Climate Change Impacts Modeling

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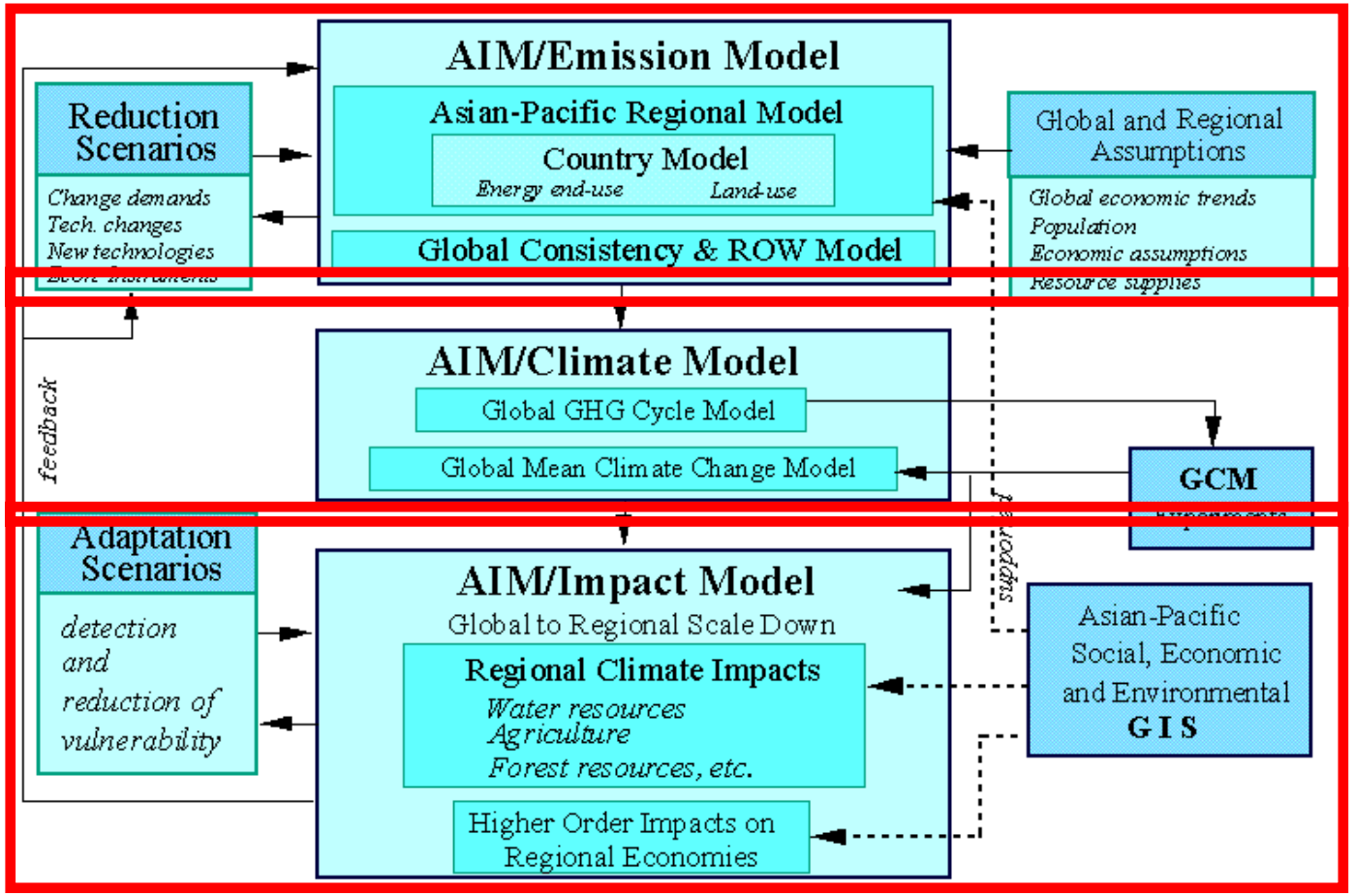
Objective of AIM/Impact

- 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.

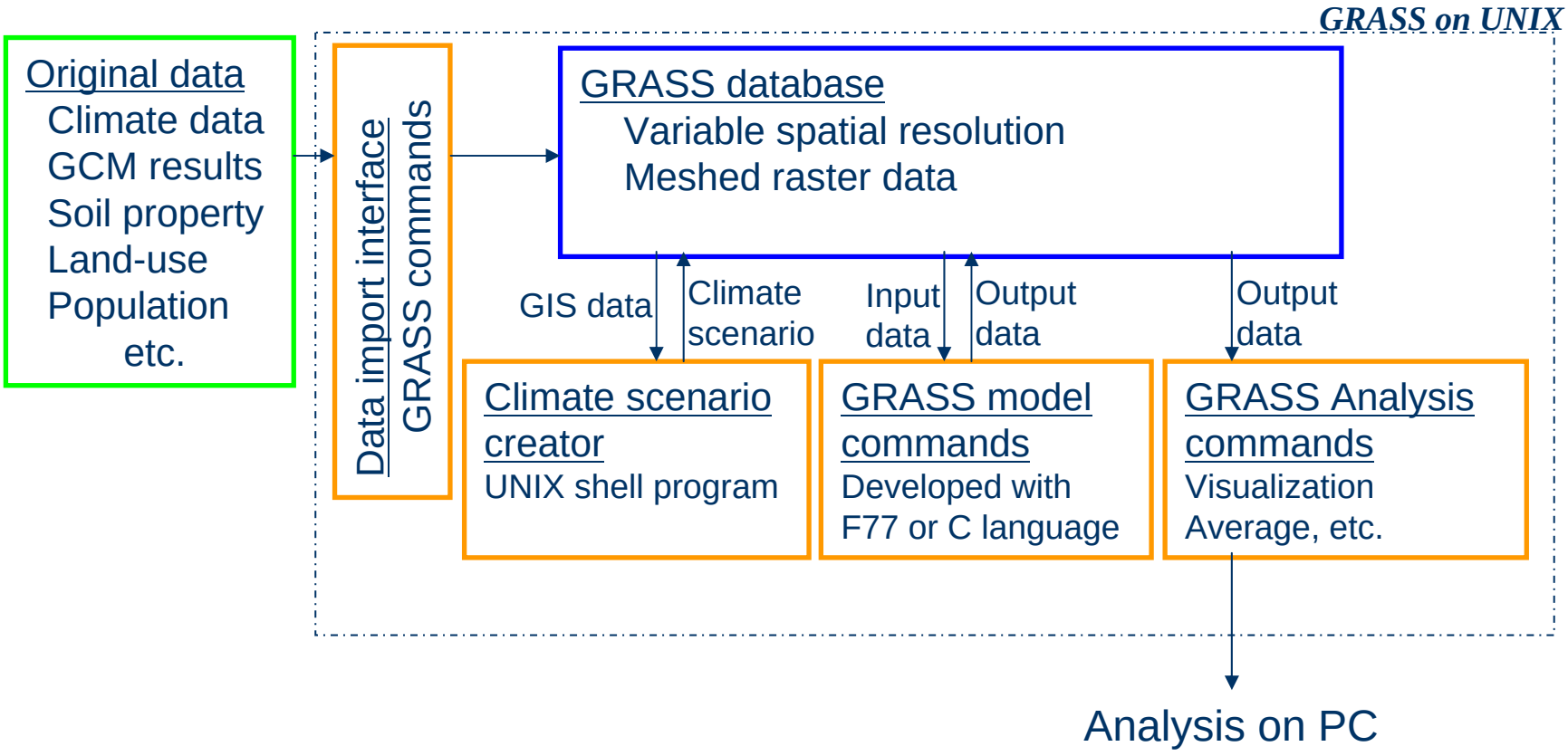
AIM/Impact in AIM Framework



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



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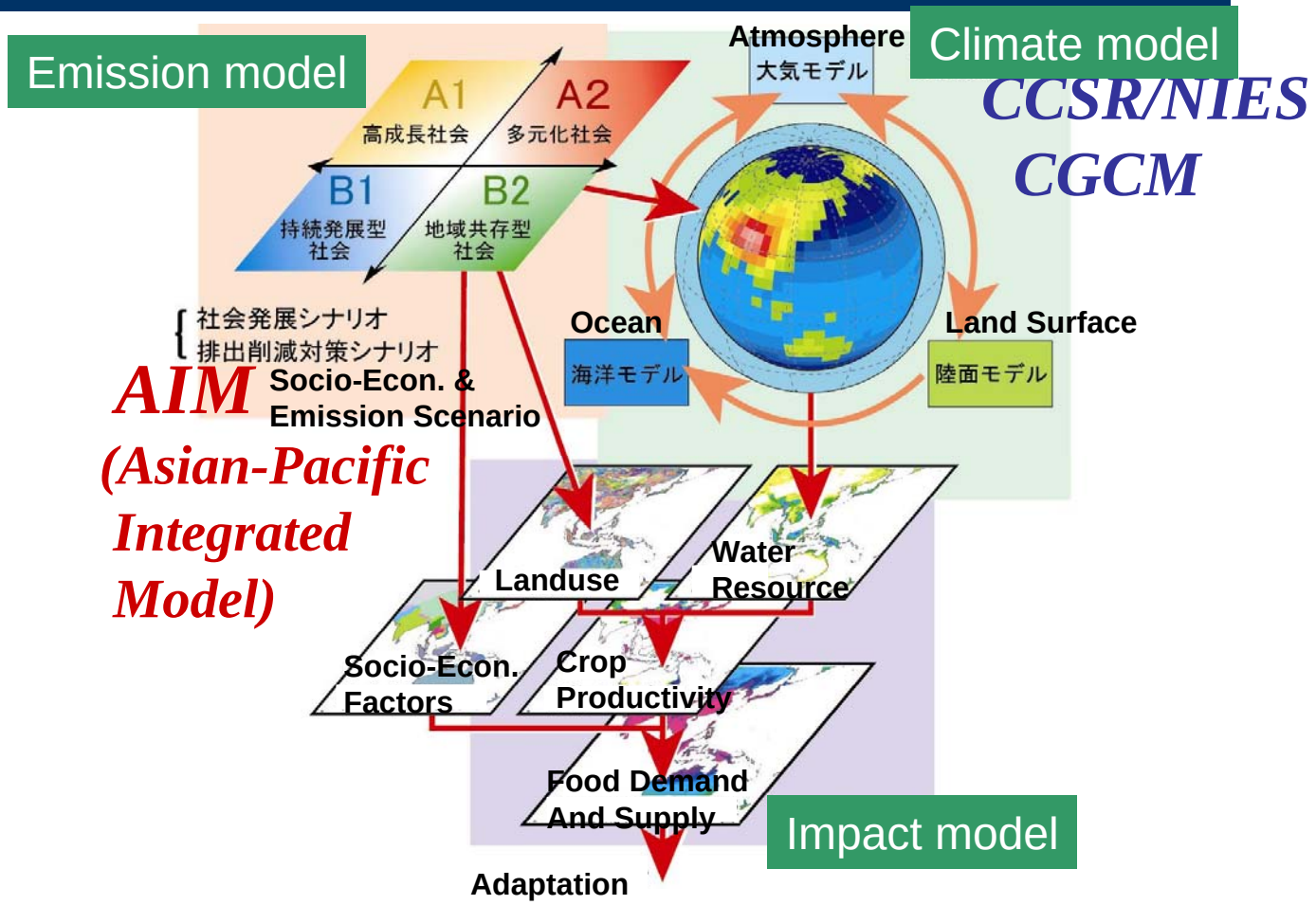
Collaboration with climate model



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

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	1.30	-4.59	-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	0.15	-0.01	0.30	[illegible]	-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	[illegible]	-3.97	[illegible]	[illegible]	[illegible]	-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	[illegible]	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	5.047	0.513	0.017	-0.010
Income change per capita (%)	0.026	-0.236	-0.617	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.

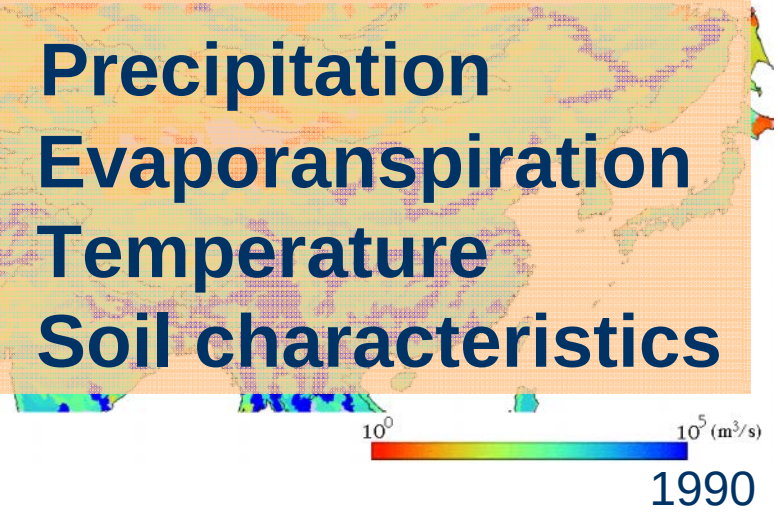
River discharge

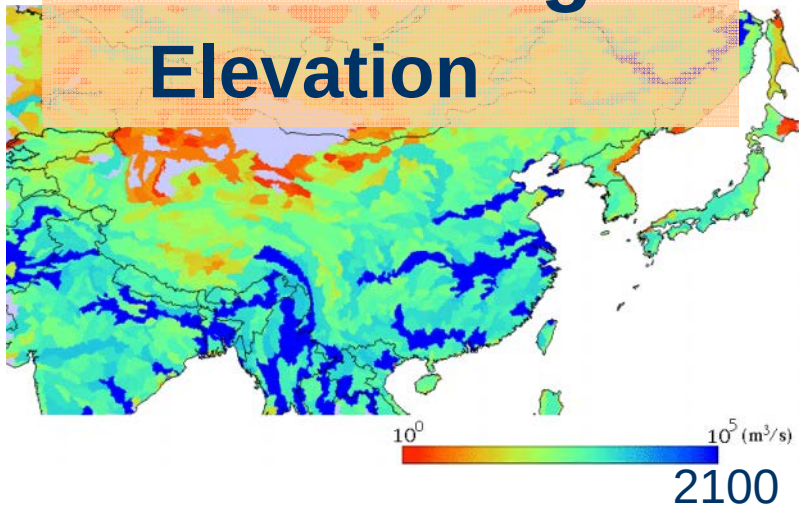
Surface runoff

- Precipitation
- Evaporanspiration
- Temperature
- Soil characteristics

River routing

- Elevation





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

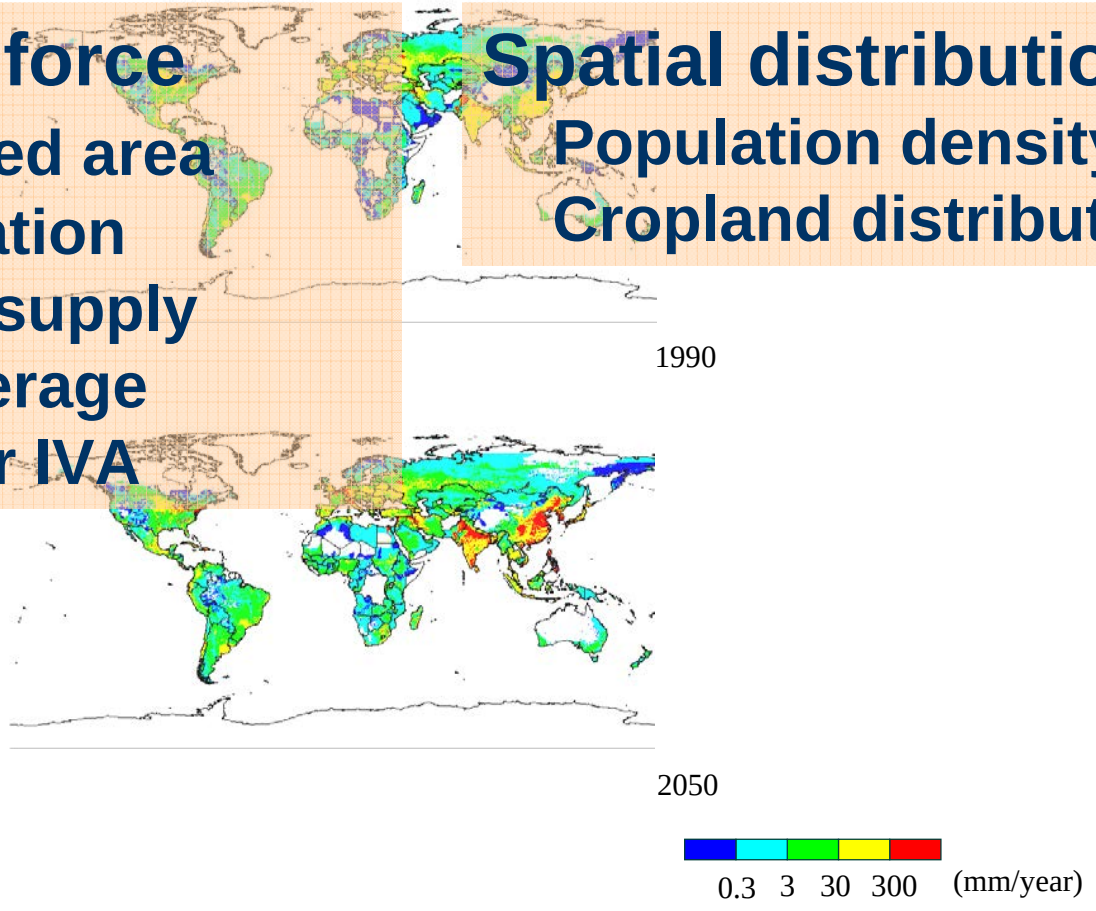
Water demand (withdrawal)

Driving force

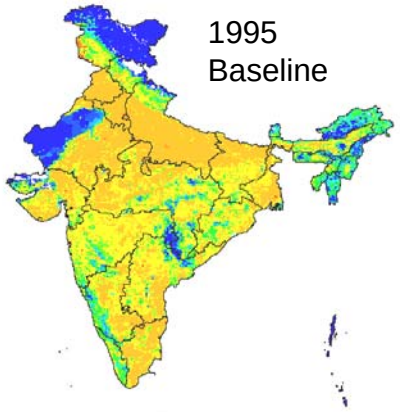
- Irrigated area
- Population
- Water supply coverage
- GDP or IVA

Spatial distribution

- Population density
- Cropland distribution



Water consumption in India (scenario analysis)



1995
Baseline

2032
Fortress World

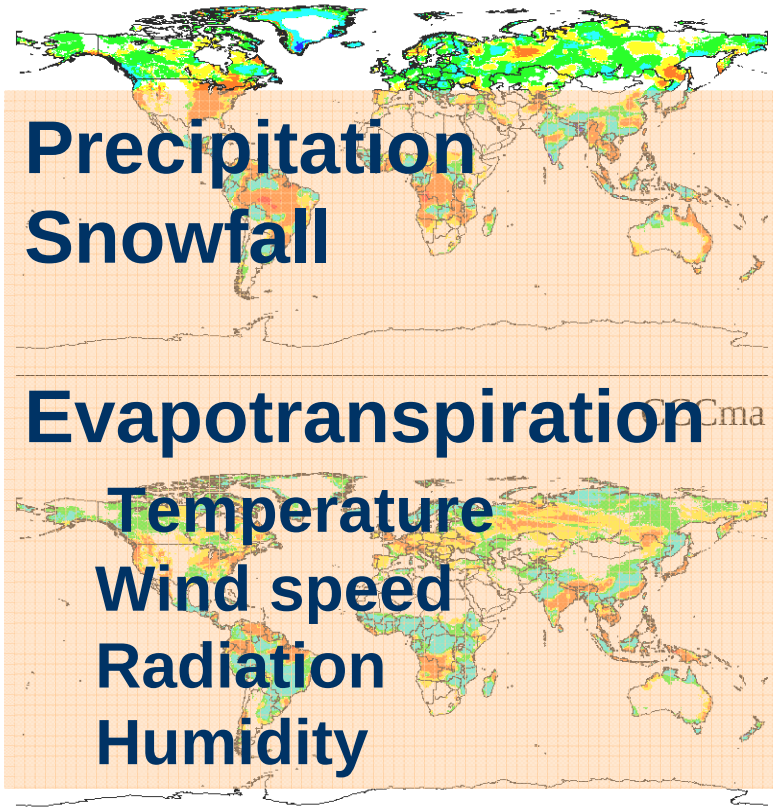
2032
Policy Reform

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

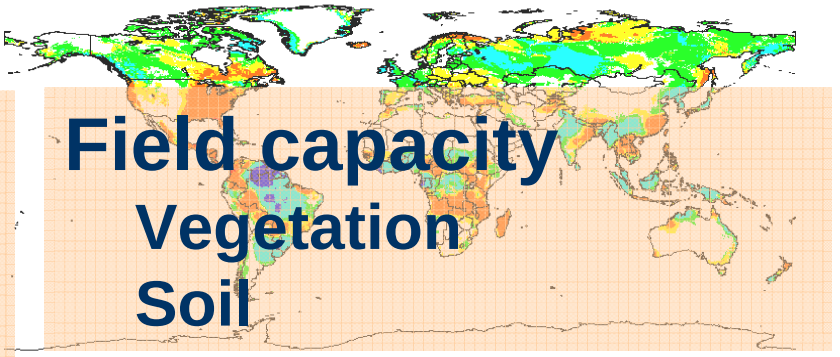
m^3/ha/year

1 40 200 1000 5000

Surface runoff as Water supply



MPI



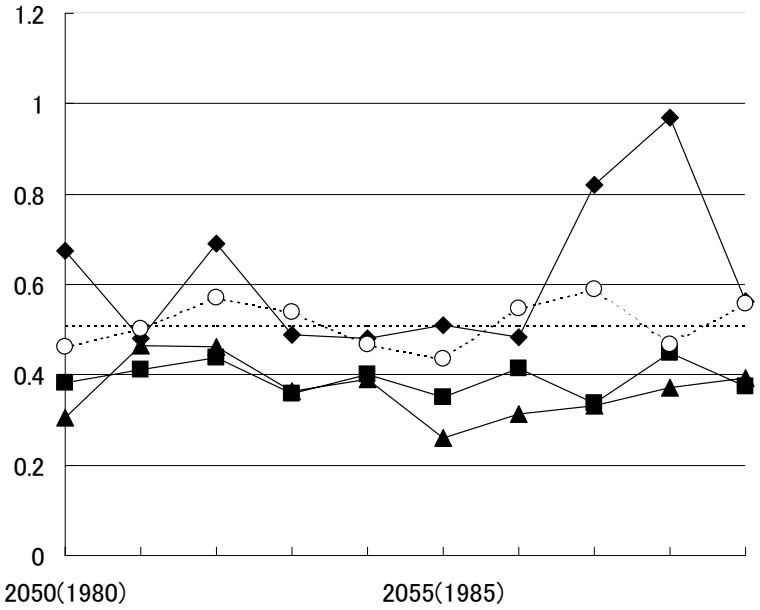
NIES

Change of surface runoff
(2050s – 1980s)

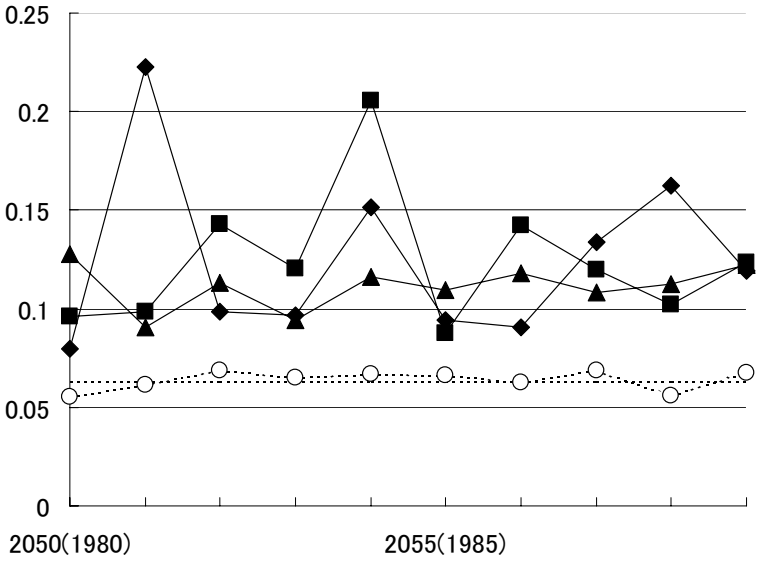
-100 -10 0 10 100 (mm/year)

Water scarcity

Scarcity index
= Withdrawal
/ Surface runoff



Ganges



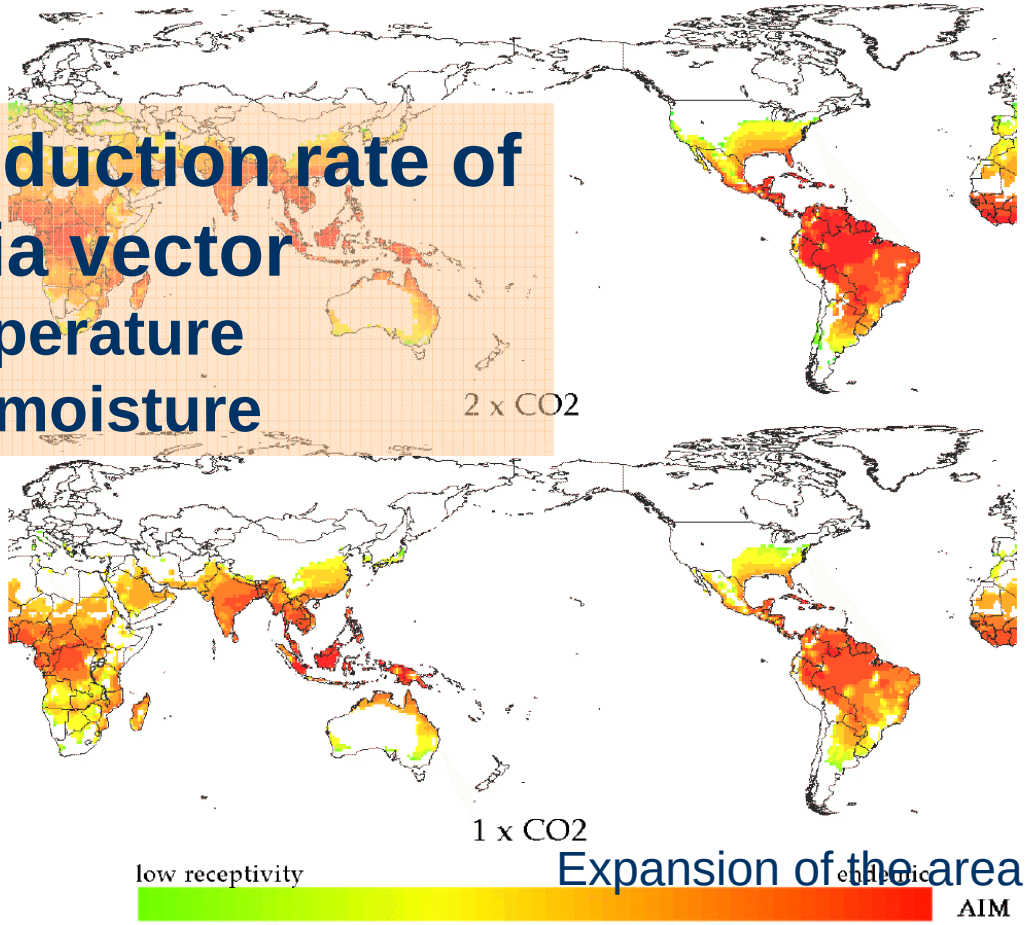
Mekong

CCC
ECHAM4
CCSR/NIES
LINK (1980-89)
Ten-year average (1980-89)

Malaria

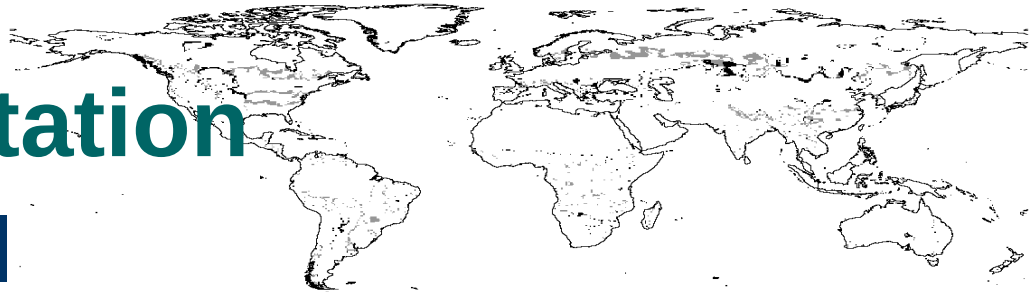
Reproduction rate of malaria vector

- **Temperature**
- **Soil moisture**



Expansion of the area affected by malaria

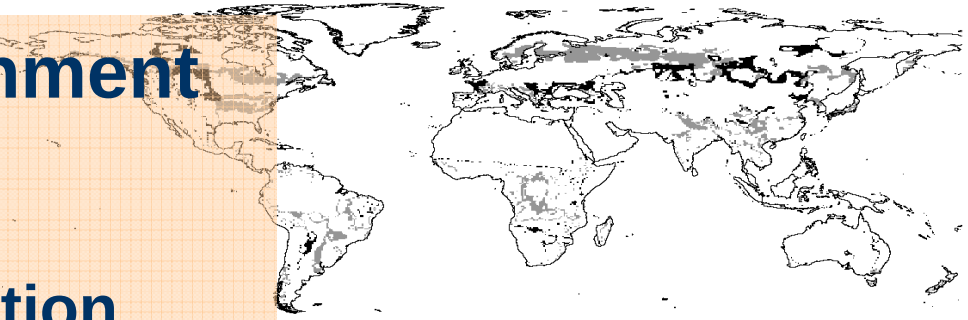
Forest vegetation



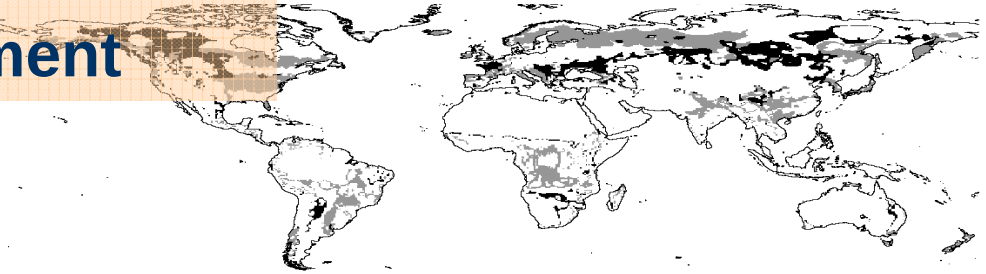
IS92c scenario with low climate sensitivity

Forest diminishment

- Temperature
- Precipitation
- Evapotranspiration
- Max. velocity of forest movement



IS92a scenario with medium climate sensitivity



IS92e scenario with high climate sensitivity

Diminishment of forest

Replacement of forest type with the risk of diminishment

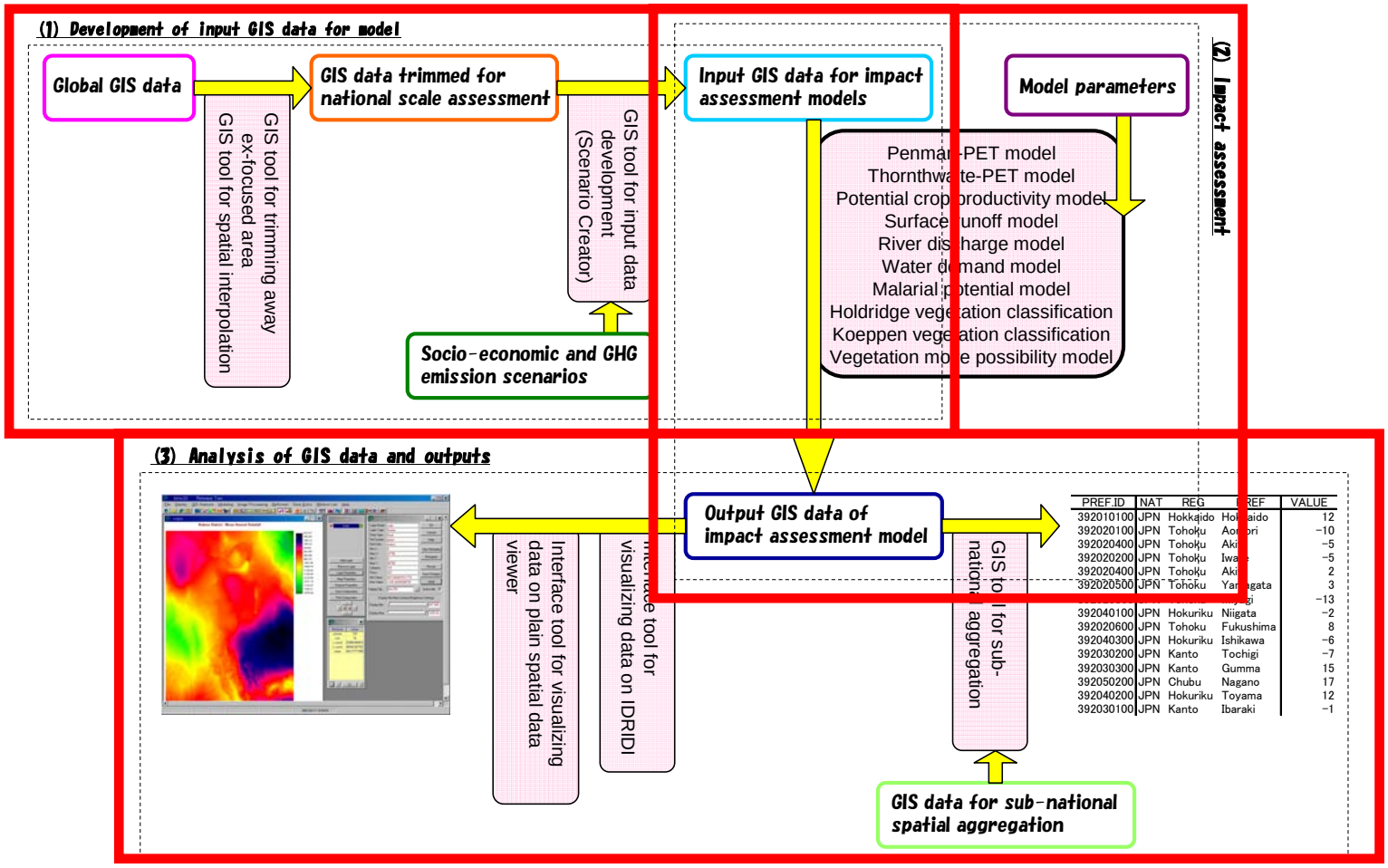
From global scale to national scale

- Increasing attention to national-scale impact studies.
  - AIACC (Assessment of the Impact of and Adaptation to Climate Change Project)
  - National Communication
- Concrete adaptation measures can be evaluated only on an appropriate spatial scale which corresponds the stakeholders.

Development of AIM/Impact [Country]

- Package of models, tools and data for scenario analysis of national-scale climate change impact assessment.
- Executable on PC-Windows (no need to learn UNIX & GRASS)
- Bundled datasets for basic assessment.
- Readily achievement of spatial analysis.
- Detailed manual documents.

Framework of AIM/Impact [Country]



Potential usage of AIM/Impact[Country]

- Outside AIM project.
  - Researchers, governmental officers or others who are interested in assessing future national impact of climate change .
  - Interactive user interface and ready-made datasets are provided for instant achievement of scenario analysis.
  - Spatial visualization is achieved with a plain spatial data viewer controlled from AIM/Impact [Country] interface.
- Inside AIM project.
  - Model is improved by replacing the ready-made parameters and data with the specific and detailed ones collected for each country.
  - Use of IDRISI-GIS is recommended.
  - Source code and the latest databases are shared among the teams for flexible improvement.

Future Direction of Impacts Study

- Global to National, Local Impacts
- Vulnerability and Adaptation
- Impacts of Extreme Climate Events
- Asia Impacts Research Network

- Global Warming Research Initiative (Council for Science and Technology Policy, Cabinet Office of Japan)
- IPCC 4th Assessment Report & AIACC
- Millennium Ecosystem Assessment (MA)
- APN Network Activity for Capacity Building