

From planning to implementation

Update information of **M**onsoon
Asia **I**ntegrated **R**egional **S**tudy
(MAIRS)

(January of 2007)

Development of MAIRS

- **1996-2000: Initial studies of integrated Asia monsoon system**, including the development of a concept of **General Monsoon System** and **Regional Integrated Environmental Model System** for Asia;
- **2000-2004: Rationale study**, Hanoi meeting, Bangkok meeting and **Rapid assessment project**;
- **2005-2006: Planning for MAIRS**, including **acceptance of ESSP**; Establish **IPO, SSC** and development of **Initial Science Plan**.

The formal launch of MAIRS in Earth System Science Conference in November of 2007



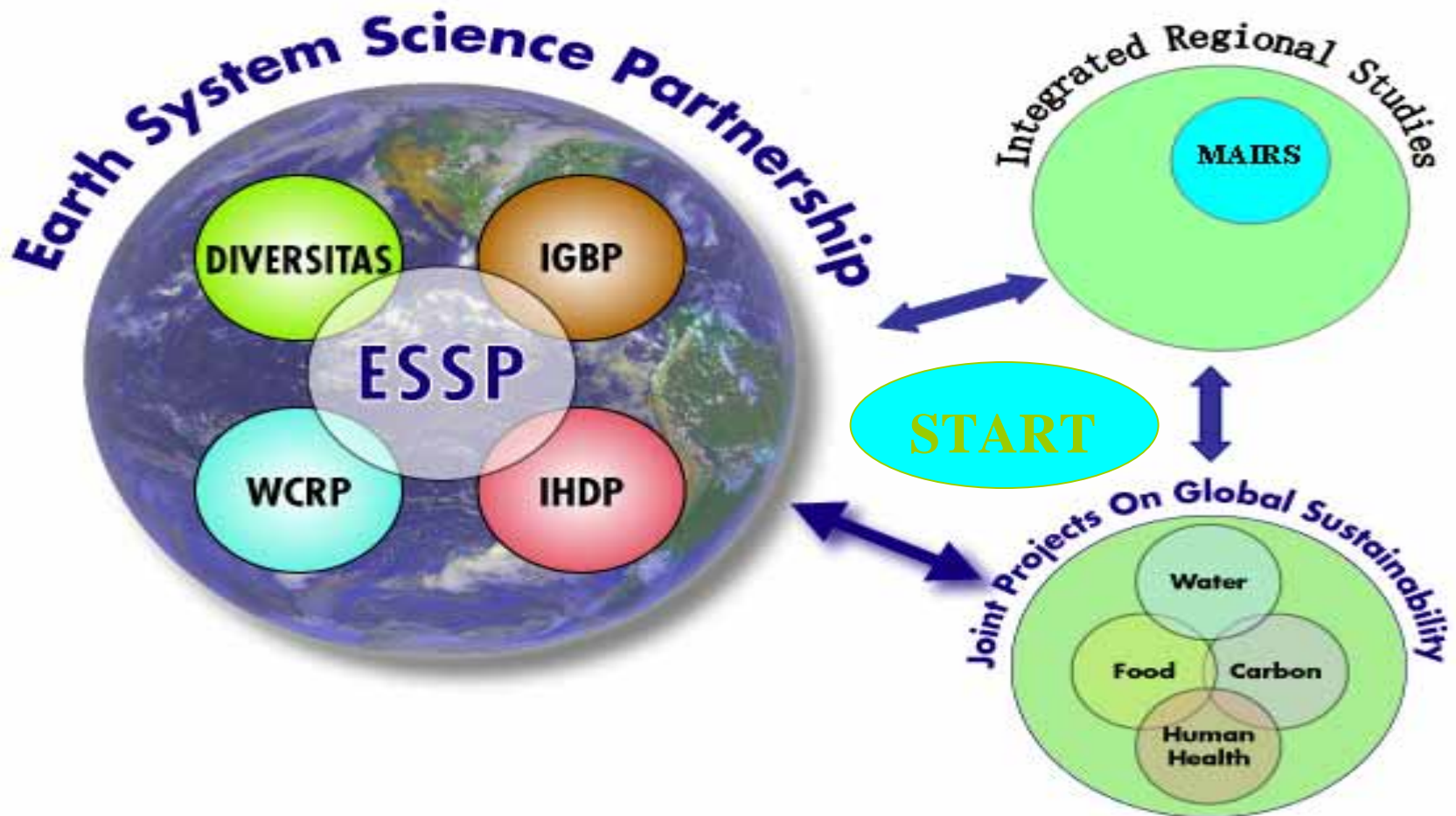
Officially recognizing the MAIRS as an ESSP program

Recognising that there are issues special to regions, the Beijing Conference initiated the Monsoon Asia Integrated Regional Study to examine the threats posed to populations and ecosystems in Monsoon Asia.

The Statement of the Beijing Conference on Global Environmental Change

November of 2006

MAIRS – an New Element of Earth System Science Programs



MAIRS SSC members as October of 2006

- Congbin FU (Chair, CEOP and AAMP, China);
- M. Manton (vice-chair, WCRP, Australia)
- J. Matsumoto (vice-chair, MAHASRI, Japan)
- A.P. Mitra (vice-chair, ABC, India)
- S. Anold (START-SEA, Thailand)
- A. Chen (GCP, LOICS, China Taipei)
- P. Kabat (IGBP-iLEAPS, Netherlands)
- T. Koike (CEOP and GEOSS, Japan)
- L. Lebel (IHDP, Thailand)
- K. Seto (IHDP, USA)
- Liqin Shao (MOST, China)
- S. Liu (IGAC, China Taipei)
- Frits Penning De Vries (IPO, Netherlands).

MAIRS International Program Office

MAIRS IPO located at the Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, supported by CAS and Ministry of Science and Technology of China;

Staff:

Frits Penning de Vries, director

Ai Likun, deputy director

Yang Ying, information officer

Liqin Shao, science advisor

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Initial Science Plan of MAIRS approved by START SSC on behalf of ESSP



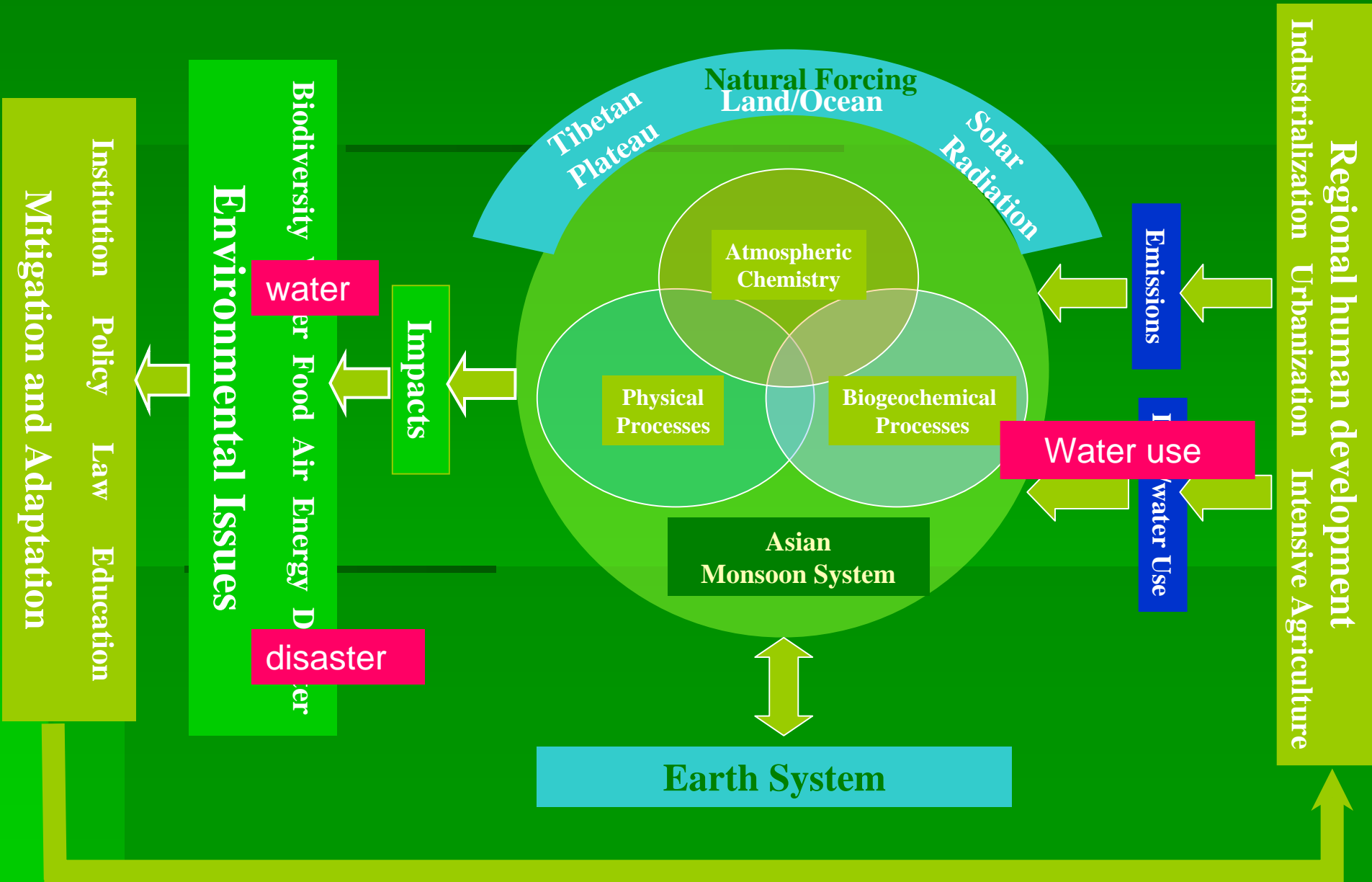
Vision



To significantly advance understanding of the interactions among the human-natural components of the overall environment in the Asian region. Earth System, in order to support the strategies for sustainable development.

Human-monsoon interaction

Conceptual Framework of MAIRS



Lead questions for research

- *Is the Asian monsoon system resilient to this human transformation of land, water and air?*
- *Are societies in the region becoming more, or less, vulnerable to changes in the Asian monsoon?*
- *What are the likely consequences of changes in the monsoon Asia region on the global system?*

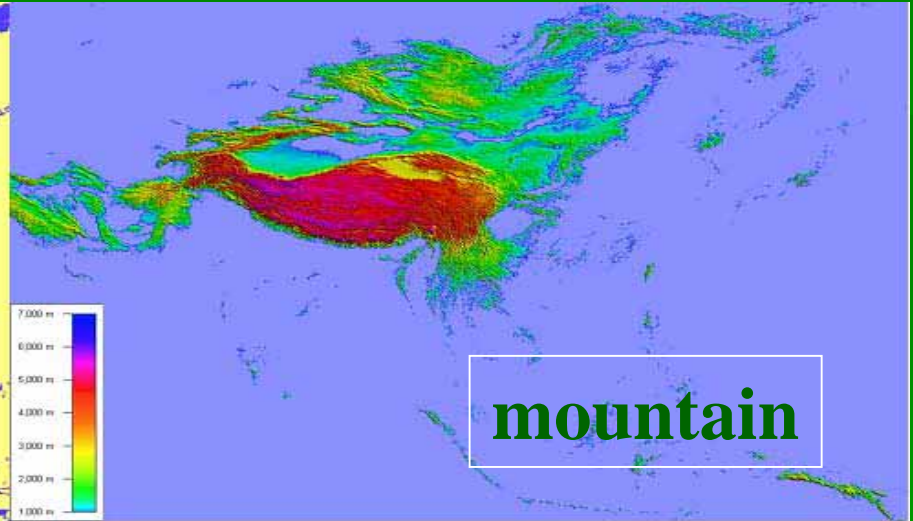
Objectives



- *To better understand how human activities in the monsoon Asia region interact with atmospheric, terrestrial and marine environmental components.*
- *To contribute to the provision of a sound scientific basis for sustainable regional development.*
- *To develop predictive capacity for estimating changes in global-regional linkages in the Earth System and to recognize the future consequences of such changes.*

4 critical zones in monsoon Asia

coastal



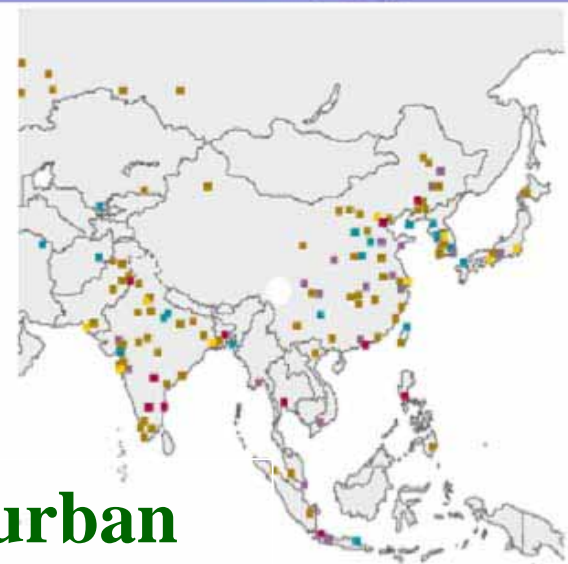
mountain



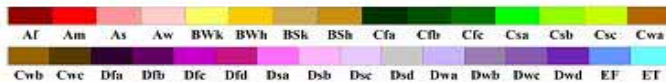
Semi-arid

- | | |
|--------------------------|----------------------|
| Main climates | Precipitation |
| A: equatorial | W: desert |
| B: arid | S: steppe |
| C: warm temperate | f: fully humid |
| D: snow | s: summer dry |
| E: polar | w: winter dry |
| | m: monsoonal |
| Temperature | |
| h: hot arid | F: polar frost |
| k: cold arid | T: polar tundra |
| a: hot summer | |
| b: warm summer | |
| c: cool summer | |
| d: extremely continental | |

- 1-2 million inhabitants
- 2-3 million inhabitants
- 3-5 million inhabitants
- 5-10 million inhabitants
- More than 10 million



urban



Research themes in critical zones

Coastal

Rapid transformation of land and marine resources

Mountain

Multiple stresses on ecosystem and biophysical resources

Semi-arid

Vulnerability of ecosystem due to changing climate and land use

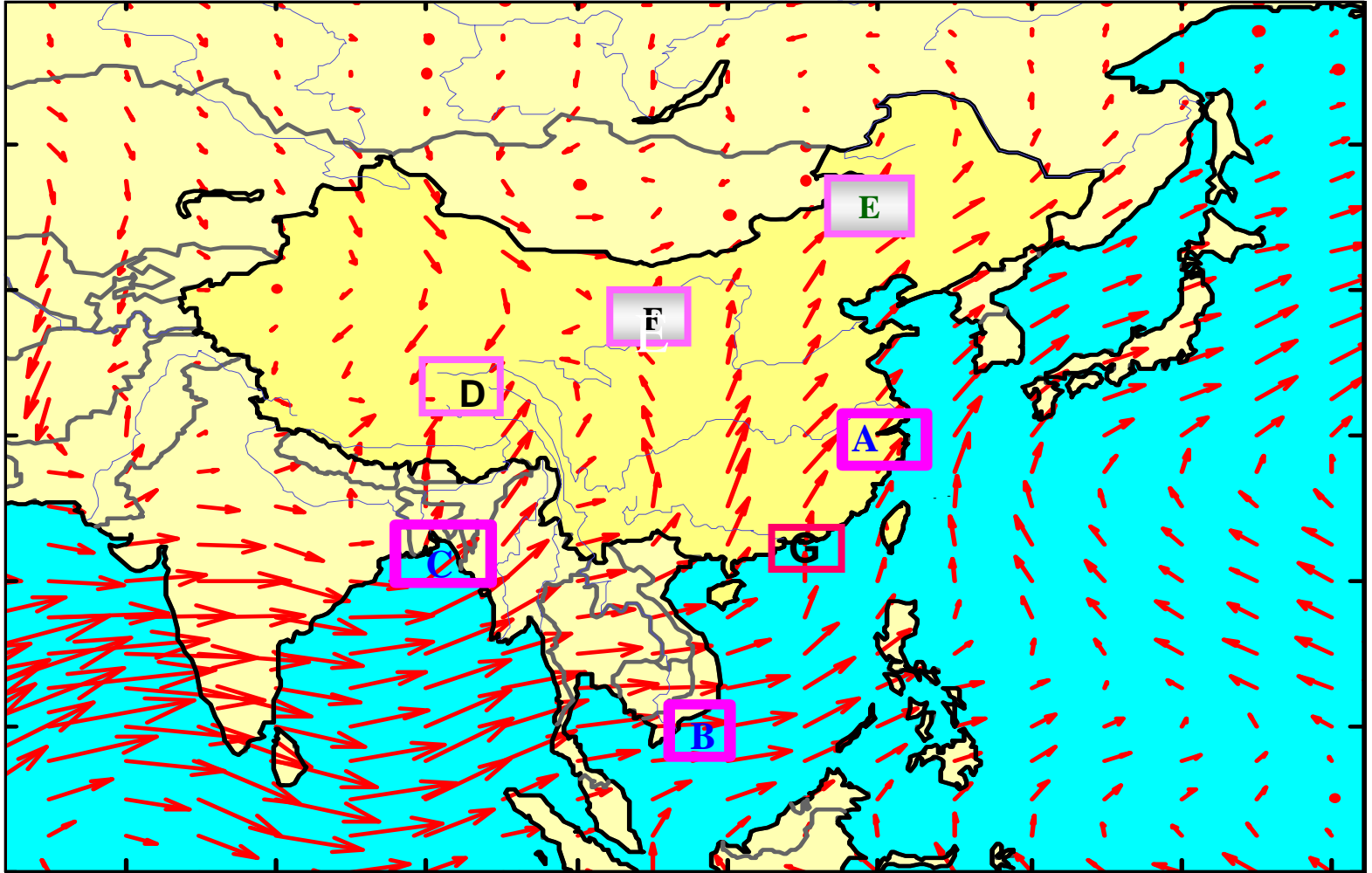
Urban

Changes in resources use and emission due to rapid urbanization

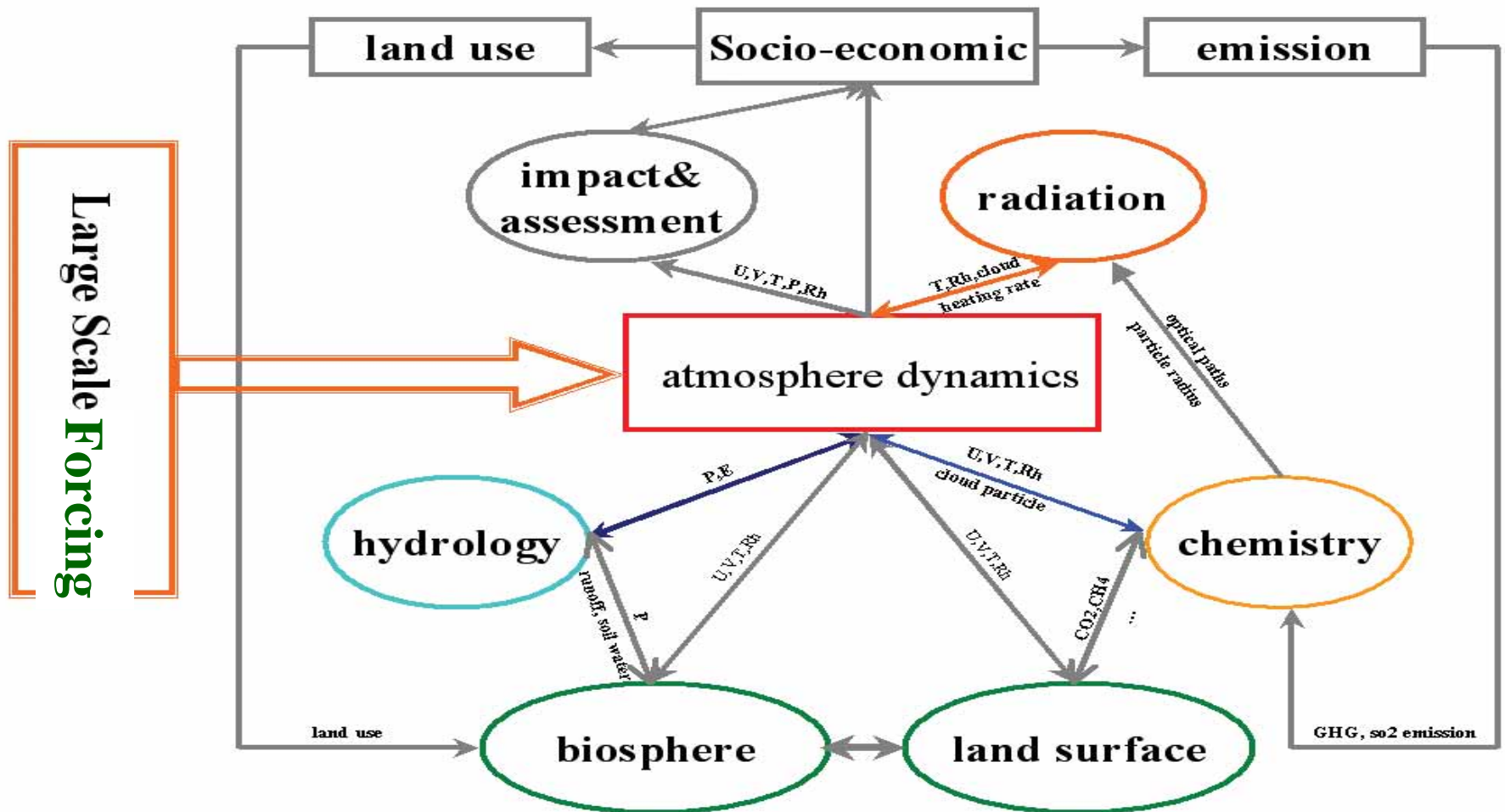
Development of Tools for Integrated Study

- **Coordinating enhanced multidisciplinary field observations in key areas;**
- **Development of Regional Earth System Models.**

Selected key areas for coordinated enhance-observation



A Regional Model of Earth System



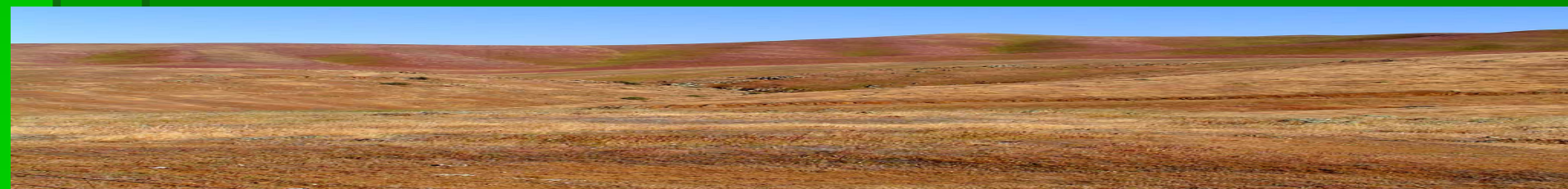
EARTH SYSTEM DYNAMICS

Examples of Potential Pilot Projects in 2007-2009

- MAIRS-CEOP Joint integrated study on land – atmosphere -**hydrosphere** interaction in semi-arid Asia;
- Atmospheric chemistry-monsoon interaction integrated study in city cluster of Yangtze Delta;
- Global warming-deglaciation-**river system** integrated study over the Tibetan Plateau as well as Asia;
- Development of an Regional Earth System Model for Monsoon Asia.

MAIRS-CEOP Joint integrated study on land –atmosphere -hydrosphere interaction in semi-arid Asia

- Water resource and ecosystem service goods are very crucial to the people living in semi-arid regions
- Semi-arid regions are sensitive to monsoon variability and human perturbations
- Semi-arid areas in monsoon Asia are one of the major sources of dust aerosol



Main research themes

- Interactions among global warming, monsoon variability and aridity
- Atmosphere, land surface and ecosystem interaction
- Dust aerosols, hydrological cycle and climate

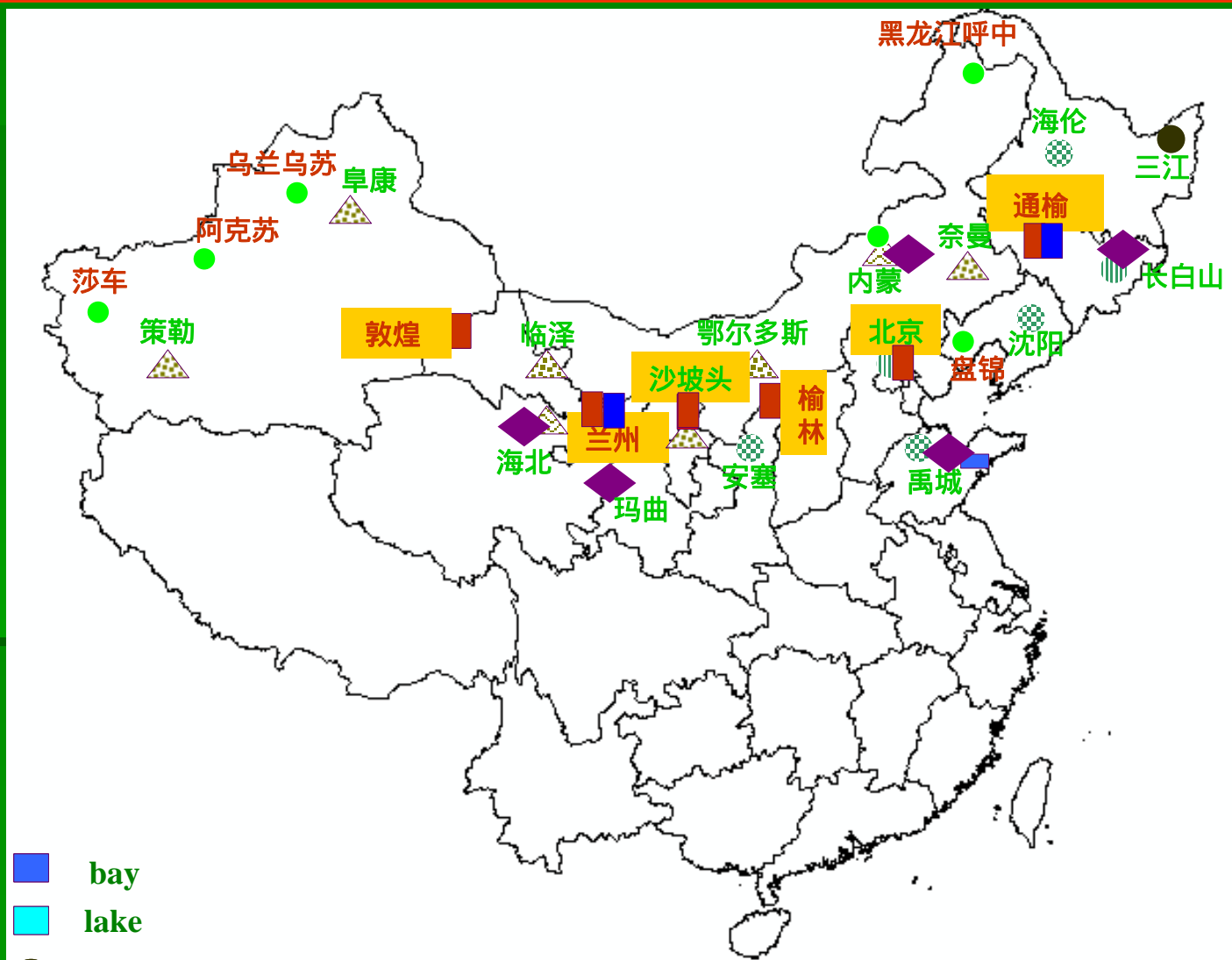
Leading research question:

How will semi-arid zones change in the next decades with respect to water resource, air quality, provision of ecosystem goods and services, extreme events and hazards?



CEOP/MAIRS coordinated enhanced observation in arid /semi-arid region of Northern China

- CEOP
- ◆ China Flux
- dust
- Land-atm.



(CERN)

- crop
- forest
- ▲ grassland
- ▲ desert

- bay
- lake
- wetland

Tongyu CEOP reference site, Northeastern China



Lanzhou station over Loess Plateau



Atmospheric chemistry-monsoon interaction in city cluster of Yangtze Delta

- Urbanization is a major driver, and outcome of economic and social development
- Urban zones are the major sources of all pollutants
- Urbanization is occurring at very rapid rate and is expected to continue in next decades



Main research themes

- Energy, emissions and urban air quality
- Urbanization, flood regimes, disaster management
- Urbanization and water security

Leading research question:

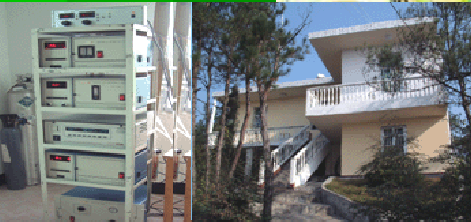
What are the impacts of urban landscape change and emissions on the climate system, ecosystem, agriculture and human health?



Coordinated observation in city cluster of Yangtze delta

- **Emissions of atmospheric pollutants;**
- **Observation of physics and chemistry of atmospheric aerosols and their pre-bodies;**
- **Remote sensing of aerosols distribution and their radiative characters, in cooperation with surface stations;**
- **Other meteorological and land surface elements.**

Observation network in city cluster of Yangtze Delta



Regional Model Inter-comparison Project for Asia(RMIP)

- USA: CU , A. Lynch; ASU , W.Gutowski
- Japan: NIES , S. Emori; CRIEPI, H.Kato
MRI , Sato
- Australia: CSIRO, J.McGreger
- R.Korea: SNU, D.Lee; YU, J.Kim
- China: TEA-RC, C.Fu; NU, B.Su

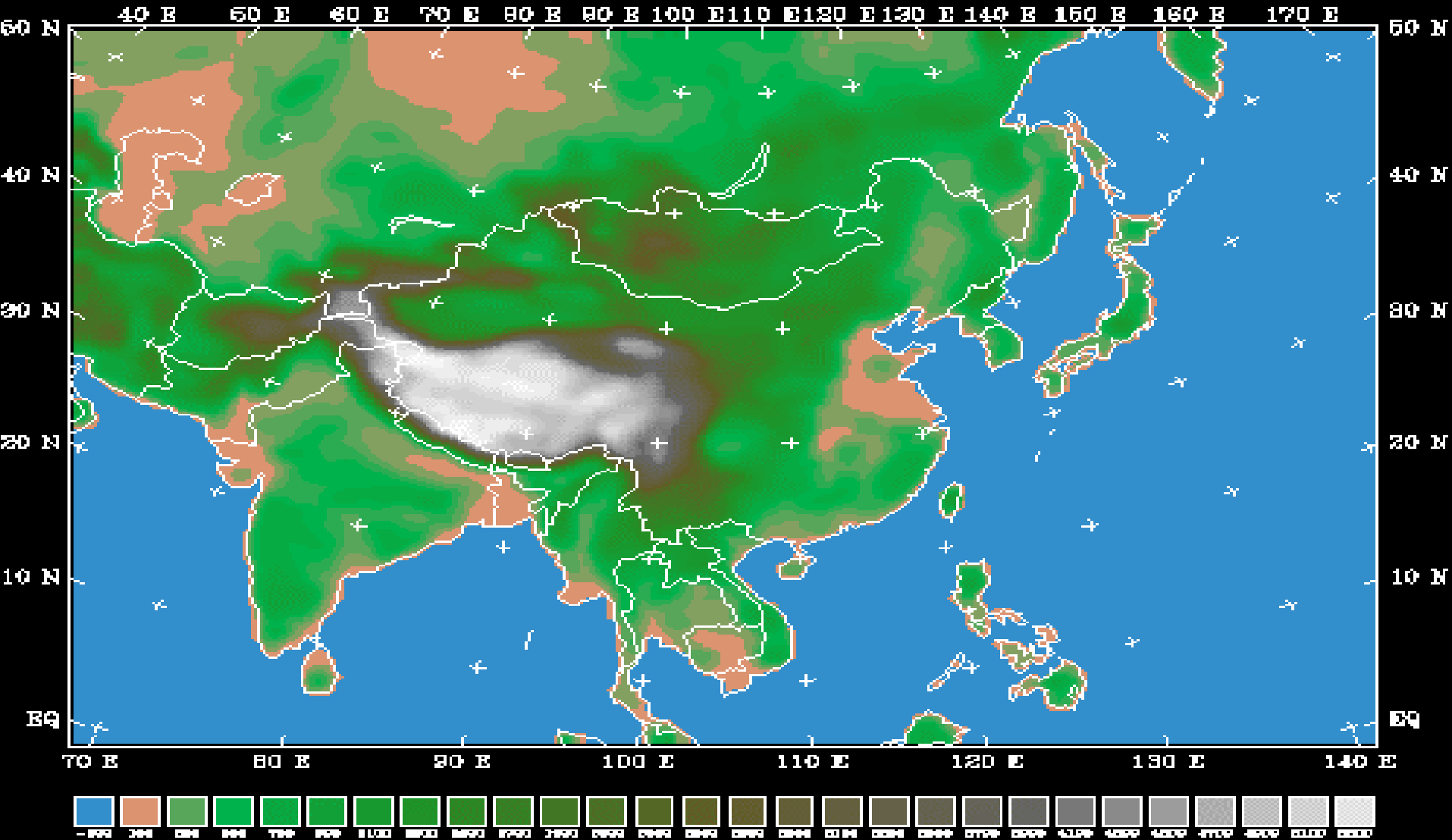
A Joint effort of 10 research groups of 5 countries

(Fu et al, Bulletin of AMS, Feb.2005)

TASKS OF RMIP FOR AISA

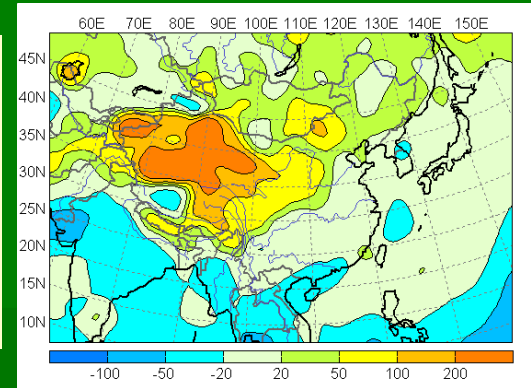
- Phase I, 18 months run, annual cycle and extreme
- Phase II, 10 years run, statistical behaviors
- Phase III, nesting with GCM, projection of climate change in 21 Century,

Topography in model domain

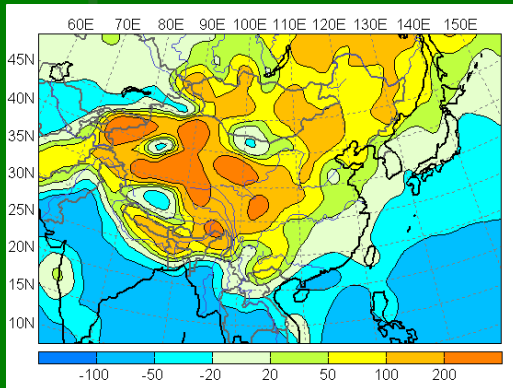


Bias of Simulated Annual Total Precipitation to Observation (%)

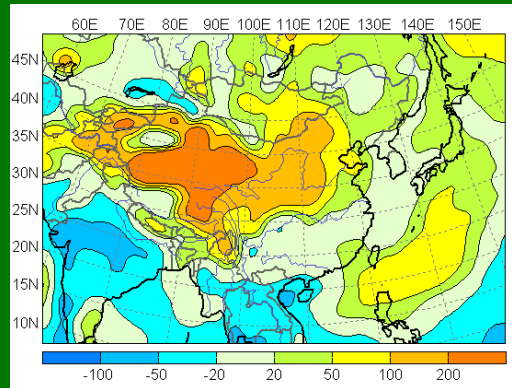
Too much rain over Central Asia (100-200%)



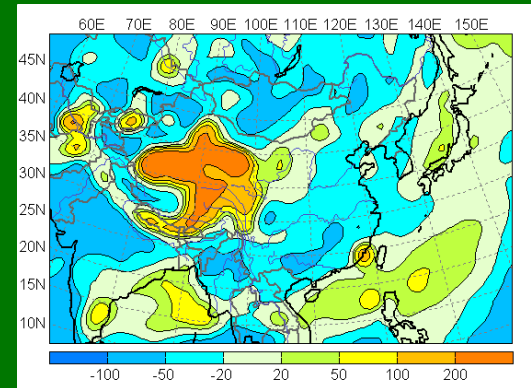
Ensemble



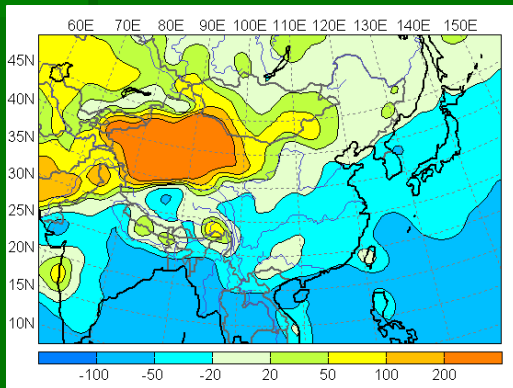
RIEMS



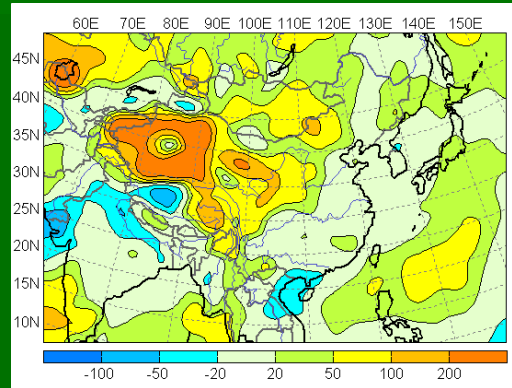
NJUM



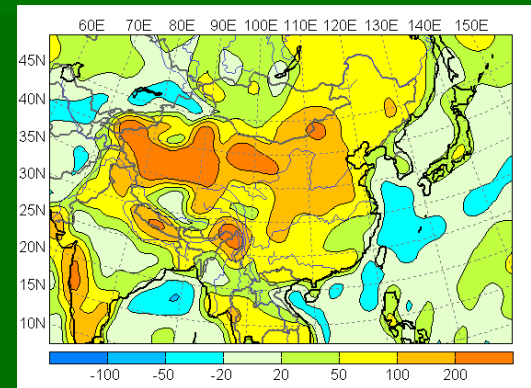
MRI



RegCM3



SNU RCM



CSIRO CCAM

MAIRS related meetings in future

- **Symposium on Global Change: Asia monsoon, extreme weather and climate, in Pacific Science Congress (PSC), 13-17, Jun. 2007, Okinawa, Japan;**
- **MAIRS-CEOP Workshop on Semi-arid region study , 25-27, Jul. 2007, Lanzhou, China.**
- **MAIRS Workshop on Anthropogenic effects on Asia monsoon, Taipei, China, Fall of 2007;**
- **Regional Modeling workshop in 2007 - 2008;**
- **An MAIRS session in AGU 2007;**

New development of ESSP

In Transition

Partnership  **Program**

Earth System Science Partnership

1. Mission

The Earth System Science Partnership (ESSP) is a global environmental change science partnership which addresses the biogeophysical and socioeconomic factors that influence the Earth System and, in turn, the consequences for human societies, wellbeing and health. Our mission is to integrate the intellectual capital of disciplines required to enhance the understanding of the complexity of the earth system and to explore the policy relevance of its main findings for mutually inclusive ecological, social and economic sustainability.

2. Governance

ESSP is governed by a Scientific Committee (SC) whose composition is as follows:

SCIENTIFIC COMMITTEE

- 4 Programme Chairs
- 4 Programme Directors
- 1 ESSP Coordinator
- 4 External Members#, of which 1 is Chair
- 1 representative for each Joint Project (=4*)
- 1 ICSU representative
- 1 START representative
- 1 representative for each IRS (=1*)

* as of now

appointed by ICSU, in consultation with the 4 programmes

3. Administration

ESSP is administered by a Secretariat headed by a fulltime Executive Officer (EO) as well as such additional staff members as needed to carry out its mission.

4. Funding

The governance structure and Secretariat costs of ESSP are funded by public and private sources. The appointed business plan task force will prepare a budget for ESSP's expenditures.

5. Outreach

ESSP is working to establish a dialogue with scientific assessments, global environmental change policy activities and other stakeholder groups to deliver its scientific findings and to develop and impart the understanding necessary to respond to global environmental change.

Recommended words

- *The Earth System is the unified set of physical, chemical, biological and social components, processes and interactions that together determine the state and dynamics of Planet Earth, including its biota and its human occupants.*
- *Earth System Science is the study of the Earth System, with an emphasis on observing, understanding and predicting global environmental changes involving interactions between land, atmosphere, water, ice, biosphere, societies, technologies and economies.*
- *The Earth System Science Partnership is a partnership for the integrated study of the Earth System, the ways that it is changing, and the implications for global and regional sustainability.*

The urgency of the challenge is great: In the present era, global environmental changes are both accelerating and moving the earth system into a state with no analogue in previous history.

Challenge of Earth System Science

In the present era, global environmental changes are both accelerating and moving the earth system into a state with no analogues in the previous history.



Thank you very much!

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