Integration of Emission, Climate Change and Impacts

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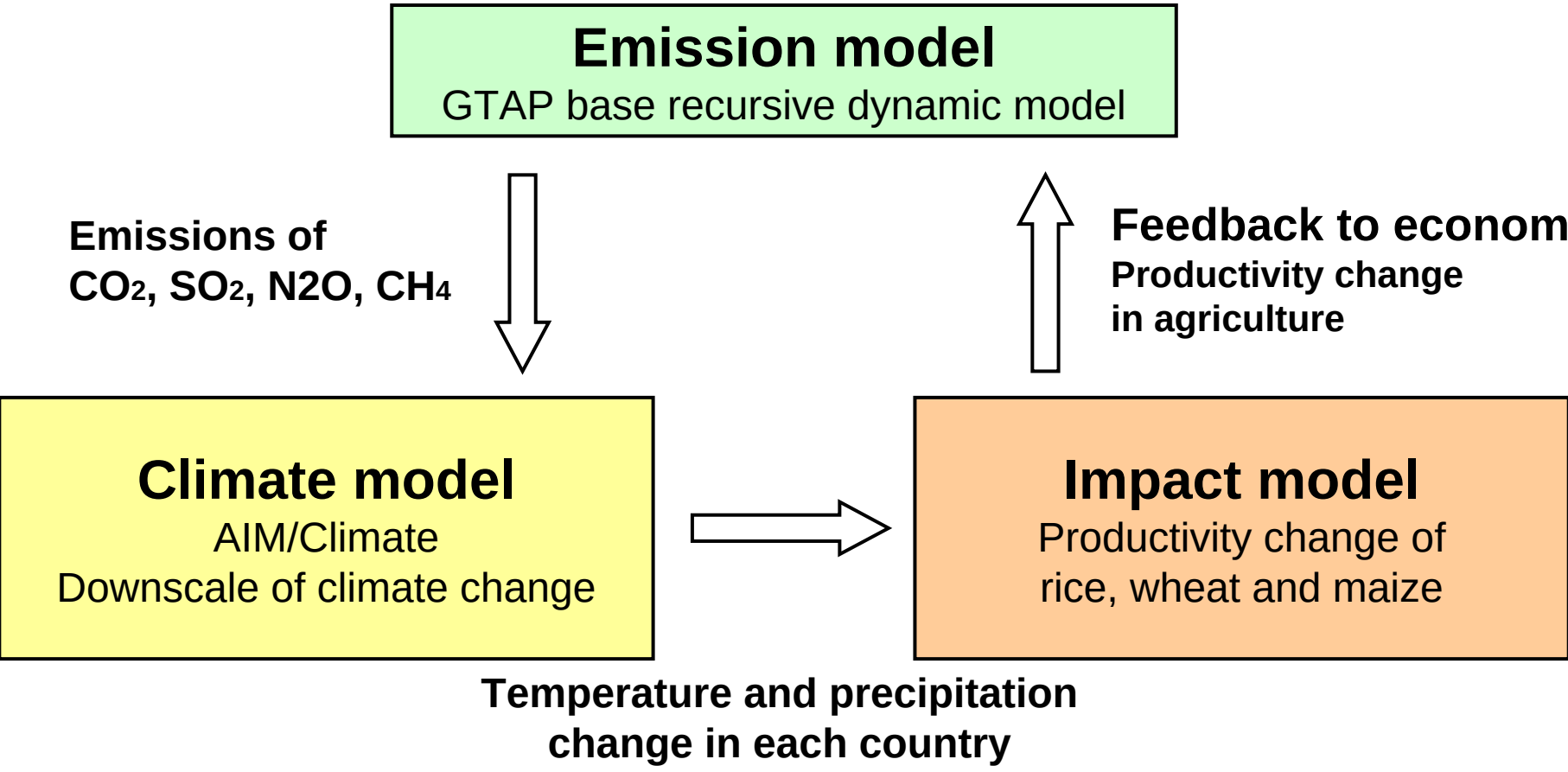
Integration of Emission model, Climate model, and Impact model



Emission model (1)

- Computable general equilibrium model with recursive dynamics (1997-2100)
- GTAP database (ver.5)
- Calibration based on SRES-B2
- Emissions: CO_2, N_2O, CH_4, SO_2 from fossil fuel combustion, land use, industrial process and landfill

Emission model (2)

- **11 Regions**

  JPN: Japan **CHN: China**
  IND: South Asia **NOA: North America**
  LAA: Latin America **AFR: Africa**
  EUR: West Europe **CIS: East Europe & CIS**
  MIE: Middle East **OCE: Oceania**
  ROW: Rest of the world including Southeast Asia

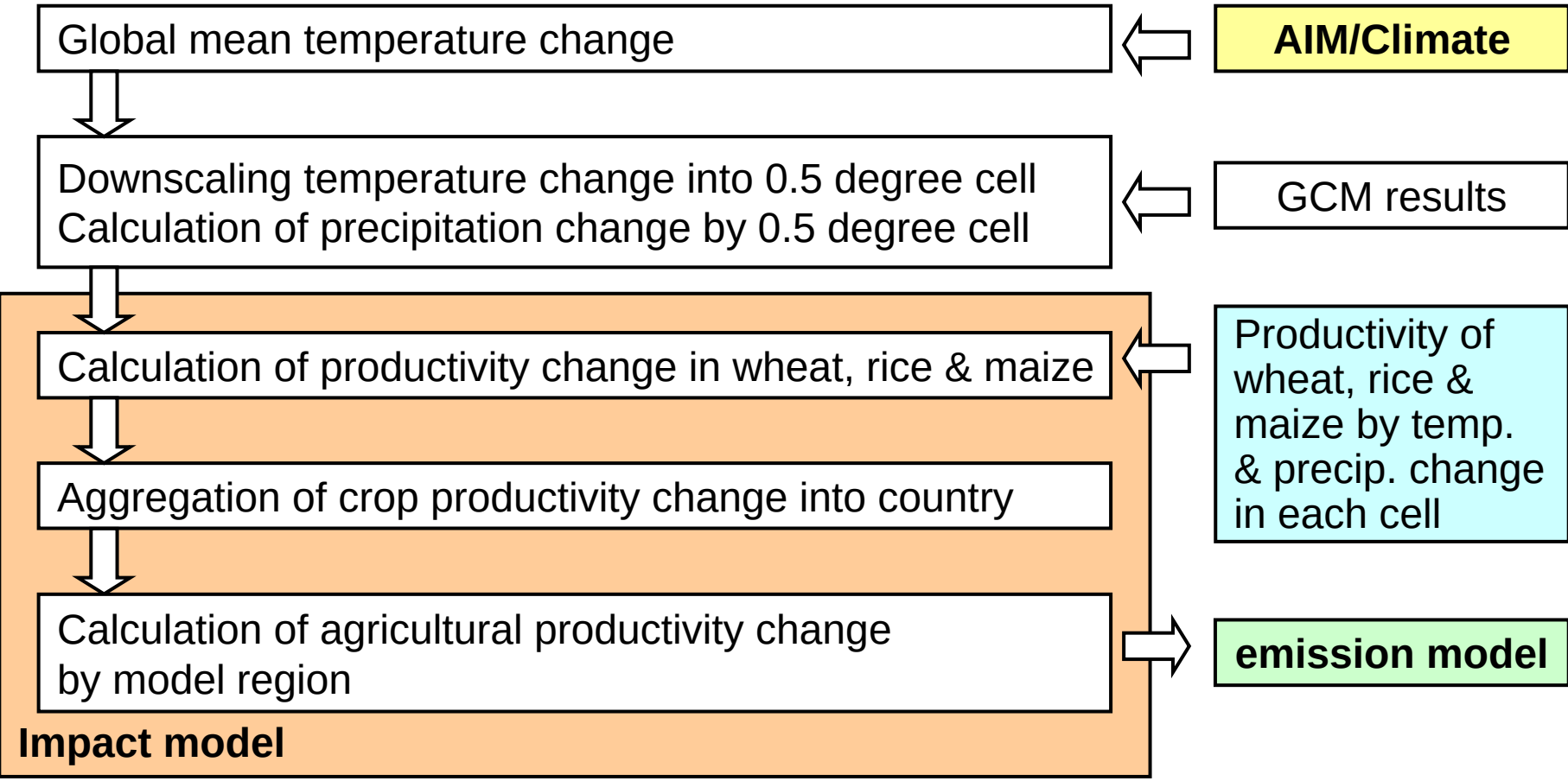
- **9 sectors**

coal	**crude oil**	**oil products**
gas	**thermal power**	**renewable energy**
agriculture	**industry**	**service**

Climate model

- **AIM/Climate by Prof. Matsuoka**
  - **Inputs:** CO_2, N_2O, CH_4, SO_2 **from emission model**
    CFCs from scenario (SRES-B2)
  - **Outputs: global mean temperature**
    sea level rise
- **Downscale of climate change**
  - **By using calculated global mean temperature and GCM runs, temperature and precipitation changes by 0.5 degree cell are estimated.**

Impact model



Scenarios (climate policy)

1. **No reduction**
2. **Annex I reduction**

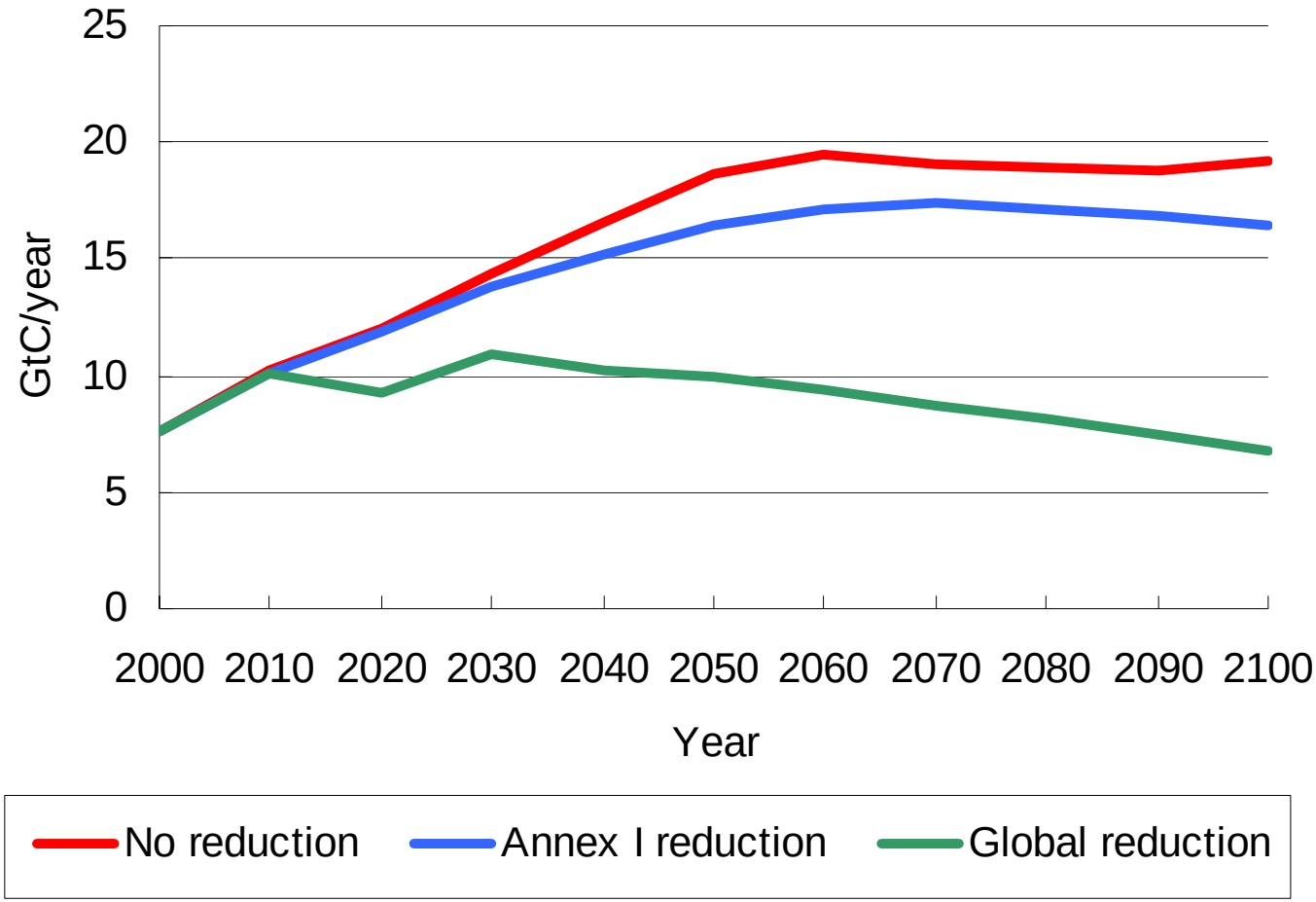
   Kyoto (-2010) + 5%/10ys reduction (2010-)
3. **Global reduction: 550 ppm stabilization**

   Annex II reduction will start after 2010.

- **Emission trade will be carried out among countries constrained by CO_2 reduction.**
- **In the case of global reduction scenarios, allocation of CO_2 emission rights is linearly changed from actual emissions in stating year to equal per capita in 2100.**
- **Each scenario has with/without climate change impact.**

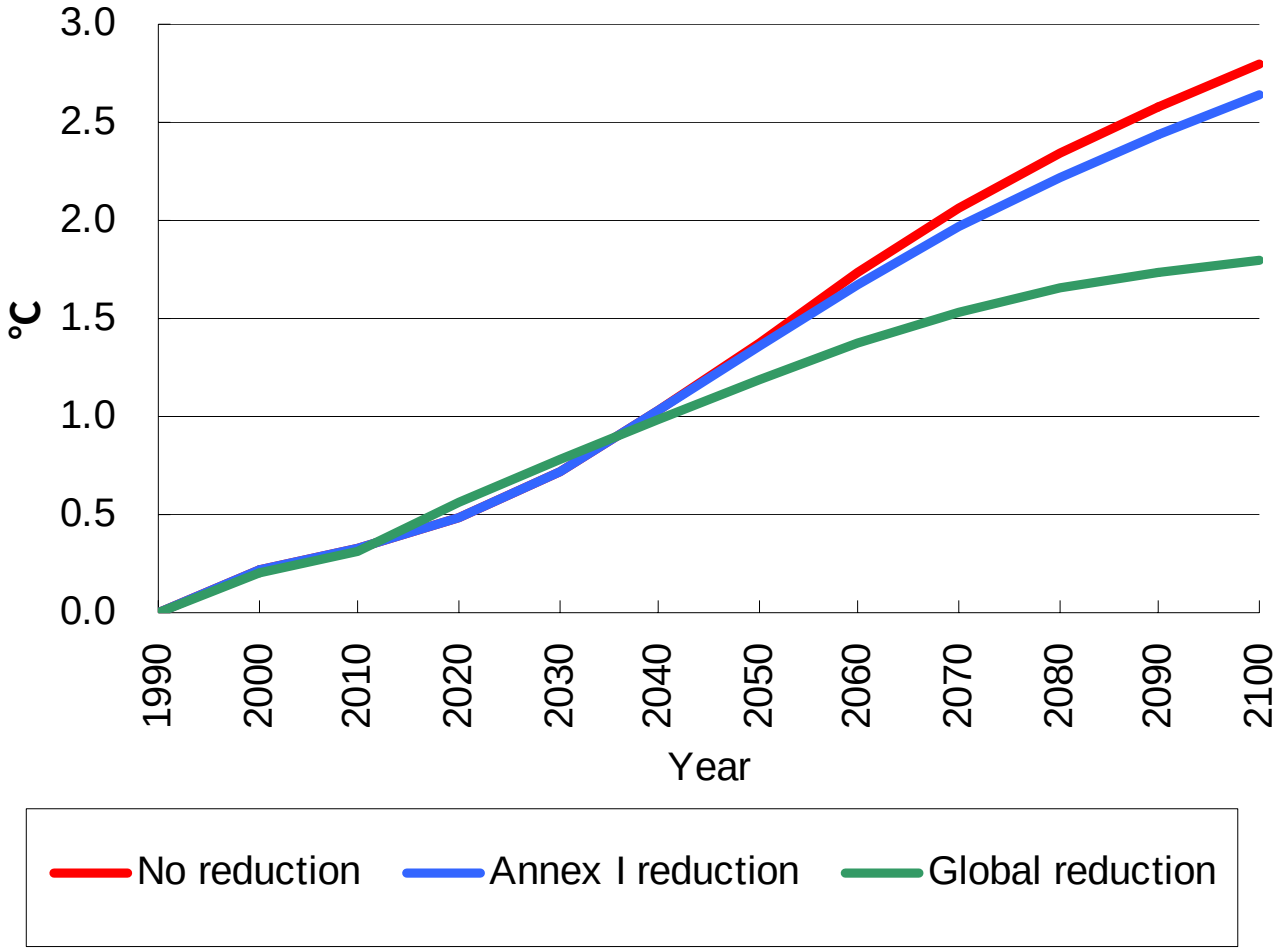
Simulation results

CO_2 emissions (scenarios with climate change impact)

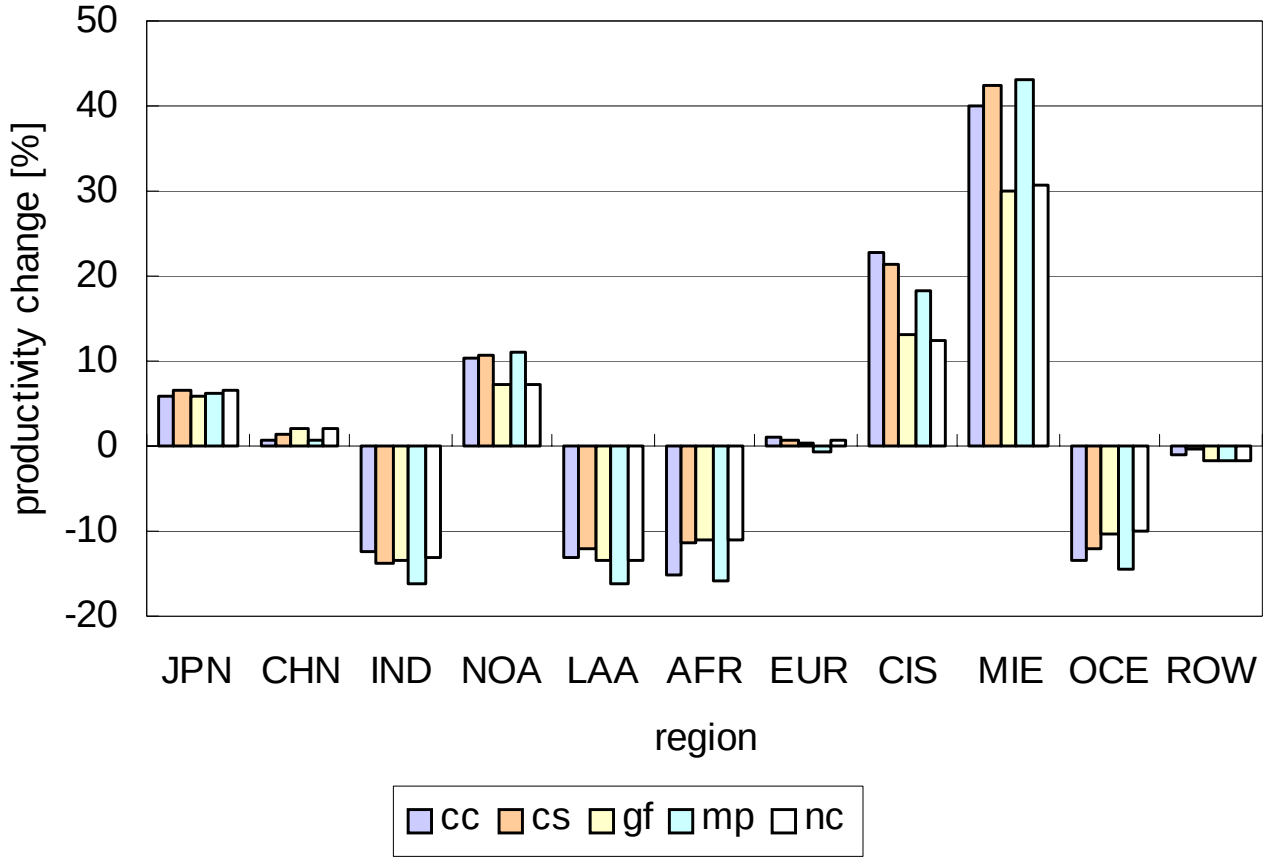


Global mean temperature change

(scenarios with climate change impact)



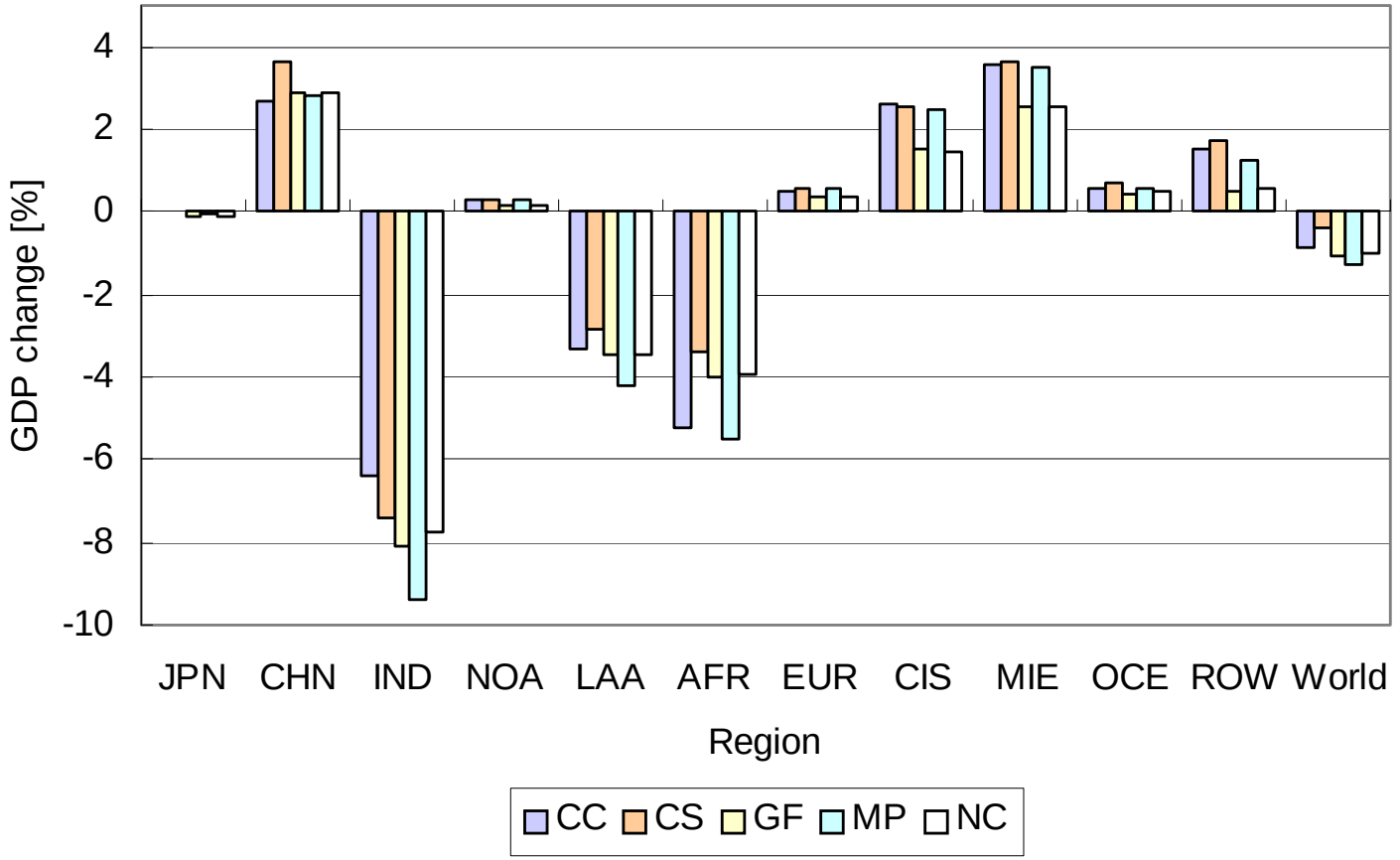
Productivity change (rice, wheat & maize) in 2100 in No reduction scenario



based GCM
cc: CCCma
cs: CISRO
gf: GFDL
mp: Max Planck
nc: NCAR

GDP change in 2100 due to crop productivity change in No reduction case

(compared with no climate change scenario)



pased GCM
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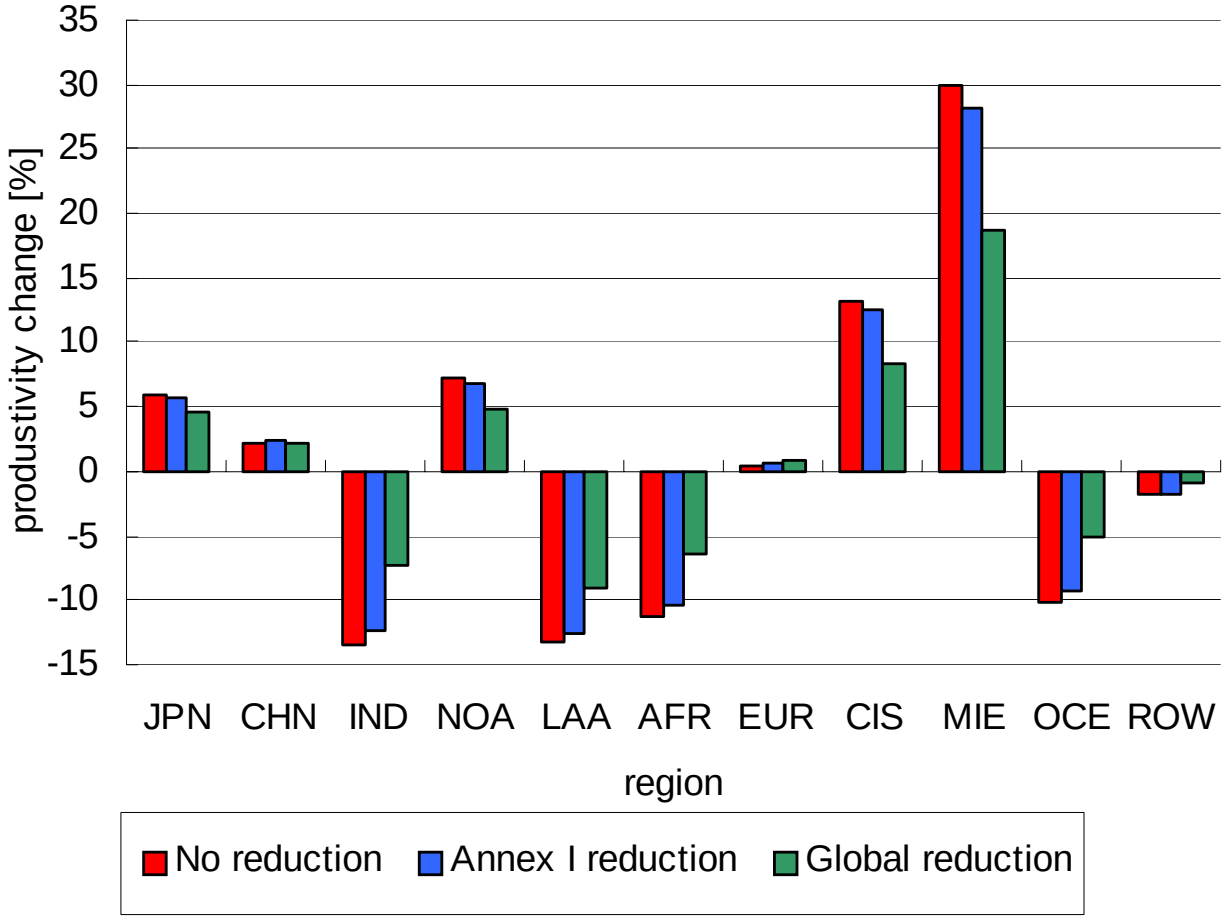
Agricultural productivity change in 2100 by scenarios

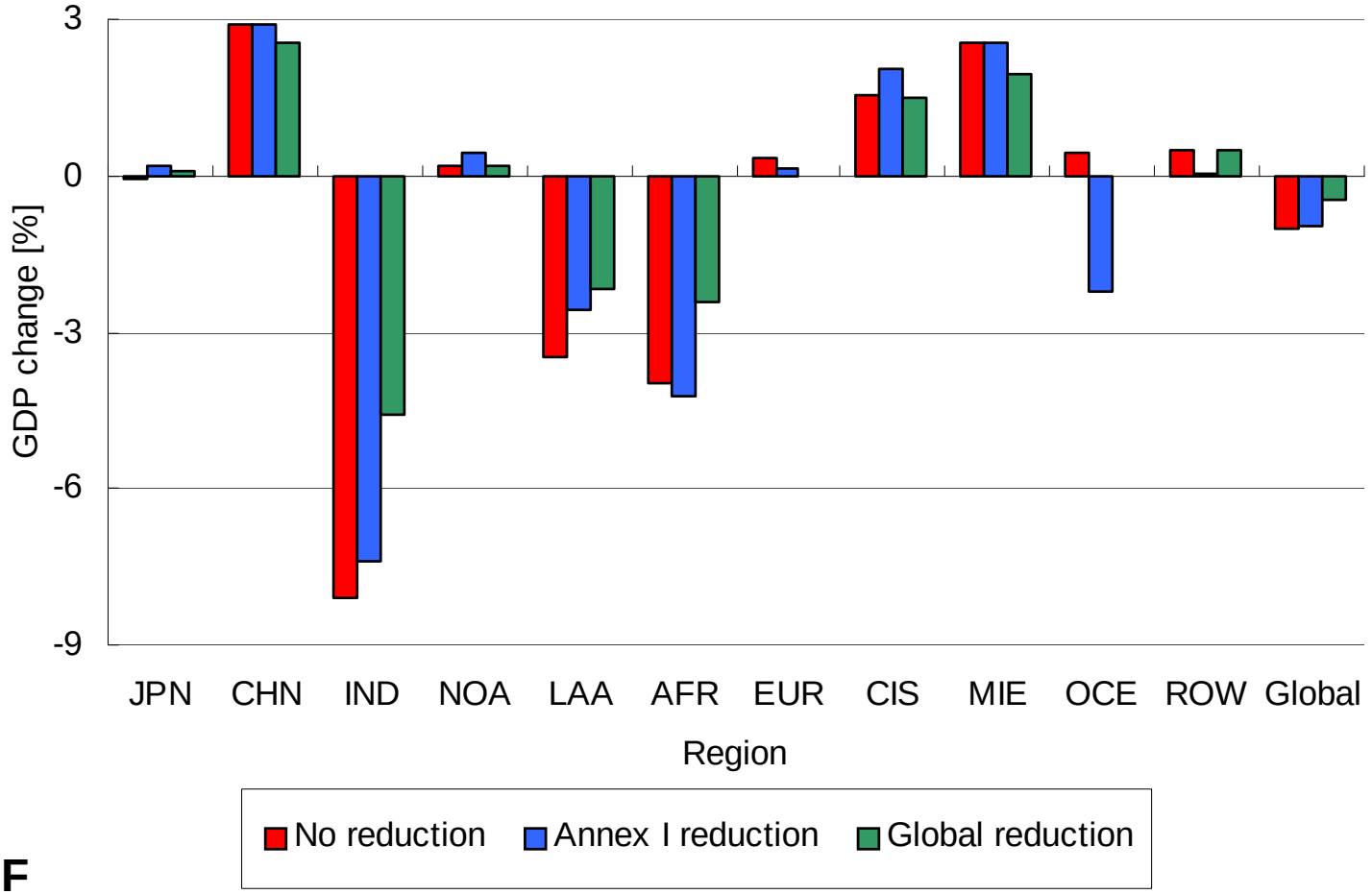


based GCM: GF

Simulation results

GDP change in 2100 by scenarios

(compared with no climate change scenarios)



based GCM: GF

Conclusions

- **In the case of no reduction case, productivity change of rice, wheat and maize will decrease global GDP by about 1% in 2100, although regional impact will be divergent.**
- **Especially in South Asia, Africa, Latin America and Oceania, crop productivity and GDP will decrease drastically.**
- **By participation of developing countries in CO_2 reduction, GDP loss in South Asia, Africa and Latin America will be mitigated by about 40% in 2100.**

- **Climate impact module is applied to AIM/Ecosystem model.**