

# Modeling groups' perspectives on CMIP6: Japan (Team MIROC & MRI)

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# CMIP5 Models from Japan

Model	Resolution	Physics pkg/ Schemes (relative to CMIP3)	Carbon/ Chemistry	Purpose
MIROC4	Low/High	Old	No	Near-term
MIROC-ESM(- CHEM)	Low	Old	Yes	Long-term
MIROC5	Medium	New	No	Near-term Long-term
MRI-AGCM3.2	Very high, High	New	No	Time Slice
MRI- CGCM3(ESM1)	Medium	New	No(Yes)	Near-term Long-term

Blue: Team MIROC (AORI(UT)/JAMSTEC/NIES), Red: MRI

Low: 280km(A)+0.5-1deg(O), High: 60km(A)+1/4-1/6(O)

Med: 130km(A)+0.5-1deg(O), Very high: 20km,L64(Atm.only)

# Schemes in old/new MIROCs

MIROC3

MIROC5

Atmos.	Dynamical core	Spectral+semi-Lagrangian (Lin & Rood 1996)	Spectral+semi-Lagrangian (Lin & Rood 1996)
	V. Coordinate	Sigma	Eta (hybrid sigma-p)
	Radiation	2-stream DOM 37ch (Nakajima et al. 1986)	2-stream DOM 111ch (Sekiguchi et al. 2008)
	Cloud	Diagnostic (LeTreut & Li 1991) + Simple water/ice partition	Prognostic PDF (Watanabe et al. 2009) + Ice microphysics (Wilson & Ballard 1999)
	Turbulence	M-Y Level 2.0 (Mellor & Yamada 1982)	MYNN Level 2.5 (Nakanishi & Niino 2004)
	Convection	Prognostic A-S + critical RH (Pan & Randall 1998, Emori et al. 2001)	Prognostic AS-type, but original scheme (Chikira & Sugiyama 2010)
	Aerosols	simplified SPRINTARS (Takemura et al. 2002)	Full SPRINTARS + prognostic CCN (Takemura et al. 2005, 2009)
Land/ River		MATSIRO+fixed riv flow	new MATSIRO+variable riv flow
Ocean		COCO3.4	COCO4.4
Sea-ice		Single-category EVP	Multi-category EVP

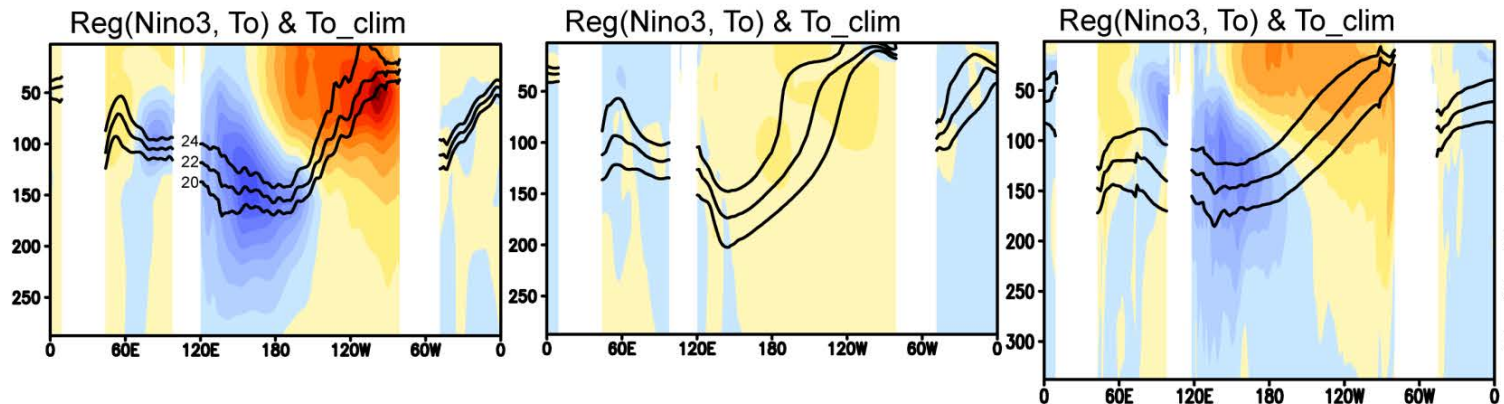
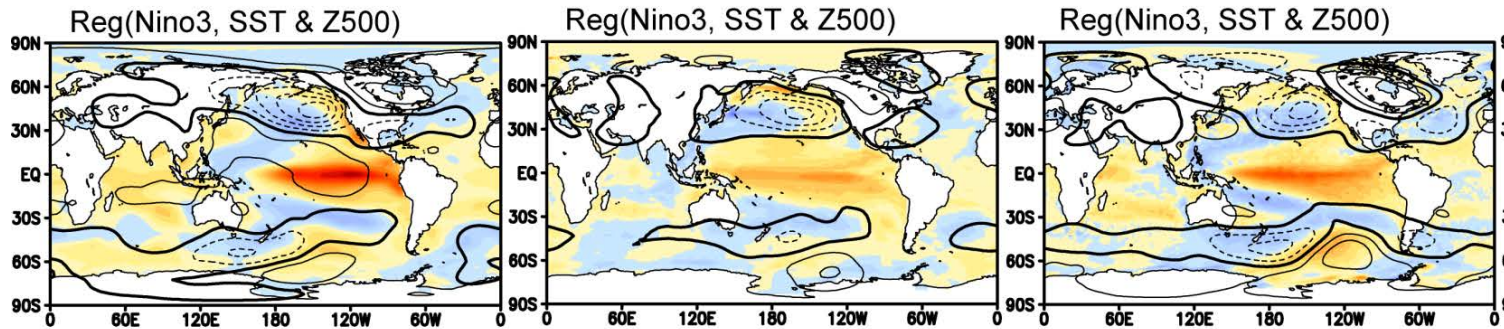
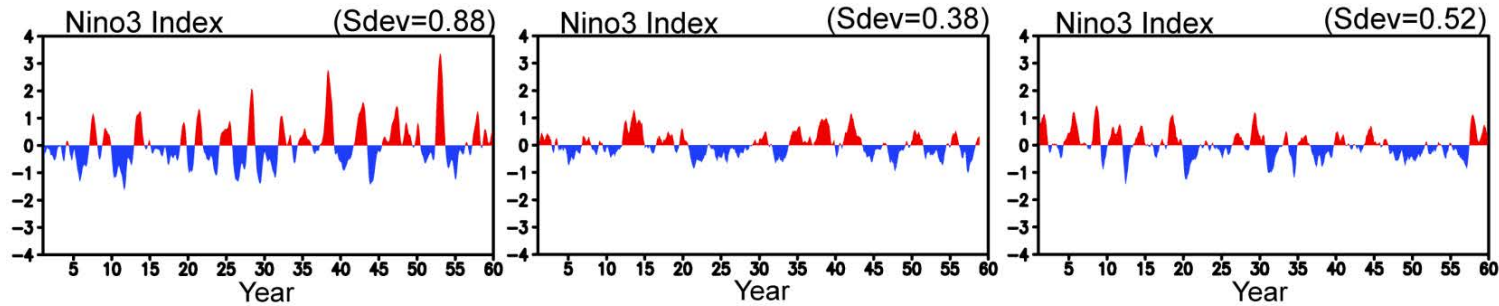
# ENSO in obs and MIROC family

Obs.

(ProjD\_v6.7 & ERA40)

MIROC3. T42

MIROC4. T213



Courtesy of M Kimoto

# Plans

- MIROC-ESM
  - Atmosphere: T85 for long-term, T42 for paleo experiments
  - Ocean: tripolar, ~100km resolution
  - Nitrogen cycle for terrestrial biosphere (possibly DGVM)
  - Iron cycle for ocean
- MIROC5
  - Atmosphere: T85, shallow convection
  - Ocean: tripolar, 100km resolution,
  - EnKF data assimilation system
  - Maybe extended to T213, maybe not...
- MRI
  - Time Slice (atmosphere only)
    - 20km resolution, steady improvements
  - ESM
    - Atmosphere: TL159(120km)
    - Ocean: tripolar, 1deg. x 0.5deg.
    - Steady improvements



**SOUSEI** Program for Risk Information  
on Climate Change

気候変動リスク情報創生プログラム

FY 2012-2016

Budget: ~8m\$/y

**A. Prediction and diagnosis of imminent global climate change (PI: M. Kimoto, U. of Tokyo)**

*D/A, E/A, Seamless Prediction, Climate Sensitivity, Data Assimilation*

**B. Climate change projection contributing to stabilization target setting (PI: M. Kawamiya, JAMSTEC)**

*Climate Scenario, Earth System Model, Tipping Element, Geo-engineering*

**C. Development of basic technology for risk information on climate change (PI: I. Takayabu, MRI)**

*Dynamical and Statistical Downscaling, High-res GCM*

**D. Precise impact assessments on climate change (Kyoto U.)**

*Weather, Water, Coastal Disasters, Water Resource, ecosystem ...*

**E. Promotion office for climate change research and linkage coordination (PI: M. Kawamiya, JAMSTEC)**

Supported by MEXT



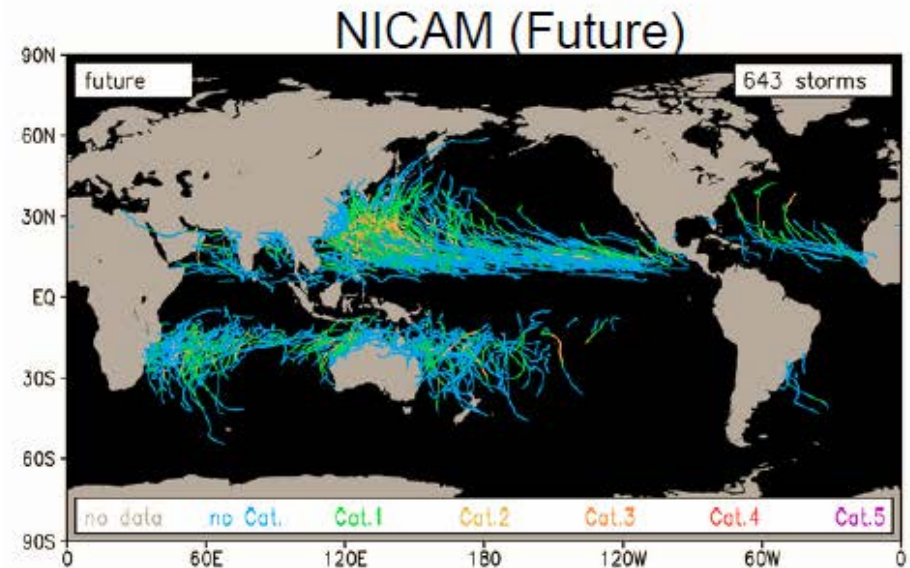
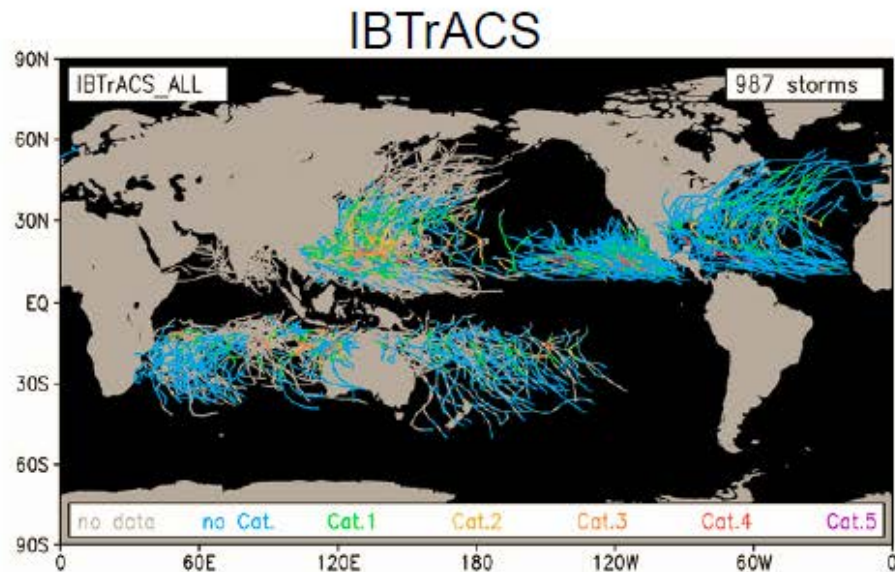
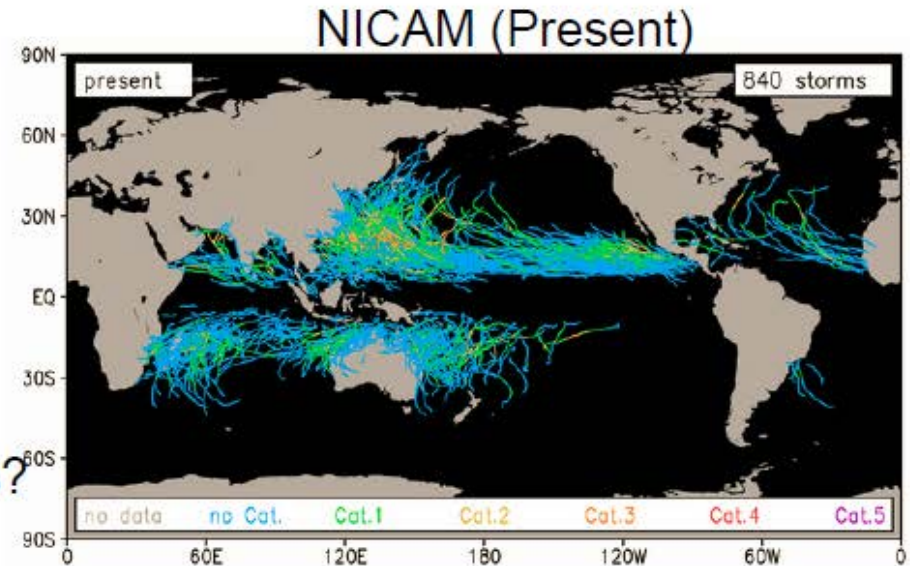
文部科学省

MINISTRY OF EDUCATION,  
CULTURE, SPORTS,  
SCIENCE AND TECHNOLOGY-JAPAN

# NICAM coming in for time slice?

## Global non-hydrostatic model (NICAM) simulation

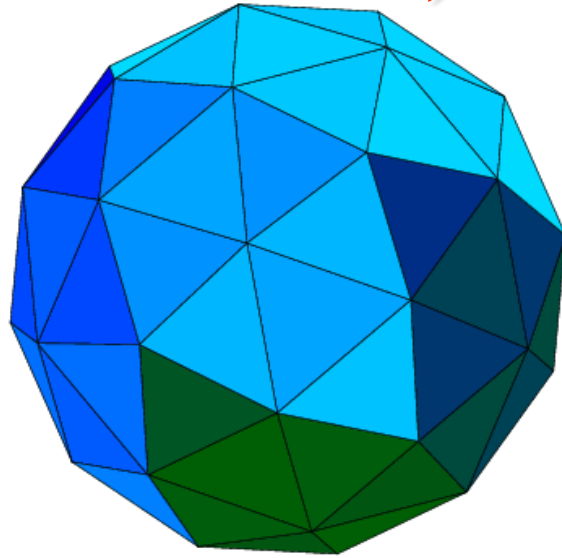
- 9yr runs w/ 14km resolution
- Frequency -23%
- Intensity +2.2%
- Within the range of current estimate,  
but could it tell us change in the genesis?



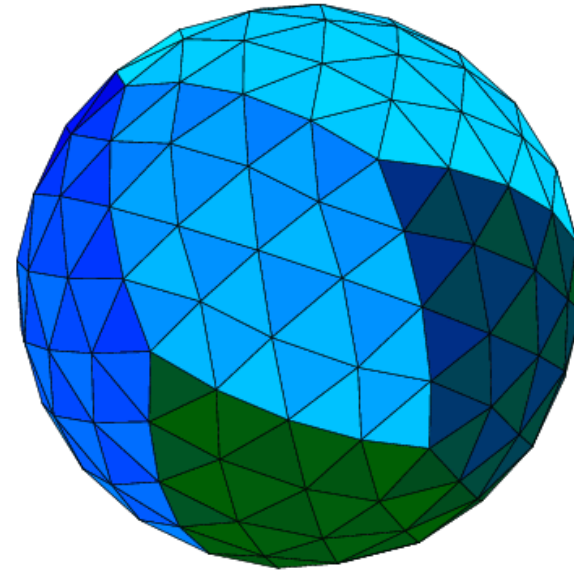
Courtesy of Y Yamada

# Grid system for NICAM (Non-hydrostatic Icosahedral Atmospheric Model)

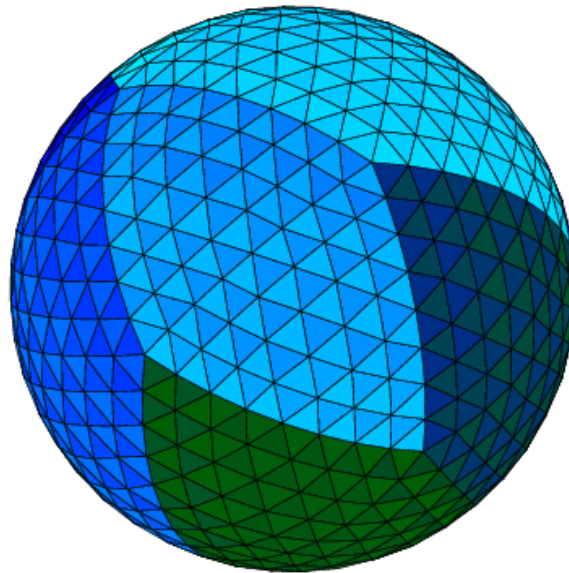
**G-level 1 (one-time division)**



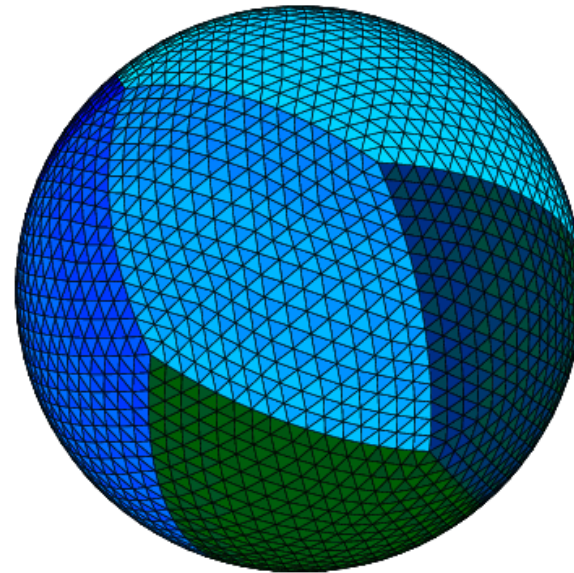
**G-level 2**



**G-level 3**



**G-level 4**



# Earth Simulator and the K(京) Computer

	Total Peak Performance (Tflops)	Total main memory (Tbyte)	Peak Performance / CPU (Gflops)	Total number of CPUs
Earth Simulator (JAMSTEC)	131	20	102.4 (single core)	1280
K Computer (Riken)	10,620	1,260	128 (16x8cores)	88,128



Earth Simulator II: “medium” size simulations such as CMIP experiments, to be updated by 2015



K Computer: ambitious, gigantic size simulations such as global cloud resolving runs with 400m mesh

# CMIP5 Survey

- 9. Model and experiment documentation
  - METAFOR: hard to understand, not user-friendly?
- 10. Data search and support
  - Japan node is maintained by a project base funding (DIAS), coming to an end in a couple of years (likely to be continued, but not guaranteed).
  - It is unclear how we can contribute to the CMIP6 data dissemination system, though we are trying to figure it out.
- 11. Timeline
  - Variable definitions have been changed during the course of model integration.
  - RCP & forcing data late -> we had to create our own forcing data due to some funding reasons -> forcing diversity

# Suggestions for CMIP6

- New MIPs are coming in. Importance, time-consumingness of details should be well conveyed.
- Some of the newly proposed MIPs could work closely, e.g., LUMIP & ScenarioMIP (& CCMI, D&A).
  - Maybe helps secure scientific significance of scenaioMIP?
  - Community including LU, scenario & climate modeling is now starting to form...
- WGCM Infrastructure Panel
  - Someone from Team MIROC or DIAS?
- Continuity of scenario experiments, i.e., RCP8.5 & “High” scenario, should be kept in mind.