ISAP2013@Pacifico Yokohama
Session: Adapting to Climate Change: Experience and Challenges for Asia

Projected Climate Change Impacts in Asia and Japan

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Center for Social and Environmental Systems Research
National Institute for Environmental Studies

Research gaps and hot topics of impact research

- Costs of inaction / benefits of climate policy
- Projections of impacts considering future socio-economic development
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- Communication of uncertainties in impact projections
- Economics of adaptation
- Detection and attribution of observed impacts

Large-scale (>$3mil./year) research projects on adaptation or related matters in Japan

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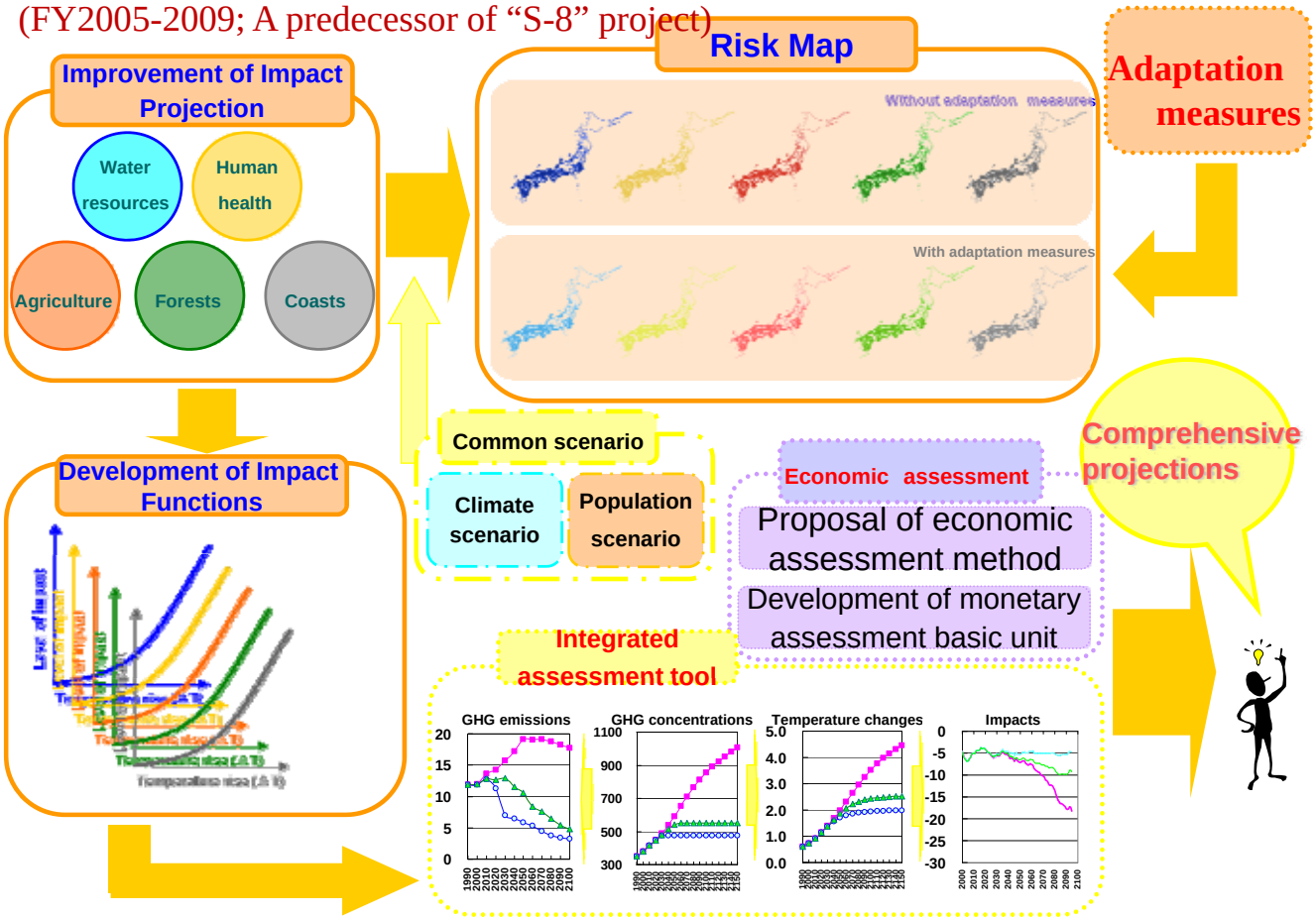
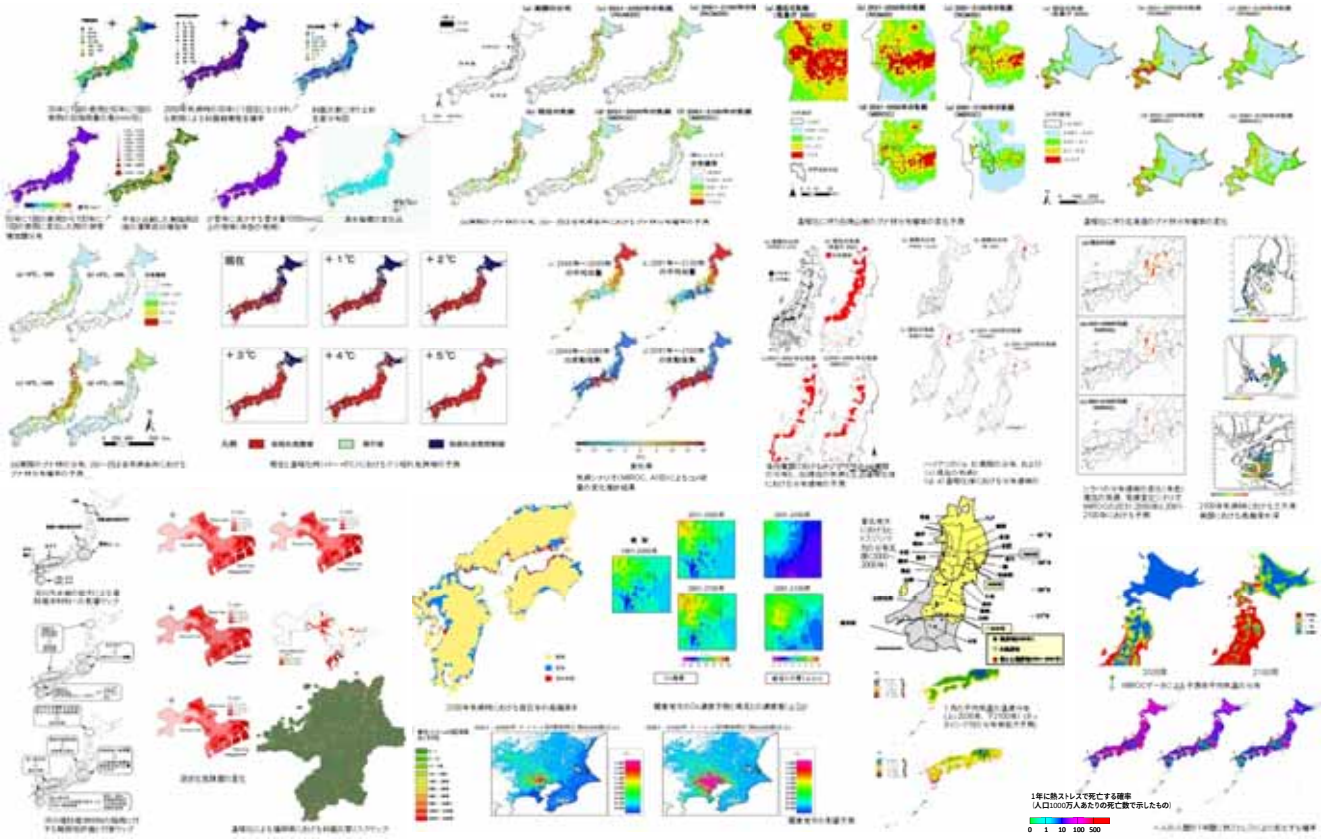
S-4: Comprehensive assessment of climate change impacts on sensitive sectors in Japan (FY2005-2009; A predecessor of "S-8" project)



Sectoral risk maps reported in S-4 project

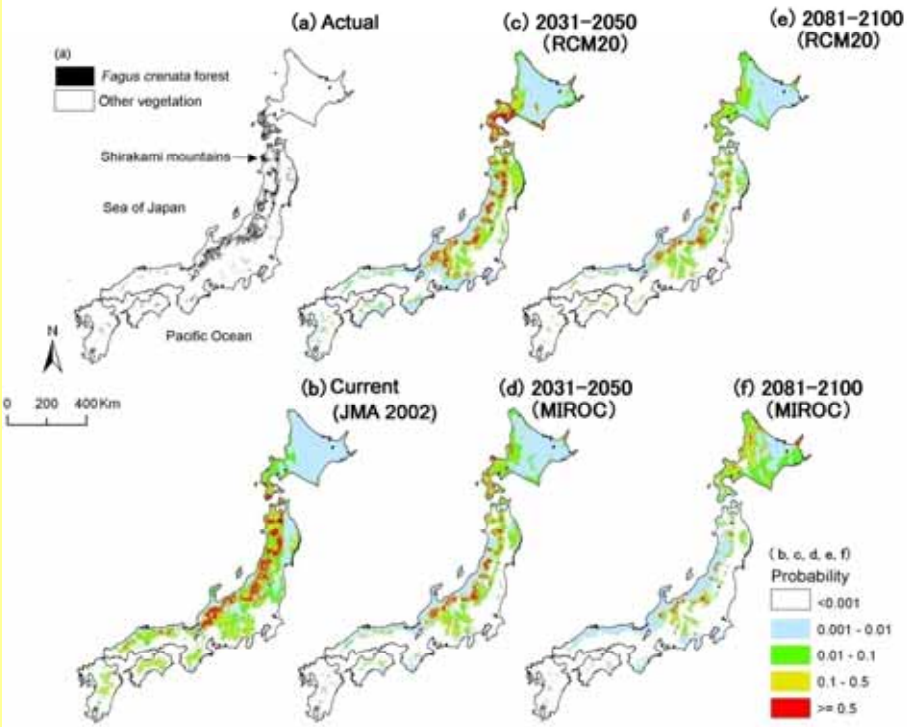
http://www.nies.go.jp/s4_impact/seika.html



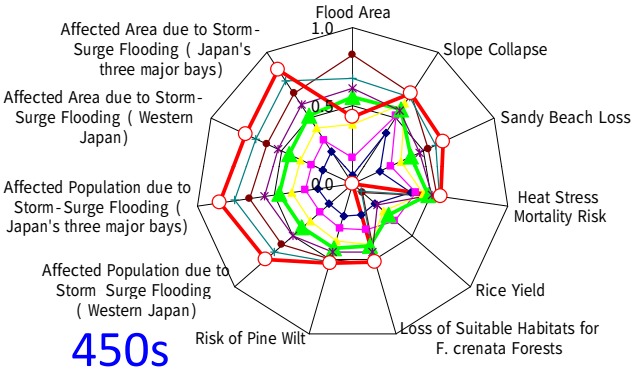
S-4 project: Impacts on Forest:

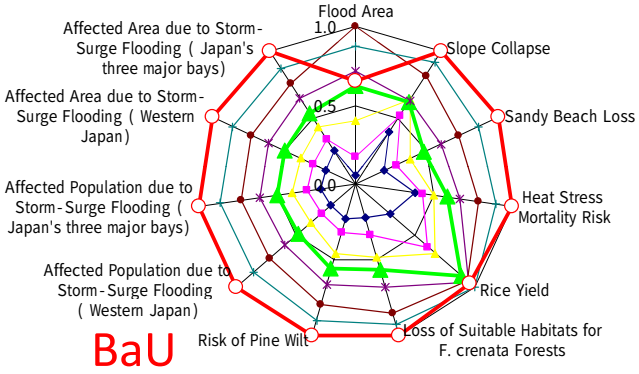
Distribution of suitable habitats for beech (Fagus crenata) forests

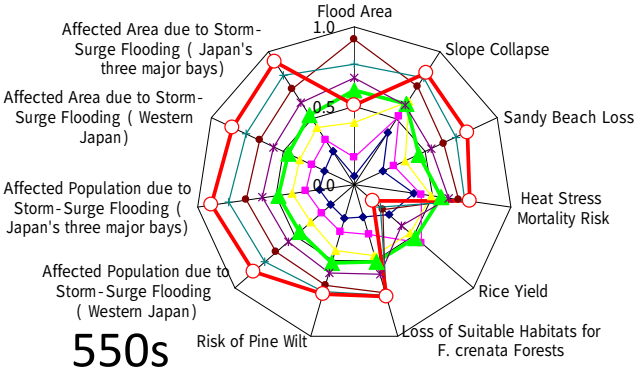
- **Beech forests**
  - Nationwide decrease of suitable habitats
    - 2031-2050: 35-56%
    - 2081-2100: 69-93%
  - Vulnerable area: western Japan, the Pacific side of Honshu

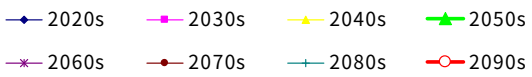


S-4 project: Synthesis of sector analyses of climate change impacts (Radar charts)



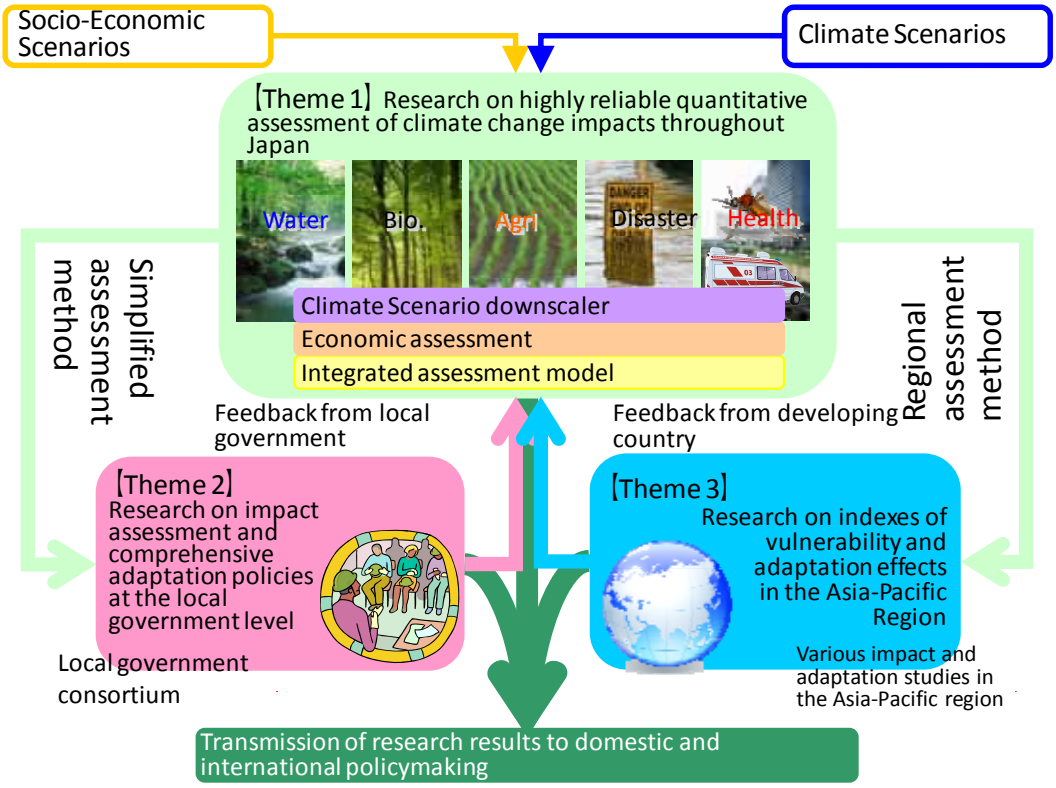






Framework of S-8 Project (FY2010-2014)

Assessment of climate change impacts and adaptation strategy on whole Japan and local government



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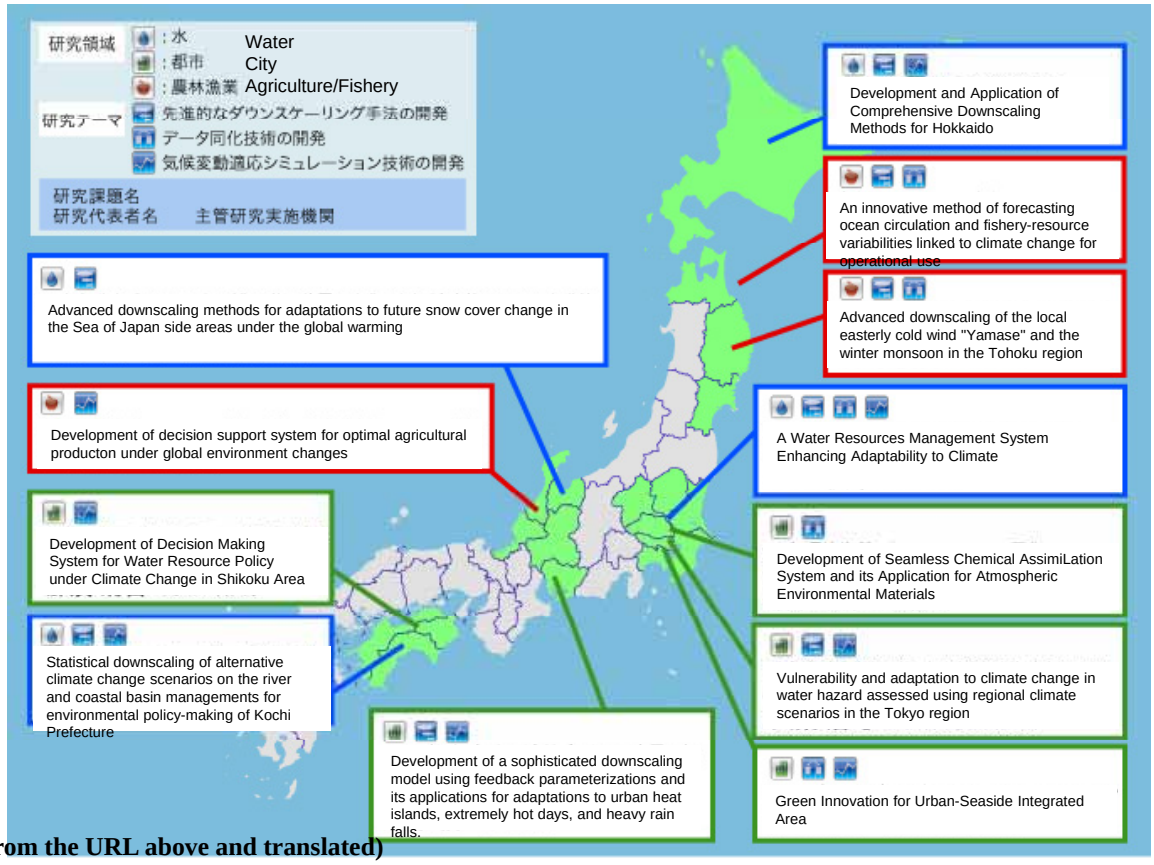
RECCA
Research Program on Climate Change Adaptation

- Develop advanced data downscaling method
- Develop data assimilation technology
- Develop simulation technology for climate change adaptation
- **http://www.mext-isacc.jp/eng/**



(cited from the URL above and translated)

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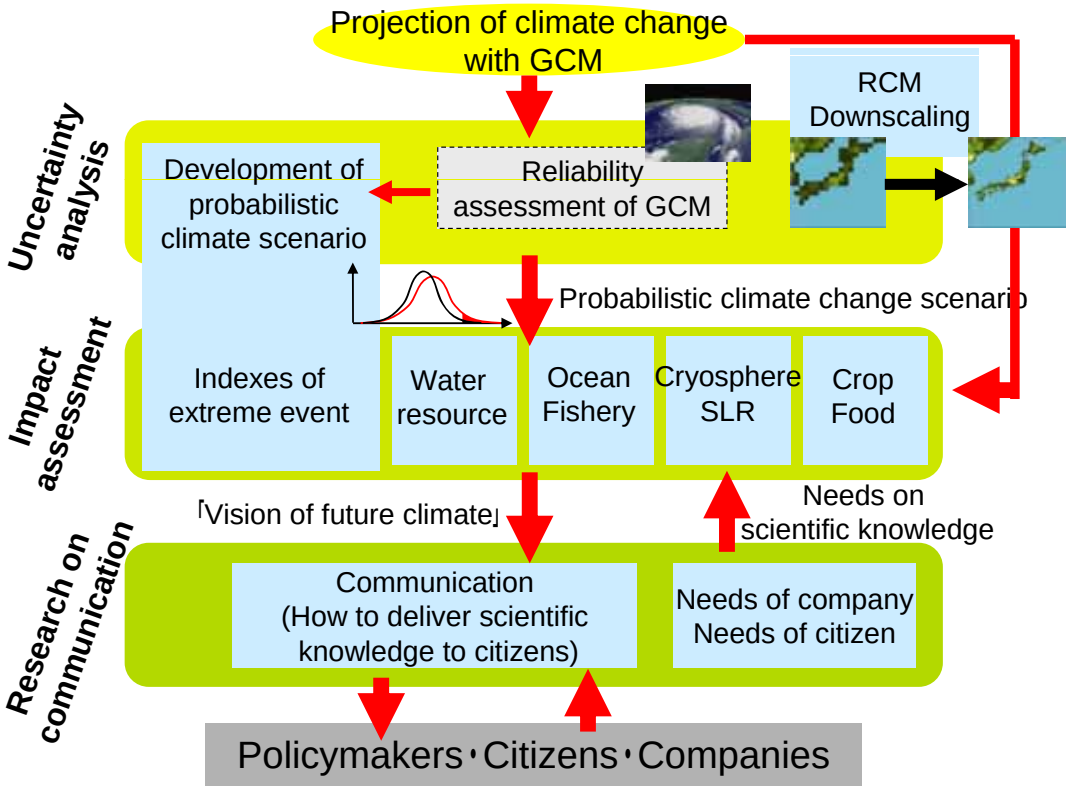
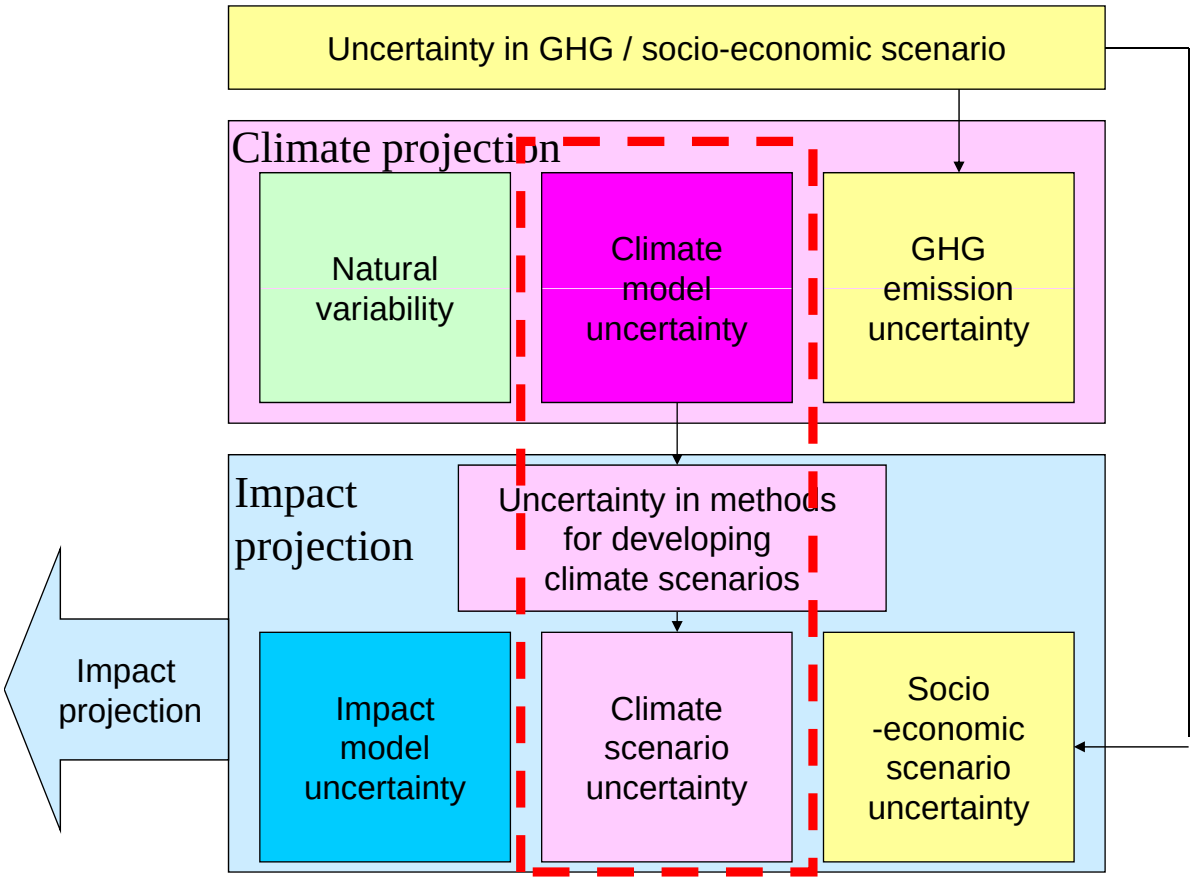
Scheme of the S-5 project (2007-2011)

Integrated research on climate change scenarios to increase public awareness and contribute to the policy process (S-5 project)

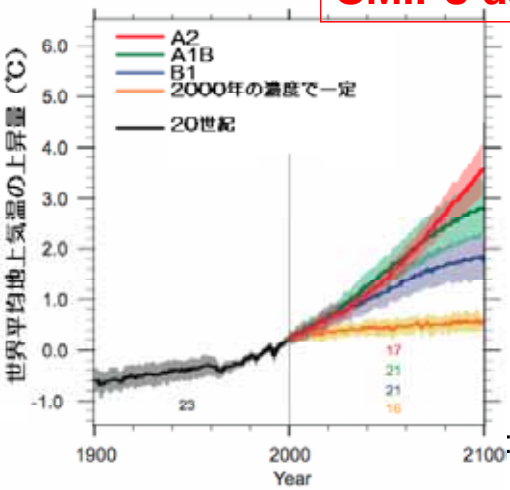


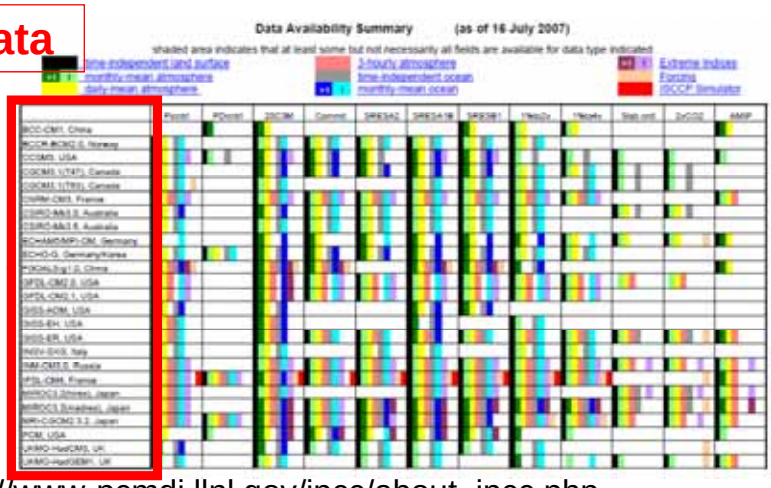
[S-5] Various uncertainties in impact projection



[S-5] Climate scenarios based on multi-GCMs

CMIP3 data





://www-pcmdi.llnl.gov/ipcc/about_ipcc.php

In order to contribute to IPCC-AR4, many research teams in the world conducted climate projections based on common GHGs emission assumptions. The results of the simulations were collected in PCMDI (US) and distributed publicly through the Internet.

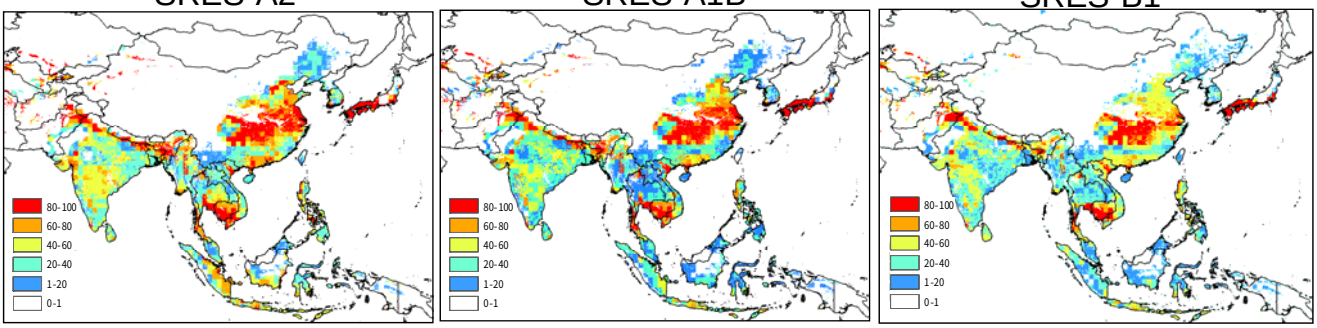
Example of impact assessment considering uncertainty of climate projection

Crop productivity assessments using plural GCM projections evaluated in IPCC-AR4

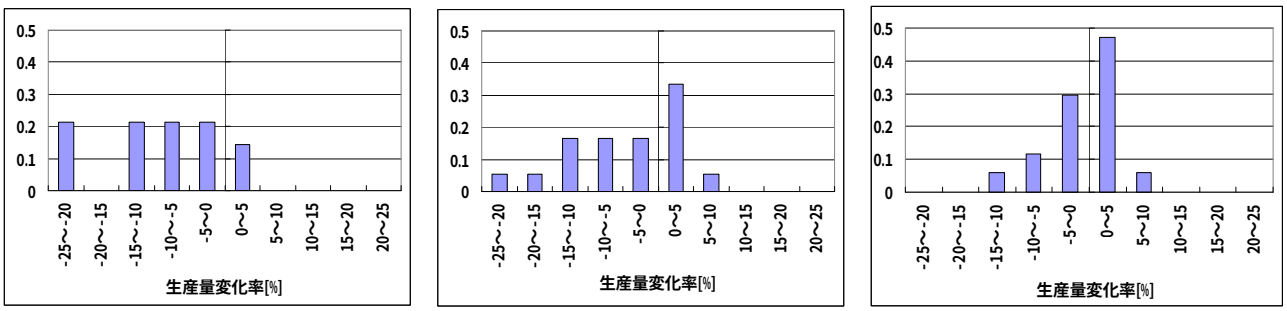
Masutomi Y. et al. (2009) ***Agric.Ecosyst.Environ.***,131,281-291

Impact on rice productivity

SRES-A2 | SRES-A1B | SRES-B1



Probability of crop productivity decrease [%] (with CO2 fertilization；２０８０s-１９９０s)



PDFs of estimated productivity change (Asia；with CO2 fertilization；２０８０s-１９９０s)

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Innovative program of climate change projection for the 21st century

KAKUSHIN

http://www.jamstec.go.jp/kakushin21/en

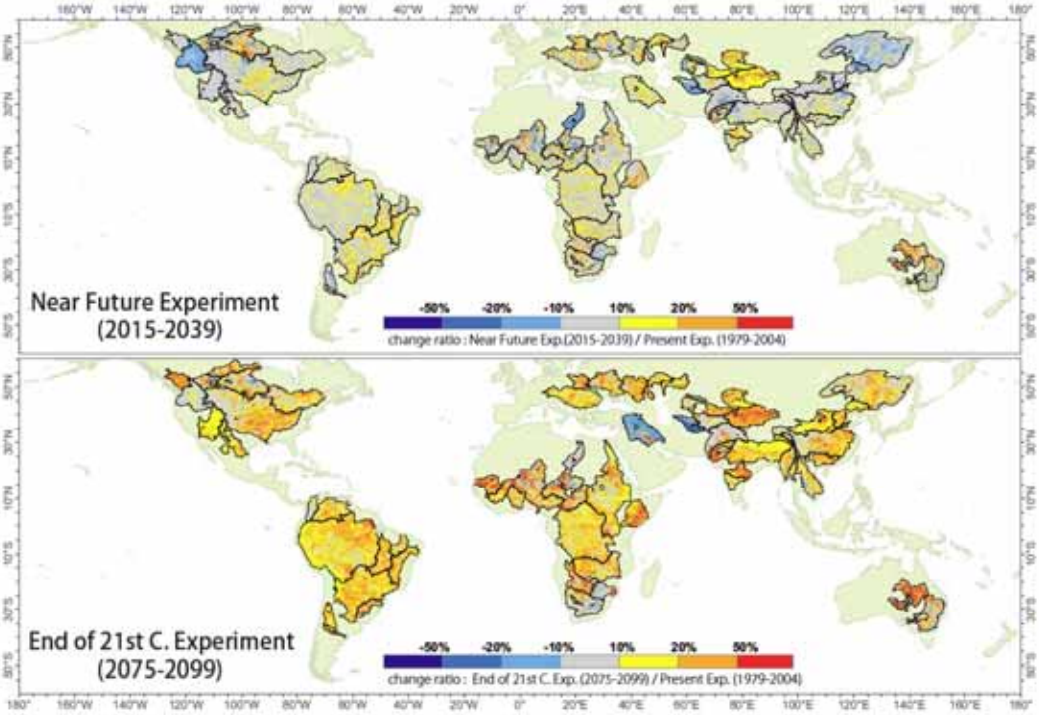
Team Name	Principal Objective	Model Specification	Resolution		Characteristic Feature	Major Institute Involved
			Atmosphere	Ocean		
1 Long-term	Projection up to 300 years for the basis of options of stabilization targets in Post-Kyoto issues	Integrated Earth system model (covering atmosphere, carbon cycle, land surface, chemistry and ocean)	280km	100km	Focused on global climate change; changes in carbon cycle and displacement of vegetation zone are also taken into consideration	JAMSTEC NIES AORI, the University of Tokyo
	Proper simulation of tropical meteorology by directly resolving convective clouds (unique in the world)	Global cloud resolving model (atmosphere-land surface model with given SST)	14km [7km]	—	Global cloud resolving model (NICAM), original and unique in the world	JAMSTEC AORI, the University of Tokyo
2 Near-term	Near-term detail projection up to 2030 (irrelevant to scenario)	High resolution coupled atmosphere-ocean model (covering atmosphere, land surface and ocean)	50km	20km	Projecting changes in sea currents such as Kuroshio; detail geographic differences such as those between Kanto area and Tohoku area in Japan	AORI, the University of Tokyo NIES JAMSTEC
3 Extreme Events	Projection of extreme weather events (typhoons, heavy precipitation, etc. in the near-term future and at the end of the 21st century)	Super-high resolution atmospheric model (atmosphere and land surface model with given SST)	20km	—	Typhoons, Baiu-fronts, heavy precipitation, etc. are to be simulated with considerable precision	MRI/JMA JAMSTEC
		Dynamic downscaling from the above (limited area model)	5km [2km&1km]			
(Reference) Atmosphere-ocean coupled models developed and/or used in Kyo-sei Project			110-280km	20-140km		

(Note) Figures inside [ ] in the column of Resolution show possible resolution cases.

(cited from a brochure of the program)

Example of KAKUSHIN's output on climate change impacts

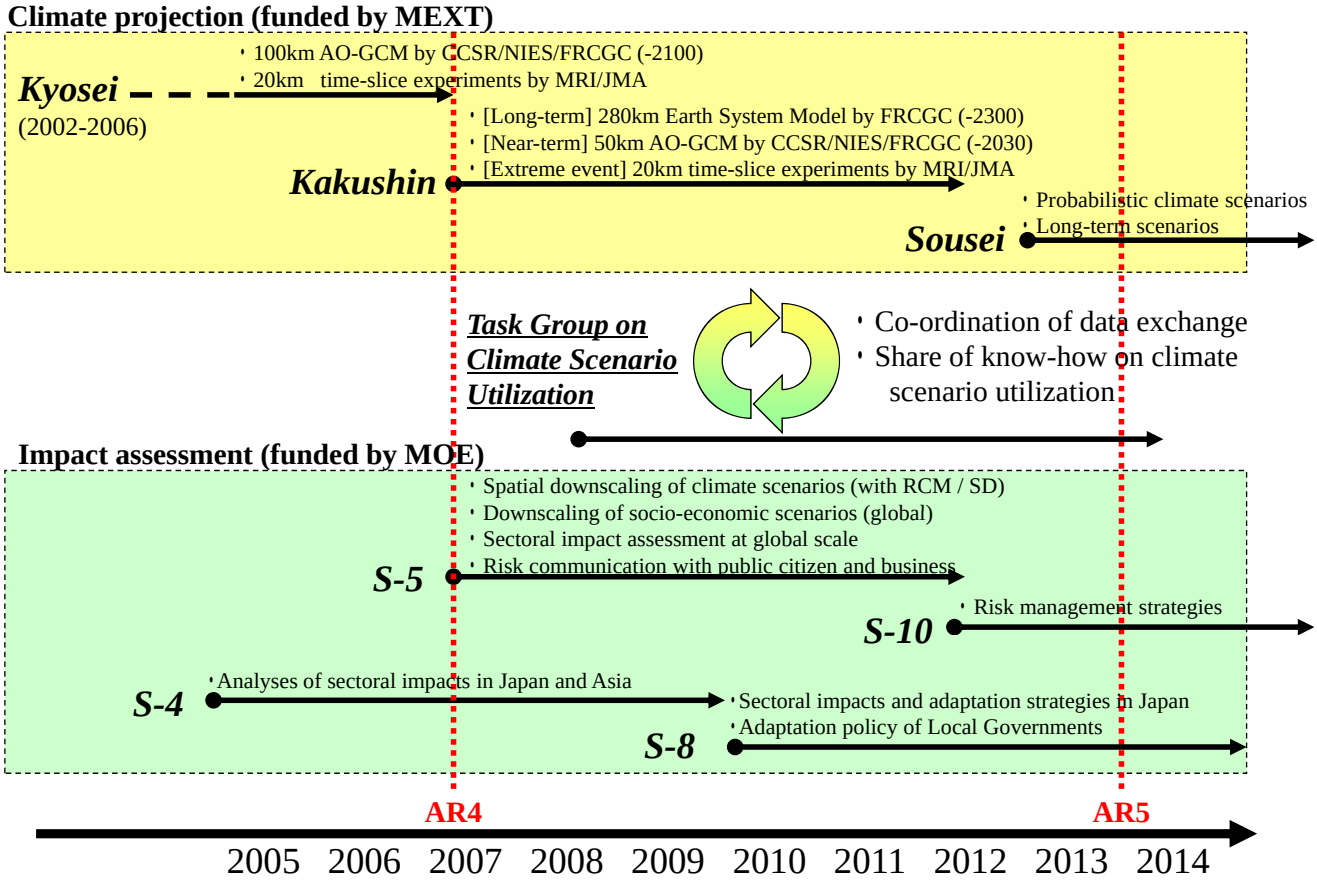
Change ratio of extreme flood discharge (yearly maximum daily discharge, 50-year return period).



The area of river basins are equal to or larger than 3000000Km^2.
Top: Ratio of near future simulations (2015-2039) to present-day simulations (1979-2004).
Bottom: Ration of the end of 21st century simulations (2075-2099) to the present-day simulations (1979-2004).

(cited from a brochure of the program)

Collaborations between research projects



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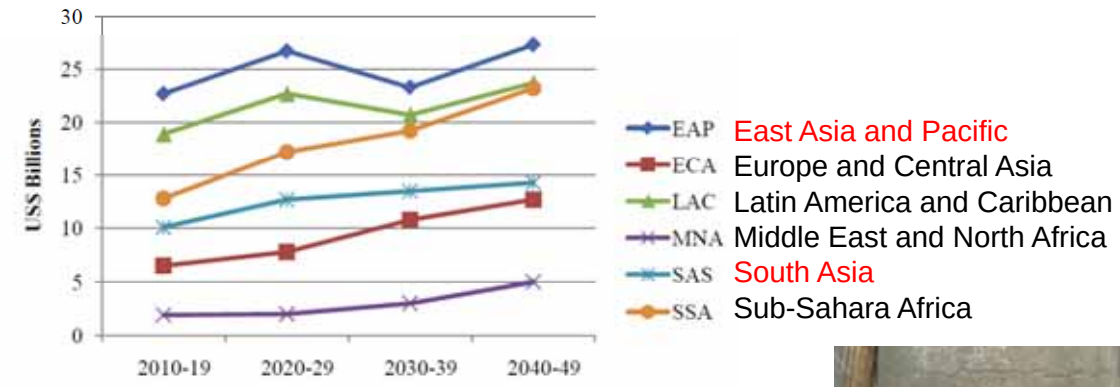
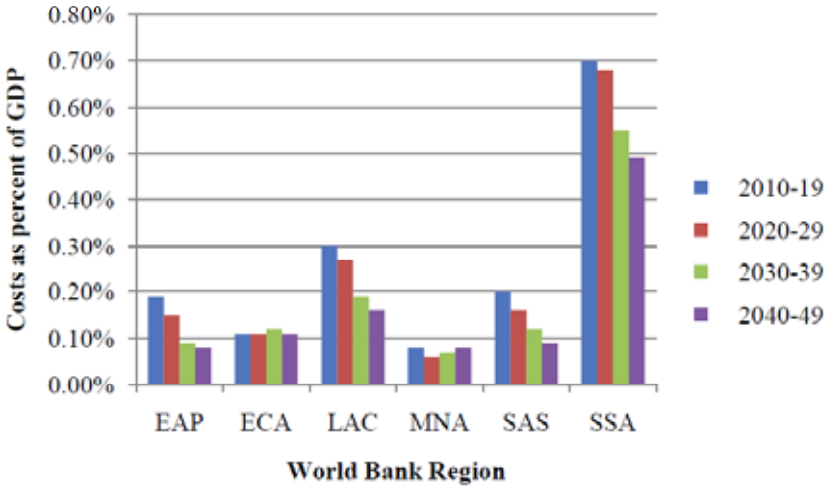
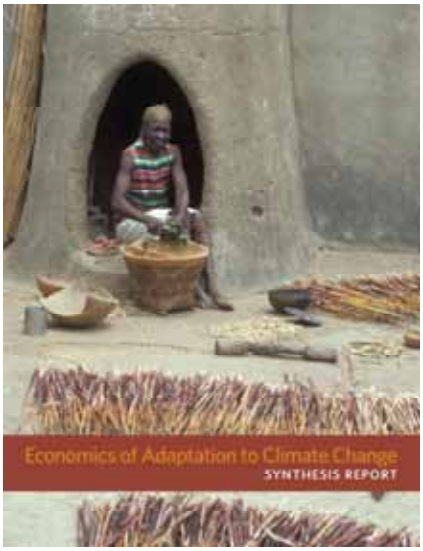
Economics of Adaptation to Climate Change (WB, 2010)







Economics of Adaptation to Climate Change (WB, 2010)

単位：10億米ドル／年	UNFCCC(2007)の推計値	NCAR (降水が増える気候シナリオ)	CSIRO (降水が減る気候シナリオ)
		Economics of Adaptation to Climate Change study	
Sector	United Nations Framework Convention on Climate Change (2007)	National Centre for Atmospheric Research (NCAR), wettest scenario	Commonwealth Scientific and Industrial Research Climate (CSIRO), driest scenario
Infrastructure インフラ	2-41	29.5	13.5
Coastal zones 沿岸域	5	30.1	29.6
Water supply and flood protection 水供給・洪水防護	9	13.7	19.2
Agriculture, forestry, fisheries 農林水産	7	7.6	7.3
Human health 人間健康	5	2	1.6
Extreme weather events 極端現象	—	6.7	6.5
Total 総計	28-67	89.6	77.7

Source: UNFCCC (2007) and Economics of Adaptation to Climate Change study team.

Toward the improvement of impact analyses in Asia
-Enhancement of collaboration -

- Data
  - Climate scenarios, especially downscaled ones
  - Socio-economic scenarios both top-down (downscaled) scenarios and bottom-up scenarios
  - Public archive system for storing and sharing the data?
- Methods
  - Collaborative researches for developing and sharing tools and methods for impact analyses
- Adaptation experiences
  - Menu of adaptation options including indigenous ones
  - Accumulation of cases (good and bad practices)