

**Orientation Seminar on Climate Change Adaptation in The Pilot Case of Solo River Basin**  
**Solo, 26 February 2020**

# **Climate Change Impact on Hydrology and Water Management**

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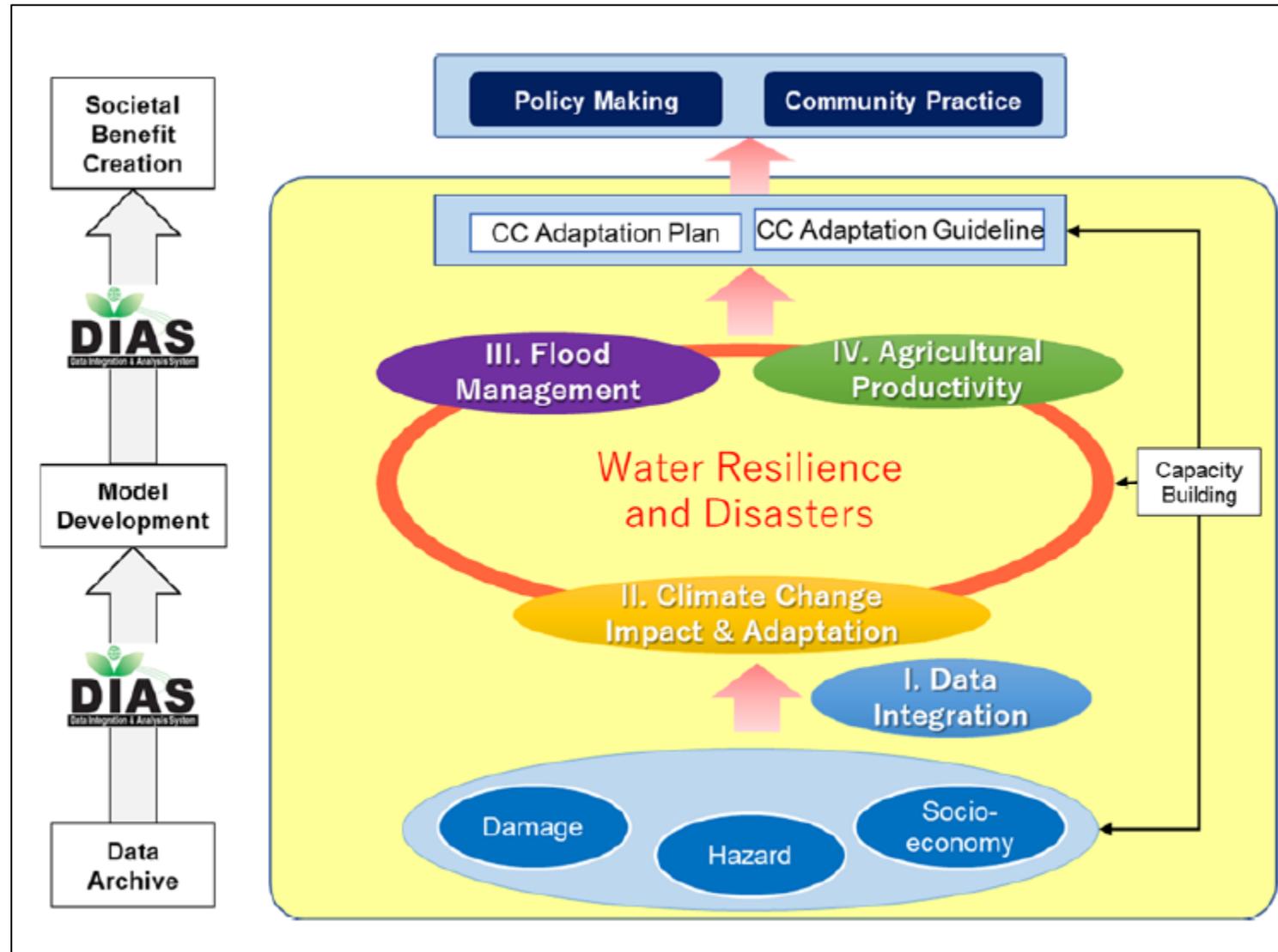


Research Center for Water Resources, Agency of Research and Development  
Ministry of Public Works and Housing

# Research and Development of RCWR in the framework of IFI Platform

## Activities of IFI Platform

- 1) Data integration
- 2) **Climate change impact assessment**
- 3) Climate change adaptation - Flood management
- 4) Climate change adaptation - Agricultural productivity improvement



# Background

- The importance of climate change impact on hydrology and water management
  - 1) Some of the climate change adaptation should be based on the quantitative value of the impact. For example: How high the flood in Solo river might be in 2045?
  - 2) At present, most of the studies estimate climate change impact in a very rough way. Java Water Resources Strategic Study (2012) just assume 3% more flood and 3% lower river flow in the dry season
  - 3) There are already many models on climate change impact on rainfall, but only a few on river flow. In fact, information on river flow is very important for climate change adaptation



# Objectives

- To socialize the results of climate change research in the Research Center for Water Resources (RCWR)
- To find opportunities of RCWR to contribute in this “*Climate Change Adaptation In The Pilot Case Of Solo River Basin*” activity
- To find out possibility of research collaboration in the framework of “*Climate Change Adaptation In The Pilot Case Of Solo River Basin*”



# Some research by Research Center for Water Resources on climate change impact assessment on hydrology and water management

- Climate change impact on **design rainfall**
  - Guideline on Assessment of climate change impact on design rainfall (2017)
  - Predicting and Managing Heavy Rainfall in Indonesia: A Study Case in Brantas River Basin, East Jawa (presented at Joint Convex HAGI – IAGI – IAFMI- IATMI, Yogyakarta, 2019)
- **Rainfall-runoff model** for climate change impact
  - Comparison of rainfall-runoff models for climate change projection - case study of Citarum River Basin, Indonesia, Conference: The 4th International Conference on Climate Change 2019 (The 4th ICC 2019), Yogyakarta. IOP Conference Series Earth and Environmental Science 423, DOI: 10.1088/1755-1315/423/1/012045
- Climate change and **drought**
  - Assessment of Climate Change Impacts using Hydrological Drought Index - a Case study at Notog, Kragilan, and Kertosono (presented at ICID Bali, 2019)
- Climate change impact on **water security**
  - Climate change impact on irrigation water security in West Java (presented at ICID Bali, 2019)
- Climate change impact on **water management**
  - Climate Change Impact on Jatigede Reservoir Operation (Accepted to presented orally at ICOLD 2020 Annual Meeting / Symposium, April 2020)

# Climate Change Impact On Design Rainfall

## Draft Guideline

RPT1: Pd T-XX-TTTT-A

Rancangan 0

# PEDOMAN

Perhitungan Hujan Rencana untuk Perhitungan Banjir Rencana akibat Pengaruh Perubahan Iklim

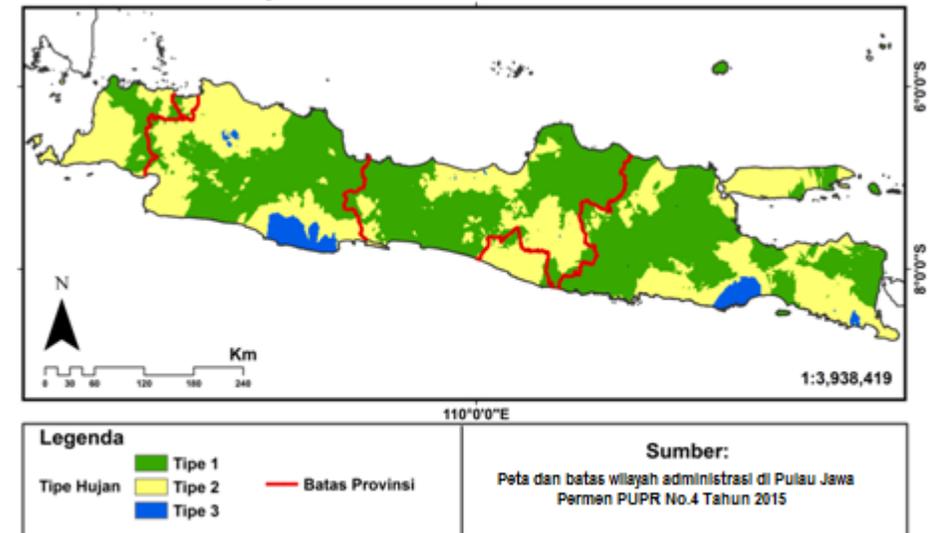
Tata Cara Perhitungan Hujan Rencana

$$P_T = P_{med} X_T$$

$P_T$  : T years design rainfall

$P_{med}$  : median of daily maximum annual rainfall

$X_T$  : T years Growth Factor



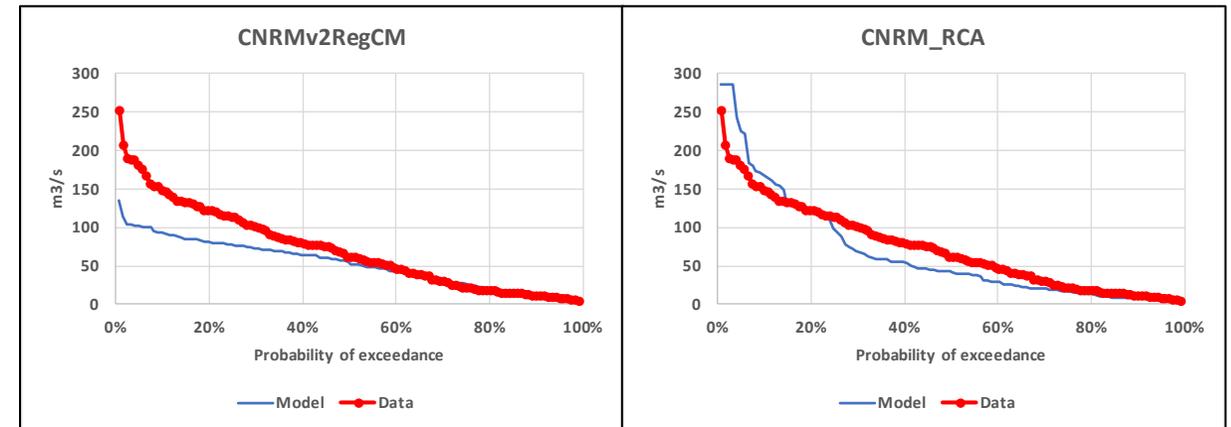
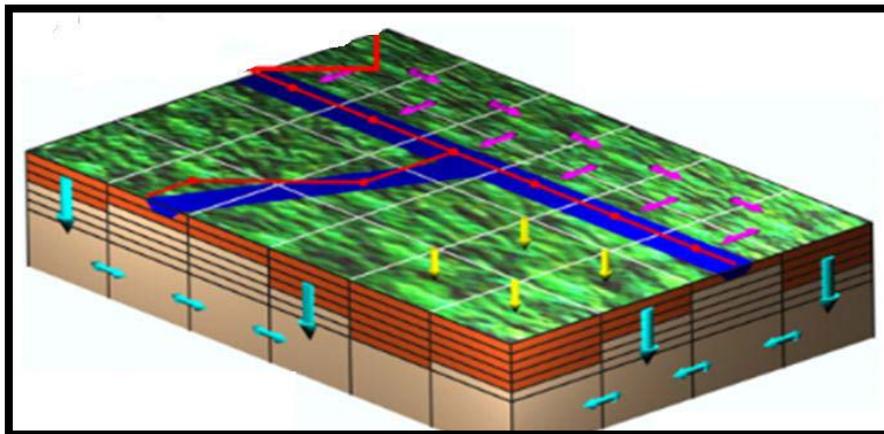
# Rainfall-runoff model for climate change impact

4<sup>th</sup> International Conference on Climate Change 2019, Yogyakarta

- *Comparison of rainfall-runoff models for climate change projection - case study of Citarum River Basin, Indonesia*

- ✓ The 4th International Conference on Climate Change 2019
- ✓ NRECA generally is better than empirical relationship

- Distributed model Wflow (2020)



Duration curve of NRECA (left) vs Empirical Relationship (right)

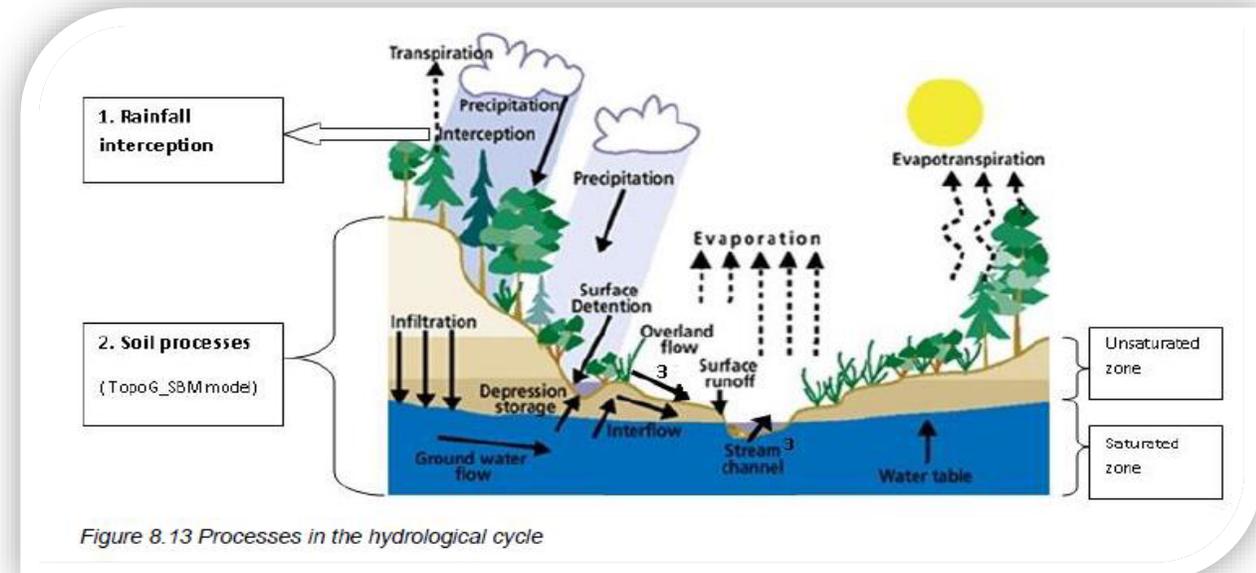
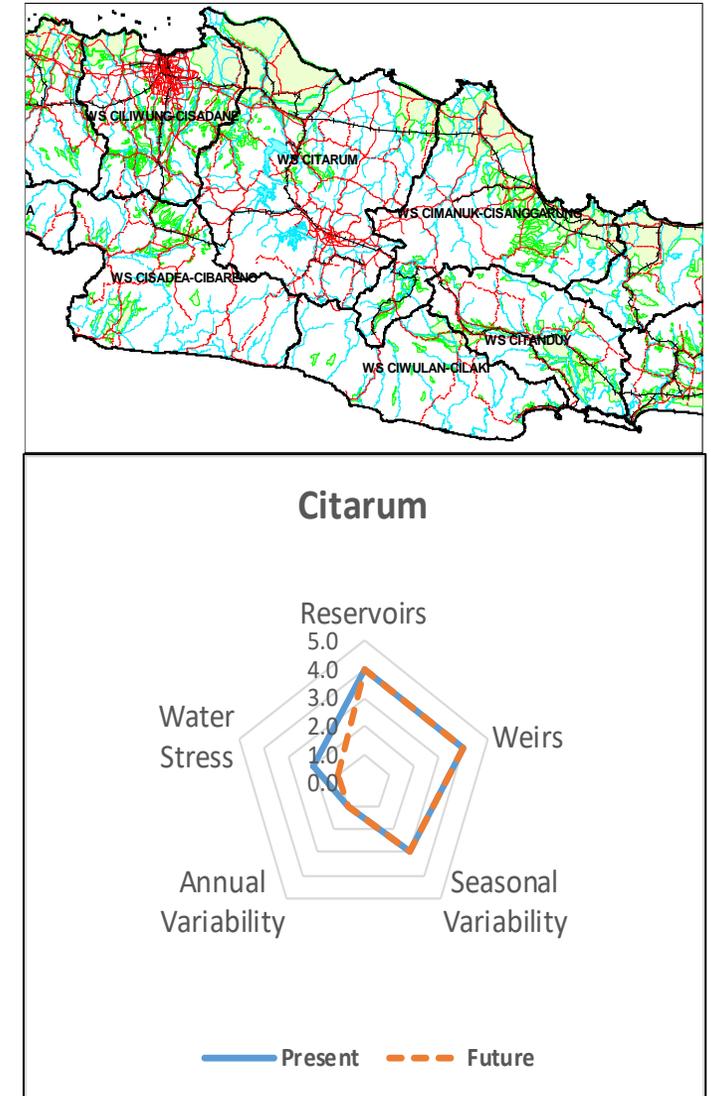


Figure 8.13 Processes in the hydrological cycle

# Climate Change Impact On Irrigation Water Security In West Java

## ICID, Bali, 2019

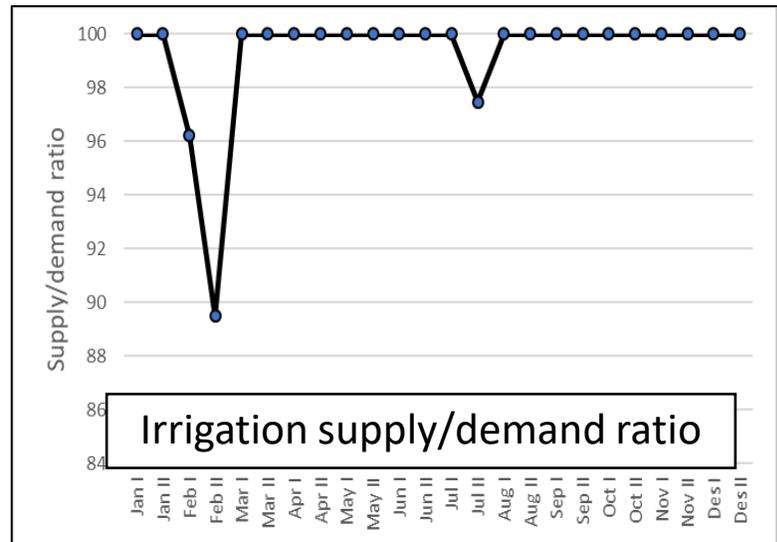
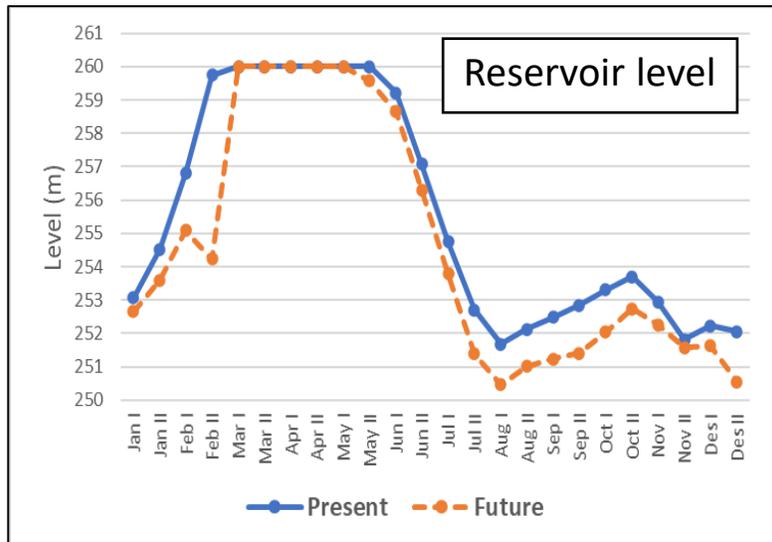
- Climate change is projected using the worst scenario RCP 8.5
  - ✓ The monthly rainfall is projected until 2045 using ensemble of seven models CNRM CM5, CNRM RCA, CNRM v2 RegCM, CSIRO MK3,6, EC EARTH, GFDL ESM, and IPSL.
- Irrigation water security index
  - ✓ **Asian Water Development Outlook** is reformulated
  - ✓ to enable assessment of nature change,
  - ✓ as well as human effort to control the water by means of reservoirs and weirs.
- The **new irrigation water security index** consists of:
  - a) Natural hydrological condition represented by coefficient of variation of the monthly discharge within year and annual discharge;
  - b) Competitive environment by water stress condition; and
  - c) Infrastructures of reservoirs and irrigation weirs. It is concluded that the West Java irrigation water security in the future would be significantly reduced if no substantial effort is made to compensate the variability of water availability.
- **All of the six river basins in West Java** except Cilaki-Ciwulan are **vulnerable** to the climate change impact on irrigation water security.



# Climate Change Impact On Jatigede Reservoir Operation

## ICOLD New Delhi, April 2020

- Climate change impact on rainfall until **2045**
- Projected using an ensemble of **7 General Circulation Model (GCM)**: CNRM CM5, CNRM RCA, CNRM v2 RegCM, CSIRO MK3,6, EC EARTH, GFDL ESM, and IPSL
- Climate change scenario: **RCP 8.5**



Inflow Scenario	Wet Year	Normal Year	Dry Year
Public water supply	100%	100%	100%
Irrigation supply	100%	100%	89% to 100%
Drops of water level	No.	No.	Up to 5 meters

# Concluding Remarks

- Climate change impact on flood and drought
  - Projection models from BMKG
  - Rainfall-runoff: empirical, NRECA, Wflow
  - River flow projection becoming input for Climate Change Adaptation
- Climate change adaptation
  - Re-design of water resources infrastructures
  - Improvement of the reservoir rule curve to incorporate climate change
- Expectation
  - Newer and better methods from ICHARM
  - Fruitful collaboration in the framework of “*Climate Change Adaptation In The Pilot Case Of Solo River Basin*”