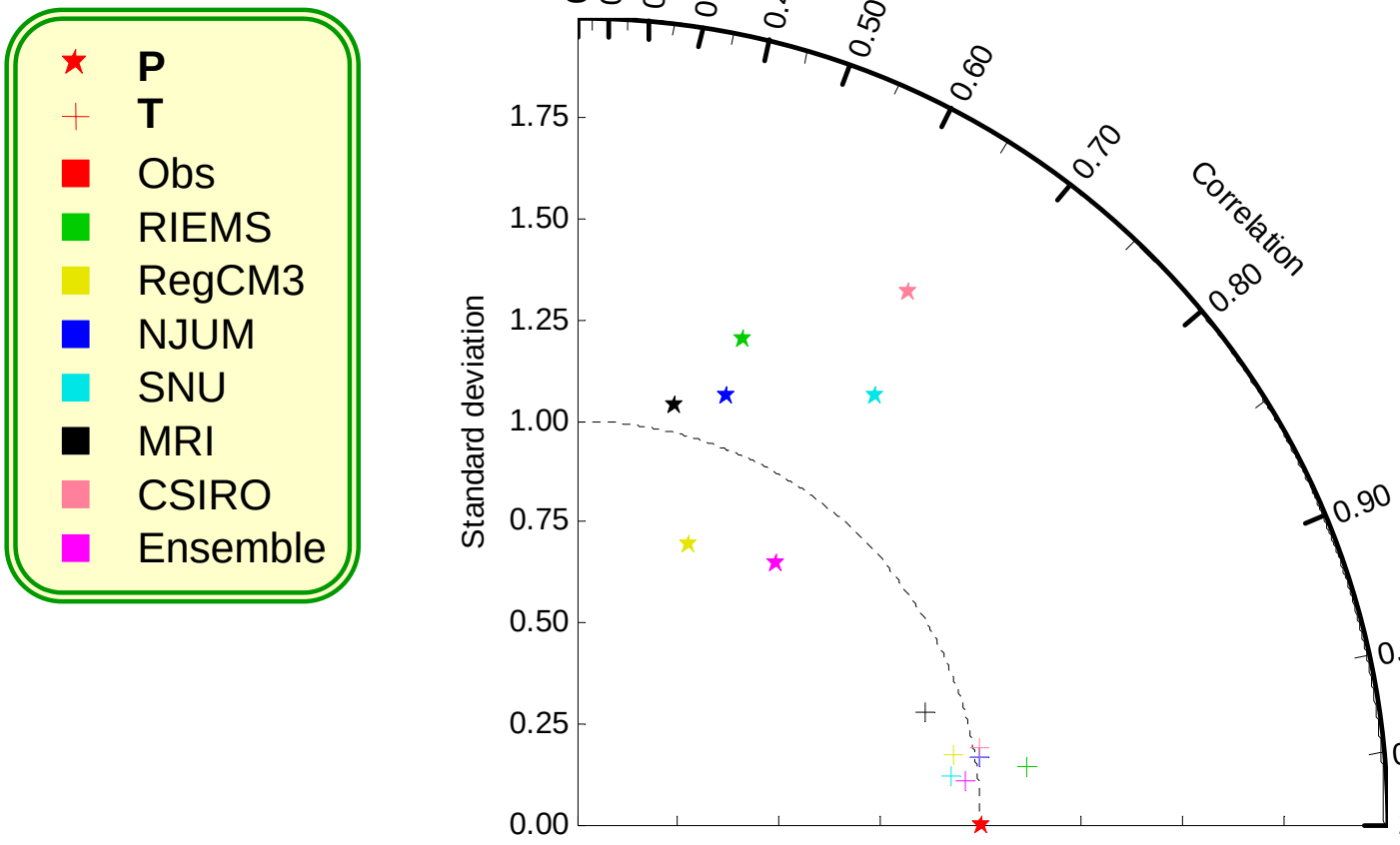


Observation **Ensemble** **CSIRO CCAM**

MEAN BIASES

- **T 0 ~ -2°C winter and summer**
- **P + 10% ~ - 10% winter**
  + 20% ~ - 10% summer
  too much precipitation in arid/semi-arid central Asia
- **Hot waves weaker than ob.**

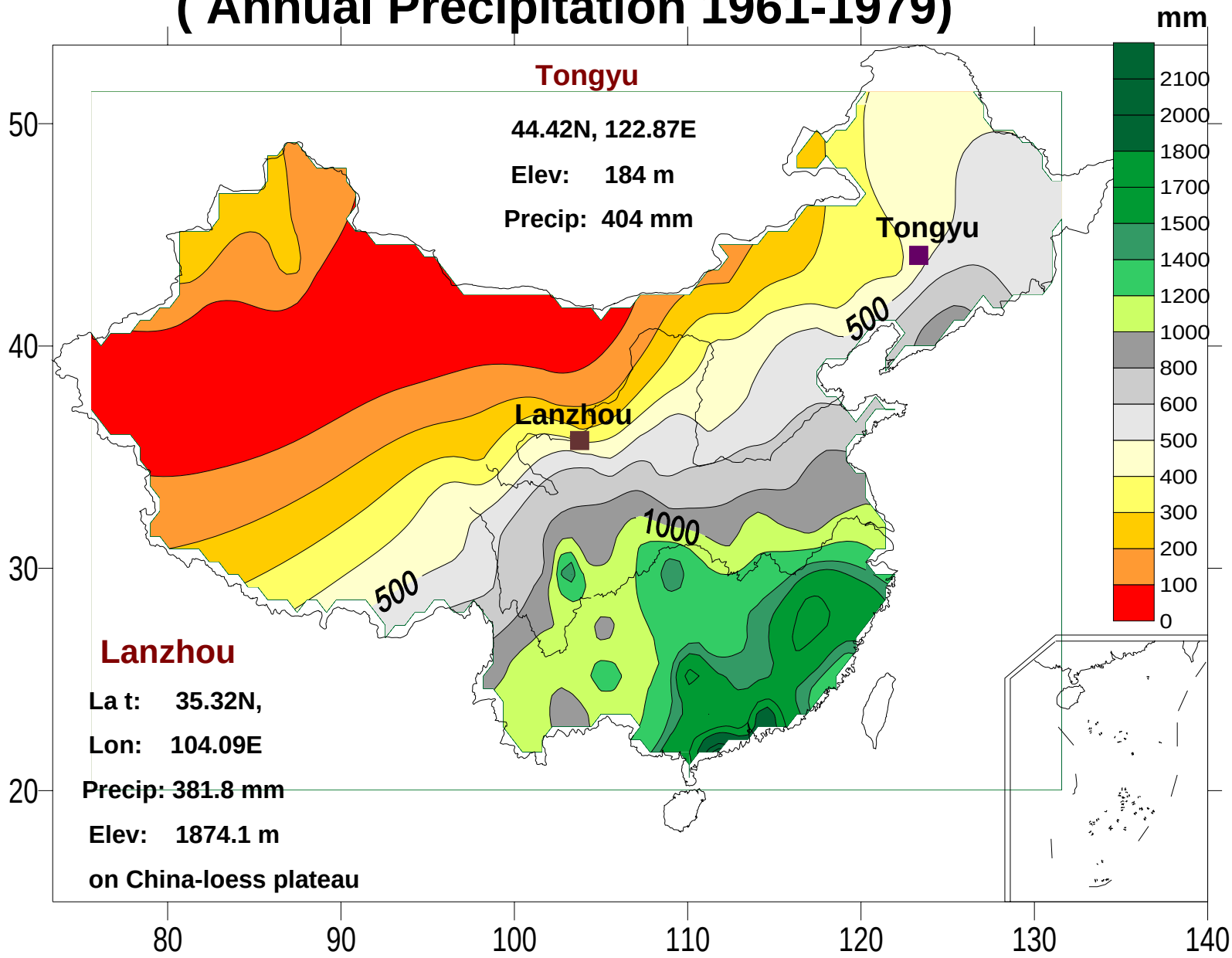
Correlation Coefficient Between Simulation and Observation and Standard Deviation Normalized by Observation of Monthly Averaged Temperature and Monthly Total Precipitation According to Total Space-Time Series



CEOP in semi-arid Asia

CEOP Reference site Tongyu and Lanzhou

(Annual Precipitation 1961-1979)



Main research themes

(1) Measurement of water vapour, CO2 and heat fluxes and related biophysical variables over different ecosystems in semi-arid Asia.

(2) Study the land surface process of arid Asia and the effects of the land use on the aridification in the north of China.

(3) Improving the parameterization schemes of land surface in climate model in semi-arid area.

(4) Study the interaction between ecosystems and atmosphere and its influence on hydrological and carbon cycles.

Parameters for measurement

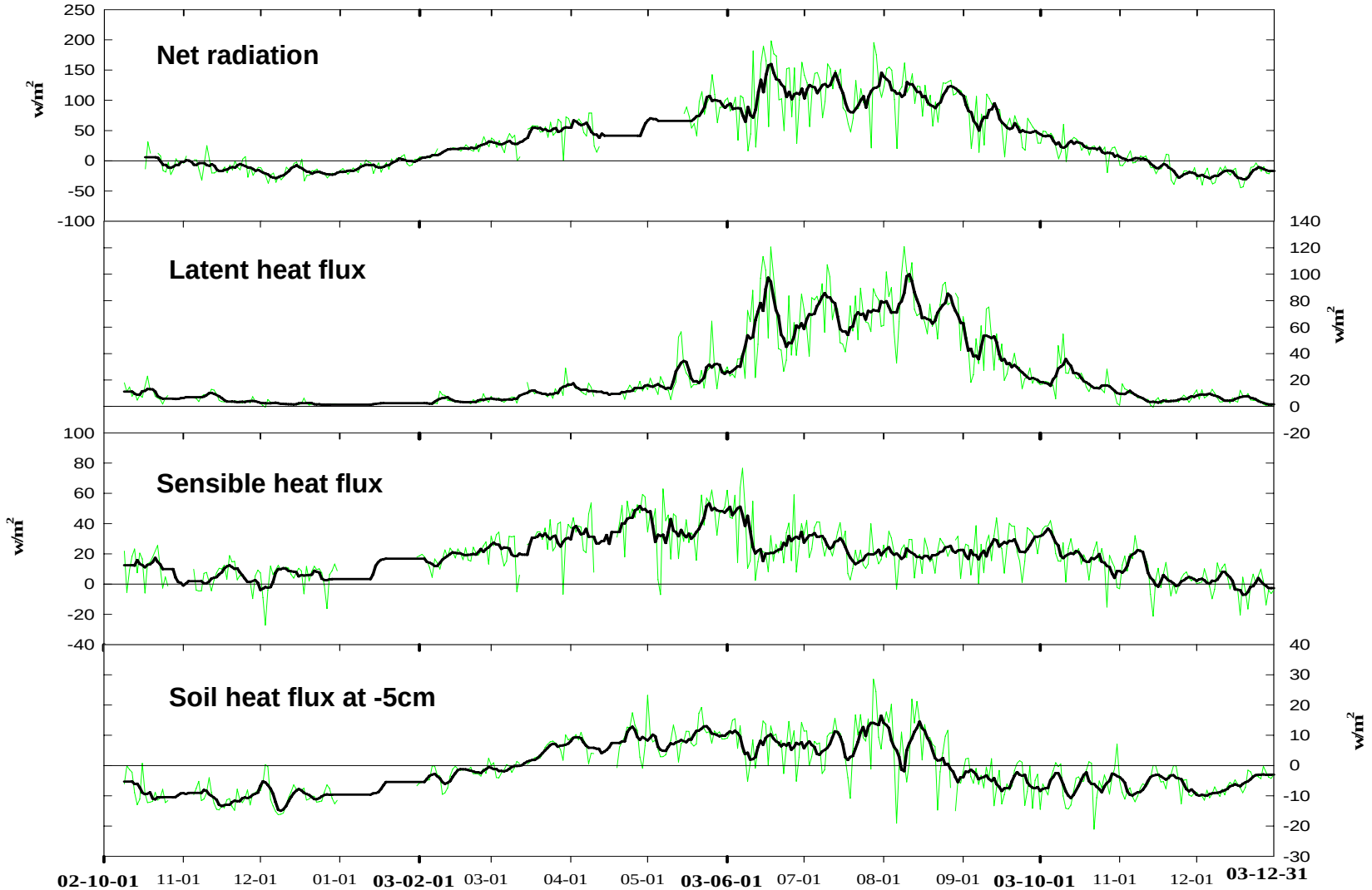
Observations	Height/depth	unit
Station Pressure	1.5 m	hPa
Air Temperature	1.95 m	deg.C
Specific Humidity	1.95 m	g/kg
Wind Speed/direction	17.06m	m/s deg.
Precipitation	1.0 m	mm
Skin Temperature	1.5 m	Deg.C
Soil Temperature, moiture	-2cm, -5cm, -10 cm, -20cm, -50cm, -80cm	%
Sensible Heat Flux	3.5 m	W/m^2
Latent Heat Flux	3.5 m	W/m^2
CO2 Flux	3.5 m	micro mol/m^2/s
Soil Heat Flux	-5cm, -10cm	W/m^2
Incoming Long-wave Radiation	3.0m	W/m^2
Incoming Short-wave Radiation	3.0m	W/m^2
Outgoing Long-wave Radiation	3.0m	W/m^2
Outgoing Long-wave Radiation	3.0m	W/m^2
Aerosols Biological parameters	Canopy, roots	

Instruments

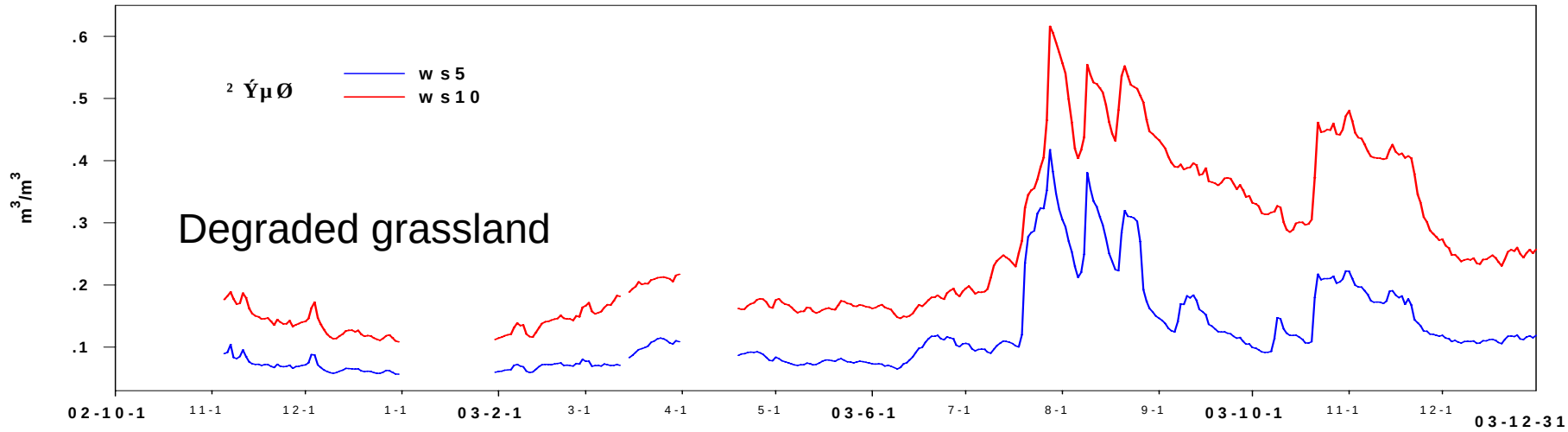
Parameter	Model	Manufacturer
Station Pressure	CS105	TEXAS ELECT
Air Temperature	HMP	VAISALA
Specific Humidity	45C_L	VAISALA
Wind Speed	034A_L,	Met One
Wind Direction	014A_L	Met One
Precipitation	TE525MM_L	TEXAS ELECT
Incoming Shortwave	CM21	Kipp & Zonen
Outgoing Shortwave	CM21	Kipp & Zonen
Incoming Longwave	CG4	Kipp & Zonen
Outgoing Longwave	CG4	Kipp & Zonen
Skin Temperature	IRTSD-P	APOGEE
Soil Temperature	STP01_L50	HUKSEFLUX
Soil Moisture	CS616_L	CAMPBELL
Sensible Heat Flux	LI-COR CS7500	CAMPBELL
Latent Heat Flux	FW05	CAMPBELL
CO2_Flux	CSAT3	CAMPBELL
Soil Heat Flux	HFP01Sc_L50	HUKSEFLUX
Aerosols	CE 318-1I	CIMEL ELEC.

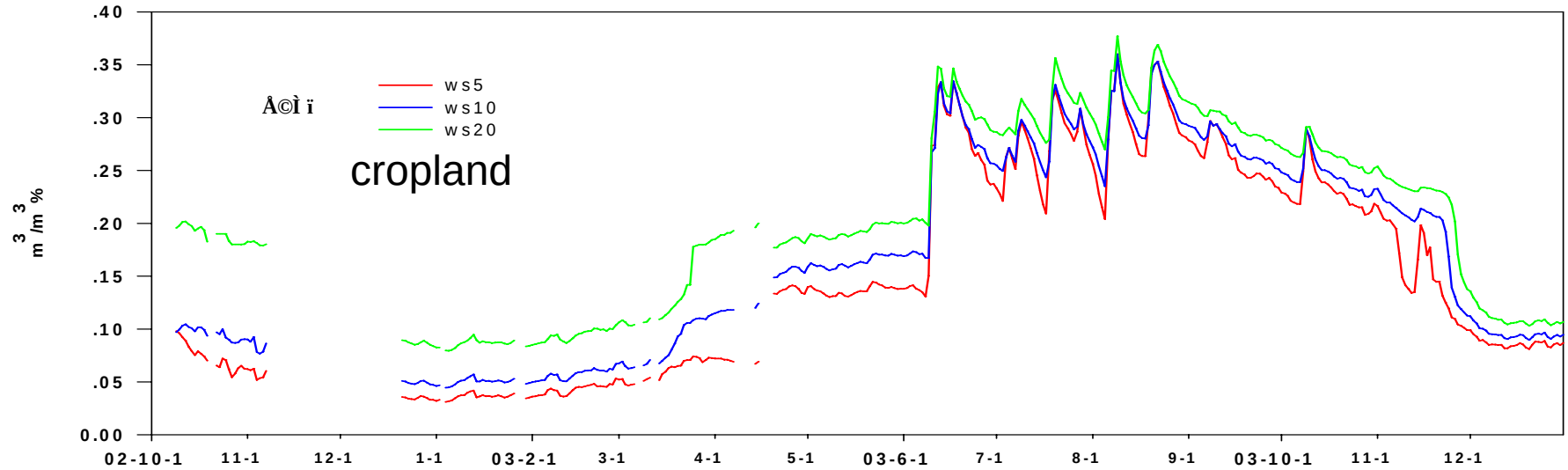
Daily average energy fluxes over degraded grassland

(black line: 10-days moving average; green line: daily average).



The volumetric soil water content





Future plan

(1) Upgrade the Station of Lanzhou to become a reference site of CEOP;

(2) Propose a new component of CEOP, the CEOP arid/semi-arid region hydrology and interactions with dust aerosols; Including two stations over Northern China as well as stations over other arid and semiarid regions, such as central Asia,North Africa, North America and Australia;

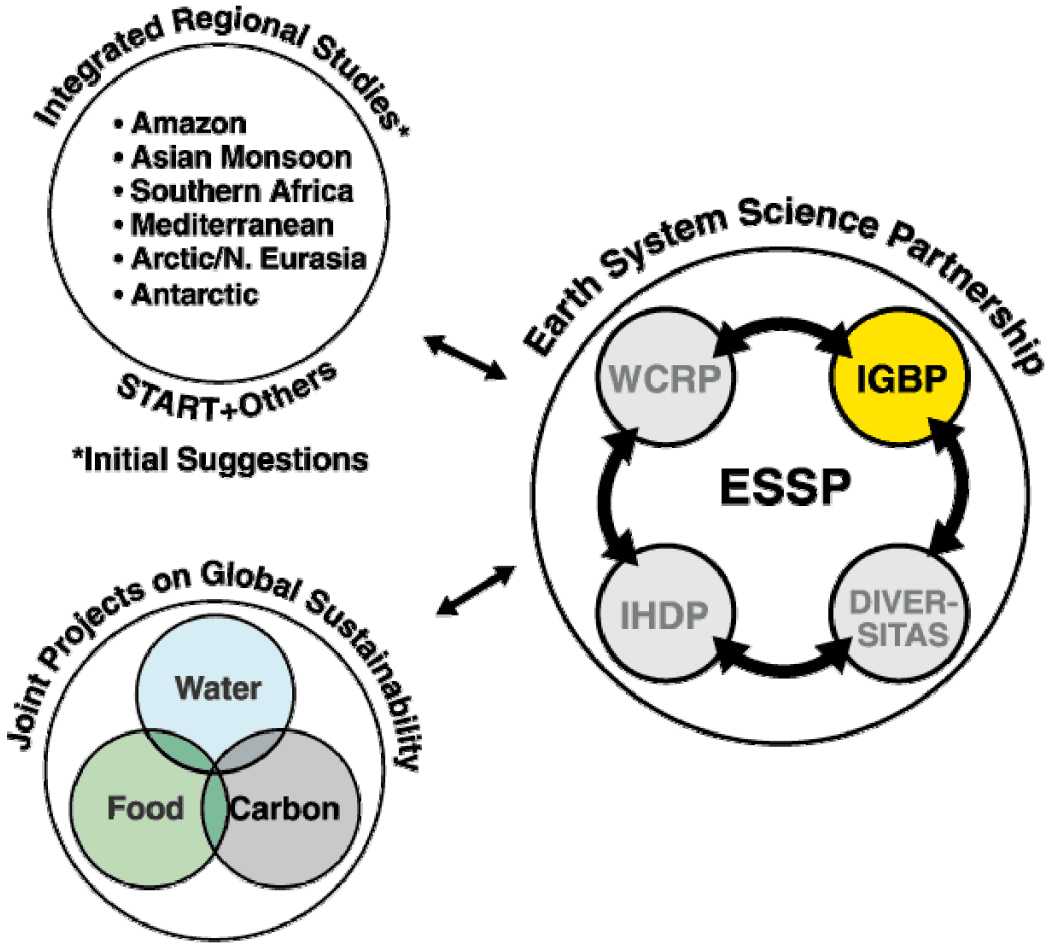
(3) Integrated analysis of land surface process and their linkages with the aridization of arid/semi-arid regions by in situ measurement, remote sensing and regional modelling.

Monsoon Asia Integrated Regional Study (MAIRS)

A new initiative of START
at the request of ESSP

MAIRS is an IRS project on Monsoon Asia, under the leadership of ESSP

Earth System Science Partnership



WCRP Climate

diversitas

GLOBAL CHANGE IGBP

Long-term objectives of MAIRS

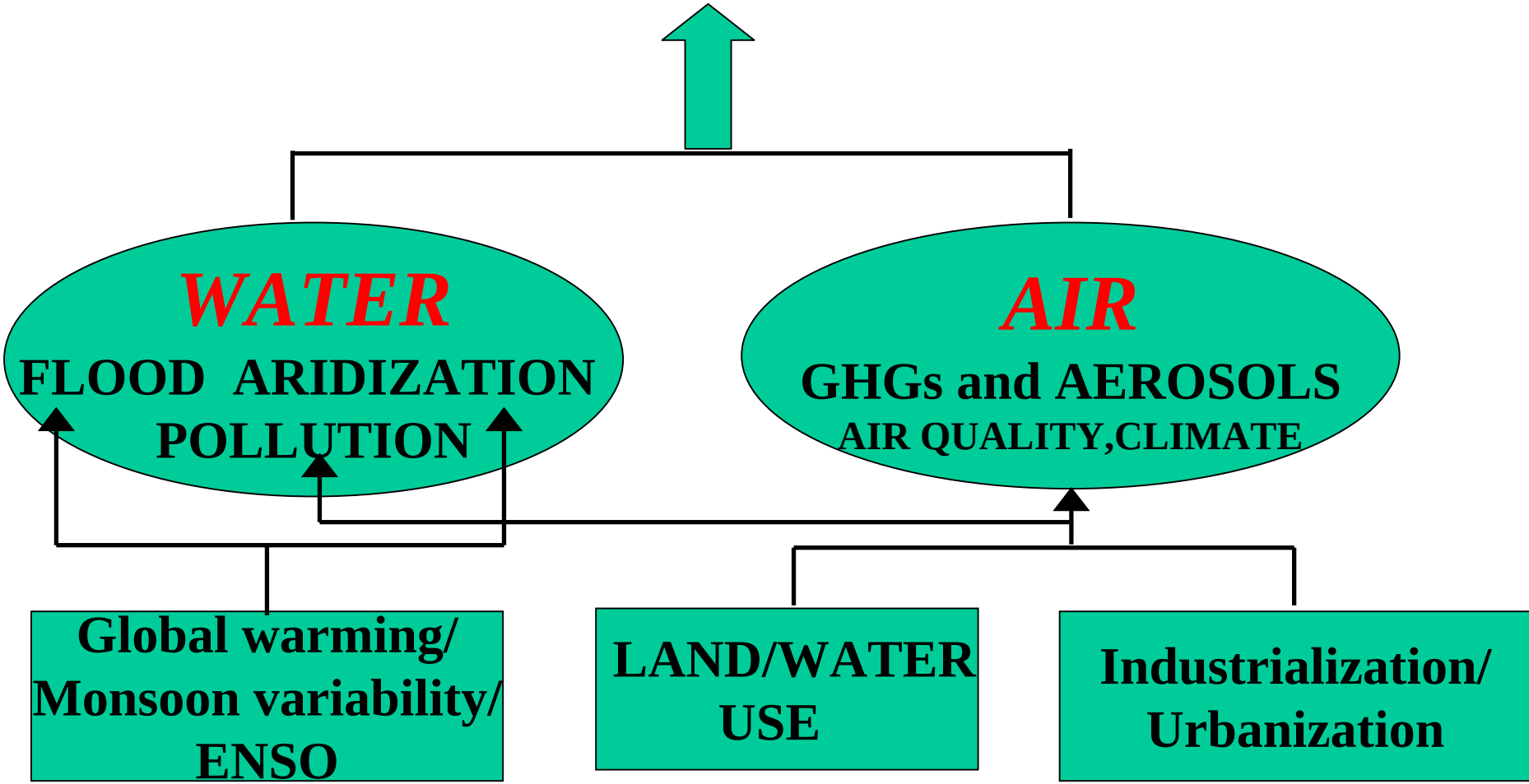
- **To better understand how human activities in the region are interacting with and altering natural variability of atmospheric,terrestrial and marine components of the monsoon system;**
- **To contribute to the provision of a sound scientific basis for sustainable development of monsoon Asia;**
- **To develop a predictive capacity of estimating changes in global-regional linkages in the earth system and to project the future consequences of such changes.**

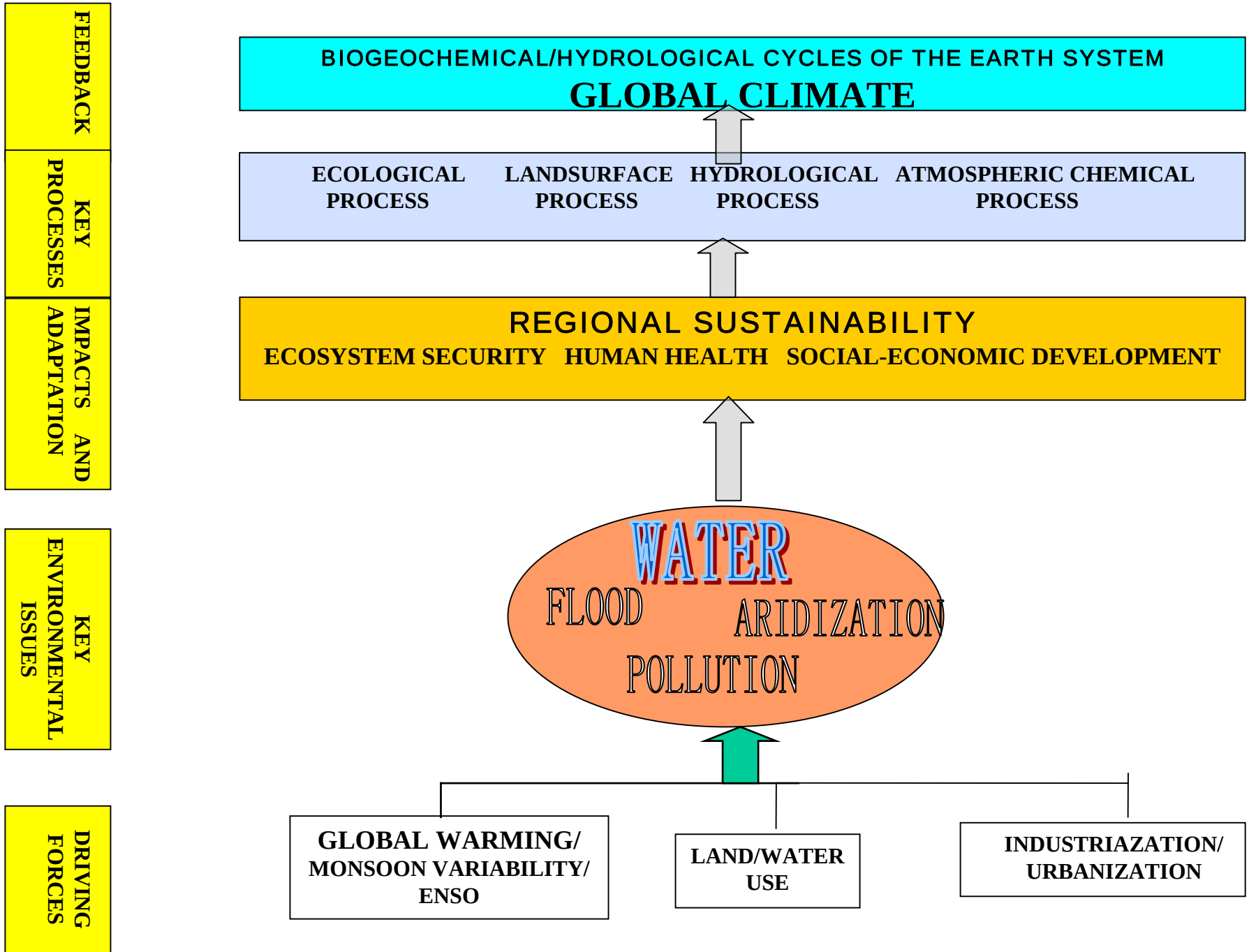
Central Scientific theme of MAIRS

Human-monsoon system interaction and their linkages with the earth system dynamics

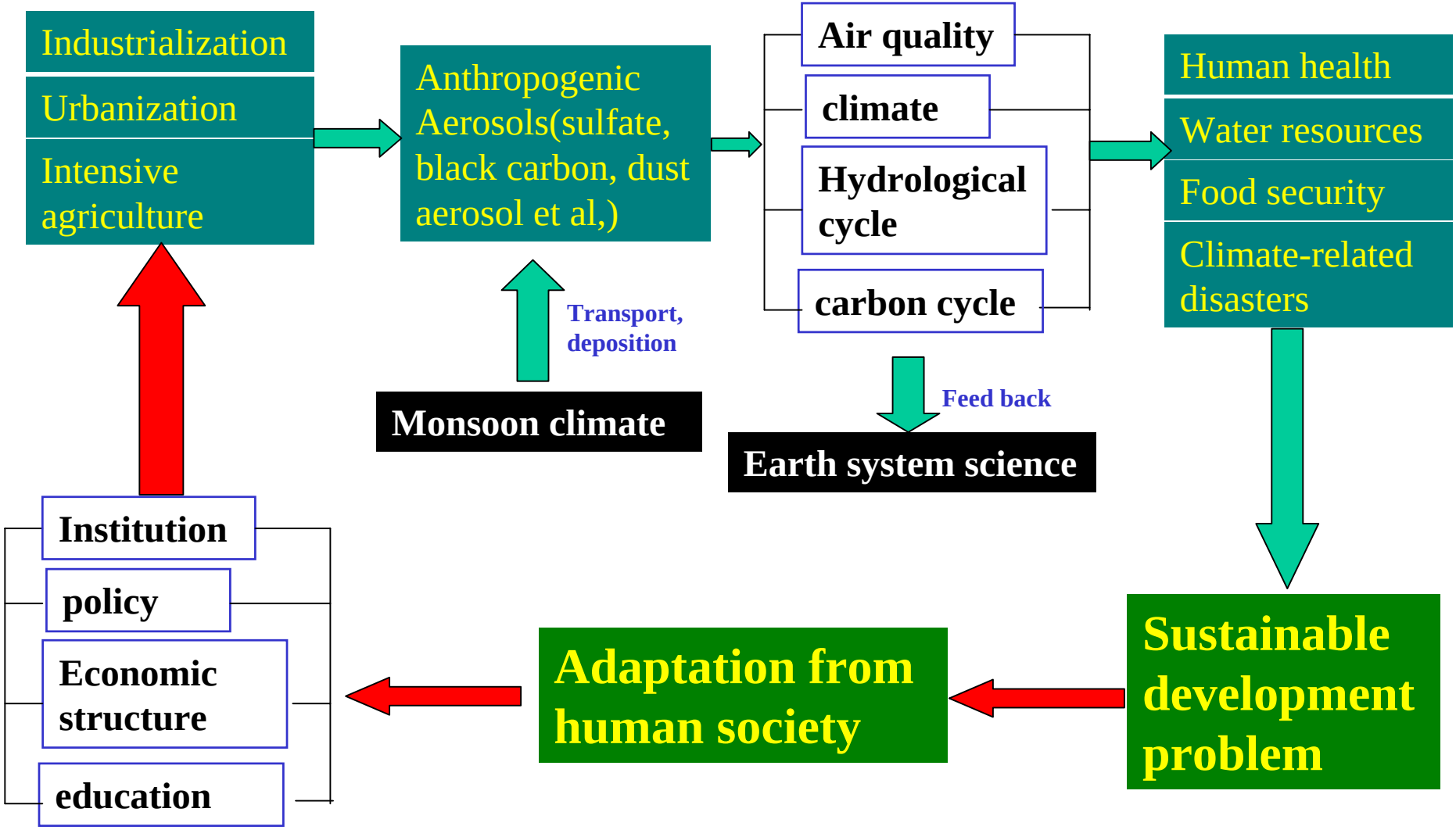
Two Key issues of for Integrated study

GLOBAL BIOGEOCHEMICAL AND HYDROLOGICAL CYCLES




FEEDBACK
KEY PROCESSES
IMPACTS AND ADAPTATION
KEY ENVIRONMENTAL ISSUES
DRIVING FORCES
BIOGEOCHEMICAL/HYDROLOGICAL CYCLES OF THE EARTH SYSTEM
GLOBAL CLIMATE
ECOLOGICAL PROCESS
LANDSURFACE PROCESS
HYDROLOGICAL PROCESS
ATMOSPHERIC CHEMICAL PROCESS
REGIONAL SUSTAINABILITY
ECOSYSTEM SECURITY
HUMAN HEALTH
SOCIAL-ECONOMIC DEVELOPMENT
WATER
FLOOD
ARIDIZATION
POLLUTION
GLOBAL WARMING/ MONSOON VARIABILITY/ ENSO
LAND/WATER USE
INDUSTRIAZATION/ URBANIZATION

Integrated aerosols study of Monsoon Asia



Development of a coordinated data,observation and modeling program of MAIRS

Including:

- Development of a coordinated data and information system;
- Networking available observation networks;
- proposal an enhanced observation experiments of monsoon-human interaction process;
- Development of a Regional model of Earth System.

Enhanced observation and experiments

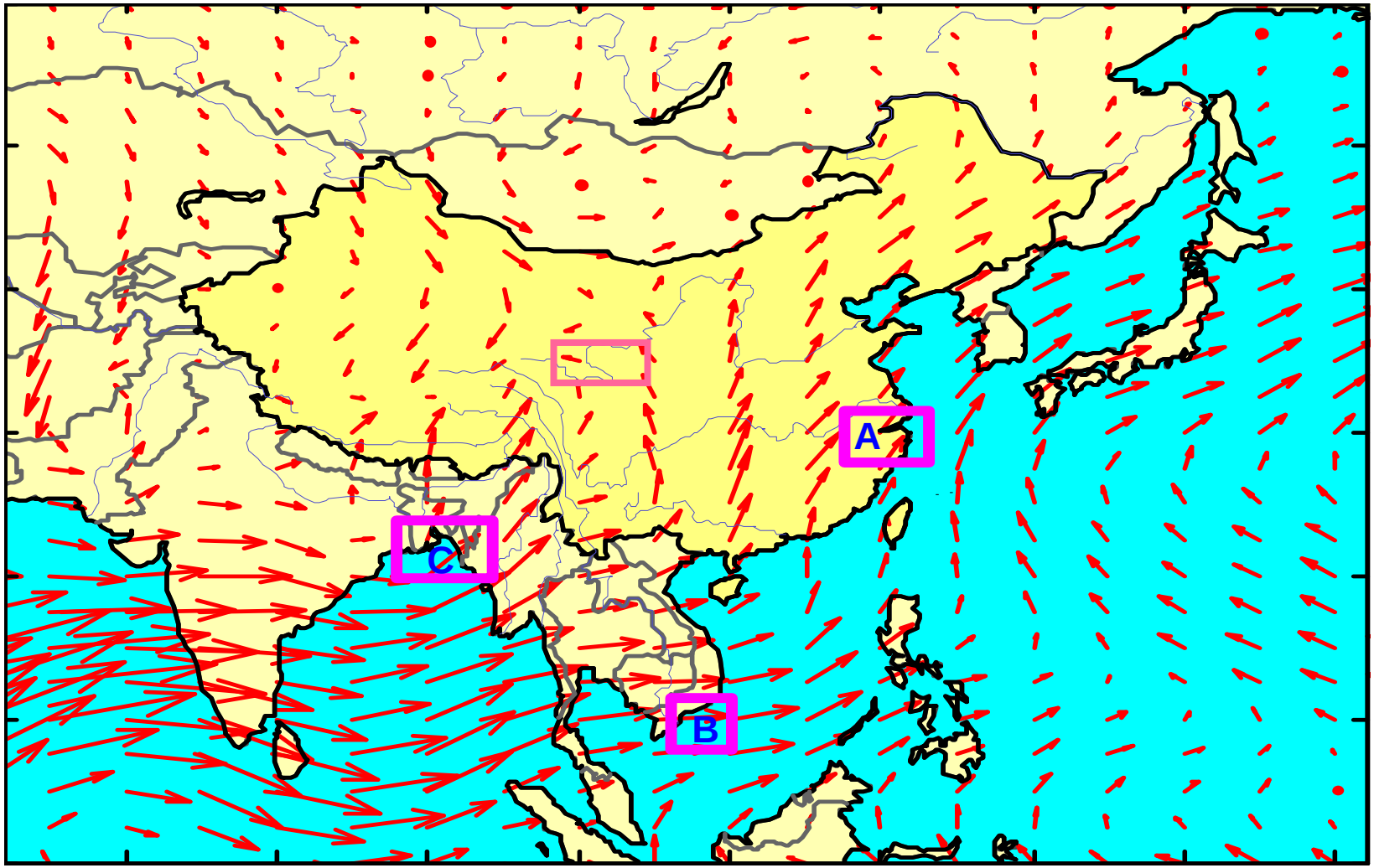
Regions:

- **Yangtze River Delta**
- **Mekong River delta**
- **Ganges River delta**

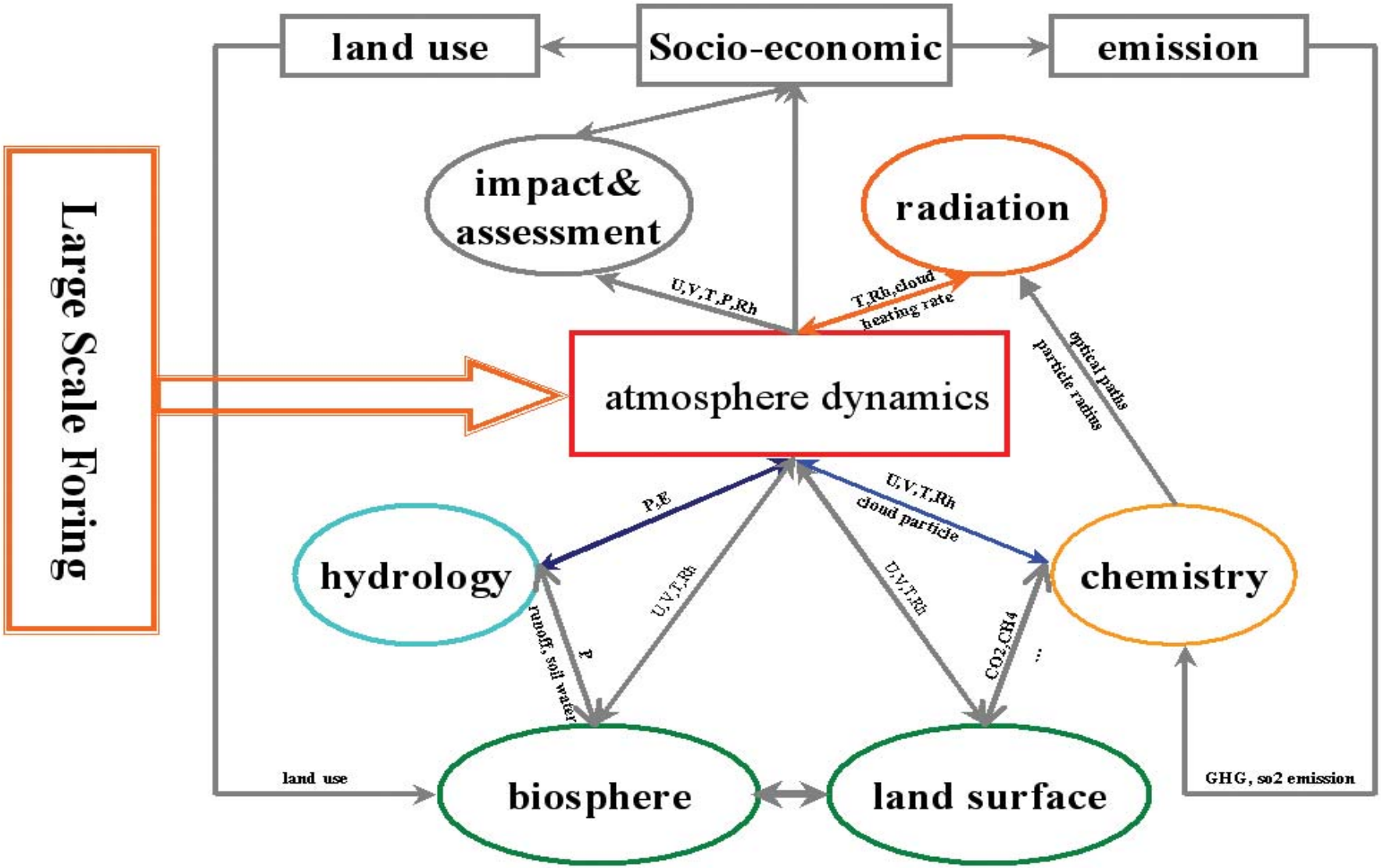
Reasons: most active human development

1. the **population** density is highest among the region;
2. the development of economy and society is **most rapidly**;
3. rapid increase of **consumption** of various kind of natural resources, such as the energy resources, water resources;
4. rapid increase of **emissions** of various kinds of green house gases, aerosols and other pollutants into air, water and soil;
5. the large scale human-induced **land cover** changes.

Enhanced observation experiments



Development of A Regional Model of Earth System



Time-Table of MAIRS

2003

Rapid Assessment Project(RAP) for East Asia

2004

MAIRS interim SSC meeting

2005

MAIRS IPO open, formal MAIRS SSC,

RAP for South Asia and Southeast Asia

2006

Scoping workshops on MAIRS data/observation system; modeling system and human dimension

2007

MAIRS Science plan presenting at next Open Science Conference

Initiate one or two pilot projects on water and anthropogenic aerosols

2008-2009


Thanks