Recent progress of the AIM/impact study

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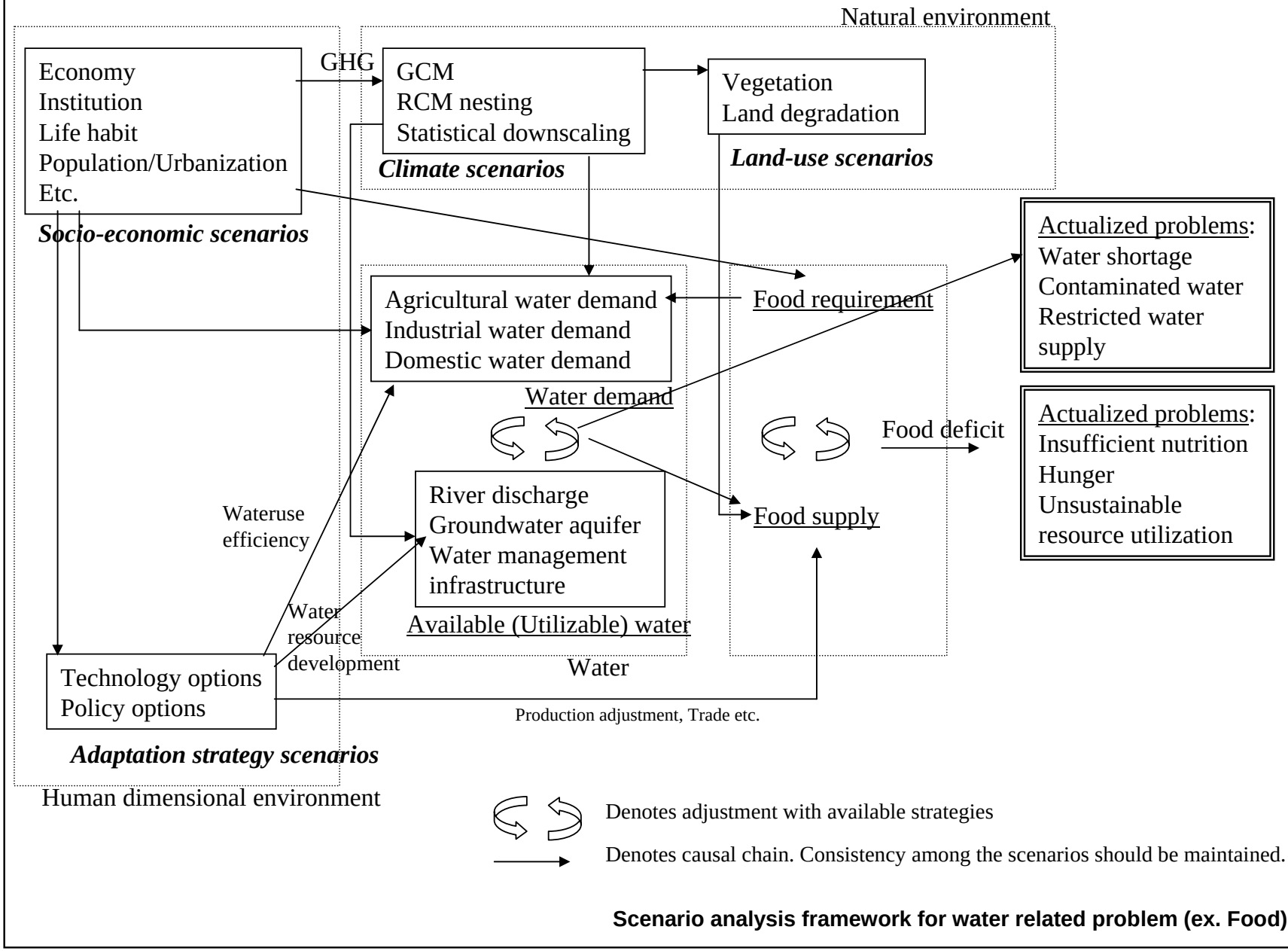
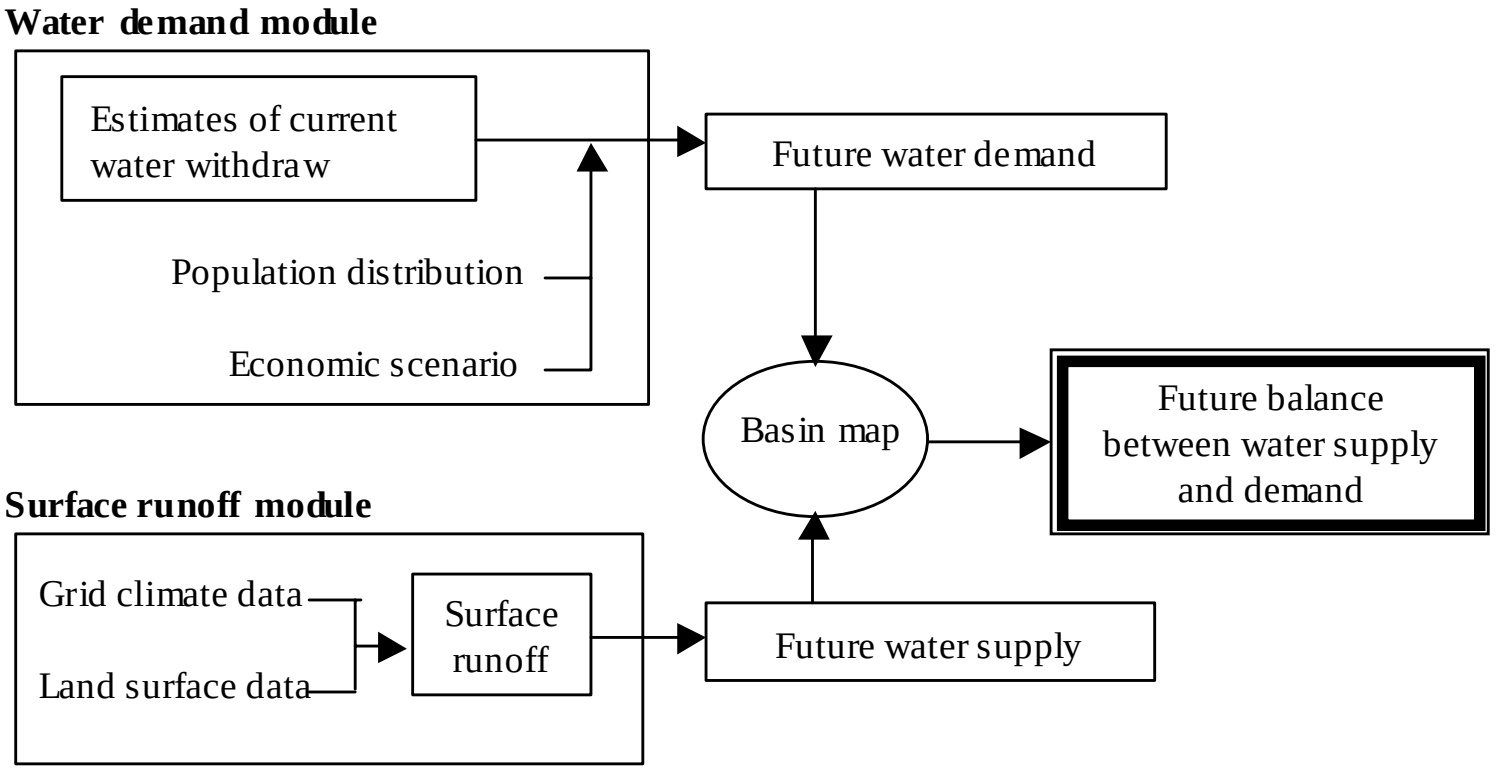
TOPICS:
- Introduction of scenario approach for water resource problem.
- Assessment of water scarcity under climate change with considering inter-annual variability.
- Country-level assessment of water demand trend for GEO3.
- Some idea on the future direction.

The 6th AIM International Workshop
27 – 28 March 2001
National Institute for Environmental Studies, JAPAN

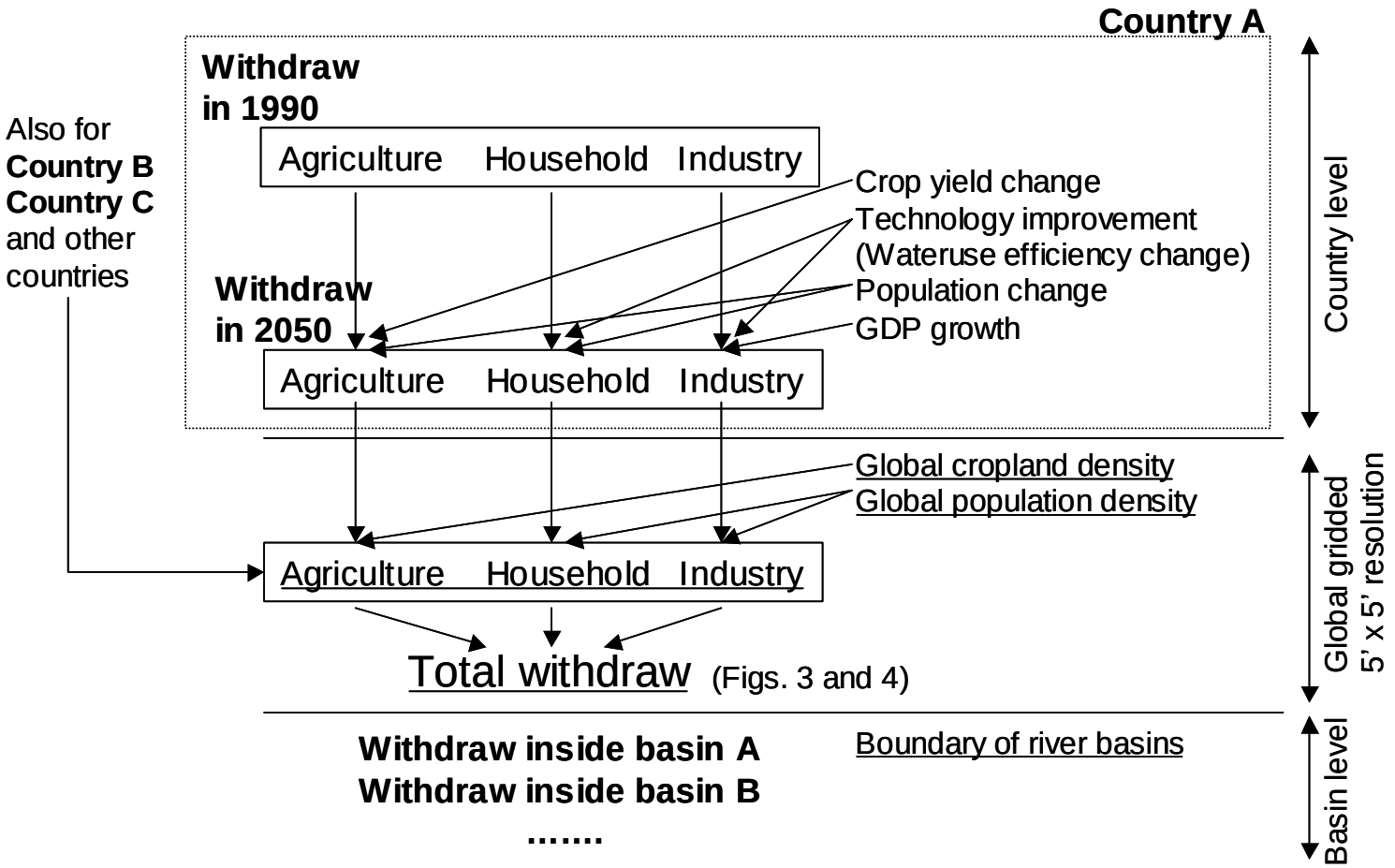


Scenario analysis framework for water related problem (ex. Food)



Target year: 2050-2059, each year
1980-1989, each year
Target area: Global

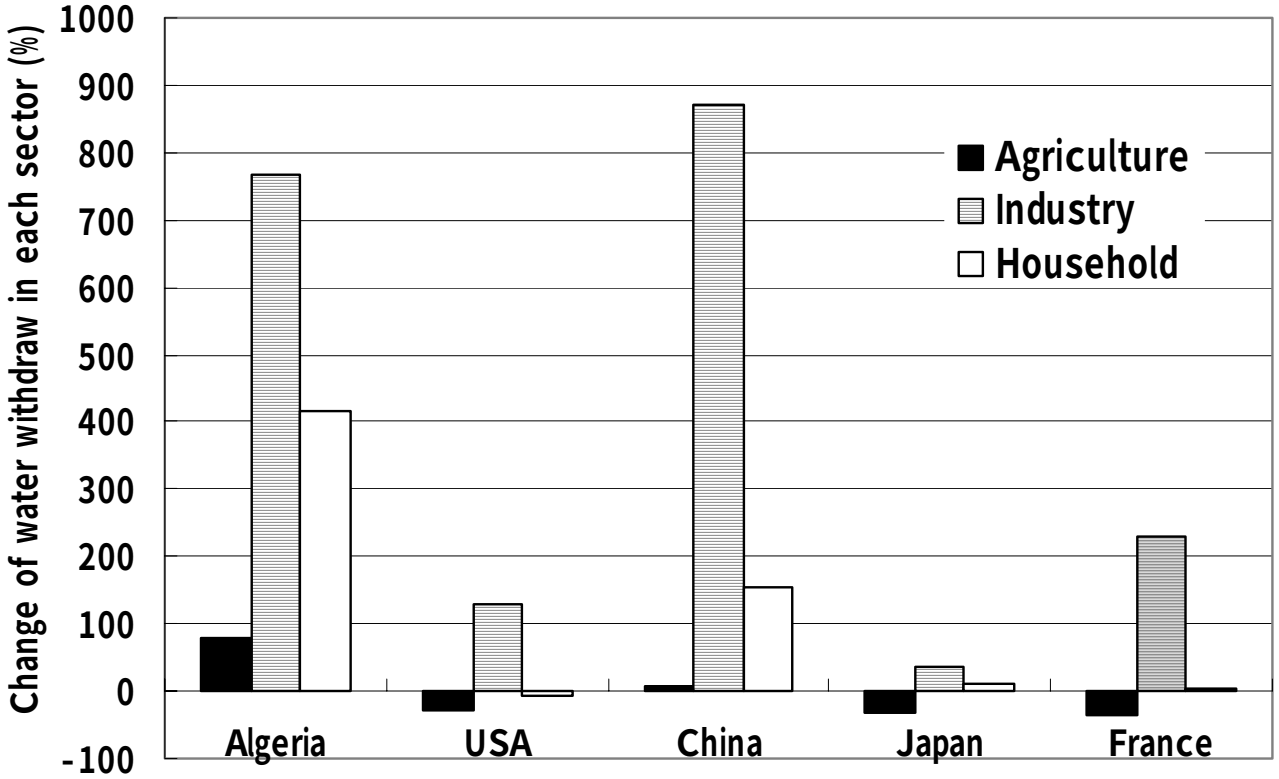
(Simplified) Estimation scheme of the study



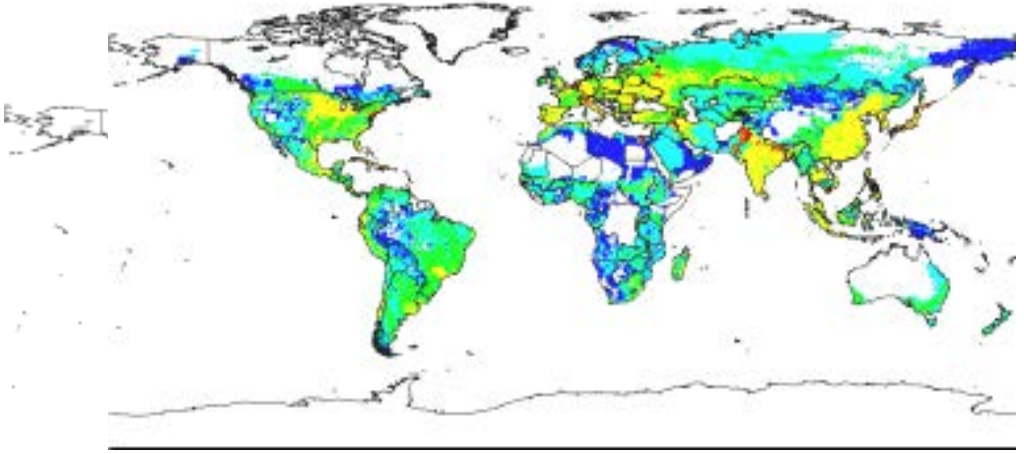
Outline of the water demand estimation

Water use efficiency improvement coefficients in 2050 (with 1990 as the base year)

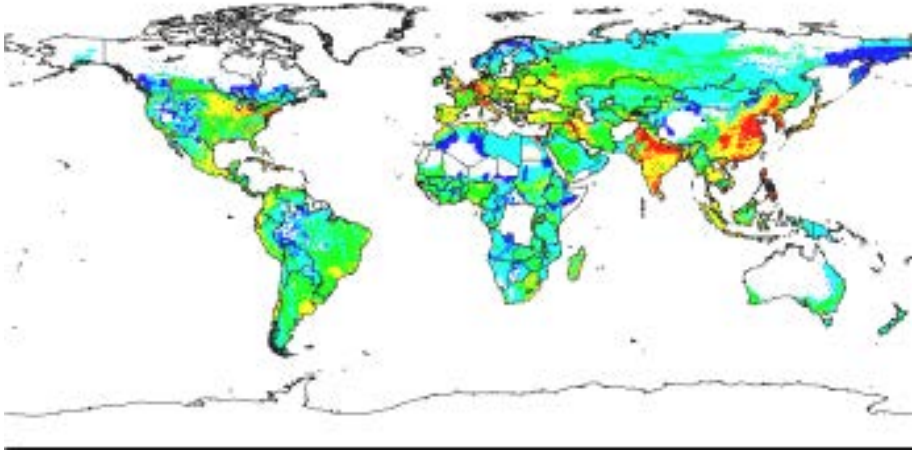
Region	Household	Industry
N. America	0.798	0.613
W. Europe	1	0.886
OECD Pacific	1.01	0.487
Former Soviet	1.233	0.696
E. Europe	1.385	0.709
Africa	1.5	0.921
Latin America	1.64	0.701
Middle East	1.951	0.938
Central Planning Asia	1.667	0.699
S. and S.E. Asia	2.278	0.763



Percentage change of sector-wise water demand between 1990 and 2050 in some countries (%)



1990

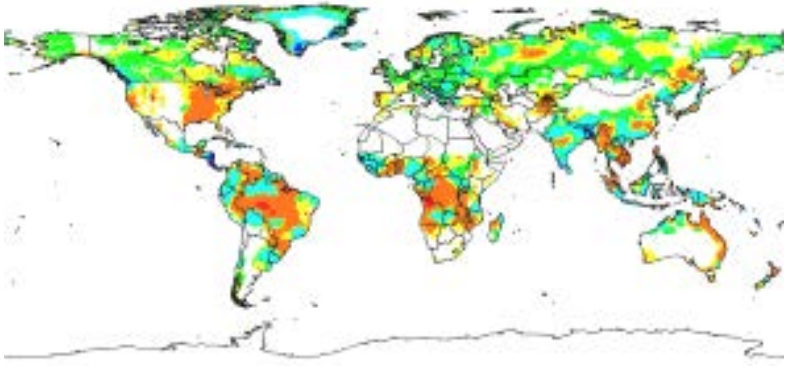


2050

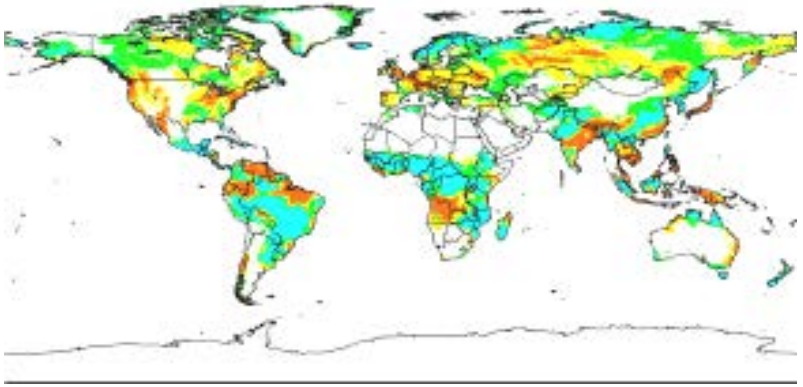
Water Demand Density

0.3 3 30 300 (mm/year)

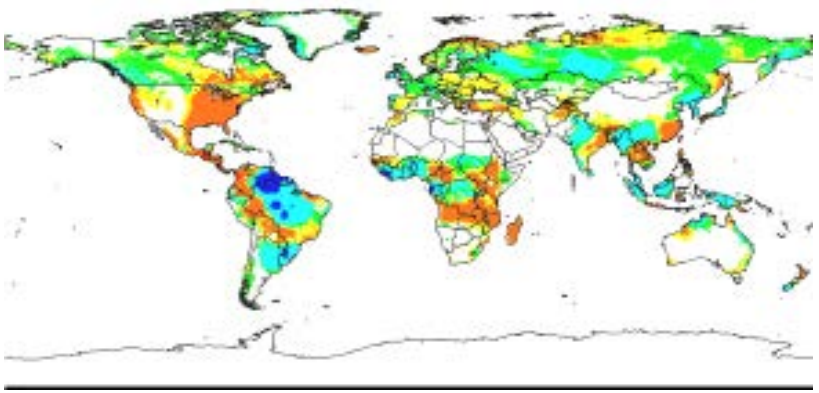
CCCma



MPI

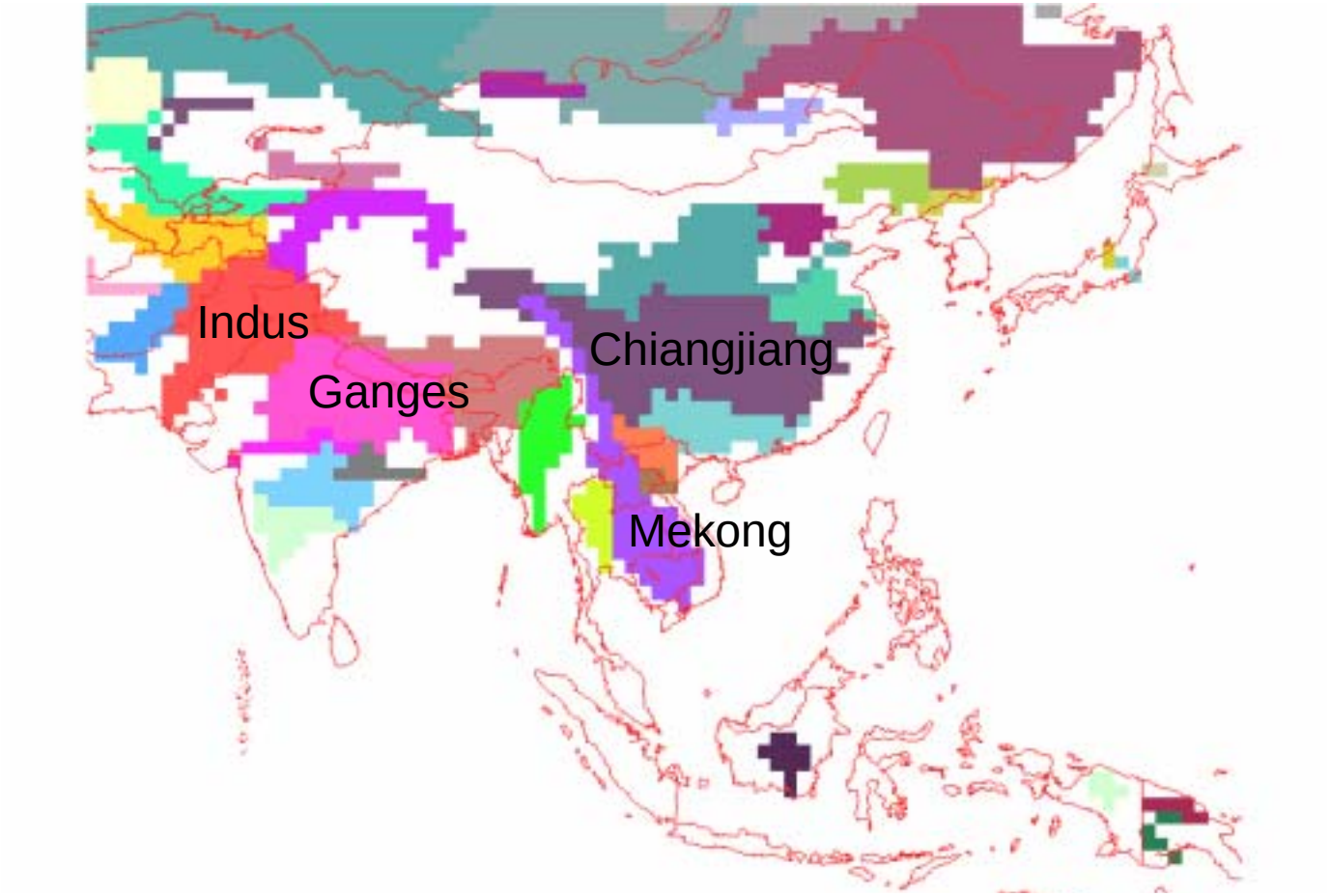


NIES

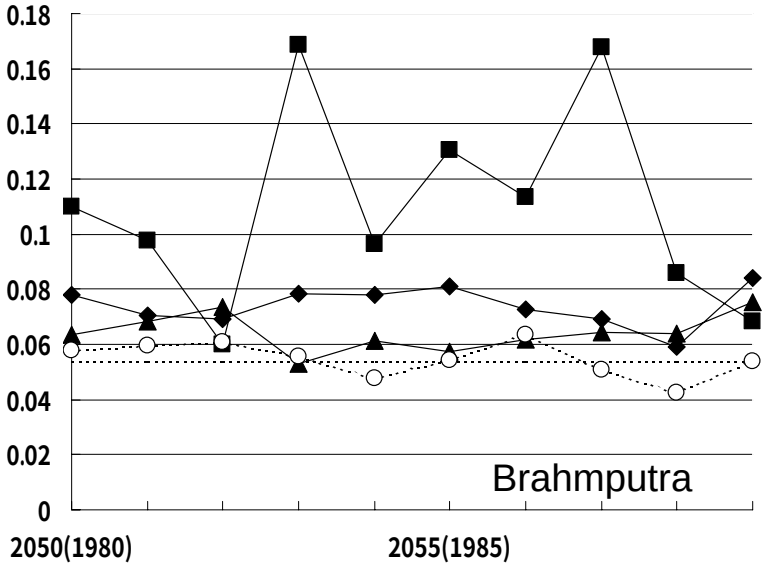


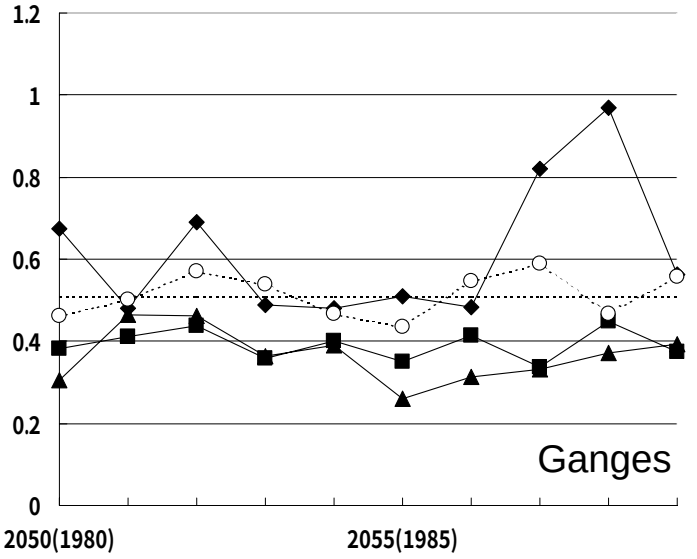
Change of surface runoff
(2050s－1980s)

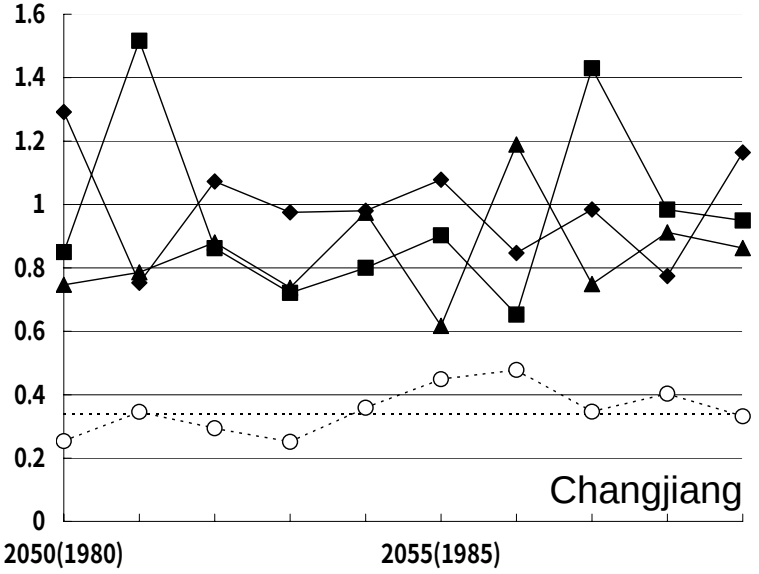
-100 -10 0 10 100 (mm/year)

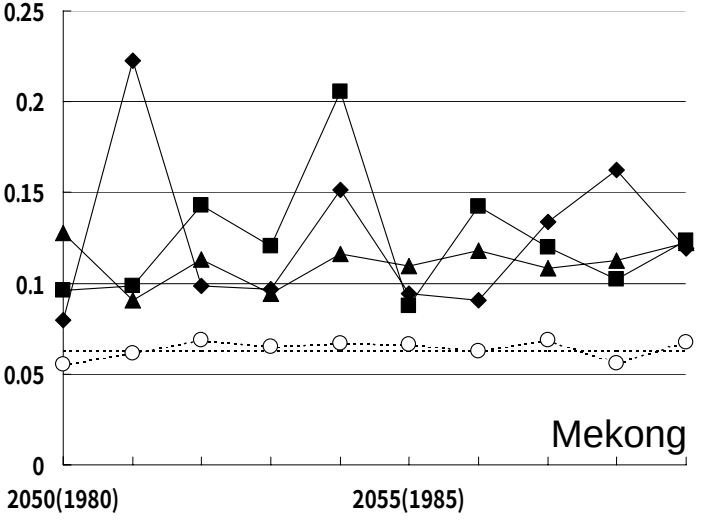


TRIP’s River Basin Boundary









Withdraw/Runoff Ratio

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

Water assessment in Asia-Pacific region for GEO3.

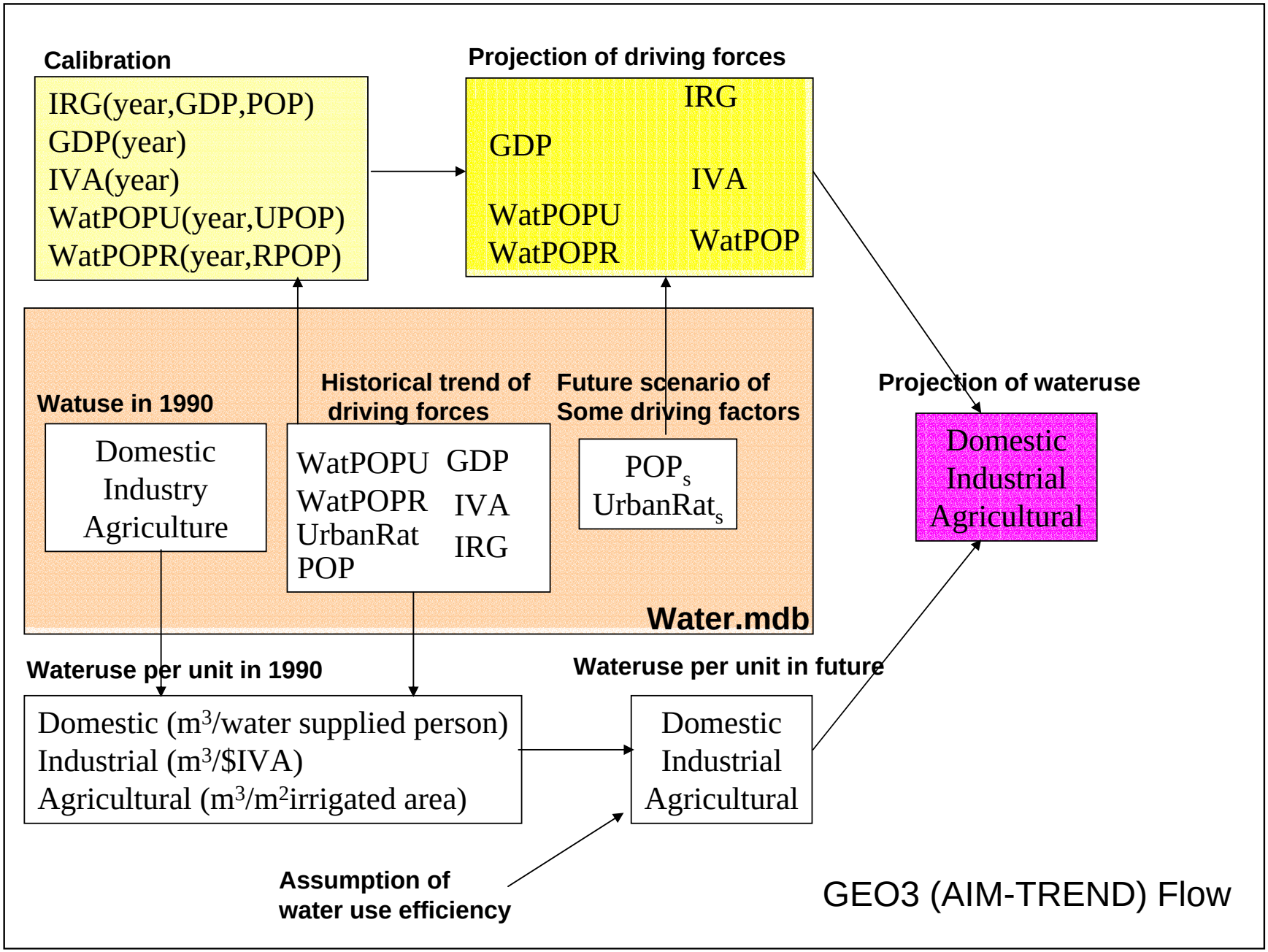
Industrial water withdraw is related to the industrial value added (IVA), not to the GDP trend. Future IVA considers the change of production share among agriculture, industry and services.

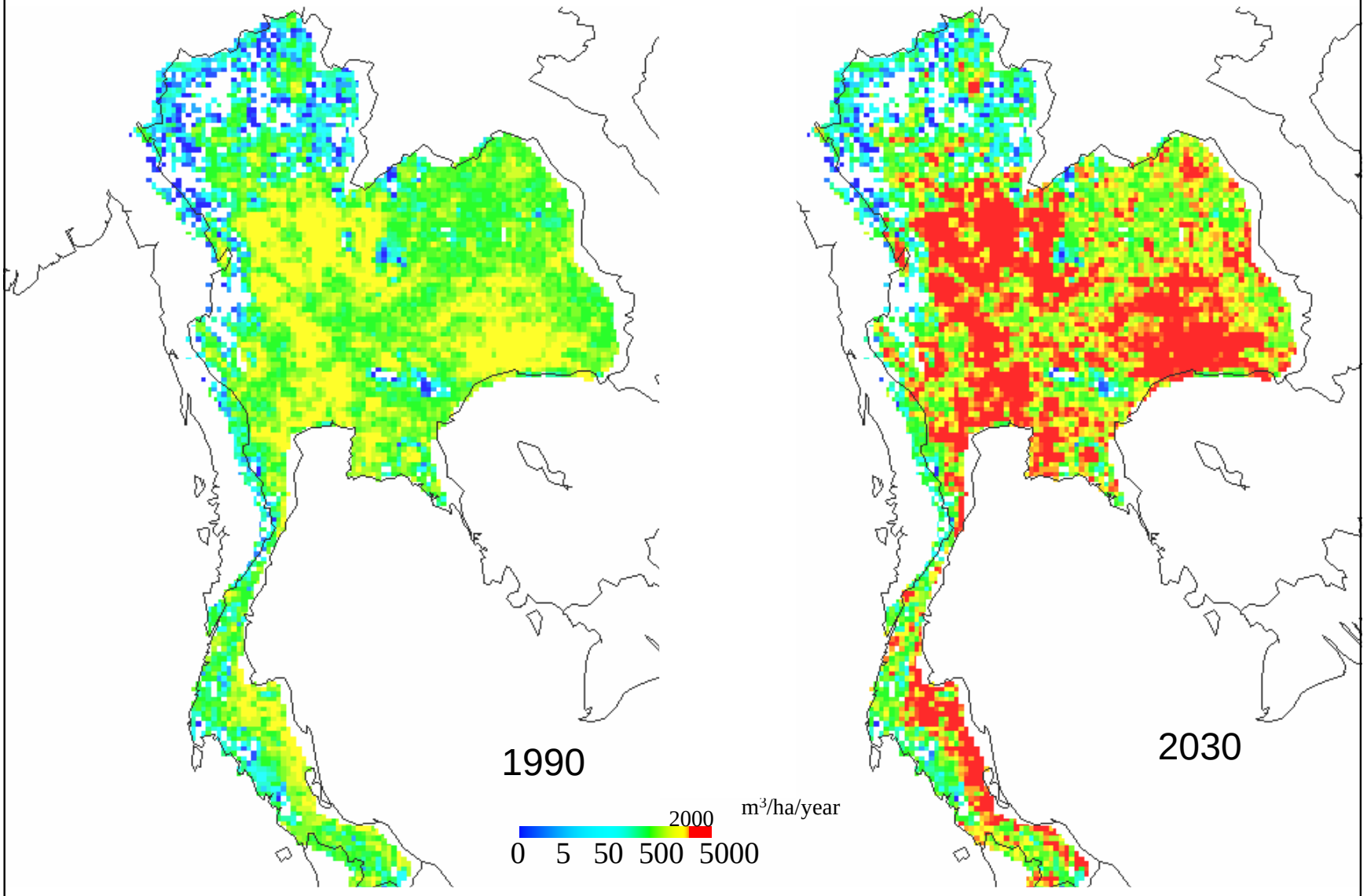
Domestic water withdraw is related to the water-service-supplied population, not to the whole population in each country. This came to be possible only for Asian-Pacific countries, since the trend of water-supplied population was available for the region from UN-ESCAP's statistical data. The water-supplied population was estimated for urban and rural area respectively.

Agricultural water withdraw is related to the trend of irrigated area, not to the population. Irrigated area is projected as the regression of logarithms of population and of GDP/capita.

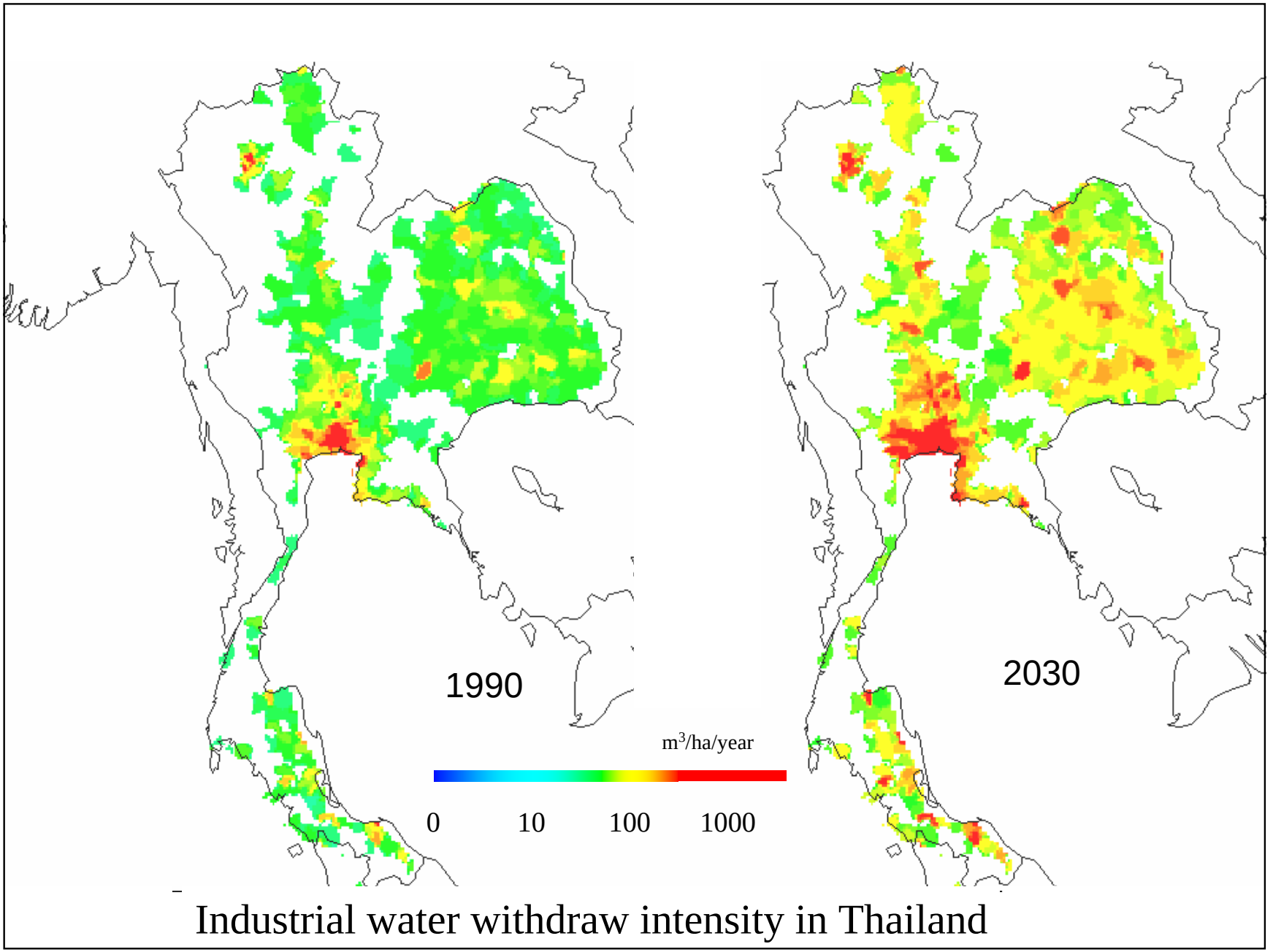
Not only withdraw in each sector, but evaporated net consumption of water is estimated with considering the return-flow rate.

For technology improvement factor and driving forces of the water withdraw, alternative scenarios are set up for the four scenarios (BAU, fortress, policy, and great transition)

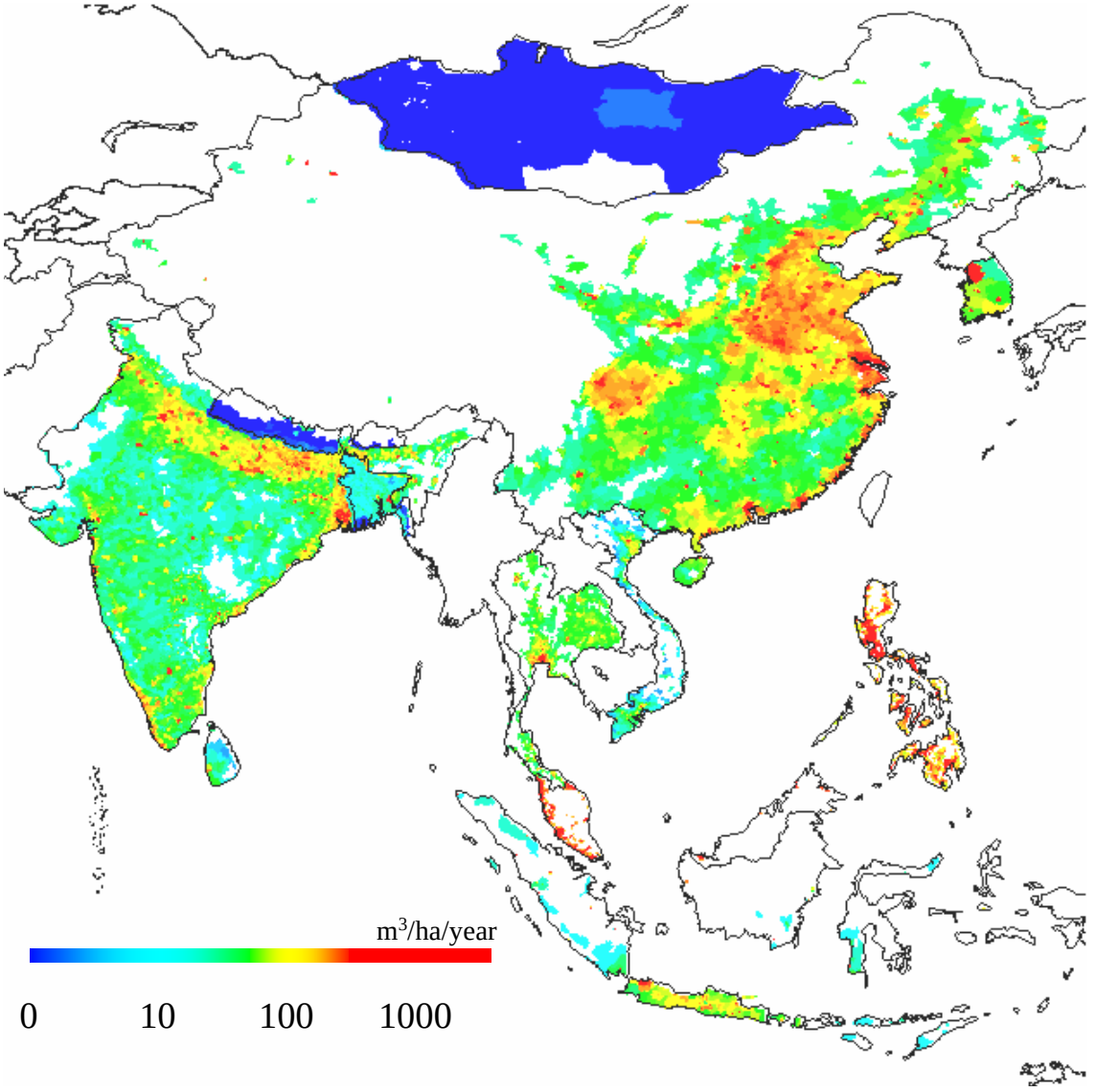

Calibration
IRG(year,GDP,POP)
GDP(year)
IVA(year)
WatPOPU(year,UPOP)
WatPOPR(year,RPOP)
Projection of driving forces
IRG
GDP
IVA
WatPOPU
WatPOPR
WatPOP
Watuse in 1990
Domestic
Industry
Agriculture
Historical trend of driving forces
WatPOPU
WatPOPR
UrbanRat
POP
GDP
IVA
IRG
Future scenario of Some driving factors
POPs
UrbanRats
Water.mdb
Projection of wateruse
Domestic
Industrial
Agricultural
Wateruse per unit in 1990
Domestic (m3/water supplied person)
Industrial (m3/$IVA)
Agricultural (m3/m2irrigated area)
Wateruse per unit in future
Domestic
Industrial
Agricultural
Assumption of water use efficiency
GEO3 (AIM-TREND) Flow



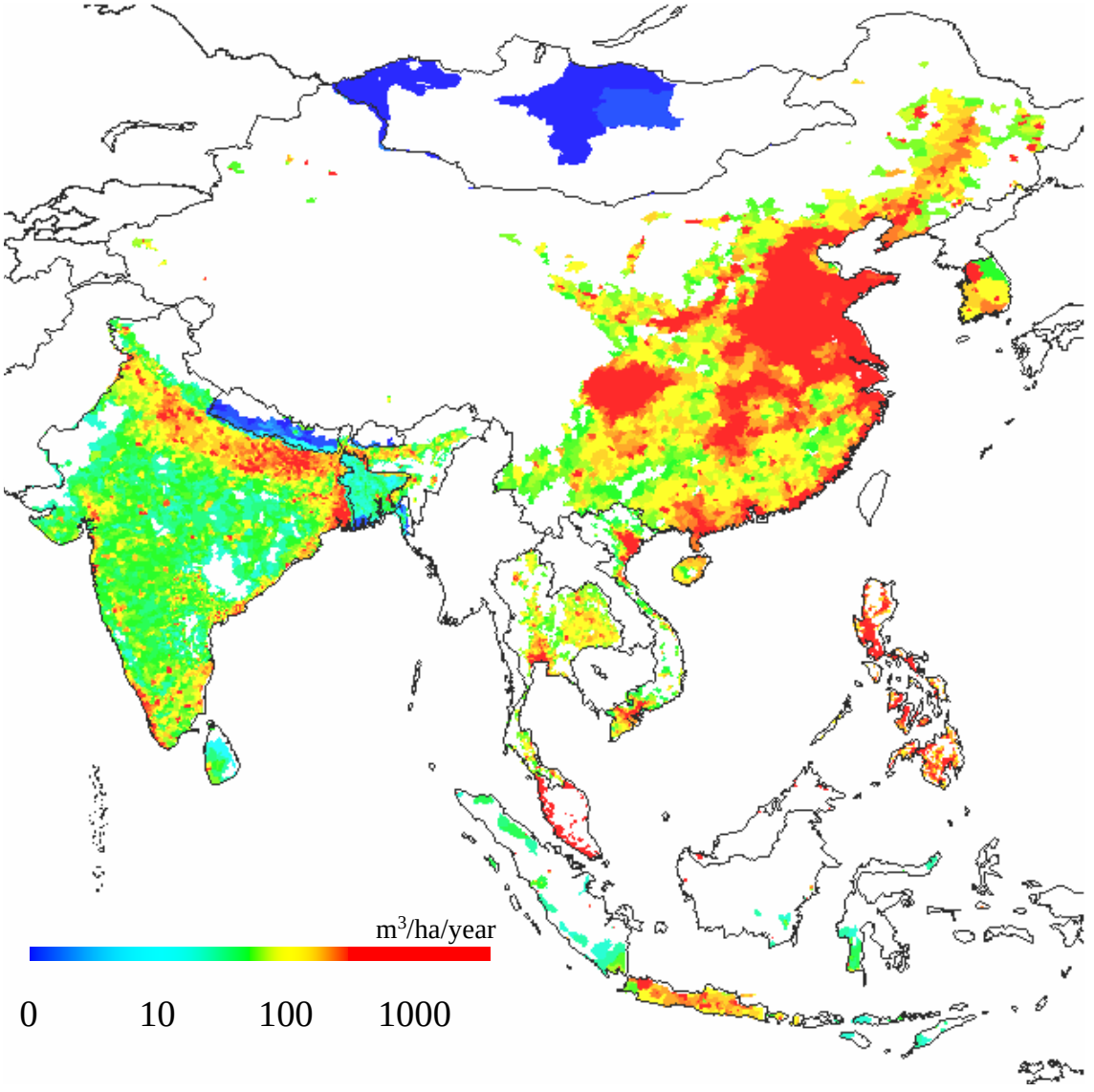
Agricultural water withdraw intensity at Thailand



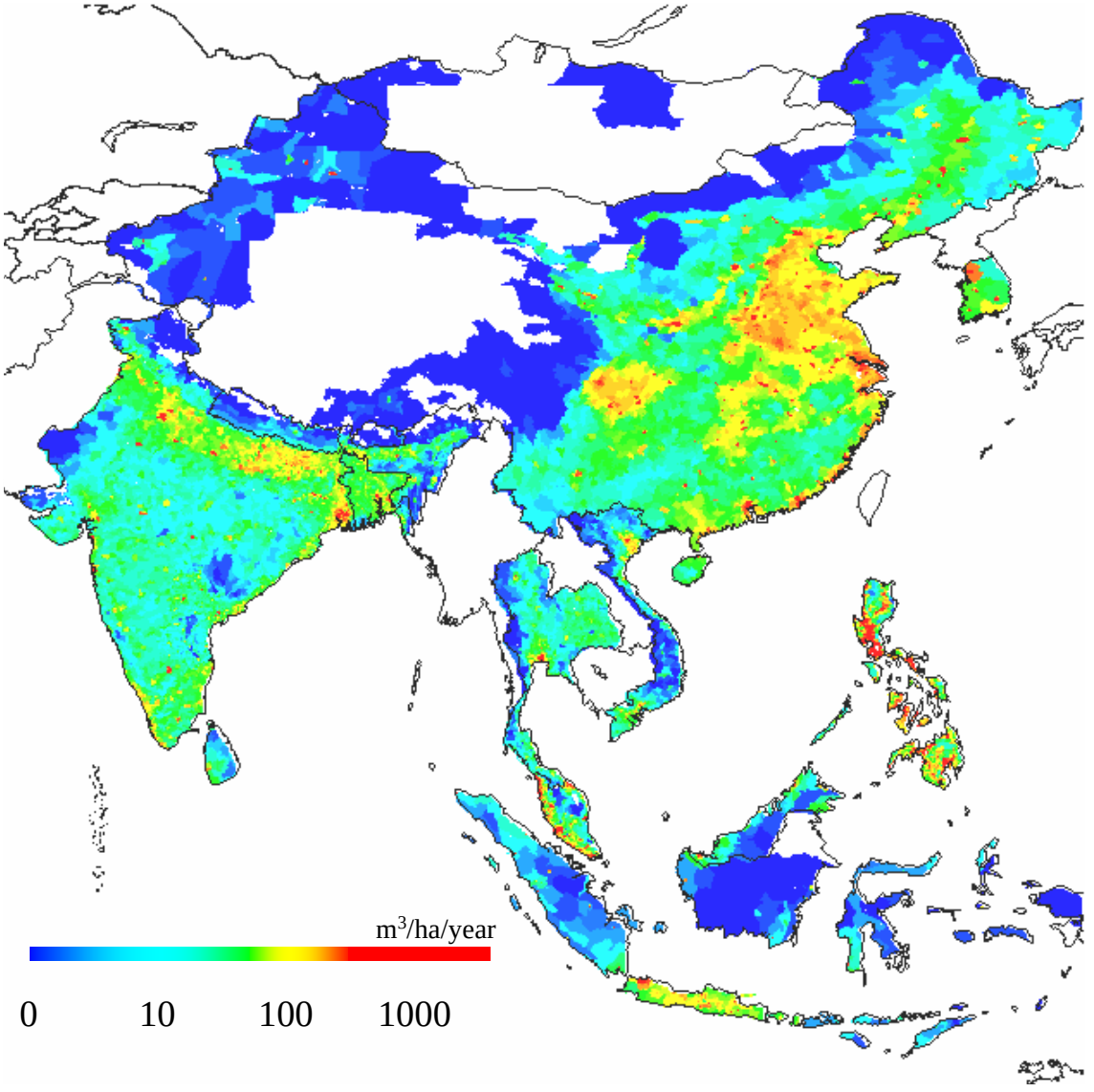
Industrial water withdraw intensity in Thailand



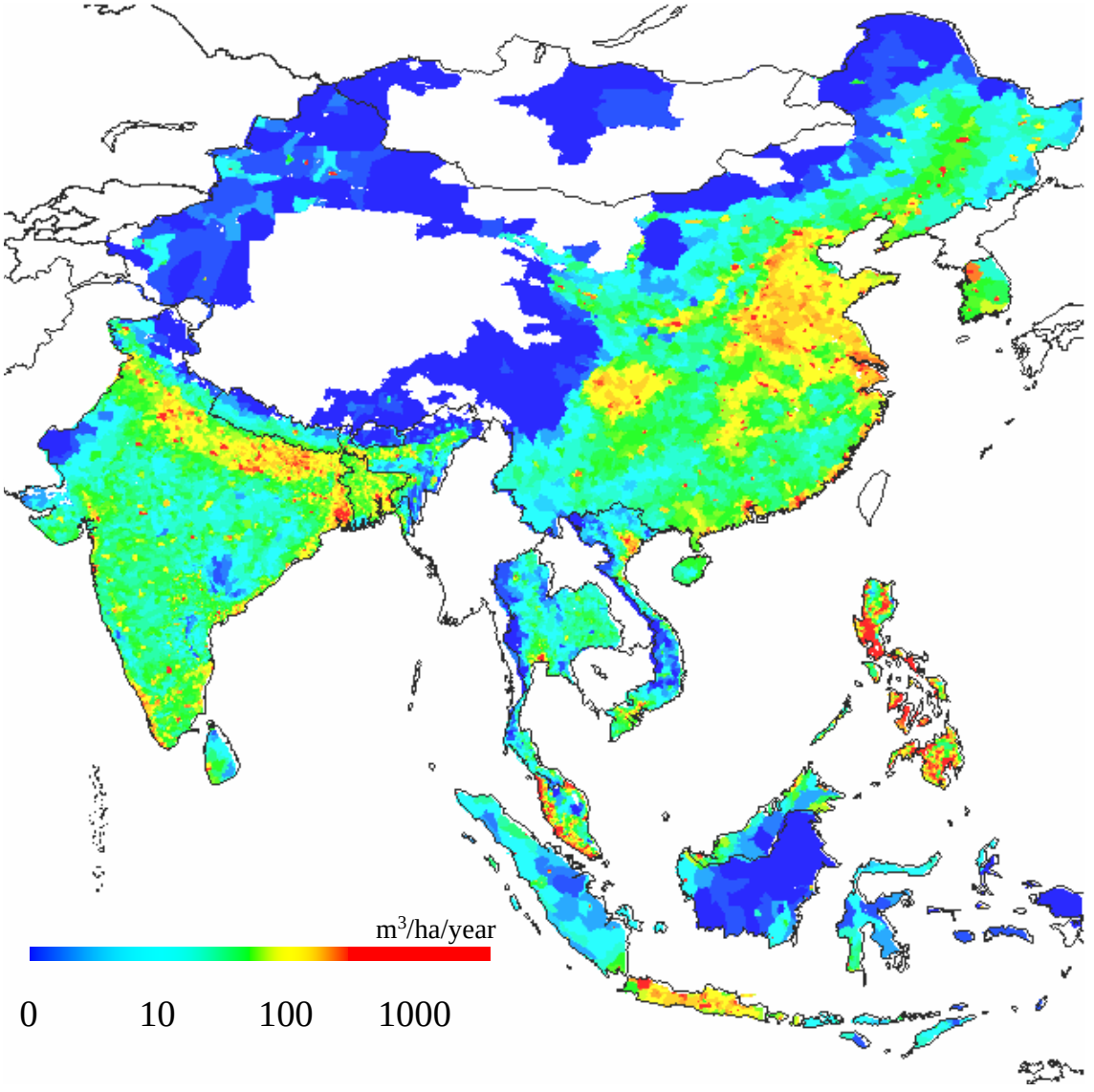
Industrial water withdraw intensity in Asia in 1990



Industrial water withdraw intensity in Asia in 2030



Domestic water withdraw intensity in Asia in 1990



Domestic water withdraw intensity in Asia in 2030

Assumption on technology improvement (general tendency)

BAU	Moderate technology improvement
Fortress	Lower rate of technology improvement than BAU
Policy	Higher rate of improvement both 1990-2015 and 2015-2032 than BAU
Great Transition	Higher rate of improvement in 2015-2032 than BAU

Improvement comes later in developing countries than in developed countries, since it requires some investment to adopt new technologies.

General tendency of estimated withdraw

For AGR and DOM, Fortress is the highest with reflecting higher population increase and lower wateruse efficient technology improvement.
For IND, Fortress is the lowest in developing countries because of the lower IVA increase even if lower technology improvement is assumed.

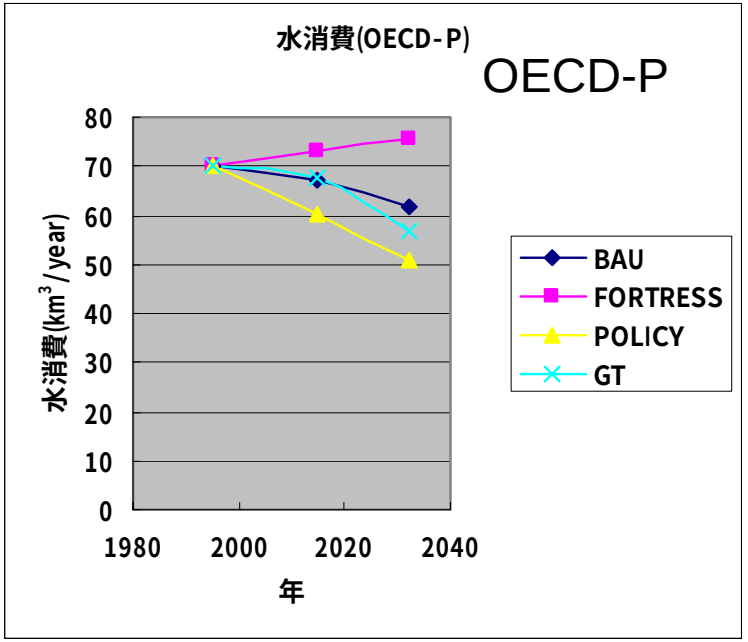
General tendency of estimated consumption

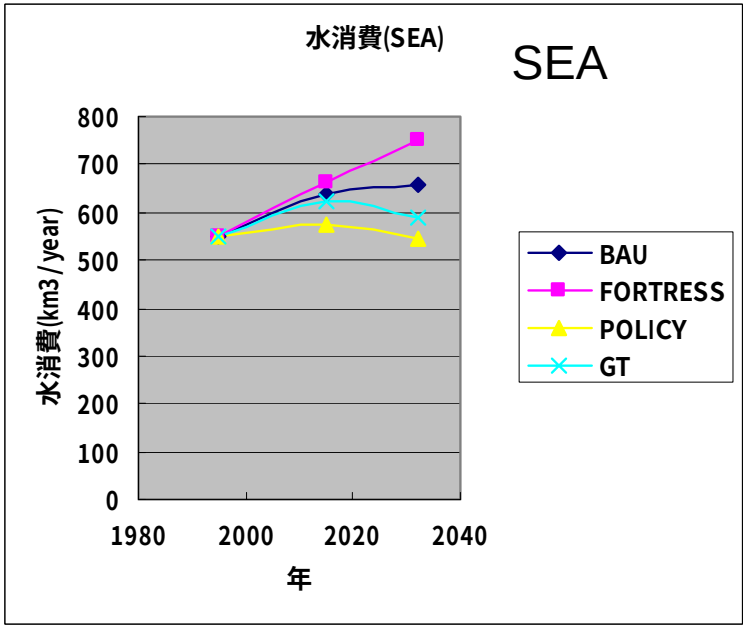
Reflecting lower return-to-stream-rate, the following order is kept in every region.

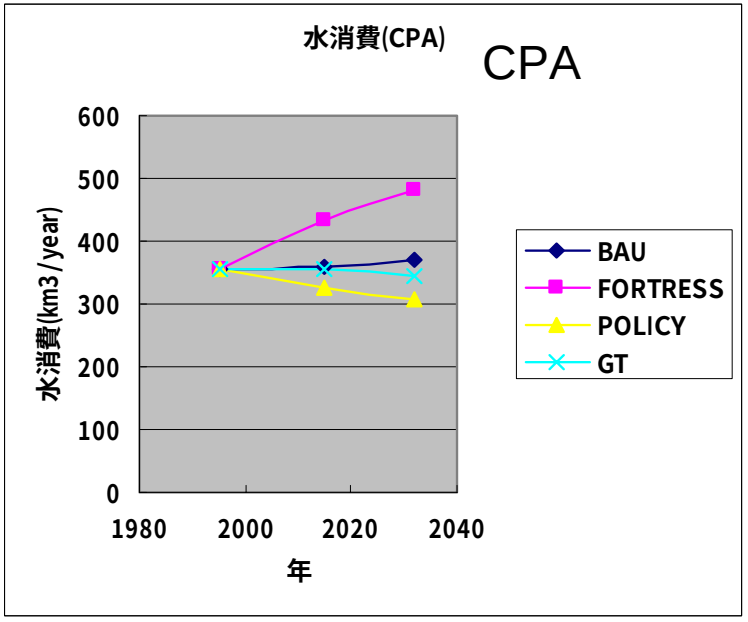
Fortress > BAU > Great Transition > Policy

Total of 3sectors (in next figures):

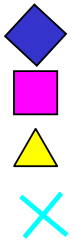
OECD-P	Only fortress scenario, increasing trend of water consumption.
SEA	Even the best case (Policy), slight increasing (or stable) trend.
CPA	Only the best case (Policy), slight decreasing trend.







Water consumption (1990 – 2032)
3sectors total



BAU
FORTRESS
POLICY
GT

Some ideas on the research direction in 2001

The share of agricultural water withdraw is very high, however the precision of estimation has not been enough. More detailed estimation of water withdraw is expected. Crop-wise estimation of evapotranspiration has been possible with GIS program developed in this year. It will be applied to the water demand assessment soon.

Inter-annual variability projected by GCMs is found to be significant factor in this year's study. Intra-annual (seasonal) variance of climate and water demand is expected to be even more important. Monthly analysis of water scarcity will follow the current annual analysis.

Economic aspect has not been considered in the current water resource assessment yet. We must design an innovative model framework which includes economic factors in order to assess the effectiveness of concrete strategies taken in each scenario.

Coupling with the output from regional climate model is still urged for country-level impact studies.