Japanese efforts on climate change research for IPCC AR4

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4: National Institute for Environmental Studies (NIES)

Japanese main groups for IPCC AR4

- **CCSR/NIES/FRSGC**
- Meteorological Research Institute (MRI), Japan Meteorological Agency

CCSR/NIES/FRSGC GCM in IPCC

Specifications of CCSR/NIES/FRSGC GCM

IPCC TAR

Atmosphere: T21L20

Ocean: 2.8°×2.8°, L17

Aerosols: off-line SPRINTARS
(direct and indirect effects)

Computer: NEC SX-4 (NIES)

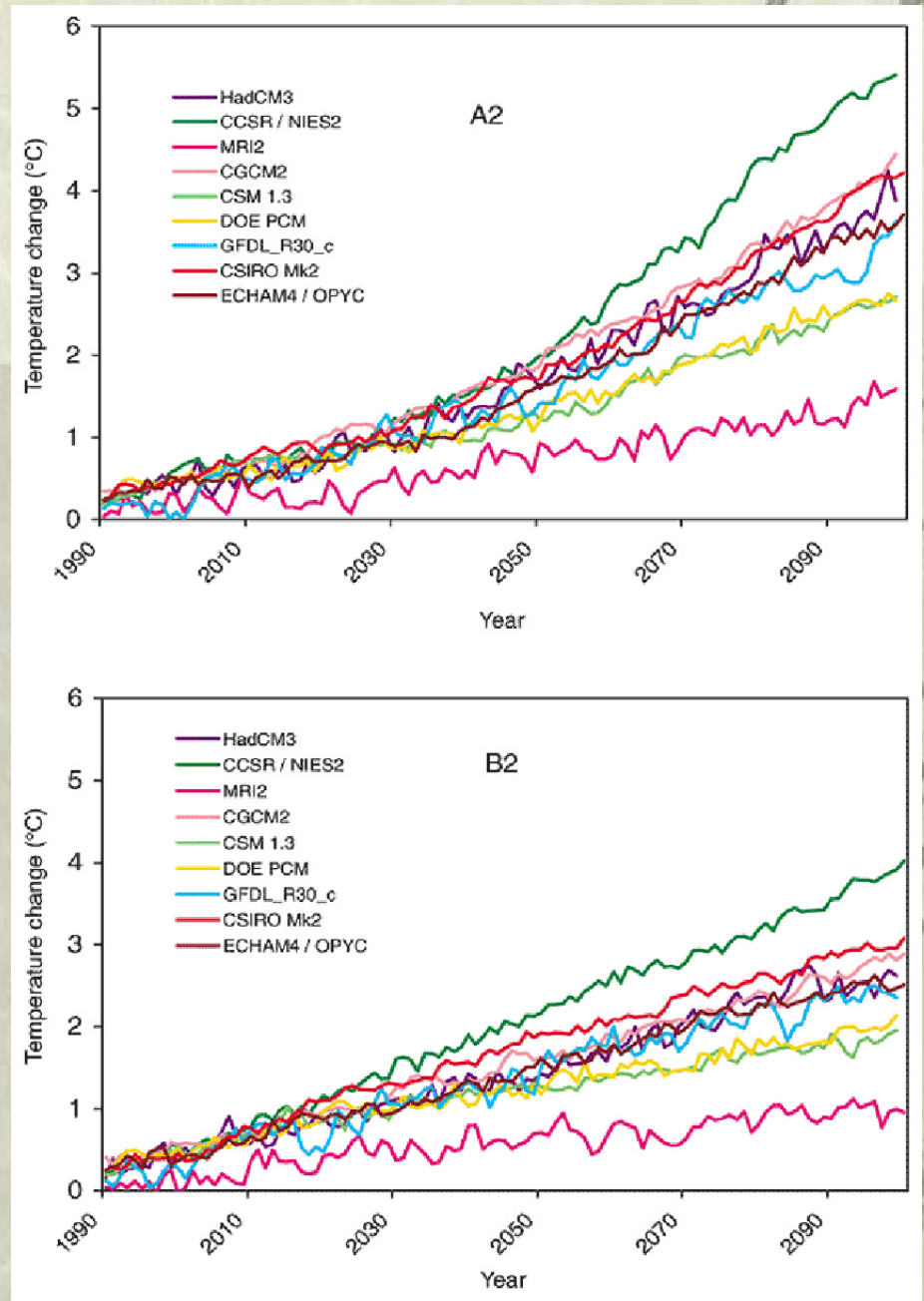
IPCC AR4

Atmosphere: T106L56/T42L20

Ocean: 0.25°×0.17°, L48/1.4°×0.5-1°, L43

Aerosols: on-line SPRINTARS
(direct and indirect effects)

Computer: Earth Simulator



Time evolution of the globally averaged temperature change relative to the years (1961 to 1990) of the SRES simulations A2 (top) and B2 (bottom) (*IPCC Third Assessment Report*).

Kyousei (共生) Project

Human, Nature, Earth Co-living Project (Kyousei Project)

managed by Ministry of Education, Culture, Sports, Science and Technology of Japan

Mission on the Japanese model for predicting global warming

- Practical use of the high-resolution ocean-atmosphere general circulation model (K-1)
- Development of the integrated earth system model (K-2)
- Development of advanced parameterizations for atmospheric and oceanic physical processes
- …

→ **Aiming to contribute toward the IPCC AR4 by reliable prediction of global warming.**

K-1

The CCSR/NIES/FRSGC Coupled Ocean-Atmosphere GCM: *MIROC 3.1*

C20c experiment by mid-resolution MIROC

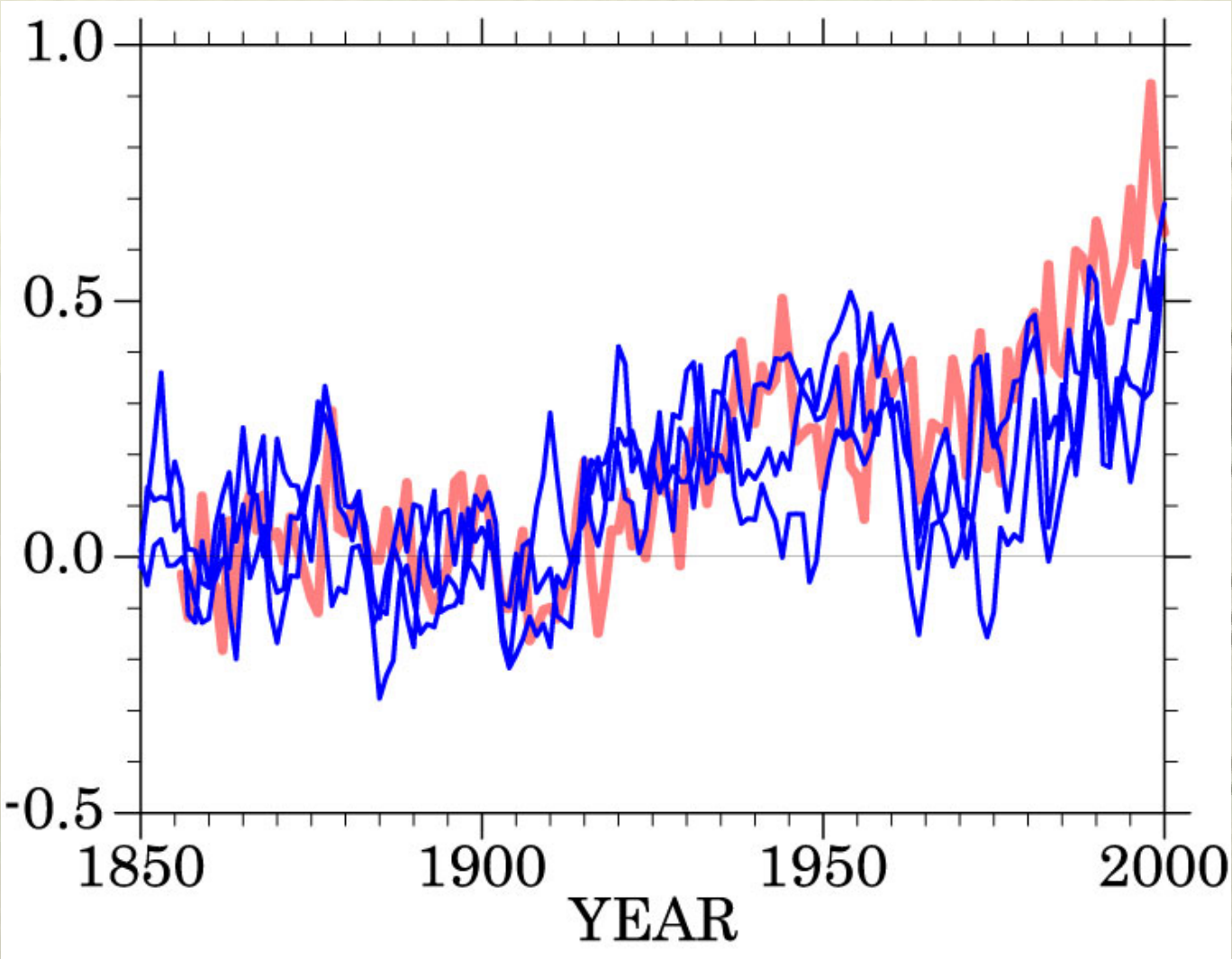
- **Atmosphere:** Spectral T42 (280km) and 20 levels
- **Ocean:** Grid 1.4°x 0.5 - 1.0° and 43 levels
- **Ice:** Semtner 0-layer thermodynamics + EVP rheology
- **Land:** MATSIRO SVATS model
- **River:** TRIP river routing model
- **Aerosols:** on line calc. w/ simplified SPRINTARS

» **No flux correction applied**

➢ **Natural forcings**
  - ✓Solar variability (Lean et al., 1995)
  - ✓Volcanic aerosols in the stratosphere (Sato et al., 1993)
  - ✓Terpene and continuous volcanic eruptions
  - ✓Soil dust and sea salt calculated inside the model

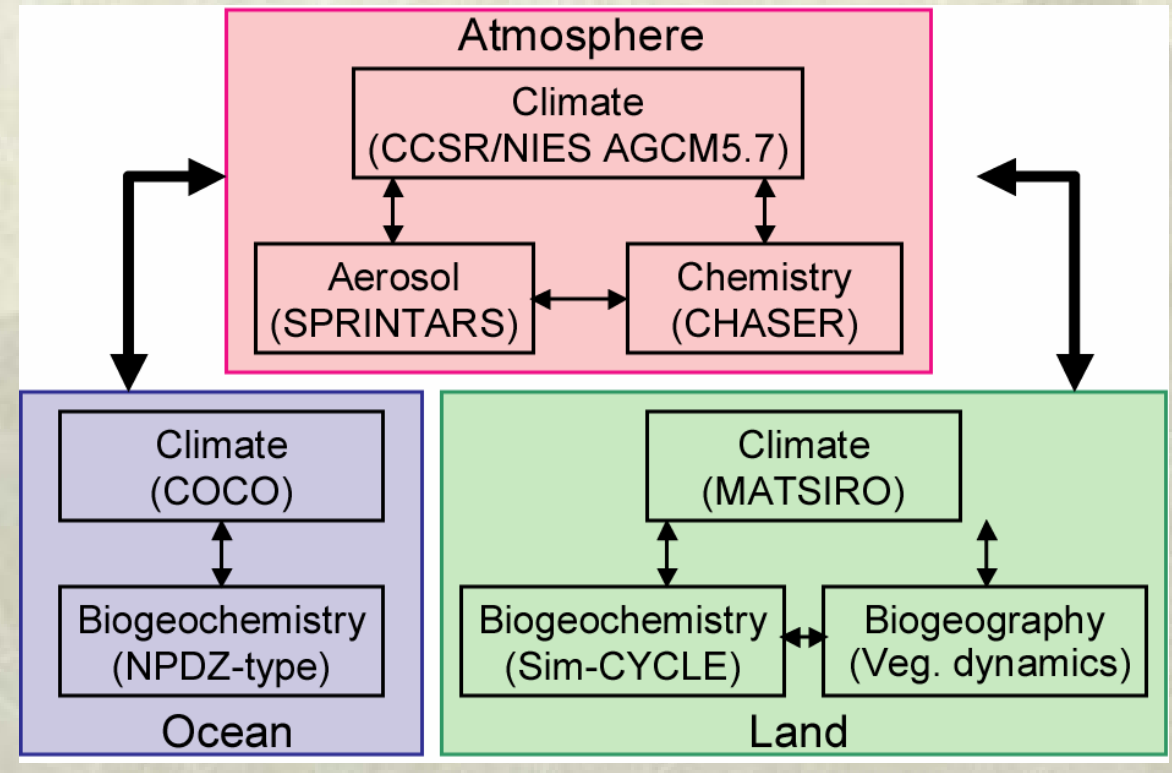
➢ **Anthropogenic forcings**
  - ✓Well-mixed greenhouse gases
  - ✓Stratospheric ozone depletion
  - ✓Tropospheric ozone increase
  - ✓Sulfate aerosols due to fossil fuel use
  - ✓Carbonaceous aerosols due to fossil fuel combustion, agricultural waste burning, fuelwood consumption, and forest fires

K-1



Change in surface air temperature from 1850 to 2000 by the observation (red) and the simulation (blue).

Kyousei Integrated Synergetic System Model of the Earth (KISSME)



Atmosphere: coupling of the full-chemistry (CHASER) model with SPRINTARS.

CHASER (Chemical AGCM for Study of Atmospheric Environment and Radiative Forcing)

Sudo et al. (J. Geophys. Res., 107, 2001JD001113/2001JD001114, 2002)

53 chemical species; 139 chemical reactions (gas, liquid, heterogeneous)