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*Researching and Serving the Best*

# Adaptation initiative in Indonesia



Collaboration with



Funded by



# Background

- Mr. Abe, the prime minister of Japan, promised to support adaptation planning and actions in developing countries in his speech of the UN Climate Summit 2014
  - “Japan’s Adaptation Initiative”
- **Indonesia** was selected as the first country implemented the initiative.
- A Japanese research team was organized and the project has started in Jun. 2015.
  - three year project (until Mar. 2018)
  - will be extended by Mar. 2019



@UN Climate Summit 2014

# Objectives of our activity

- Support regional adaptation planning
  - in collaboration with local researchers and stakeholders
    - ① create scientific evidence on regional future CC impacts
    - ② develop effective adaptation scenarios
  - mainly focusing on North Sumatra, East Java, and Bali
- Capacity building for sustainable planning and actions on adaptation
- Develop adaptation planning guideline
  - to apply our approach to other countries and regions



# Team members



- **The University of Tokyo:**
  - ✓ Coordination of the and communication with MOEJ
  - ✓ Impacts assessment on [health impact](#)



- **National Institute for Environmental Studies (NIES):**
  - ✓ Future climate projections based on climate models



- **Ibaraki University:**
  - ✓ Impact assessments on [agriculture](#)

**NIPPON KOEI**

*Challenging mind, Changing dynamics*

- **Nippon Koei:**
  - ✓ Overall coordination and guideline development
  - ✓ Impact assessments on [water resources](#)



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*Plucking and Sowing The Seed*

- **Local consultants (Profs. Pasaribu and Osawa):**
  - ✓ Support and coordination of field survey etc.

# Approach

**1st step:** Impact assessment (*done*)



**2nd step:** Discussion with stakeholders (*done*)



**3rd step:** Adaptation assessment (*running*)

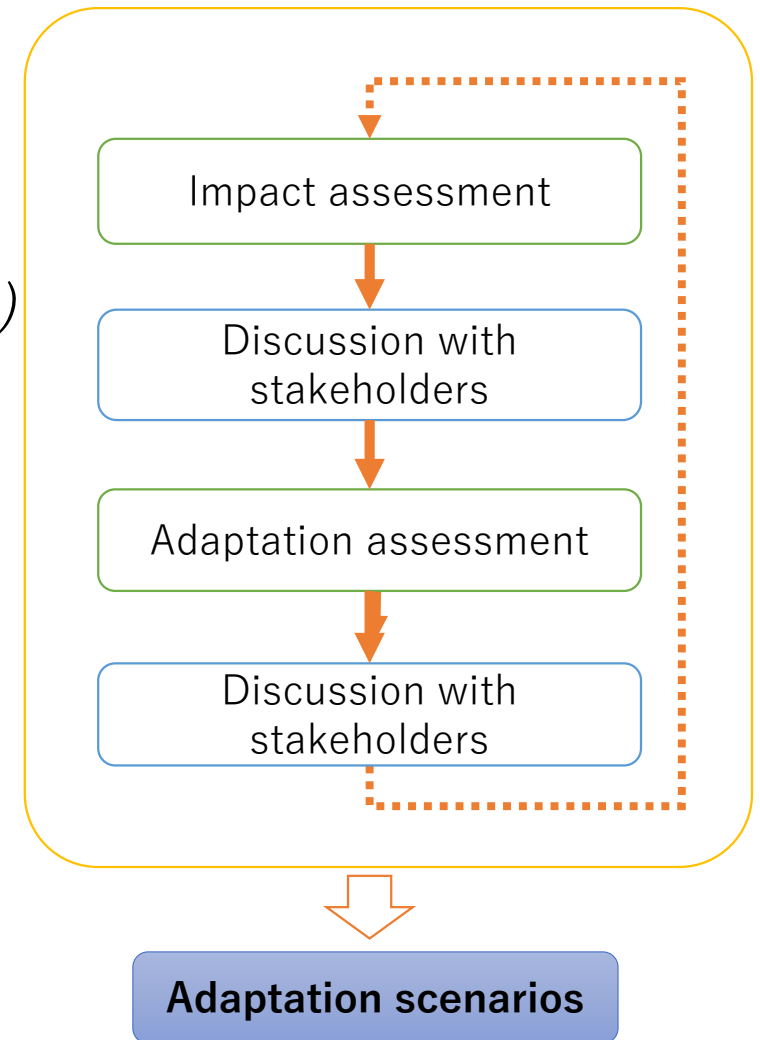


**4th step:** Discussion with stakeholders

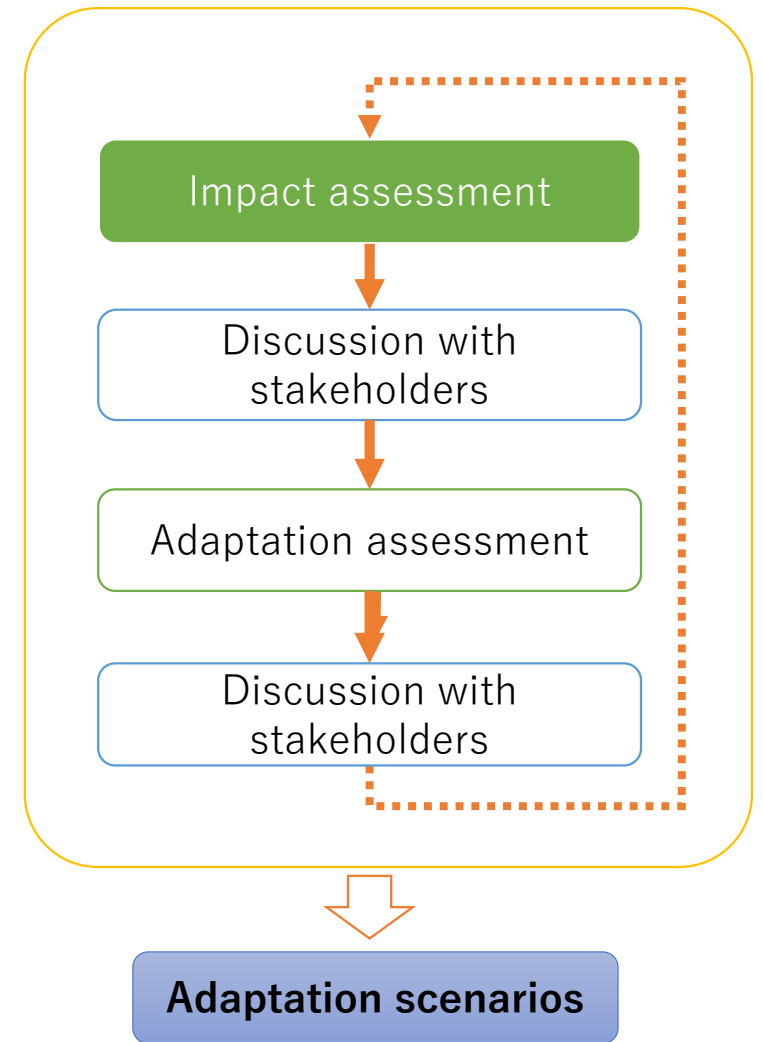


Revise 1 to 4 steps if necessary

**5th step:** Making adaptation scenarios



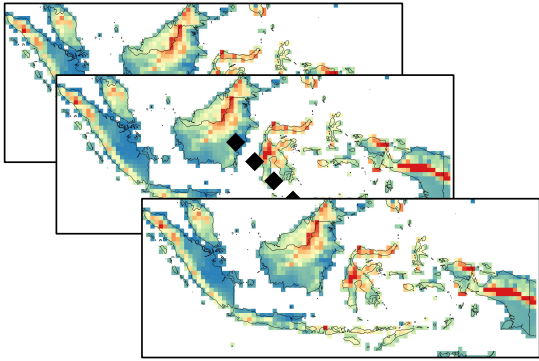
# 1st step: Impact assessment



# Method

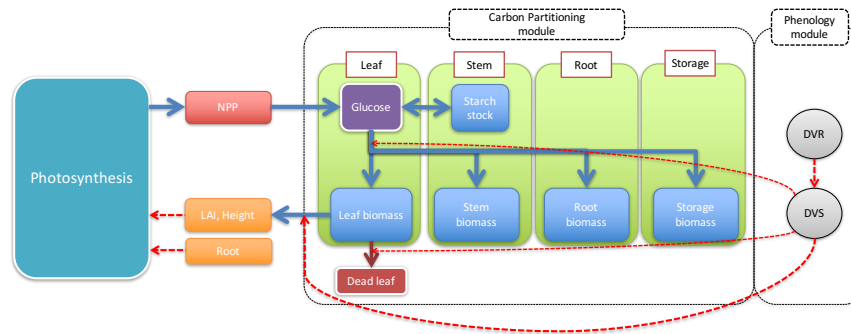
## ① Input

Future climate projections



## ② Impact model

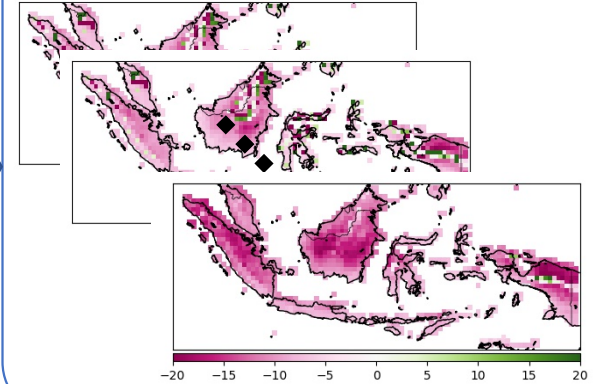
Crop Growth Simulation Model : **MATCRO**



Masutomi et al. (2016a,b)

## ③ Output

Change in rice yield [%]



Base years: 1996-2005

Assessment years: 2031-2040



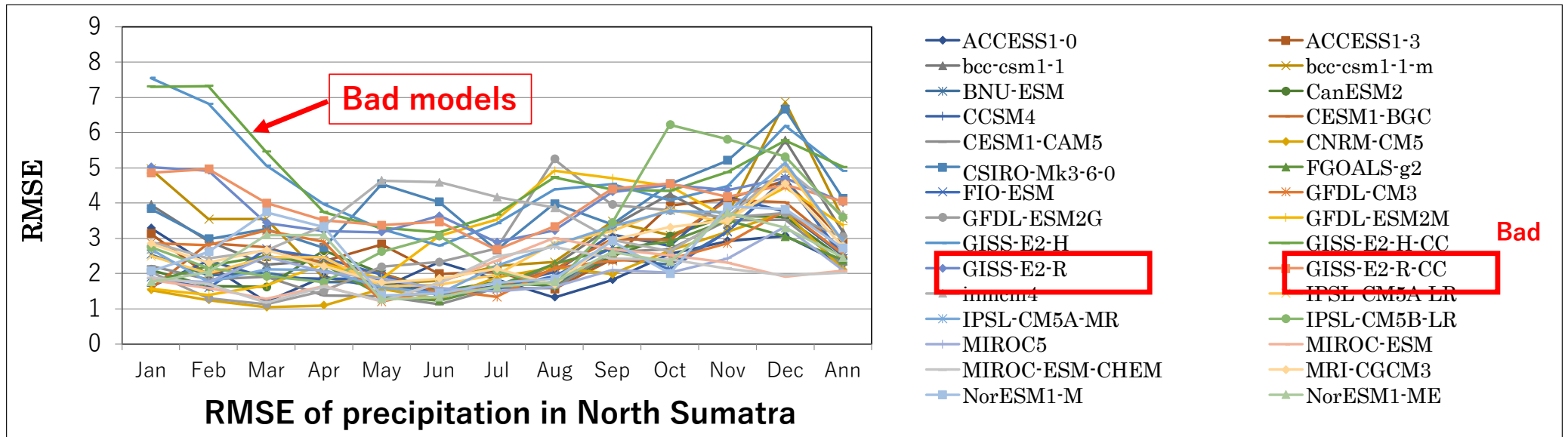
Or



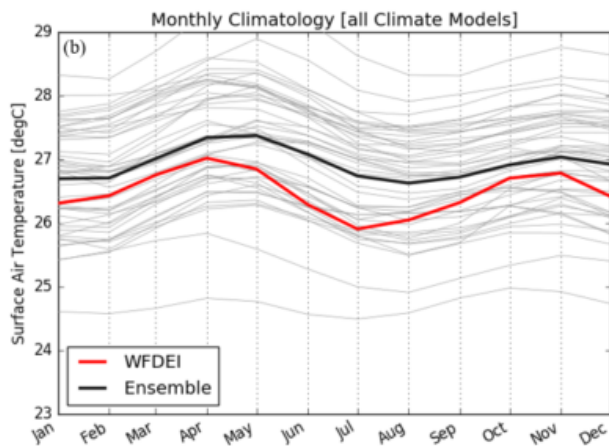
Decrease

Increase



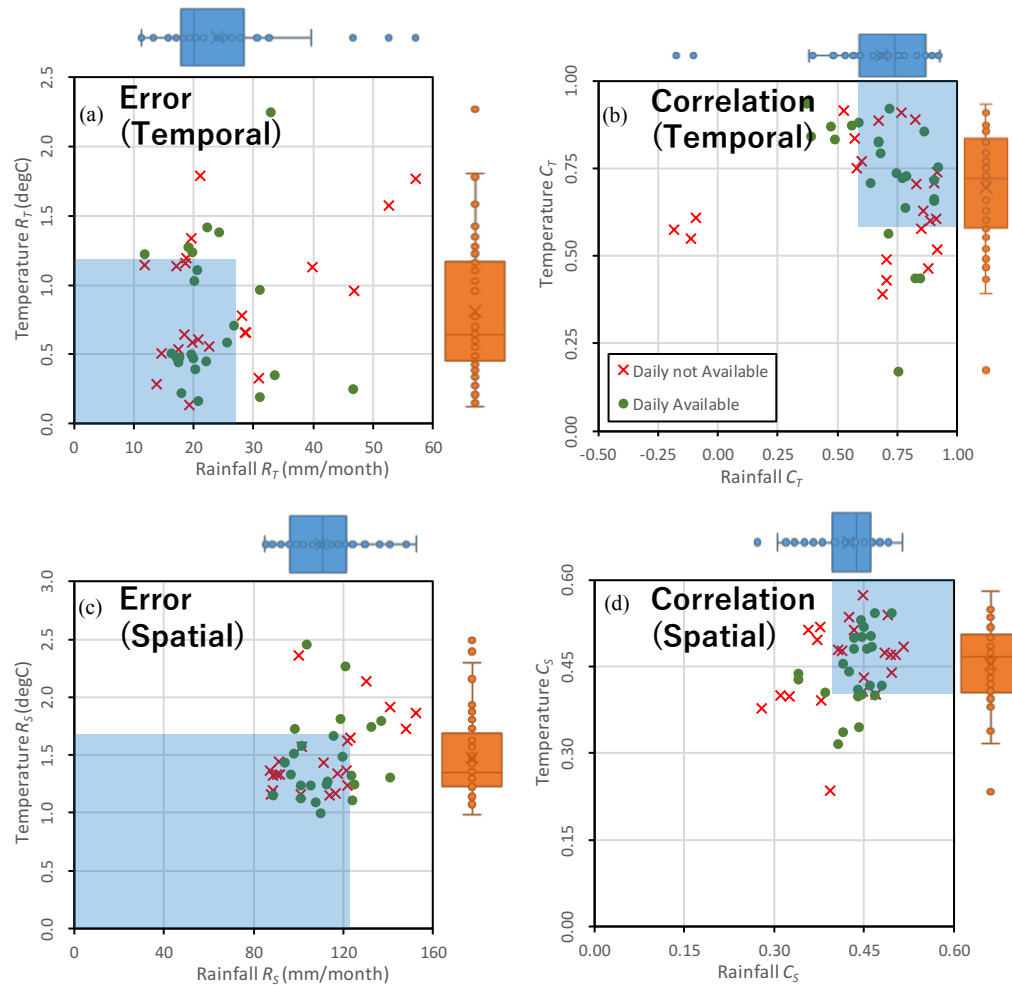


**\* We assumed WFDEI is true observation**



- There are some models with low ability.
- Ensemble mean of all models is not good

We selected climate models with higher ability according to temporal and spatial errors and correlations.



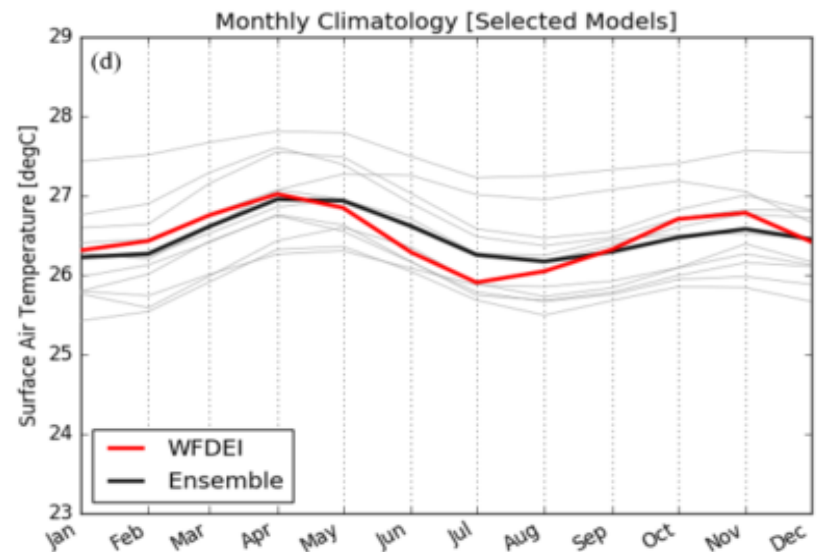
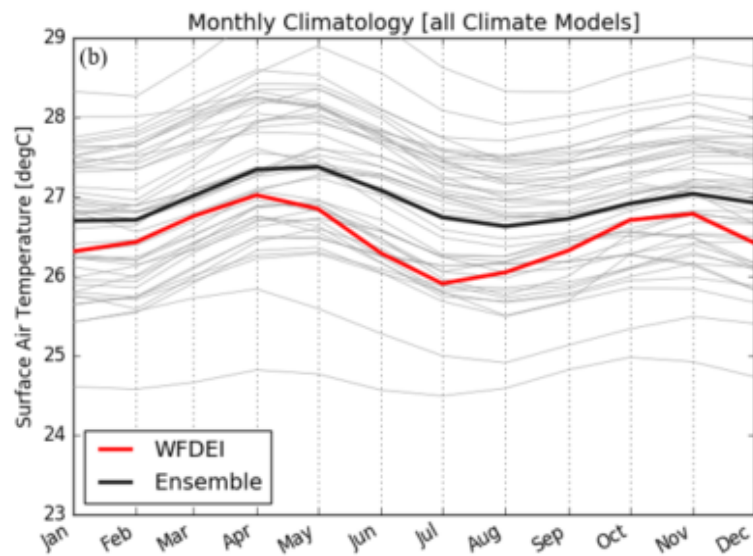
N°	Model	Temporal		Spatial	
		by $R_T$	by $C_T$	by $R_S$	by $C_S$
1	<b>ACCESS1-0</b>	✓		✓	✓
	ACCESS1-3				✓
	bcc-csm1-1		✓		✓
2	<b>BNU-ESM</b>	✓		✓	✓
	CanESM2		✓	✓	
3	<b>CNRM-CM5</b>	✓	✓	✓	✓
	CSIRO-Mk3-6-0		✓		
4	<b>FGOALS-g2</b>	✓	✓	✓	
5	<b>GFDL-CM3</b>	✓	✓	✓	✓
	GFDL-ESM2G		✓		
6	<b>GFDL-ESM2M</b>	✓	✓	✓	✓
	HadGEM2-AO		✓		✓
	inmcm4	✓			
7	<b>IPSL-CM5A-LR</b>	✓	✓	✓	✓
8	<b>IPSL-CM5A-MR</b>	✓	✓	✓	✓
9	<b>IPSL-CM5B-LR</b>	✓	✓		✓
	MIROC4h		✓		✓
10	<b>MIROC5</b>	✓		✓	✓
	MIROC-ESM	✓		✓	
	MIROC-ESM-CHEM	✓		✓	
	MRI-CGCM3				✓
	MRI-ESM1				✓
11	<b>NorESM1-M</b>	✓	✓	✓	

Blue: Appears in 4 columns

Black: Appears in 3 columns

Grey: Not considered

Meteorological Variable	Error Metric	46 models	Models in Common
Rainfall	$R_T$	24	21
	$C_T$	0.68	0.72
	$R_S$	112	104
	$C_S$	0.43	0.45
Surface Temperature	$R_T$	0.82	0.50
	$C_T$	0.69	0.73
	$R_S$	1.48	1.25
	$C_S$	0.45	0.47



Ensemble mean of all climate models

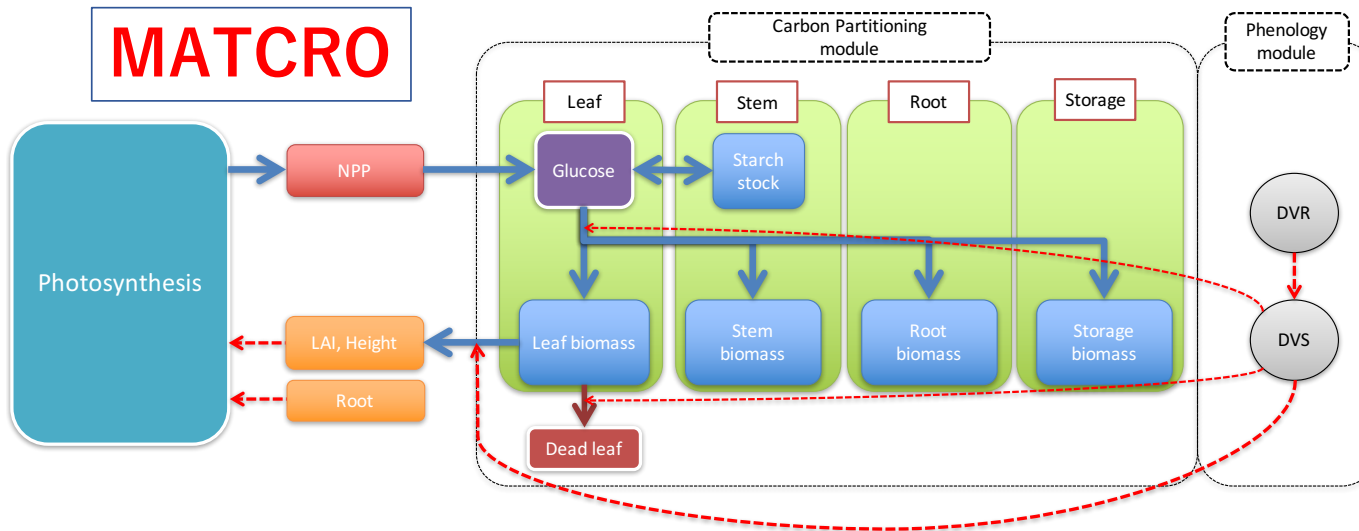
Ensemble mean of selected climate models

# Selection of future climate projections

Indonesia (whole)		Western Indonesia		Central Indonesia		Eastern Indonesia	
N°	Climate Model	N°	Climate Model	N°	Climate Model	N°	Climate Model
1	ACCESS1-0	1	ACCESS1-0	1	ACCESS1-0	1	BNU-ESM
2	BNU-ESM	2	ACCESS1-3	2	BNU-ESM	2	CanESM2
3	CNRM-CM5	3	BNU-ESM	3	CanESM2	3	CNRM-CM5
4	FGOALS-g2	4	CNRM-CM5	4	CNRM-CM5	4	GFDL-CM3
5	GFDL-CM3	5	FGOALS-g2	5	FGOALS-g2	5	GFDL-ESM2M
6	GFDL-ESM2M	6	HadGEM2-AO	6	GFDL-CM3	6	HadGEM2-AO
7	IPSL-CM5A-LR	7	IPSL-CM5A-LR	7	GFDL-ESM2M	7	inmcm4
8	IPSL-CM5A-MR	8	IPSL-CM5A-MR	8	IPSL-CM5A-LR	8	IPSL-CM5A-LR
9	IPSL-CM5B-LR	9	IPSL-CM5B-LR	9	IPSL-CM5A-MR	9	IPSL-CM5A-MR
10	MIROC5	10	MIROC5	10	IPSL-CM5B-LR	10	IPSL-CM5B-LR
11	NorESM1-M	11	MIROC-ESM	11	MIROC5	11	MIROC5
		12	MIROC-ESM-CHEM	12	MRI-CGCM3	12	NorESM1-M
		13	MRI-CGCM3	13	MRI-ESM1		
		14	MRI-ESM1	14	NorESM1-M		
		15	NorESM1-M				

- We selected **6 climate models** with high performance over three regions
  1. CNRM-CM5
  2. IPSL-CM5A-LR
  3. IPSL-CM5A-MR
  4. IPSL-CM5B-LR
  5. MIROC5
  6. NorESM1-M
- **21 climate future climate projections**
  - Each model has 2-4 RCP scenarios
- Only temperature projections are used in the impact assessment
  - We focus on the impact of future temperature increase.

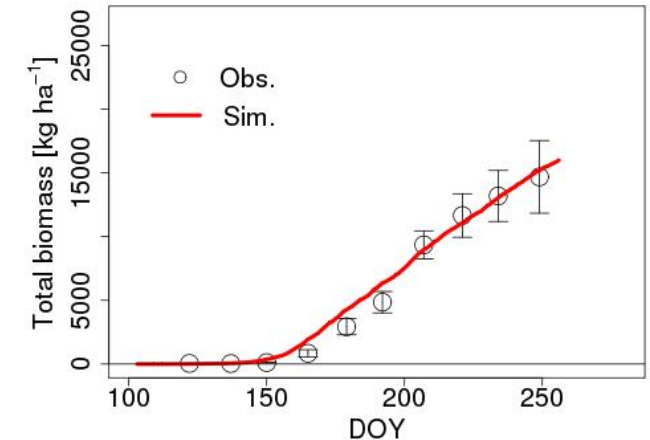
## ② Impact model



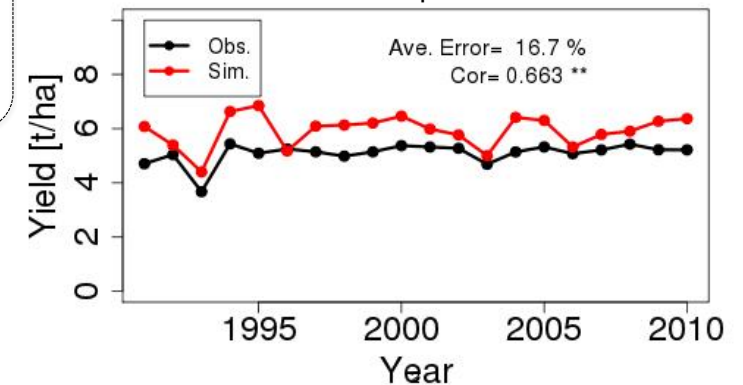
Crop growth simulation model based on crop physiology  
(Masutomi et al. 2016a,b)

- MATCRO can accurately simulate rice yields
- Planted date is about Nov. 1st (the start of wet season)
- The effect of high CO<sub>2</sub> on crop growth is not considered in the impact assessment

@Mase, Tsukuba



@Japan



# Local rice cultivars

	Cultivars	Planted area(ha)	%	type
1	Ciherang	5,034,657	37.1	Indica
2	Mekongga	1,135,893	8.4	Indica
3	Situ Bagendit	1,013,659	7.5	Indica
4	IR 64	964,241	7.1	Indica

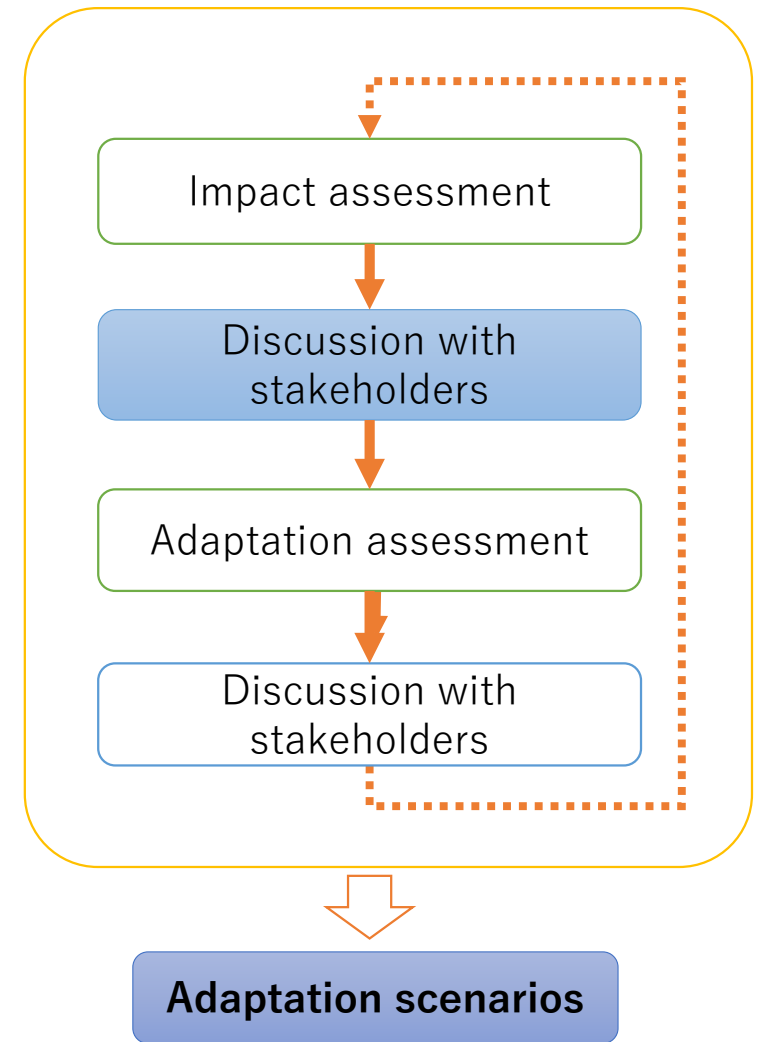
Source IAARD

We focused on “Ciherang” in this study



Ciherang

# 2nd step; Discussion with stakeholders

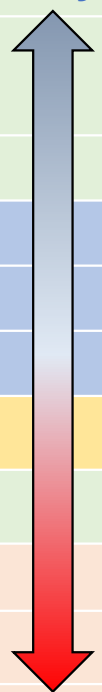


# Objective of the discussion

- To **prioritize adaptation options**, based on the impact assessment,
  - The effect of the prioritized adaptation options are assessed in Step3.
- We had two workshops with stakeholders.
  - Mar. 7, 2017@Medan, North Sumatra
  - Mar. 9, 2017@Surabaya, East Java
    - about 30 participants
    - BAPPEDA, BMKG, university researchers, etc.



# Menu for adaptation options on agriculture

No	Menu		Cost	Effect	Actor				
					Gov.	Scientist	Farmer	Company	
1	Change in variety (existing variety)	Easy	Low	Low			✓		
2	Change in agricultural management (e.g., planting date, fertilizer, etc. )		Low	Int.			✓		
3	Change in planting crop		Low	Int.			✓		
4	Real time monitoring system		Int.	Int.	✓	✓		(✓)	
5	Early warning system		Int.	Int.	✓	✓		(✓)	
6	Seasonal forecasting system		Int.	Int.	✓	✓		(✓)	
7	Climate and agricultural insurance		int.	Int.	(✓)		✓	✓	
8	Change in variety (new variety)		Int.	High	✓	✓	✓	✓	
9	Change the postharvest system		Int.	High	✓		✓	✓	
10	Development of irrigation system		High	High	✓			✓	
11	Land use change		Difficult	High	High	✓			✓

Category :

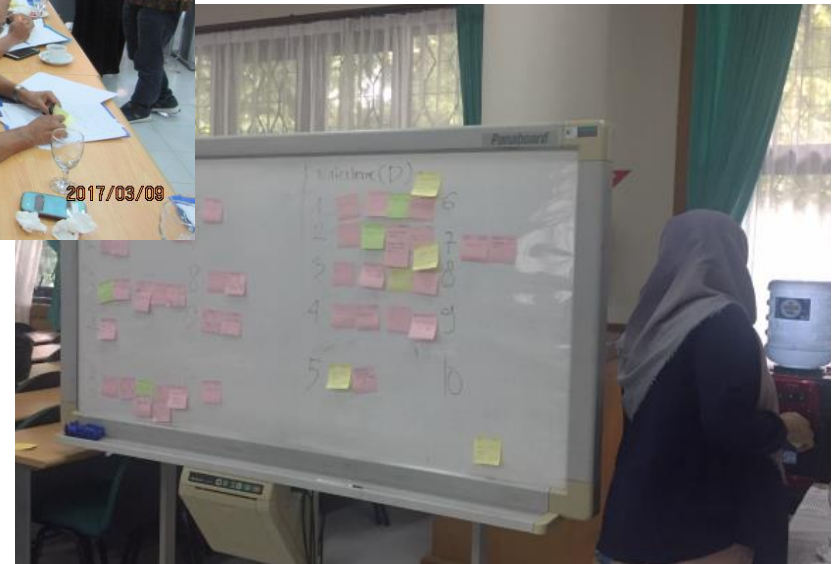
Agricultural  
technology

ICT and smart  
agriculture

Agricultural  
finance

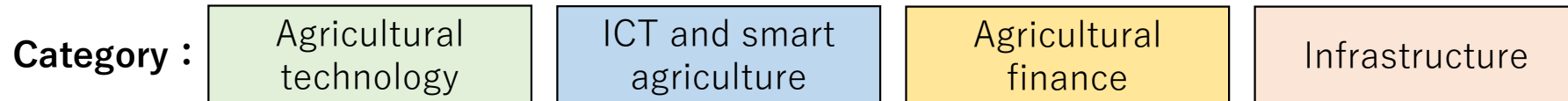
Infrastructure

# Discussion....

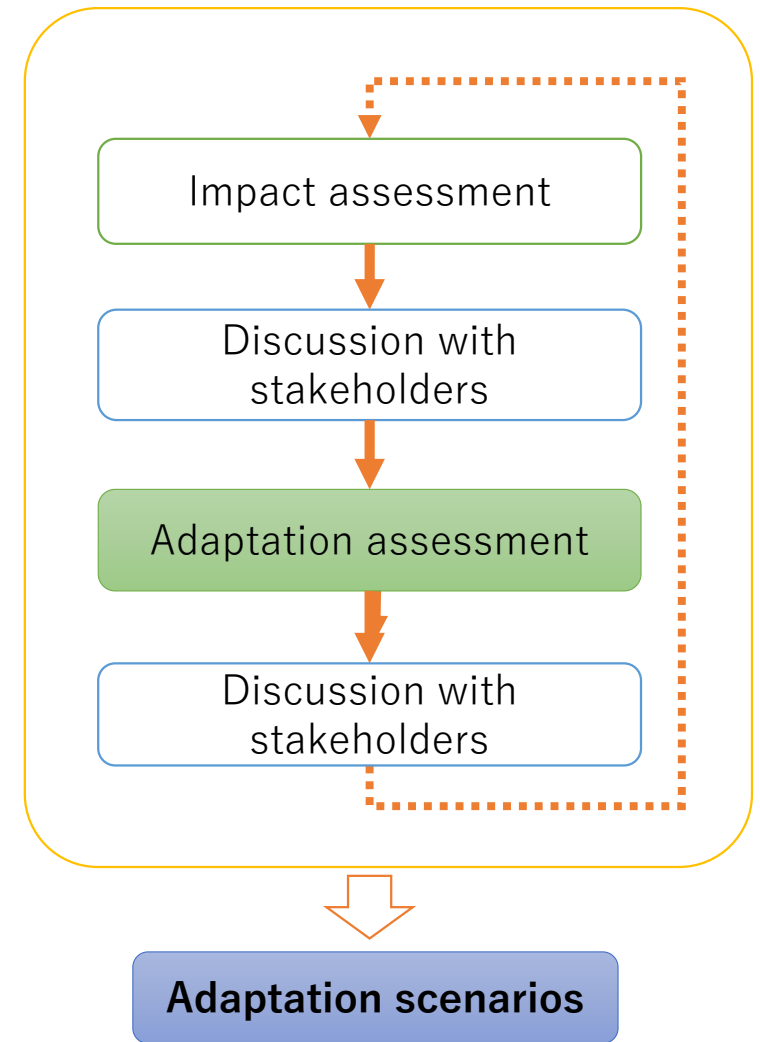


## Summary of the discussion with stakeholders (Step2)

No	Menu		Cost	Effect	Actor				PRIORITY	
					Gov.	Scientist	Farmer	Company	NS.	EJ.
1	Change in variety (existing variety)	Easy	Low	Low			✓			5
2	Change in agricultural management (e.g., planting date, fertilizer, etc. )	↑	Low	Int.			✓		4	1
3	Change in planting crop		Low	Int.			✓			
4	Real time monitoring system		Int.	Int.	✓	✓		(v)	5	
5	Early warning system		Int.	Int.	✓	✓		(v)		4
6	Seasonal forecasting system		Int.	Int.	✓	✓		(v)	2	2
7	Climate and agricultural insurance		int.	Int.	(v)		✓	✓		
8	Change in variety (new variety)		Int.	High	✓	✓	✓	✓	3	
9	Change the postharvest system		Int.	High	✓		✓	✓		
10	Development of irrigation system	↓	High	High	✓			✓	1	3
11	Land use change		Difficult	High	High	✓		✓		



# Step3: Adaptation assessment



# Adaptation option #1

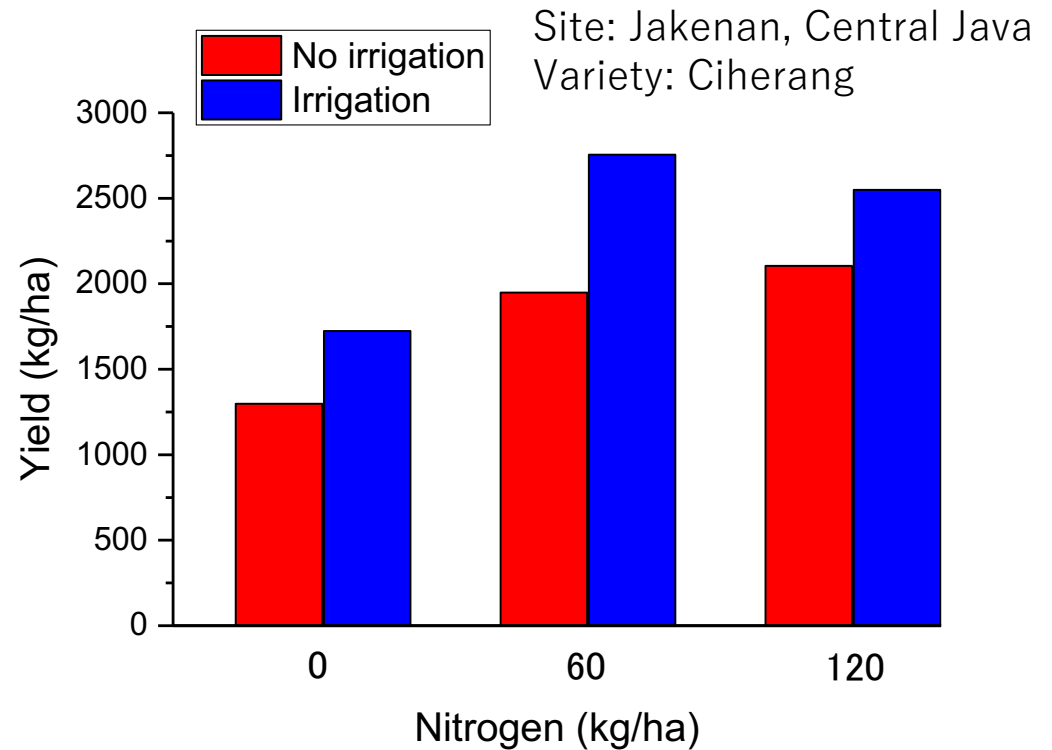
## Irrigation

# The effect of irrigation system



Province	Irrigated paddy field	Not irrigated paddy field
North Sumatera	62%	38%
East Jawa	77%	23%

Source: BPS



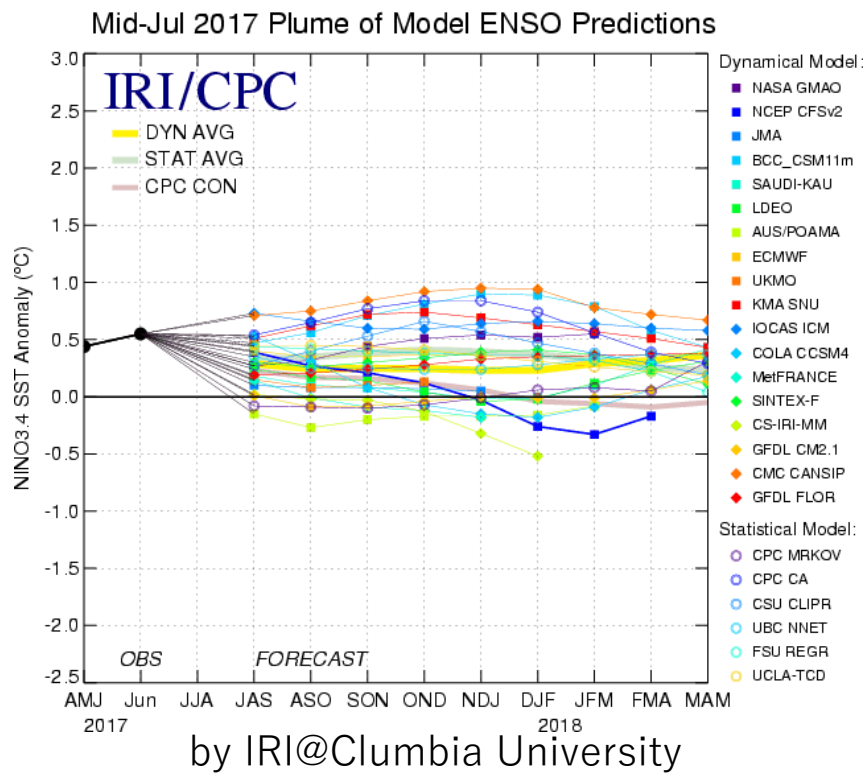
Provided by Dr. Hayashi@IRRI

Irrigation system can increase rice yield.

# Adaptation Option #2: Seasonal Climate Forecast

# Link ENSO and IOD predictions with precipitation prediction and adaptive actions

## ENSO prediction



ENSO and IOD prediction

Correlation

Precipitation prediction

Precipitation prediction using ENSO and IOD prediction could be useful information for adaptive actions

# Summary

1. The Japanese research team is trying to support regional adaptation planning in Indonesia.
2. The preliminary results show global warming will have large impact on rice production over Indonesia.
3. Based on the impact assessment, adaptation assessment has started.

**Thank you for you attention**