

# **Structure of Model for the APEIS Project**

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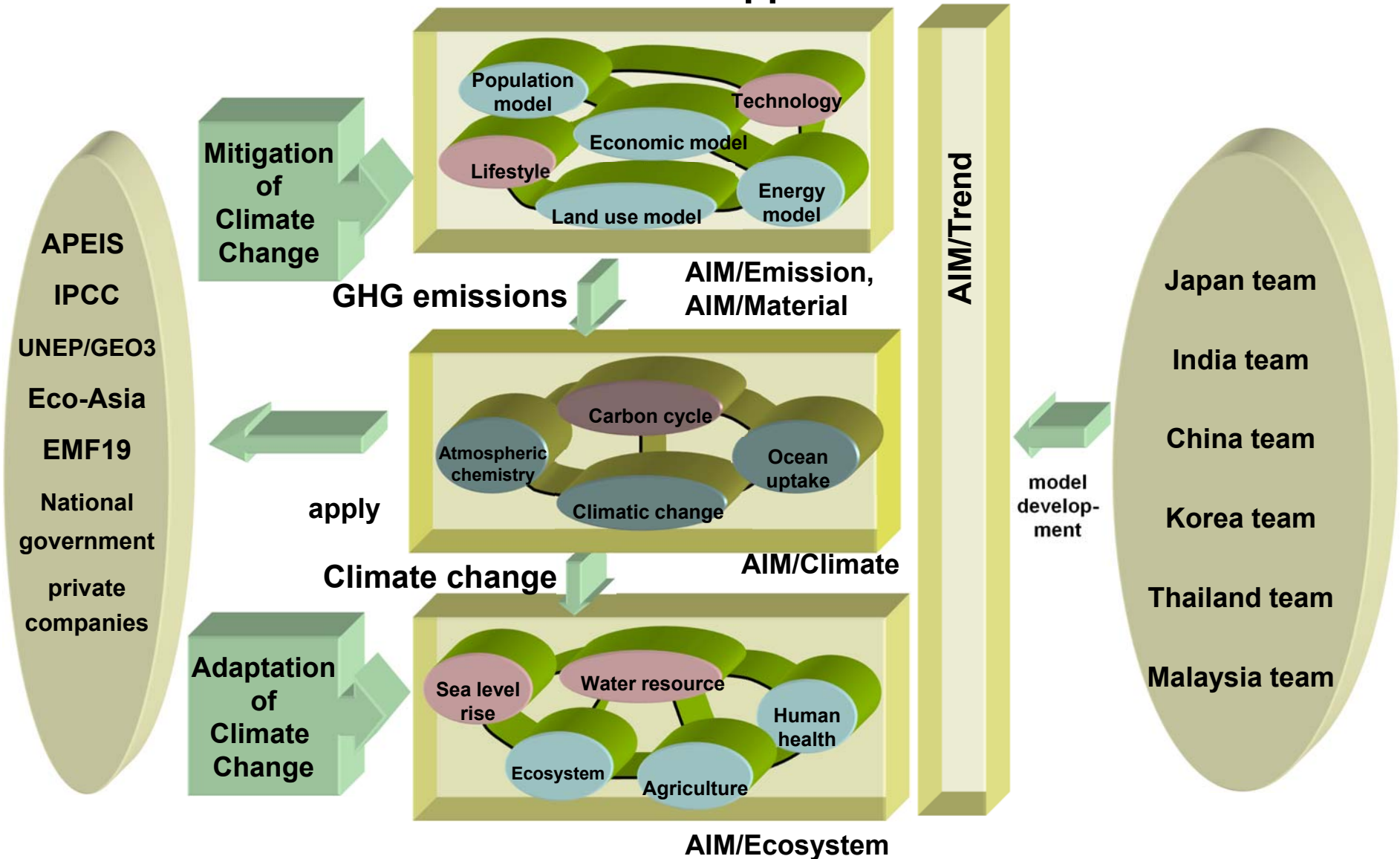
- 1. Brief introduction of the AIM**
- 2. Models used for APEIS Project**
- 3. AIM/Emission, Ecosystem,  
Material and AIM/Trend**

# The Asia-Pacific Integrated Model

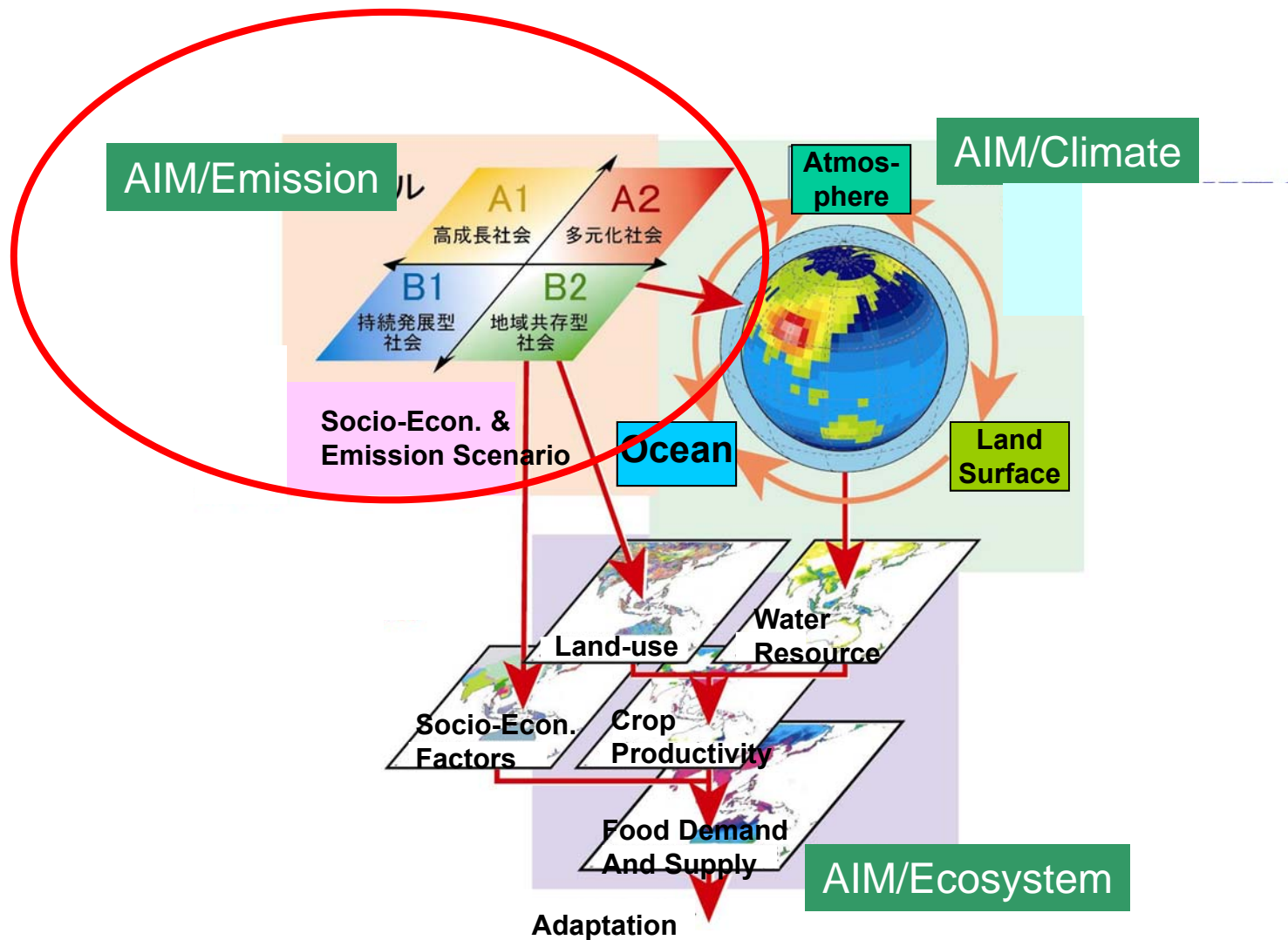
- **AIM is an abbreviation of Asia-Pacific Integrated Model.**
- **It is one of Integrated Assessment Models (IAM), and a large-scale computer simulation model developed to promote the integrated assessment process in the Asia-Pacific region**
- **Collaborated study by Japan, China, India , Korea, Thailand and Malaysia members.**
- **The AIM project is started in July 1990, and began an international collaboration system from 1994.**

# Integrated Assessment Model of Climate Change:

## The AIM Approach



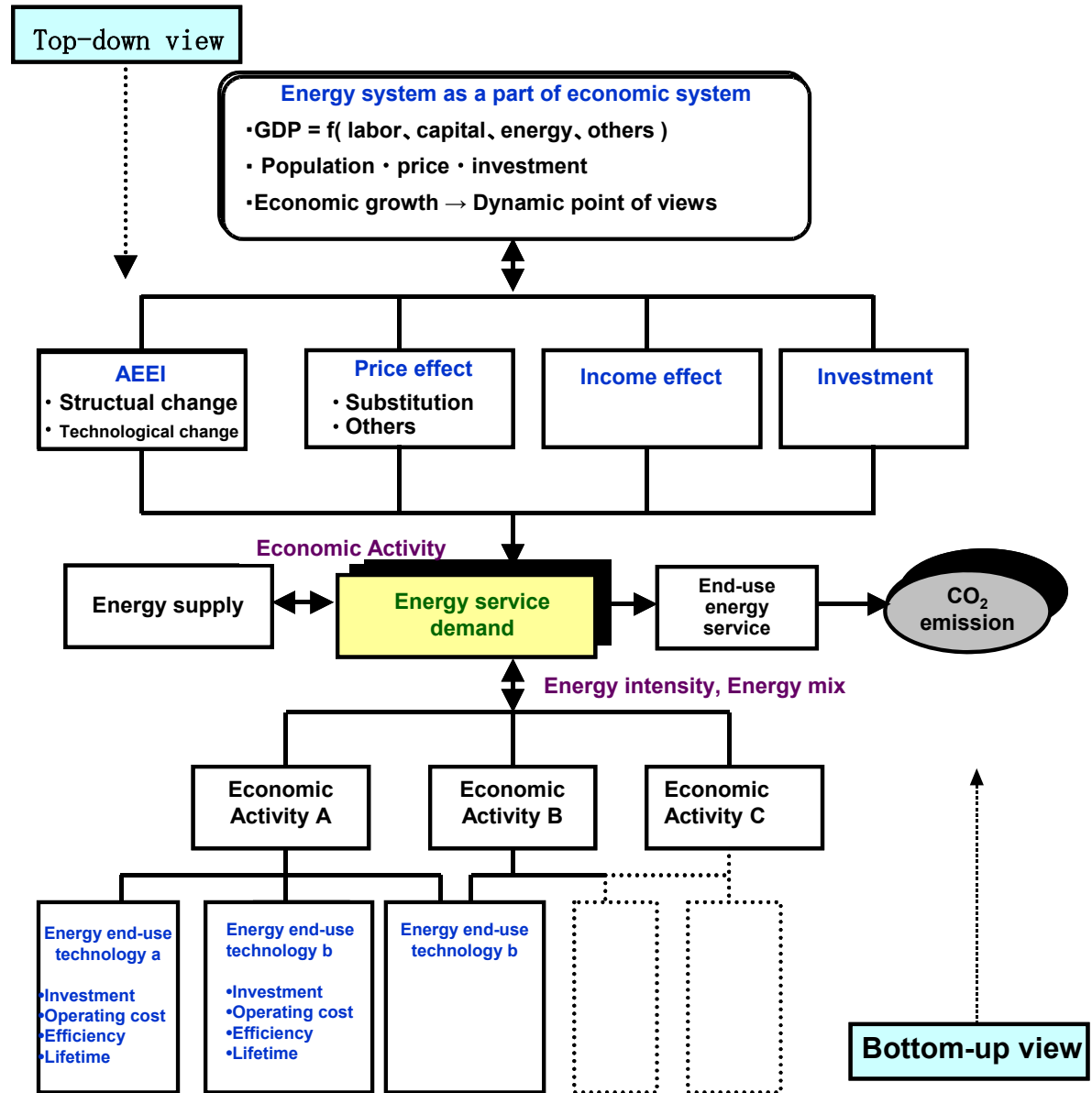
# Linkages of AIM models



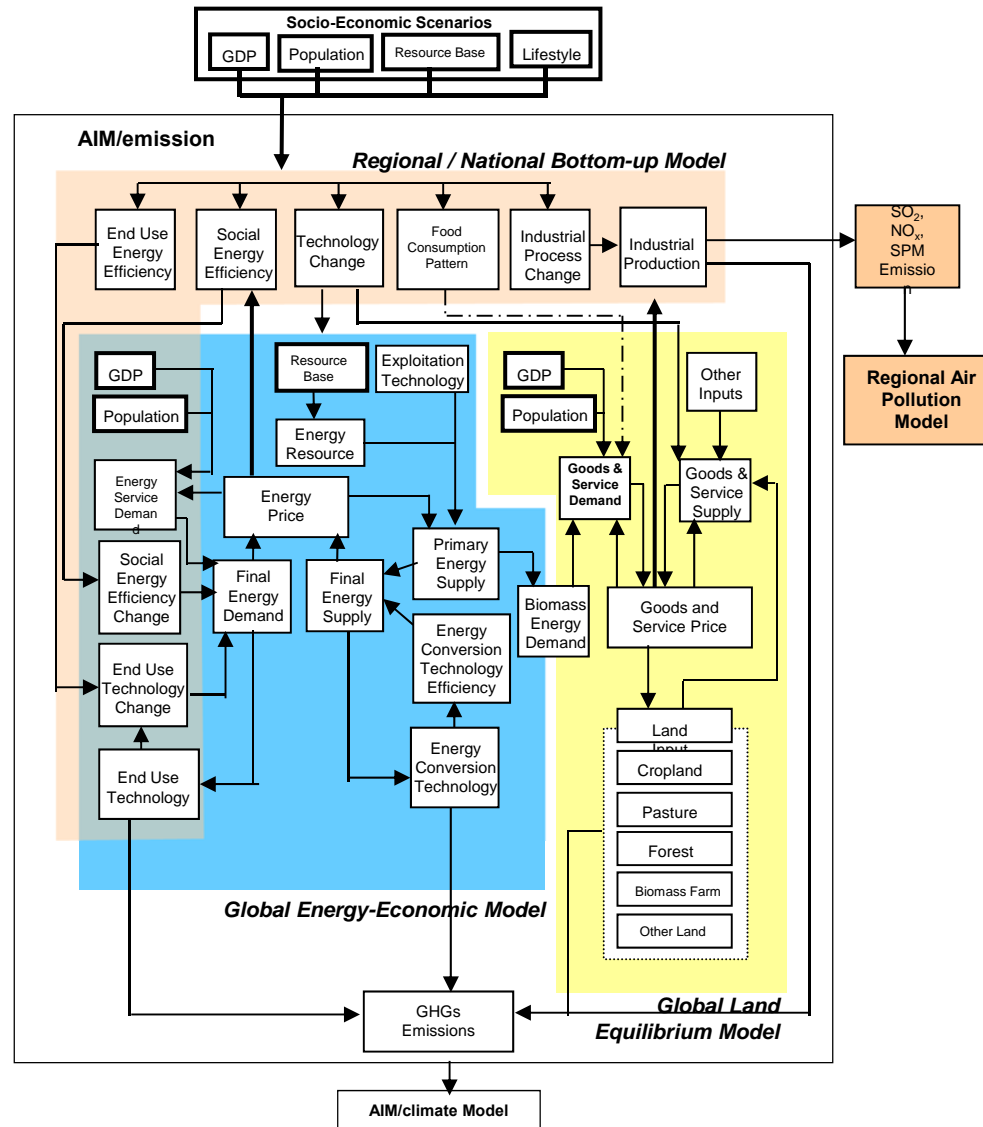
# **AIM/Emission Bottom-up and Top-down**

- **The AIM/Emission has two types of models, i.e. Bottom-up type energy models and Top-down type energy models.**
- **Bottom-up type energy models : Energy demand is calculated by multiplying energy service and energy efficiency. Energy efficiency is calculated with the diffusion of new technologies, and energy prices. Within the model, recruit processes of energy technologies, choice and operation of energy devices are described in detail.**

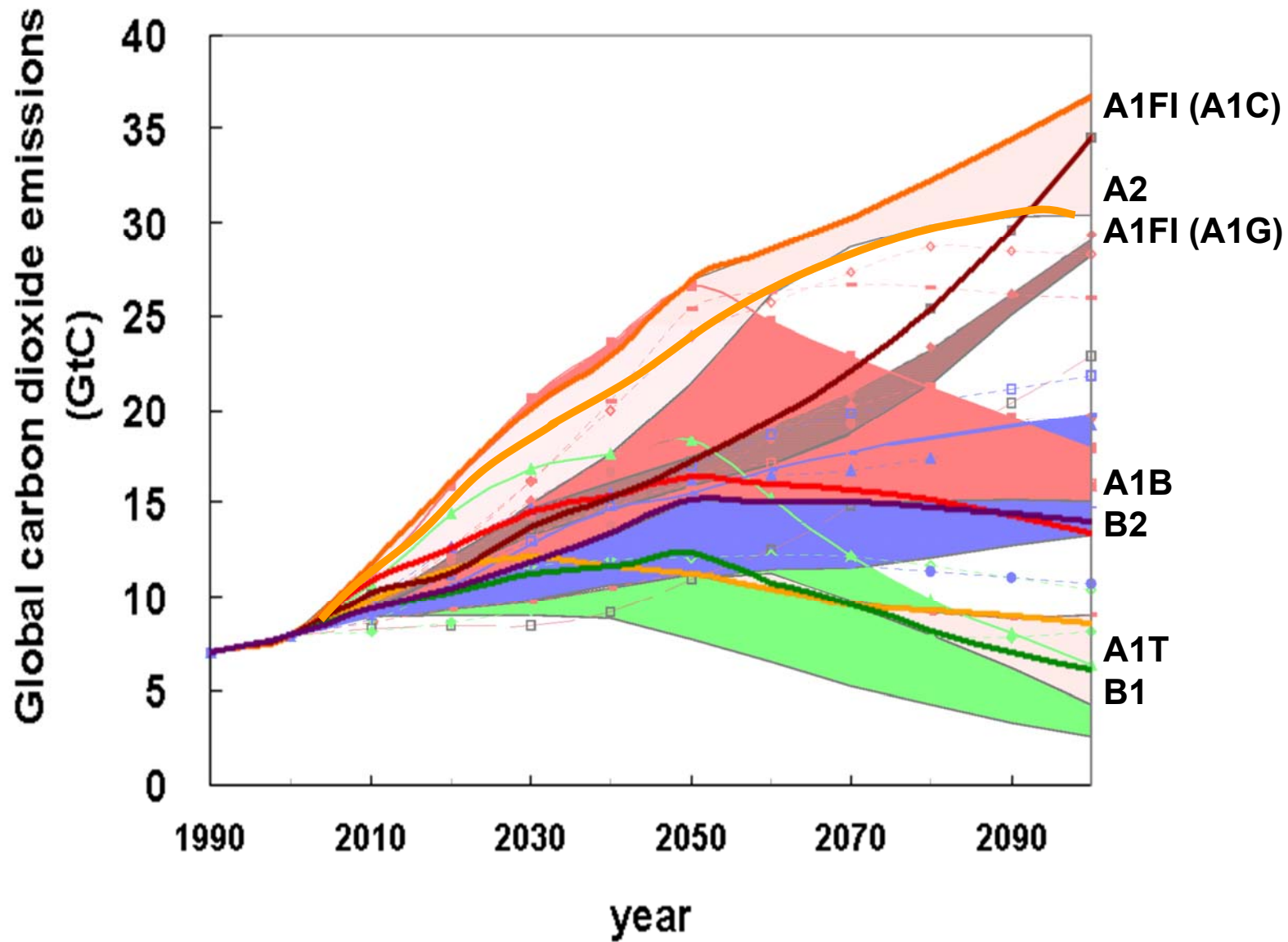
# Top-down and Bottom-up Energy models in AIM Family



# AIM/Emission - Coupling of models -

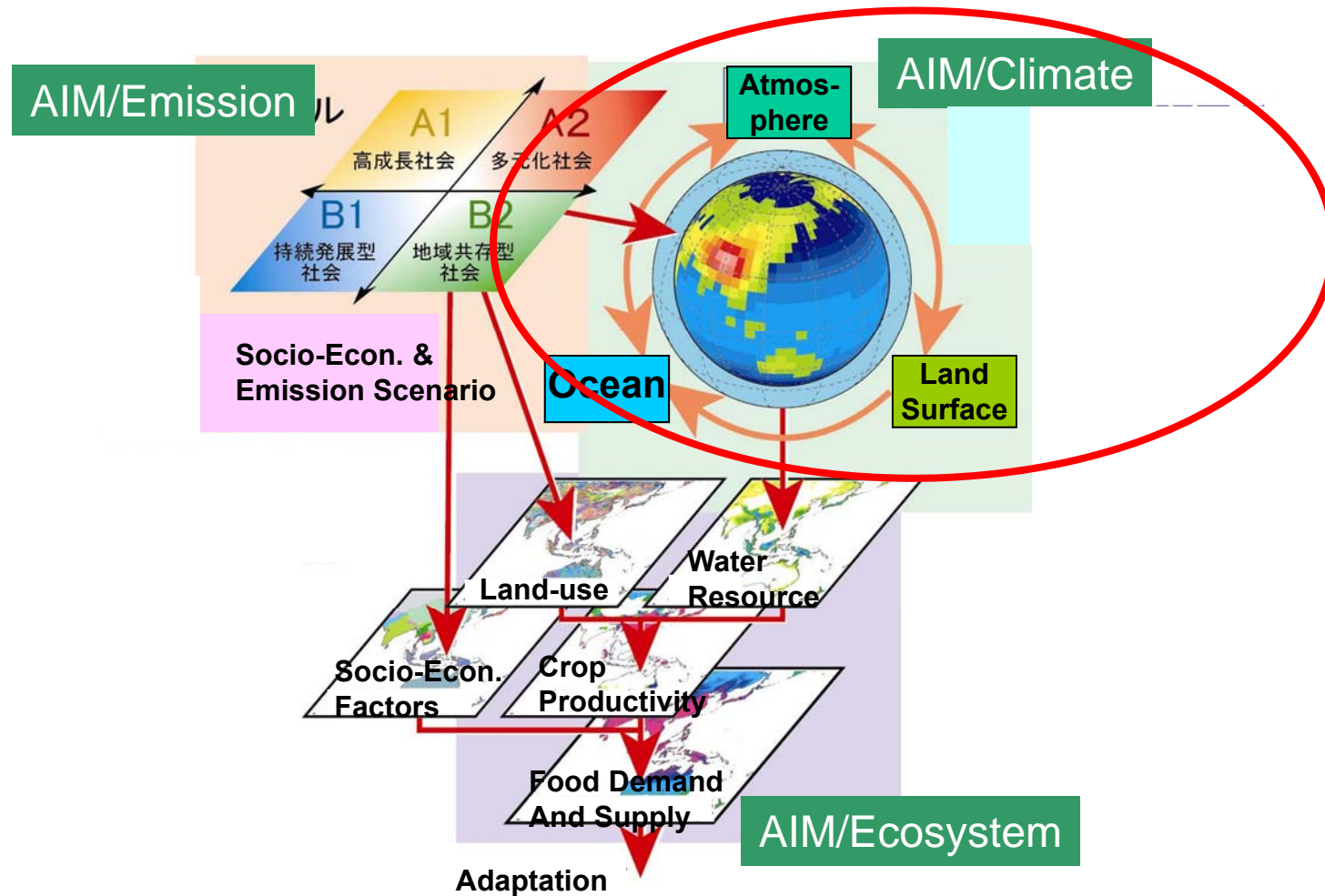


# CO<sub>2</sub> Emission Scenarios

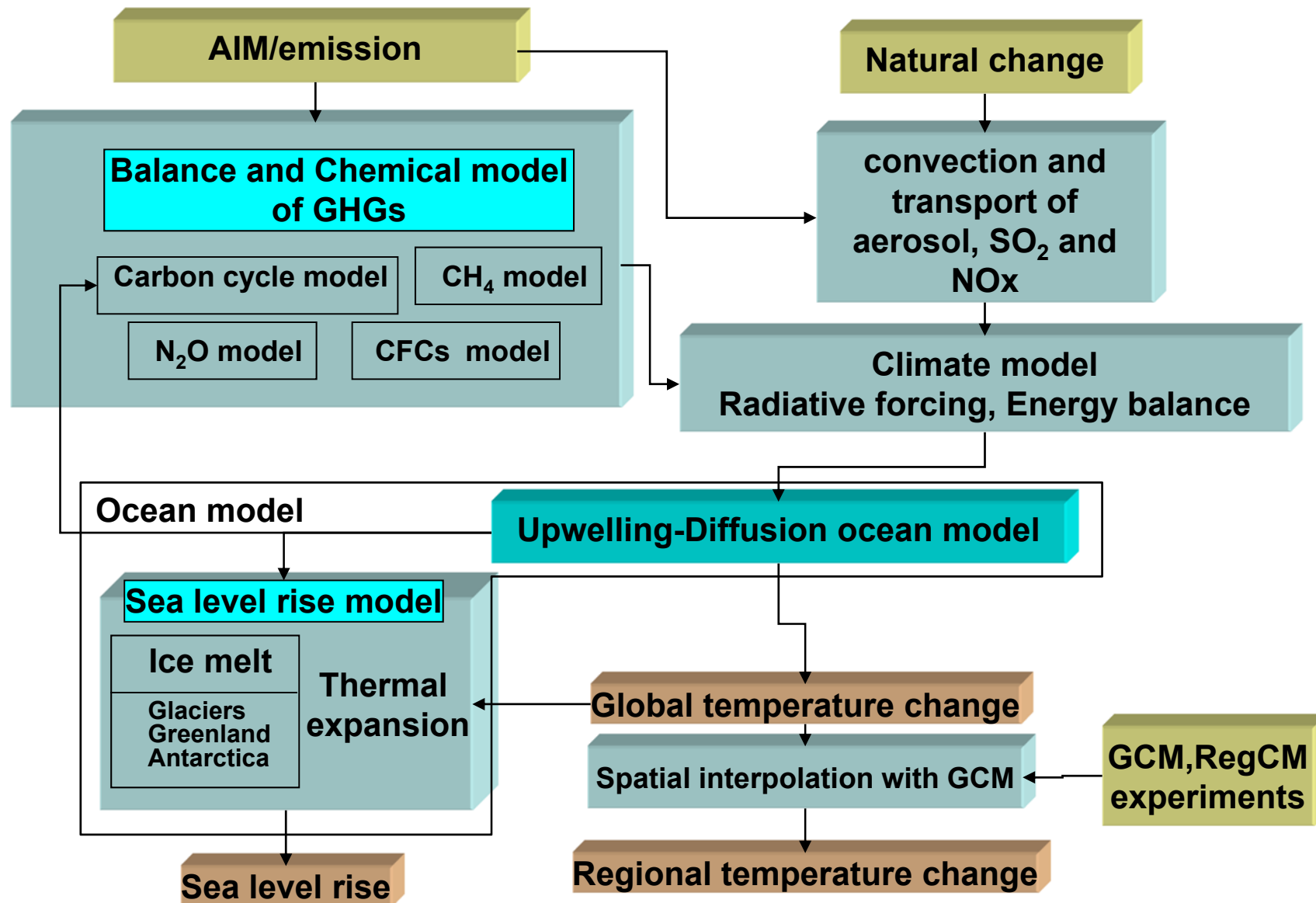




# Linkages of AIM models

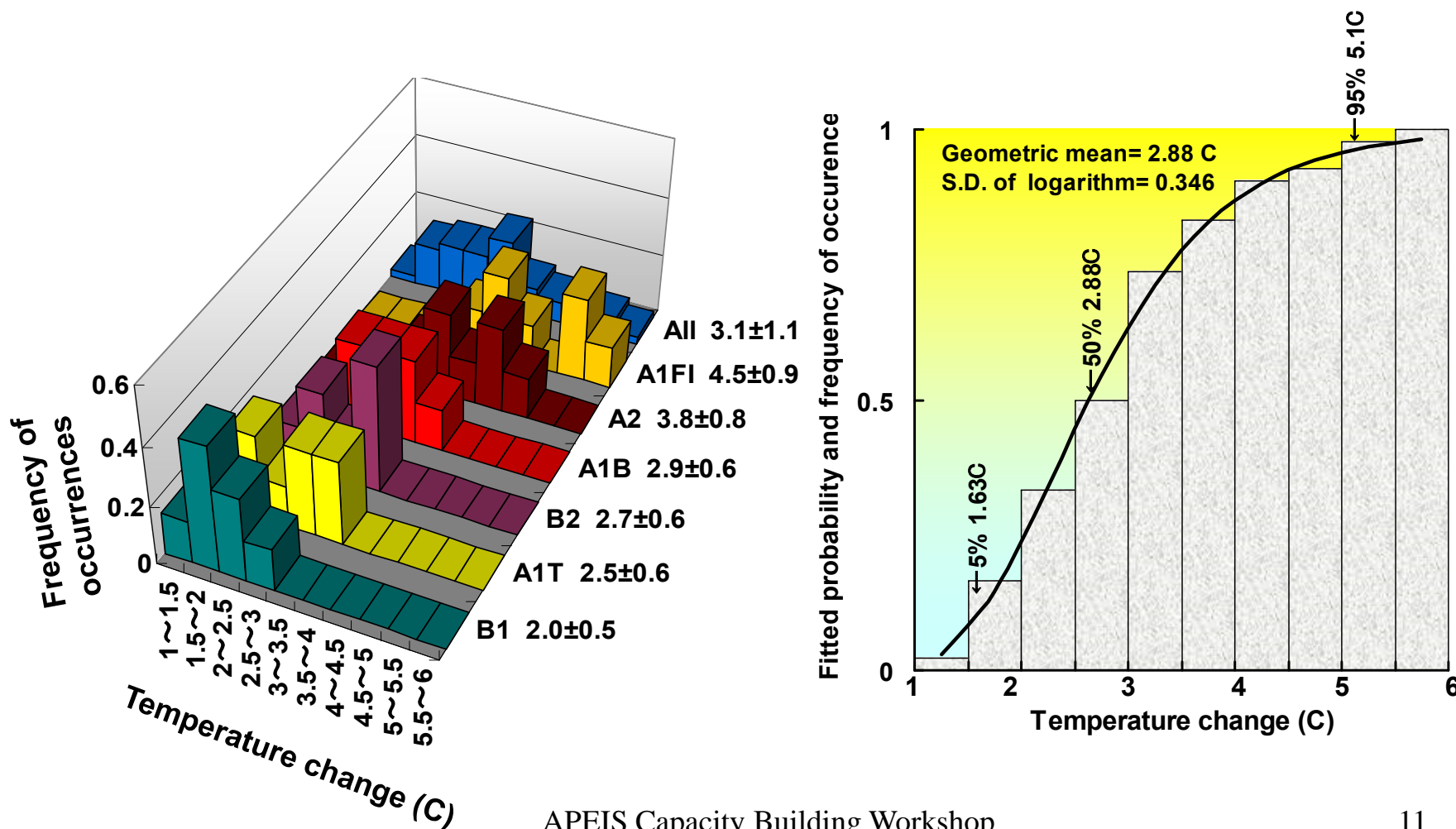


# AIM/Climate



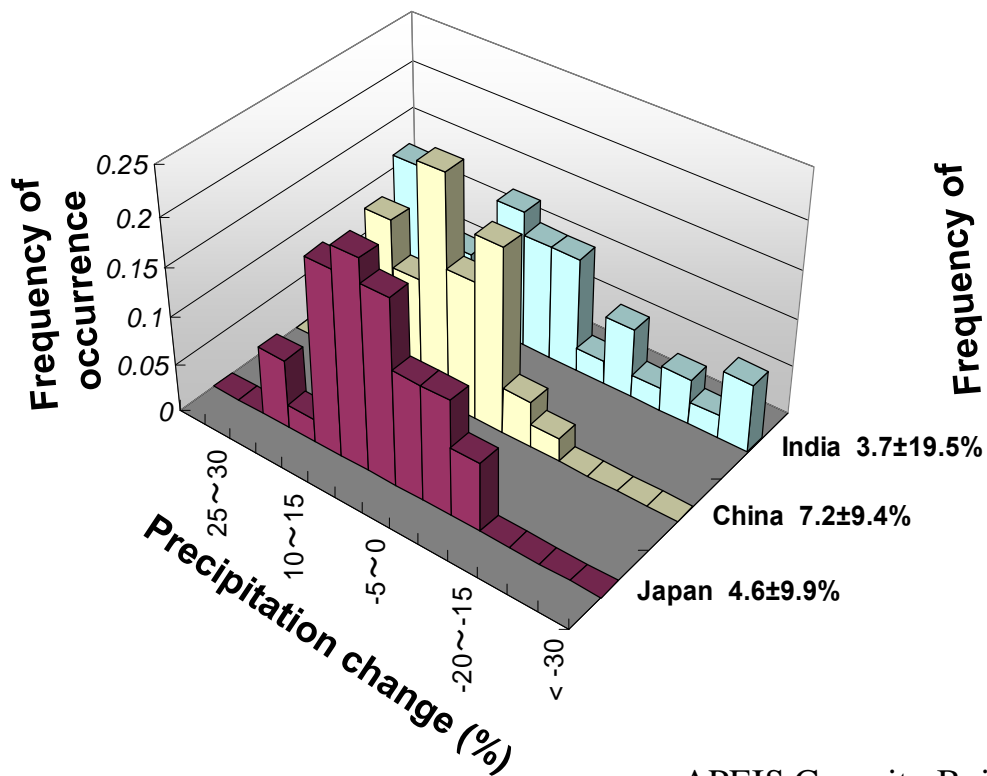
# Temperature change between 1990 and 2100

Simulated 7 GCMs are GFDL R15a, CSIRO Mk2, HadCM3, HadCM2, ECHAM4/OPYC, CSM 1.0 and DOE PCM

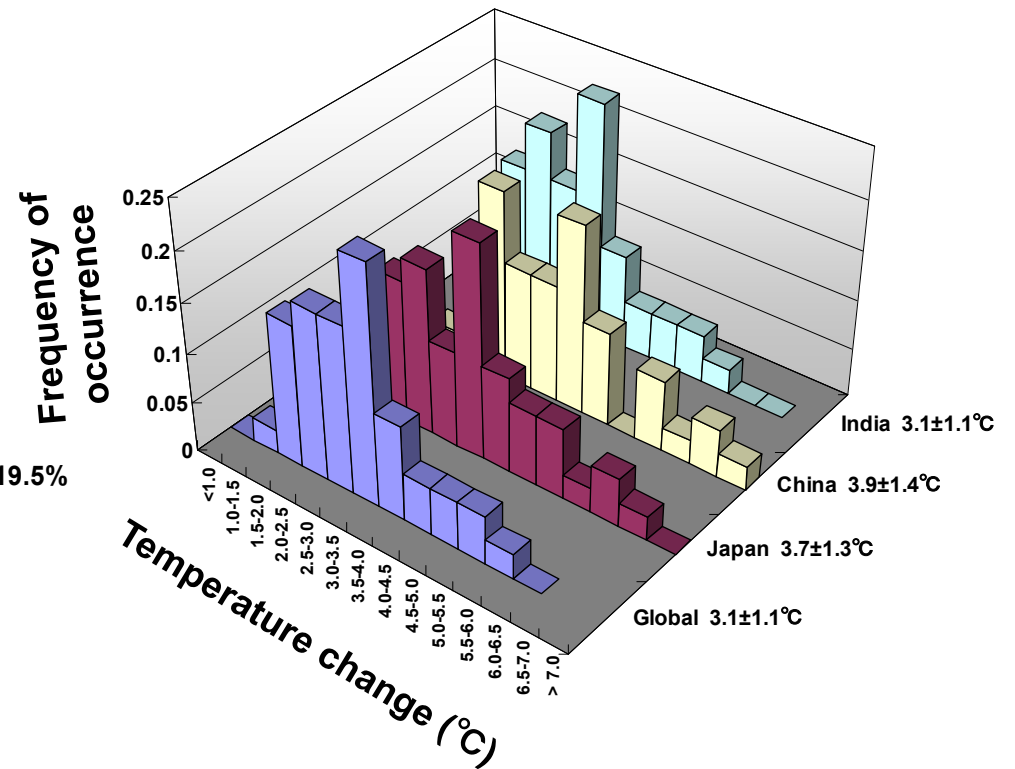


# Climate change in Asian-Pacific countries from 1990 to 2100, increase in DJF

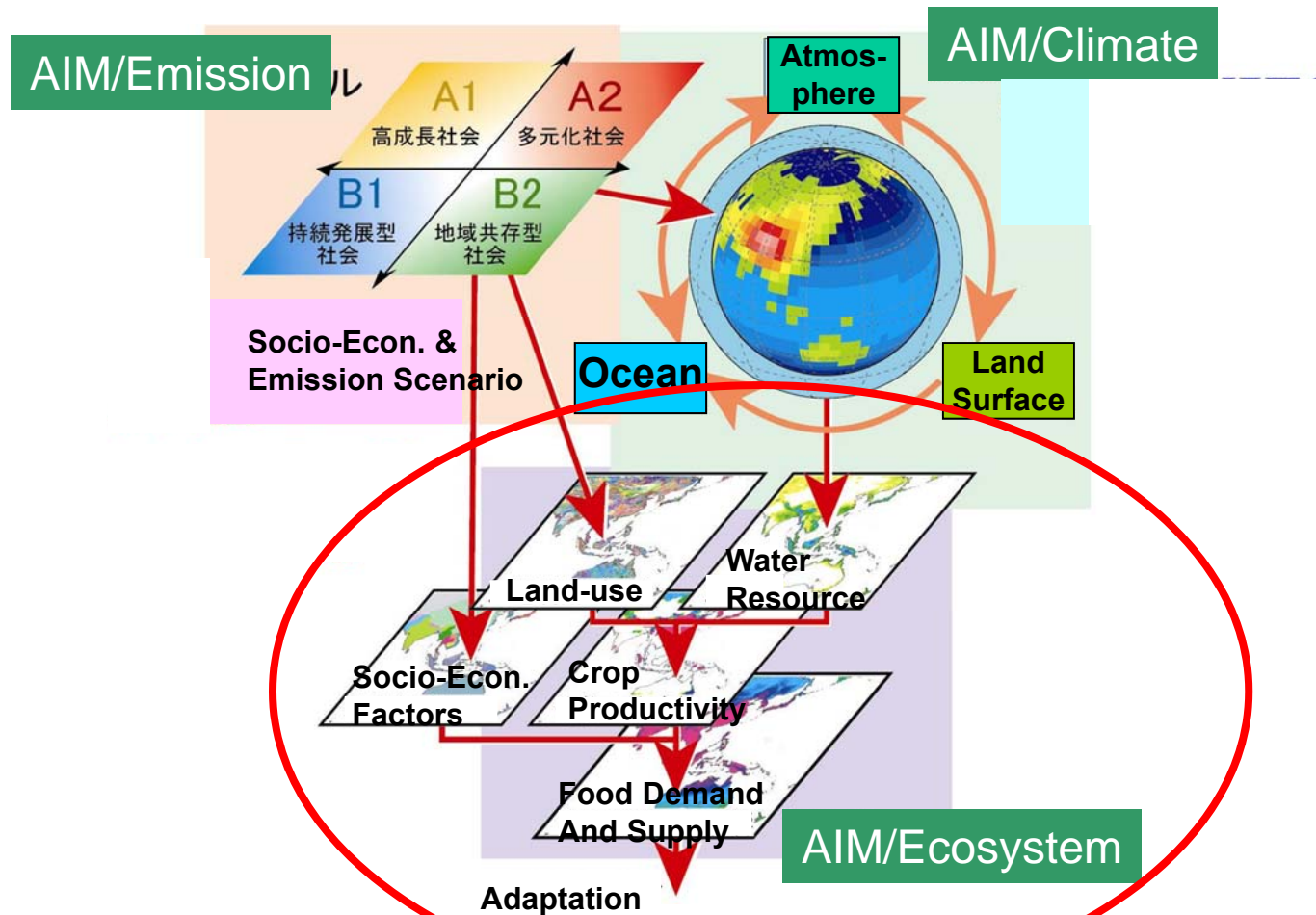
Precipitation change



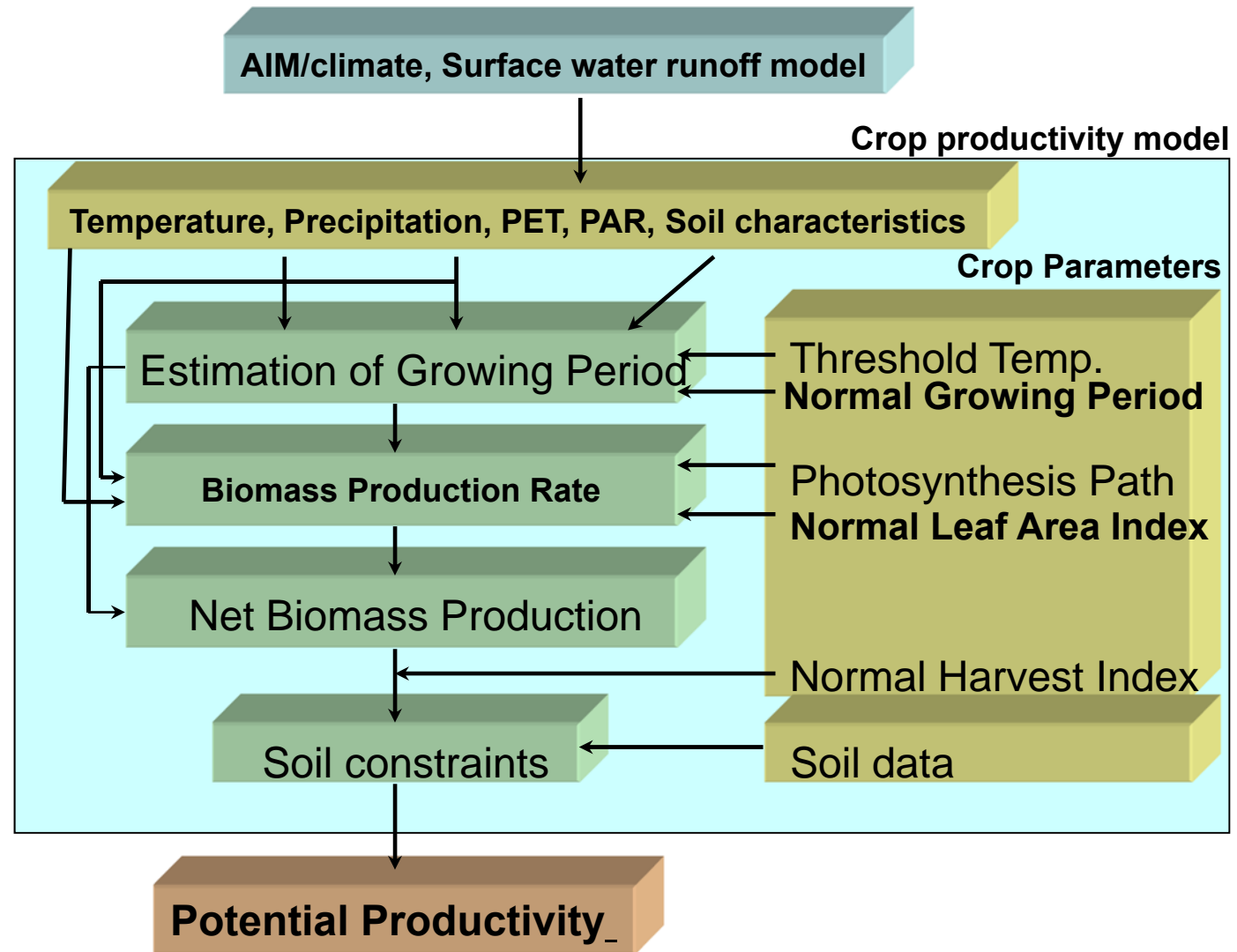
Temperature change



# Linkages of AIM models

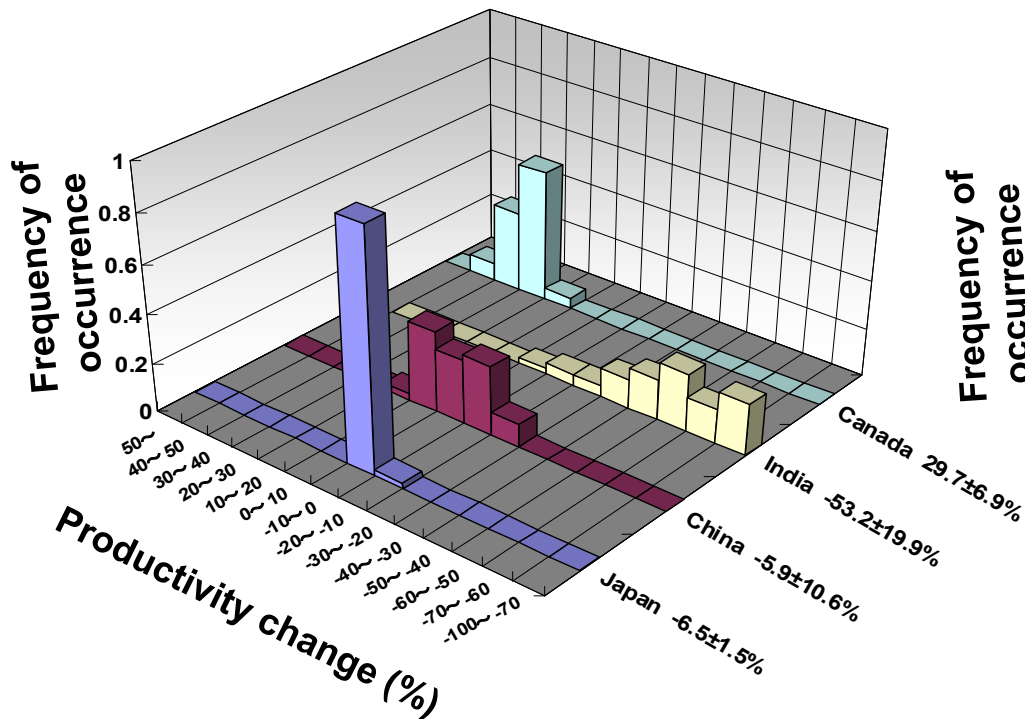


# Outline of the Crop Productivity Model

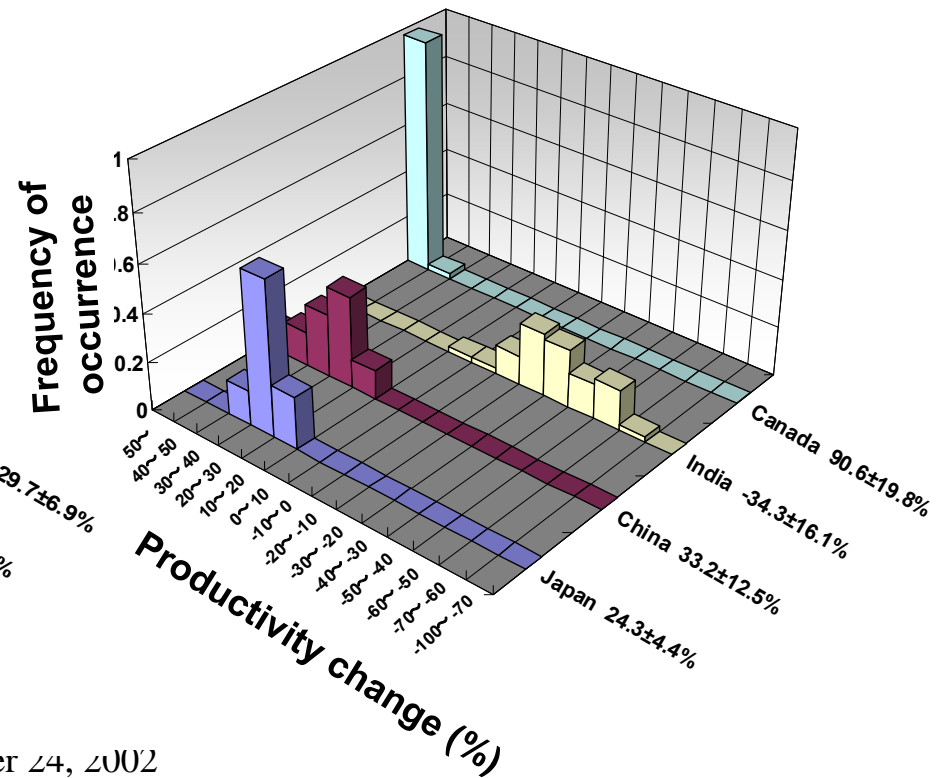


# Wheat productivity change in some countries from 1990 to 2100

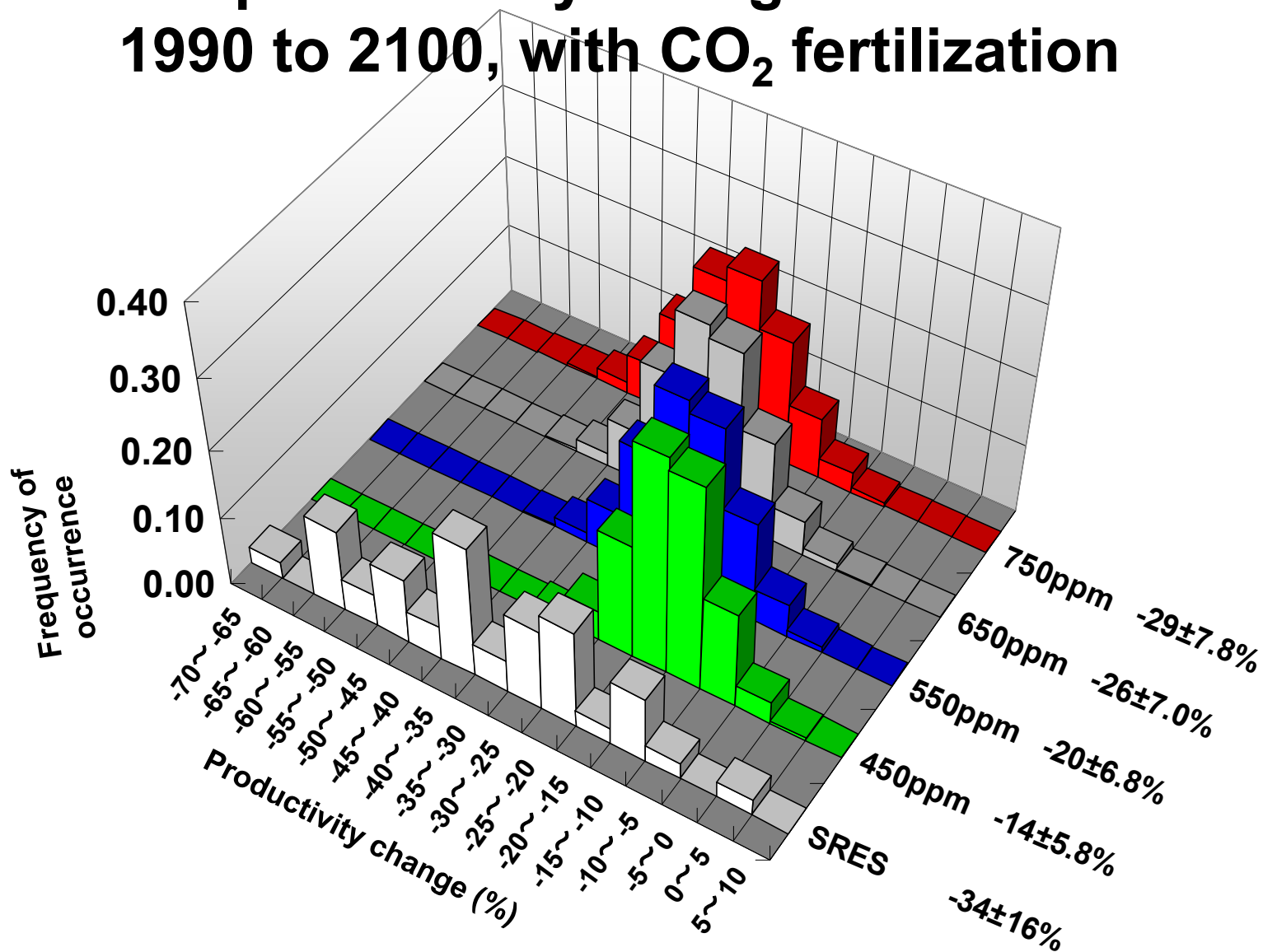
Without CO<sub>2</sub> fertilization



With CO<sub>2</sub> fertilization

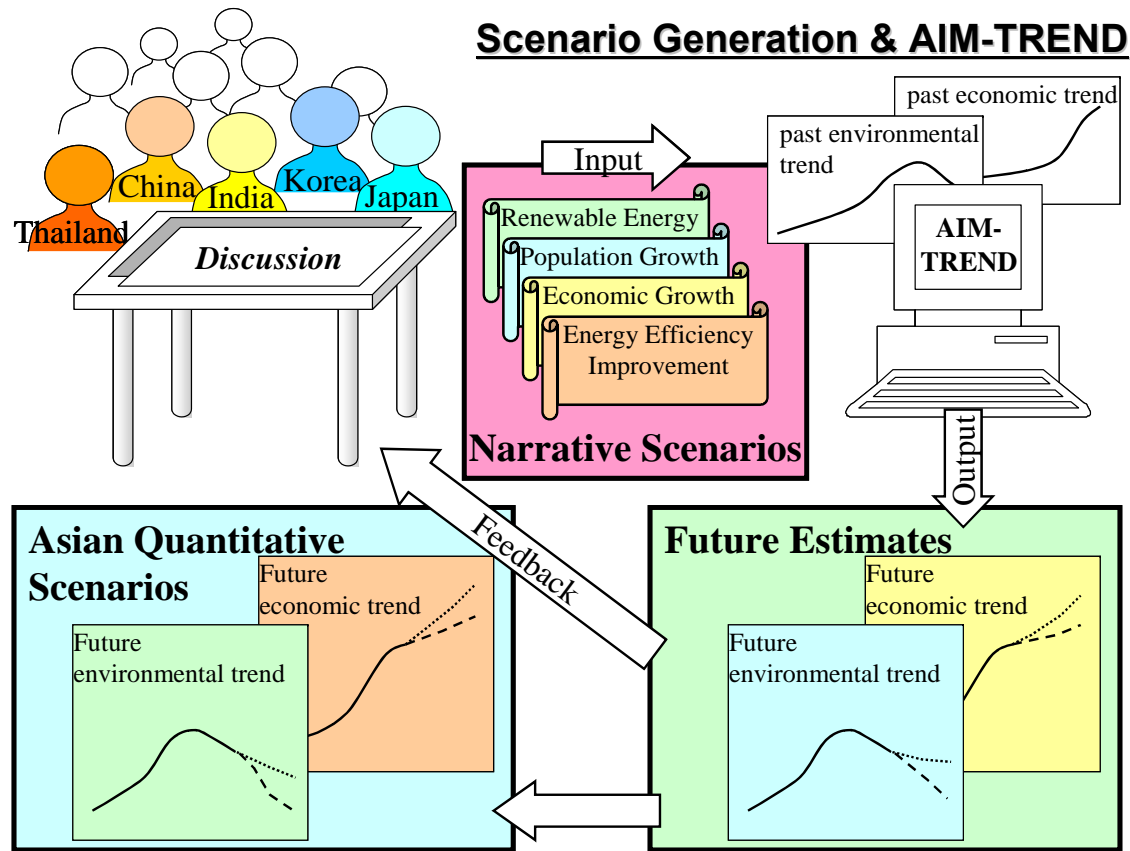


# Wheat productivity change in India from 1990 to 2100, with CO<sub>2</sub> fertilization

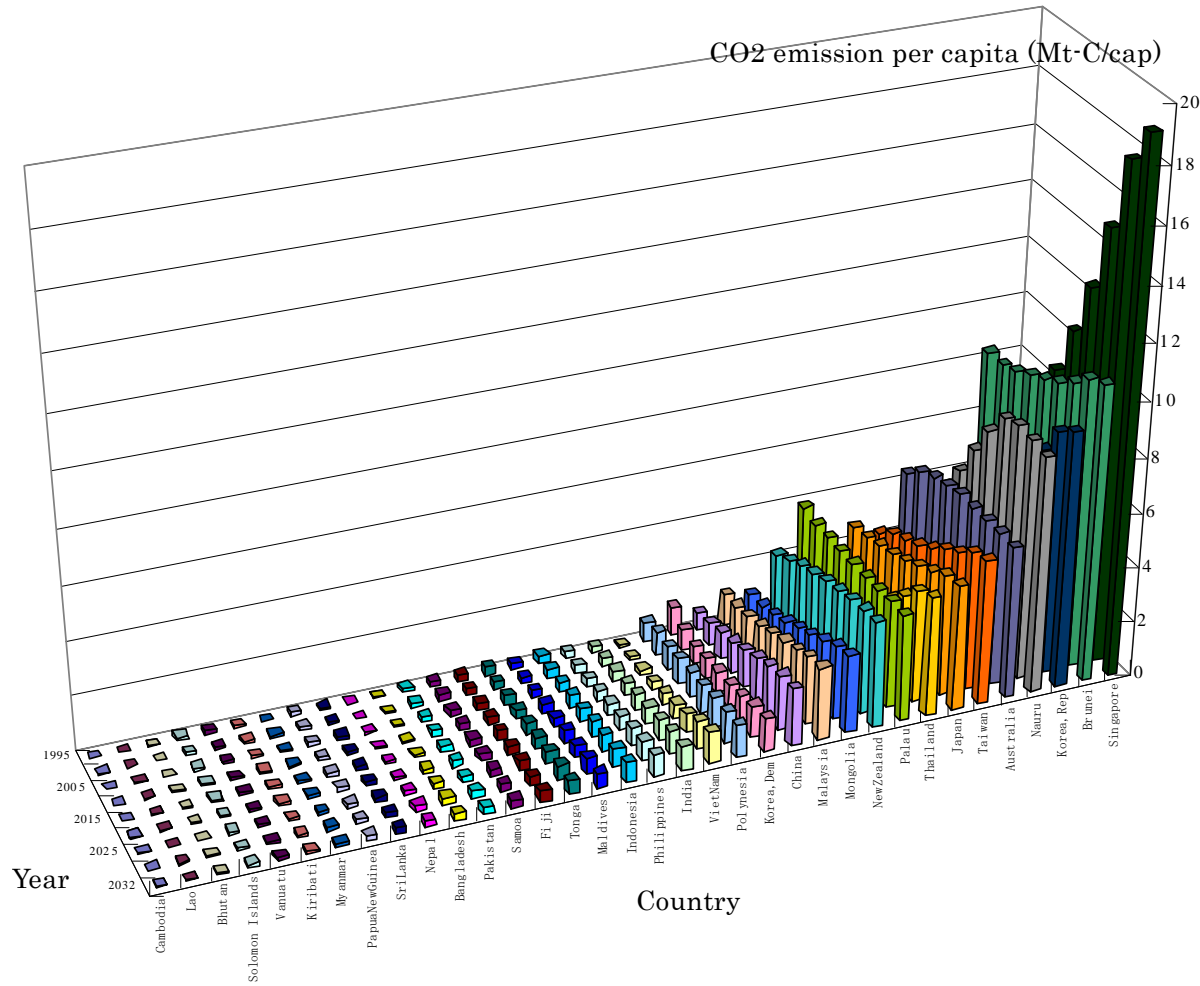




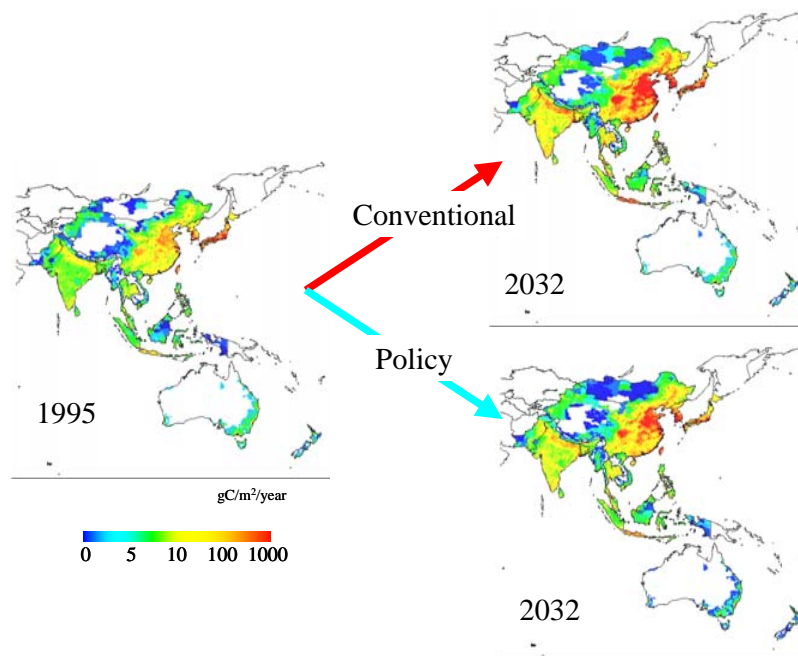
# AIM/Trend



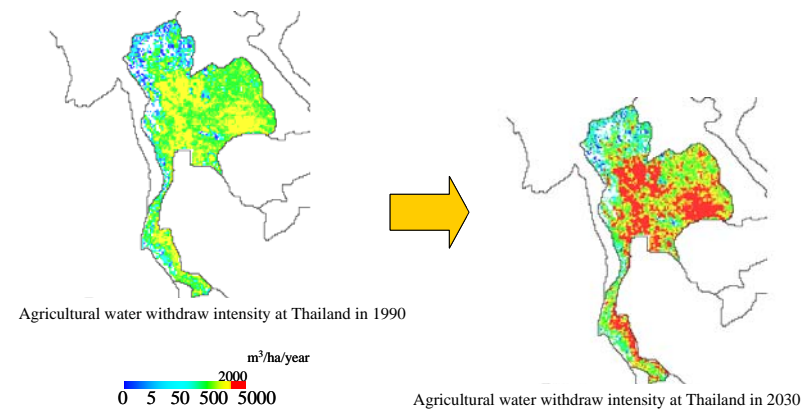
# Projection of CO<sub>2</sub> emission per capita for each country



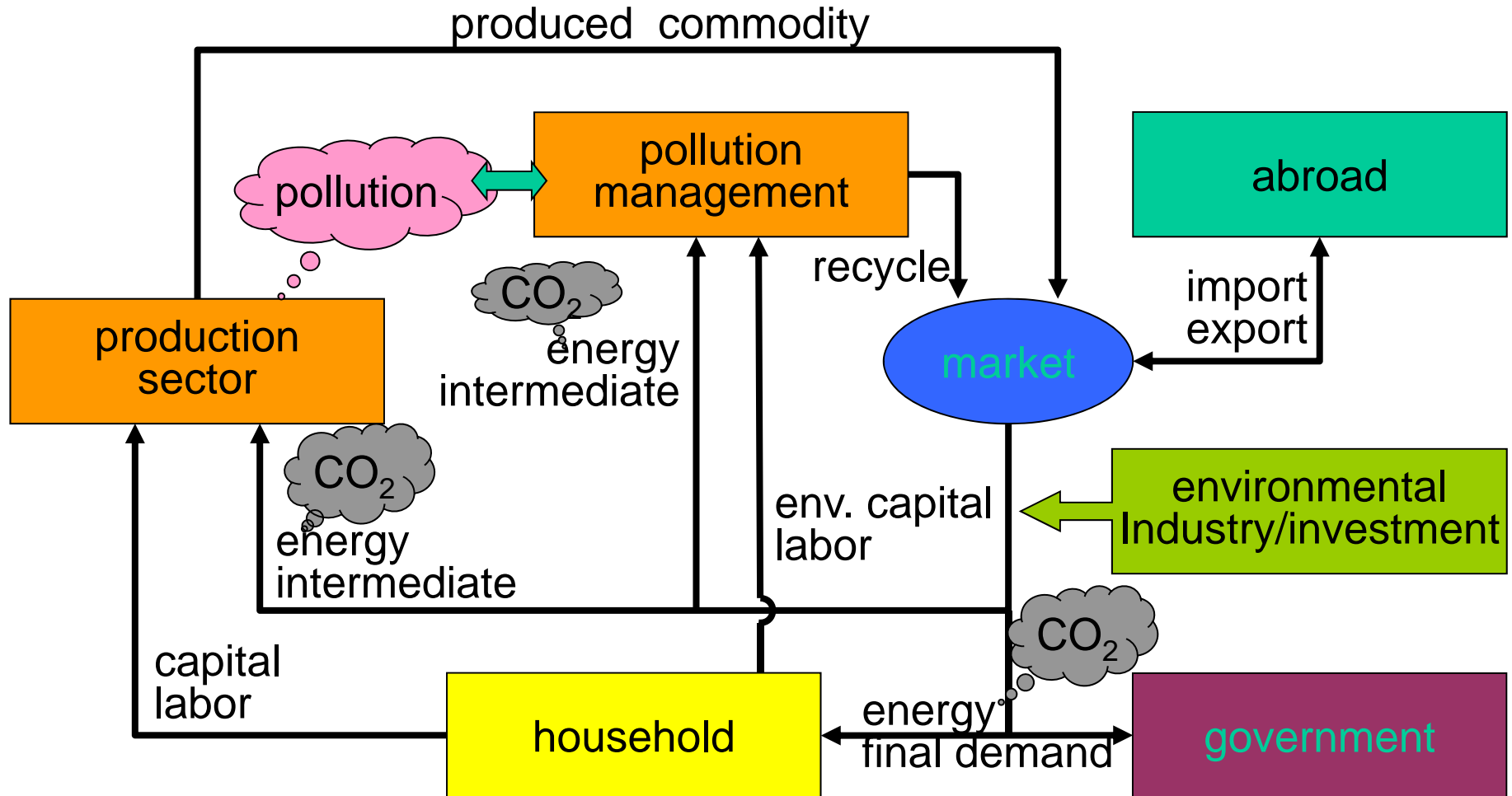
## CO<sub>2</sub> emission intensity for each scenario



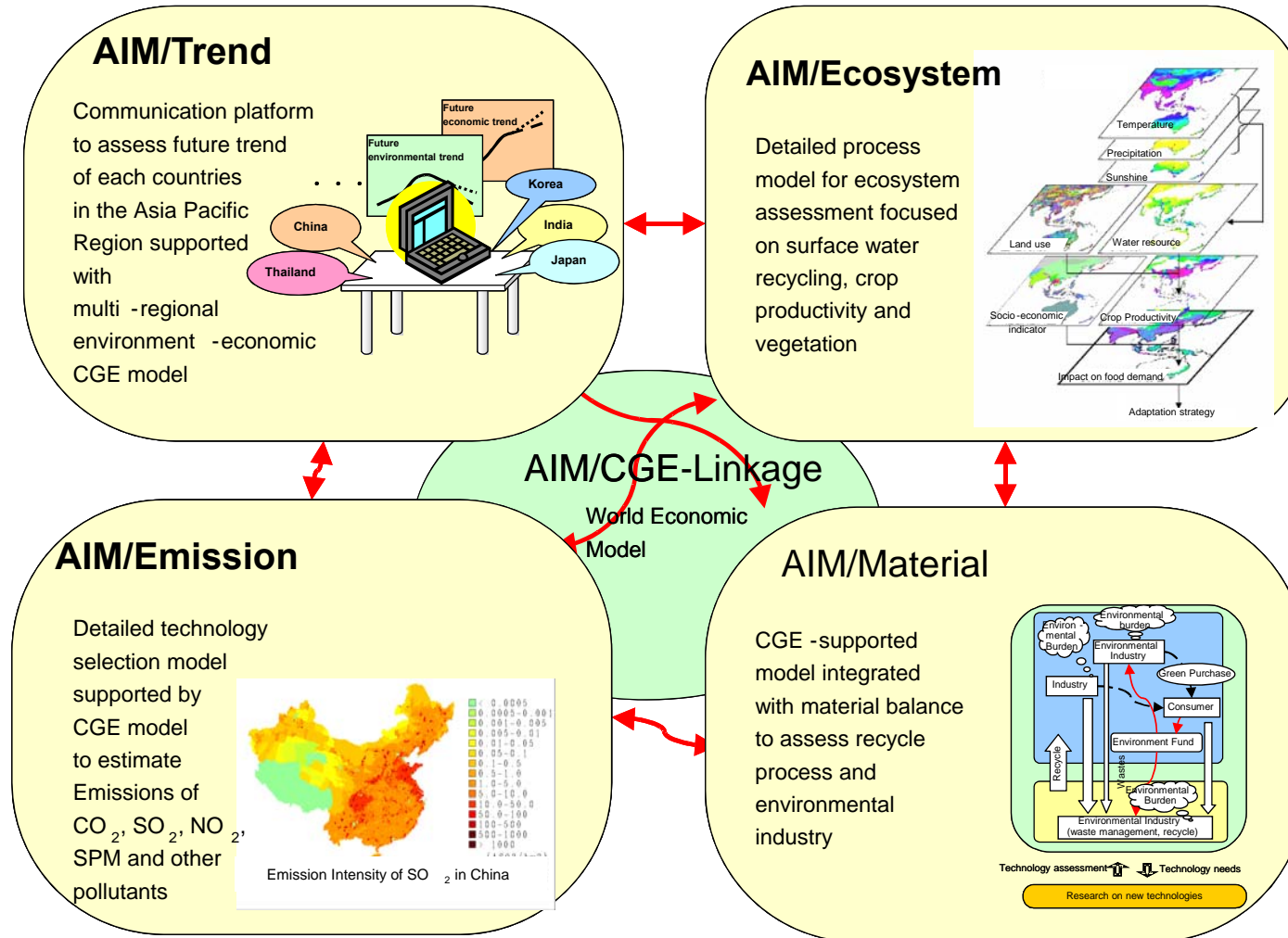
## Change of agricultural water withdraw intensity at Thailand



# AIM/Material



# AIM models for this Workshop



# Review of Models used in this Workshop

- **AIM/Emission** : AIM/Enduse is a bottom-up energy model, which focuses on the activities of the people who deal with energy consumption and production, plus the changes in technologies. Based on detailed descriptions of these items, it calculates the changes in energy consumption from technological substitution caused by changes in energy prices, using its bottom-up structure.
- **AIM/Ecosystem** : calculates global and regional climatic impacts, especially on primary production industries, such as water supply, agriculture, forest products and human health.
- **AIM/Material** : intends to estimate economic and environmental effects of environmental investment. It assesses the effects of policy integration for comprehensive environmental problems. It has a consistency of material flow and a consistency of activities and reality of technology and policies.
- **AIM/Trend** : is developed to prospect the basic situation of economy, energy and environment in Asia-Pacific region. It covers 42 countries in Asia-Pacific region. It uses simple method (econometric) and develops several scenarios for capacity building.

# AIM/Emission family

Model	Situation	Object	Characteristics	Implementation
AIM/Enduse	Operating	National CO <sub>2</sub> reduction program	Bottom up, end-use energy-emission model, Constant lifetime cohort, Optimum subsidy option	Fortran program named "engd"
AIM/Local	Operating	Linkage of CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>2</sub> , SPM reduction program, National/Regional scale, Coupling reduction program with Emission Inventory  AIM-COUNTRY APEIS	Bottom up, end-use energy-emission model, simple cohort structure, coupling with air pollutant emission inventories <u>ALICE</u> :Ancillary-effects estimating model for local governments to improve their comprehensive environment  <b>Device combined version (AIM/Enduse Vr.2):</b> Able to treat combined input and output services, e.g. Power generation and secondary use of electricity  <u>Subsidy version (SUB)</u> : optimum subsidy to reduce gas emission	MS access interface and GAMS main program, Supported with AIM/Database
AIM/Energy-economics	Obsolete but Operating (First Generation)	Long-term GHG emission projections from the point of energy supply and demand equilibrium	Based on the ASF/ER model, Backcasting ability from emission and concentration targets, Coupling with the enduse model in near-term projection	Fortran program
AIM/CGE (energy)	Operating	Economic assessment of global GHG reduction, EMF14/19 comparative study	Global multi-regional CGE model with energy resource sectors and interface to bottom-up model	GAMS/MPSGE, GTAP4, IEA energy balance table
AIM/CGE (Asia)	Developing	Environmental and Economic assessment of Global Environmental Policy, focuses on Asia-Pacific region  AIM-COUNTRY APEIS	Global multi-regional CGE model with economic goods/bads, natural resource sectors and interface to bottom-up model	GAMS/MPSGE, GTAP5, IEA energy balance table, Commodity statistics, Detailed database of natural resources AIM/Database

# AIM/Ecosystem family

Model	Situation	Object	Characteristics	Implementation
<b>AIM/Ecosystem</b>		Climate change impact assessment with detailed process model, surface water cycle, crop productivity, vegetation, health	Grid or basin level hydrological model, crop model, vegetation model, malaria model. Interface with GCM/RegCM output	
<b>Global/Regional version</b>				
	Operating and Developing (First Generation)	Global assessment Linkage with World crop trade model		GRASS, ArcGIS FORTRAN, C
<b>Country/Local version</b>				
	Developing	Country impact assessment  AIM/Country	Packaged and Disseminate version of global version	IDRISI, FORTRAN,C, VB, AIM/Database
<b>AIM/Ecosystem2</b>	Developing	Assessment of global environmental changes and their counter-measures	Assembly of rather independent modules LAND, WATER, AGRI, ENV, HEALTH, VEG, Exploratory models for next generation AIM activities	GRASS, ArcGIS FORTRAN, C, GAMS



# AIM/Material and AIM/Trend

Model	Situation	Object	Characteristics	Implementation	Prospect
<b>AIM/Material</b>	Operating , Applying to Japan, India and China	Economic assessment of nation environmental policy, focused on CO <sub>2</sub> reduction and waste recycling  APEIS	One country CGE model with material balance and interface to environmental technology model	GAMS/MPSGE MS ACCESS MS EXCEL	Coupling with bottomup engineering models, Coupling with Household production approach
<b>AIM/Trend</b>	Operating, Distributing	Communicating platform for constructing Asia- Pacific regional environmental outlook,  ECO-ASIA, APEIS, GEO3,AIM/Country	Country econometric model. Assembly of Energy, Water, Agriculture and other modules	Visual Basic for MS Excel, National and International statistics AIM/Database	Developing/ evolving to an econometric tool (ATPL/ATML) included in the AIM/Database and AIM/CGE/ASIA