



# On the Kakushin and Sosei Programs

Eiichi Nakakita  
Disaster Prevention Research Institute, Kyoto  
University



# Kyoto University





# Kyoto University

- Established in 1897
- Number of Faculty 2,858
- Non-teaching staff 2,556
- Number of Students
  - ◎ Undergraduate 13,473
  - ◎ Graduate 9,314
- International Students 1,563
- 10 Faculties
- 17 Graduate Schools
- 42 Research Institute and Centers
- President Dr. Hiroshi Matsumoto





# Top-Class Research

- Many winners of international awards  
– **Seven Nobel Prize Laureates**



Dr. Hideki Yukawa  
Physics 1949



Dr. Sin-Itiro Tomonaga  
Physics 1965



Dr. Kenichi Fukui  
Chemistry 1981



Dr. Susumu Tonegawa  
Physiology or  
Medicine 1987

– Two Fields Medal Winners



Dr. Ryoji Noyori  
Chemistry 2001



Dr. Makoto Kobayashi  
Physics 2008



Dr. Toshihide Maskawa  
Physics 2008



Dr. Heisuke Hironaka  
1970



Dr. Shigefumi Mori  
1990



# DPRI

Disaster Prevention Research Institute  
Kyoto University



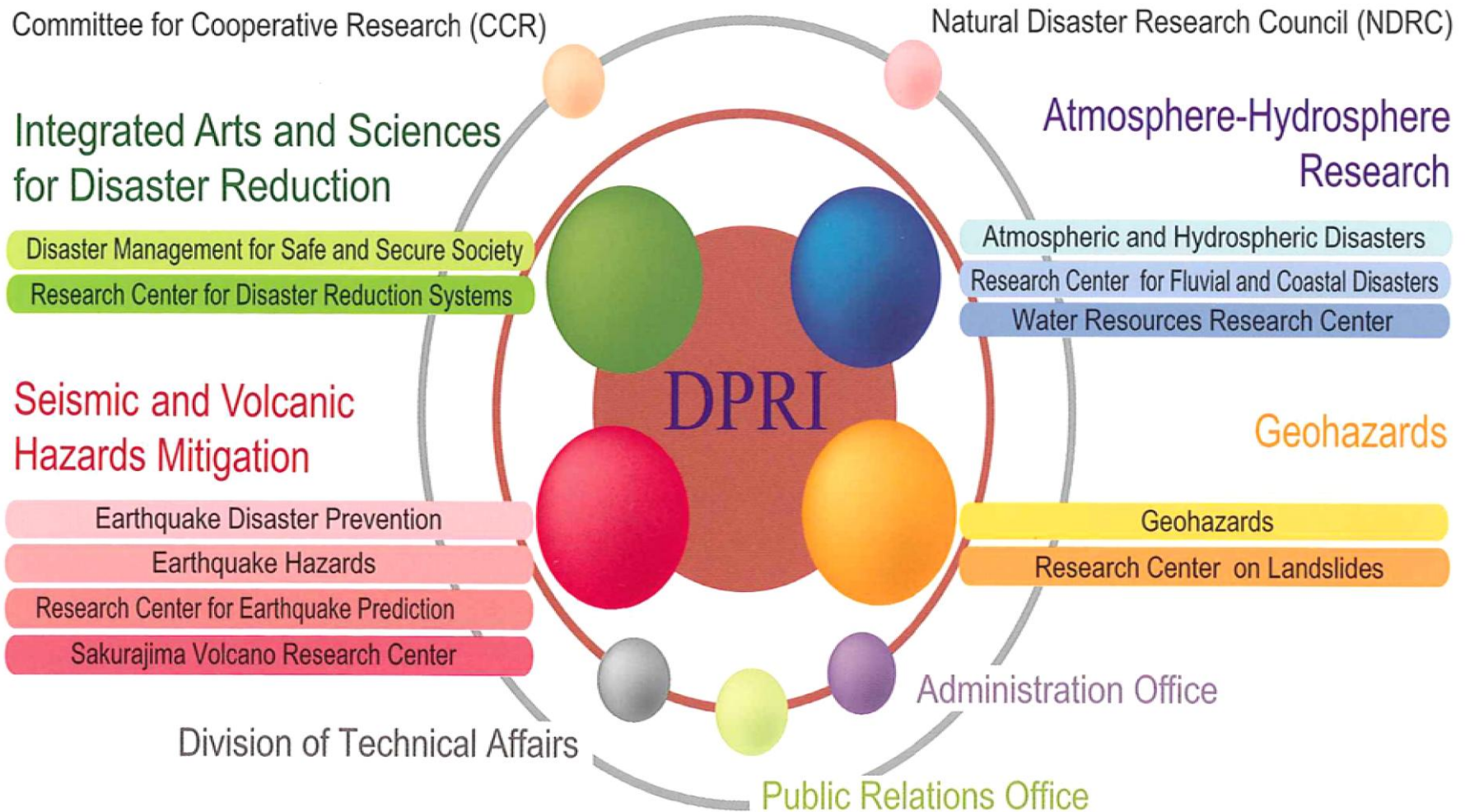
# DPRI, Kyoto University

- Established in 1951 (Kyoto Univ. in 1897)
- 4 Research Groups
  - Integrated Arts and Science for Disaster Reduction
  - Seismic and Volcanic Hazards Mitigation
  - Geohazards
  - Atmosphere-Hydrosphere
- 5 Research Divisions, 6 Research Centers
- 34 Professors, 38 Associate Professors, and 34 Assistant Professors + 10 Visiting Professors
- 192 Graduate Students (70 DC + 122 MC) and 42 Undergrads [as of June 2006]
- Open to many other Japanese institutes
- More than 20 MoU's with research organizations abroad

# Research division and center



## Organization





# **Innovative Program of Climate Change Projection for the 21st Century (KAKUSHIN Program)**

by  
**Ministry of Education, Culture, Sports, Science and Technology  
(MEXT)**

Secretariat of the Outreach Committee of the Program  
Frontier Research Center for Global Change  
Japan Agency for Marine-Earth Science and Technology



**KAKUSHIN**



# Program plan

- ◆ **A 5-year initiative (FY 2007-2011)** by the **MEXT** (Ministry of Education, Culture, Sports, Science and Technology ) launched in April 2007.
- ◆ The Program is to follow-up and develop the **“Kyo-sei” Project (FY 2002-2006)**.
- ◆ The **Earth Simulator** to be further utilized.
- ◆ The Program intends to **contribute to the possible AR5**.
- ◆ **Coordination** with studies outside the Program in **impact, adaptation and response strategies** to be closely kept.



# Participating groups and their studies

## ◆ *Long-term global environmental projection*

*with an earth system model*

- Frontier Research Center for Global Change (**FRCGC**) et al.

## ◆ *Near-term climate prediction*

*with a high-resolution coupled ocean-atmosphere GCM*

- Center for Climate System Research (**CCSR**) of the University of Tokyo et al.

## ◆ *Projection of changes in extremes in the future*

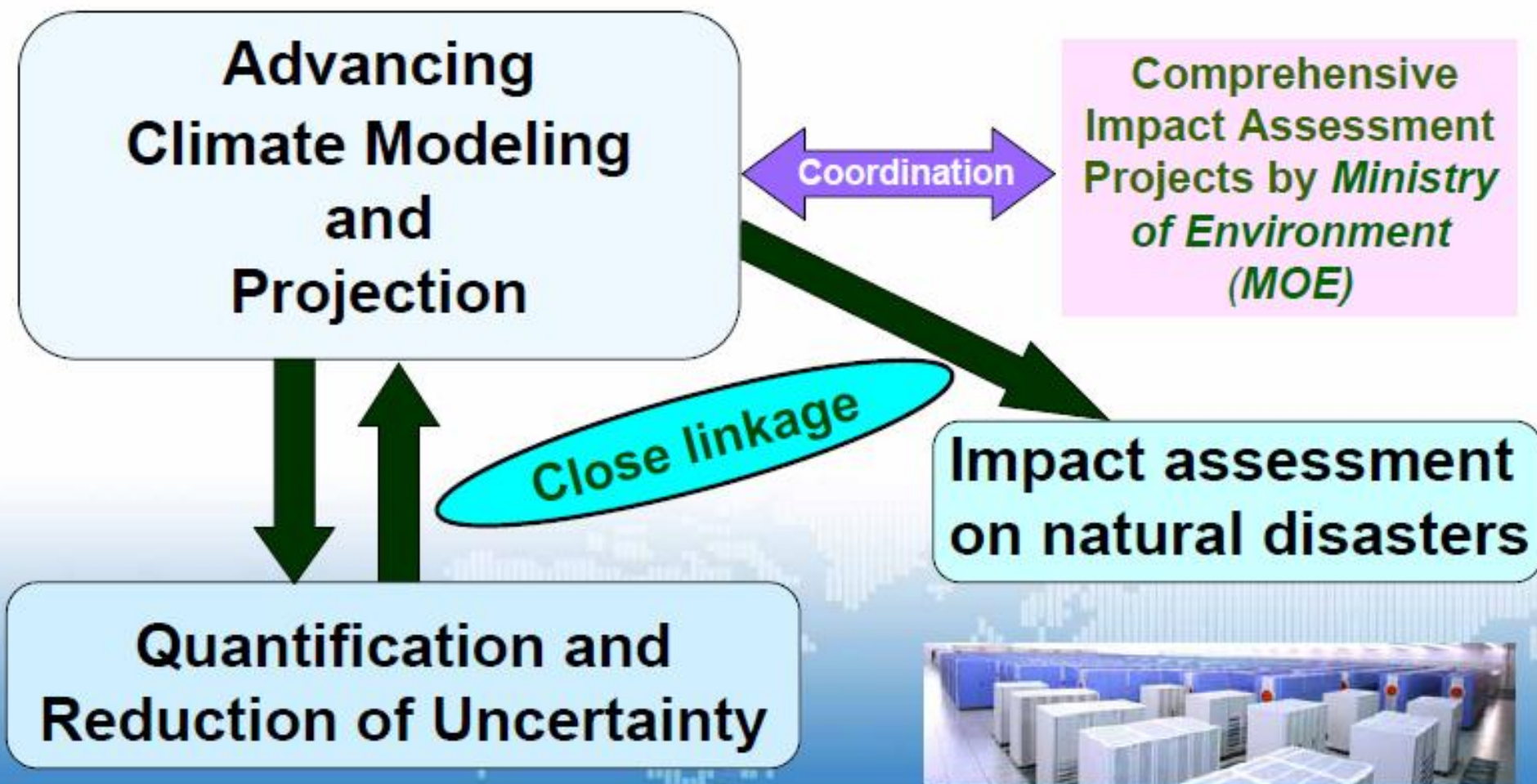
*with super-high resolution atmospheric models*

- Meteorological Research Institute (**MRI**) et al.
- Disaster Prevention Research Institute (**DPRI**), Kyoto University
- International Centre for Water Hazard and Risk Management (**ICHARM**),  
Public Work Research Institute (**PWRI**)



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# Program structure





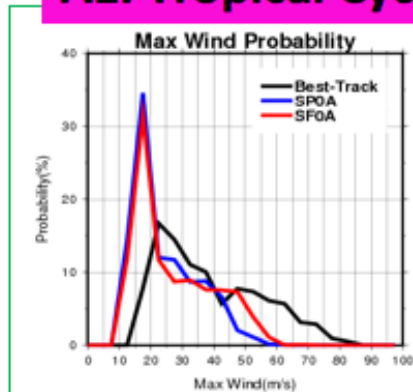


# Projection of the Change in Weather Extremes Using Super-High-Resolution Atmospheric Models in the KAKUSHIN Program

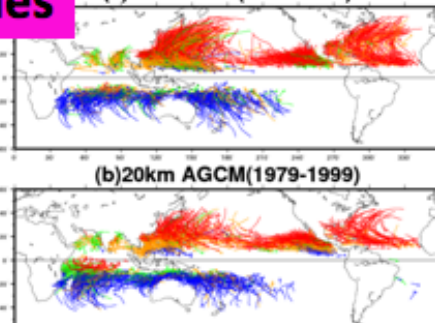


Akio Kitoh (MRI/JMA), Shoji Kusunoki (MRI/JMA), Eiichi Nakakita (DPRI/Kyoto-Univ.),  
Kunivoshi Takeuchi (ICHARM/PWRI)

## A1. Tropical Cyclones

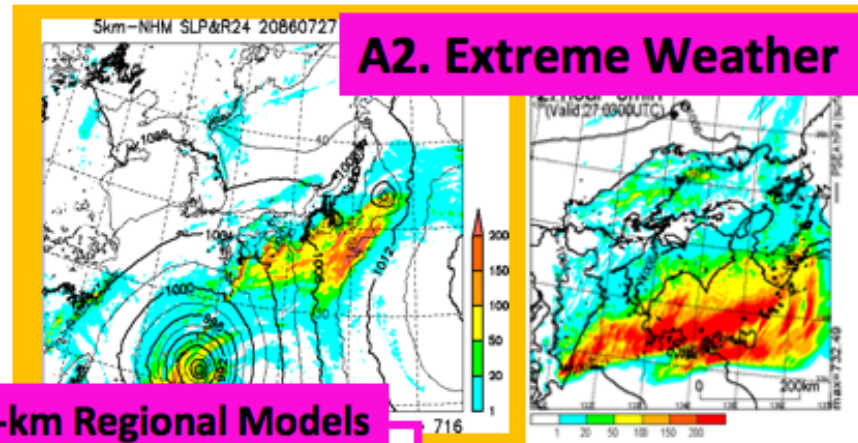


(a) Best-Track (1979-1999)



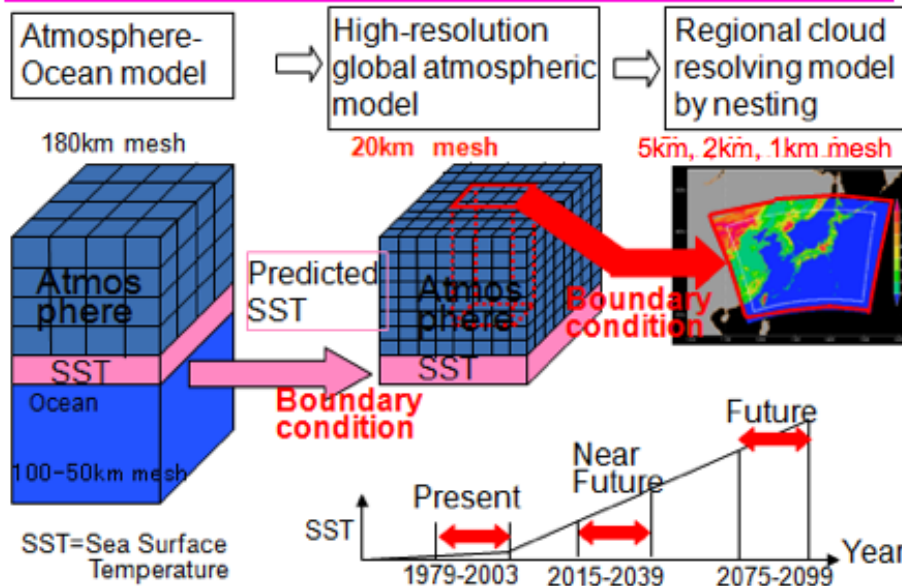
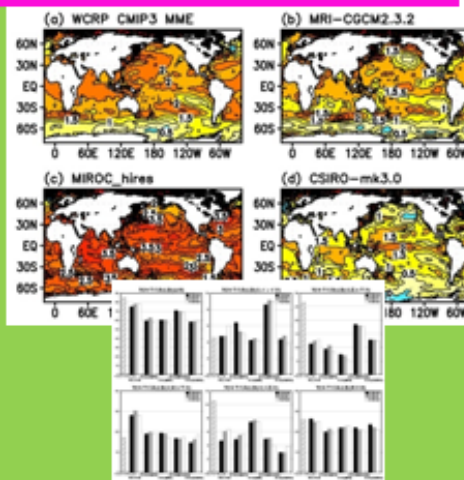
(b) 20km AGCM (1979-1999)

## A2. Extreme Weather

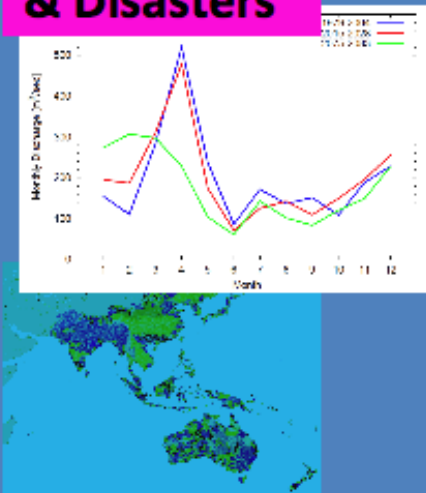


## 20km Global and 1-, 2- & 5-km Regional Models

## B. Uncertainty



## C. Flood & Disasters



# Points in climate change assessment on Japanese hazard

- There are various types of hazards that bring disasters.
- Spacio-temporal information with high resolution is required for representing reasonable river discharge in Japan.



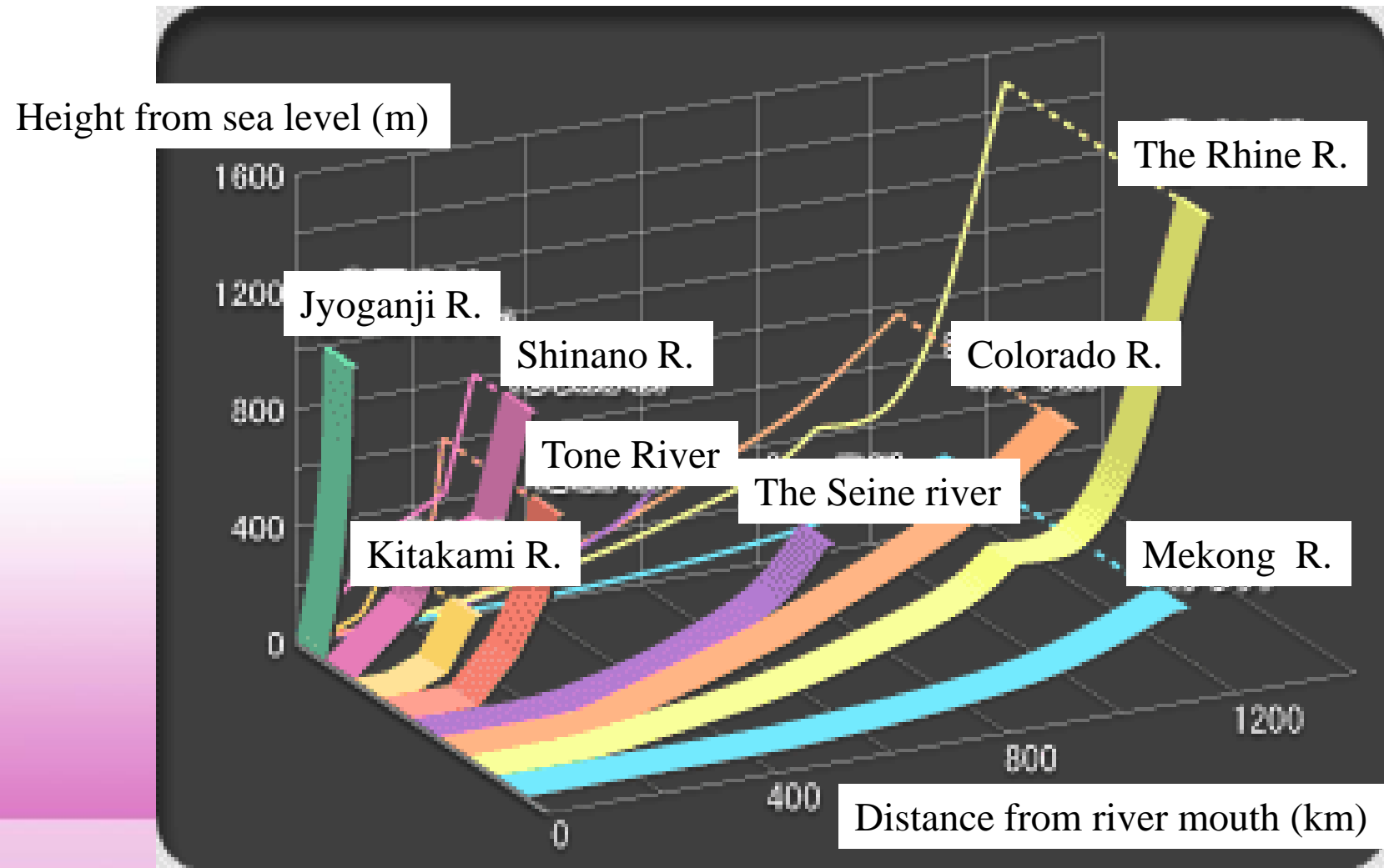
01 Sep 208X 00 UTC





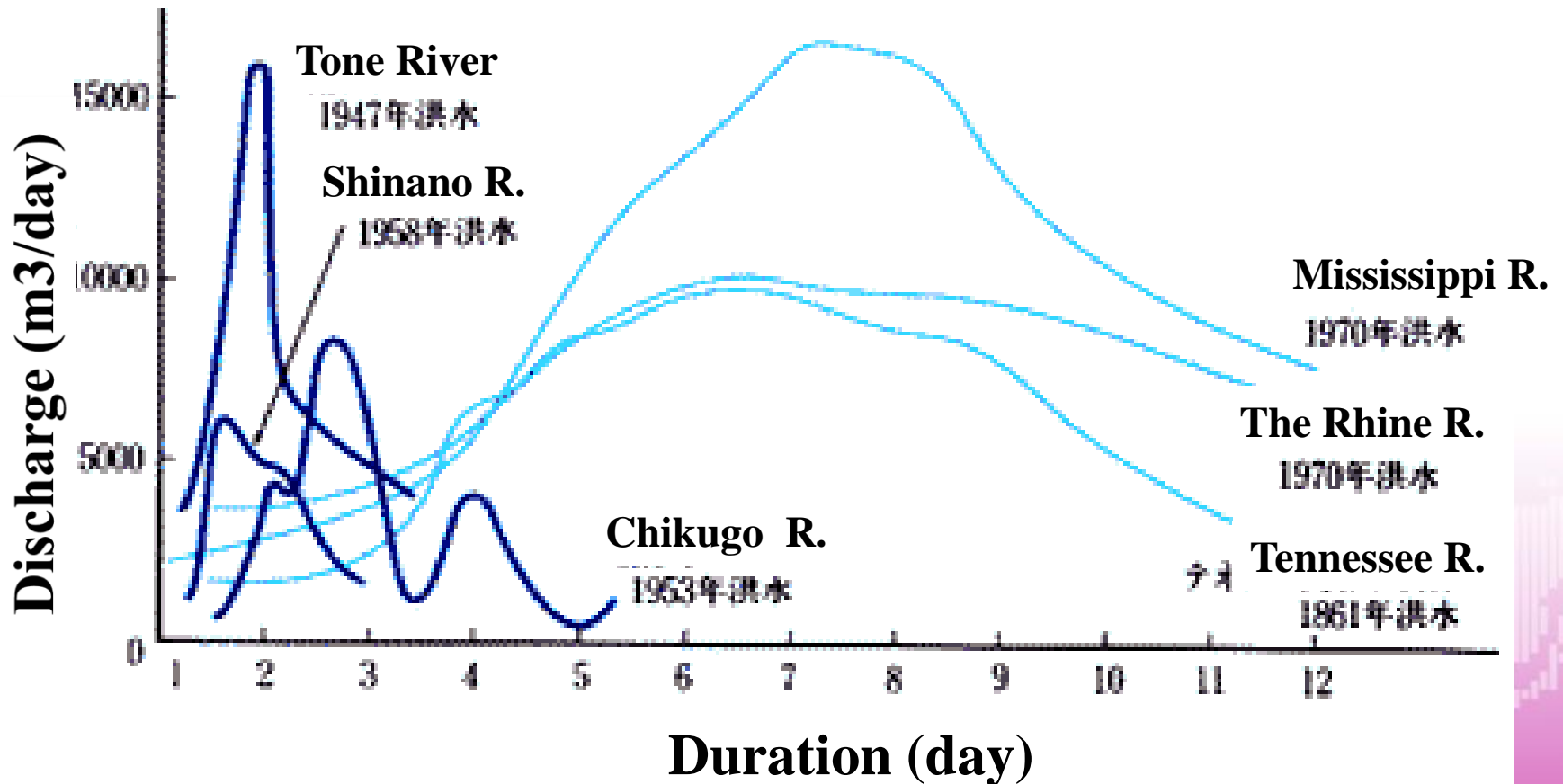
# Features of Japanese River(1)

- Short length and steep slope.

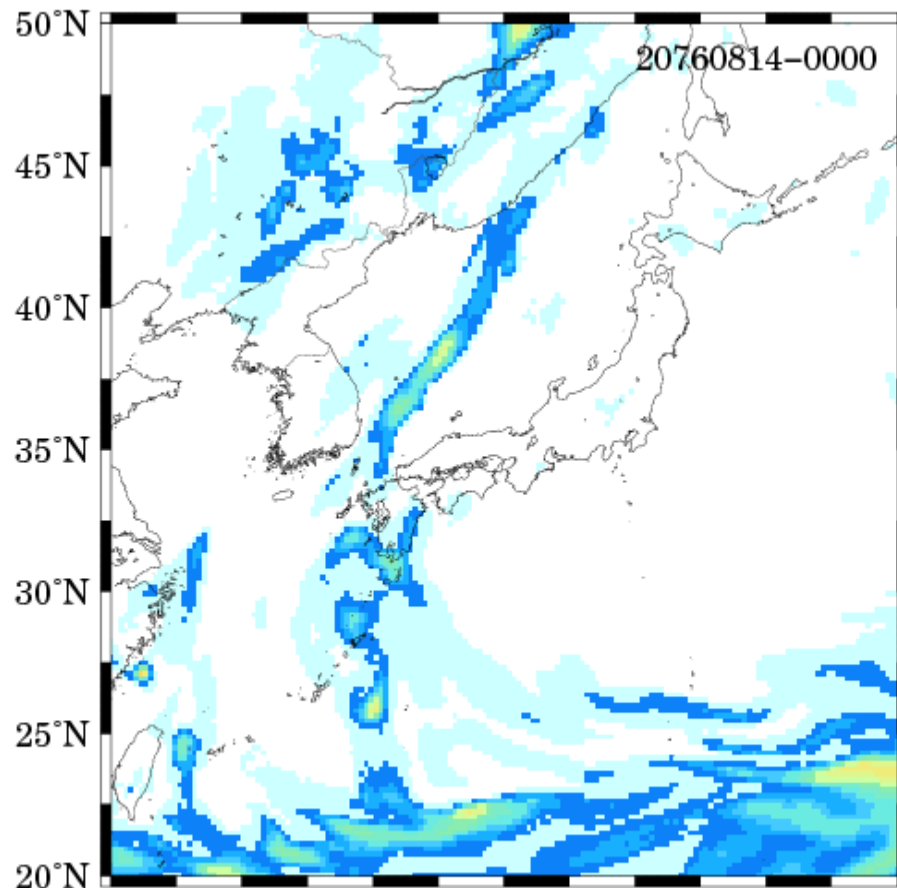


# Features of Japanese River(2)

- Large peak discharge, short duration



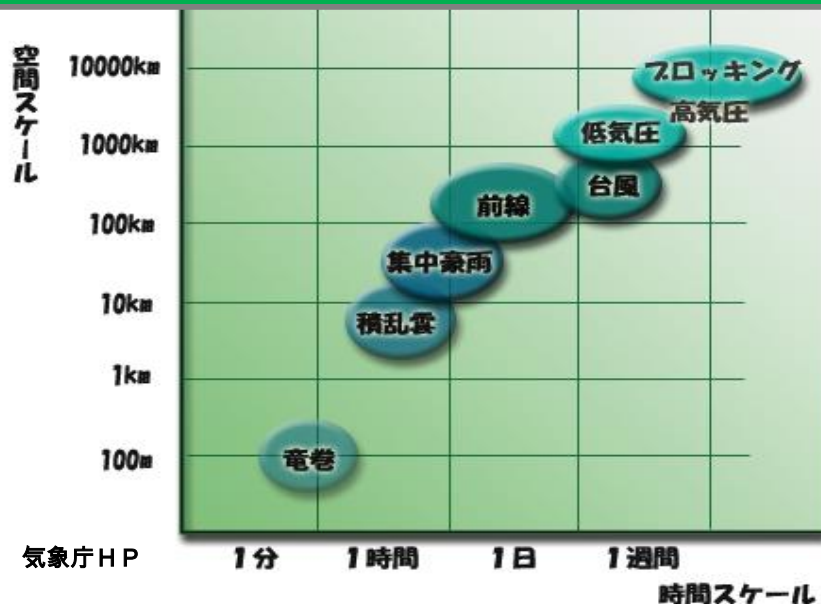
# Projected typhoon by GCM20



It is the typhoon resolving output from GCM20 that has realized the impact assessment on Japanese river regime



# Spacio-temporal scale

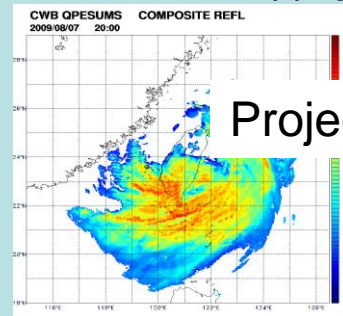


## Typhoon

Range : 1000km

Duration : 1 day to a few days

大河川での洪水、大規模水害、土砂災害  
2009/08/08 in 台湾



Projected by AGCM20



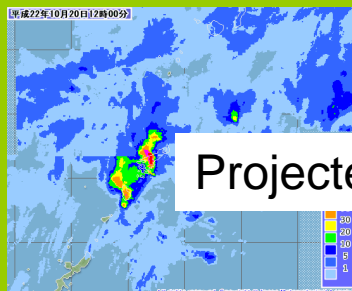
台湾中央気象局、台湾国家災害防救科技中心

## Localized heavy rainfall (Baiu season)

Range : 100km

Duration : 6 hours to half a day

中・小河川での洪水、内水氾濫、土砂災害  
2010/10/20 in 奄美



Projected by RCM



南日本新聞 OFFICIAL SITE

## Shower

Range : 10 km

Duration : about half an hour

小河川や下水道内での鉄砲水、都市内水氾濫  
2008/07/28 at 都賀川 2008/08/05 at 雑司ヶ谷



都賀川モニタリング映像



共同通信

Impossible?

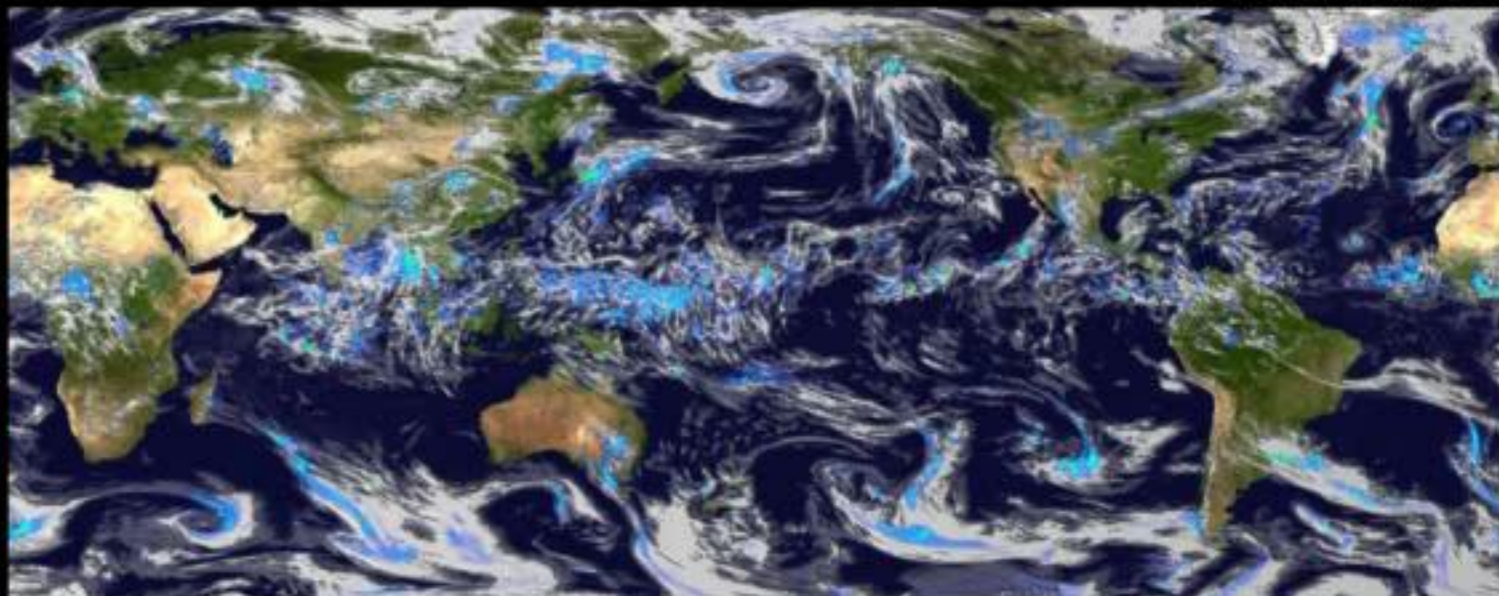
5km Regional Model



2km Regional Model



05 Sep  
208X  
00 UTC



20 km Global Model



# Rainfall output from GCM and RCM

- **GCM20 (Hourly rainfall, Globe)**
  - Extreme rainfall and Ocean wave in the world
  - Major and all Japanese rivers basins
- **RCM5 and RCM2 (30 minutes, Around Japanese Archipelago)**
  - Inundation in major metropolitan areas
  - Land slide, debris flow
  - Major Japanese river basins
- **RCM1 (10 minutes rainfall, Piecewise sections in Japanese Archipelago)**
  - Inundation in major metropolitan arears
  - Land slide and debris flow
  - Strong wind hazard





# Prediction and evaluation of disaster environment in Japan

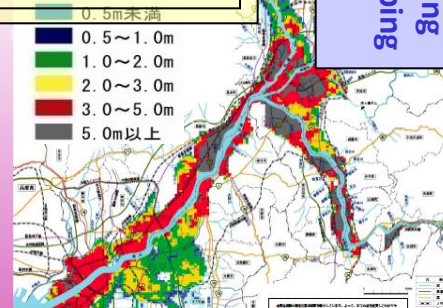
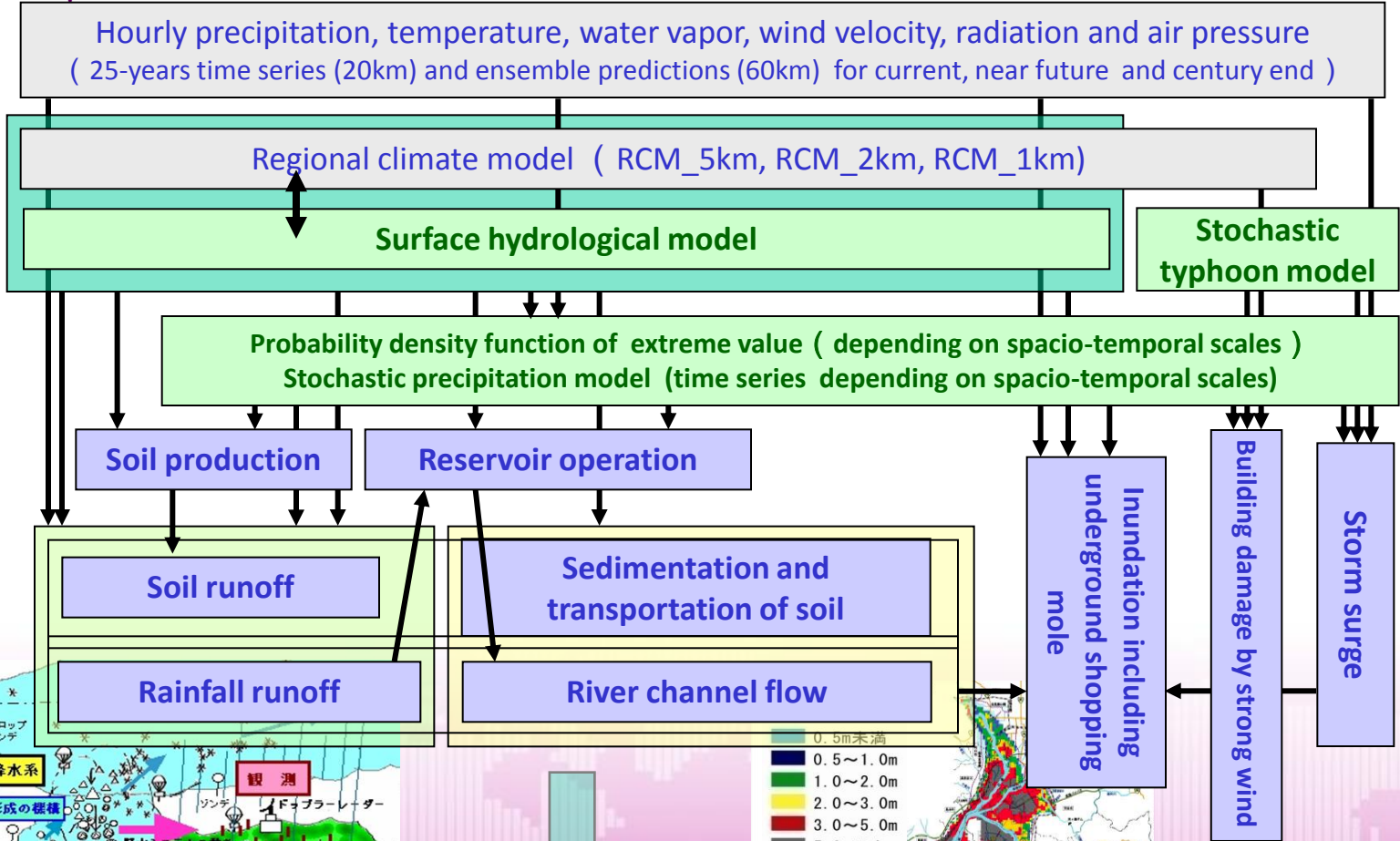
**DPRI / Kyoto-Univ.**

Slope      Mountains      River      Habitable Area      Coastal Area

**Output  
from GCM  
and RCM**

**Interpreta-  
tion of  
output**

**Various  
Models  
( with  
long-term  
run )**



**Evaluation**

Decreasing of safety against landslide, debris flow, flood, draught, storm surge and strong wind .  
Assessment of current protection system and proposal of alternatives



# Sosei (創生) Program (2012-2016)

## Situation of output from Climate models



### Topics:

Natural hazard, Water Resources  
and Ecosystem and Eco-service

For adaptation decision making  
Deterministic, Probabilistic and Beyond



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