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NEW MODEL DEVELOPMENT

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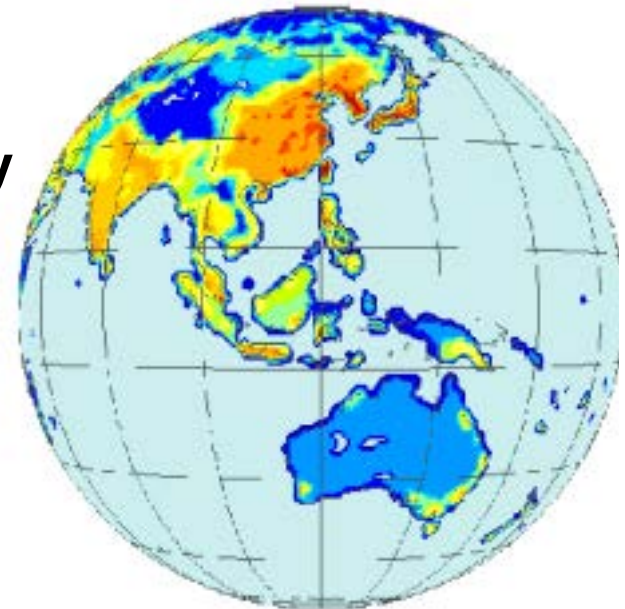
AIM/Emission

AIM/Impact

Other AIM models

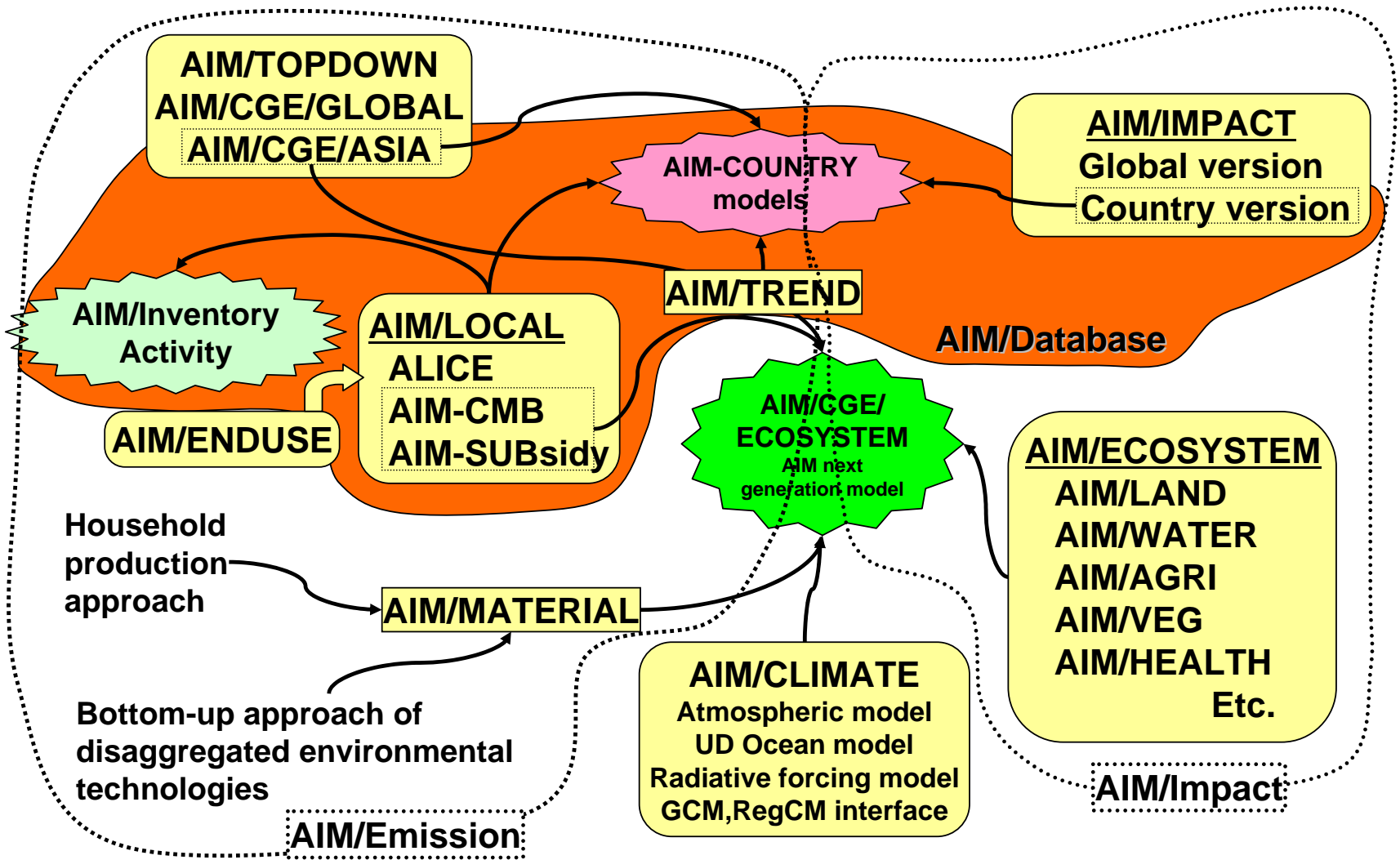
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3. Summary



Focuses of modeling activity in year 2001-2002

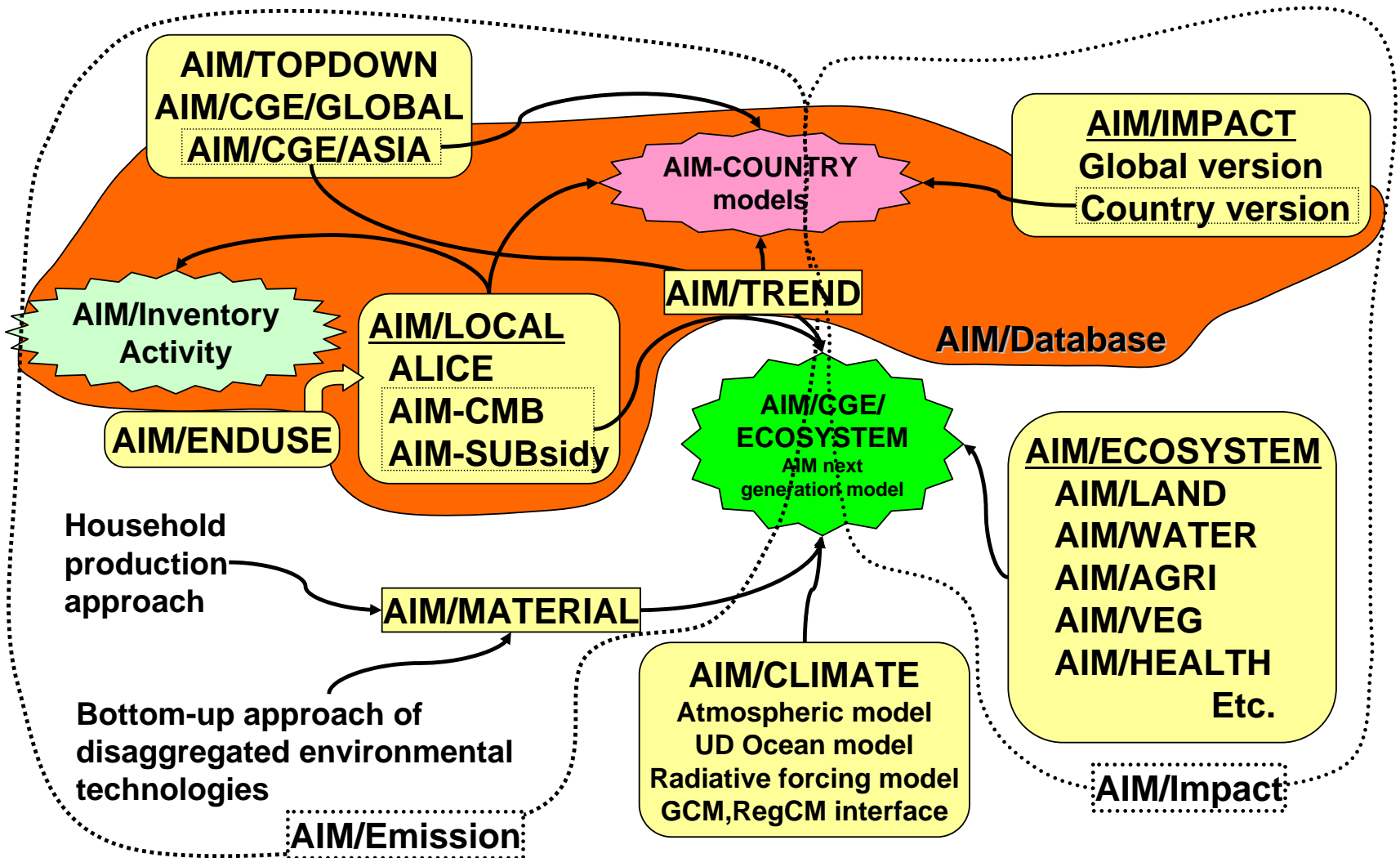
- **Organization, Dissemination of developed model for national and regional climate action plans as well as wider comprehensive environmental policy AIM / COUNTRY , AIM/DATABASE**
- **Extension of modeling perspectives from climate policy to more wider points of view, and Increasing the applicability to various policy processes from AIM/IMPACT to AIM/ECOSYSTEM**



Roadmap of the AIM family

AIM/Emission family

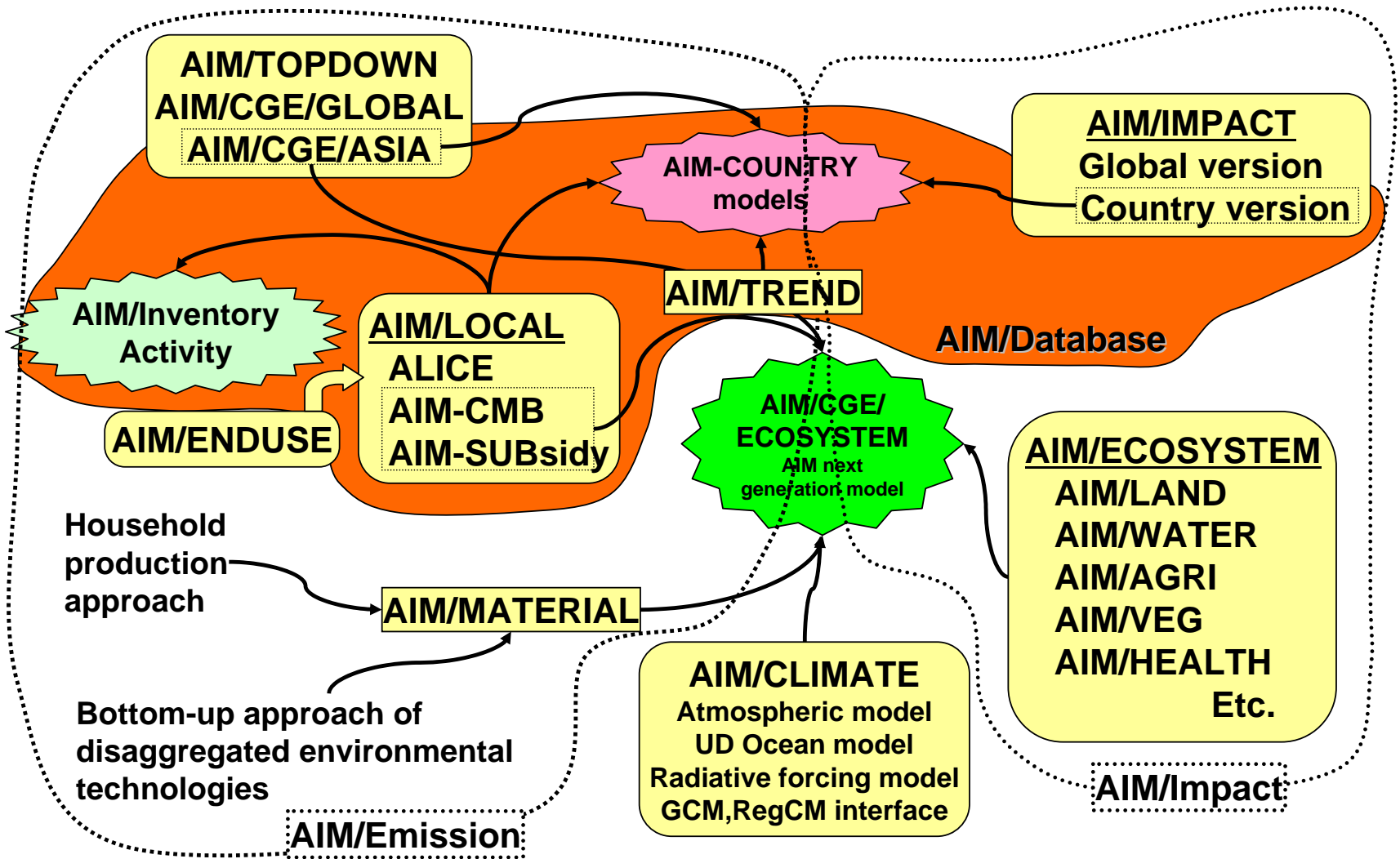
Model	Situation	Object	Characteristics	Implementation
AIM/ENDUSE	Obsolete (First Generation)	National CO ₂ reduction program	Bottom up, end-use energy-emission model, Constant lifetime cohort, Optimum subsidy option	Fortran program named "engd"
AIM/LOCAL	Successor of AIM/ENDUSE, Operating	Linkage of CO ₂ , SO ₂ , NO ₂ , 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 <u>Device combined version (CMB)</u> : 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/TOPDOWN	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/GLOBAL	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



Roadmap of the AIM family

AIM/Impact family

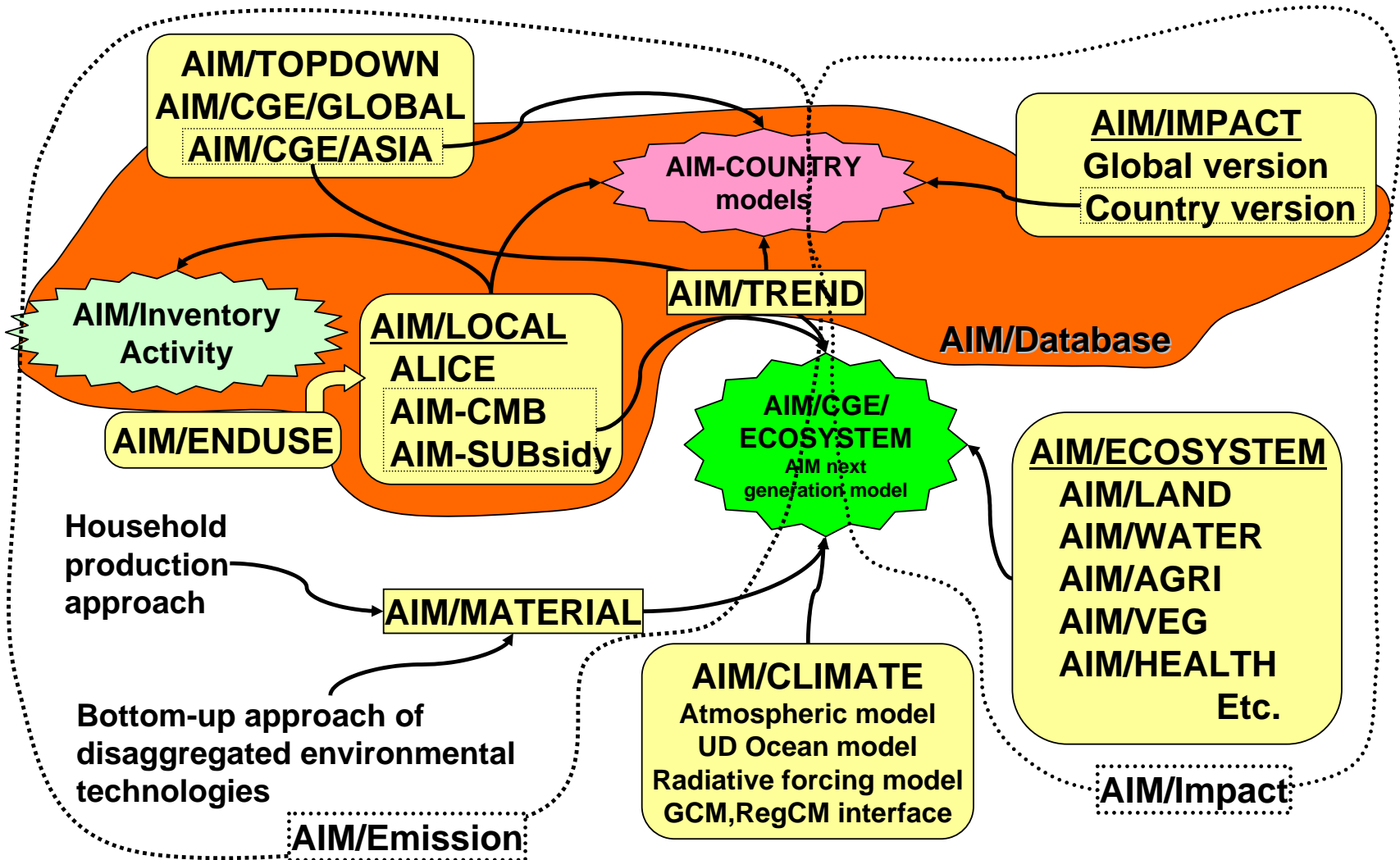
Model	Situation	Object	Characteristics	Implementation
AIM/IMPACT		Climate change impact assessment with detailed process model, surface water cycle, crop productivity, vegetation, health	Grid or basin level hydrological model, crop model, vegetation model, malaria model. Interface with GCM/RegCM output	
		Global/Regional version		
	Operating and Developing (First Generation)	Global assessment Linkage with World crop trade model		GRASS, ArcGIS FORTRAN, C
		Country/Local version		
	Developing	Country impact assessment AIM-COUNTRY	Packaged and Disseminate version of global version	IDRISI, FORTRAN,C, VB, AIM/Database
AIM/ECOSYSTEM	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



Roadmap of the AIM family

Other Models which enlarge the Perspectives of AIM activity

Model	Situation	Object	Characteristics	Implementation	Prospect
AIM/MATERIAL (RECYCLE)	Operating , Applying to Japan, India and China	Economic assessment of nation environmental policy, focused on CO₂ 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 Waste/GHG/Water balances and Household production approach
AIM/TREND	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 to an econometrical tool (ATPL/ATML) in AIM/Database and AIM/CGE/ASIA



Roadmap of the AIM family

AIM/CGE/ECOSYSTEM

Overview

Approach : Soft merge of a Top-down (Story-line + Macroeconomic) model and Bottom-up (technology models, mechanistic models, case studies) approach

Objects: Integrated Assessment of Economic and Sustainable Development with Environmental protection, Adaptation to climate change

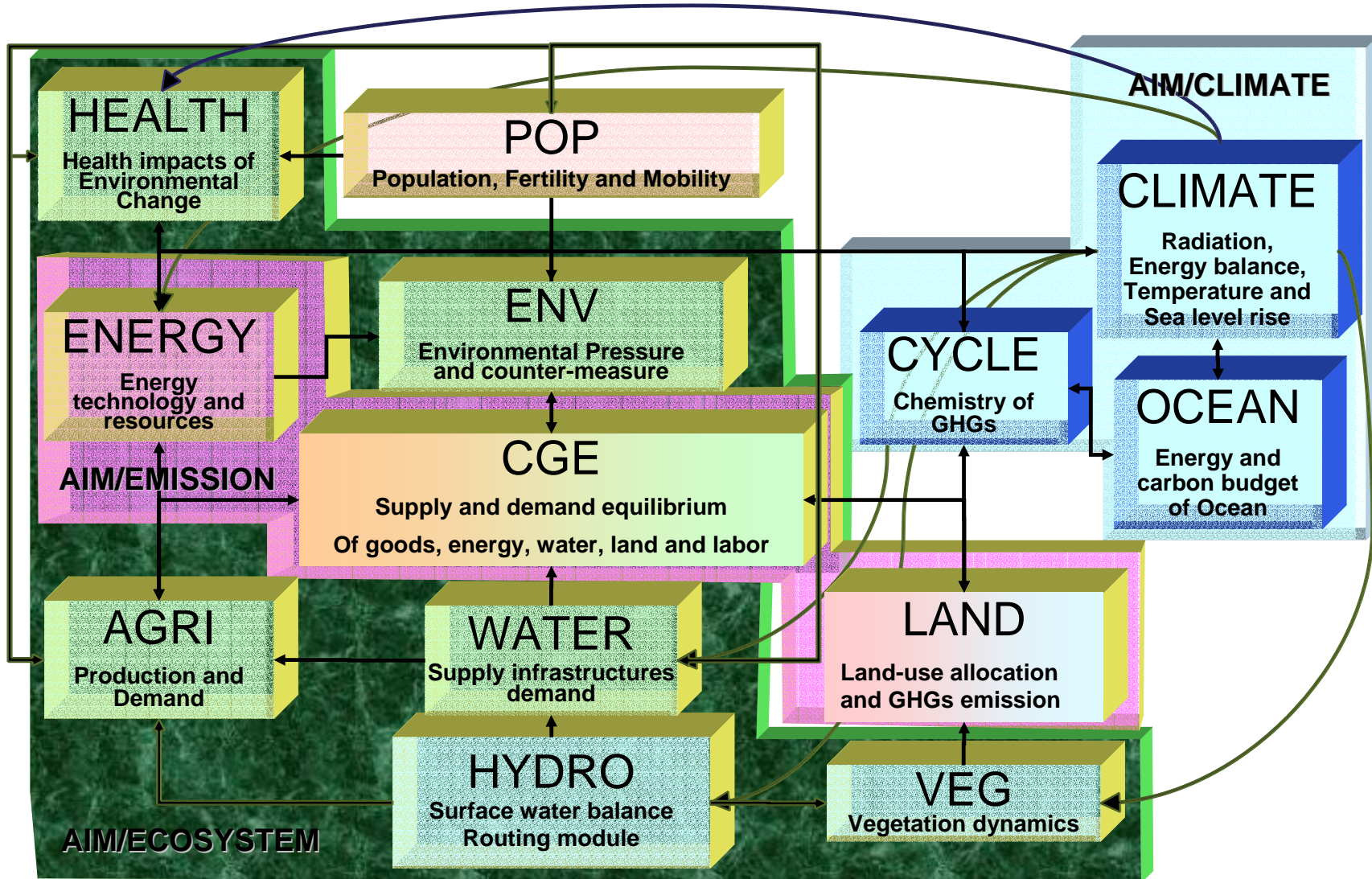
Scale : Country (Asia and Pacific) , Provincial (China and India), Regional (Rest of the World)

Present (1971-2000), Near future (2021-2050), Long-term (2071-2100), Yearly / Daily

Modules of AIM/CGE/ECOSYSTEM

- CGE (Economic market: Top down, Productions, Capitals, Income, Trades)**
- ENERGY (Energy technology and resource: bottom-up process type, Resource, Supply and consumption)**
- LAND (Land-use: Spatially distributed, Land-use allocation, degradation, GHG emission and sink)**
- HYDRO (Hydrology : spatially distributed, ET, Soil moisture, Snow depth, Drought index VEG (Vegetation: Spatially distributed, Potential vegetation, Dynamic vegetation)**
- WATER (Water Supply and Demand: Spatially distributed, Intake, Consumption, Water infrastructure)**
- AGRI (Foods and Agriculture: bottom-up process type, spatially distributed, Agricultural production potential, Crops / Livestock / Wood Demand and Supply)**
- ENV (Environmental Pressure and counter-measure : spatially distributed , GHGs, Atmospheric and water pollutants, Wastes)**
- POP (population: Total, Age distribution, Life length, TFR etc.)**
- HEALTH (Health impacts : Health impact models, Environmental burden of disease, Health Service)**

AIM/CGE/ECOSYSTEM MODULES AND THEIR LINKS



The CGE module

(Extension of AIM/CGE/GLOBAL,ASIA)

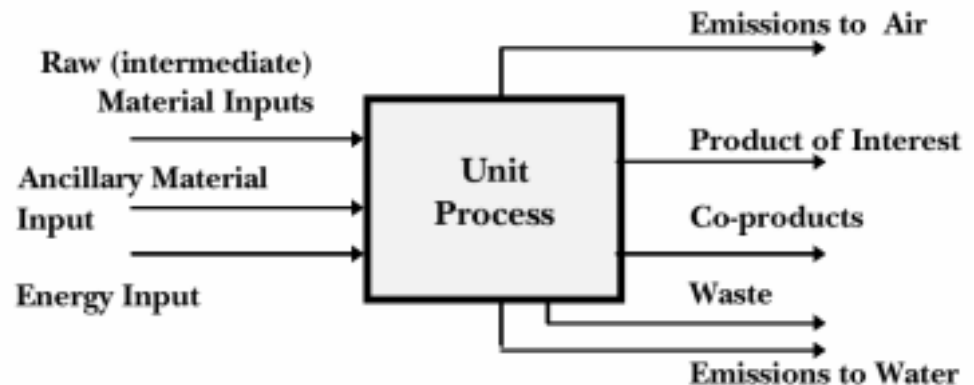
- **Multi-regional, multi sector CGE model**
- **Sectors: Goods and service production, Resource supply, Consumers, Public service**
- **Markets : Capital/Resources: Goods, Capital, Energy, Water, Lands**
- **Products (Goods/Bads): Industrial and Agricultural products, Energy, Water, Pollutants, Wastes**
- **Sequential equilibrium**
- **Hybrid linkage with bottom-up modules**

Coupling of the CGE and bottom-up technology based modules

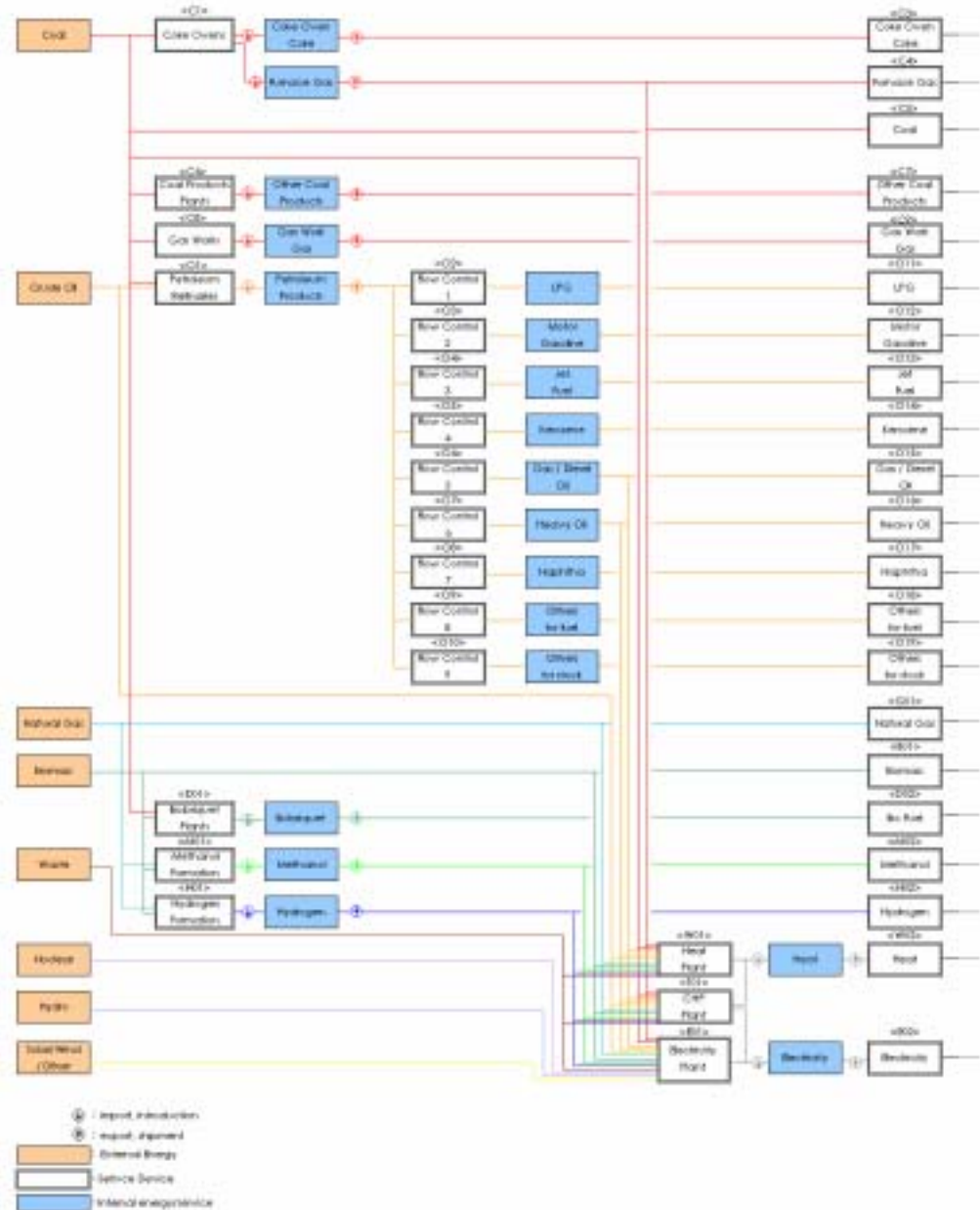
- *Energy Supply, transformation and demands (Technology)* ENERGY
- *Household (Final consumption, Labor supply, Life-style, Time budget, Education)* POP, WATER
- *Environmental Services (Air and water loads reduction technology)* ENV
- *Crop production* LAND
- *Water supply and demand* WATER
- *Land-use allocation* LAND

The ENERGY (energy technology) module

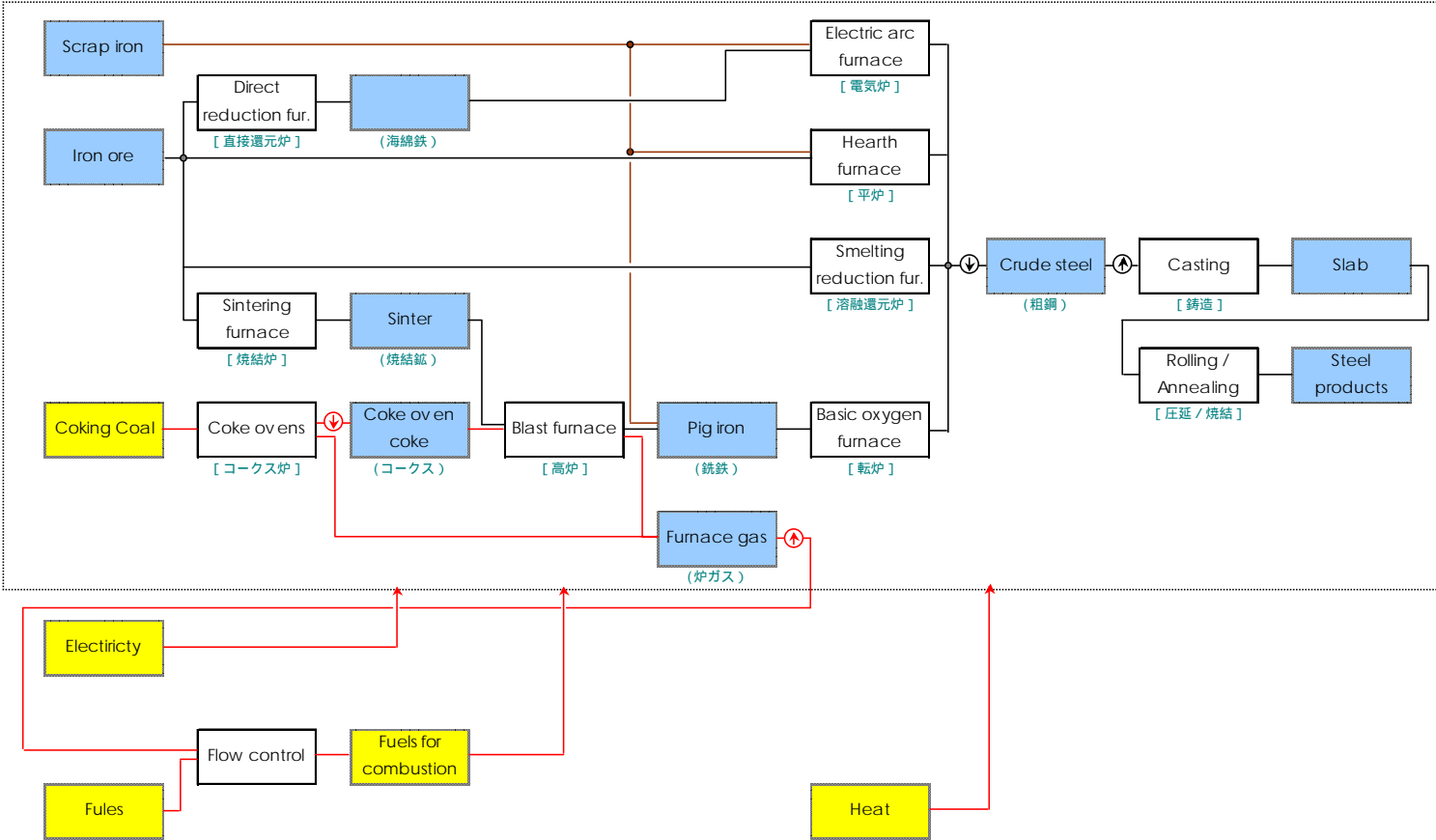
- Country (regional) base
- Based on AIM/LOCAL GAMS program
- Stylized Industrial and Household Processes
- Including default devices lists
- Including the Stackelberg Problem
- Extension to generalized process description of Energy and Materials (merging with AIM/MATERIAL)



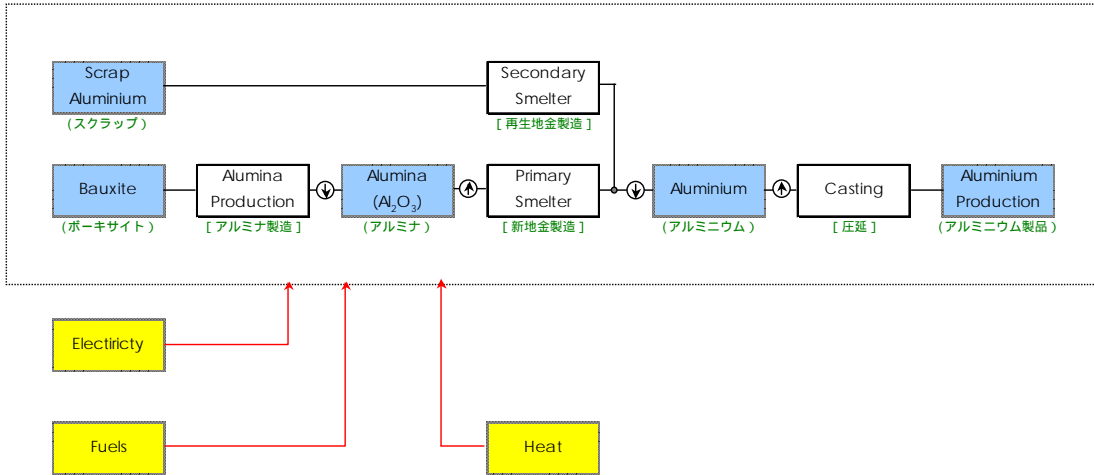
Stylized Energy Processes in the ENERGY module (Transformation sector)



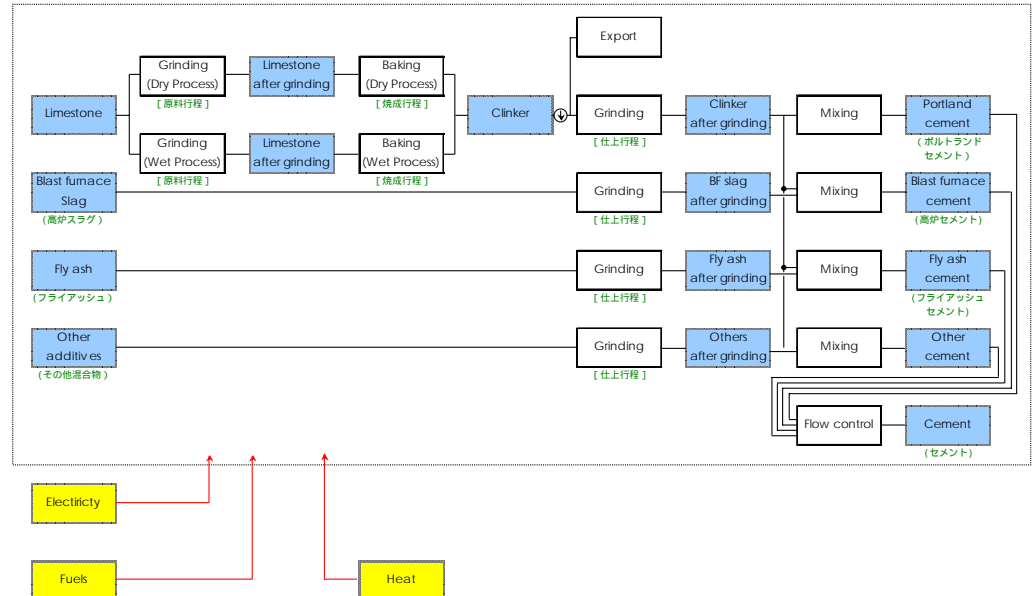
Stylized Energy Processes in the ENERGY module (Iron and Steel Sector)



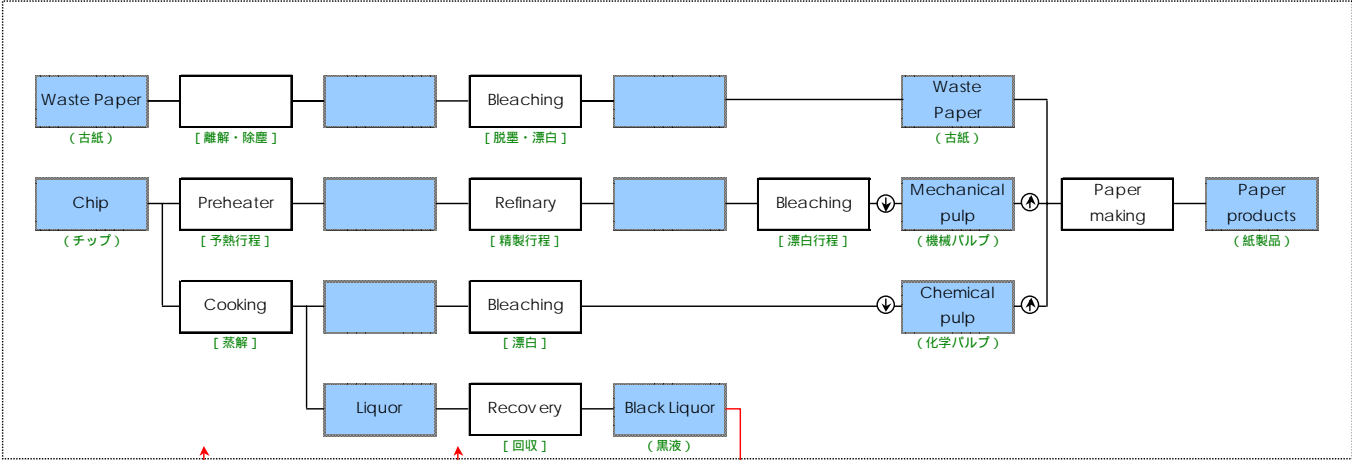
Stylized Energy Processes in the ENERGY module (Aluminum Sector)



Stylized Energy Processes in the ENERGY module (Cement Sector)



Stylized Energy Processes in the ENERGY module (Paper and Pulp Sector)

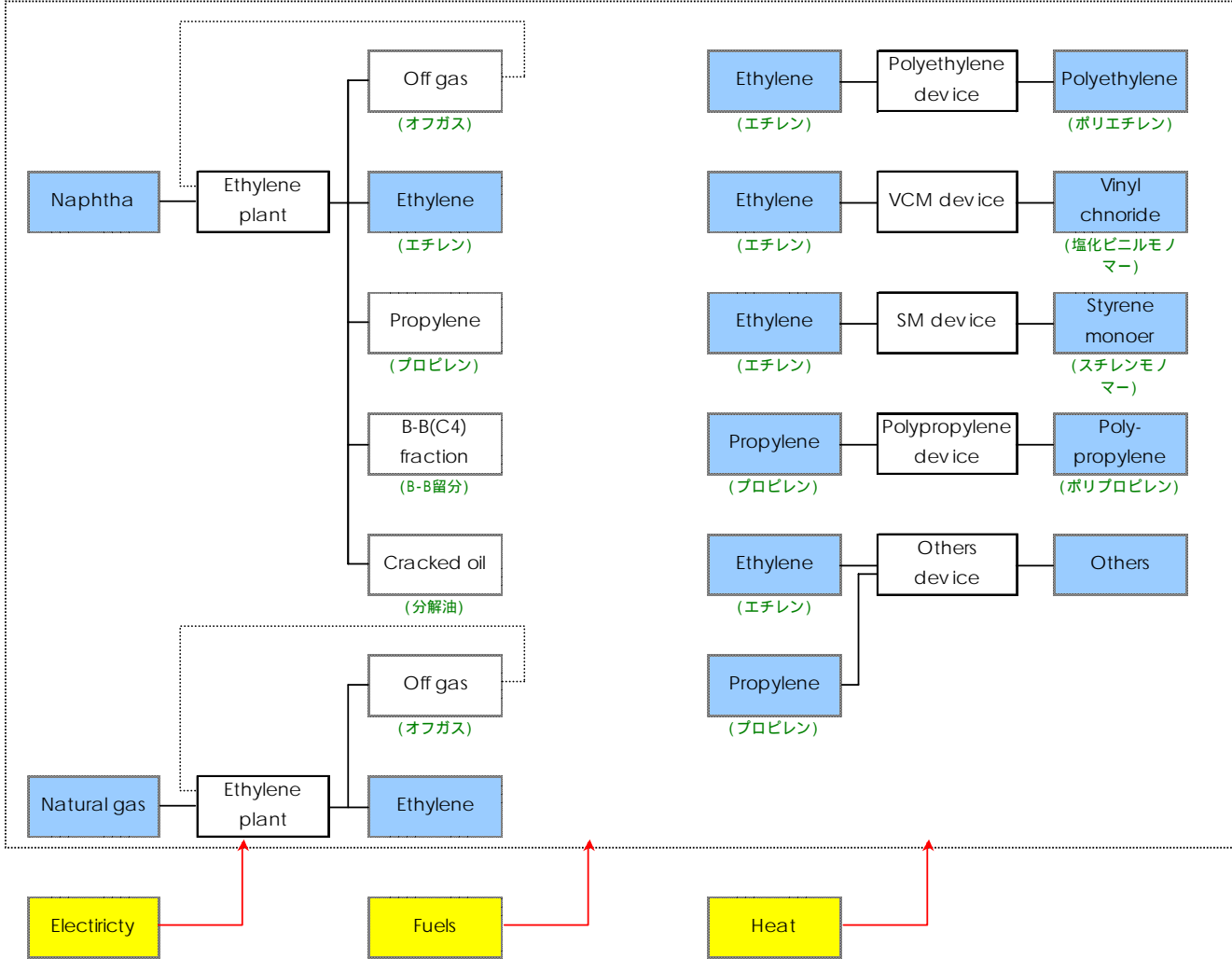


蒸解：木釜，洗浄，未晒精選

回収：エバポレーター，苛性化，石灰焼成

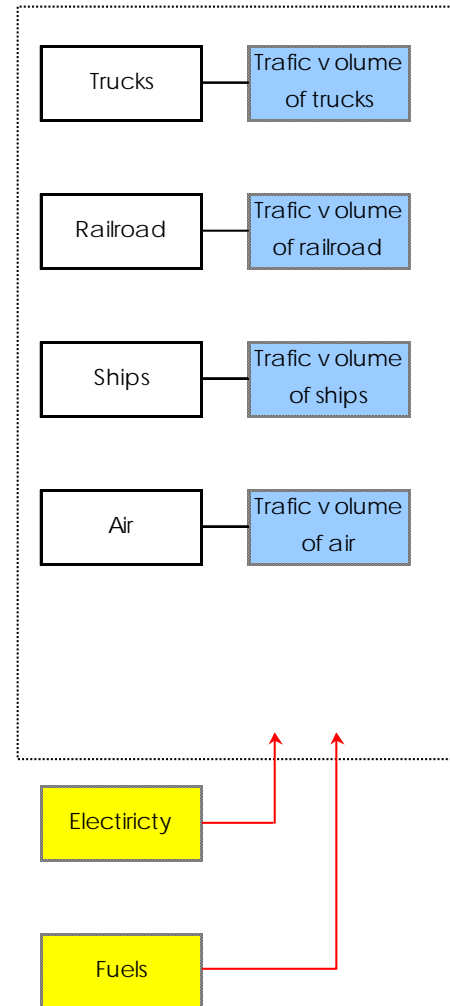
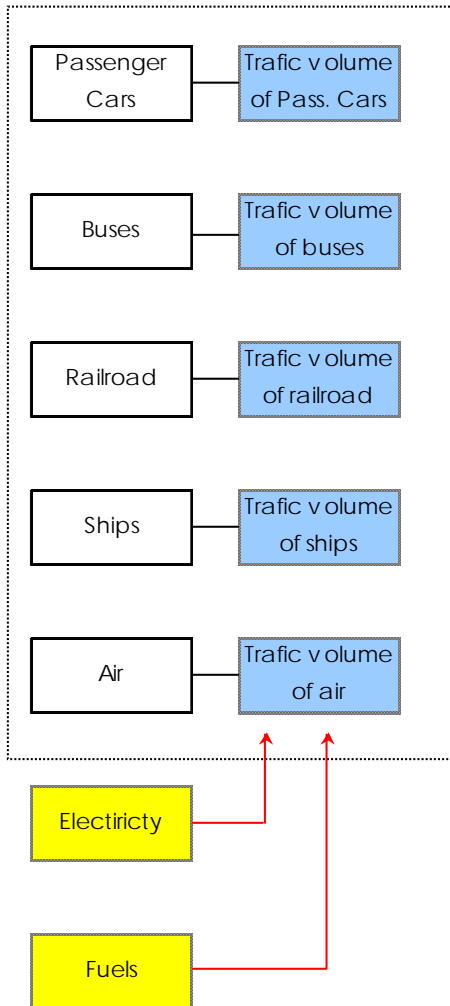
晒：晒，晒精選，晒薬品製造

Stylized Energy Processes in the ENERGY module (Petrochemical Industry Sector)

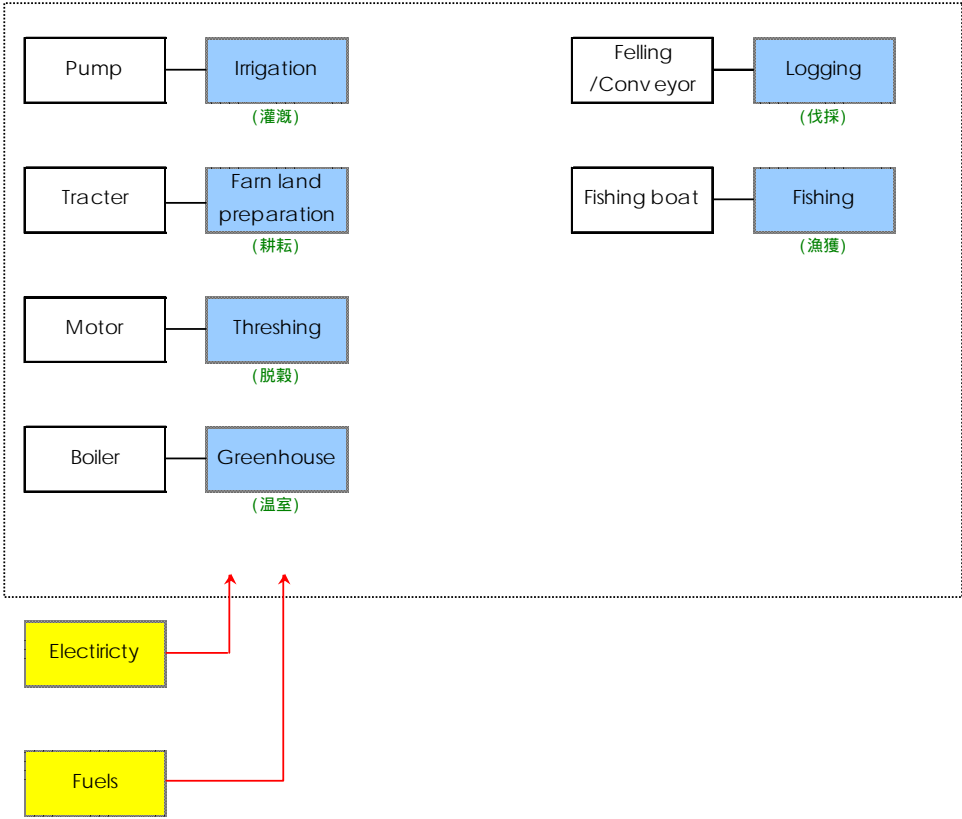


Stylized Energy Processes in the ENERGY module

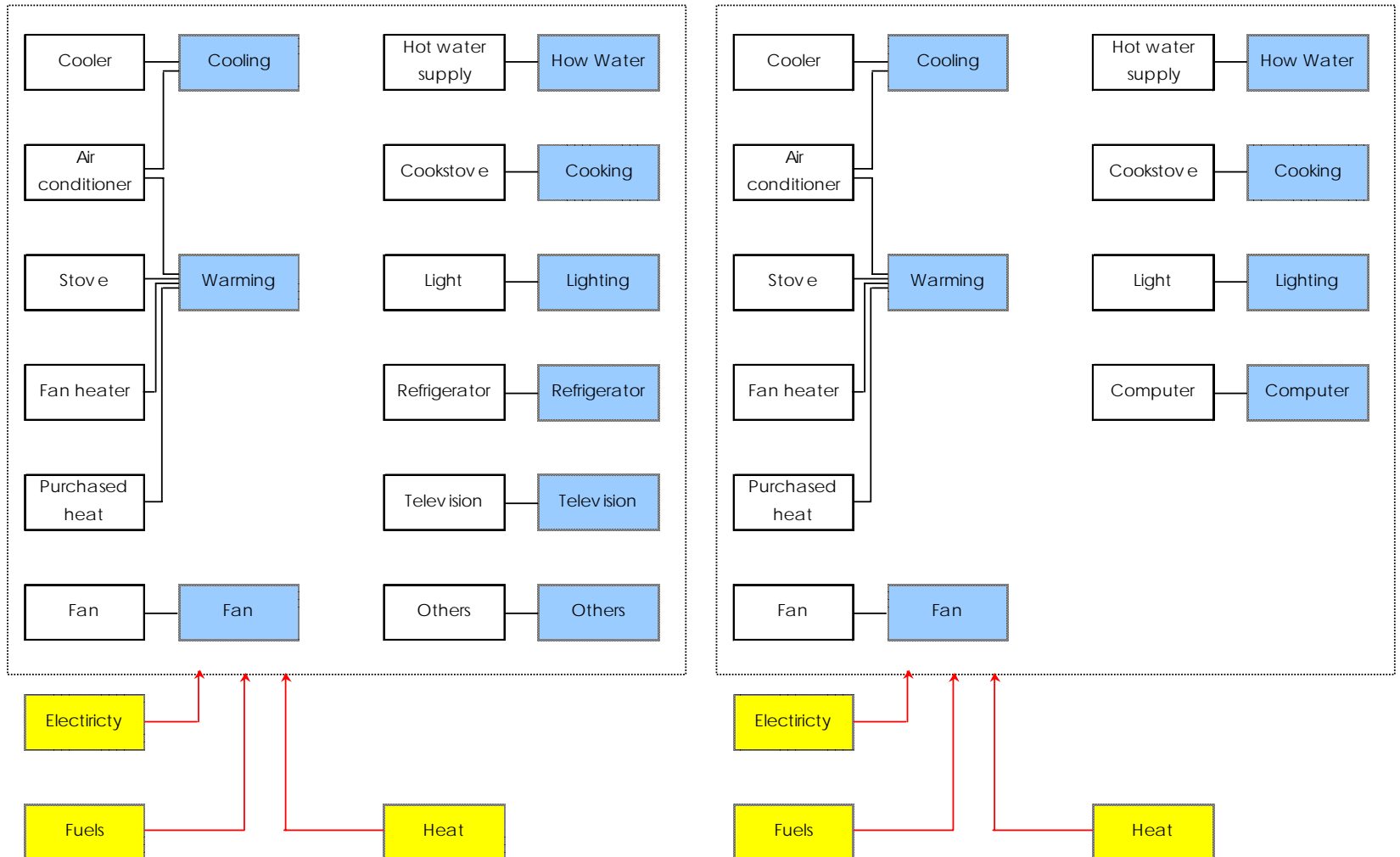
Energy system in passenger transport (left) and freight transport (right)



Stylized Energy Processes in the ENERGY module (Agriculture, Fishery and Forestry Sectors)

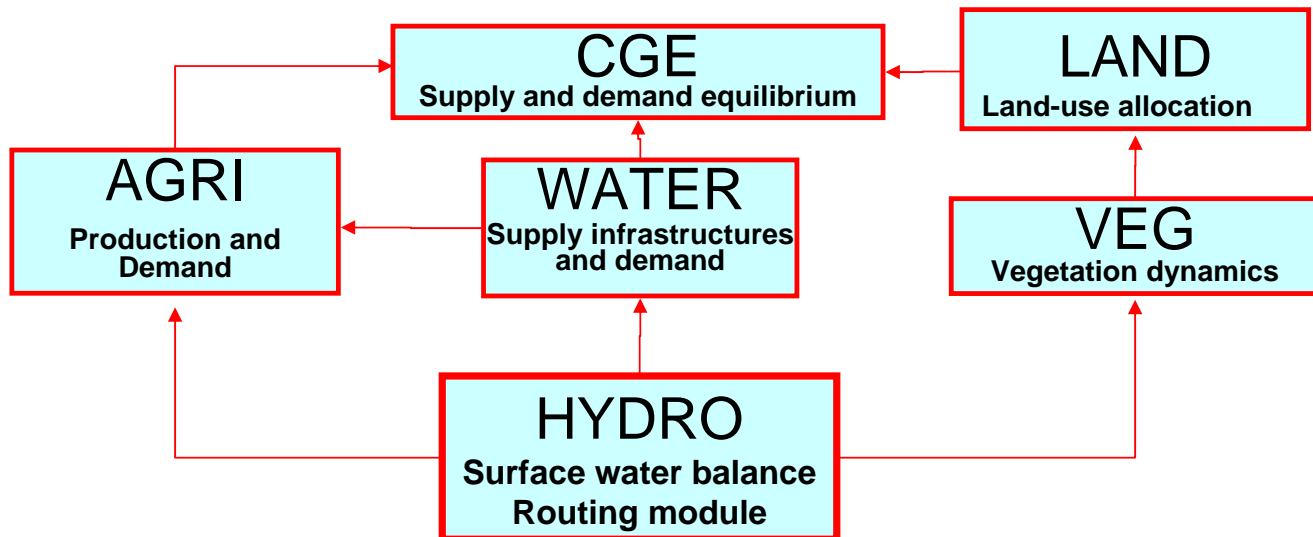


Stylized Energy Processes in the ENERGY module Energy system Residential (left) and commercial (right) sectors



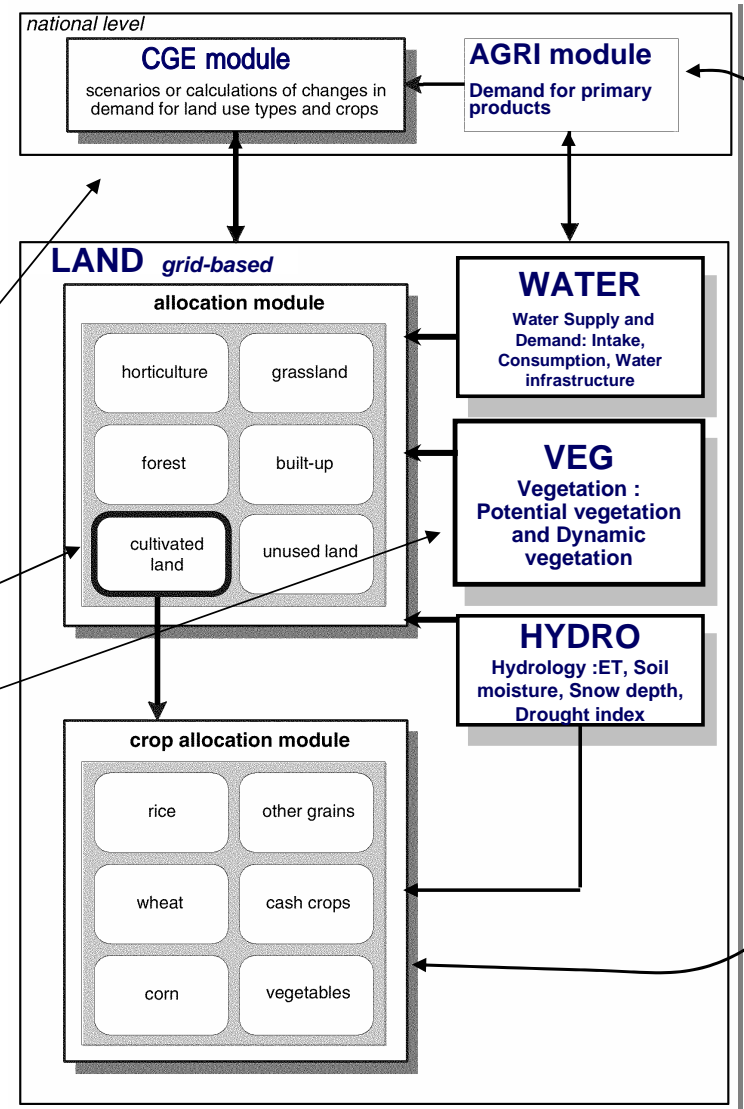
HYDRO (Hydrology) and WATER module

- Input from CLIMATE module of climate
- Calculate Evapo-transpiration, Soil moisture, Snow condition, Surface runoff, water routing
- Base of other ecosystem/impact modules



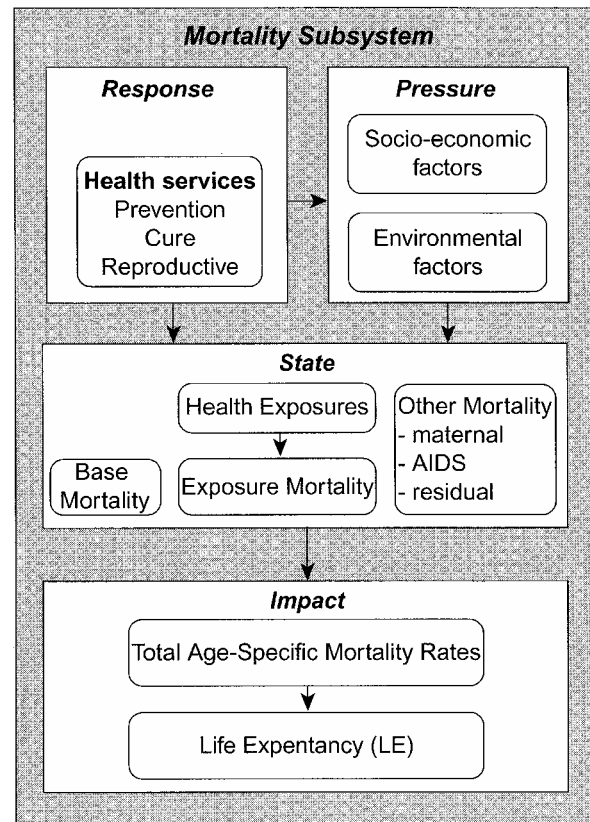
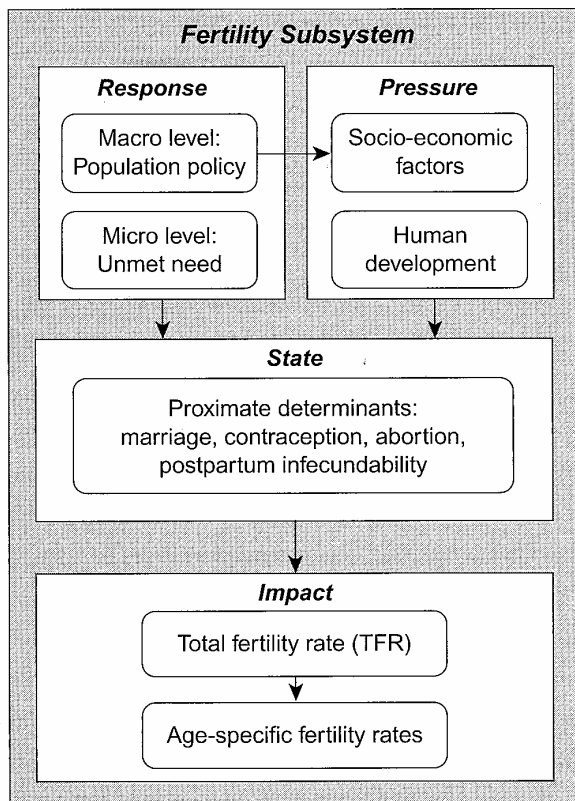
The LAND module

- Food, timber and biomass demand
- Land requirement and supply
- Expansion, reallocation and abandonment of cultivated land
- Vegetation dynamics



POP (Population) Module

- Cohort component model
- Fertility model
- Mortality Model (Epidemiological transition)
- Internal Migration Model
- Coupling with HEALTH module



HEALTH (Health impacts) module

Environment related diseases

Climate Change: Malaria, Dengue,
Schistosomiasis, Heat & Cold stroke

Outdoor and Indoor pollution: Lead, Acute and
Chronic respiratory diseases

Water pollution: Diarrhoeal, Arsenic, Cholera

ENV module

Emitter-Acceptor relation

Pollutant transports

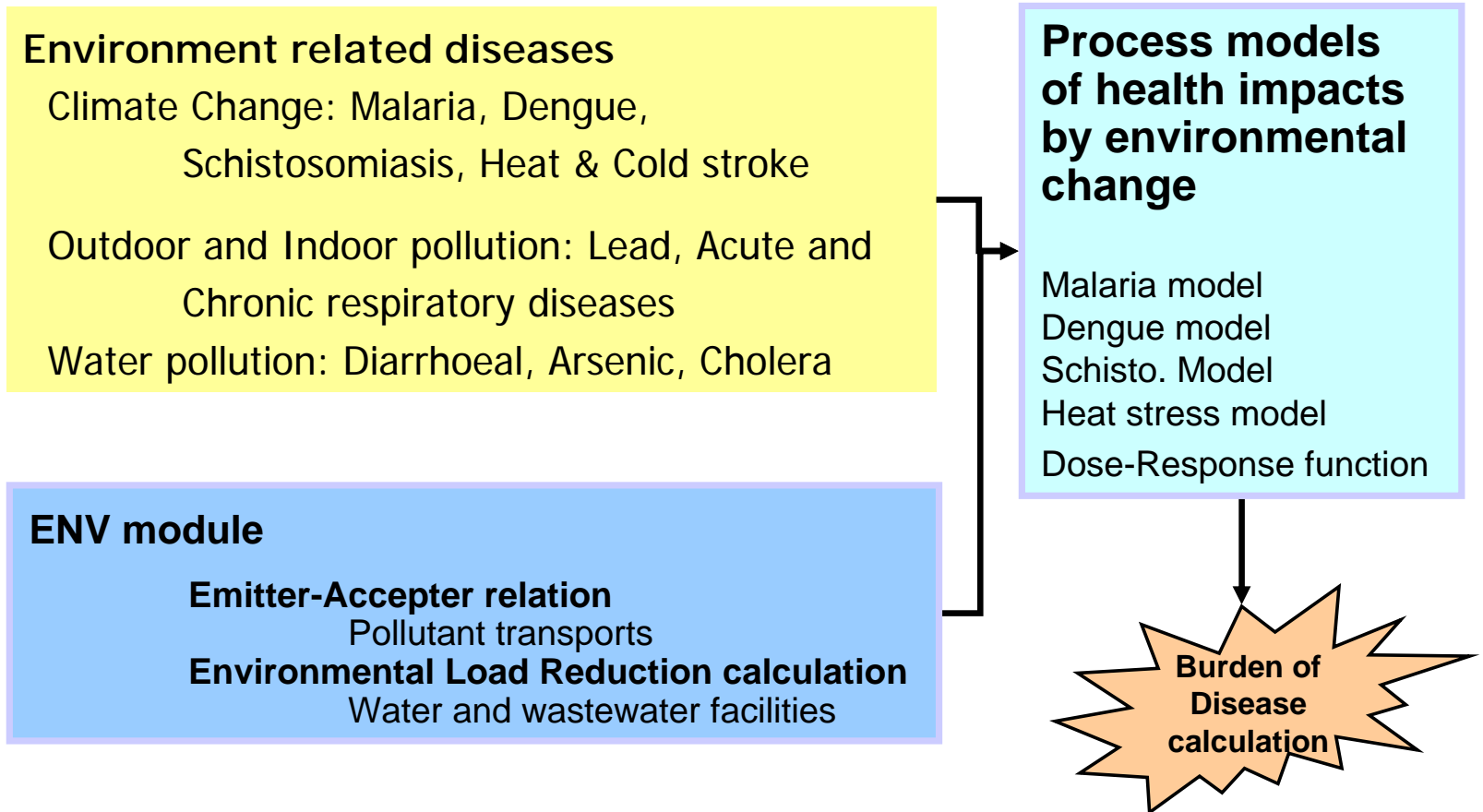
Environmental Load Reduction calculation

Water and wastewater facilities

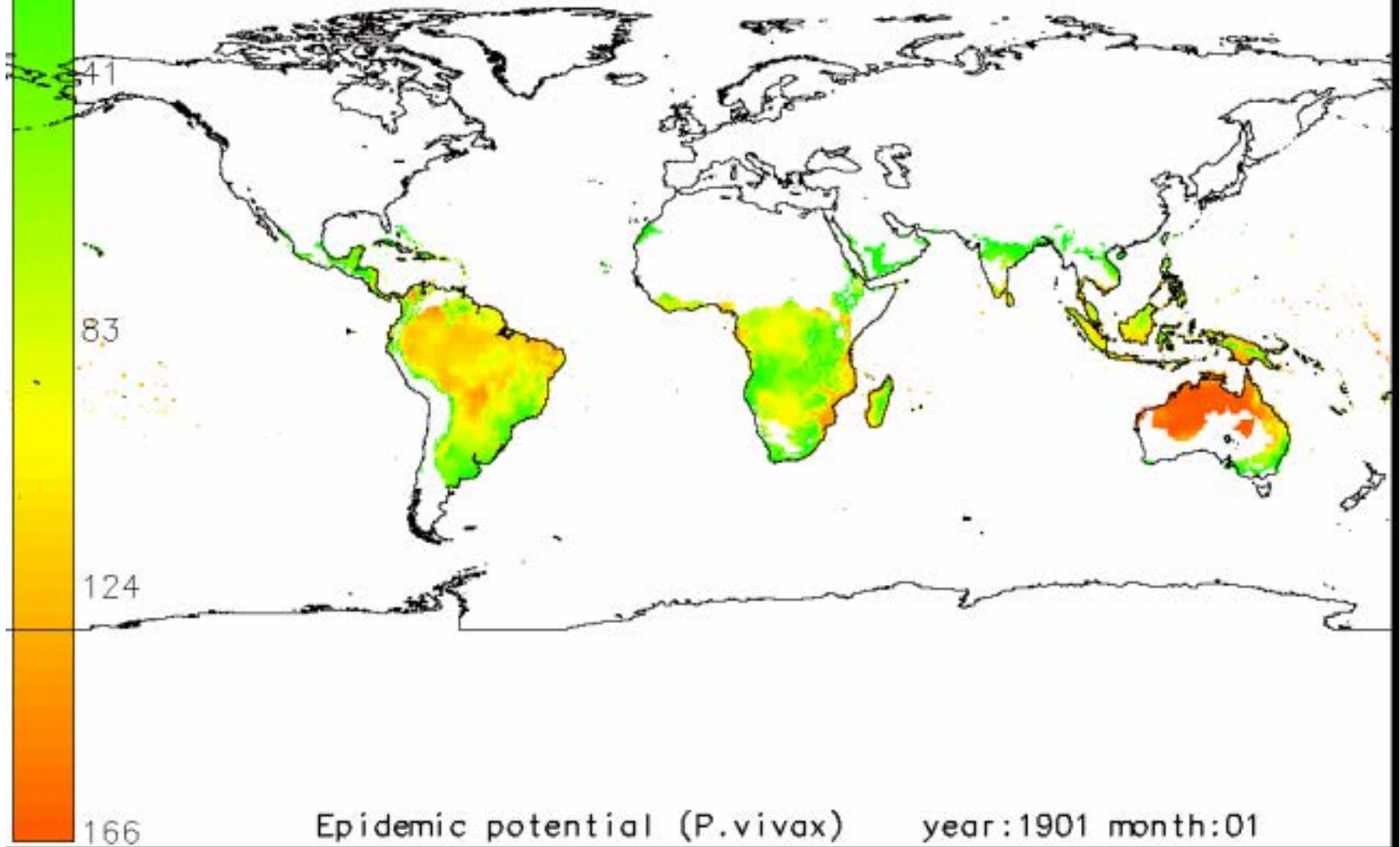
Process models of health impacts by environmental change

Malaria model
Dengue model
Schisto. Model
Heat stress model
Dose-Response function

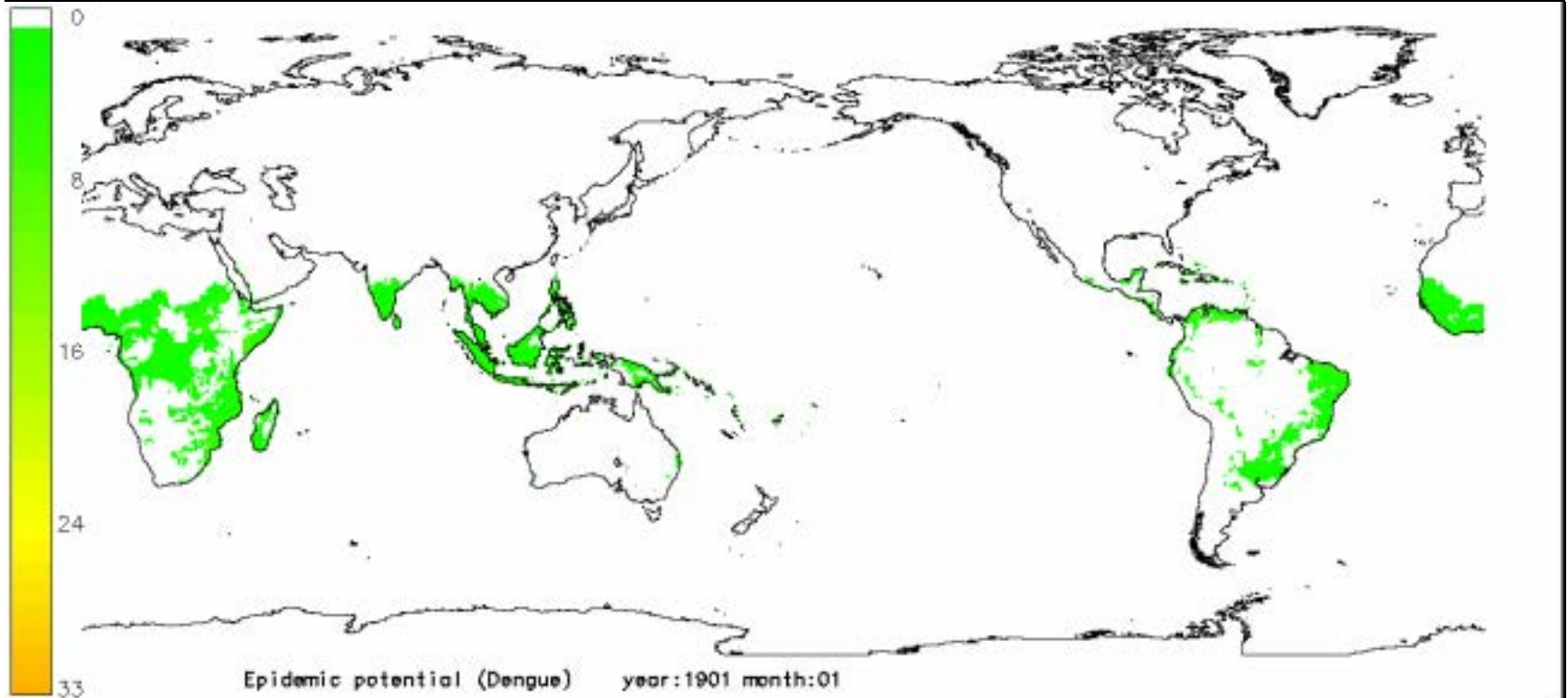
Burden of
Disease
calculation



A simulation of Malaria epidemic potential AIM/HEALTH

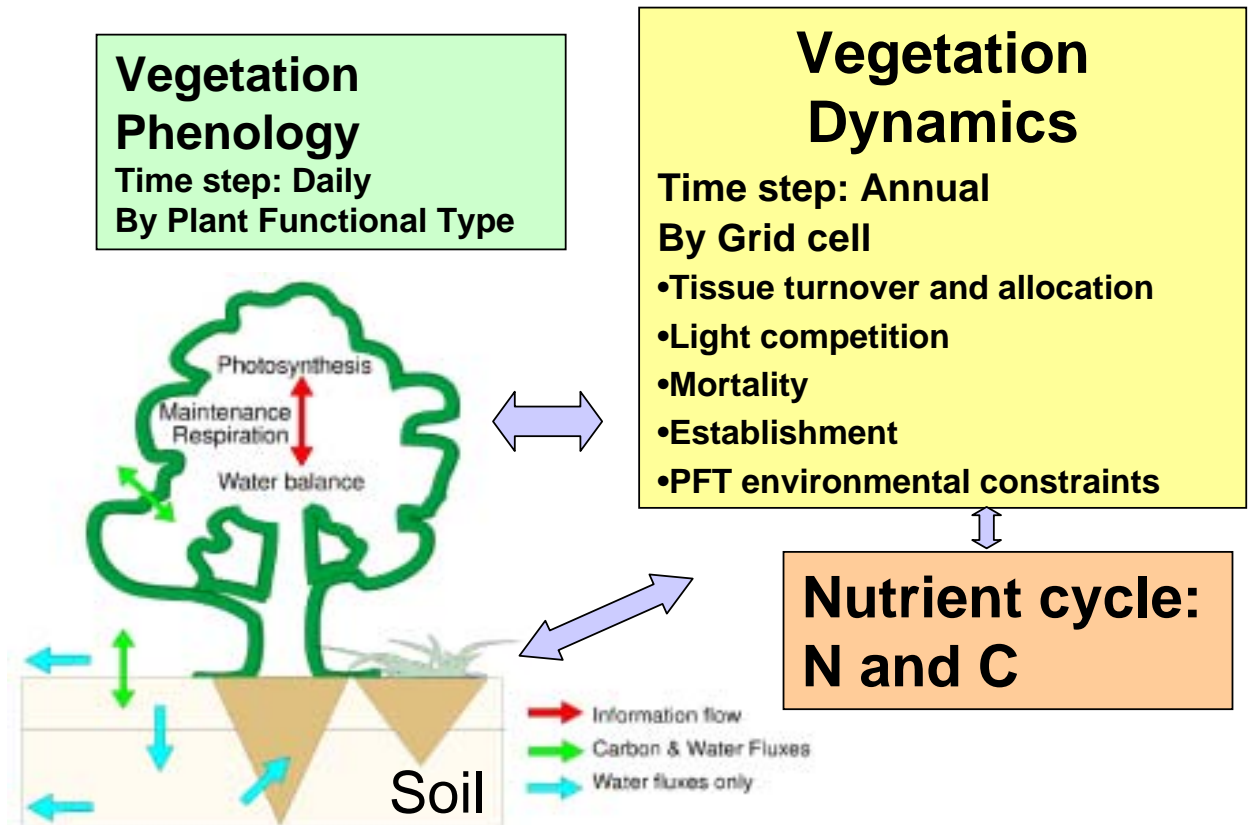


A simulation of Dengue epidemic potential AIM/HEALTH



The VEG (vegetation) module

- Process-oriented formulations of biogeochemical fluxes as well as vegetation dynamics
- Establishment, Productivity and Competition for resources, Growth, Disturbance and Mortality.
- Plant Functional Types (PFTs) as basic units



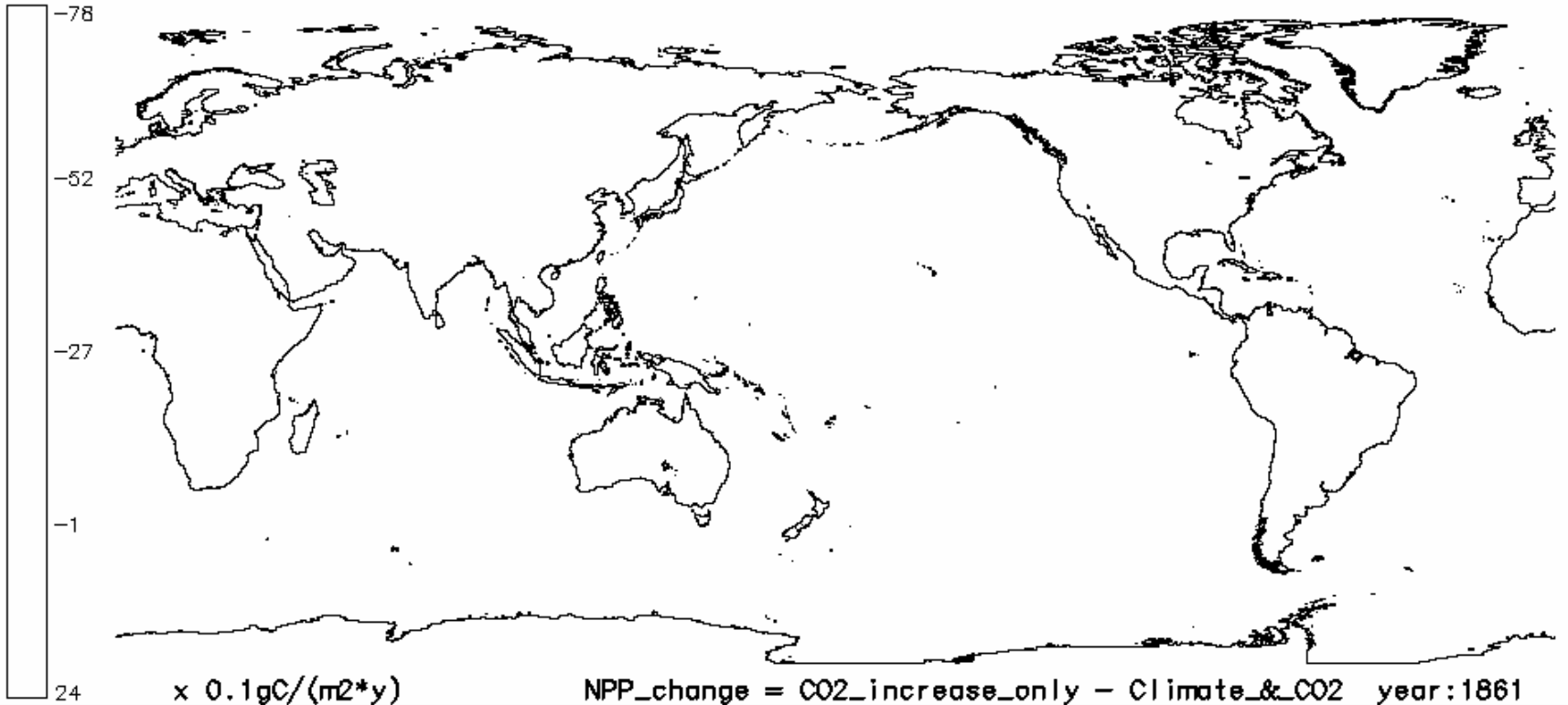
A recent result of DGVM simulation suggests a strong CO₂ source from vegetation change with global warming

Cox, P. M., Betts, R. A., Jones, C. D., Spall, S. A. & Totterdell, I. J. *Nature* **408**, 184–187 (2000).

Model	Mean surface warming in 1860–2100 Global (land)	CO ₂ in 2100 (p.p.m.)	Carbon uptake in 2000–2100 (Pg C)	
			Land	Ocean
1. Predefined CO ₂ emissions without global warming	0.0 °C (0.0 °C)	700	450	300
2. Predefined CO ₂ concentration with global warming	4.0 °C (5.5 °C)	713	-60	250
3. Predefined CO ₂ emissions with global warming	5.5 °C (8.0 °C)	980	-170	400

Climate change effect on NPP

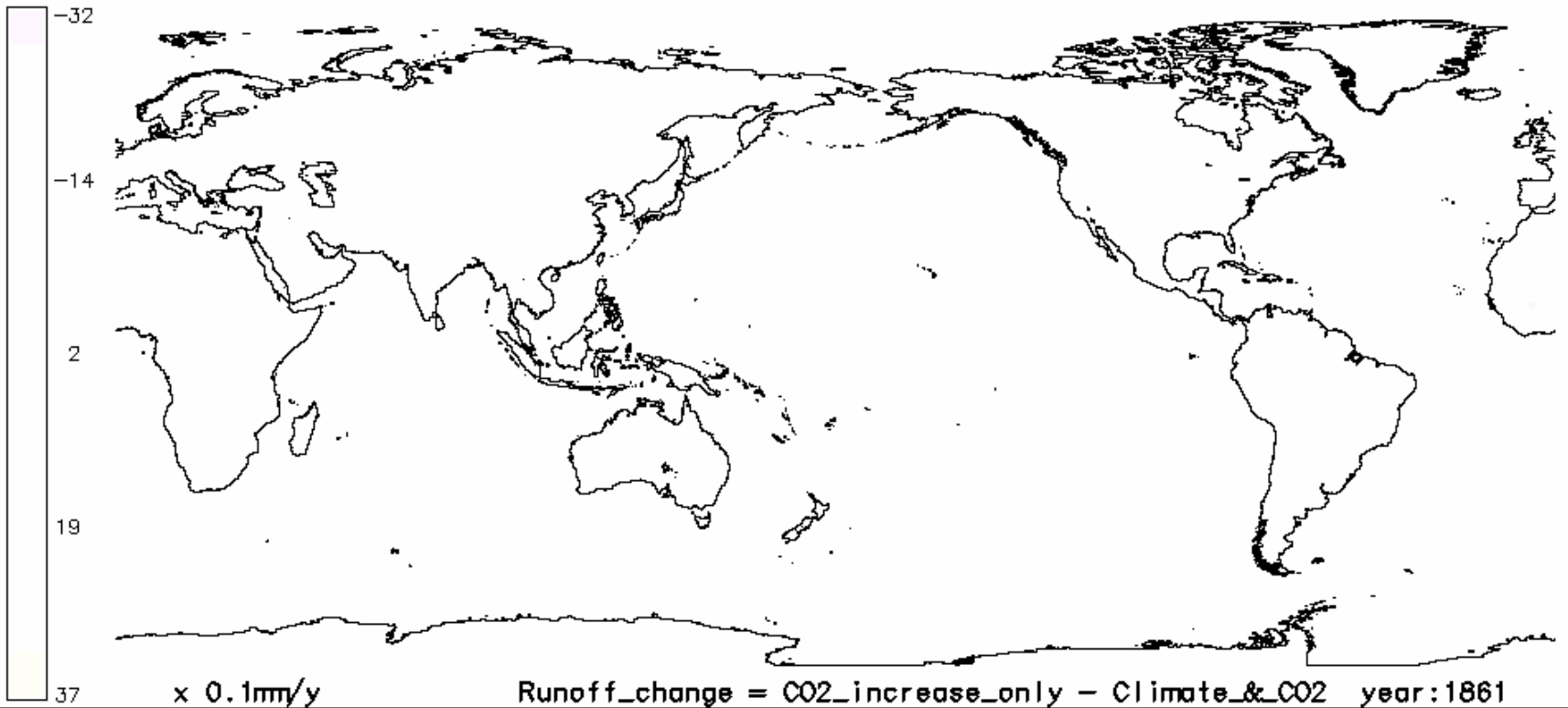
Emission:IS92a, Climate:HADCM2_SUL



(preliminary calculation by AIM/VEG)

Climate change effect on runoff

Emission:IS92a, Climate:HADCM2_SUL



(preliminary calculation with AIM/VEG)

Focuses of modeling activity in year 2001-2002

- **AIM/COUNTRY , AIM / Database : In order to organize and to distribute AIM models for national and regional climate action plans as well as wider comprehensive environmental policies**
- **From AIM/IMPACT to AIM/ECOSYSTEM : In order to broaden modeling perspectives from climate policy to more wider points of view, and increase the applicability to various policy processes**

Important Acronyms and Abbreviations to communicate with AIM team

AIM	Asian-Pacific Integrated Model
ALICE	Ancillary-effects estimating model for local governments to improve their comprehensive environment
APEIS	Asia-Pacific Environmental Innovation Strategy Project
ATML/ATPL	AIM Trend Macro/Program Language
C G E	Computable General Equilibrium Model
GAMS	Generalized Algebraic Modeling System
MPSGE	Mathematical Programming System for General Equilibrium analysis
