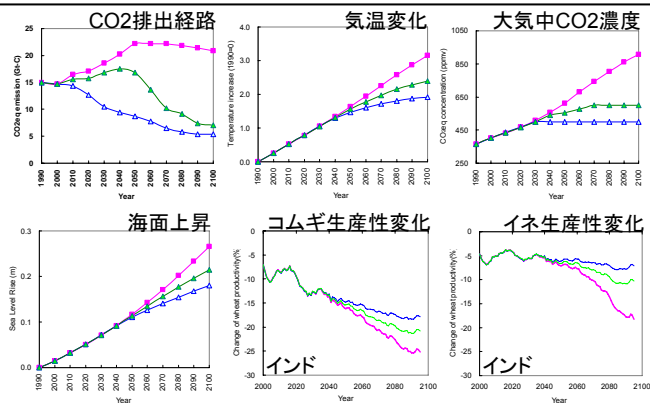


# Introduction to impact assessments in NIES

Kiyoshi Takahashi

Climate Risk Assessment Research Section  
Center for Global Environmental Research  
National Institute for Environmental Studies

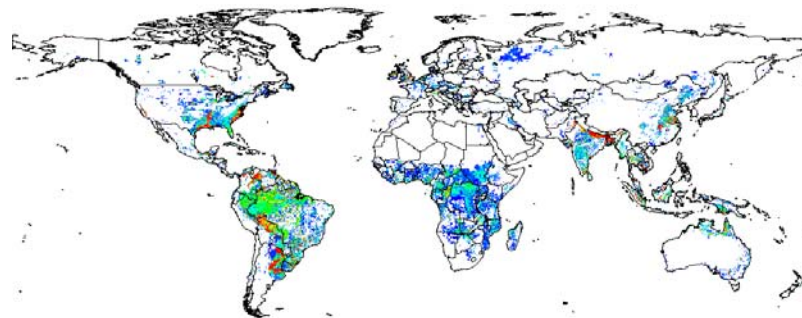
**(1) Comprehensive assessment of climate change impact for discussing long-term stabilization target**



■ SRES-B2: Business as usual    ■  
 ▲ GHG-500ppmv: 500ppmv cap on total GHG concentrations    ■  
 ▲ GHG-600ppmv: 600ppmv cap on total GHG concentrations    ■  
 > To achieve around 2°C temperature increase in 2100, 550ppmv cap on total GHG constraint is needed

**Optimal emission path for achieving 2 degC target and consequent temperature change, SLR and crop impacts.**

**(2) Impact assessment considering effects of extreme climate events**



**Climate change impact on crop productivity using daily climate scenario with high spatial resolution.**

**Application to the discussion of post-2012 framework**

**(Project S-3-2 and S-4)**

**Improvement of impact model**

**(Project B-12)**

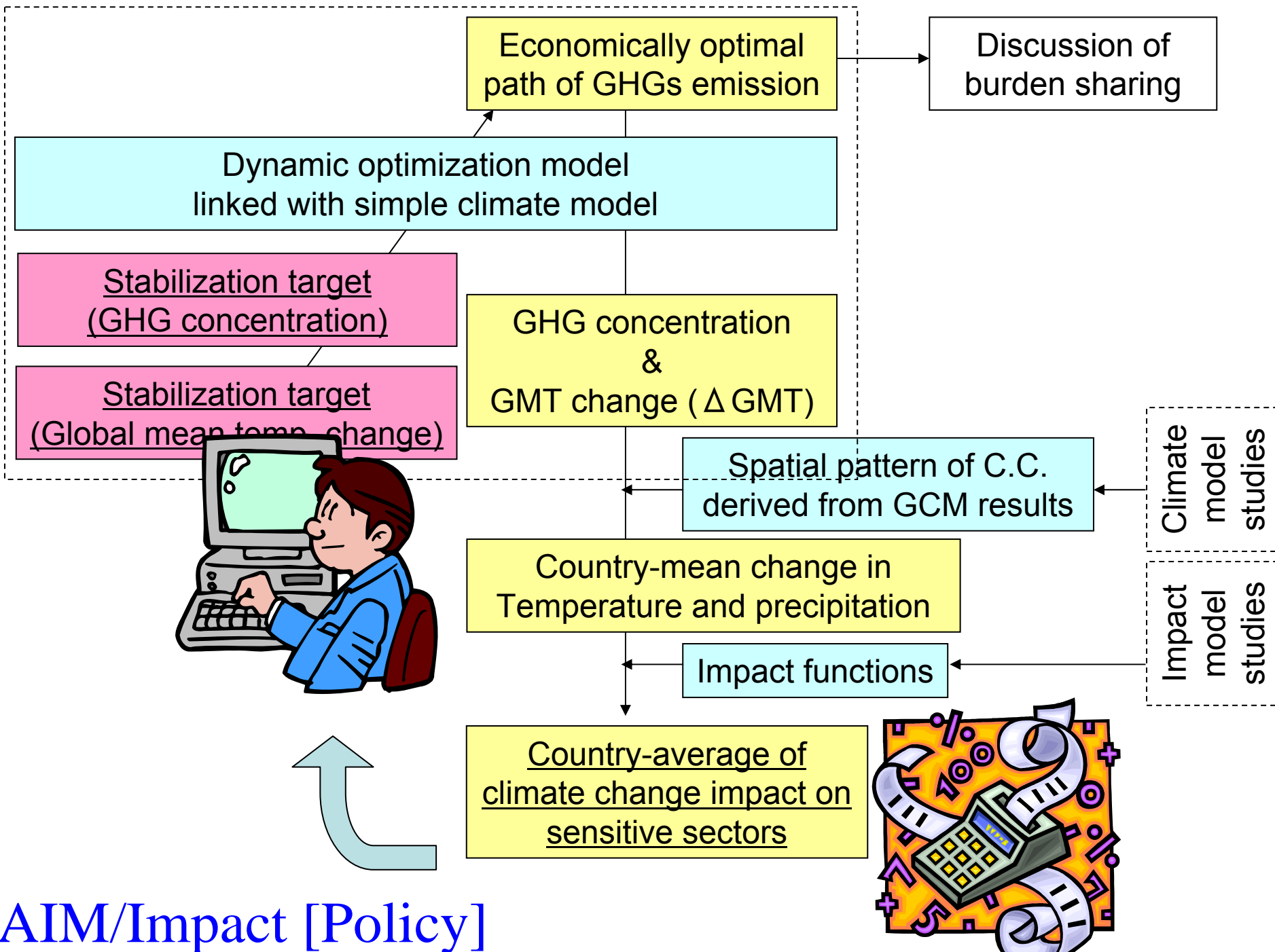
**Development of AIM/Ecosystem (Project B-52)**

**(3) Impact assessment considering interaction between climate change, other environmental problems, and development target.**

**Three main research directions of AIM impact study**

# Specification of AIM/Impact [Policy]

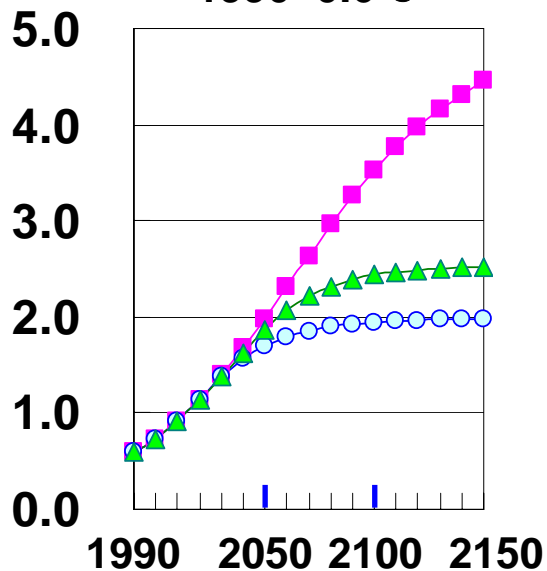
- Objective
  - Comprehensive analysis and assessment of global warming control targets such as stabilization of GHG concentrations, economically efficient emissions paths to realize those targets, and the impacts and risks under the sets of those targets.
- Input
  - Future scenarios of Population, Economic growth, Technology improvement, energy reserve, etc.
  - Assumption on constraints (Limits of GHGs emission/concentration, temperature increase, and SLR), etc.
- Output
  - Time-series of GHGs emission, GHGs concentration, temperature, precipitation, SLR, sector-wise impacts, etc.
- Model components
  - Dynamic optimization model linked with simple climate model for exploring an optimal emission trajectory.
  - Database-type country-wise/sector-wise impact assessment model.
  - Burden sharing model for estimating country-wise GHGs emission reduction necessary for achieving global emission reduction target.
- Reference
  - Hijioka, Y., T. Masui, K. Takahashi, Y. Matsuoka, H. Harasawa (2006): Development of a support tool for greenhouse gas emissions control policy to help mitigate the impact of global warming. *Environmental Economics and Policy Studies*, **7(3)**, 331-346.



AIM/Impact [Policy]

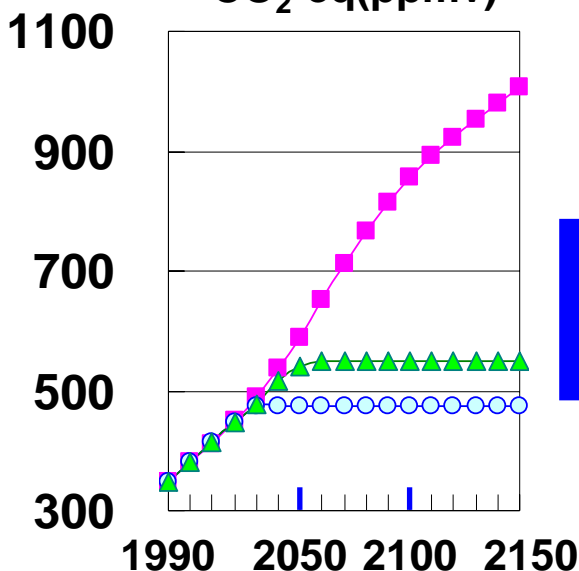
### Temperature increase

1990=0.6°C



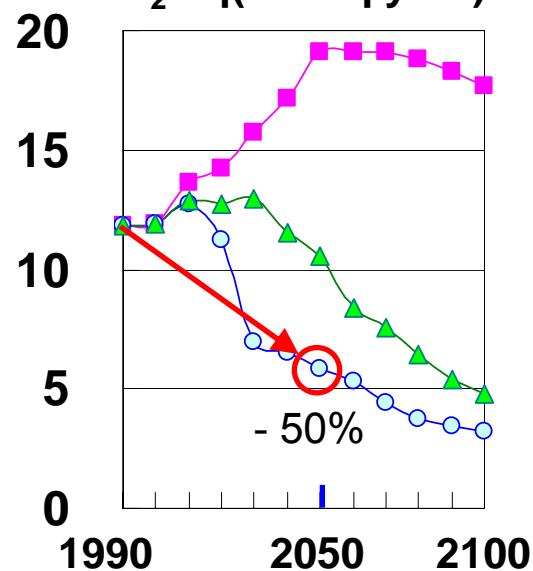
### GHGs concentration

CO<sub>2</sub>-eq(ppmv)

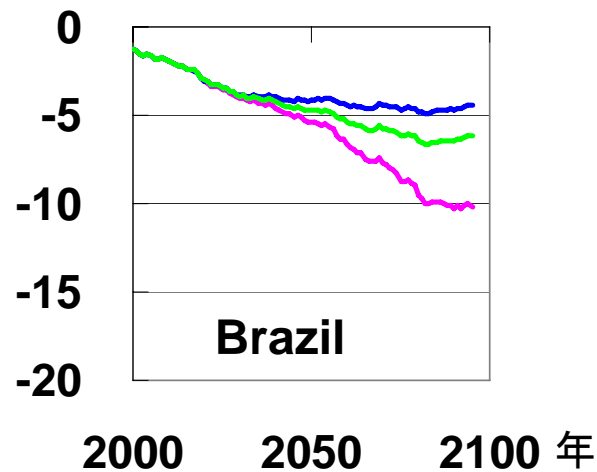
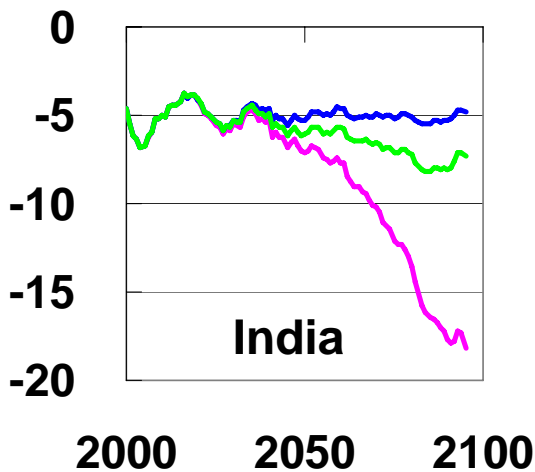
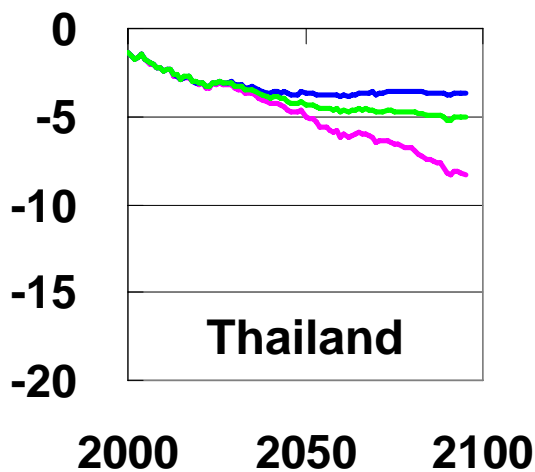


### GHGs emission

CO<sub>2</sub>-eq(GtCeq/year)

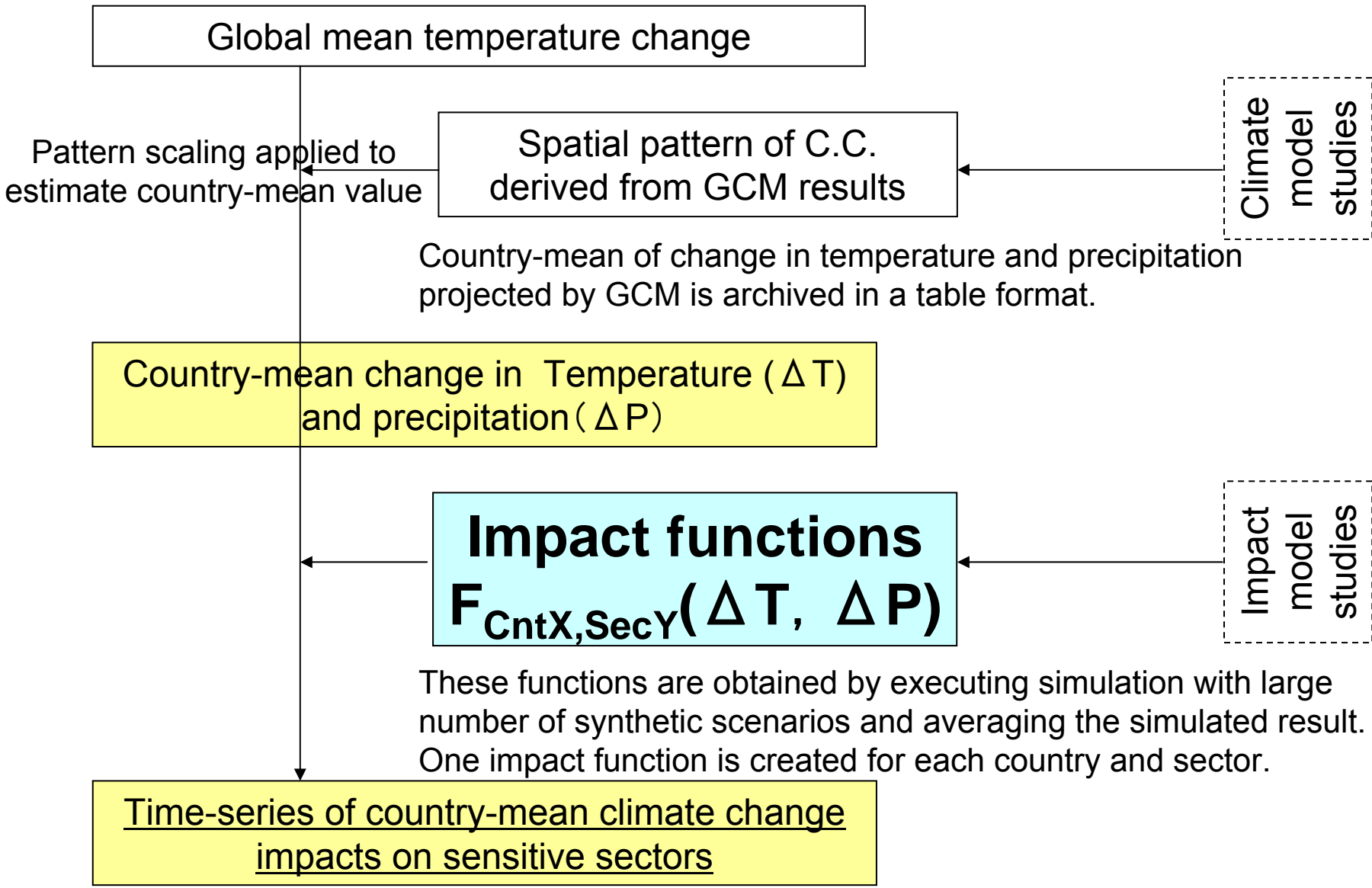


### Potential productivity change in rice (%)



# Impact assessment module

Database-type country-wise/sector-wise impact assessment model



# Extension of impact functions

- Agriculture
  - [Revision] Consideration of some adaptations (Masutomi & Takahashi)
- Health
  - [New] Change in heat stress mortality (Takahashi)
- Water resource
  - [New] Change in Renewable water resource (Hanasaki)
  - [New] Water Severity Index (Hanasaki & Masutomi)
  - [New] Falkenmark Index (Hanasaki & Masutomi)

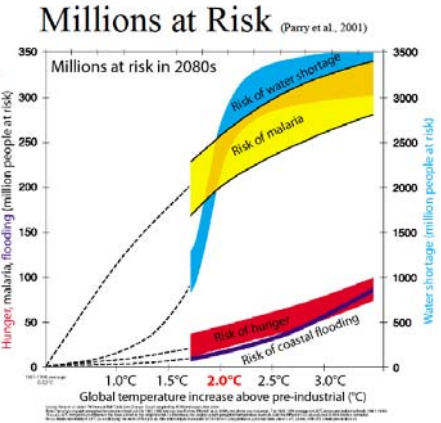
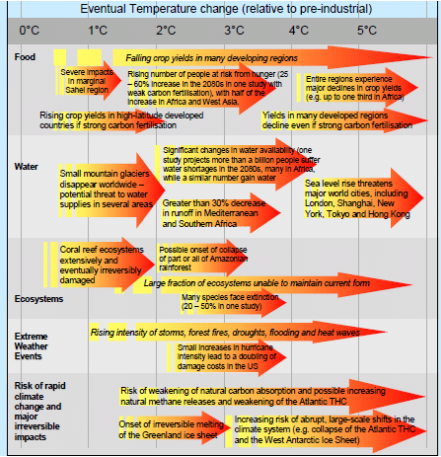
# Climate Change Impact Database

for enhancing impact functions

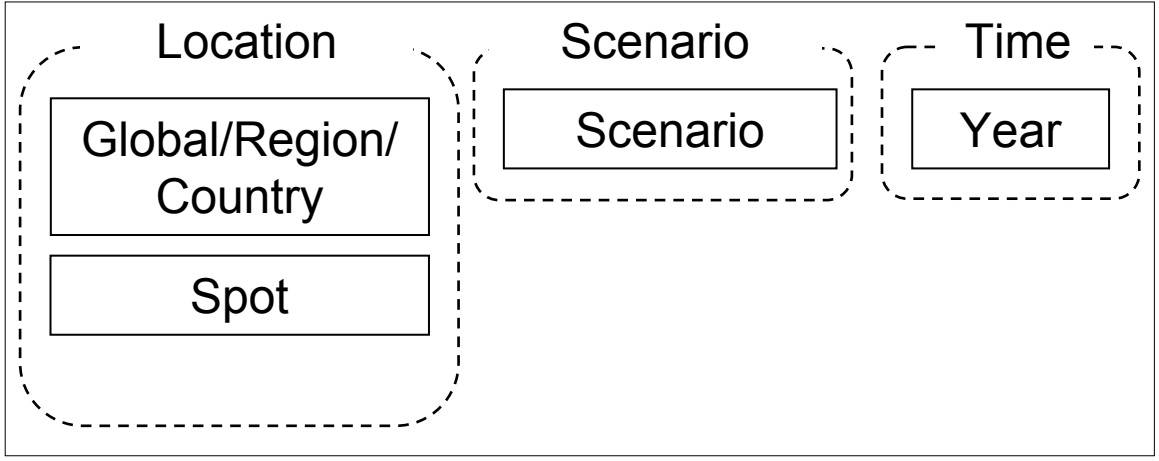
- Scientific literatures of existing impact assessments are collected and archived.
- Relationships between global mean temperature increase (or other climate factors) and degree of impact are extracted from figures/tables in the literatures.
- Database has a user interface to search and show archived data graphically.
- Archived data is used for enhancing impact functions used in AIM/Impact [Policy].



# Properties archived in the database



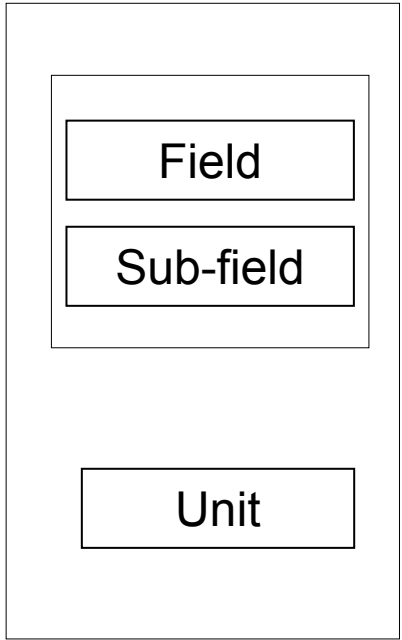
Assumption



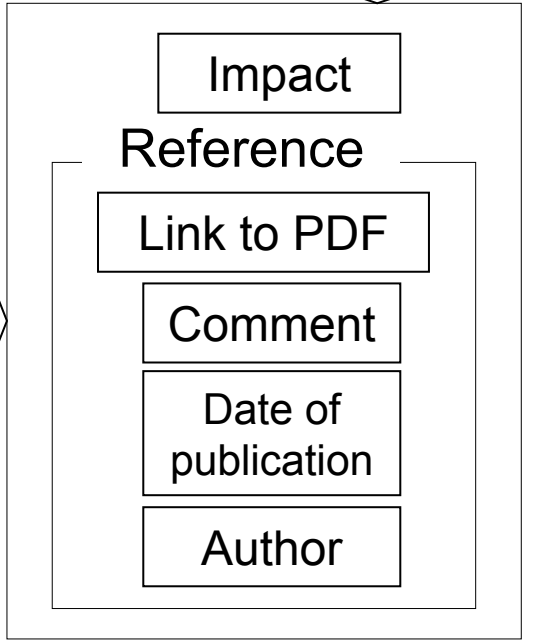
Climate



Affected Sector



Result



# Climate Change Impact Database

for enhancing impact functions

- ① Selection of spatial scale (Global/ Region/ Country)
- ② Region / Country
- ③ Spot
- ④ Scenario
- ⑤ Affected sector
- ⑥ Sub-affected sector
- ⑦ Author
- ⑧ Date of publication
- ⑨ Unit
- ⑩ X-axis
- ⑪ Links to references

温暖化影響DB : フォーム

Global/Region/Country ① Unit population at risk ⑨ 図表の更新 X-axis GMTI Scenario Year ⑩

Region/Country ②

Spot Countryの決定 ③

Scenario B1 B1a ④

Field Coastal Hazard Ecosystem Loss ⑤

Sub Field AAPF\_CP\_w/\_CC\_HPop AAPF\_CP\_w/\_CC\_LPop ⑥

Author R.J. Nicholls ⑦

Date of publication 2004 ⑧

Date of publicationの決定

Data List ⑪

link	comment	Global/Reg	Region/Country	Spot	Scenario	Field
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A1 F1	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A1 F1	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A1 F1	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A2	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A2	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	A2	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	B1	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	B1	Coastal Hazard
0404-GEO-Coast-Nich	11P_Table12(additional impacts due to sea-le	Global	-	-	B1	Coastal Hazard

year すべて

合計 : Global-temp 合計 : Impact

Population at risk (million)

Global Mean Temperature Increase

Global-temp

Region/Country Spot Scenario Field Sub-field GMTI\_G GCM comment

- ◆ --- A1F1 - Coastal Hazard - AAPF\_CP\_w/\_CC\_HPop --- 11P\_Table12(additional impacts due to sea-level rise)
- --- A2 - Coastal Hazard - AAPF\_CP\_w/\_CC\_HPop --- 11P\_Table12(additional impacts due to sea-level rise)
- ▲ --- B1 - Coastal Hazard - AAPF\_CP\_w/\_CC\_HPop --- 11P\_Table12(additional impacts due to sea-level rise)

レコード: 1 / 1

# Applications of AIM/Impact [Policy]

in the research projects supported by Ministry of Environment

- Research project on establishing of methodology to evaluate middle to long term environmental policy options toward low carbon society in Japan (S-3; FY2004-2008)
  - For exploring optimal emission reduction trajectory to achieve prescribed long-term targets.
- Comprehensive assessment of climate change impacts to determine the dangerous Level of global warming and to determine the appropriate stabilization target for atmospheric GHG concentration (S-4; FY2005-2009)
  - For synthesizing scientific knowledge on climate change impacts both at global, national and sub-national scales.

# Comprehensive Assessment of Climate Change Impacts

to Determine the Dangerous Level of Global Warming and to Determine the Appropriate Stabilization Target for Atmospheric GHG Concentration

**Water resource**

- Inundation damage
- Sedimentation disaster
- Snow water resource

**Human health**

- Heat stress mortality
- Air quality
- Communicable diseases

**Forest vegetation**

- Potential distribution of beech, fir, and other trees.

**Agriculture**

- Rice production in Japan, China, Thai, Viet Nam
- Impact on food market

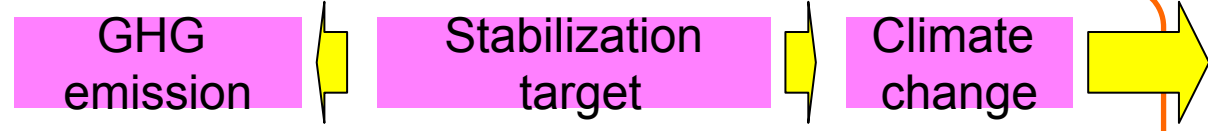
**Coastal**

- Liquefaction risk
- High tide risk due to change in typhoon.

*Sector-wise impact as*

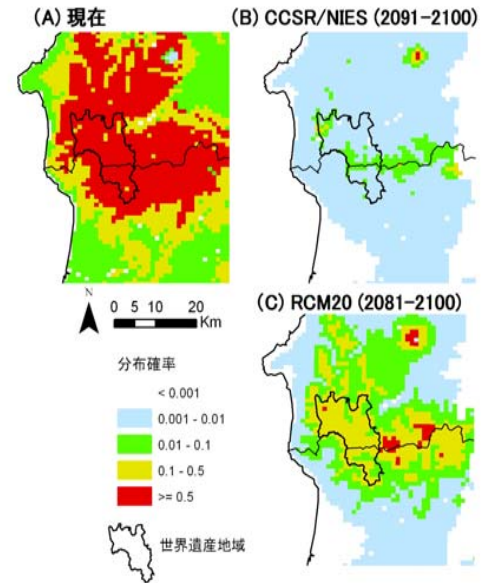
*Economic evaluation of climate ch*

**Impact Function**



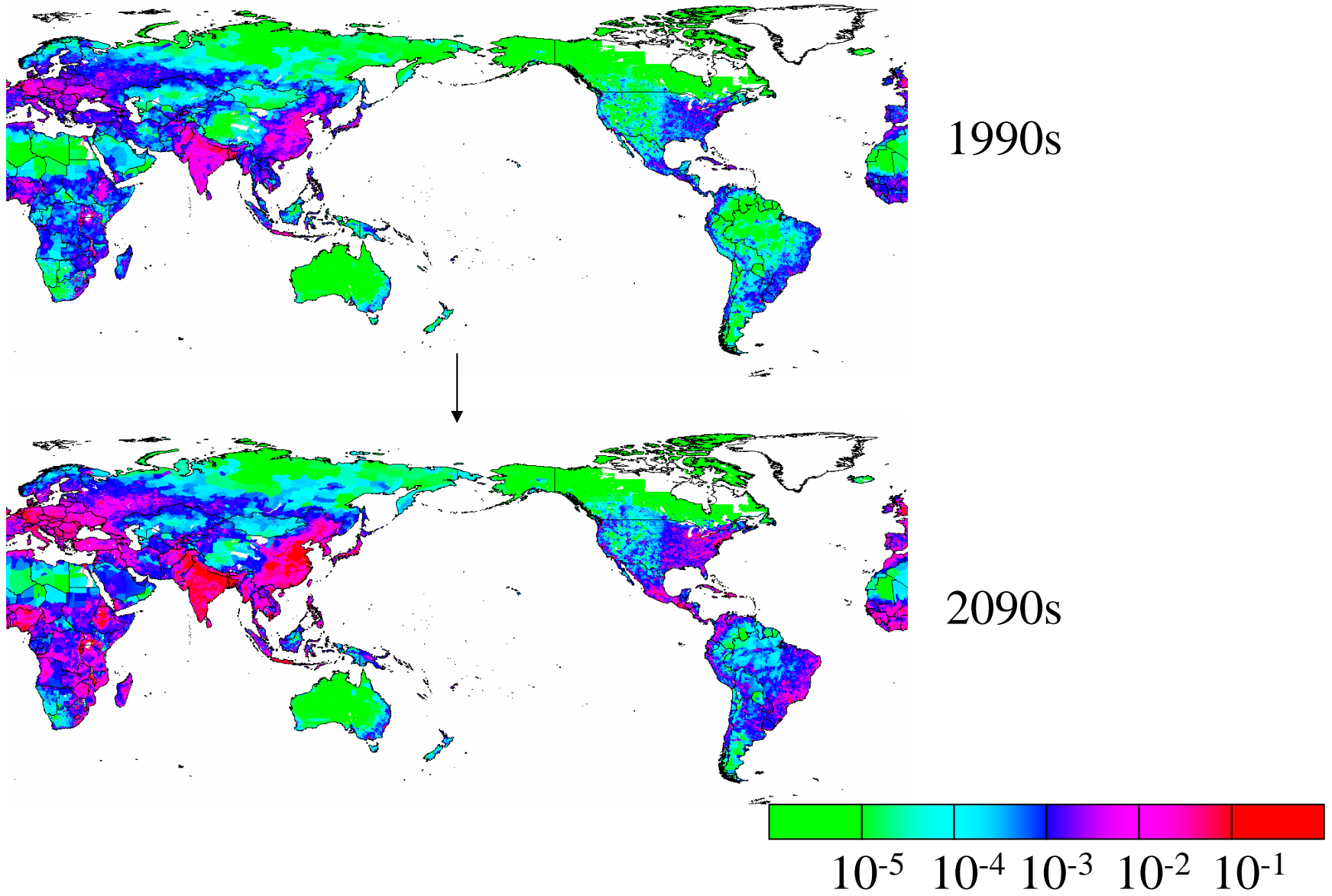
**AIM/Impact [Policy] (Long-term targets)**

Example of sectoral impact assessment  
Beech tree in Shirakami Mt. range



Without any mitigation, beech trees in Shirakami Mt. range, a world heritage site in north Japan, may disappear in 100 years.

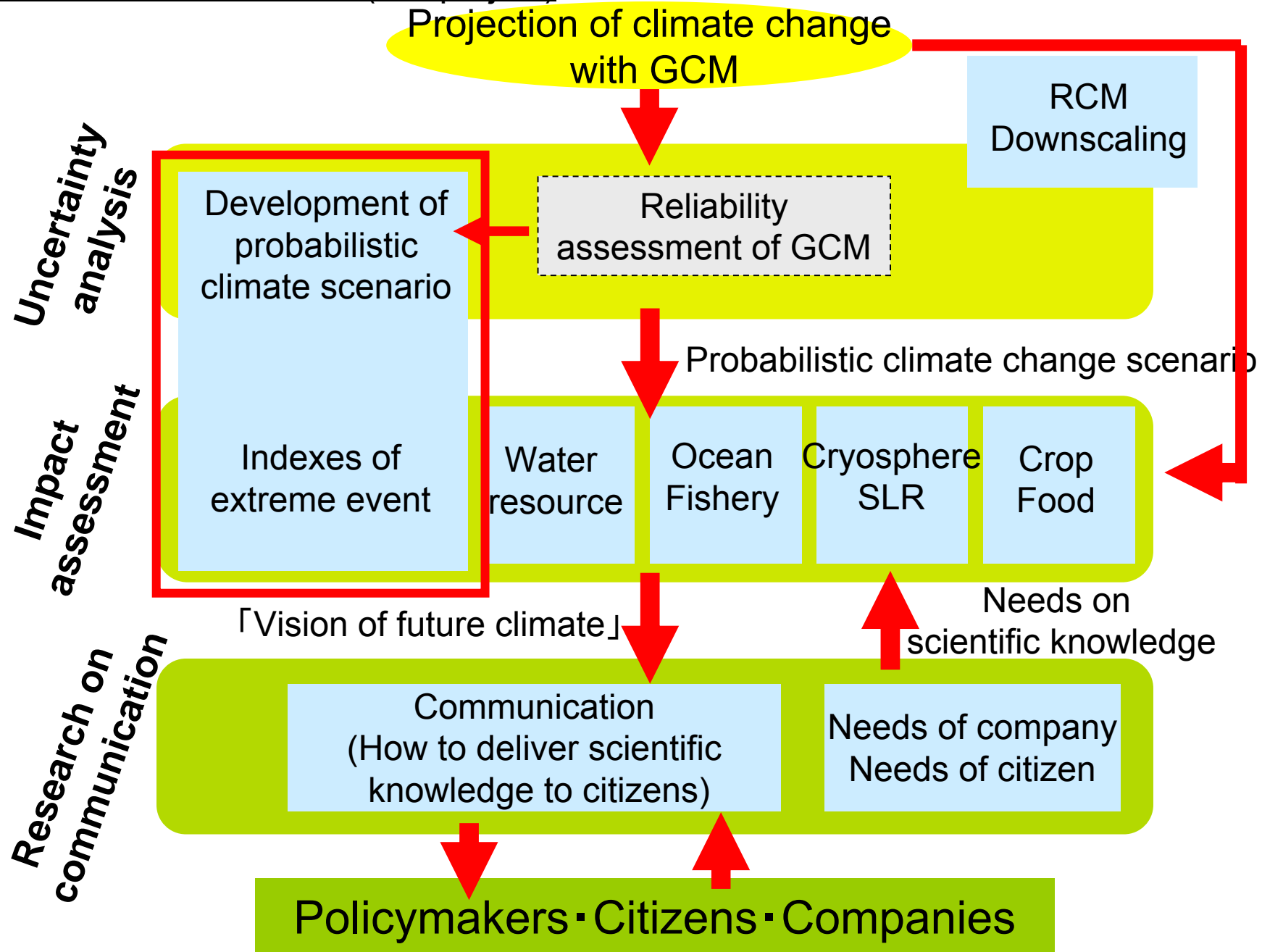
# Change in heat stress mortality per unit area (1990s and 2090s)



Takahashi, K., Honda, Y. and Emori, S. (2007) Assessing Mortality Risk from Heat Stress due to Global Warming, Journal of Risk Research. (In press)

(person/km<sup>2</sup>)

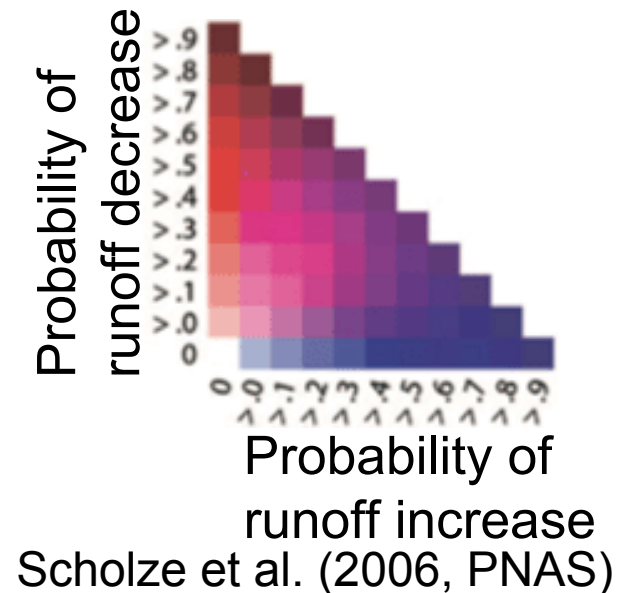
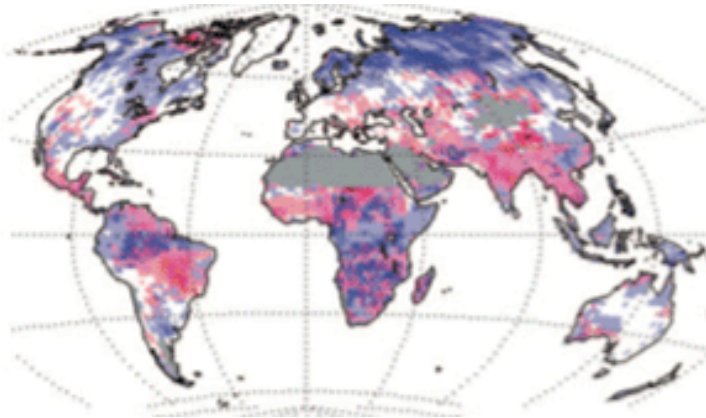
Research on development of comprehensive scenarios of climate change and means of communication (S-5 project)



# Challenge of impact study in S-5

1. Impact assessment with uncertainty range based on probabilistic climate change scenarios  $\Rightarrow$  Risk analysis

Example: Probabilistic analysis of runoff change based on multi-model / multi-scenario



2. Comprehensive assessment of global scale impact through original simulation and review of existing knowledge  $\Rightarrow$  「Vision of future climate and its risks」

# Summary of presentation

- Demand on AIM/Impact[Policy] has been increasing.
  - Expansion of impact functions is an urgent need, and new members of the team is struggling with the task.
  - AIM Climate Change Impact Database is expected to support the expansion on impact functions.
- New large research project on development of comprehensive climate change scenarios will start from the coming April.
  - Global scale impact assessment based on the latest climate model results.
  - How to transfer the research knowledge with large uncertainty to people in general is also studied.