Future hydrologic change analysis in Southeast Asia using GCM/NHRCM outputs

Yasuto TACHIKAWA

Hydrology and Water Resources Research Lab.
Dept. of Civil & Earth Resources Engineering, Kyoto University

Impact assessment of climate change on water-related disasters and water resources

Future climate projection for water resources impact assessment:

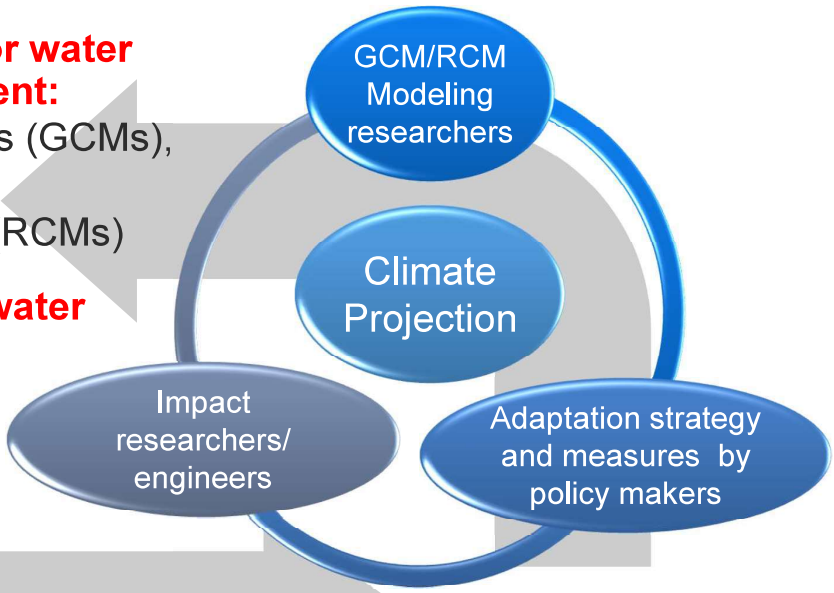
- General Circulation Models (GCMs), and
- Regional Climate Models (RCMs)

Future change analysis of water resources:

- Hydrologic models,
- Hydraulic models,
- **Storm surge models,**
- Risk assessment models

Assessment of hazard and risk change:

- Probabilistic hazard analysis,
- Largest-class hazard analysis, and
- Risk analysis.



Adaptation strategy:

- Structural measures,
- Non-structural measures

TOUGOU | Integrated Research Program for Advancing Climate Models

Supported by MEXT (2017-2022)


Prof. Watanabe

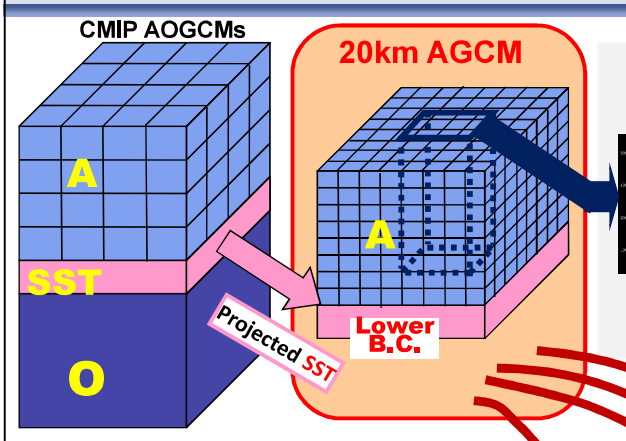

Dr. Kawamiya

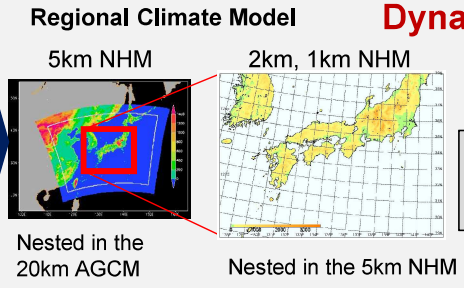

Dr. Takayabu


Prof. Nakakita

Imminent global climate change (AORI,UT)	Stabilization target setting (JAMSTEC)	Risk Information (MRI)	Impact assessments (DPRI,KU)
Climate variability and change	Long-term projection	Probabilistic climate projection	Natural Hazards
Integrated prediction system	Large-scale variations	Producing a standard climate scenario	Water Resources
A	B	C	D

Global Dynamical Downscaling





Dynamical Downscaling by RCM

From Dr. Nakaegawa, MRI Japan

Study of Future Change in Extreme Events

Tropical Cyclones (e.g.Oouchi et al. 2006)
→less number, more intense
East Asia Monsoon (e.g.Kusunoki et al.2006)
→seasonal migration delayed
Extreme Rainfall (e.g.Kamiguchi et al. 2006)
→more frequent
Blockings (e.g.Matsueda et al. 2009)
→less frequent
Extratropical Cyclones(e.g.Mizuta et al.2011)

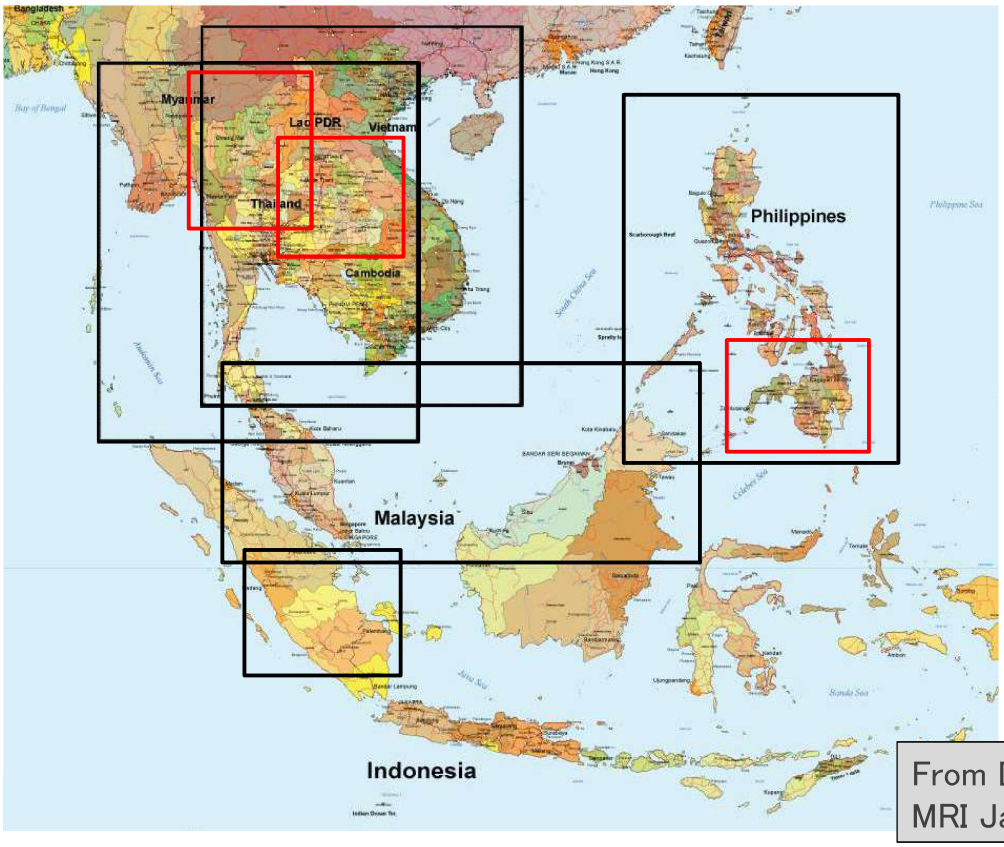
Impact Assessments

Disasters
Agriculture
Water Resources

Regional Climate Change

Outputs provided to researchers of each region
(Korea, China, Taiwan, Philippines, Thailand, Indonesia, Viet Nam, Bangladesh, India, Israel, Saudi Arabia, Senegal, Spain, Netherland, UK, Ireland, Denmark, Switzerland, Germany, USA, Mexico, Columbia, Barbados, Belize, Bolivia, Peru, Ecuador, Brazil, Argentina, Australia, Papua New Guinea)

Climate Change Scenario made by NHRCM in Southeast Asia during TOUGOU Program



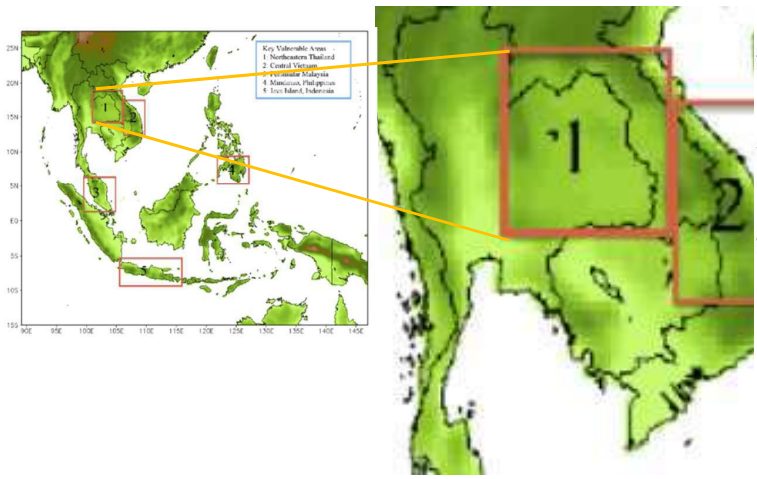
5km
2km

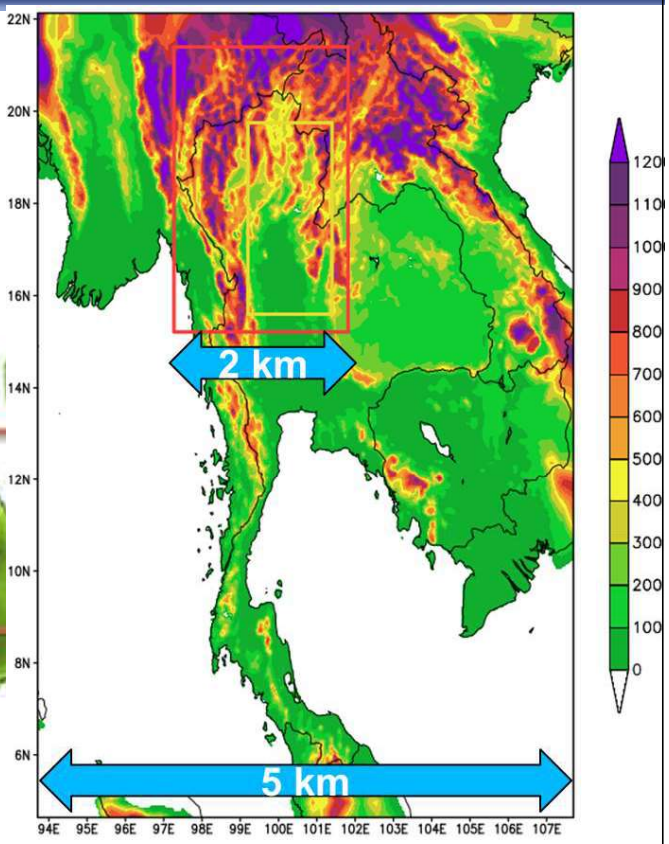
From Dr. Sasaki, MRI Japan

Regional dynamical downscaling with NHRCM

CORDEX-SEA Phase Ⅱ

led by Jerasorn Santisirisomboon, Ramkhamhaeng University





From Dr. Nakaegawa, MRI Japan

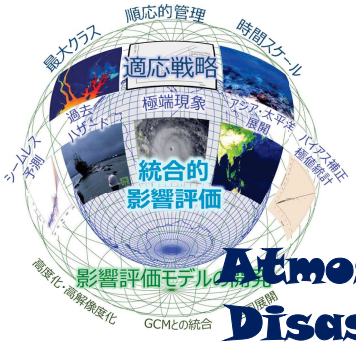
Meteorological Research Institute

TOUGOU Integrated Research Program for Advancing Climate Models

January 25, THA2019

Integrated Research Program for Advancing Climate Models

Theme D : Integrated Hazard Prediction



Principal Investigator: Eiichi NAKAKITA

TOUGOU
Integrated Research Program for Advancing Climate Models

Atmosphere-Hydrosphere Research Group, Disaster Prevention Research Institute, Kyoto University

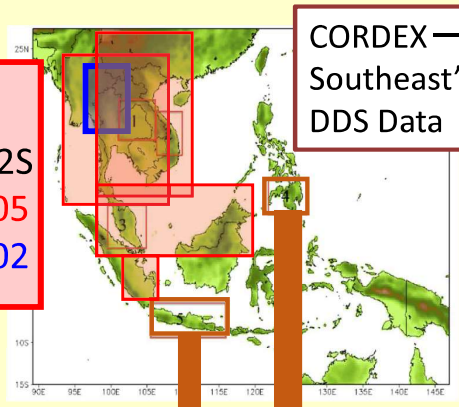
International collaborations in TOUGOU Theme C & D

Change prediction of water-related hazards for Asia-Pacific region (Kyoto University)

1. Analyze change of flood and drought hazards in Indochina peninsula by developing a river model considering effects of flood plain and water-demand during irrigation, as well as by correcting grid-discharge of land surface model
2. Analyze change of flood and inundation hazards of rivers in Thailand, Indonesia and Vietnal with researchers from Chulalongkorn University, Lembaga Ilmu Pengetahuan Indonesia (LIPI), and Thuy Loi University
3. Conduct long-term change prediction of high-tide and surges in Pacific island nations

Collaboration with Theme C: "Prediction of Integrated Climate Models"

d4PDF
AGCM3.2S
NHRCM05
NHRCM02



CORDEX—SEA II
Southeast's
DDS Data

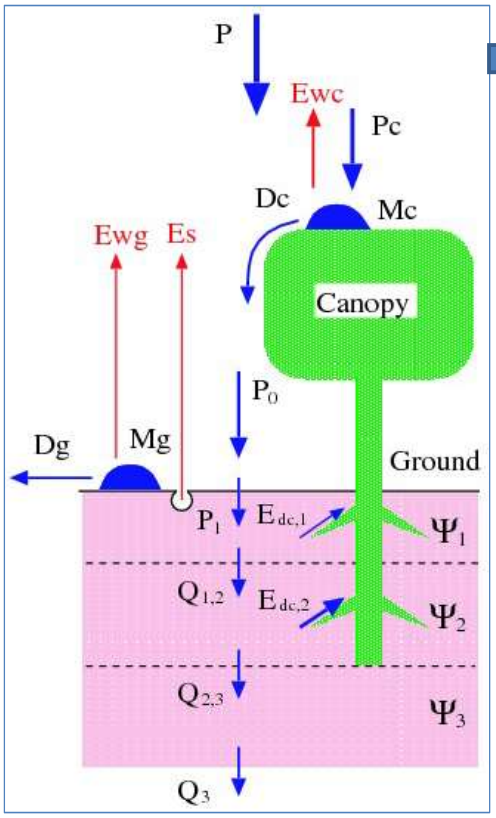
Development of prototype for field implementation of climate change adaptation strategy (ICHARM)

Development of prototype for field implementation of climate change adaptation strategy with the help of stakeholder in the field in the watersheds in Philippines and Indonesia

1. Risk analysis of water-related hazards: estimation of flood and drought damages using mechanical-downscaling rainfall and rainfall-runoff & flood model
2. Understanding the demand and capability of in-situ condition for climate change adaptation
3. Field implementation of climate change adaptation strategy

Provide assistance foundations for no-regret adaptations in Asian countries

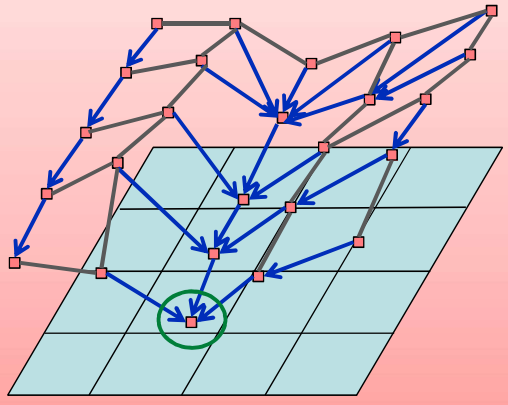
SiBUC/SiB + Routing model



ROF
（ROFS+ROFB)

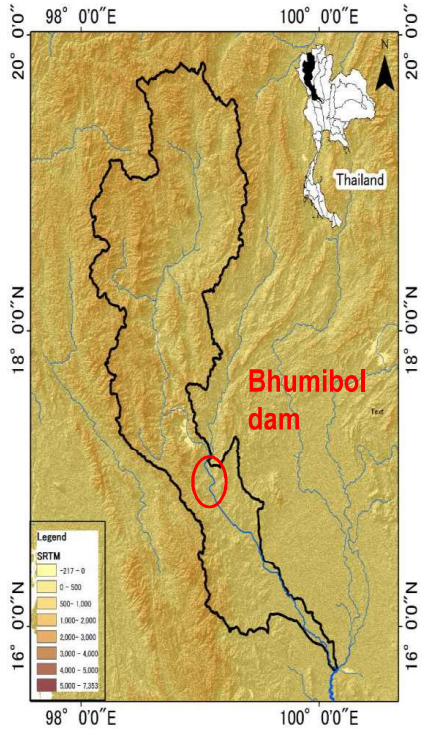
Natural runoff
＋(irrigation outflow-
irrigation water taken)

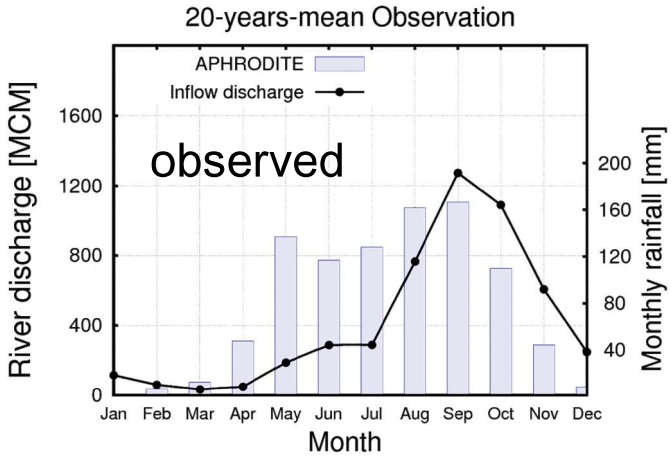
River flow routing 1K-FRM

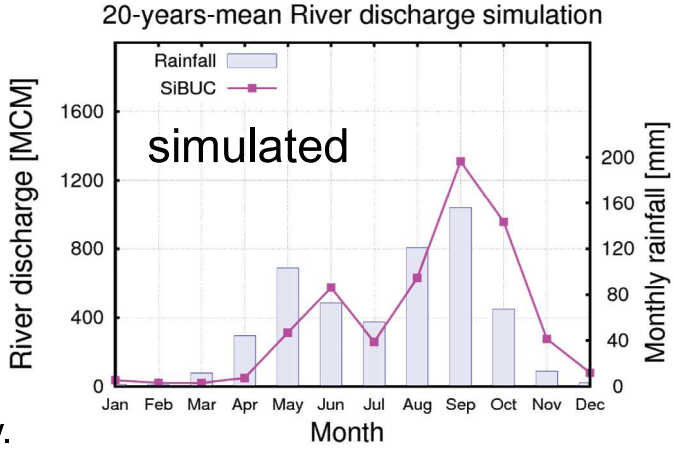


River flow for each grid cell

Simulation Bhumibol Dam inflow by SiBUC LSM using 5km-NHRCM in Thailand

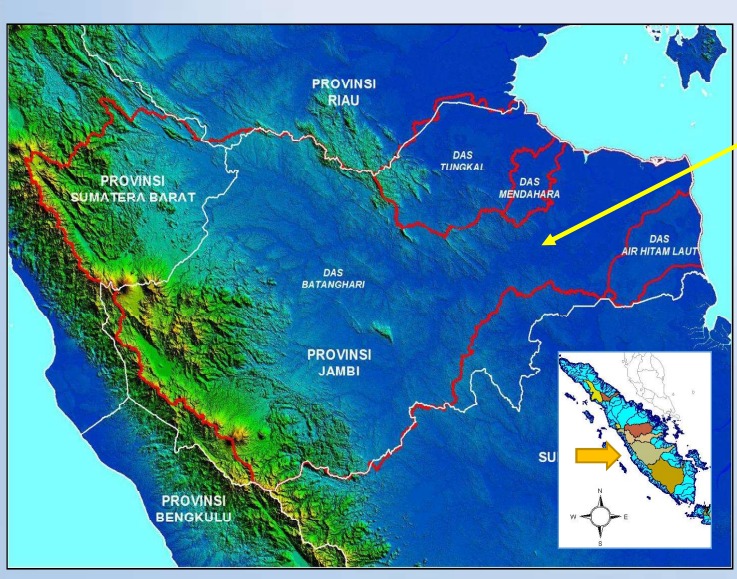






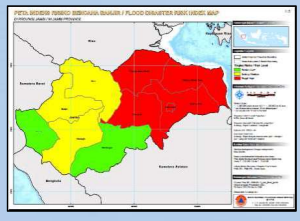
Aulia, Yorozu and Tachikawa, Kyoto Univ.

Indonesia Batanhari River basin
Impact assessment of land use and climate change



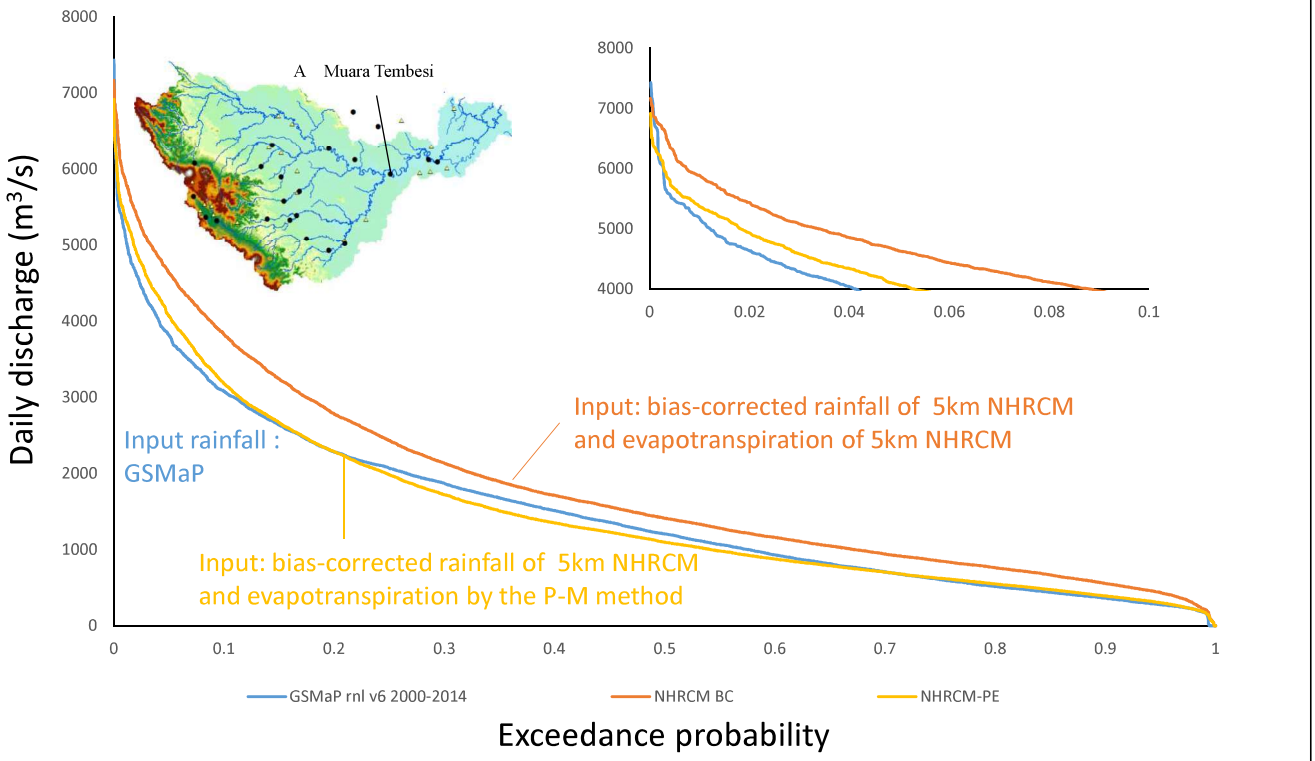
Flood in Janbi City
in March 15, 2017

Batanhari River basin (42,960 km²)



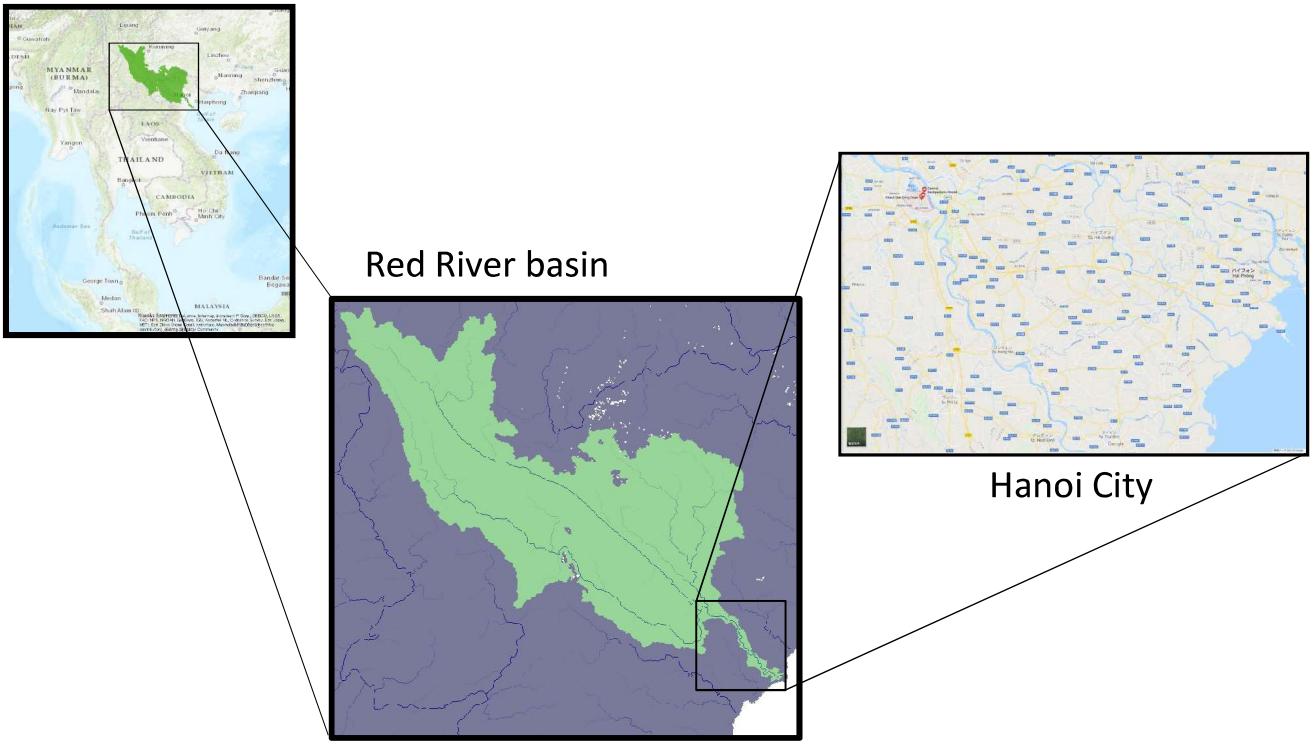
Existing flood hazard map

Runoff simulation at Batanhari River Basin in Indonesia using NHRCM5km present climate data



Provided by Prof. Sayama at DPRI, Kyoto University

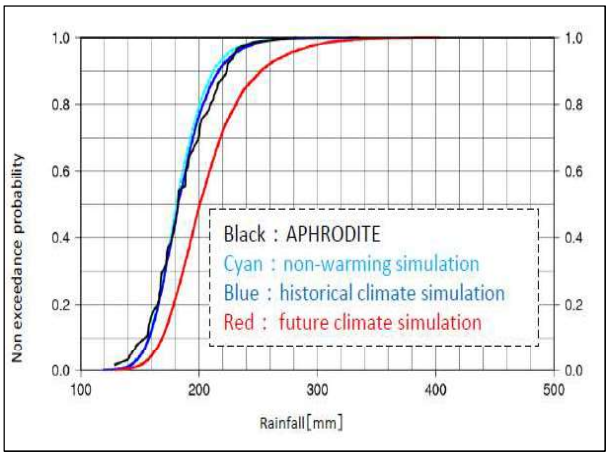
Red River basin

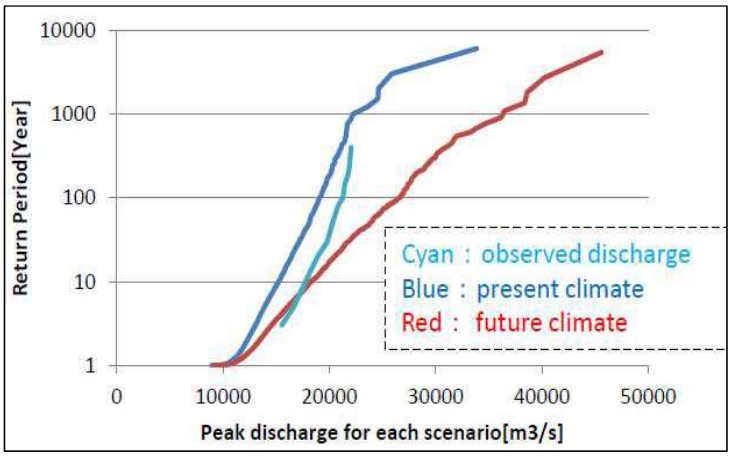


Discussion at Thuy Loi University in Hanoi

January 7, 2019

Annual maximum 15-days rainfall and annual maximum river discharge in the Red River basin using d4PDF





Provided by Mr. Kato at Nagoya Univ. and Mr. Kato at Tokio Marine Research Institute

Recent activities in ICHARM

Water-related platform activities in Indonesia

Discussion on August in 2018 in Public Works Ministry in Indonesia

United Nations Educational, Scientific and Cultural Organization

International Centre for Water Hazard and Risk Management under the auspices of UNESCO

Public Works Research Institute, National Research and Development Agency, Japan

ICHARM activities in Philippine

Meetings on "Platform on Water-related Disasters"

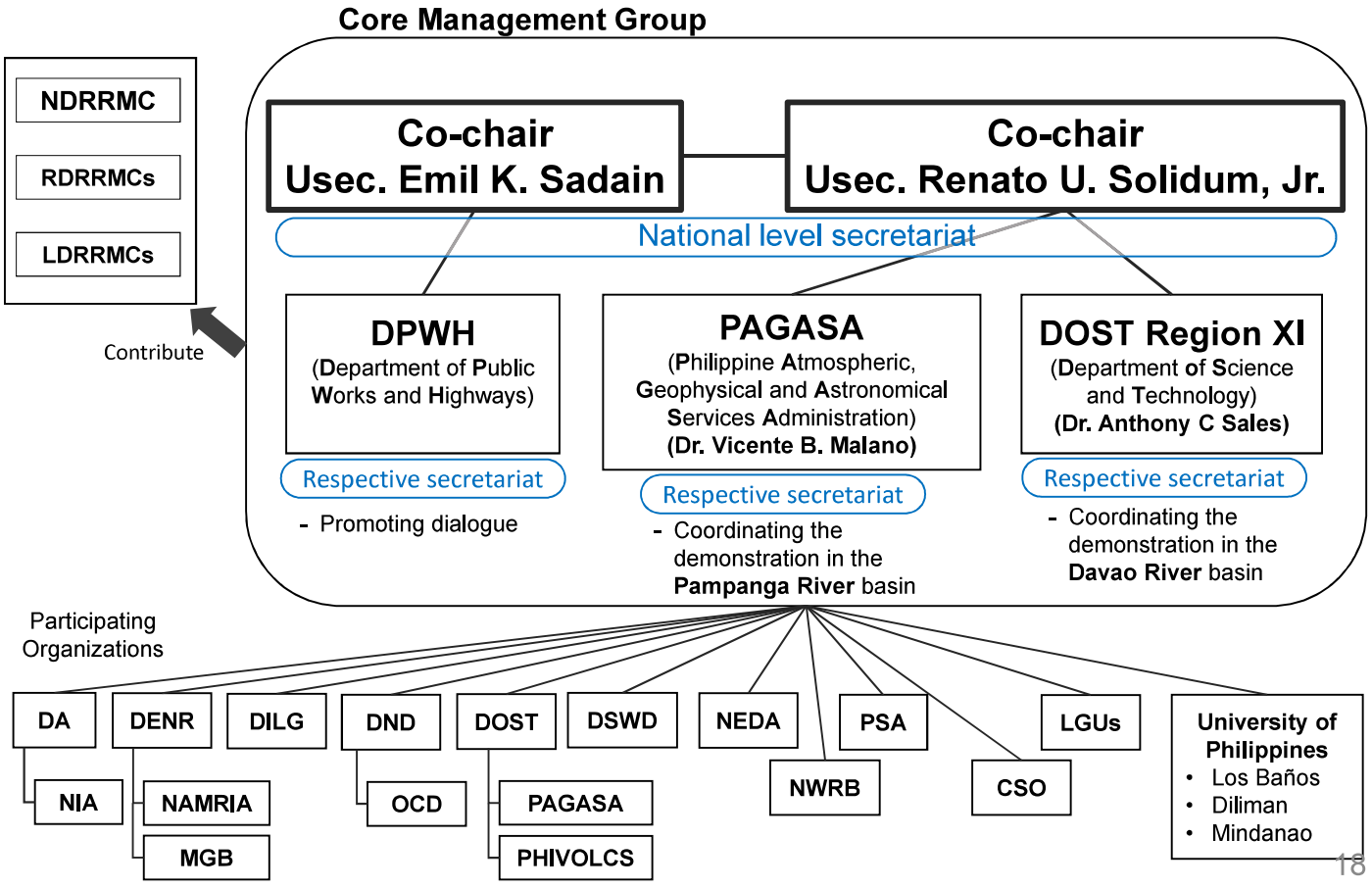
- 13 March at Metro Manila
- 15 June at Metro Manila
- 18 September at Vietnam (Separate Mtg.)

Participated Stakeholders

	• **DOST**	: **D**epartment **o**f **S**cience and **T**echnology
Hydro-Met	• **PAGASA**	: **P**hilippine **A**tmospheric, **G**eophysical and **A**stronomical **S**ervices **A**dministration
River Bureau	• **DPWH**	: **D**epartment of **P**ublic **W**orks and **H**ighways
Disaster	• **OCD**	: **O**ffice of **C**ivil **D**efense
Economy	• **NEDA**	: **N**ational **E**conomic and **D**evelopment **A**uthority
Statistics	• **PSA**	: **P**hilippine **S**tatistics **A**uthority
Geology	• **NAMRIA**	: **N**ational **M**apping and **R**esource **I**nformation **A**uthority
Academia	• **UP**	: **U**niversity of **P**hilippines
	• **JICA**	
	• **ICHARM**	

Philippines

Institutional Structure of "Platform on Water-related Disasters"



New opportunity for future hydrologic prediction and design in Southeast Asian region using 5km downscaled data under TOUGOU Program.

Thank you very much for your attention