

Group Reports: Japan
(Team MIROC, NICAM & MRI)

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Lineup of Japanese models for CMIP6

	MIROC6- CGCM	MIROC- ESM2	NICAM	MRI- ESM1.2	MRI- AGCM3.2	NHRCM
Resolution (Atm.)	140km and 60km	280 and 140km	14, 28, 56km	120km	14km (or 20km)	O(5km)
Resolution (Ocean)	1deg. X 0.25-0.5deg.	1deg. X 0.5-1deg.	n.a.	1deg. X 0.3-0.5de g.	n.a.	n.a.
Top	0.004hPa	0.004 and 3hPa	40 or 50km	0.01hPa	0.01hPa	
Biogeo- chemistry	No	Yes	No	Yes	No	No
Institutions	AORI/UT, JAMSTEC, NIES	JAMSTEC, AORI/UT, NIES	AORI/UT, JAMSTEC, RIKEN	MRI	MRI	MRI
DECK runs start in...	Nov. - Dec., 2016	early 2017	(*)	Jan., 2017	(*)	n.a.

(*) Models for HighResMIP may not cover all the DECK experiments.

Participation in endorsed MIPs

	Short name of MIP	MIROC6-CGCM	MIROC-ESM	NICAM	MRI-ESM1.2	MRI-AGCM3.2	NHRCM
1	AerChemMIP	0	1	0	1	0	0
2	C4MIP	0	1	0	1	0	0
3	CFMIP	1	0	1	1	0	0
4	DAMIP	1	0	0	1	0	0
5	DCPP	1	0	0	1	0	0
6	FAFMIP	1	0	0	1	0	0
7	GeoMIP	0	1	0	1	0	0
8	GMMIP	1	0	0	0	0	0
9	HighResMIP	1	0	1	1	1	0
10	ISMIP6	0	1	0	1	0	0
11	LS3MIP	0	0	0	1	0	0
12	LUMIP	0	1	0	0	0	0
13	OMIP	1	1	0	1	0	0
14	PMIP	0	1	0	1	0	0
15	RFMIP	1	0	0	0	0	0
16	ScenarioMIP	1	1	0	1	0	0
17	VolMIP	0	1	0	1	0	0
18	CORDEX	0	0	0	1	0	1
19	DynVar	1	1	1	1	0	0
20	SIMIP	1	1	0	1	0	0
21	VIAAB	1	1	0	0	0	0
		12	12	3	17	1	1

Model improvements (1): examples from MIROC6 (Update from MIROC5)

AGCM (T85L81)

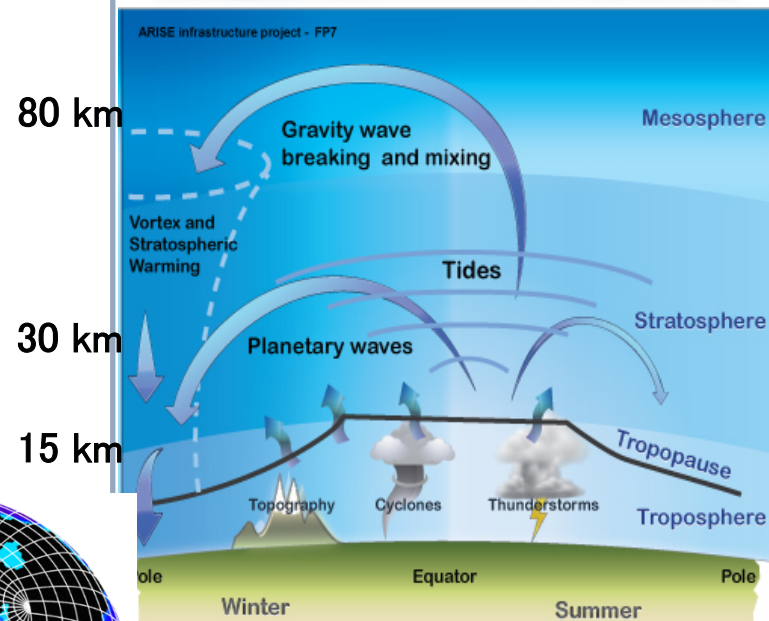
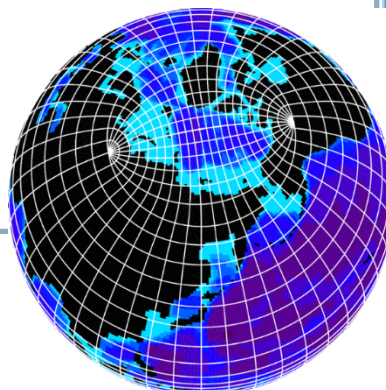
- Shallow convection
- High-Top TOA (3hPa → 0.004 hPa)
- SOA, Oceanic organic Aerosol
- Scattering by non-spherical cloud ice
- Non-orographic GWD
- modified CMT, water leak fixed, etc.

OGCM

- Higher resolutions (1.4°L50 → 1°L63)
- Tripole coordinate
- Improved TKE estimate under sea-ice

Land Surface Model

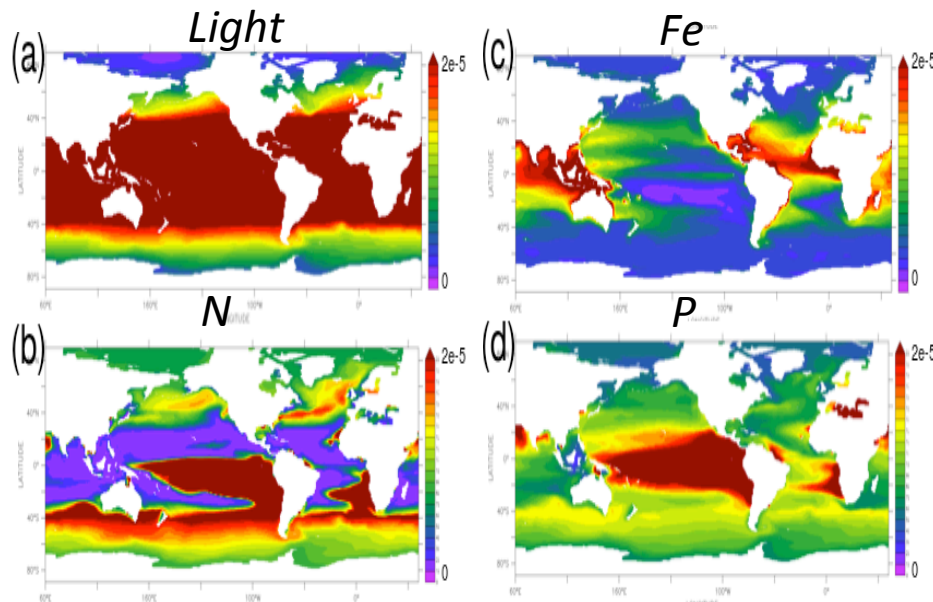
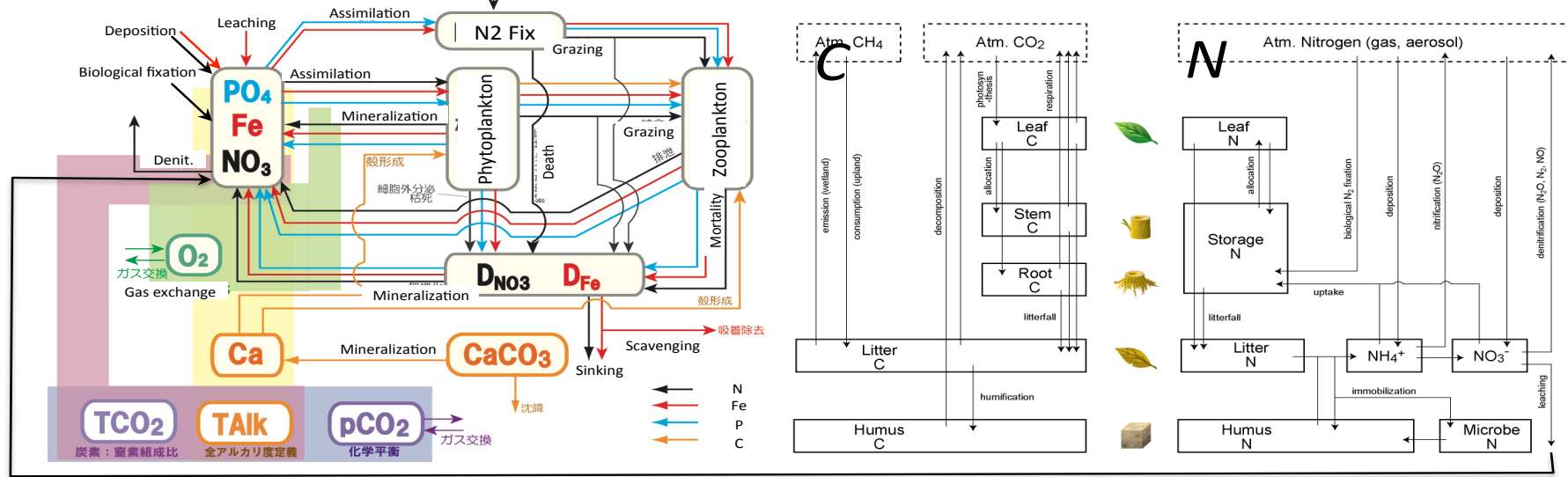
- Subgrid snow cover distribution
- Wet land due to snow melting



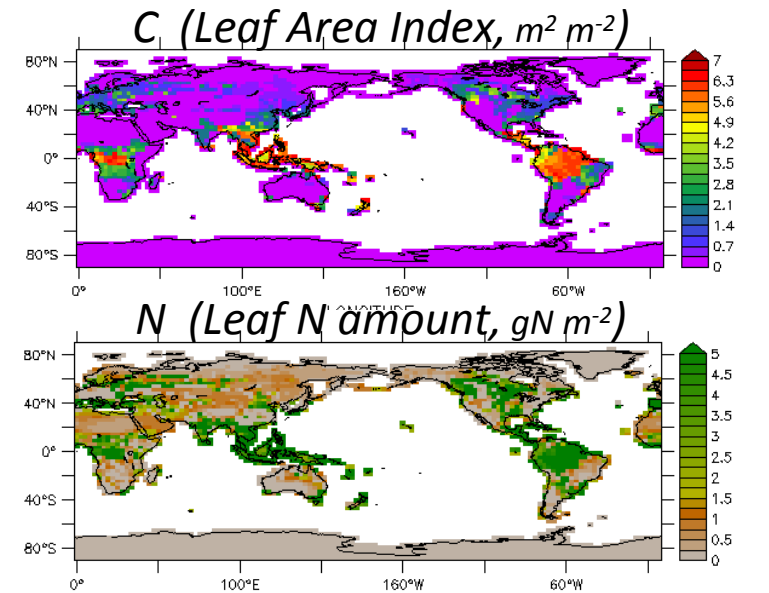
(ARISE Infrastructure Project)

Model improvements (2) Biogeochemical processes in the ESMs

OCEAN: N, Fe, P, & O cycles control C dynamics **LAND:** N & Hydro. cycle controls C dynamics



Dependency of phytoplankton productivity on Light, Nitrogen, Iron, and Phosphorus: Annual mean in P.I. run



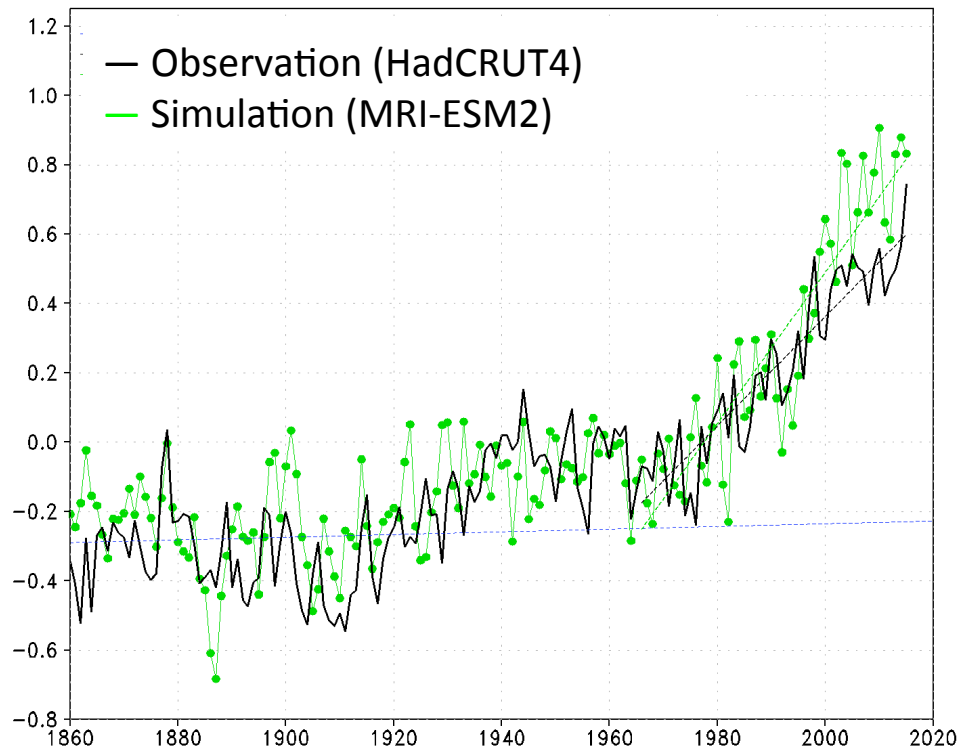
Leaf Area Index & Leaf Nitrogen Amount in Vegetation: Annual mean in P.I. run

Improved performance of MRI-ESM

Preliminary historical simulation By the MRI-ESM2 (concentration driven)
forced with CMIP5 forcing data
for 1850-2015 (historical + RCP4.5)

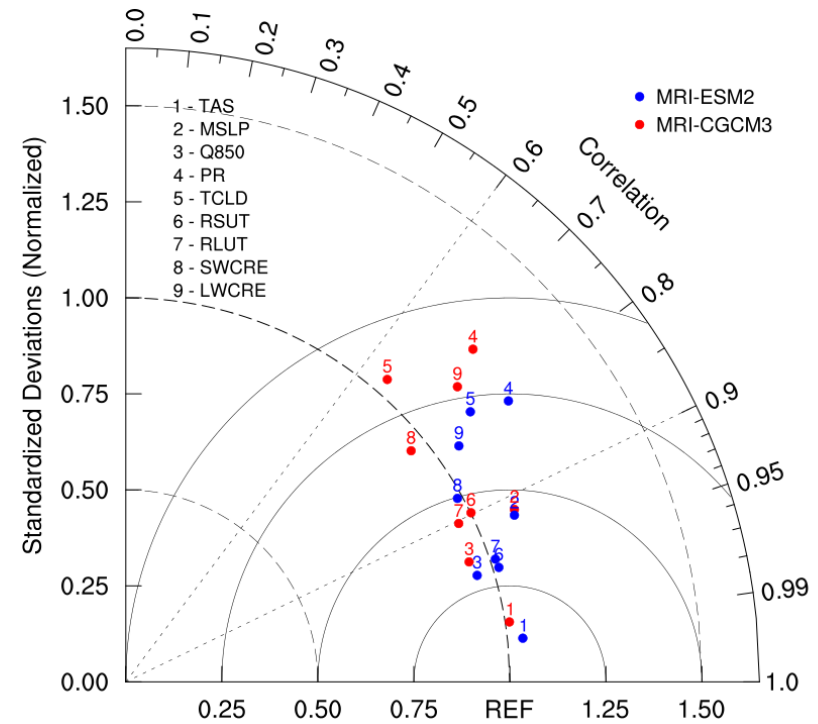
Global-mean SAT change

Anomaly relative to the 1961-1990 mean



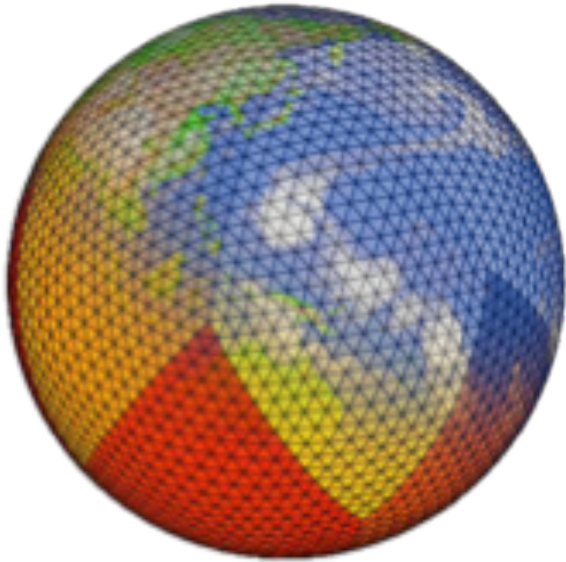
The interdecadal change is well reproduced

Taylor-diagram for present-day climate (1986-2005) of various fields

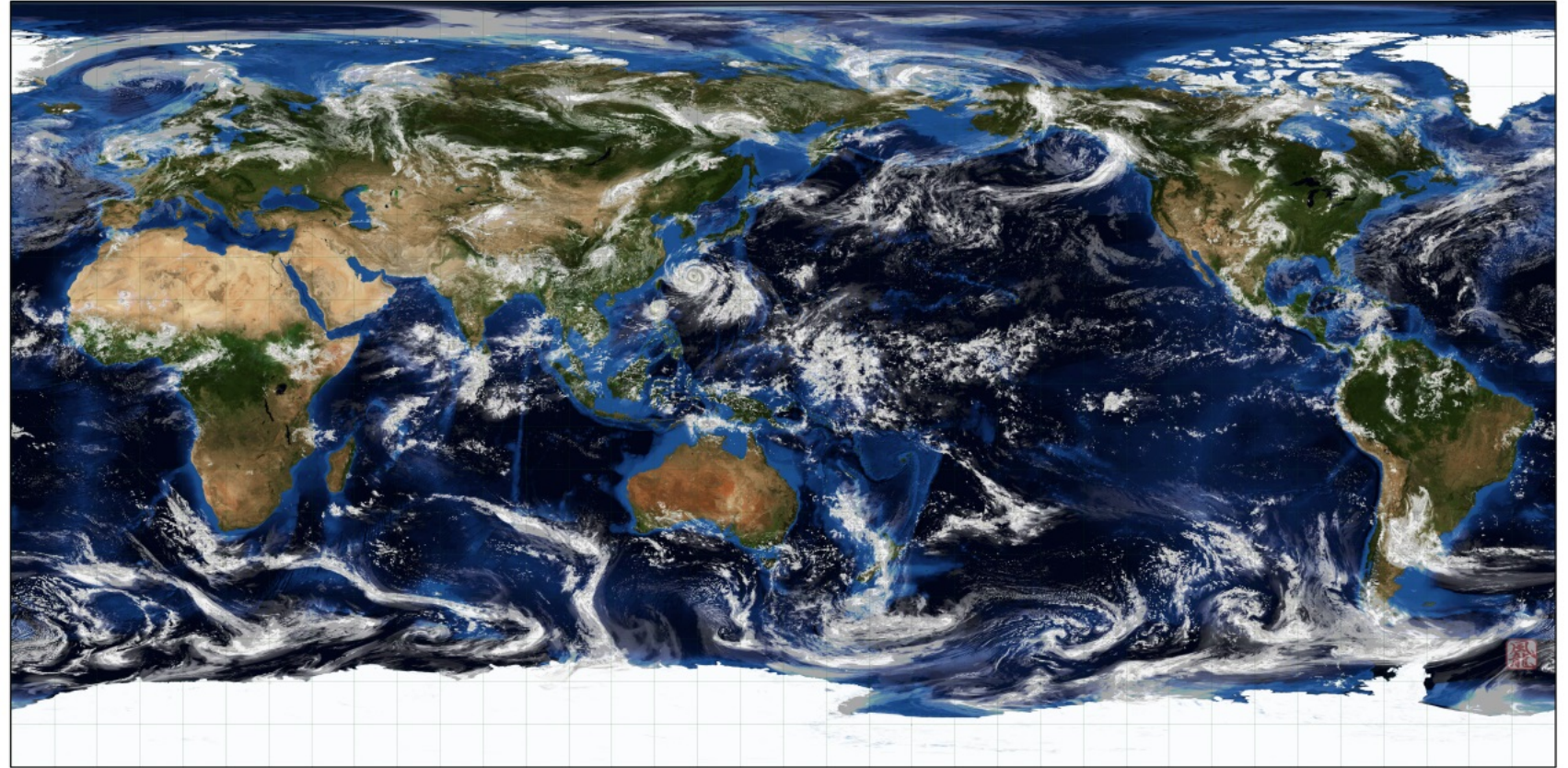


Overall performance is improved

NICAM: A global cloud resolving model



Icosahedral grid system



NICAM (Nonhydrostatic Icosahedral Atmospheric Model)
simulation with 870m resolution globally (Miyamoto et al. 2013)

Earth Simulator for most of the CMIP6 experiments

	Total Peak Performance (Pflops)	Total main memory (Tbyte)	Peak Performance / CPU (Gflops)	Total number of CPUs
Earth Simulator (JAMSTEC)	1.31	328	256 (4 cores)	5120
K Computer (Riken)	10.6	1,260	128 (16x8cores)	88,128



Earth Simulator: “medium” size simulations such as CMIP6 experiments. Operation started in March, 2015.



K Computer: ambitious, gigantic size simulations such as global cloud resolving runs with 870m mesh



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: ~6m\$/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

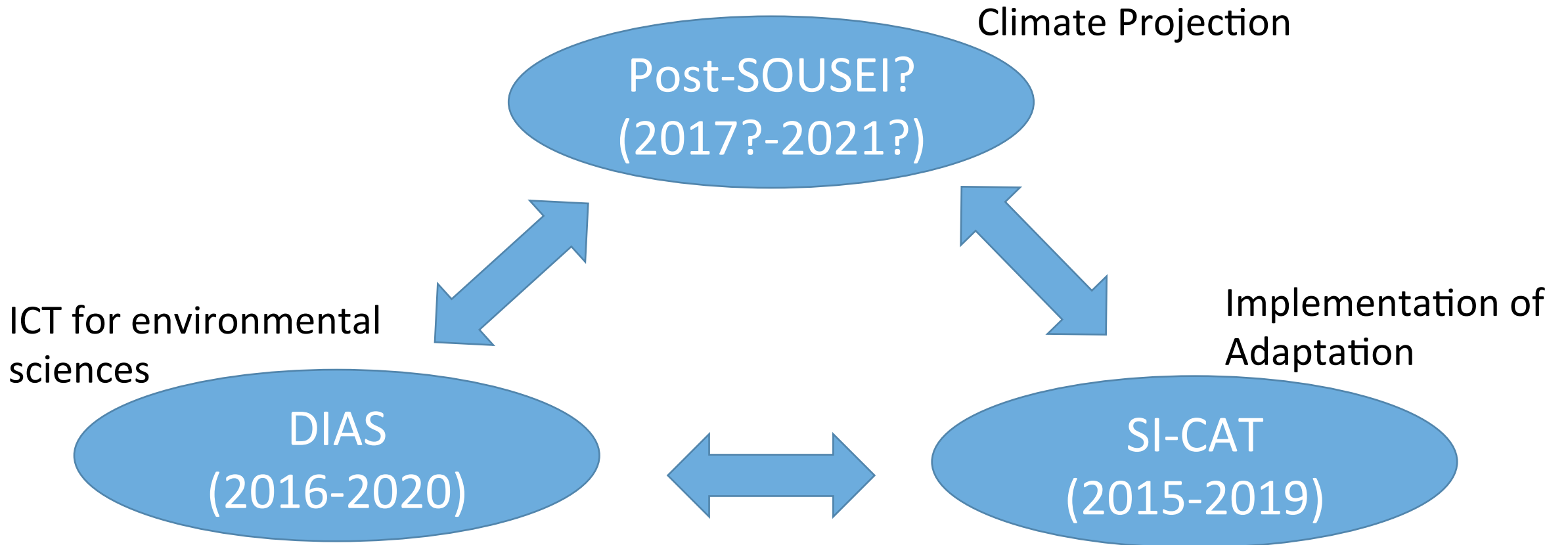
**D. Precise impact assessments on climate change (PI: E. Nakakita,
Kyoto U.)**

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

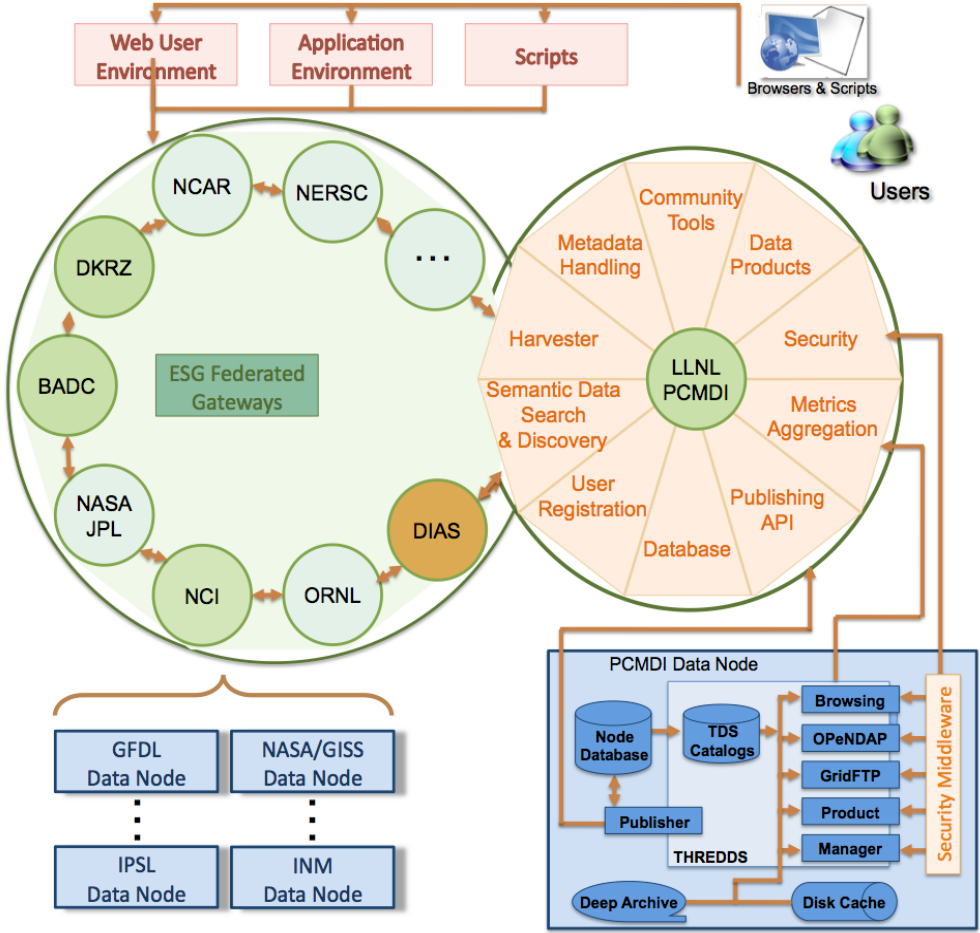
**E. Promotion office for climate change research and linkage
coordination (PI: M. Kawamiya, JAMSTEC)**

SOUSEI is coming to an end in March 2017. A follow-on program is likely to be established.

“Trinity” of global change research programs



DIAS for CMIP6



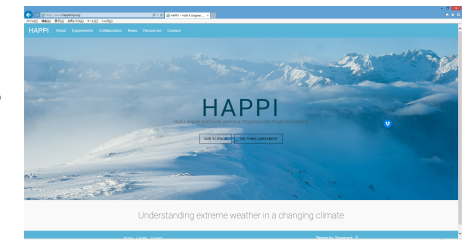
- DIAS has started its third phase and planning to contribute to ESG for CMIP6
- CDNOT Member from DIAS
 - Dr. T. Nemoto of U. Tokyo
- Mr. T. Inoue (RIST) is joining ESGF meeting this December to mediate ESGF and DIAS.
 - *RIST: Research Organization for Information Science and Technology

Responses for the 1.5°C trend



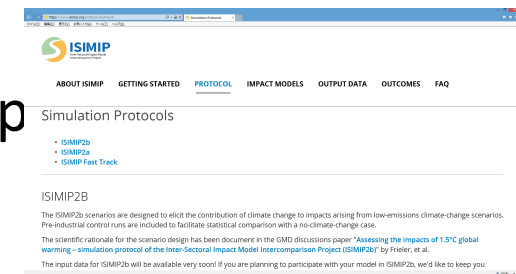
- HAPPI-MIP

- Half a degree Additional warming, Prognosis and Projected Impacts
- “Time” slice ensembles for +1.5°C and +2.0°C
- Participants: MIROC5; NCAR CAM4,5; HadGEMx; CanAM4 etc.

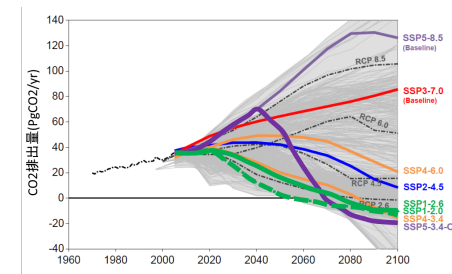


- Extension of RCP2.6 for ISI-MIP

- Warming projected by MIROC5 is close to 1.5oC
- ISI-MIP asked Team MIROC, among others, to extend RCP2.6 exp



- 1.5°C scenarios of scenarioMIP



O'Neil et al. (2016) GMDD

Summary

- Japanese models for CMIP6
 - MIROC family, NICAM, MRI models
 - With all the Japanese models combined, the endorsed MIPs are fully covered.
 - CMIP6 activities will be supported by a post-SOUSEI program
- Computer resource
 - The Earth Simulator (1.3PFlops) run by JAMSTEC, the K Computer (11PFlops) by RIKEN, plus MRI supercomputer
- Earth System Grid
 - Contribution via DIAS
 - An IT-oriented climate person will be mediating ESG and DIAS