Summary of Workshop on GHG Stabilization Scenarios (22-23 January, 2004, Tsukuba)

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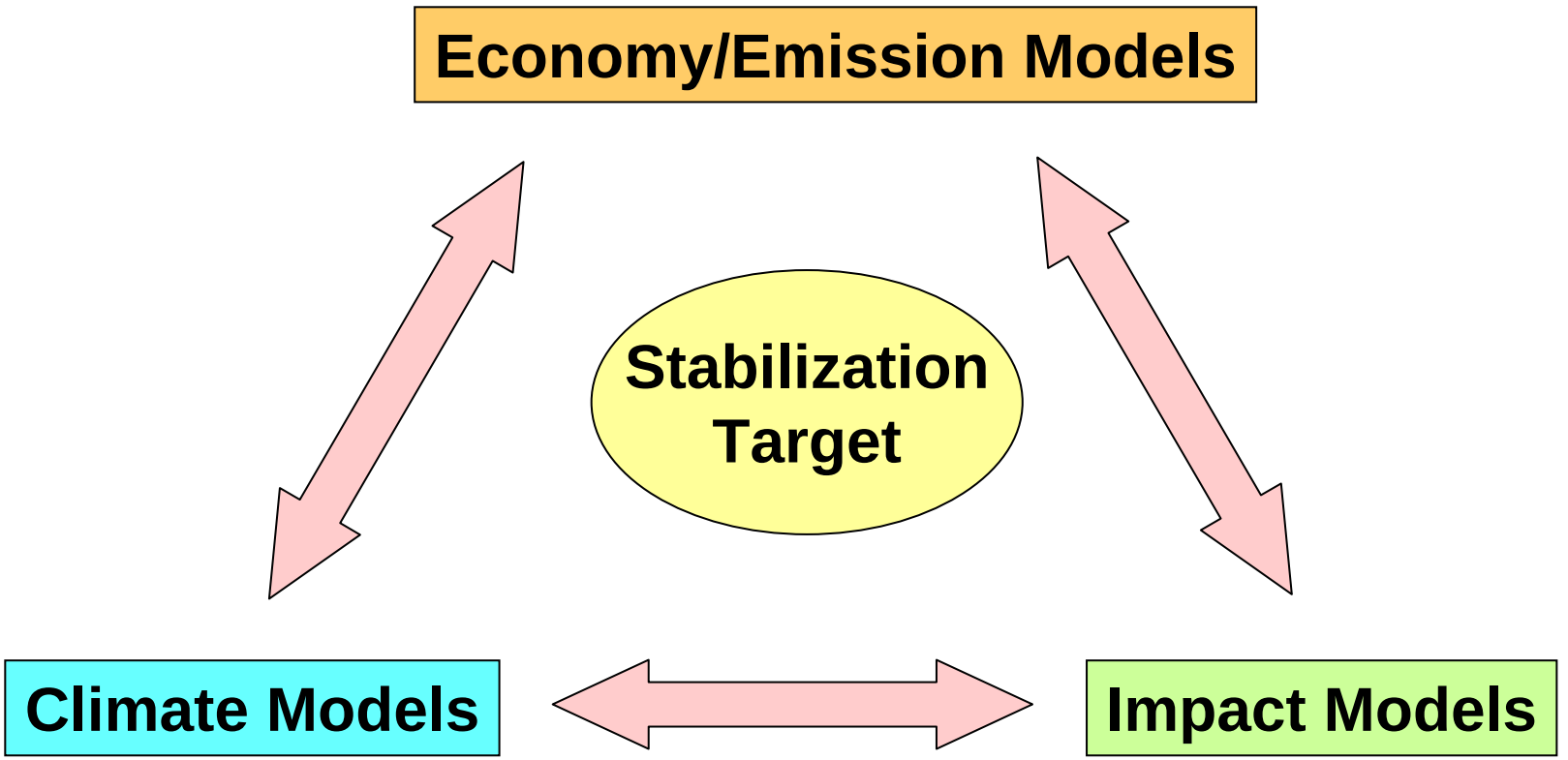
Overview

- **SRES (2000) and Post SRES (2001)**
  - SRES: long-term(-100yr) social and environment baseline emission scenario
  - Post SRES: stabilization scenarios target on
    - Reduce CO_2 emissions
    - Stabilize concentration (450, 550, 650, 750ppm…)

- **EMF21 (since 2002)**
  - Multi-gas (CO_2, CH_4, N_2O, HFC, PFC, SF_6) control
  - Stabilize radiative forcing (4.5W/m2 after 2150)

- **Workshop on GHG Stabilization Scenarios (2004)**
  - What should be the stabilization levels?
  - Downscaling of scenarios
  - Fully integrated scenarios

Components


Economy/Emission Models
Stabilization Target
Climate Models
Impact Models

Next Steps on Urgent Issues from IPCC/TAR

- Limitations of downscaling need to be considered (need for scaling methods; other to proportional)
- Emissions modeling community could be asked to include all GHGs and particulates in multigases baseline scenarios
- Role of additional GHGs and particulates to be considered in stabilization scenarios (e.g. burden-sharing; uncertainties)

Nebojša Nakićenov

EMF21 scenarios for long-term model

(1) BaU Modeler's reference (B2-like)

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(2) Long-term stabilization scenarios

Stabilize radiative forcing at 4.5 W/m^2 by 2150 relative to pre-Industrial times

(2-1) CO_2 only (2-2) multi gas

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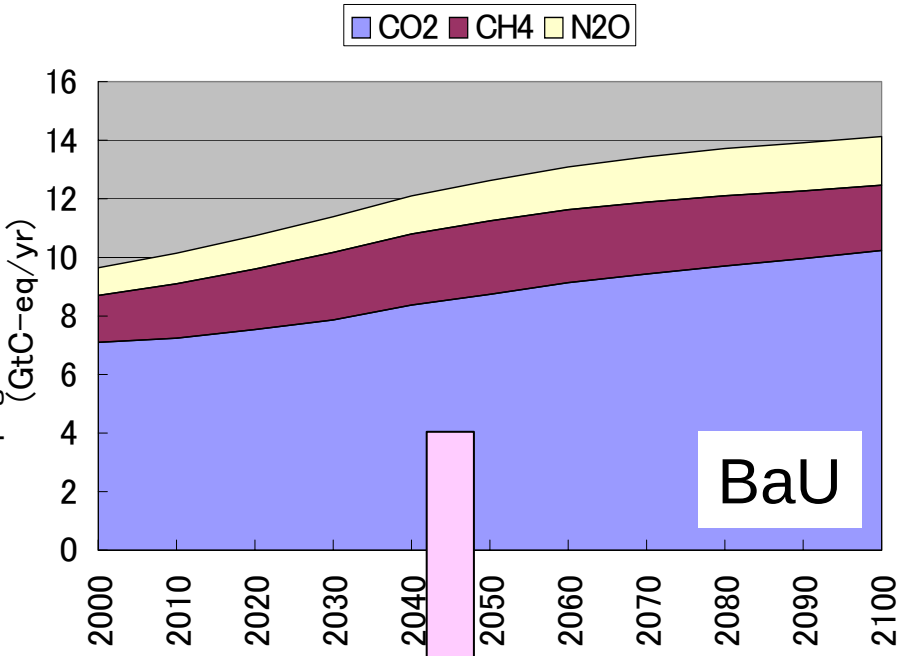
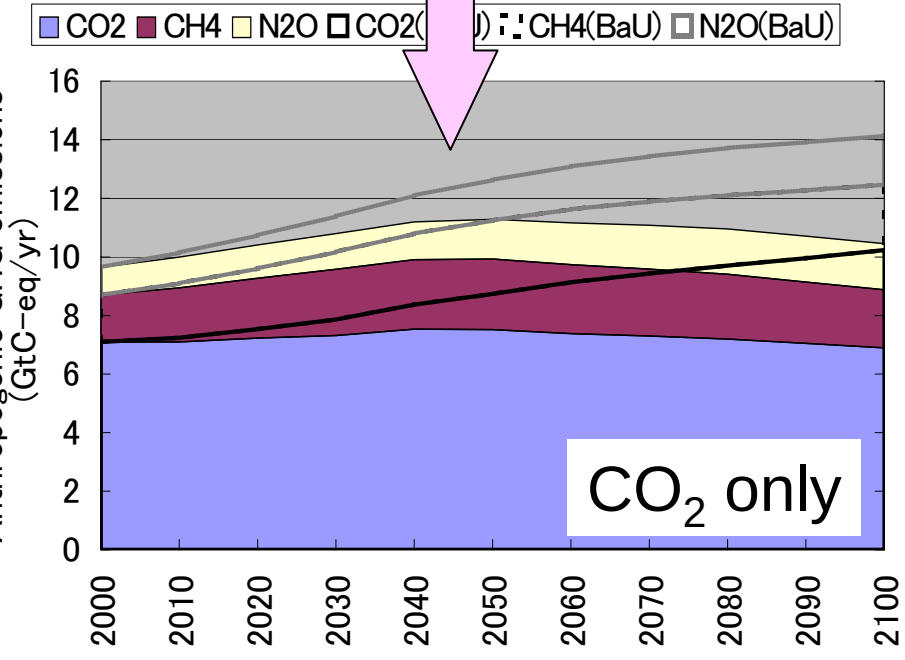
(3) Long-term stabilization scenarios with rate of temperature change

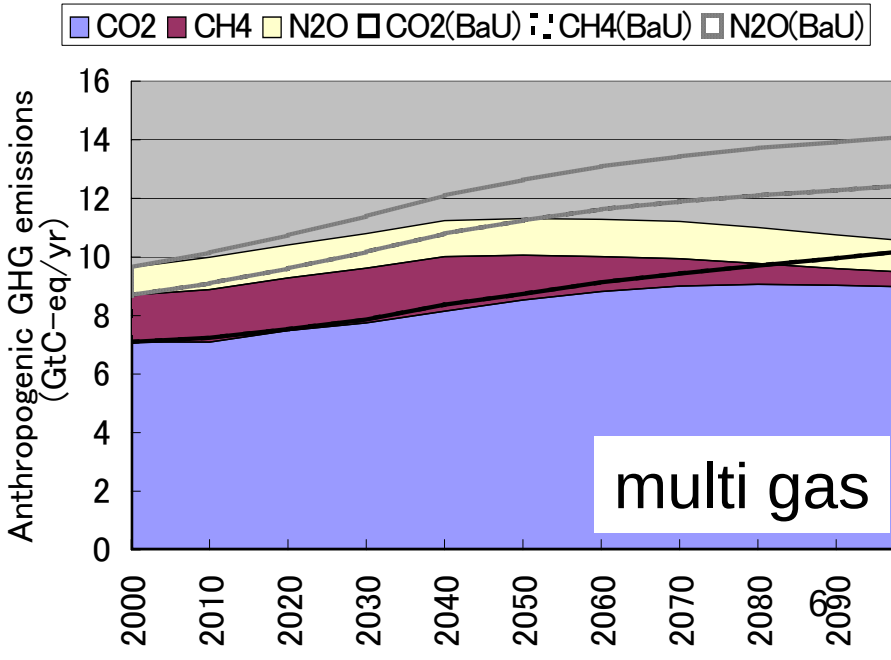
global mean temperature change to an average decadal rate of 0.20ºC

(3-1) CO_2 only (3-2) multi gas

Anthropogenic GHG emissions







Discussions from Emission Modeling

- The inclusion of **non-CO_2 gases** has important implications for stabilization.
- Limiting the change in **radiative forcing at 4.5W/m2** implies stabilizing **CO_2 concentrations at 500 ppm** and **temperature at 2 degree**.
- **Uncertainty in climate sensitivity** has huge implications for a 2^{o}C limit on GMT change:
  - Low climate sensitivity means no mitigation until the second half of the century
  - High climate sensitivity means immediate, radical emissions mitigation.
- An improved **technology portfolio** could reduce the cost substantially; e.g. demand reduction, fuel switching, carbon capture and storage, bio-technology, hydrogen and advanced transportation systems.

Based on Dr. Jae Edmonds' presentatio

Topic of Climate models

AOGCM

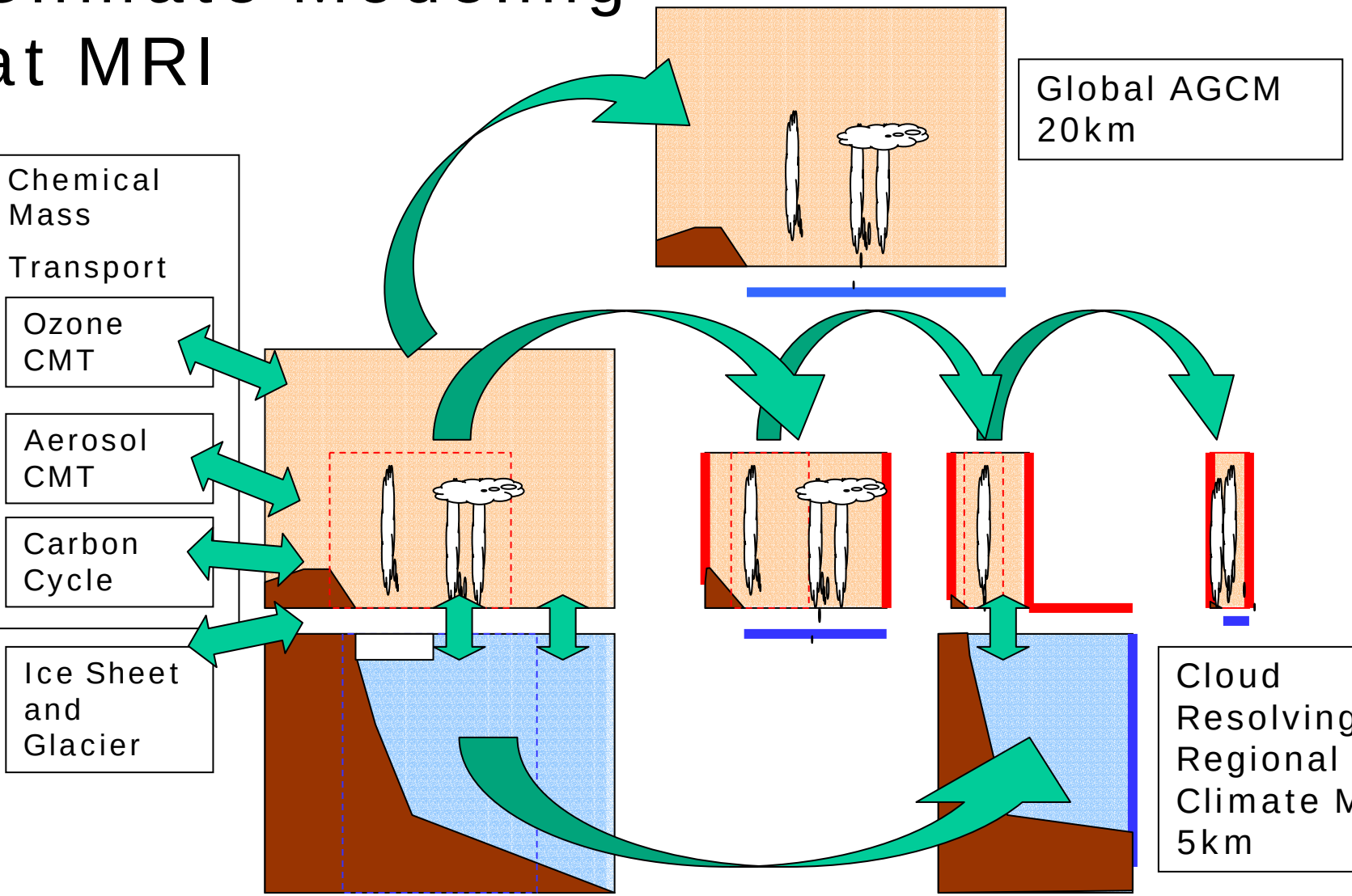
- Downscaling, High resolution
- Earth system modeling for the carbon cycle and chemical mass transport
- ENSEMBLE – The European climate modeling project
- Probability density functions of temperature change

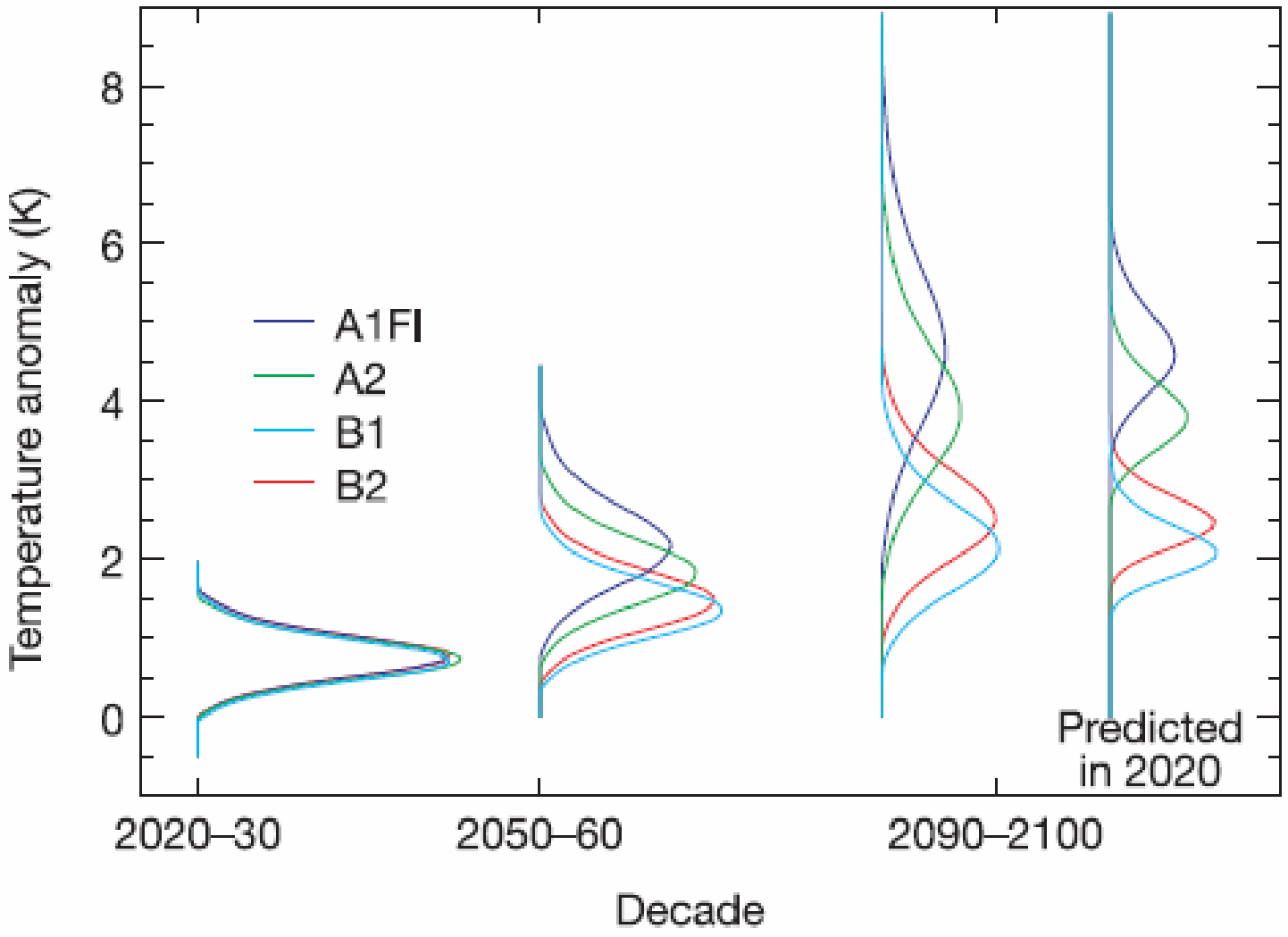
Simple climate models

- revised MAGICC carbon cycle model
- Climate sensitivity

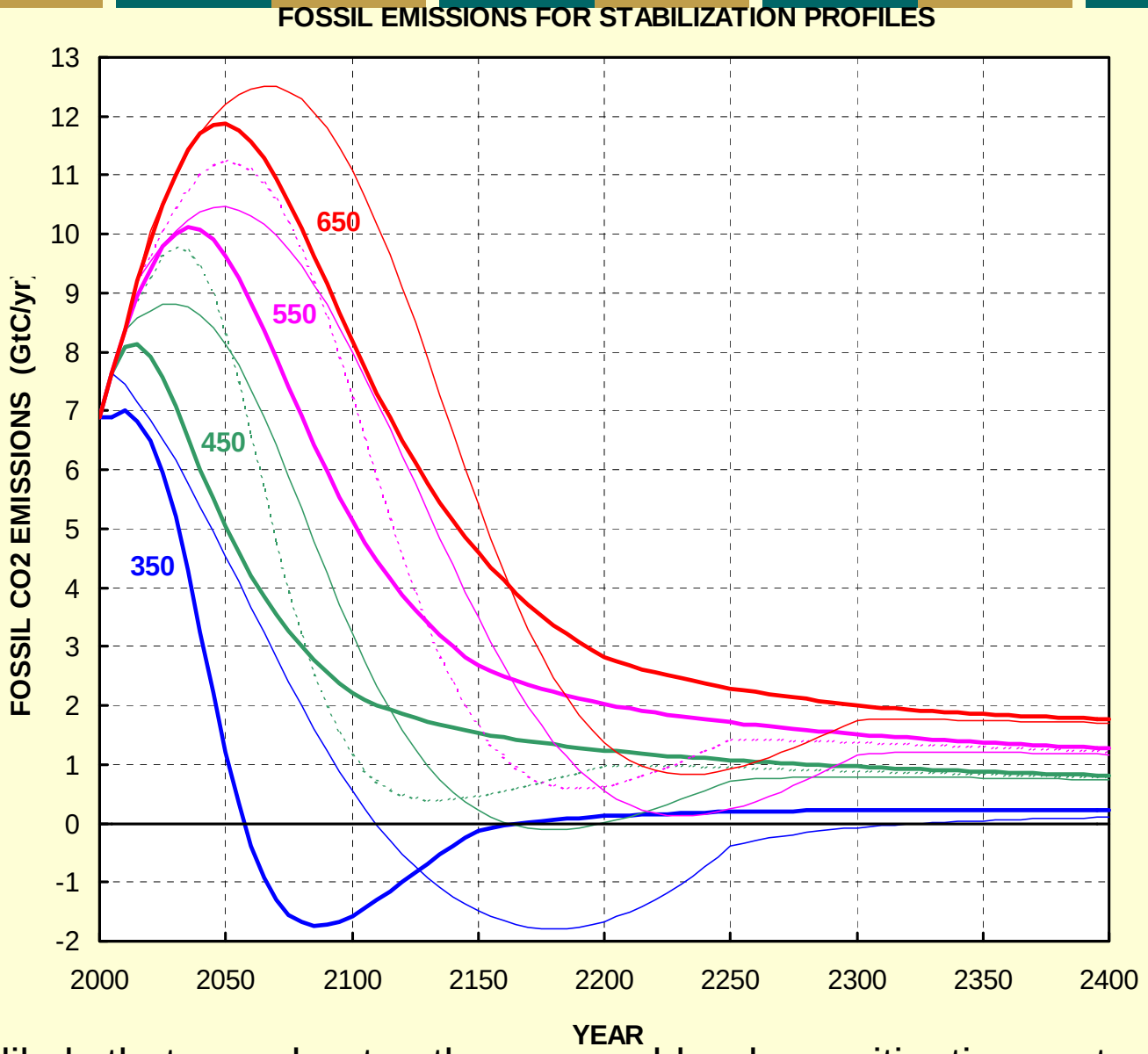
Climate Modeling at MRI

Akira Noda





Probability density functions of temperature change simulated with the Hadley Centre model



Tom Wigley

It seems likely that overshoot pathways would reduce mitigation costs much more than they would increase climate-change damages – unless there are nonlinearities that lead to much larger damages if thresholds are passed

Topic of Impact models

- Impact analysis on water resource/ agriculture/ health/ natural vegetation/ biodiversity…
- Risk and robustness, Uncertainty, Investment to avoid damage
- Critical impact thresholds

Stabilization scenarios and climate scenario for impact assessment

- GCM experiments driven by variety of stabilization scenarios
  - It is usually infeasible and unexciting work for GCM modelers to simply repeat simulations.
- Utilization of SRES-based (or other existing) GCM simulation as substitution
  - Emission trajectory in 21st century may cause a significant difference on spatial pattern of climate change.
- Pattern scaling (SCM's result + GCM's spatially high-resolution info.)
  - Pattern scaling is based on the very rigid assumption.
  - Pattern scaling which considers spatial difference of climate changes caused by GHGs and Aerosols separately might be better for considering stabilization scenario.
- It is difficult for majority of impact researchers to judge what is the best way to develop climate scenarios.

Stabilization scenarios and adaptation

- Socio-economic conditions assumed in the background of stabilization scenarios affect adaptive capacity.
- Socio-economic scenarios reported in SRES scenario (4 regions in the world) was spatially too rough.
- GDPpc is not the only factor of adaptive capacity.

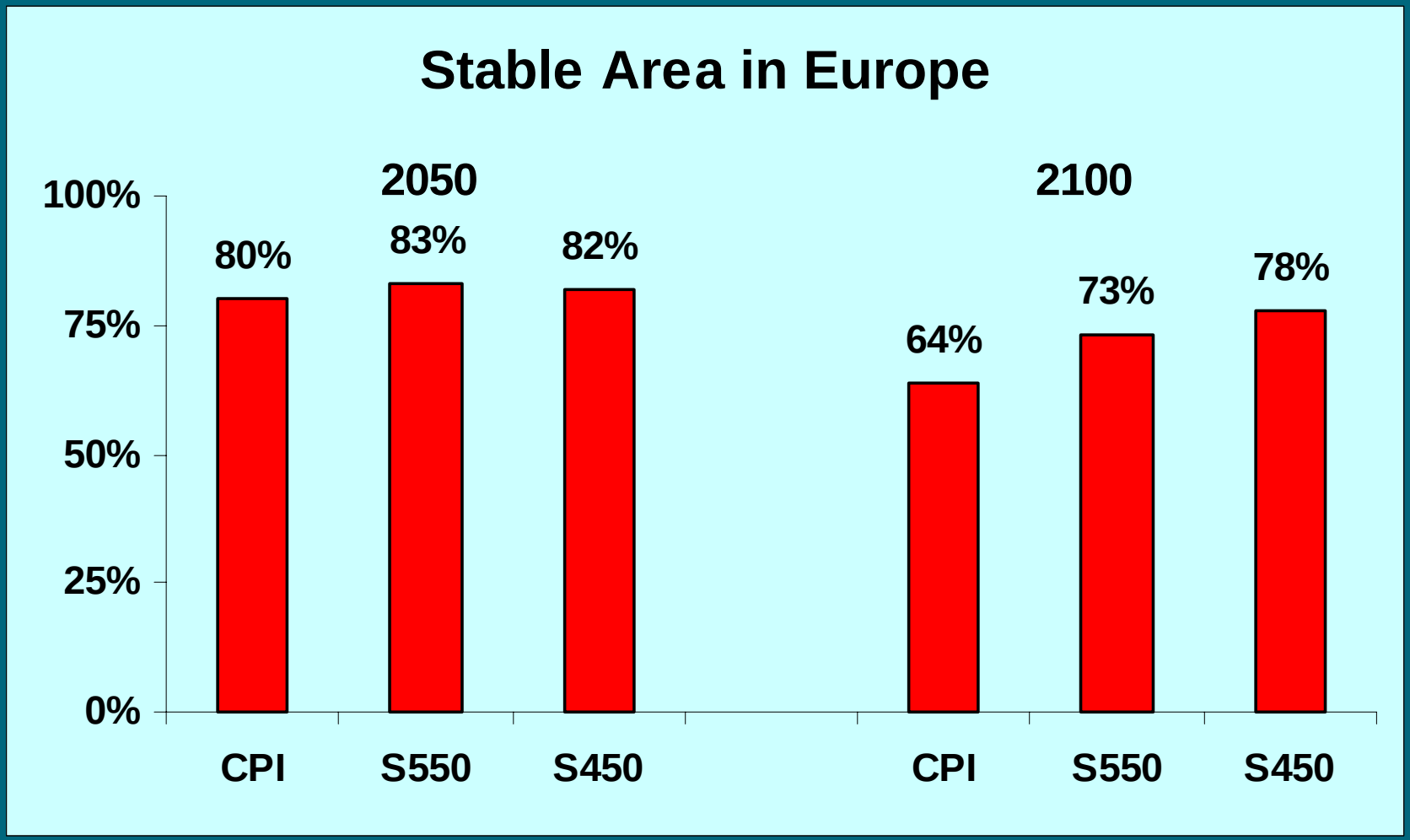
Stabilization scenario and resources

- GHGs mitigation options assumed in some stabilization scenarios may compete with adaptation options for the usage of limited resources.
  - Agricultural land for crop cultivation may be exploited by land for biomass farm in some scenarios.
- More comprehensive integrated assessment framework seems required to treat this relation.

Biodiversity: EUROMOVE/IMAGE

(Note: RIVM contribution to Nature article)

- EUROMOVE estimates presence of 1400 vascular plant species in gridcells from 6 climate variables
- Calibration with Atlas Flora Europaeae (1989)
- Aggregated to 20 European regions
- Climate variables from IMAGE + GCM patterns
- Baseline (CPI) and stab.scenarios (S550, S450)
- Sensitivity to different GCM patterns


Stable Area in Europe
100%
75%
50%
25%
0%
2050
2100
80%
83%
82%
64%
73%
78%
CPI
S550
S450
CPI
S550
S450

Issues in Designing Stabilization Scenarios

- Whether of Not to Use Stabilization Targets?
  - Could Just Project Implications of Baselines & Baselines X Policies
  - Possible Ranges of Various Metrics Could Then Be Highlighted
- What to Stabilize (or Report) and When?
  - Concentrations
  - Radiative Forcing
  - Temperature or Other Climate Changes
  - Climate Change Impacts
  - Rates of Change of Any of the Above
- What Range of Stabilization Targets to Consider?
- What Baseline Assumptions to Use?
- What Transition Pathways to Consider (Implementation Uncertainty)?
- What Policy Options to Include (Implementation Feasibility)?
  - Carbon Taxes
  - R&D, Technology Diffusion and Transfer
  - Non-CO_2 Gases, Sinks, Etc.

Issues in Designing Stabilization Scenarios

- How to Provide Hedging Relevant Information Via Scenarios?
  - For “No Surprise, “Surprise” or “Not Implausible” Scenarios
  - Adaptation and Implementation as Risk Mgt. Tools
- What to Assume About International Trade?
- What Burden Sharing Assumptions to Make?
- What to Assume About Other “Climatically Important Substances?”
- What Feedbacks to Consider?
  - Land-Use
  - Carbon Cycle
- How to Provide Useful Input to Impacts Community?
  - Down-Scaling of GCM Information
  - Down-Scaling of Socio Economic Information
  - Input to - And Input From - Adaptation Community
- What Outputs to Look At?
  - Shorter Run “Metrics”
  - Meaningful “Longer Run” Metrics
  - Implementability Metrics

- What should be the stabilization levels?
- Uncertainty in climate sensitivity, technology, climate impact
- Bridge short-middle term countermeasures and long-term ultimate target

Discussion will be continued intensively…

✓ Develop and Enhance IAM
✓ IPCC new database

This workshop homepage can be browsed at
“http://www-iam.nies.go.jp/aim/workshop.htm”