

Update information of MAIRS

(January of 2007)

The formal launch of MAIRS in Global Change Open Science Conference in November of 2007



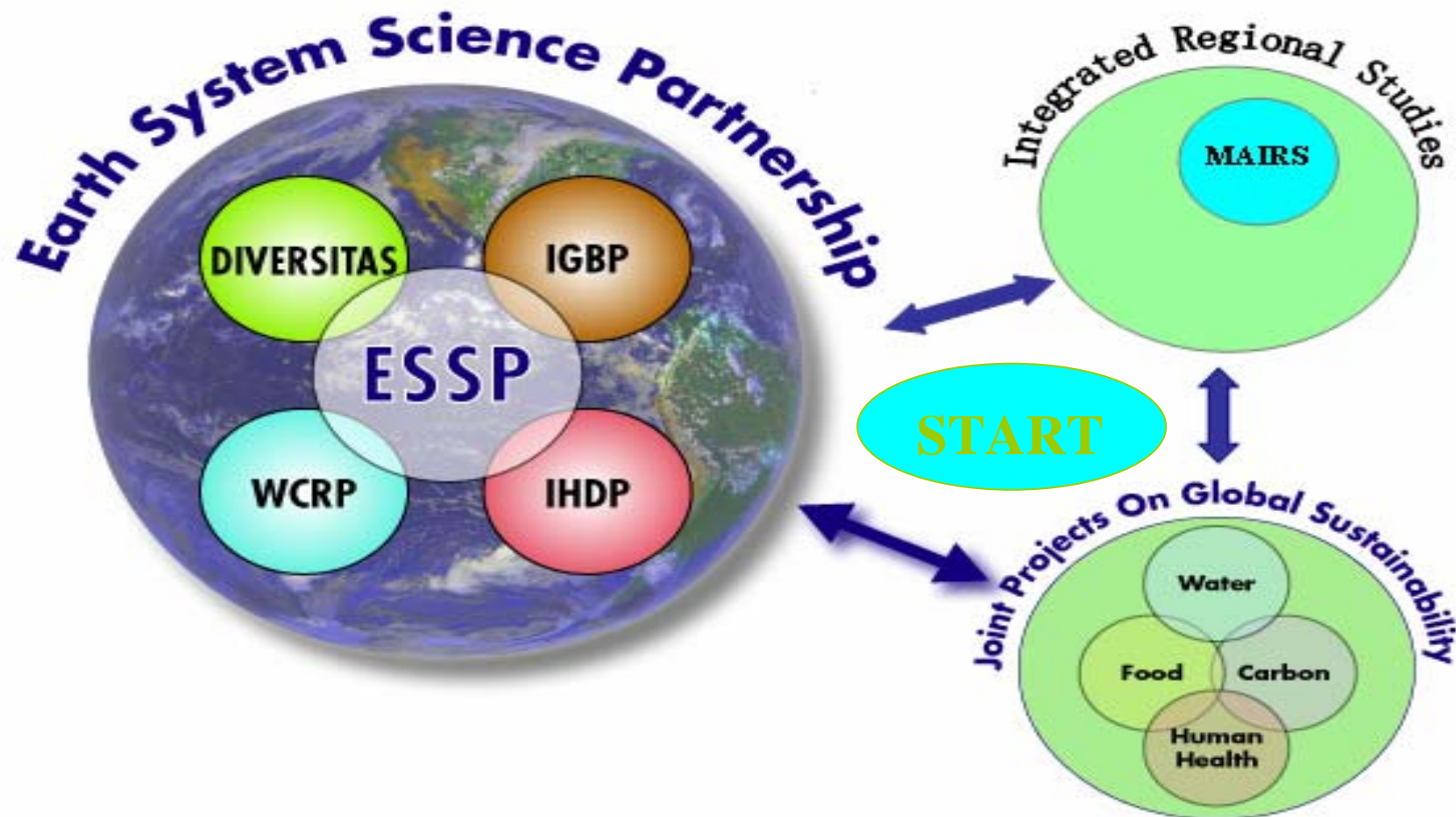
Officially recognizing the MAIRS as an ESSP program

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



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

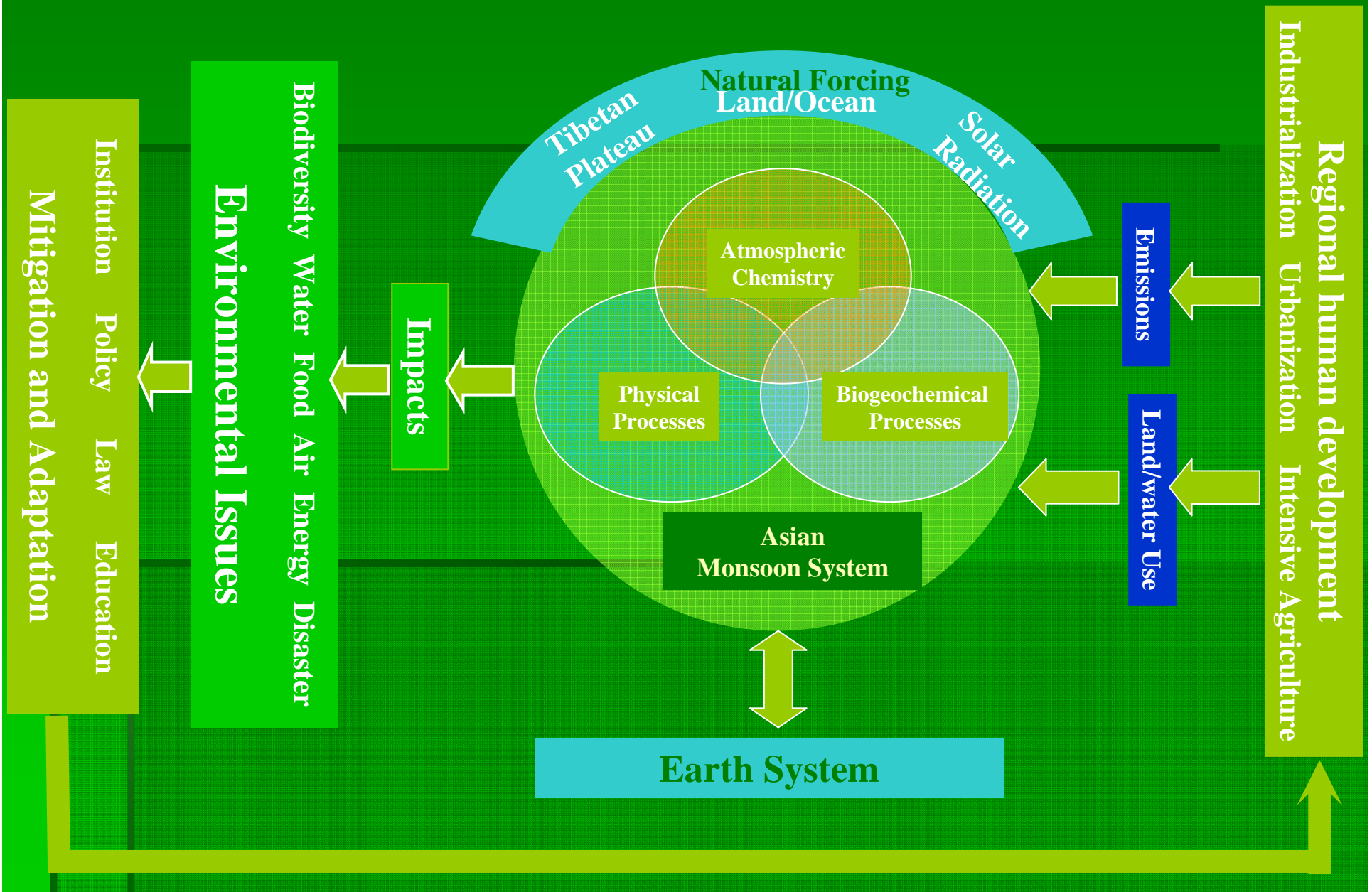


Vision



To significantly advance understanding of the interactions among the human–natural components of the overall environment in the monsoon Asian region and **implications for the global Earth System**, in order to support the strategies for sustainable development.

Conceptual Framework of MAIRS

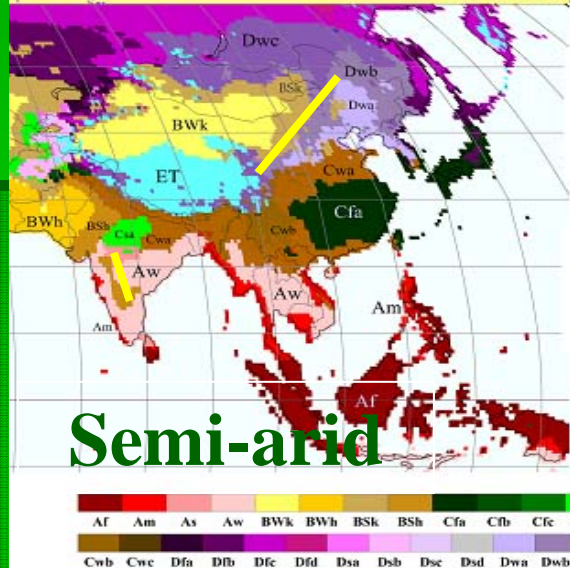
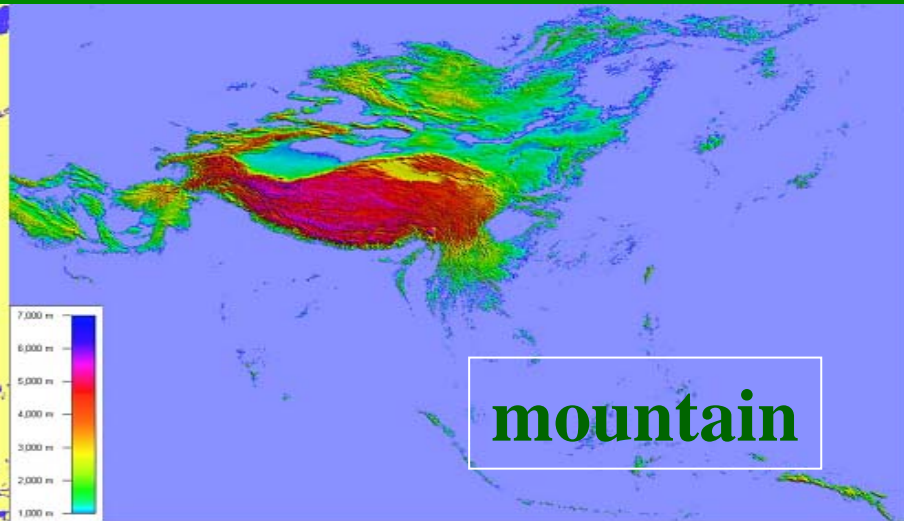


Objectives



- *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

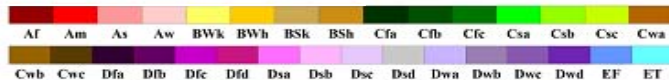


Main climates
 A: equatorial
 B: arid
 C: warm temperate
 D: snow
 E: polar

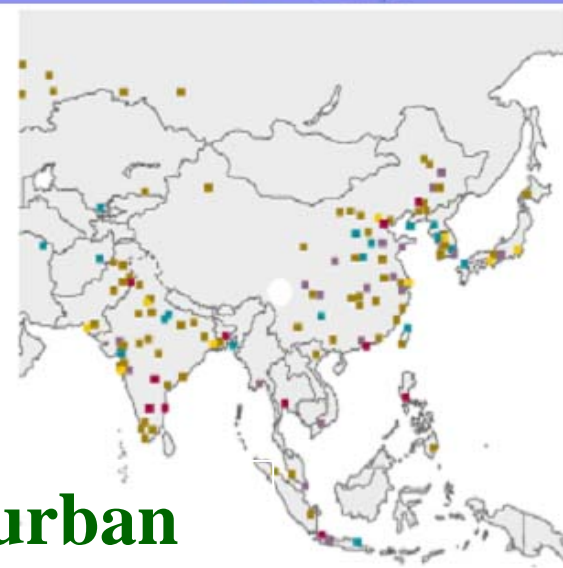
Precipitation
 W: desert
 S: steppe
 f: fully humid
 s: summer dry
 w: winter dry
 m: monsoonal

Temperature
 h: hot arid
 k: cold arid
 a: hot summer
 b: warm summer
 c: cool summer
 d: extremely continental

Frost/Tundra
 F: polar frost
 T: polar tundra



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



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

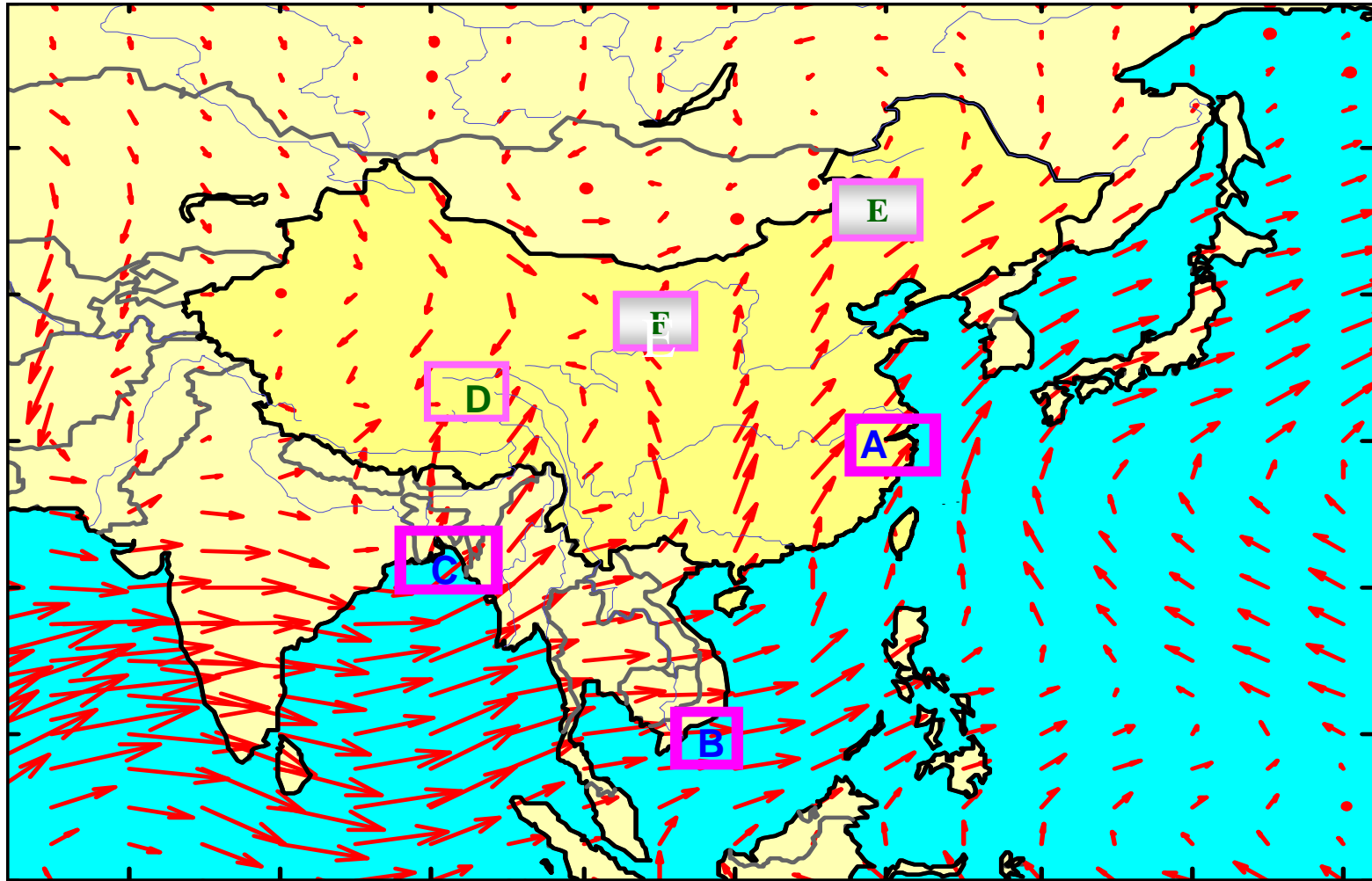
Urban

Changes in resources use and emission due to rapid urbanization

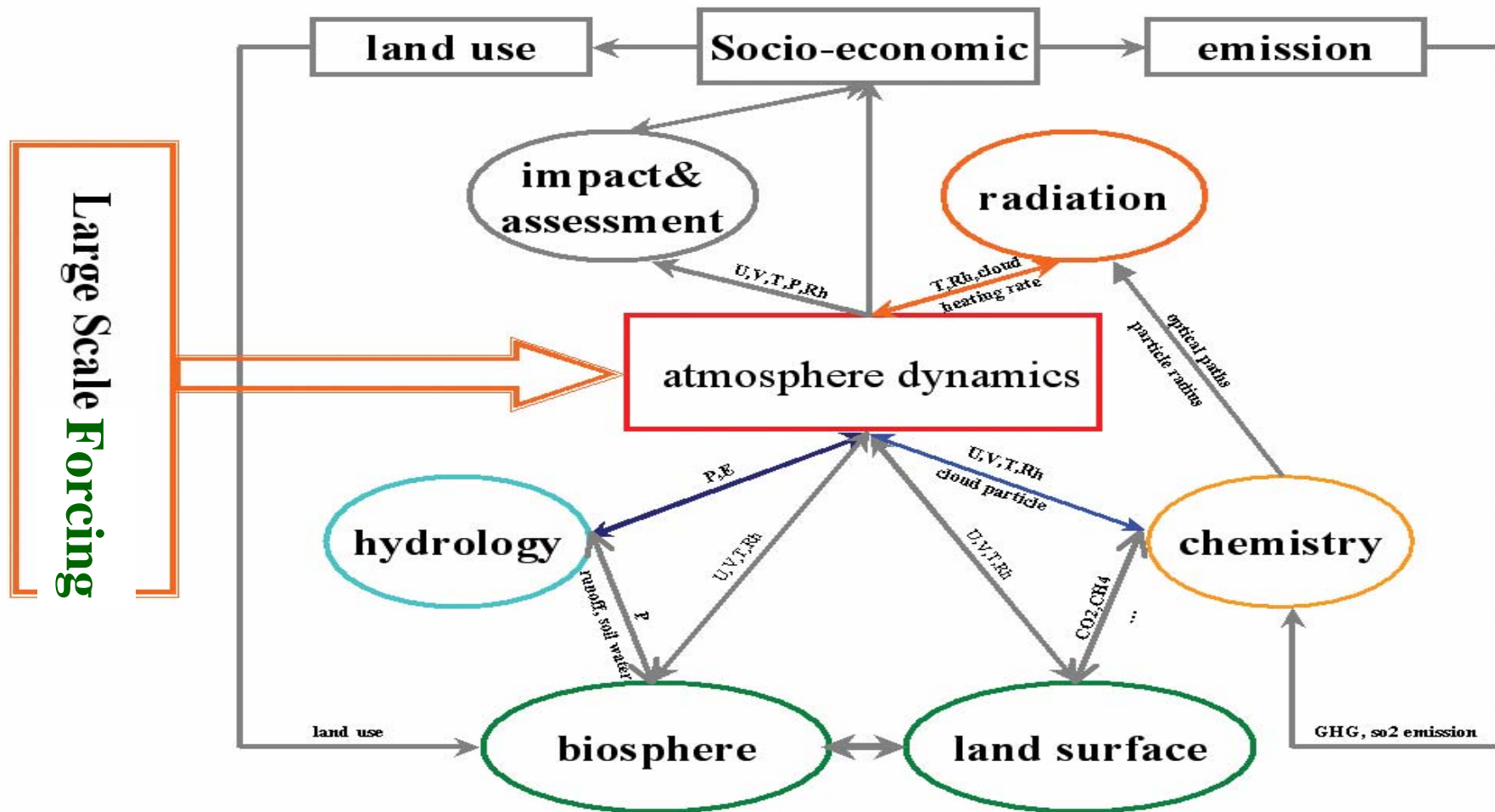
Development of Tools for Integrated Study

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

Enhanced Key Observation Areas



A Regional Model of Earth System



EARTH SYSTEM DYNAMICS

Examples of Potential Pilot Projects in 2007-2009

- MAIRS-CEOP Joint study on land-atmosphere-hydrosphere integrated study in semi-arid Asia;
- Atmospheric chemistry-monsoon interaction in city cluster of Yangtze Delta;
- Global warming-deglaciation-river system over the Tibetan Plateau area;
e.t.c

MAIRS-CEOP Joint study on land-atmosphere-hydrosphere integrated study 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

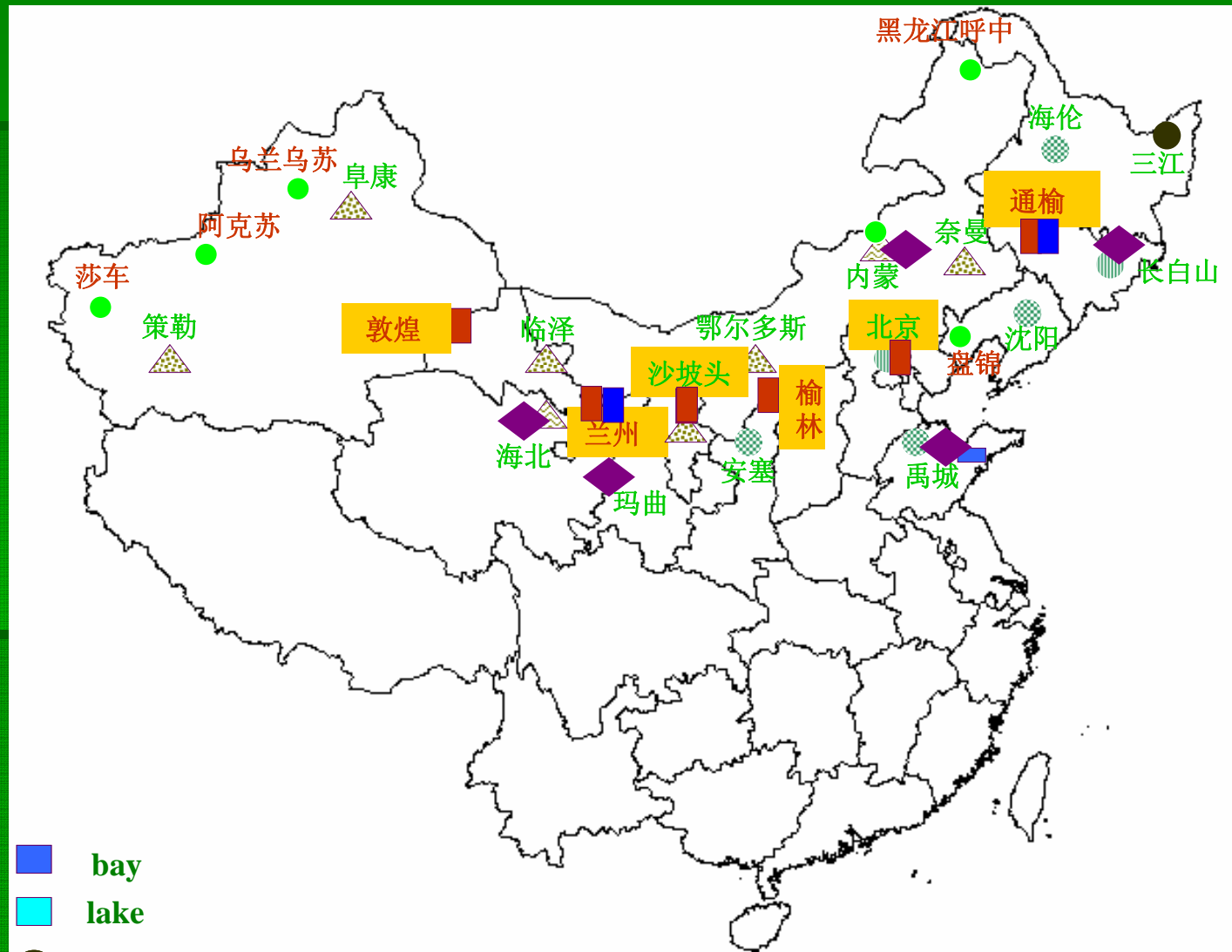
Leading research question:

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

In-situ observation

Subsurface (-1.6m): soil temperature, moisture, heat flow

Surface(0+2m): radiation, surface temperature, moisture, precipitation, vegetation, snow

Near surface(16m-20m): temperature, specific humidity, wind speed, momentum, latent and sensible heat flux

Atmospheric aerosols and related variables

Ecological observation

Sample fields with fence

at sandy land, grassland and culture land
each with 100m x 100m

Observation items on

biodiversity, above- and under-ground productivity,
vegetation height, fraction, LAI, photosynthesis,
water vapor potential, soil organic substance,
litter decomposition, chemical elements cycling, etc.

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 318-11	CIMEL ELEC.

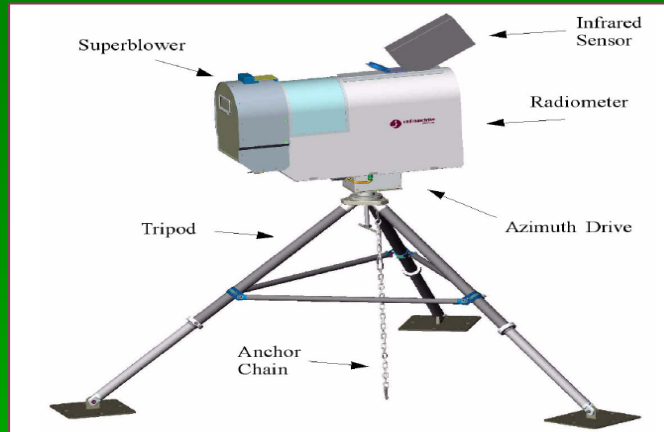
Tongyu(semi-arid) reference site, Northeastern China



Lanzhou over Loess Plateau



Three Additional Instruments



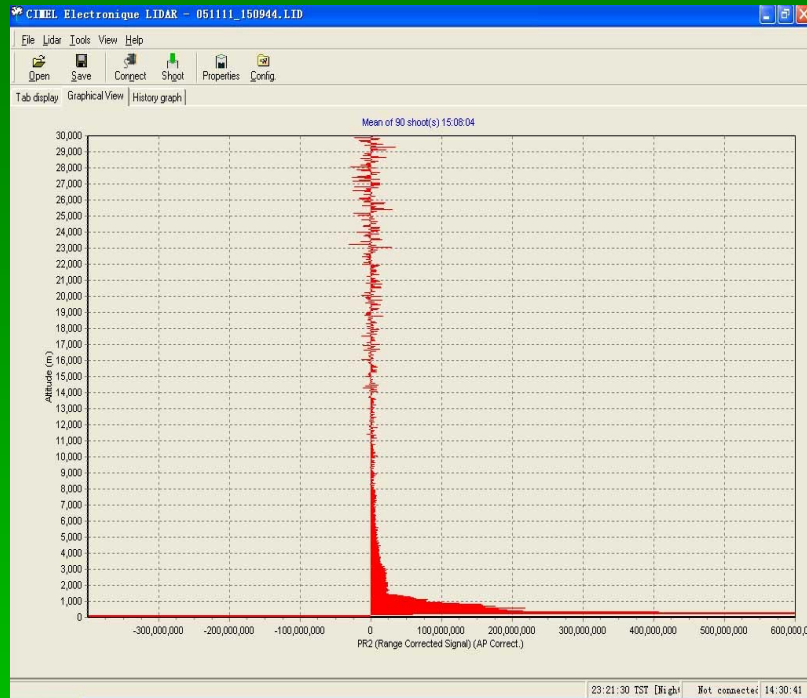
1. Microwave Temperature, Humidity & Liquid Water Profiling Radiometer



2. Cimel Sunphotometer

It is a multi-channel, automatic sun-and-sky scanning radiometer that measures the direct solar irradiance and sky radiance at the Earth's surface.

3. CAMEL™ CE370-2 Lidar, Wavelength = 532 nm



**Winter, Clear Sky, Lanzhou
03: 52: 03 (UTC), Nov 11,
2005**

Major Instruments in Phase II



Multi-Filter Radiometer (MFR)

It is simply the head from a multi filter rotating shadowband radiometer (MFRSR) mounted on a tower pointing at the surface.

Multi-Filter Rotating Shadowband Radiometer (MFRSR)

Diffuse shortwave irradiance
Direct shortwave irradiance
Shortwave irradiance



Major Instruments in Phase II



Micropulse Lidar (MPL)

- Aerosol extinction
- Backscatter profile
- Cloud decks Cloud layer
- Lidar backscatter
- Relative backscatter

Vaisala Ceilometer

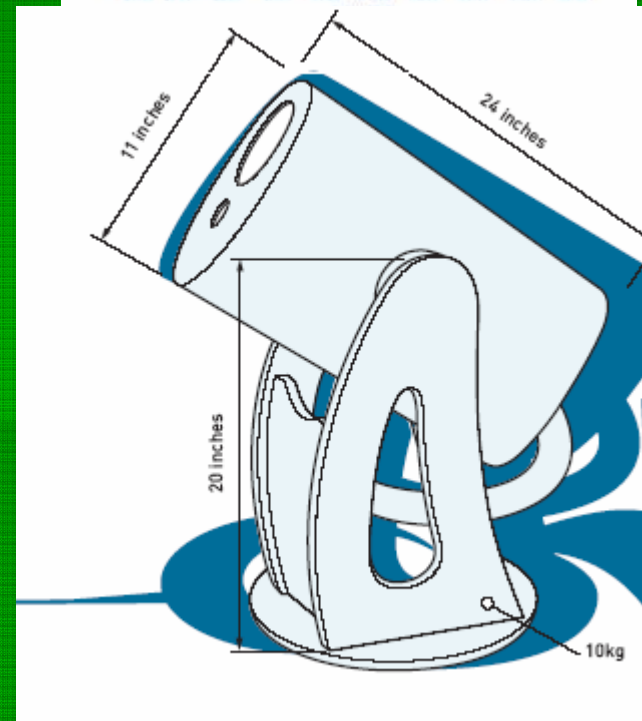
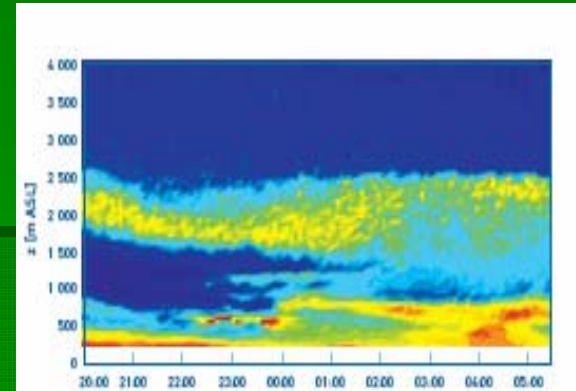
- Backscatter profile
- Cloud-bottom height
- Lidar backscatter



Major Instruments in Phase II

Raman Lidar

The Raman Lidar (RL) is an active, ground based laser remote sensing instrument that measures vertical profiles of water-vapor mixing ratio and several cloud- and aerosol-related quantities.



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:

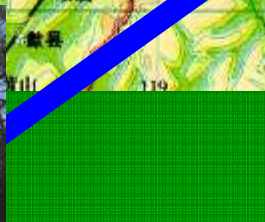
What are the impacts of urban landscape change and emissions on the climate system, ecosystem, agriculture and human health?



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



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 , 9-13 Aug. 2007, Lanzhou, China.**
- **MAIRS Workshop on Anthropogenic effects on Asia monsoon, Taipei, China, Fall of 2007;**
- **Regional Modeling workshop in 2007 -2008;**



Thank you very much!

Contact: info@mairs-essp.org
www.mairs-essp.org

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

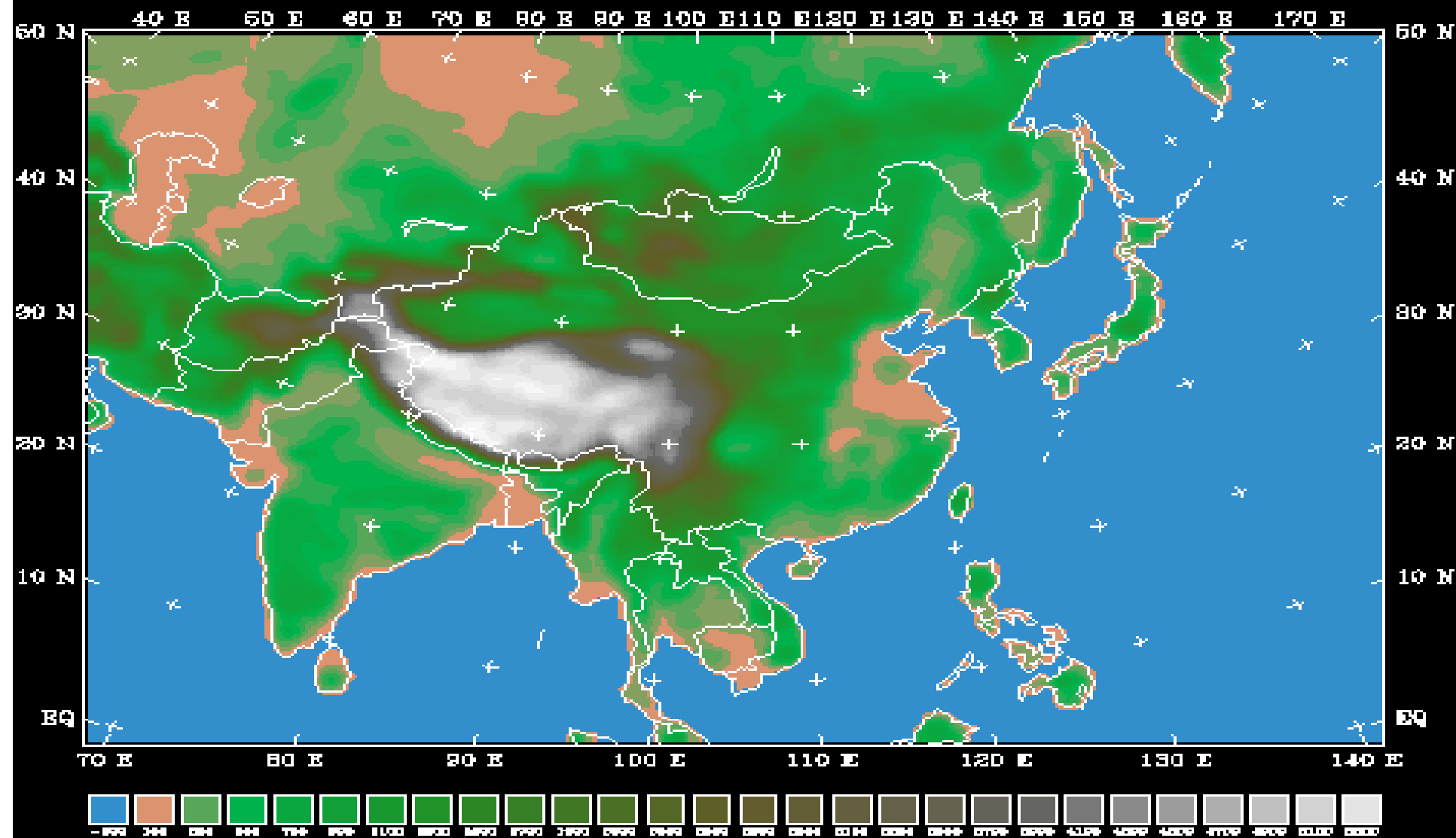
A Joint effort of 10 research groups of 5 countries

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

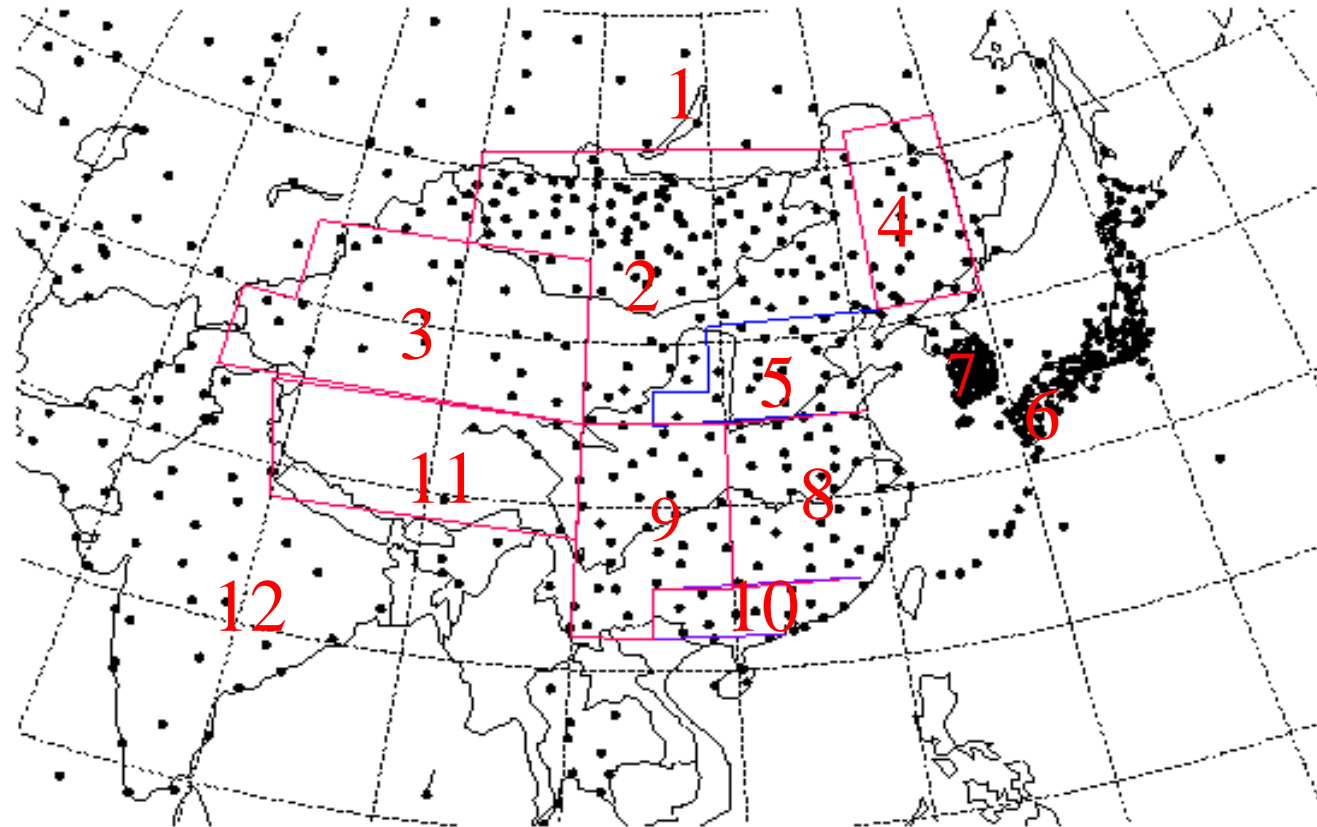
TASKS OF RMIP FOR AISA

- 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

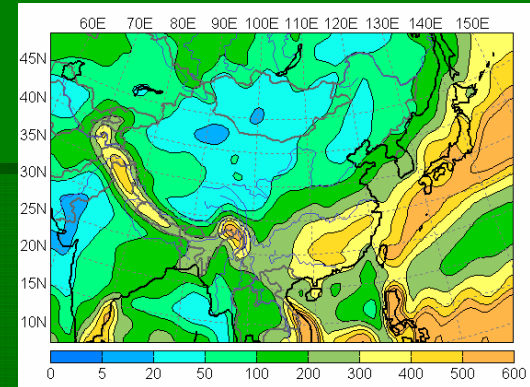
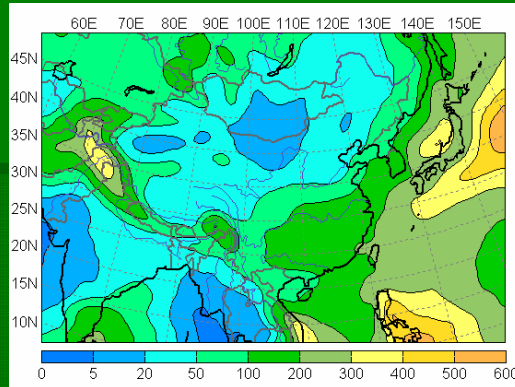
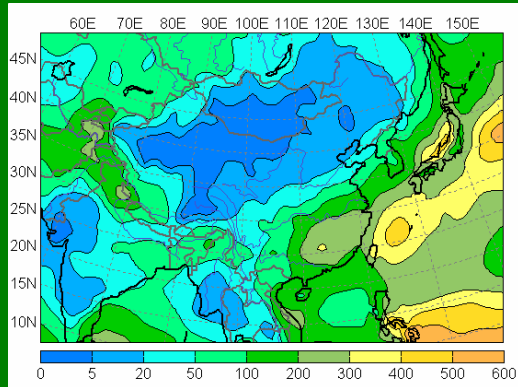


Distribution of observation stations and classification of sub-regions

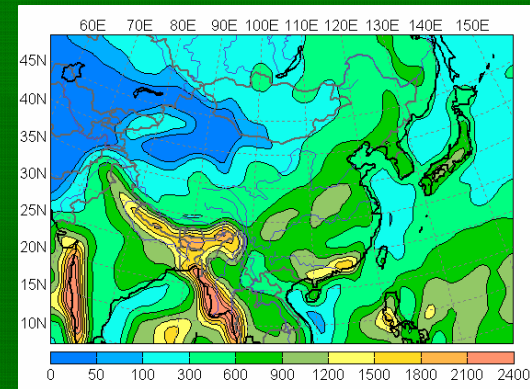
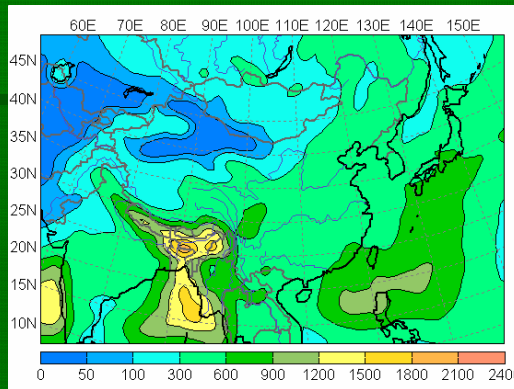
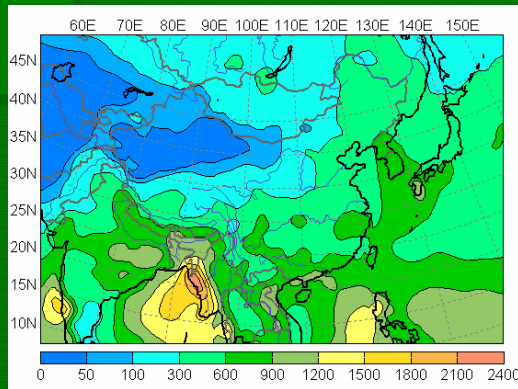


1:Siberia 2:Eastern arid/semi-arid regions 3:western arid/semi-arid regions
4:Northeast China 5:North China 6:Japan islands 7:Korea peninsula 8:Center China
9:Southwest China 10:South China 11:Tibetan platform 12:Indian sub-continent

10-winters Averaged Total Precipitation(mm)



10-summners Averaged Total Precipitation(mm)



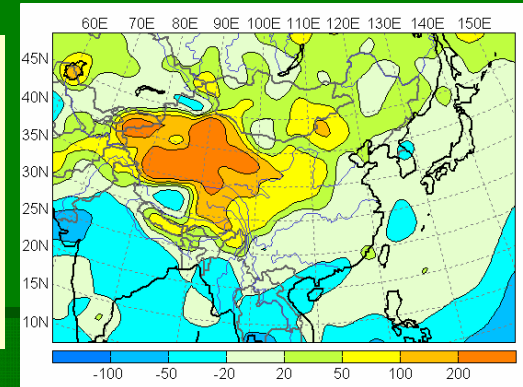
Observation

Ensemble

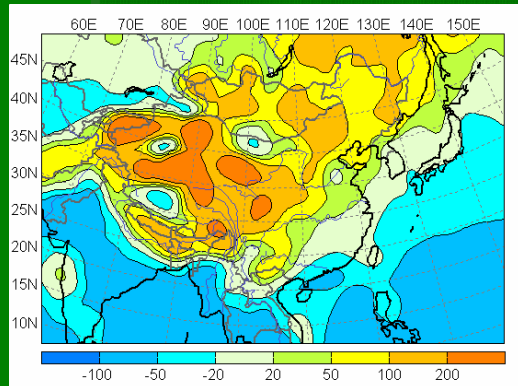
CSIRO CCAM

Bias of Simulated Annual Total Precipitation to Observation (%)

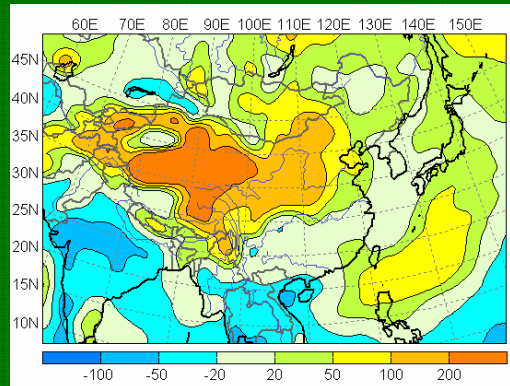
Too much rain over Central Asia (100-200%)



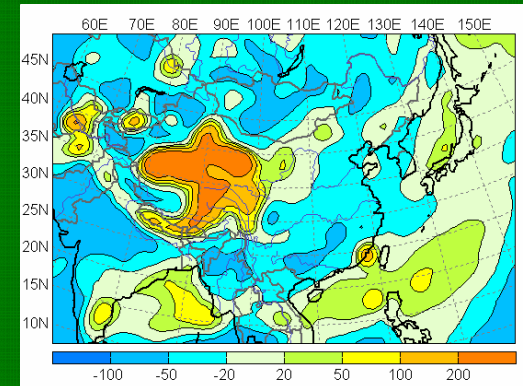
Ensemble



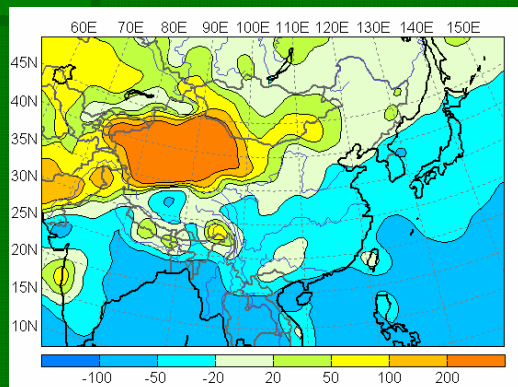
RIEMS



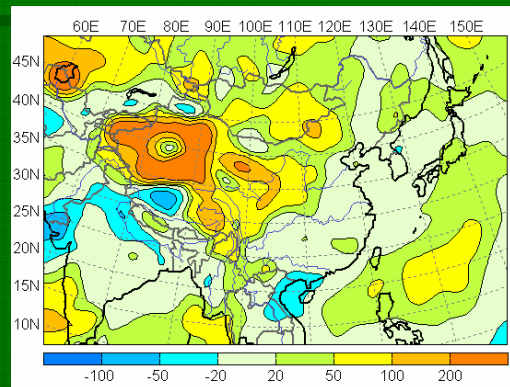
NJUM



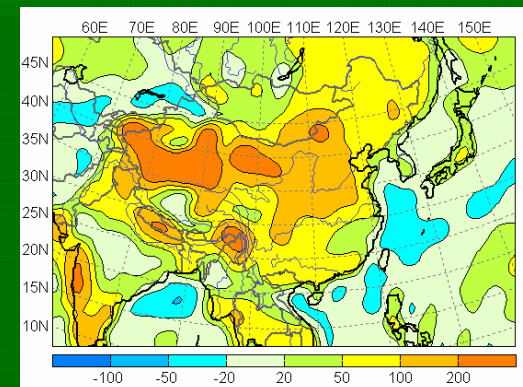
MRI



RegCM3



SNU RCM



CSIRO CCAM