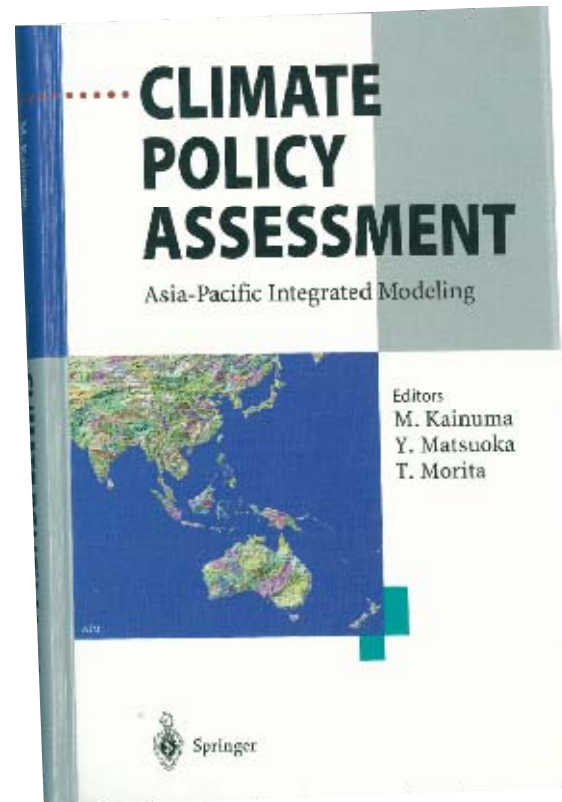# Introduction to AIM/Impact model
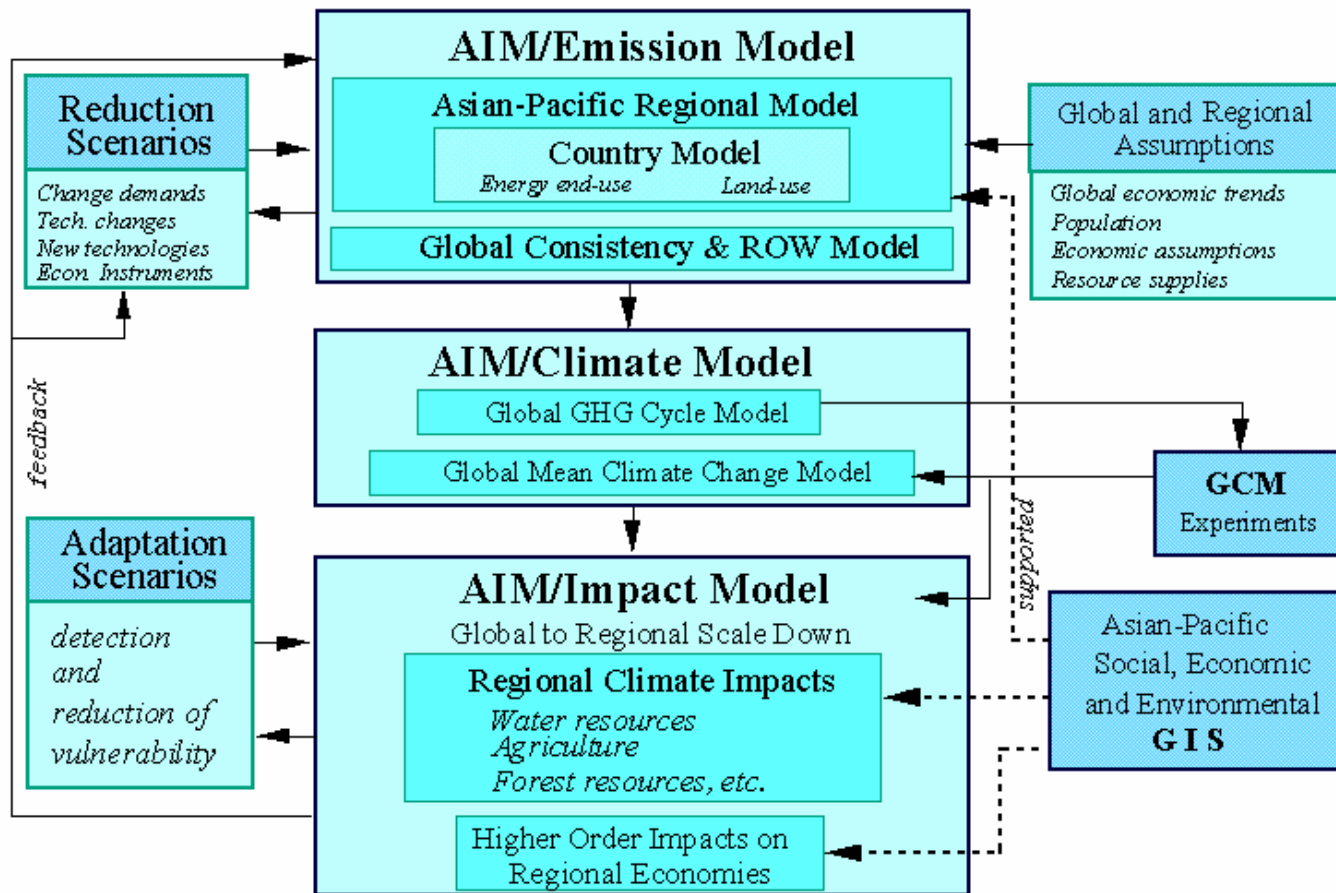
National Institute for Environmental Studies

Items of the presentation

- Overview of AIM/Impact model
  - Structure
  - Examples of the assessed results
- Reference
  - Chapter 3 of AIM BOOK

AIM/Impact in AIM Framework

Objective of AIM/Impact

- Projection of potential impacts of climate change on sensitive sectors.
- Consideration of linkages among affected sectors.
- Proposition of effective adaptation measures to cope with climate change.
- Accounting feedback effects on GHGs concentration and climate system.
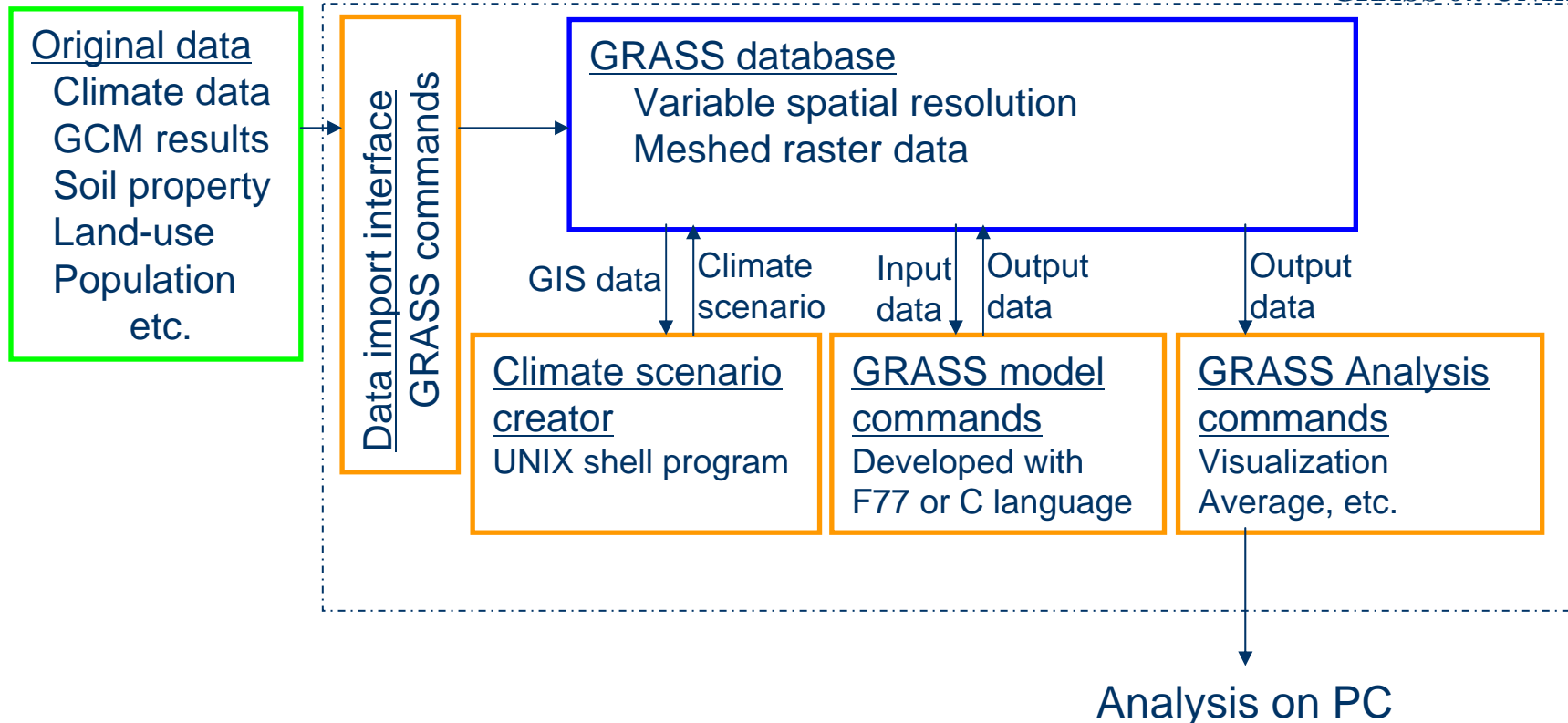
Framework of the AIM/Impact model
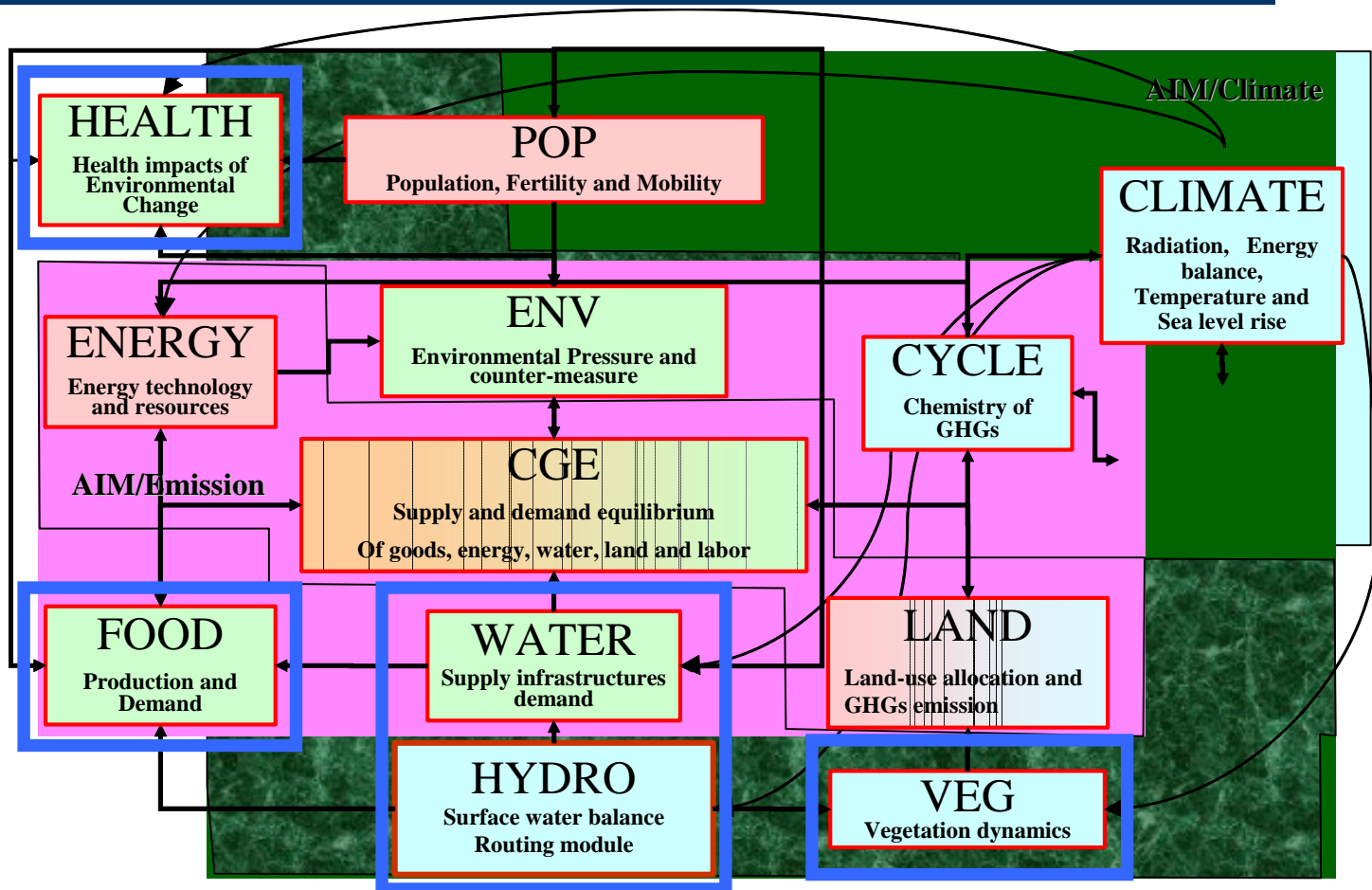
Characteristics of AIM/Impact

- Area focused: Whole Asia to Global
- Spatial analysis (Modules run on GIS)
- Consistency between socio-economic scenario and climate change scenario.
- Integration of emission (WG3), climate (WG1) and impact and adaptation (WG2) in the institute.

Computation framework

GRASS on UNIX

Original data
- Climate data
- GCM results
- Soil property
- Land-use
- Population
- etc.

Data import interface
GRASS commands

GRASS database
- Variable spatial resolution
- Meshed raster data

GIS data | Climate scenario | Input data | Output data | Output data

Climate scenario creator
UNIX shell program

GRASS model commands
Developed with F77 or C language

GRASS Analysis commands
Visualization
Average, etc.

Analysis on PC

GRASS (Geographic Resoucres Analysis Support System)

- Gegraphical Information System Software
- Run on unix oprating systems (Solaris, Linux, etc.)
- Advantage
  - Distributed on internet (Free)
  - Raster (gridded) data
  - Source codes available (C language)
  - Modules can be developed by users with the GRASS developers' library.
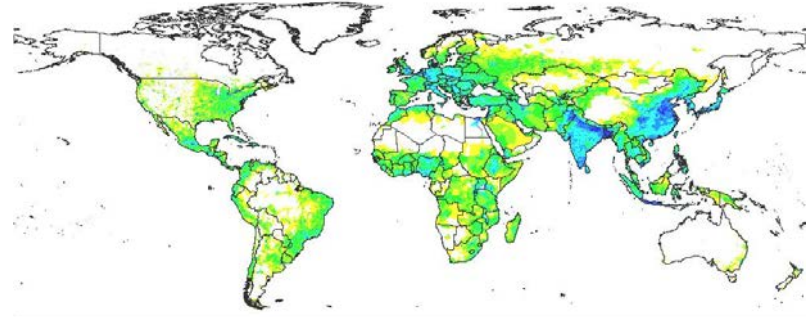- Disadvantage
  - Unix
  - Inexcelent graphical user interface
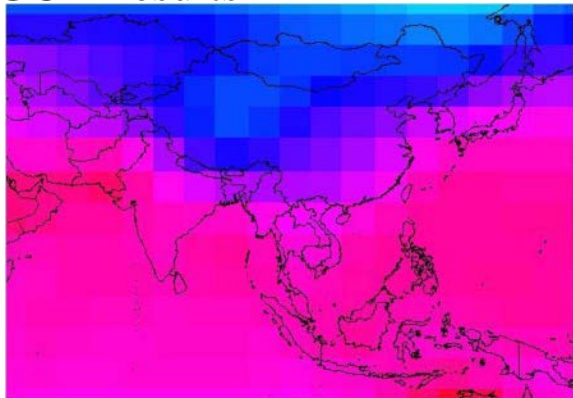
Example of spatial data managed in GRASS GIS

Obserbation climatology
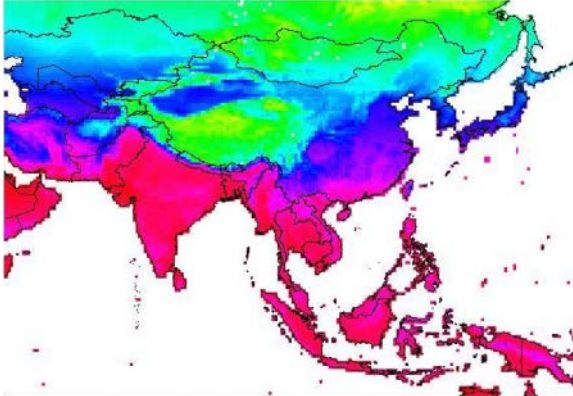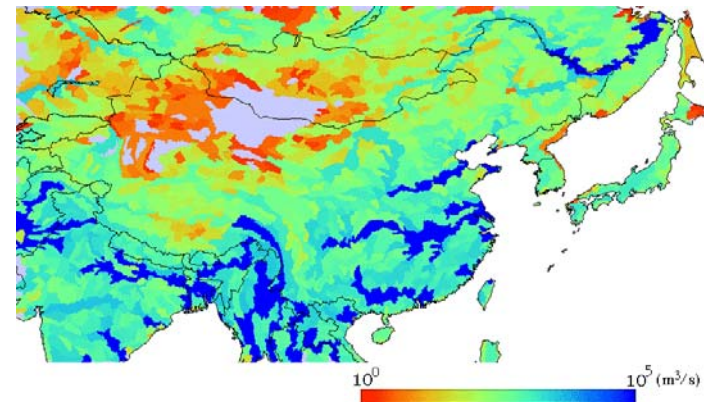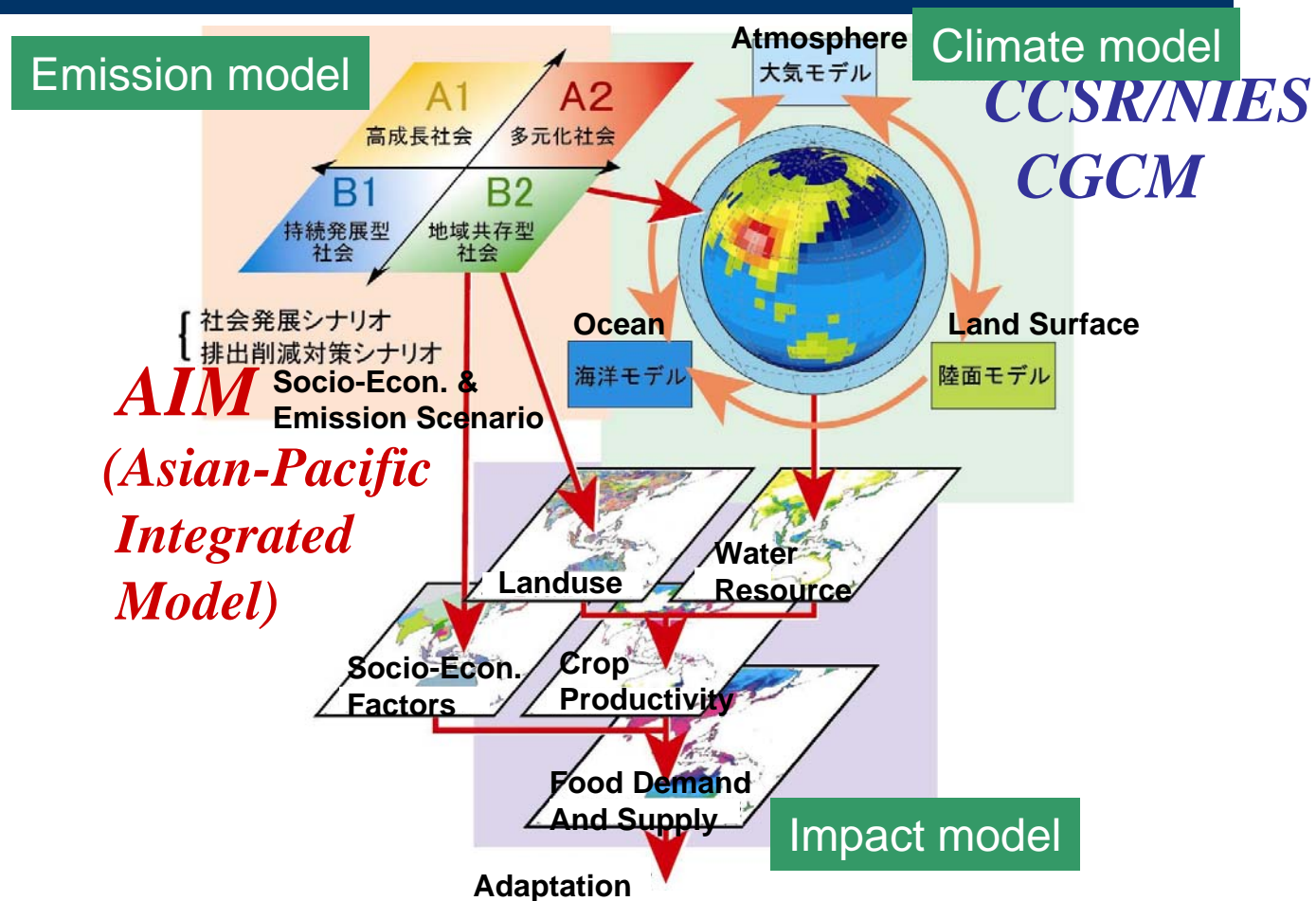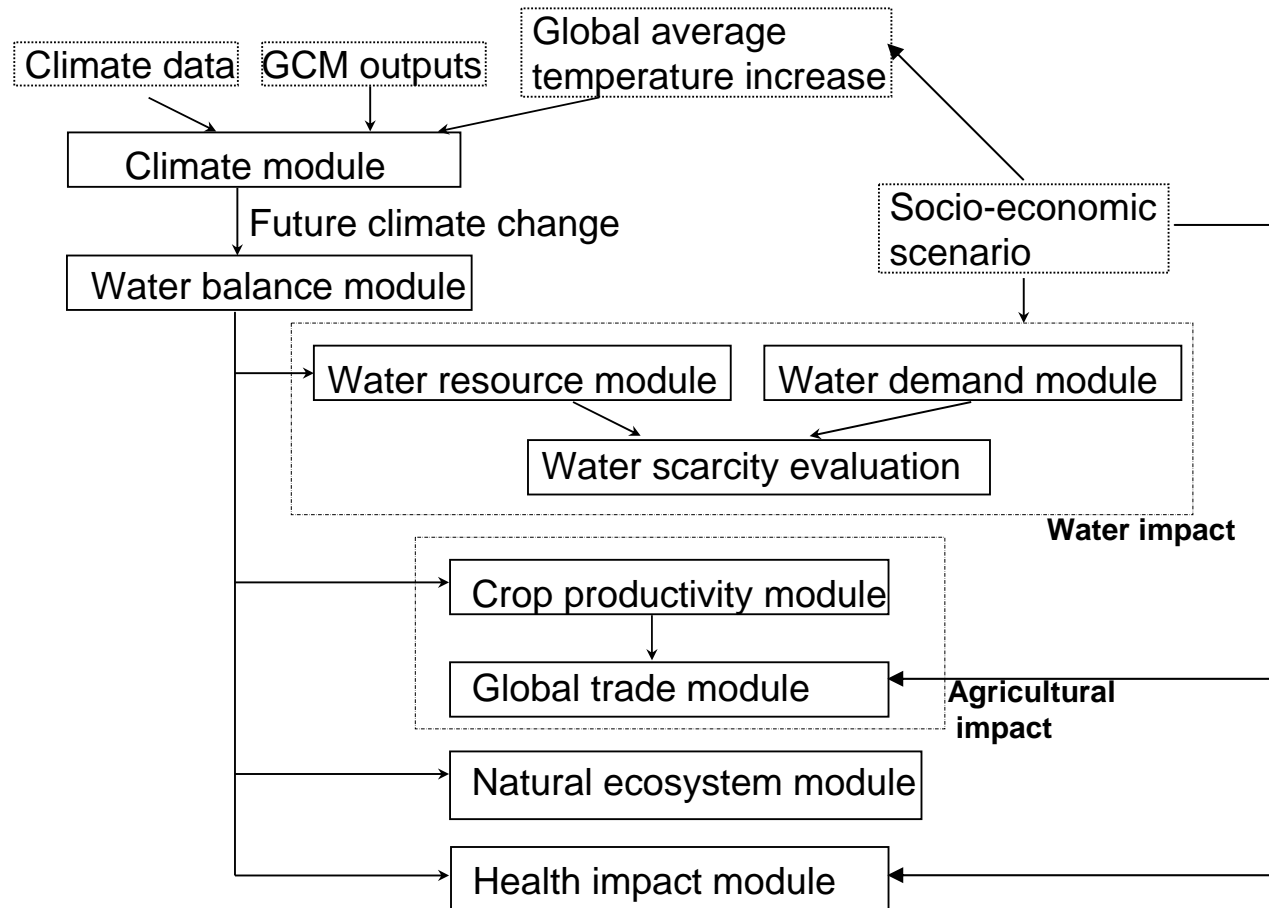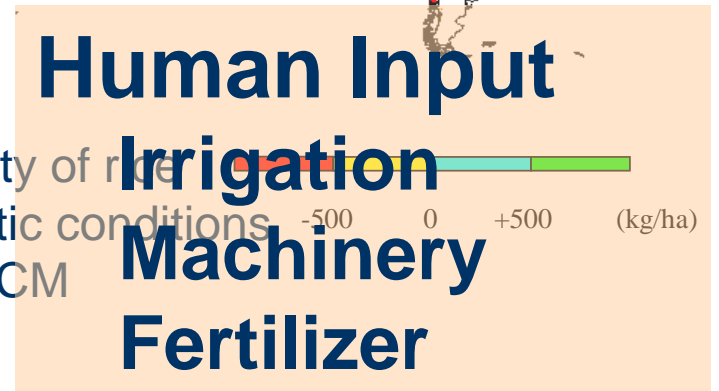

Population density

GCM results

Assessment results
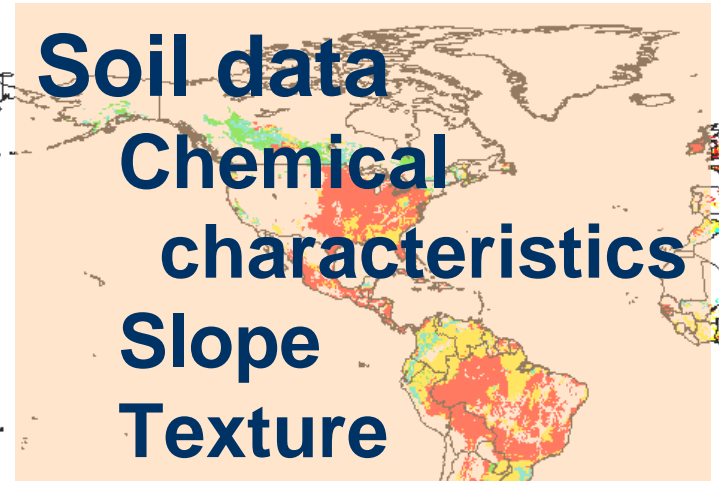

10^0 $10^5\,(m^3/s)$

Collaboration with climate model

Simplified framework

Crop productivity
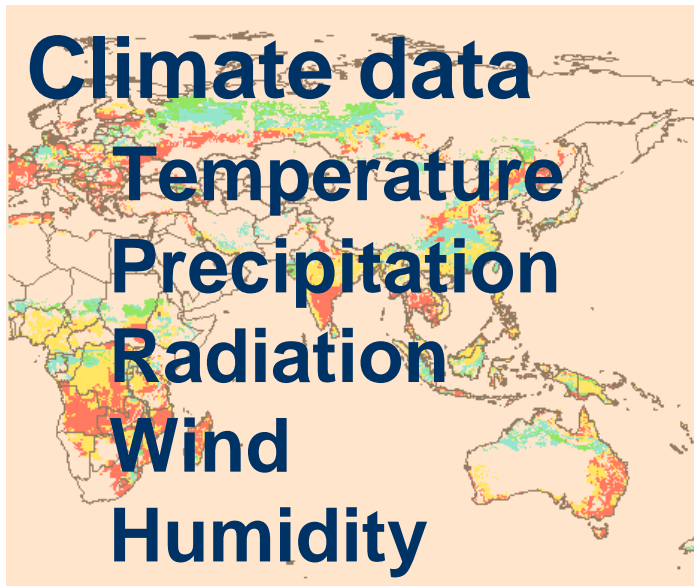
Climate data
Temperature
Precipitation
Radiation
Wind
Humidity

Soil data
Chemical characteristics
Slope
Texture

Human Input
Irrigation
Machinery
Fertilizer

Changes in the potential productivity of rice from 1990 to 2050 under the climatic conditions projected using the CCSR/NIES GCM

-500   0   +500   (kg/ha)
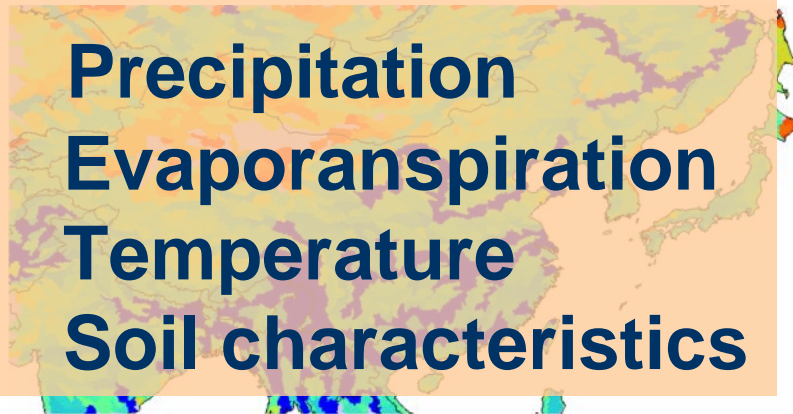
River discharge

Surface runoff
- Precipitation
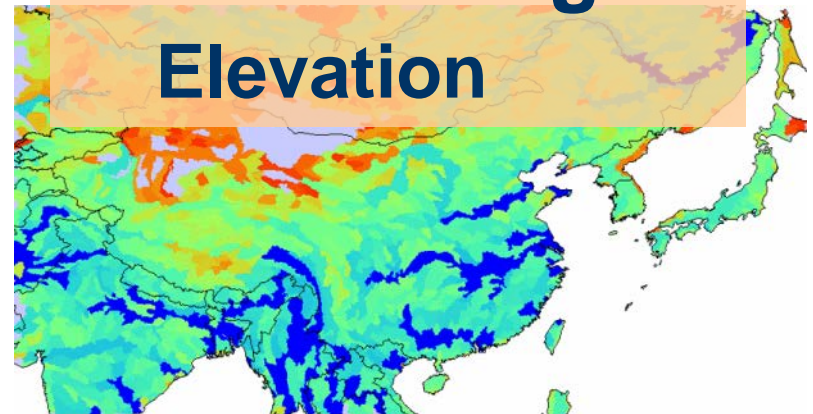- Evaporanspiration
- Temperature
- Soil characteristics

1990

River routing
- Elevation

2100

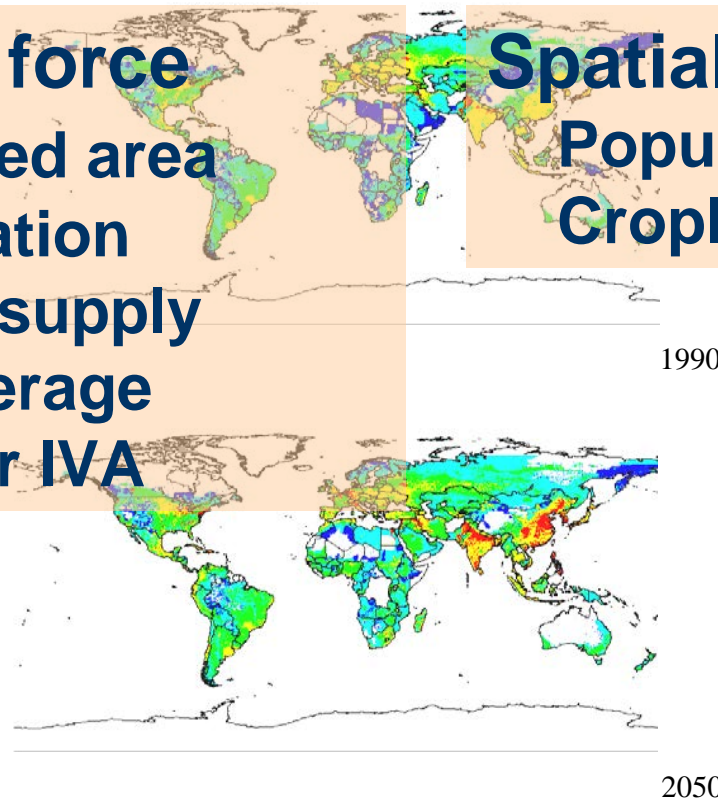Annual river discharge in 1990 and 2100 (UIUC climate model)
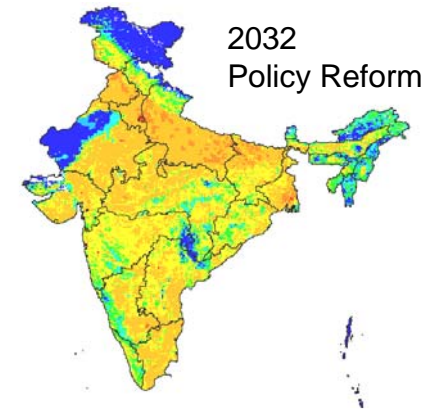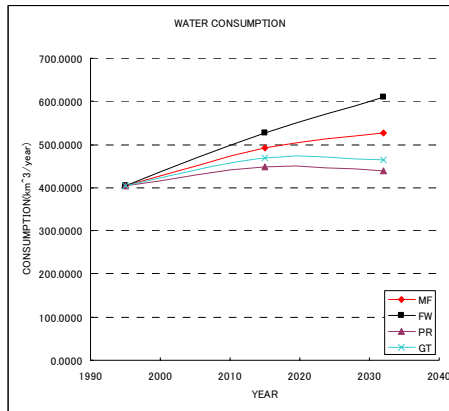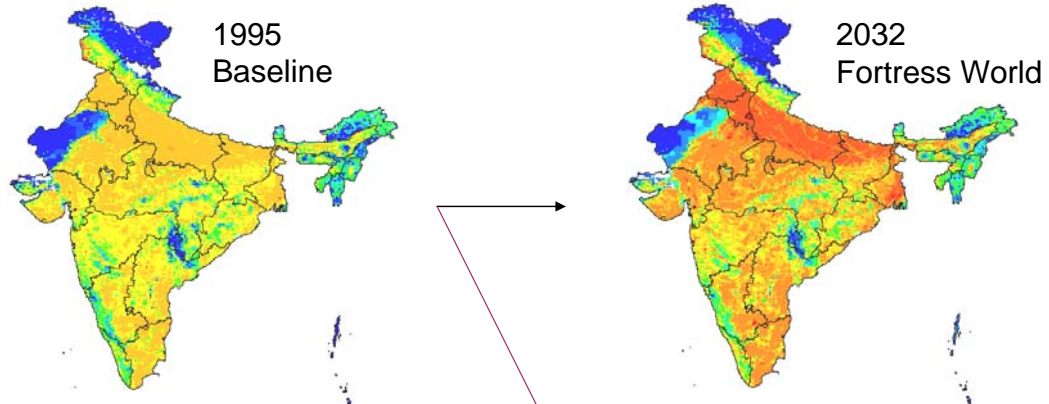
Water demand (withdrawal)

Driving force
  Irrigated area
  Population
  Water supply
   coverage
  GDP or IVA

Spatial distribution
  Population density
  Cropland distribution

1990

2050

0.3   3   30   300   (mm/year)

Water consumption in India (scenario analysis)

1995
Baseline

2032
Fortress World

2032
Policy Reform

Change of water consumption from 1995 to 2032
(Domestic + Agriculture + Industry)

$m^3/ha/year$

1   40   200   1000   5000

Surface runoff as Water supply

Evapotranspiration
Temperature
Wind speed
Radiation
Humidity

CCCma

Field capacity
Vegetation
Soil
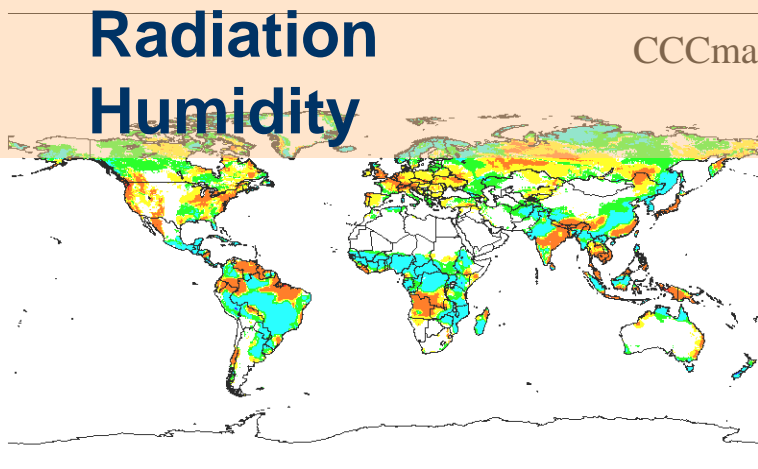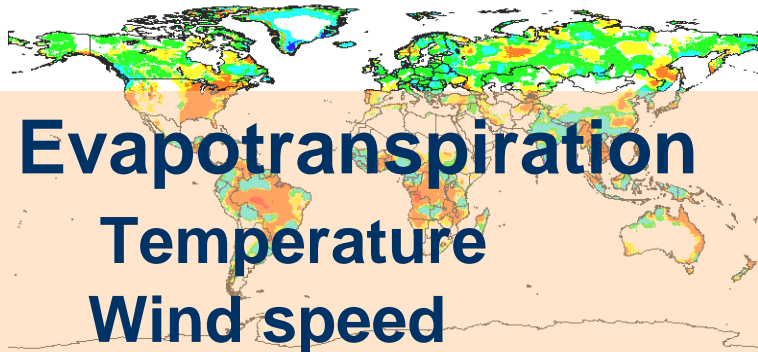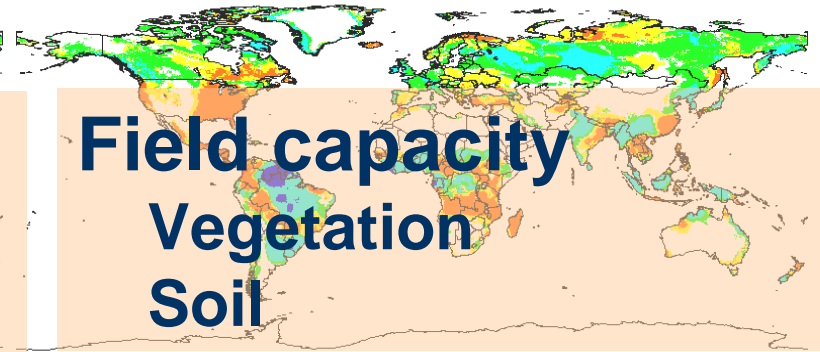
NIES

Change of surface runoff
(2050s – 1980s)

-100 -10   0   10 100   (mm/year)

MPI
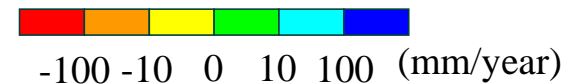
River basin for water scarcity assessment
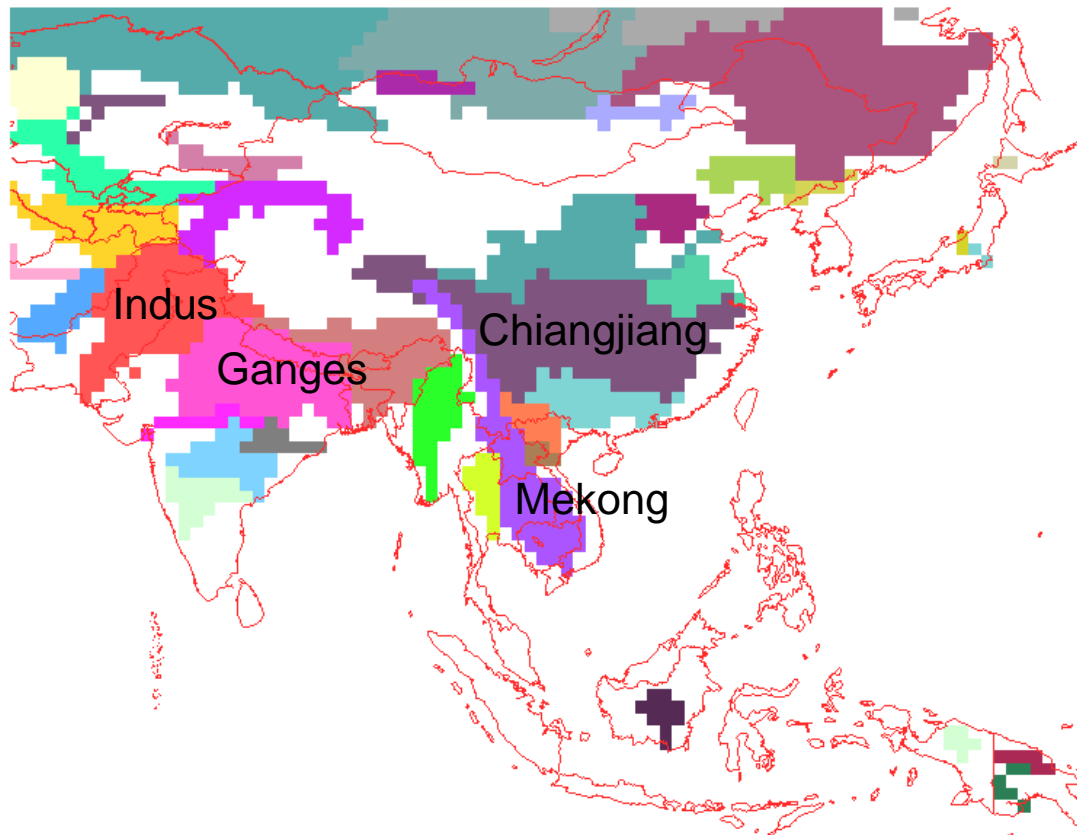
Water Stress Index (=Withdrawal/Renewable Water)

2000

2020

2050

1 5 10

0 20 40 60 80 100 ~

(%)
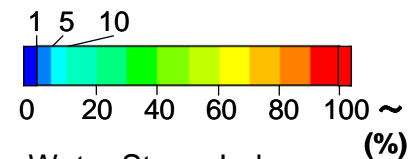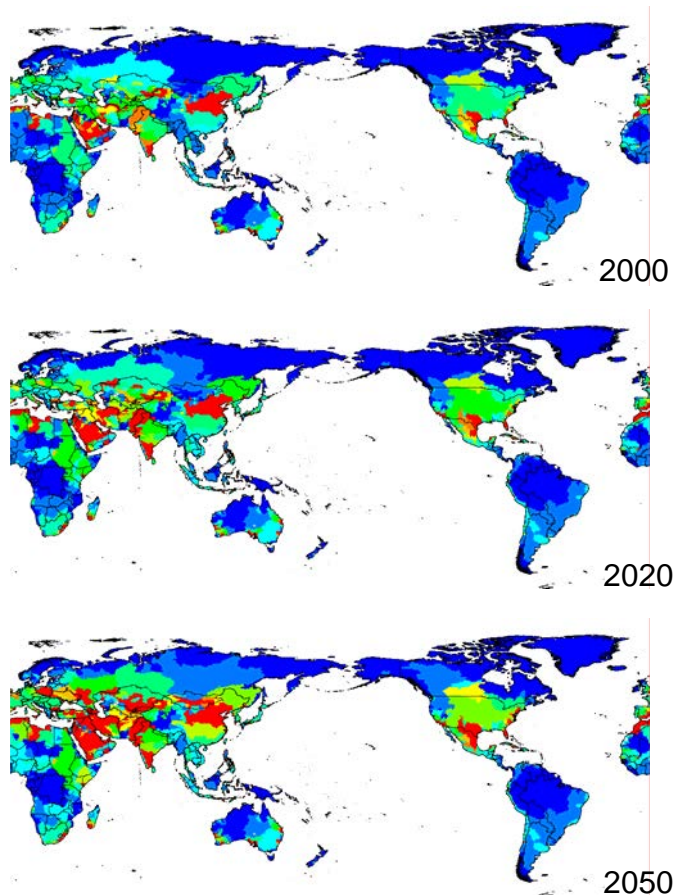
Water Stress Index
(ratio between total withdrawal
and renewable water resource)
ECONOMIC OPTIMUM

Water scarcity

Water stress index = Withdrawal / Surface runoff
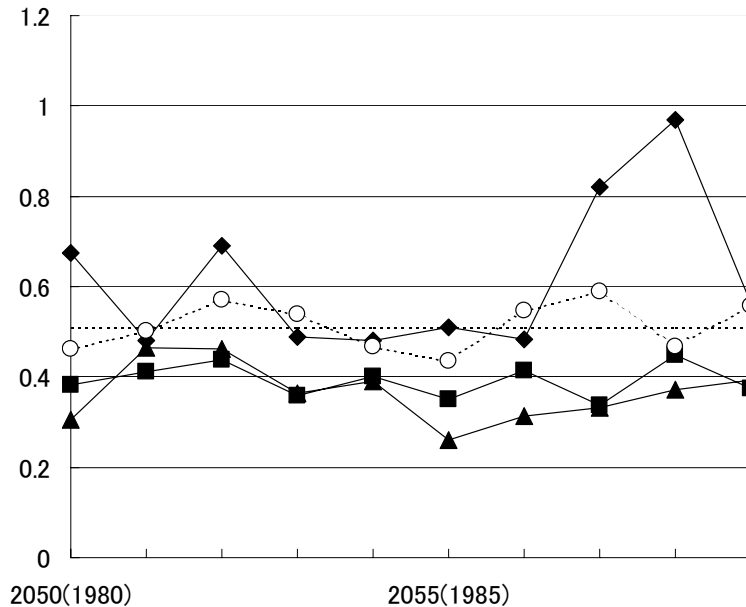
Ganges
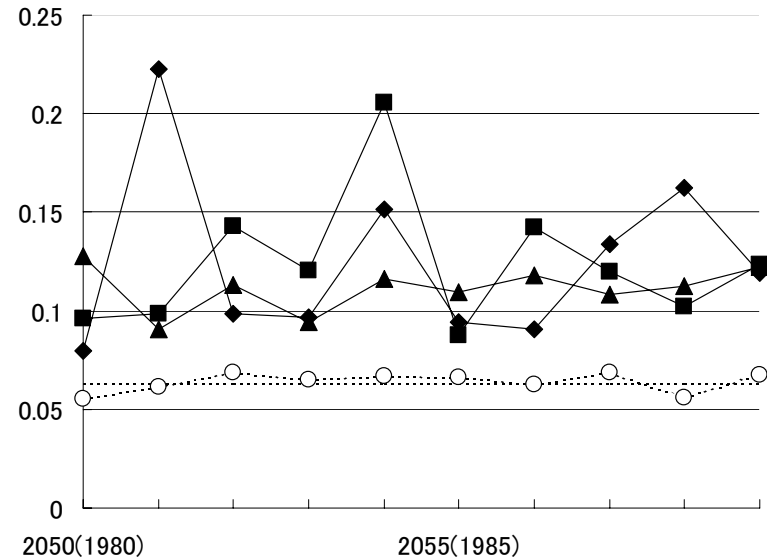
Mekong

■ CCC   ⋯○⋯ LINK (1980-89)

▲ ECHAM4   ⋯⋯ Ten-year average (1980-89)

◆ CCSR/NIES

Malaria

Reproduction rate of malaria vector
Temperature
Soil moisture
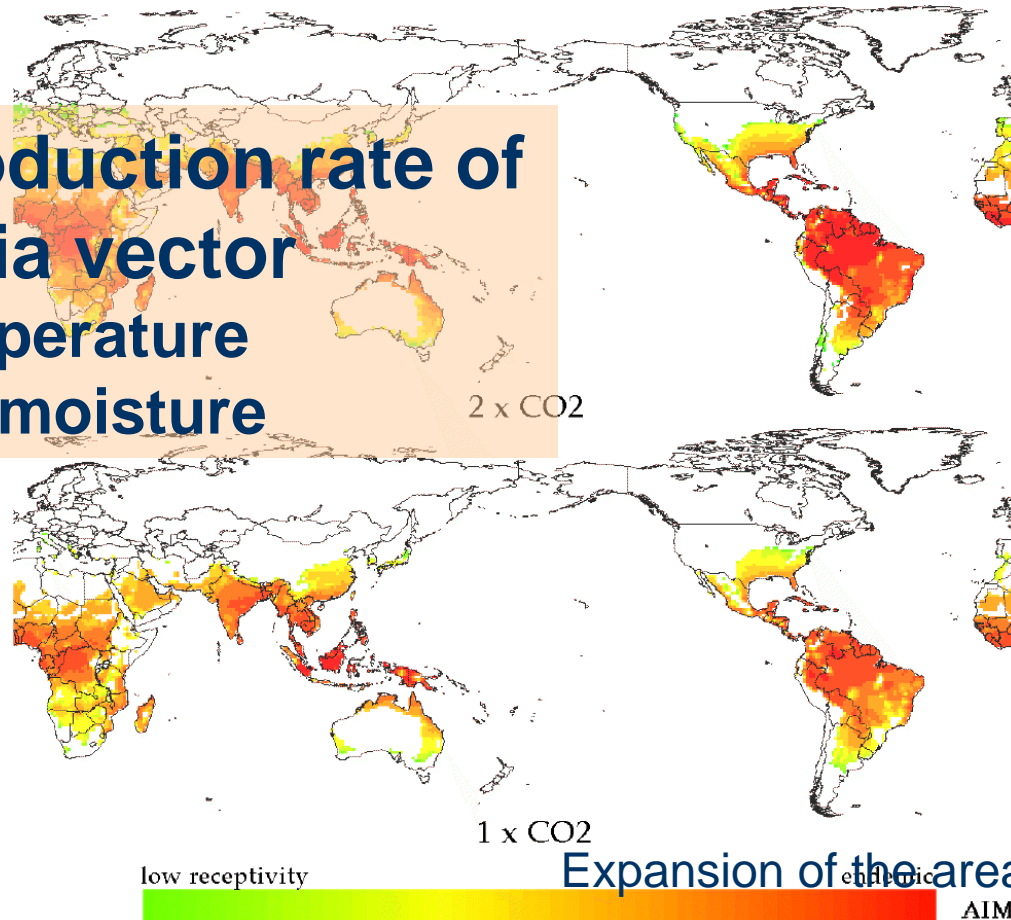
Expansion of the area affected by malaria

Diarrhea

Diarrhea / capita
Water supply coverage
Temperature

Water supply coverage
GDP/capita
Environmental consideration
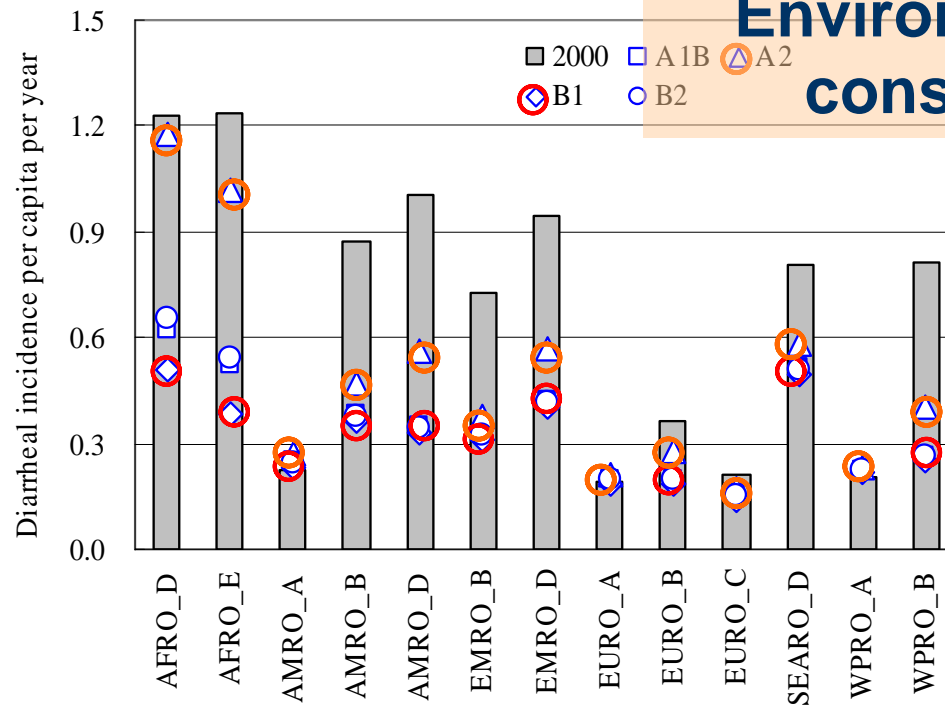
Diarrhea incidence per capita per year in 2000 (bar graph) and in 2055 for 4 SRES scenarios (□A1B,△A2,◇B1,○ B2).

Forest vegetation

Forest diminishment
- **Temperature**
- **Precipitation**
- **Evapotranspiration**
- **Max. velocity of forest movement**
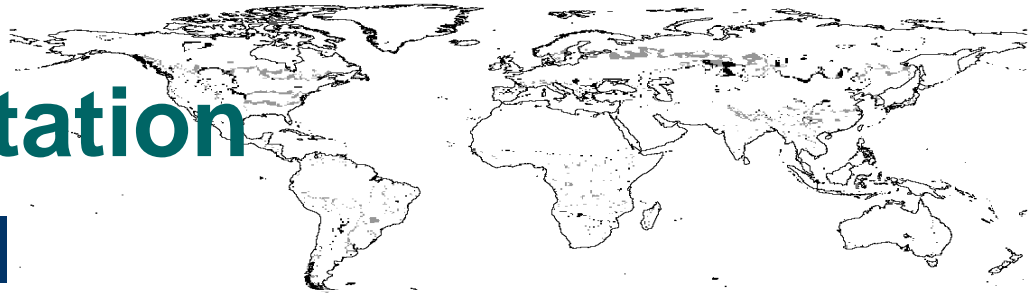
IS92c scenario with low climate sensitivity
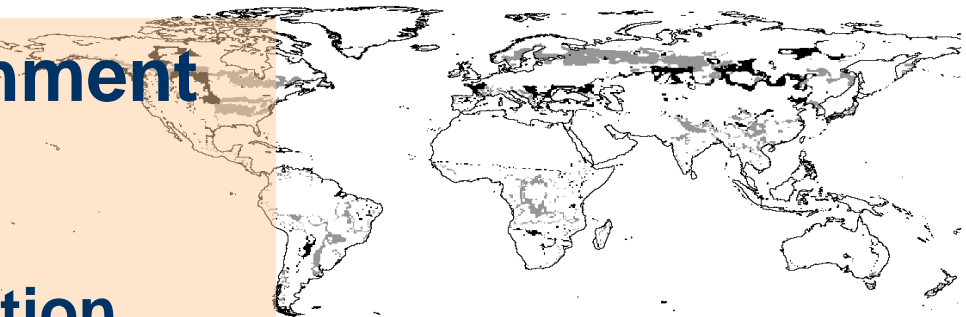
IS92a scenario with medium climate sensitivity
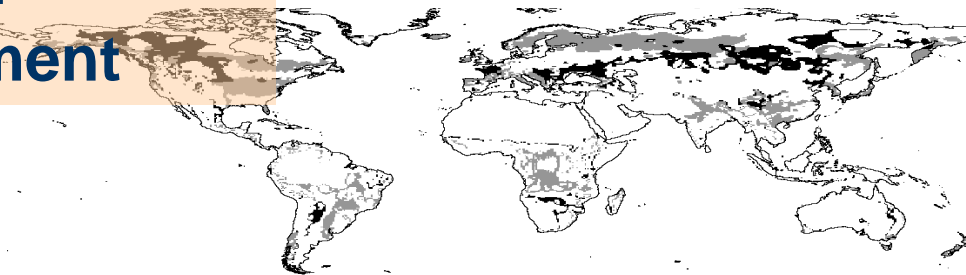
IS92e scenario with high climate sensitivity

Diminishment of forest

Replacement of forest type with the risk of diminishment

Future extension

- Linkage with AIM/CGE model
  - Results of

Crop productivity

Climate data
Temperature
Precipitation
Radiation
Wind
Humidity

Soil data
Chemical characteristics
Slope
Texture

Human Input
Irrigation
Machinery
Fertilizer

Changes in the potential productivity of rice from 1990 to 2050 under the climatic conditions projected using the CCSR/NIES GCM

-500   0   +500   (kg/ha)
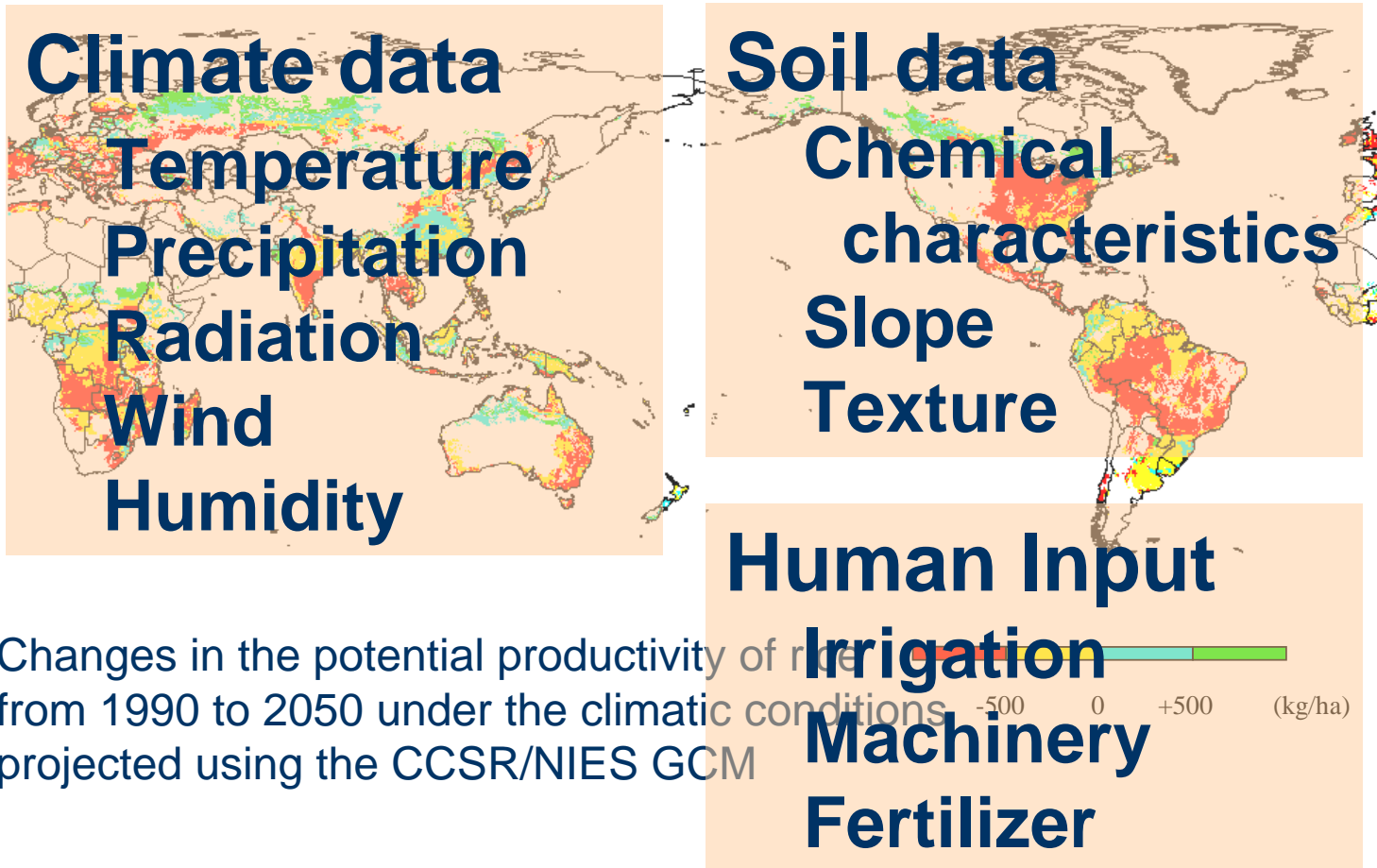
Agricultural trade

	JPN	CHN	IDI	CAN	USA	E_U
Producer price change (%)						
Rice	-0.01	-1.58	17.96	-40.16	-0.06	-4.93
Wheat	4.91	8.47	125.11	-13.10	4.76	8.92
Other grains	1.81	0.79			-1.46	-3.36
Other crops	-0.01	-0.28	1.90	2.76	-0.10	-0.05
Livestock	-0.19	-0.09	2.84	-1.22	-0.59	-0.04
Other agricultural products		-0.01			0.07	0.04
Manufacture	0.03	-0.12	-1.10	0.61	0.03	-0.02
Services	0.03	-0.16	0.93	0.69	0.02	-0.02
Production change (%)						
Rice	0.11	-0.25	-1.76	105.99	0.23	2.03
Wheat		-3.97				-3.64
Other grains	-15.56	-1.39	-1.33	89.41	-4.04	-6.50
Other crops	0.11	-0.07	-4.25	-2.26	0.25	-0.03
Livestock	0.09	-0.24	-2.27	0.94	0.03	-0.22
Other agricultural products	0.11	-0.27		0.69	0.04	-0.22
Manufacture	-0.01	0.31	-0.97	-1.62	0.03	0.05
Services	0.00	0.00	-2.62	-0.02	0.01	0.01
Consumer price index (%)	0.001	0.001		0.513	0.017	-0.010
Income change per capita (%)	0.026	-0.236		0.853	0.026	-0.009
Social welfare change (%)	0.022	-0.219	-4.892	0.343	0.009	0.003

Production
Crop productivity change
Tech. Improve
Labor
Land

Demand
Population
Consumer preference

Trade
Tariff etc.