2nd Asia International Water Week ON AIR

3rd Webinar

Water and Climate Change

8 April 2021 (Thur) 16:00 (GMT+9)

- **Zoom:** http://us02web.zoom.us/j/85383685037 (Password: 123)
- **Youtube:** bit.ly/3s4i25s (Search "Asia Water Council")

Asia Water Council & Ministry of Public Works and Housing of Indonesia

Program at a glance

Time	Contents	Presented by
16:00 - 16:02	• Introduction of the session	AWC Secretariat
16:02 – 16:08	• Opening and Congratulatory Remarks	Senior Executive Vice President, K-water Vice President, China IWHR
16:08 – 16:40	• Introduction of the session and the presenters	Moderator
	[Presentations] (10 min/each presentation) **1) Adapting Water Resources to Climate Change** **2) Evolution Characteristics of Global Terrestrial Water Resources and the Integrated Adaptation Strategies for Climate Change** **3) Climate Change and Water Infrastructure**	Presenters
16:40 - 17:00	**[Q&A]** • Panel Discussion (Open to All) • Panelist: Dr. Qian Yu (China IWHR) **[Wrap-up]**	All participants
	• Announcement of the 4th Webinar "Water-Energy-Food Nexus" • Closing	AWC Secretariat

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- **Opening Remarks**

Dr. Han-goo Lee
Senior Executive Vice President
K-water

- 32 years in K-water
- Chief Management Officer of Water Resources & Environment Division
- Former General Director of Water Cycle Research Center, Green Algae Technology Center, Disaster and Safety Dept.

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- **Congratulatory Remarks**

Dr. WANG Jianhua
Vice President
China Institute of Water Resources and Hydropower Research (IWHR)

- Expertise in Water Resources Planning and Management
- Research focus: Water cycle, Comprehensive water saving and water ecological protection
- Project: Xiong'an Development Zone, Yellow River Basin, South-to-North Water Diversion Project etc.

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- **Moderator**

Dr. Mukand S. Babel
Professor
Asian Institute of Technology
(Chair of AWC Special Committee)

- Professor for Water Engineering and Management
- Specializes in Hydrologic and Water Resources Modeling
- Research: Watershed Modeling, Climate Change on Hydrology, Water resources and Socio-economic development

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Presenters

1) Dr. German Velasquez
Director
Green Climate Fund

2) Dr. Denghua Yan
Deputy Director
China IWHR

3) Mr. Ewin Sofian Winata
Deputy Director
BAPPENAS, Indonesia

ADAPTING WATER RESOURCES TO CLIMATE CHANGE

GREEN CLIMATE FUND

Jerry Velasquez

Director, Division of Mitigation and Adaptation

2nd Asia international Water Week –

3rd Webinar "Water and Climate Change"

THE GREEN CLIMATE FUND

GREEN CLIMATE FUND

- **Operating entity of the financial mechanism** of the United Nations Framework Convention on Climate Change (UNFCCC) established at the 16th Conference of Parties in 2010
- A critical **element of the historic Paris Agreement**
- The **world's largest climate fund**, mandated to support developing countries raise and realize their Nationally Determined Contributions (NDC) ambitions towards low-emissions, climate-resilient pathways.

GCF PORTFOLIO TO DATE (USD)

121 Developing countries with approved projects

173 Approved projects

8.4b GCF funding approved

21.9b Co-Financing

30.3b Total value of approved projects

122 Projects under implementation with 5.0b of GCF funding

103 Accredited Entities

49 Direct Access (National)

13 Direct Access (Regional)

41 International Access

1.7b disbursed

APPROVED PROJECTS VALUE BY THEME

Adaptation	USD 1.8b	22%
Mitigation	USD 3.9b	47%
Cross-cutting*	USD 2.6b	31%

**The impact of the intervention will, to some extent, both reduce future GHG emissions (to avoid climate change), as well as improve the resilience of an industry or community (to deal with climate change once it occurs)*

GREEN CLIMATE FUND

GCF makes investments within **8 strategic result areas**, in line with country priorities.

- Energy generation and access
- Transport
- Buildings, cities, industries and appliances
- Forests and land use
- Health, food and water security
- Livelihoods of people and communities
- Ecosystems and ecosystem services
- Infrastructure and the built environment

GCF WATER PORTFOLIO OVERVIEW

GREEN CLIMATE FUND

Climate resilient water supply

Integrated water resources management

Flood management

Drought management

Coastal zone management

Drainage

Wetland protection & restoration

Irrigation

Hydropower

Sanitation

- CONCENTRATION into 2 major subsectors
- While some subsectors are cross-cutting and may be categorised under other sectors, they all involve changing the way water is managed and/or used.
- Most projects include:

  - water governance and enabling environment initiatives

  and/or

  - capacity building

ONE FOCUS AREA OF GCF PROJECTS
ADDRESSING WATER SCARCITY DUE TO CLIMATE CHANGE

Adaptation options include:

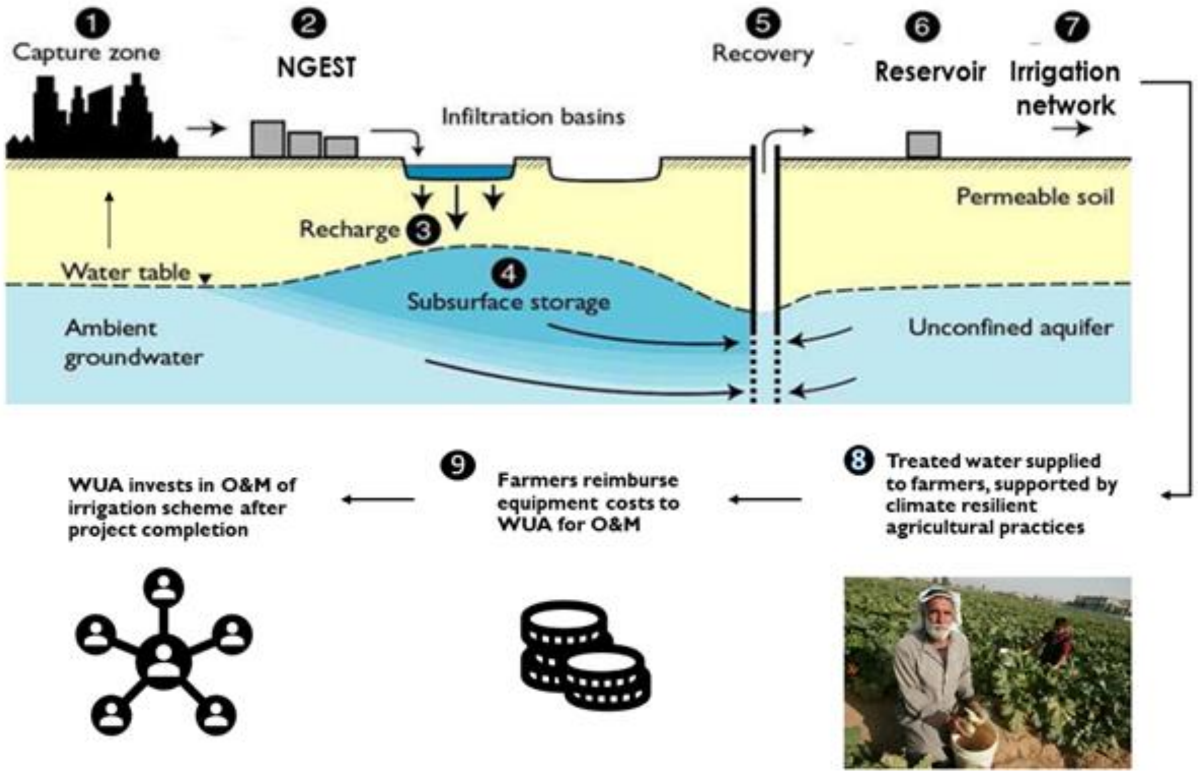
Demand management

1. Leakage reduction
2. **Wastewater reuse & recycling**
3. Efficient irrigation

Supply enhancement

1. **More storage, e.g. rainwater harvesting**
2. New water supply infrastructure
3. Conjunctive use of groundwater and surface water

FP119 Water Banking and Adaptation of Agriculture to Climate Change in Northern Gaza



STATE OF PALESTINE

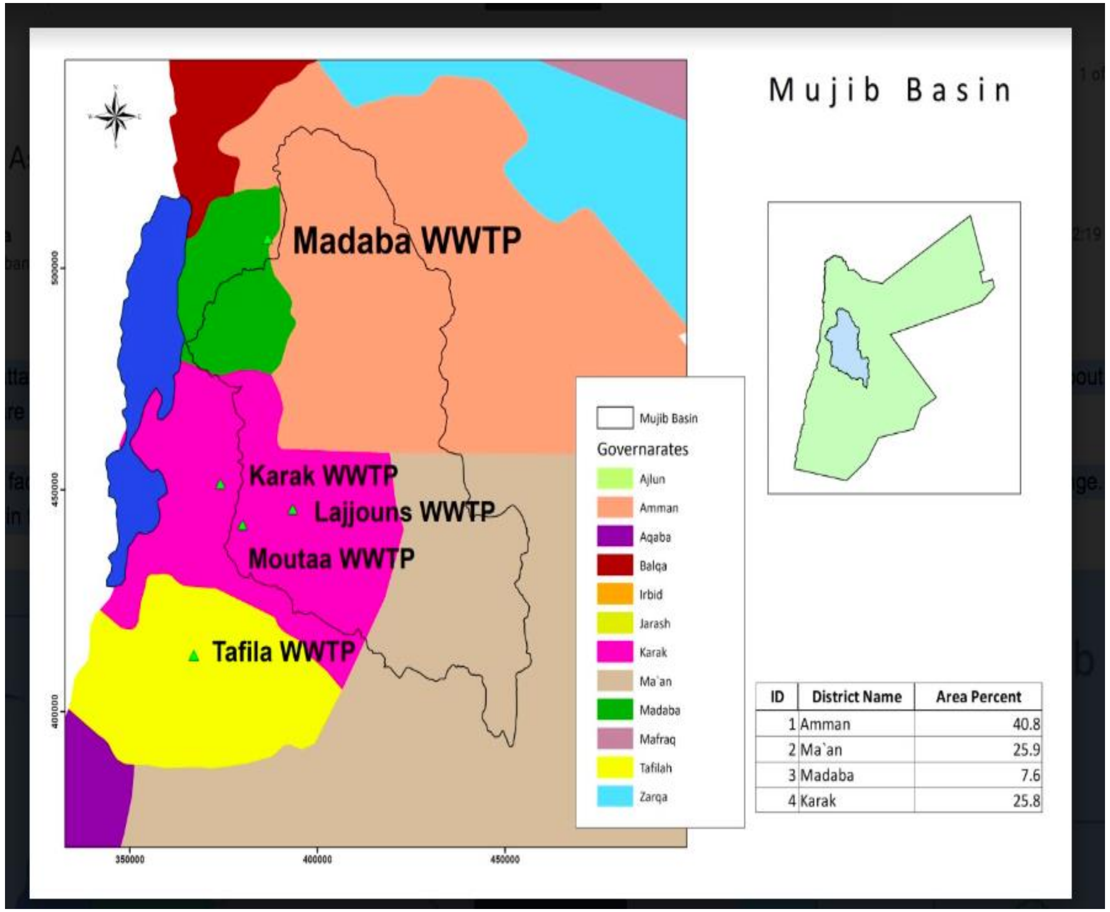
- **AE:** Agence Française de Développement (AFD)
- **EEs:** Palestinian Water Authority; Food and Agriculture Organization
- **Beneficiaries:** 23,553 (direct) / 200,000 (indirect) [50% women]
- **Mitigation potential:** 5,561.95 tCO2eq (yearly) / 166,858.5 tCO2eq (lifetime)
- **ESS Category:** A
- **Total financing:** EUR 44.7 million
- **GCF Contribution:** EUR 23.7 million (grant)
- **Co-financing:** EUR 13.0 million (grant) from AFD, EUR 8.0 million (grant) from IrishAid
- **Project Duration:** 5 years

PALESTINE –WASTE WATER AND RAIN HARVESTING

GREEN CLIMATE FUND

- Problems
  - **15% decrease in precipitation** by 2050
  - water level in the coastal aquifer in Gaza only freshwater resource, **rapidly declining resulting in saltwater intrusion**
  - **agricultural inefficiencies lead to overuse of water and high evaporation**, pressure on aquifer
- Solutions
  - **rehabilitation of existing wastewater** infiltration basins
  - Drilling **deep wells for recovery of the treated wastewater**
  - construction of **reservoir**
  - development of an **irrigation system**
  - provision of 4,200 **on-farm water saving equipment**
  - powered by **renewable energy**

FP155 Building resilience to cope with climate change in Jordan through improving water use efficiency in the agriculture sector (BRCCJ)

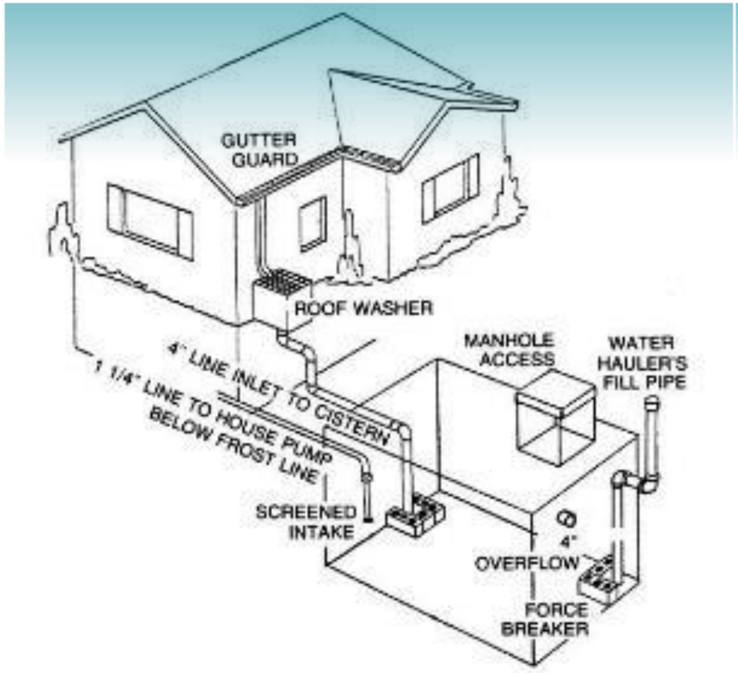


Jordan

- **AE:** Food and Agriculture Organization of the United Nations (FAO)
- **EE:** FAO, UNDP, Ministries of Water and Irrigation (MWI), Agriculture (MoA), and Environment (MoE)
- **Beneficiaries:** 83,743 (direct) [40% female] / 128,673 (indirect) [51% female]
- **ESS Category:** B
- **Total financing**: USD 33.25 million
- **GCF Contribution**: USD 25 million (grant)
- **Co-financing**: USD 8.25 million
  - USD 3.95 million (grant, in-kind) from GoJ-MWI
  - USD 1.86 million (in-kind) from GoJ-MoA
  - USD 0.38 million (in-kind) from GoJ-MoE
  - USD 1.0 million (grant) from FAO
  - USD 1.06 million (grant, in-kind) from UNDP
- **Project Duration:** **7** years

Components of "Building resilience to cope with climate change in Jordan through improving water use efficiency in the agriculture sector (BRCCJ)"

Component 1	Component 2	Component 3
$ 19,800,637	$ 8,018,627	$ 3,771,781
- Waste-water recycling for alfalfa production - Rainwater harvesting • Household water efficiency gadgets	-Farmer Field Schools -Women Change Agents	Addressing gaps in policy and regulatory frameworks to incentivize water efficiency



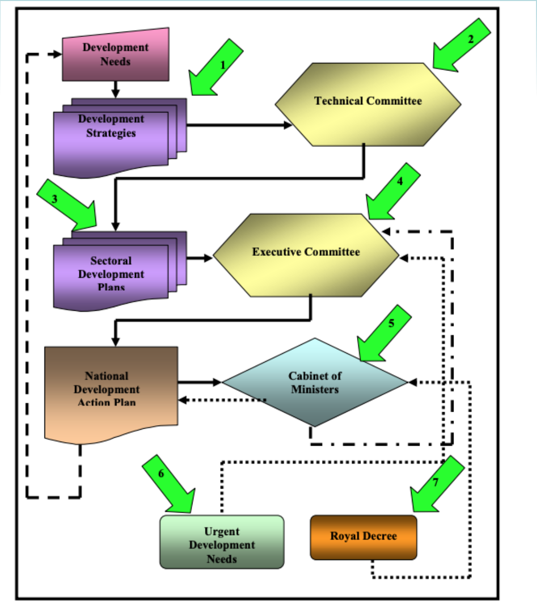


Figure 1.4: Jordan's Planning Process Flow Chart

GREEN
CLIMATE
FUND

Evolution Characteristics of Global Terrestrial Water Resources and Integrated Adaptation Strategies for Climate Change

Presented by: Yan Denghua

Department of Water Resources, China Institute of Water Resources and Hydropower Research (IWHR)
State Key Laboratory of Simulation and Regulation of Water Cycle in River Basin

8 April 2021

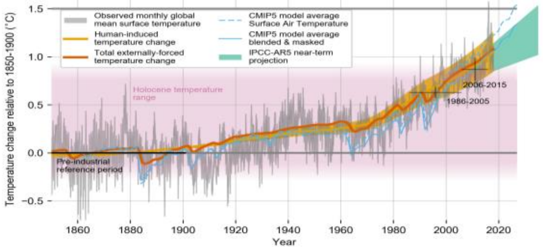
Outline

1. Research Background—Climate Change and Human Activities Significantly Affect the Global Terrestrial Water Cycle

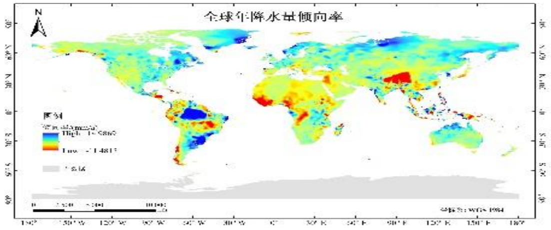
Climate change and human activities have worsened the imbalance and unsteady state of the terrestrial water cycle, thus directly affecting the availability, controllability and renewability of water resources, as well as their total amount, composition and distribution.

Climate change

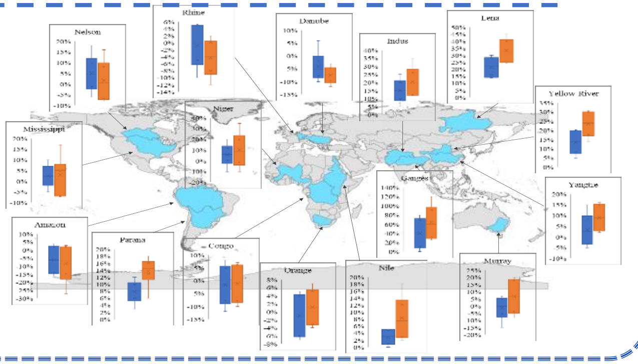
Climate warming



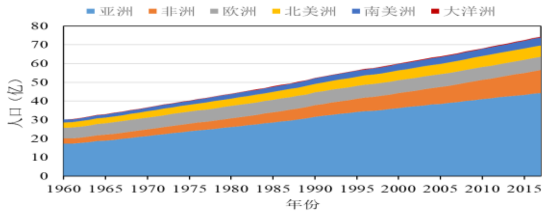
Rainfall change



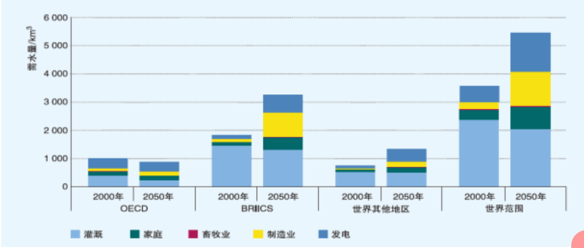
Runoff change



Human activities

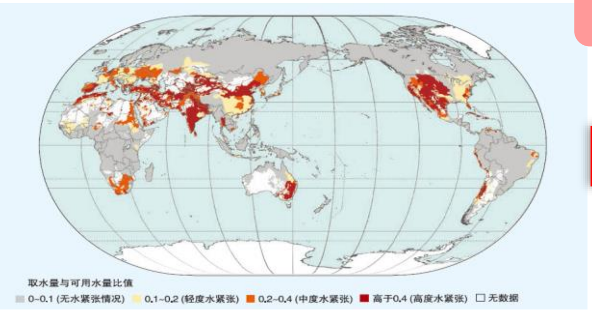


Population growth



Water demand growth

1960-2017 water consumption 1.95-4.18 trillion m^3



Resource shortage

1. Research Background—Widely Concerned by the International Community

- Since the birth of the UNFCCC in 1992, international community, government departments and academic circles have conducted a series of negotiations on climate change and water resources;
- In 2020, World Water Day on March 22 and World Meteorological Day on March 23 shared the same theme "Water and Climate Change", which further demonstrates that the international community attaches great importance to research on climate change and water resources;
- There is an urgent need to accurately identify the evolution characteristics of global terrestrial water resources, so as to provide important scientific basis for the BRI and other national development strategies, as well as China's participation in global governance.

1. Research Background—Purpose and Significance

- **Unveil the evolution characteristics of global terrestrial surface water resources**
- **Propose the climate adaptation strategies in typical areas/regions**

Promote China's water resources evaluation method to the world, revise and unfold the global land surface-hydrological basic information, obtain the global surface water resources data set, and reveal the evolution characteristics of the global terrestrial surface water resources; delineate the global climatic-ecological-hydrological zoning, and propose the adaptation strategies in typical areas/regions, so as to provide support for the diagnosis of water security in key areas covered by the national strategy, and share Chinese solutions and practice with the global community.

1. Research Background—Key Scientific Issues

Evolution characteristics of global terrestrial surface water resources

Problem	Key scientific issue	Outcome
Lack of basic data	How to obtain the basic data set of multiple types and long sequences?	Global complete set of basic data sets
Lack of large-scale regional zoning plans	How does the human development of water resources affect the climatic-ecological-hydrological zoning?	Global climatic-ecological-hydrological zoning
Lack of large-scale regional water resources evaluation	How to obtain the key evaluation parameters of a large number of lack-data watersheds in large-scale areas ?	Evolution characteristics of global surface water resources

2. Key Support Technologies

- **1: Grading and Coding Technology of Global River Networks and Water Resources Zones**
- **2: Acquisition and Optimization Technology of Water Resources Evaluation Parameters in Lack-data Watersheds**
- **3: Global Climatic-Ecological-Hydrological Comprehensive Zoning Technology**

□A global river network coding method with wide applicability, strong flexibility and consistent with Chinese practices has been developed

- Absorbing the comprehensive advantages of tree-like method and hierarchical nesting, with the coding results simple and easy to understand, clear topological relationship, and being ready to adjust
- Superior to the Pfafstetter method in multiple features such as river network hierarchy, coding expression and topological relationship indication

Journal of Hydrology


Journal of Hydrology

Research papers

A new topological and hierarchical river coding method based on the hydrology structure

Kun Wang, Denghua Yan, Tianling Qin, Baisha Weng*, Hao Wang, Wuxia Bi, Xiangnan Li, Batsuren Dorjsuren

ARTICLE INFO

ABSTRACT

1. Introduction

The characters comparison of different methods

	Characteristics	Our New Method	Tree-like Method	Pfafstetter Method
Ordinary advantage	Identify the river hierarchy clearly	√	×	√
	Character the topological relationship easily	√	√	×
	Determine the stem-tributary relationship explicitly	√	√	×
	Support other indicator to determine river level, such as flow	√	×	√
	the structure of river segment code is simple	√	×	√
Outstanding advantage	Determine the river standard of different level individually	√	×	×
	Modify the code easily when river network has changed	√		×
	Transform the river code length is simple	√	×	
	Suitable for large watershed with a mass of river segments	√		
	Support multiple river converge easily	√		×
	Indicate the river flow path precisely	√		×

Wang, k. Yan, D. Weng B. et al., 2019. Journal of Hydrology. 【Q2 TOP, IF=4.405】

2. Key Support Technologies—Acquisition and Optimization Technology of Water Resources Evaluation Parameters in Lack-data Watersheds

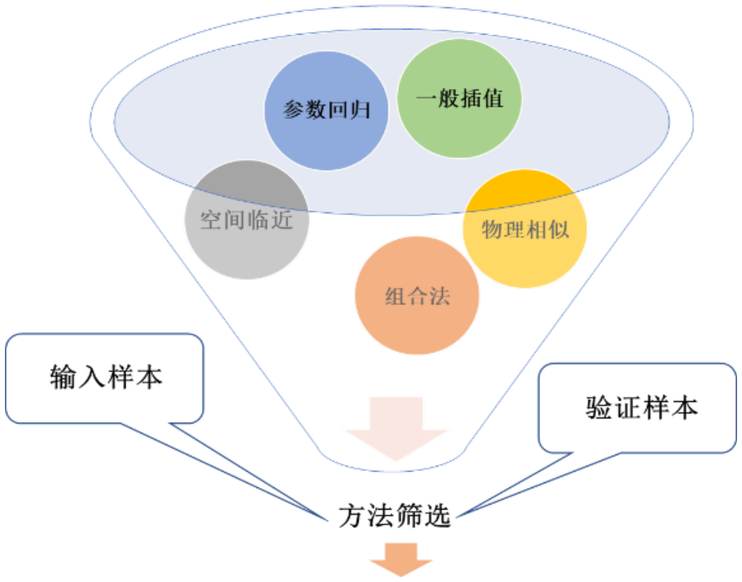
☐A parameter transplantation method based on climatic-ecological zoning has been developed to obtain key parameters in lack-data watersheds

- Most commonly used methods of parameter transplantation in lack-data watersheds only focus on statistical methods or climatic and geomorphological features
- A parameter transplantation method for lack-data watersheds has been developed considering the climatic-ecological coupling relationship, superior to the commonly used parameter transplantation methods

Basic principles/methodological assumptions

Method	Methodological assumptions
Spatial proximity	Watersheds that are close to each other show more similar hydrological characteristics than watersheds that are far apart
Physical similarity	Watersheds with similar attributes behave similarly in the hydrological process
Regression	There is a good relationship between indicators and parameters of known physical features in the watersheds, and it can be transplanted from "study watersheds" to "non-study watersheds"
Combination	Coupling space proximity and physical similarity methods, fully considering the joint influence of spatial positions and physical attributes
Spatial interpolation	The closer the distance, the more similar the attributes of the watersheds

Technical solutions

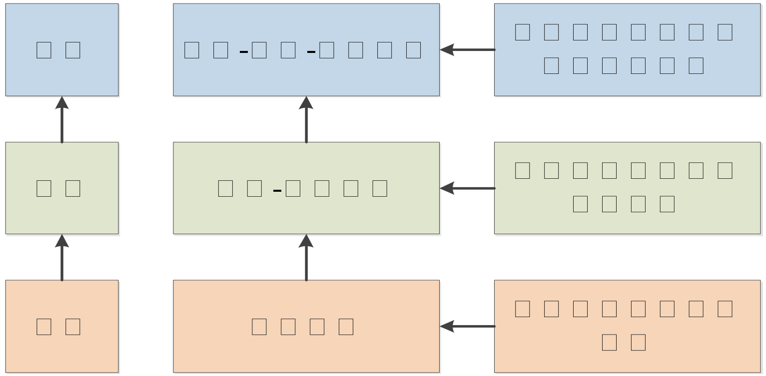


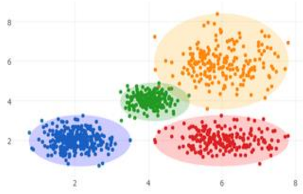
□A global climatic-ecological zoning technology has been developed to provide basic support for parameter transplantation

- Previous climatic and ecological zoning schemes by a single feature fails to reflect the interrelationship between climate, ecology and hydrology
- Integrating the Köppen climate classification and 13 key ecological zoning indicators, the global climatic-ecological zoning method has been developed

Technical solutions

Technical principles





$$\begin{cases} |d_k - d_{k+1}| \le m \\ |d_{k+2} - d_{k+1}| \le m \\ |d_{k+3} - d_{k+2}| \le m \end{cases}$$

Unsupervised classification

Optimization of number of categories

Hydrological key feature indicators

	Classification of water production coefficient					
Classification	1	2	3	4	5	6
Conditions of water production coefficient	< 0.2	0.2~0.4	0.4~0.6	0.6~0.8	0.8~1.0	>1
Number of Level 4 Water Resources Zones	20866	21796	10524	4369	1660	1349

	Classification of surface water resources development and utilization rate				
Classification	1	2	3	4	5
Conditions of development and utilization rate	< 0.1	0.1~0.2	0.2~0.4	0.4~0.8	>0.8
Number of Level 4 Water Resources Zones	45158	3775	3907	3535	4189

Ecological key feature indicators

Indicator category	Indicator selected
Topography	Elevation (m)
	Surface undulation (m)
Land cover	Arable land area(%)
	Wetland area (%)
	Water area (%)
	Tundra area (%)
	Artificial ground surface area (%)
	Bare land area (%)
	Glacier area (%)
Vegetation	Forest area(%)
	Grassland area (%)
	Shrub area (%)
Soil	Soil type

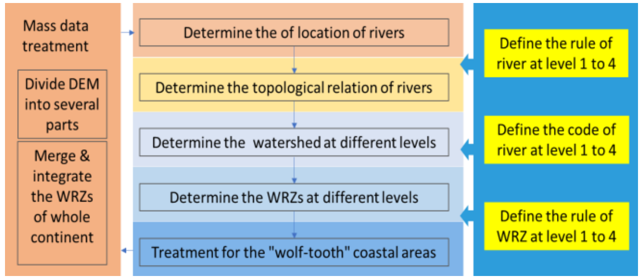
3. Main Research Results

- 1: Global Complete Set of River Network and Hydrological Basic Data Sets
- 2: Global Climatic-Ecological Zoning Schemes
- 3: Restoration and Transplantation of Global Water Production Coefficient
- 4: Global Terrestrial Surface Water Resources Evaluation and Evolution Characteristics Analysis
- 5: Adaptive Management Countermeasures in Typical Areas/Regions

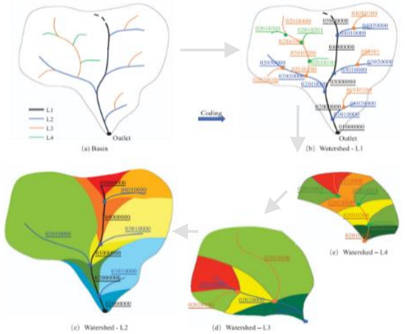
3. Main Research Results 1—The World's First High-precision Data Set of Level 1-4 River networks and Water Resources Zones

□Obtained and released the world's first high-precision data set of Level 1-4 river networks and water resources zones, attracting wide international attention

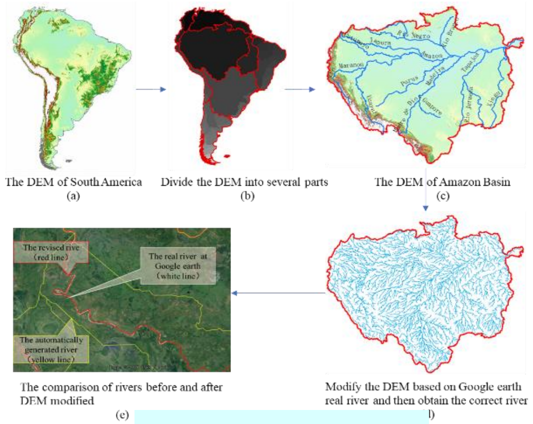
- ◆ Its data accuracy was 74% higher than the HDMA river network data released by USGS
- ◆ Cumulative views/downloads reached 10,813 times, about 22 times a day (2019.10.22-2021.3.1)



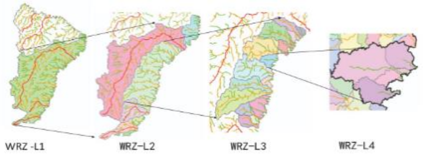
The process to build the river network and WRZ



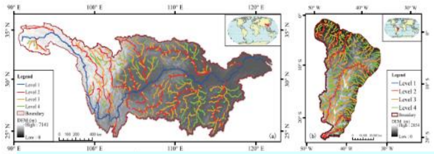
b. The level of lonely WRZ



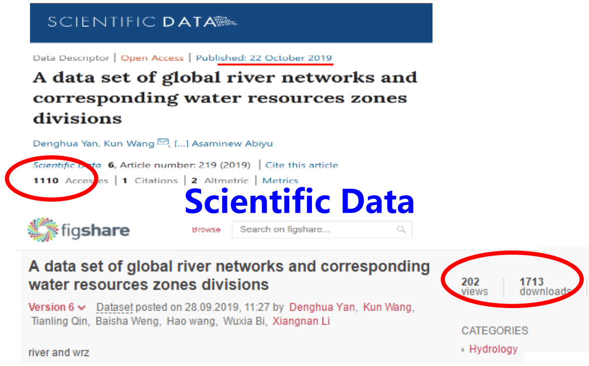
a. Modify the DEM



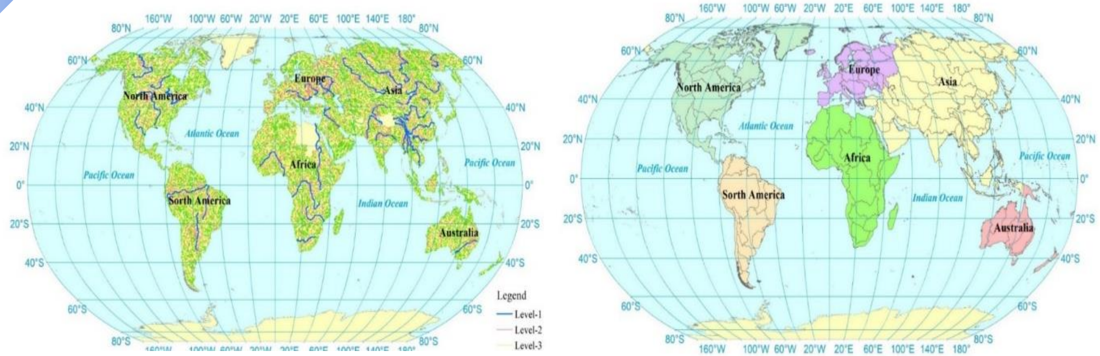
c. The level of combined WRZ



d. The level of different river



"Obtained the global terrestrial water resources zoning for the first time"---Academicians and experts such as Wang Hao, Zhang Jianyun, Deng Wei



The global river networks and corresponding WRZs

(https://doi.org/10.6084/m9.figshare.8044184.v6)

Yan D, Wang K, et al., 2019. Scientific Data.【Nature Sub-journal, Q 2, IF=5.929】

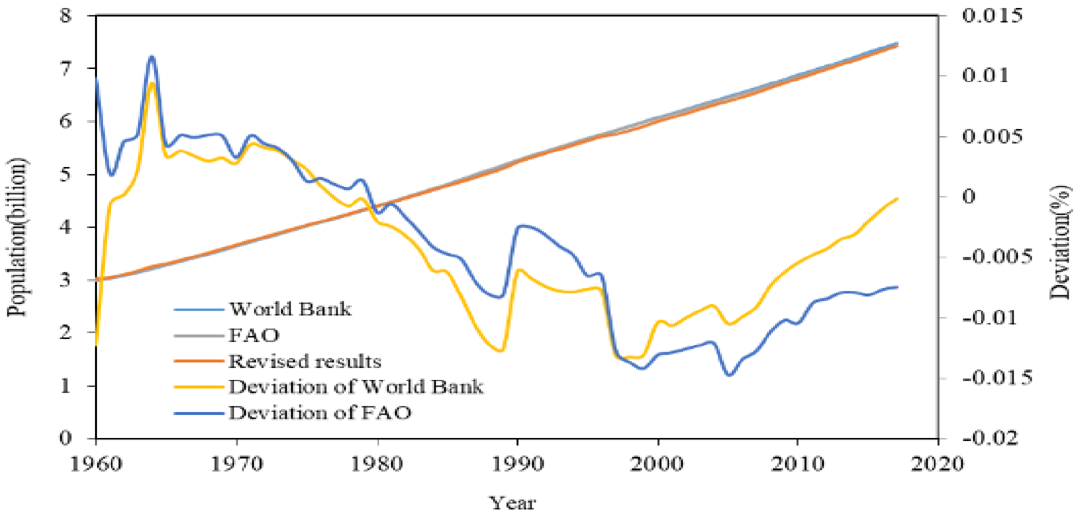
3. Main Research Results 1—Global Population and Water Withdrawal Data Sets

□Collected and verified global population and water withdrawal data, improving the data accuracy of World Bank and FAO, etc.

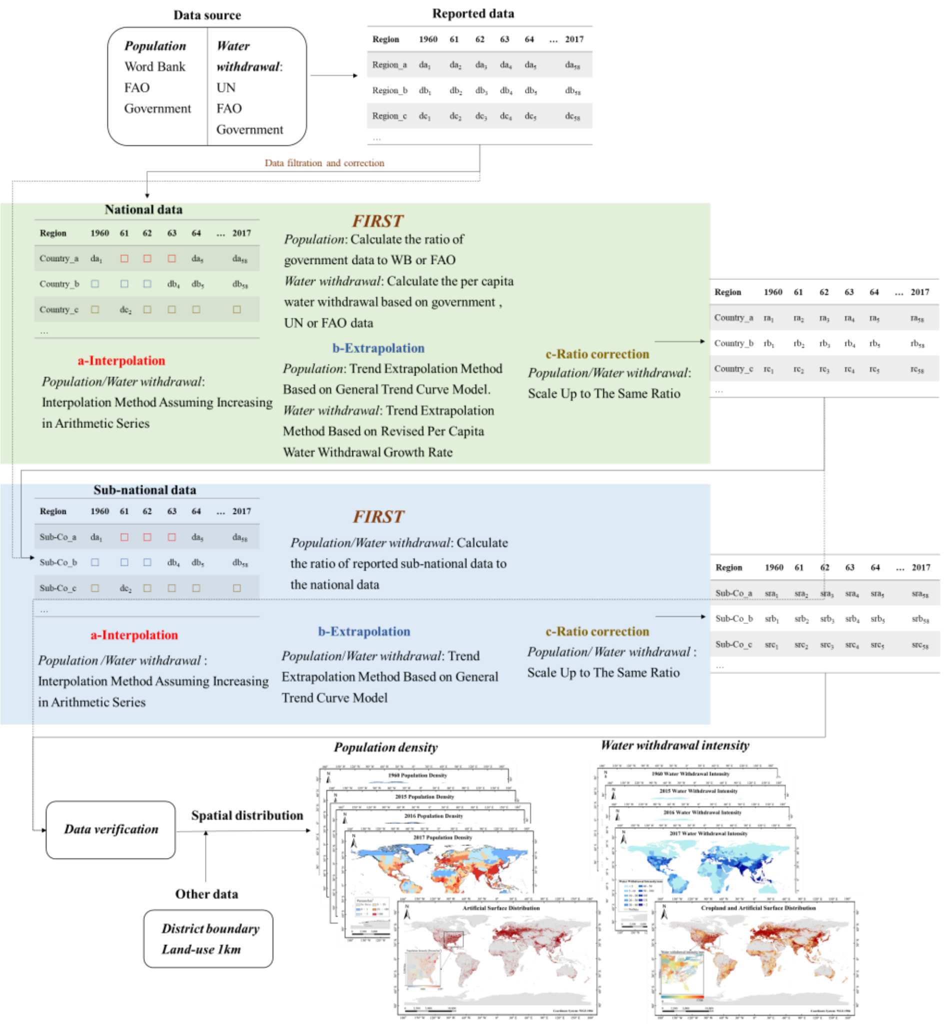
- In response to the lack of global long-series water withdrawal data sets, collected and revised the global population and water withdrawal data
- Obtained global population and water withdrawal data sets from 1960 to 2017:

  1) Population: 214 countries, 1804 provinces or regions

  2) Water withdrawal: 214 countries, 616 provinces or regions



Comparison of population data

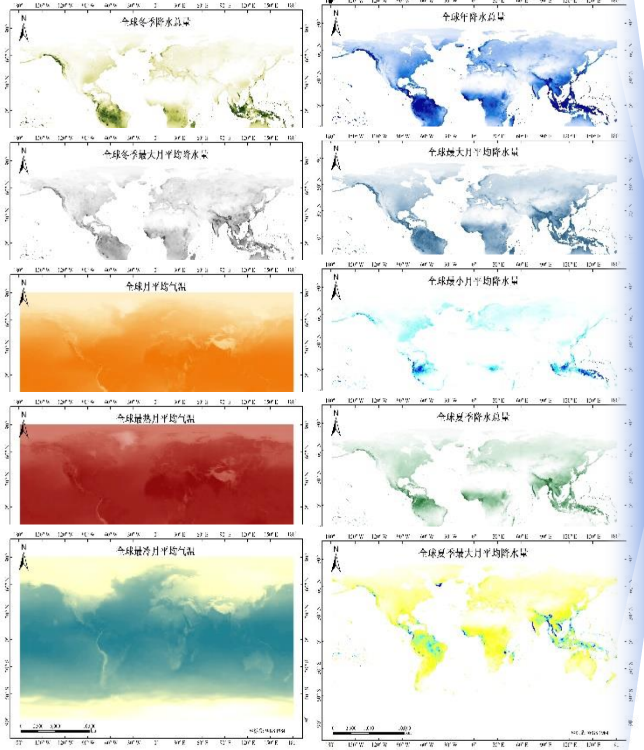


Figshare (https://doi.org/10.6084/m9.figshare.10012559.v1)

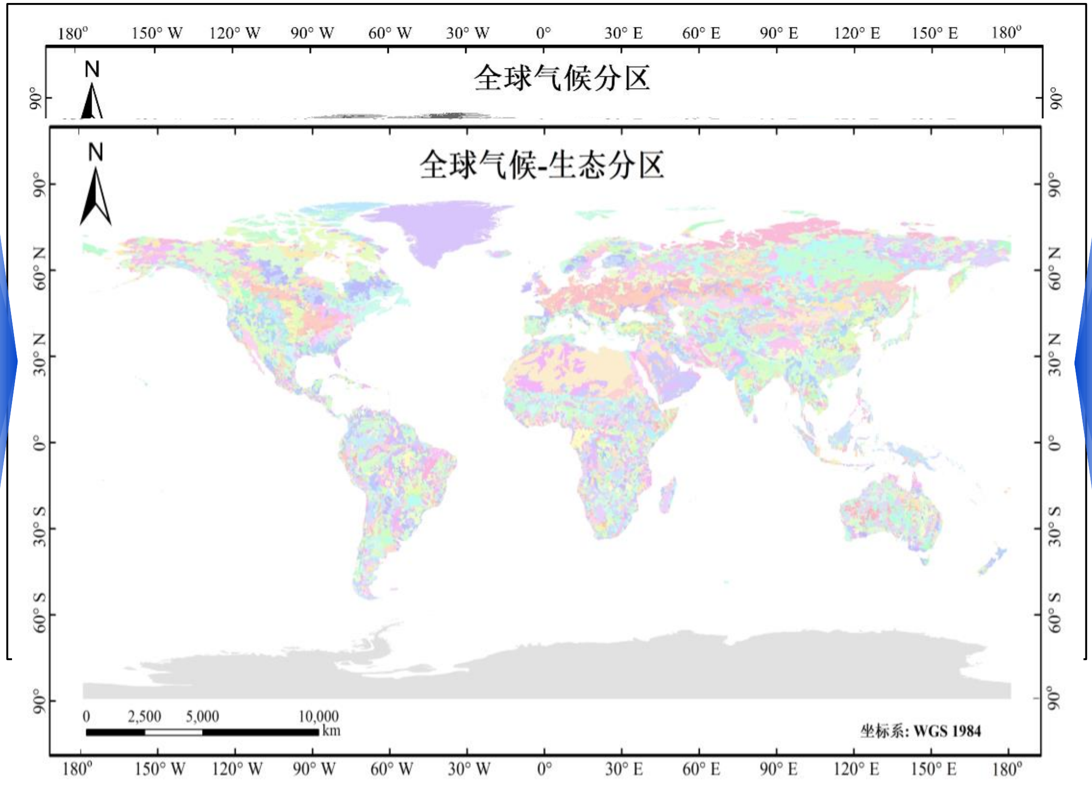
3. Main Research Results 2—Global Climatic-Ecological Zoning

- Based on the Köppen climate classification and 13 ecological indicators, obtained the global climatic-ecological zoning

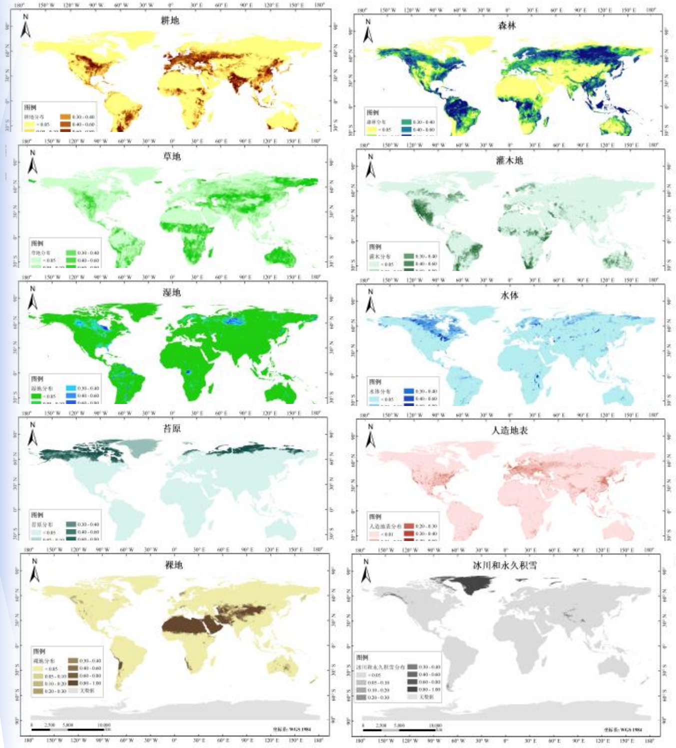
Various temperature and precipitation indicators in the northern and southern hemispheres



Unsupervised classification + optimization of number of categories→229 kinds



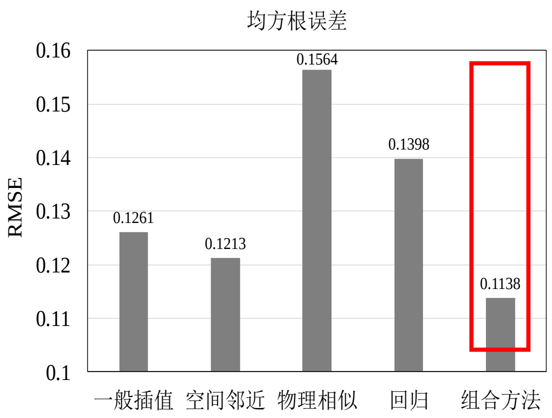
Land use Vegetation
Topography Soil characteristics

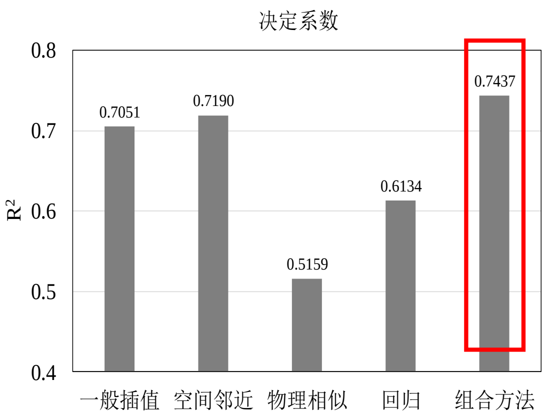


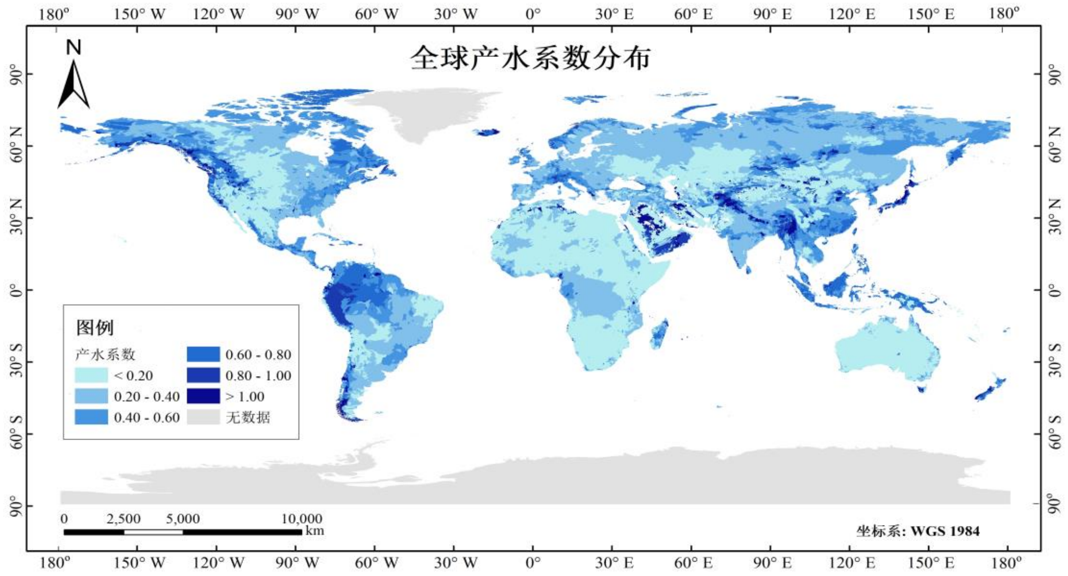
3. Main Research Results 3—Restoration and Transplantation of Global Water Production Coefficient

□Through comparison of multiple parameter transplantation methods, selected the spatial proximity method considering climatic-ecological zoning

- 20,568 four-level water resources zones were used as input samples, 8815 were used as verification samples, and 5 methods were compared and selected. The results showed that the spatial proximity method considering the climatic-ecological zoning had the best interpolation effect
- Areas with large water production coefficients were mainly distributed in Southwest China, South Asia, west coast of North America, Amazon basin of South America and northern Europe

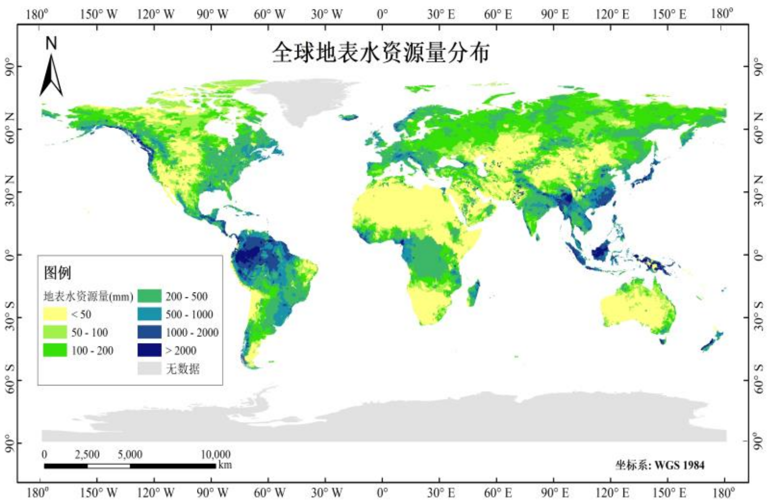


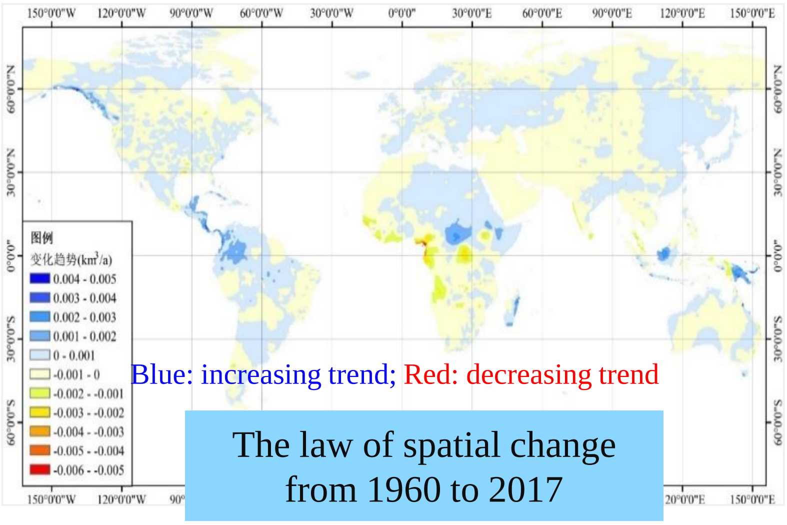




Analyzed the spatial distribution of surface water resources in the global terrestrial Level 4 water resources zones

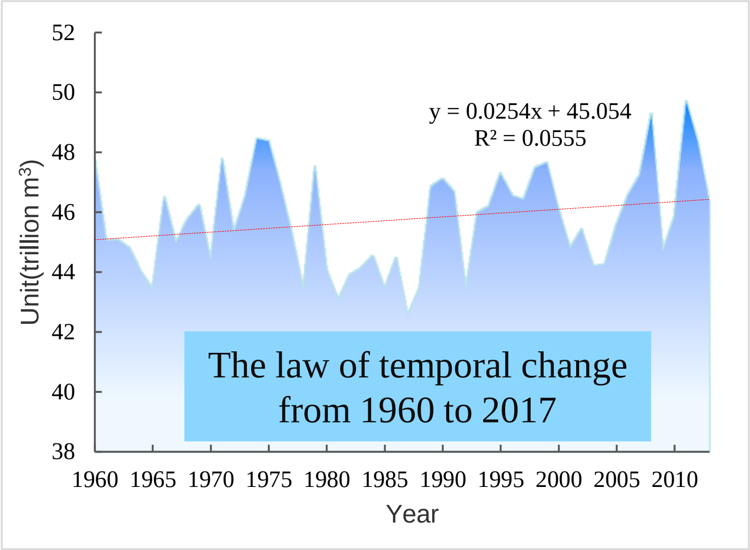
- Level 4 water resources zones with a natural runoff depth of more than 500mm were mostly concentrated in Southeast and Southwest China, the Amazon basin, the west coast of North America and Indonesia, while the natural runoff depth was less than 50mm in most areas of Africa, central North America and central Australia
- The area showing an increasing and decreasing trend accounted for 45.03% and 54.30%, respectively. The amount of surface water resources near the equator has changed significantly





Blue: increasing trend; Red: decreasing trend

The law of spatial change from 1960 to 2017

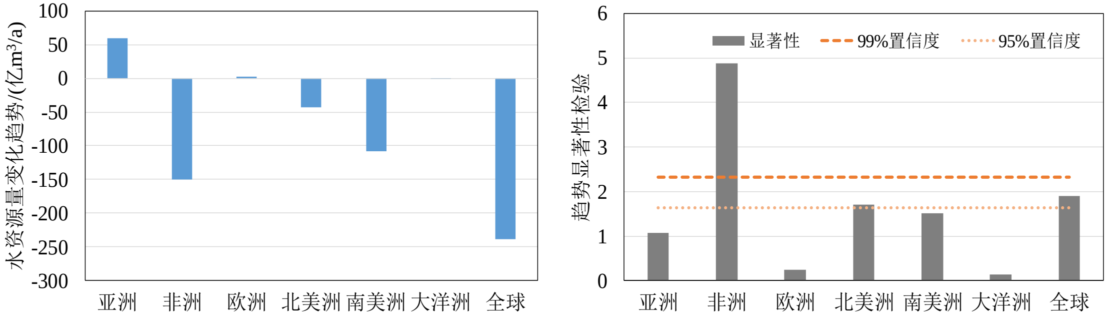


The law of temporal change from 1960 to 2017

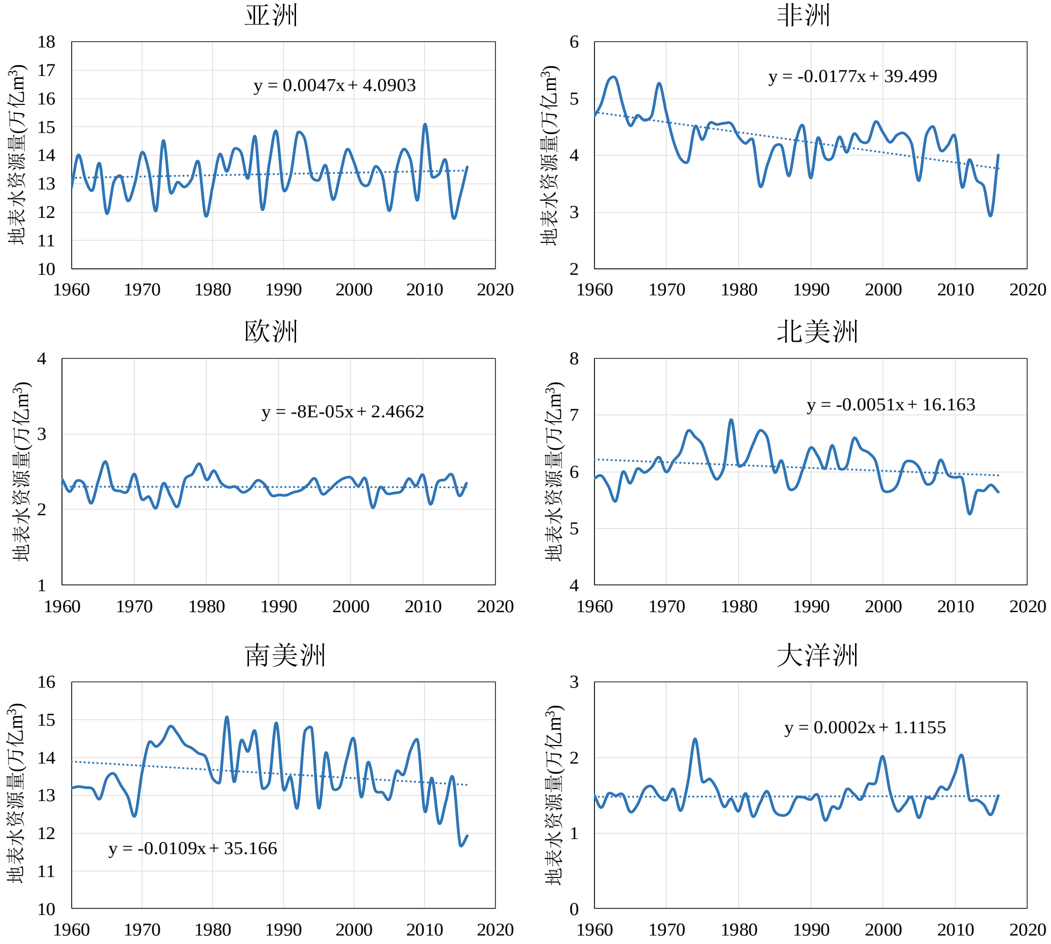
3. Main Research Results 4—Global Terrestrial Surface Water Resources Evaluation and Evolution Characteristics Analysis

■ Significant differences seen in the temporal evolution of terrestrial surface water resources across continents in the world

- At 95% confidence, the surface water resources in North America and Africa, and the global surface water resources showed a significant downward trend
- Around 1990, there were significant differences in the changing trends of surface water resources; Europe and Oceania showed a first decline and then upward trend, while Asia, North America, South America and the global surface water resources showed a first rise and then downward trend



Significance of the changing trends



Temporal change of surface water resources

3. Main Research Results 4—Global Terrestrial Surface Water Resources Evaluation and Evolution Characteristics Analysis

- The evaluation results of this study are basically consistent with existing international research results on global and continent scales

Sources	Asia	Africa	Europe	North America km³/year	South America	Oceania	Global
L'vovitch,1974	13190.0	4225.0	3110.0	5960.0	10380.0	1965.0	38830.0 *(1)
Korzun,1974	14100.0	4600.0	2970.0	8120.0	12200.0	2510.0	44690.0
Korzun,1978	14410.0	4570.0	3210.0	8200.0	11760.0	2390.0	44490.0 *(2)
Baumgartner, 1975	12200.0	3400.0	2800.0	5900.0	11100.0	2400.0	37700.0 *(3)
Gleick,1993	14410.0	4570.0	3210.0	8200.0	11760.0	2388.0	44540.0 *(4)
Shiklomanov,1996, 1997	13508.0	4040.0	2900.0	7770.0	12030.0	2400.0	42650.0
World Resources Institute 2000	13508.0	4040.0	2900.0	7770.0	12030.0	2400.0	42650.0
Shiklomanov,2000/ IHP-IV UNESCO	12510.0	4050.0	2900.0	7890.0	12030.0	2400.0	42780.0
FAO,2003	12461.0	3950.2	6619.4 *(5)	7443.1	12380.0	910.7	43764.3
This study	13340.1	4266.7	2300.1	6076.2 *(6)	13587.5	1487.2	41057.8 *(7)

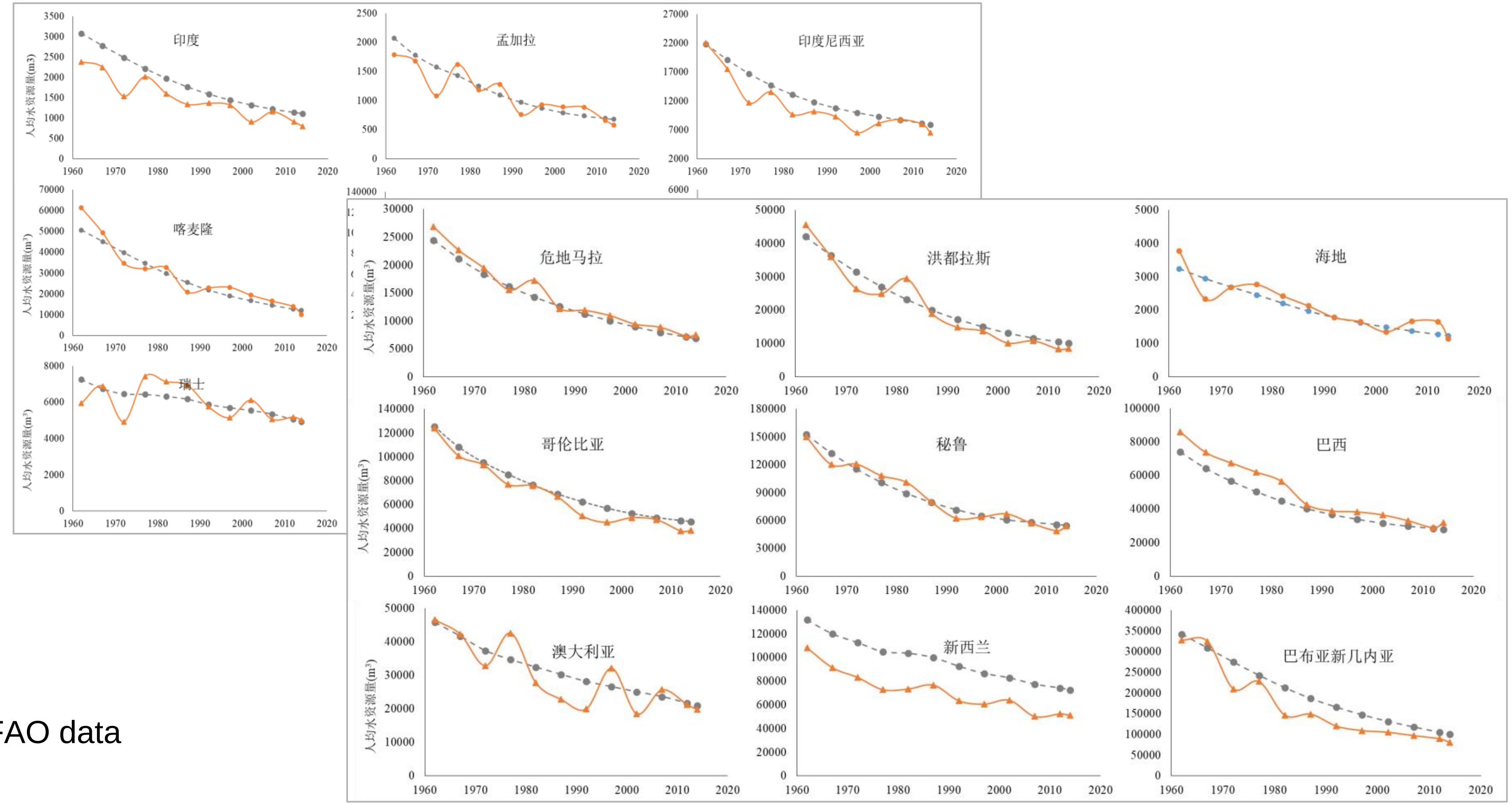
The global surface water resources are about **41.058** trillion m3

Notes: (1) Including Antarctica 2100 km3/year; (2) Including Antarctica 2310 km3/year; (3) Including Antarctica 2000 km3/year; (4) Including Antarctica 2230 km3/year; (5) FAO included The Russian Federation in Europe, and other studies separated Russia into two parts: Europe and Asia; (6) North America excluded Greenland in this study; (7) The global total in this study excluded Greenland and Antarctica

3. Main Research Results 4—Global Terrestrial Surface Water Resources Evaluation and Evolution Characteristics Analysis

- **Compared with data from FAO and other international organizations, the findings of this study can better reflect the law of fluctuations in water resources**

- Randomly selected 18 countries on 6 continents for accuracy verification
- The calculation results of most countries were consistent with the FAO data
- The FAO data trend in some countries was relatively smooth as it was the fitting result based on the data of some years



Findings of this study — FAO data

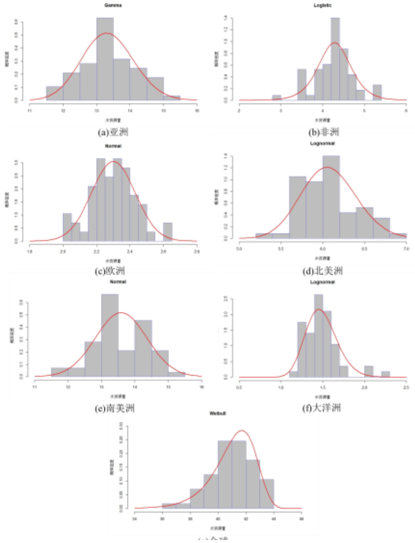
- **Africa, North America, South America, Oceania and the global total surface water resources showed obvious time-varying characteristics**

➢ Consistency fitting

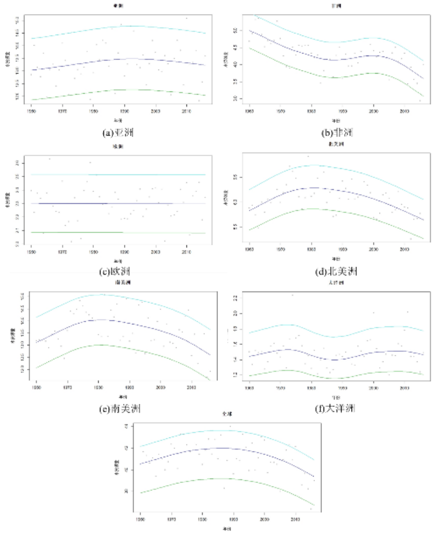
Region	Gamma	Gumbel	Logistic	Lognormal	Normal	Weibull	Optimal distribution
Asia	136.687	145.293	138.524	136.726	136.774	142.807	Gamma
Africa	80.205	87.179	77.073	81.349	78.786	82.187	Logistic
Europe	-65.889	-56.787	-65.465	-65.706	-66.069	-59.739	Normal
North America	39.616	52.332	40.957	39.494	40.024	49.282	Lognormal
South America	136.213	140.088	138.694	136.437	135.924	138.574	Normal
Oceania	-23.925	14.258	-25.367	-26.131	-18.351	-1.618	Lognormal
Global	212.744	209.85	211.502	213.229	211.857	209.243	Weibull

➢ Inconsistency fitting

Region	Consistency fitting			Inconsistency fitting		
	GD	AIC	SBC	GD	AIC	SBC
Asia	132.687	136.687	140.773	129.595	137.595	145.768
Africa	73.073	77.073	81.159	29.032	41.031	53.287
Europe	-70.069	-66.069	-61.982	-70.075	-64.075	-57.946
North America	35.494	39.494	43.580	7.119	17.120	27.336
South America	131.924	135.924	140.01	109.359	119.360	129.576
Oceania	-30.131	-26.131	-22.045	-38.48	-26.481	-14.224
Global	205.243	209.243	213.329	187.292	197.293	207.509



Distribution fitting diagram



Time-varying fitting diagram

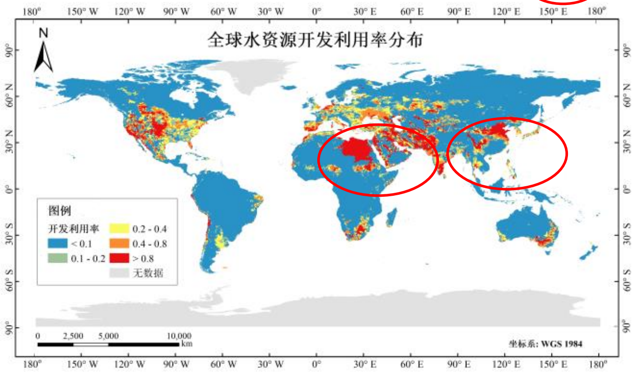
Development and utilization degree of global water resources

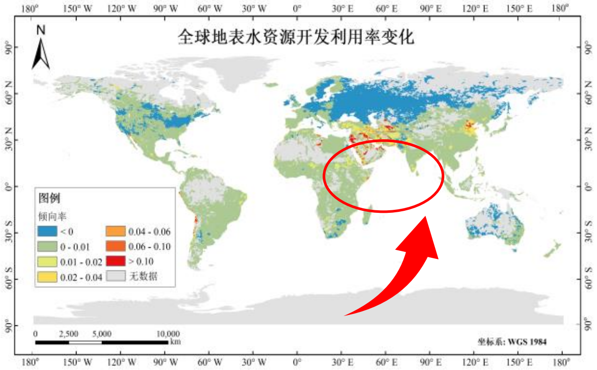
- North China, southwest Asia, southern Europe, and parts of the central and western America have high water resources development and utilization rates
- In most parts of Europe and parts of North America, the development and utilization rate of surface water resources shows a downward trend, while that in parts of North China and Western Asia shows an upward trend

Surface water resources

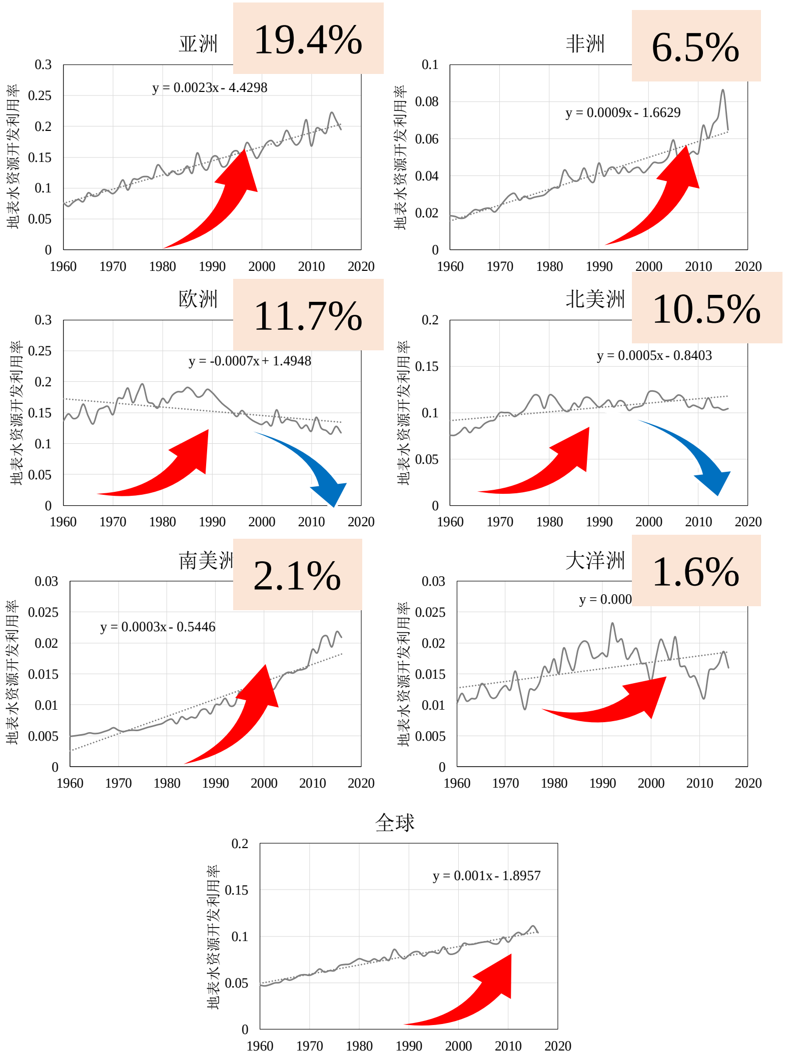
$$\beta = \frac{W}{Y^*}$$

Total regional water withdrawal





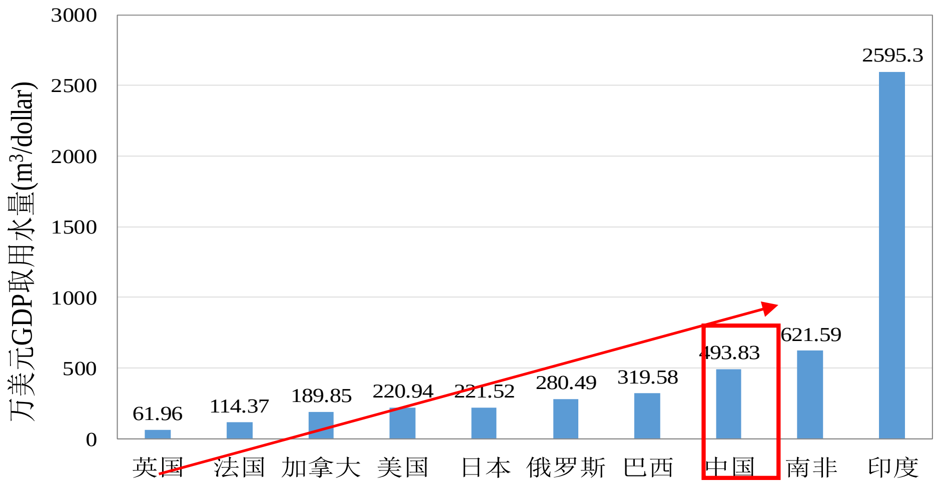
Distribution and changes of surface water resources development and utilization



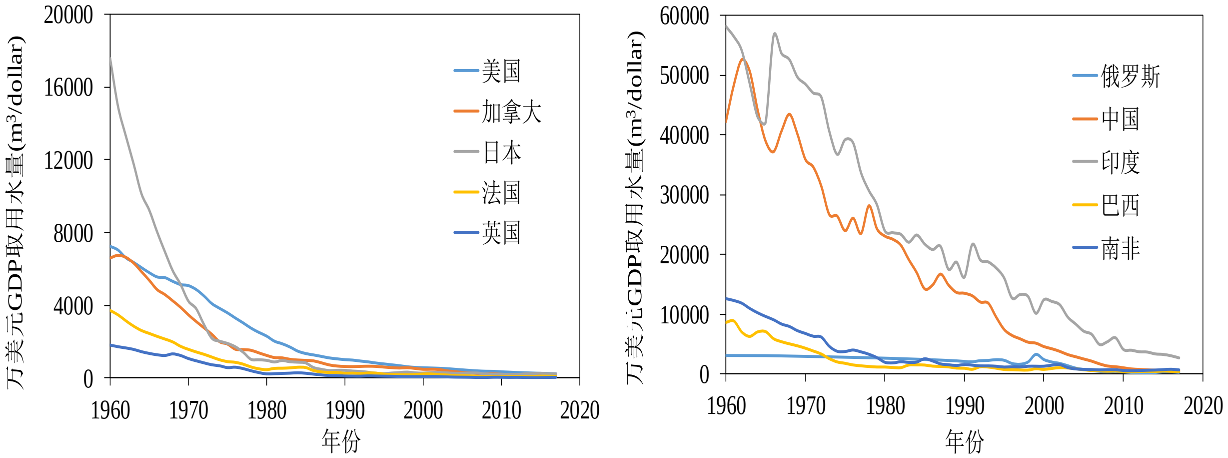
Changes in the development and utilization rate of surface water resources

Development and utilization degree of water resources in typical areas/regions

- In the past 60 years, global water consumption has tripled. Due to the global population increase and socio-economic development, global water consumption still shows a steady growth trend
- The global surface water resources are unevenly distributed, coupled with the impact of climate change, resulting in large differences in regional water resources pressure
- The population and water withdrawal in most underdeveloped countries still show obvious increasing trend, and the situation of water resources is not optimistic
- With high water resources utilization efficiency and reducing population, the total water withdrawal in some developed countries has been declining from the peak



Comparison of water consumption of 10,000 USD GDP in some countries in 2017

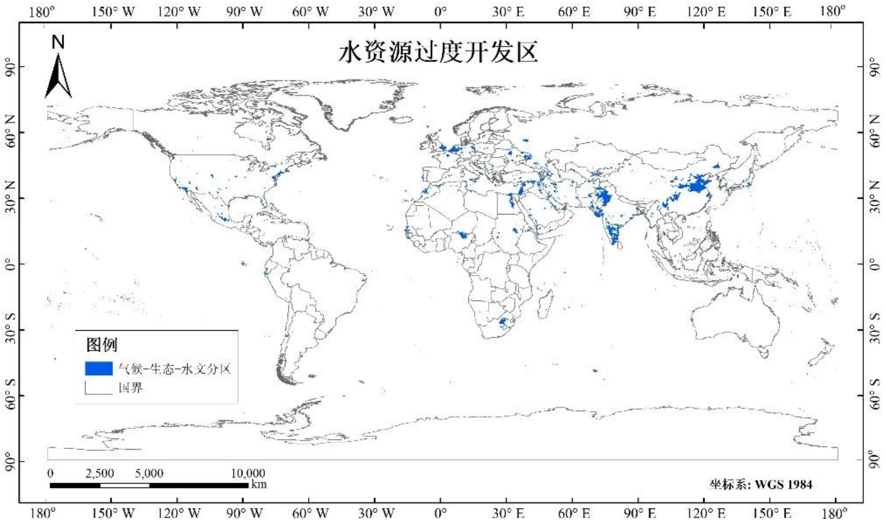


Changes in water consumption of 10,000 USD GDP in some countries

3. Main Research Results 5—Adaptive Management Countermeasures in Typical Areas/Regions

◻ Water resources over-exploitation zones: improving water resources utilization efficiency and benefits

- 414 water resources over-exploitation zones: high surface water resources development and utilization rate (>0.4), insufficient per capita water resources (<1000m3), high population density (>100 persons/km2)
- Spatial distribution: China's Huang-Huai-Hai river basin, northwestern India, parts of Africa, and parts of Europe
- Characteristics of water use: Agriculture is the largest water consumer, and future water demand from population and agriculture will continue to grow steadily
- Countermeasures:
  - ✓ Control city size;
  - ✓ Adjust the agricultural planting structure and optimize the allocation of water resources;
  - ✓ Adjust economic structure and industrial layout to reduce water-consuming and polluting projects;
  - ✓ Make full use of "unconventional" water resources.

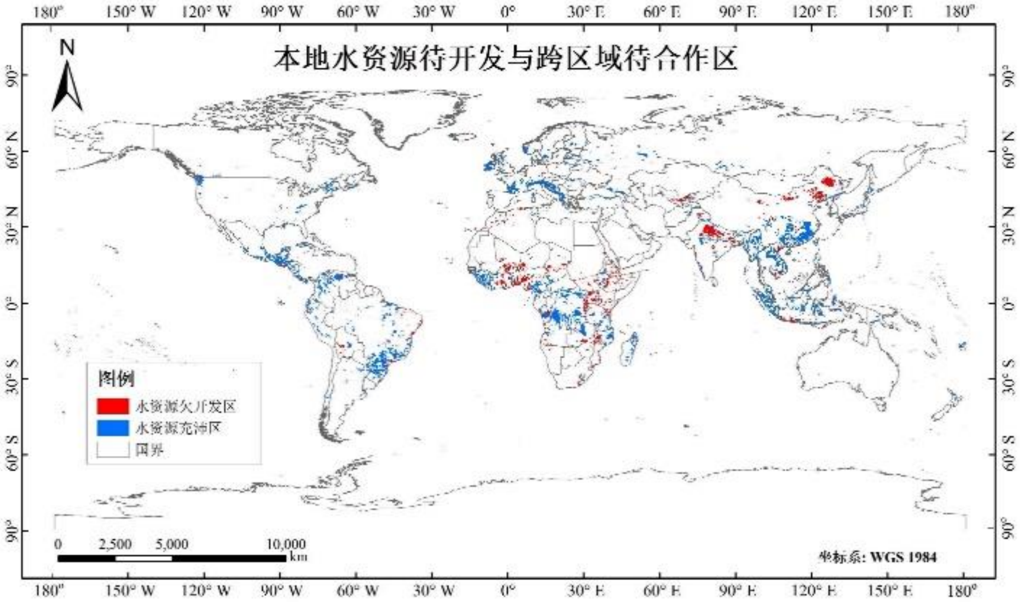


3. Main Research Results 5—Adaptation Strategies in Typical Areas/Regions

- **Water resources exploitation zones and cross-regional cooperation zones: strengthening local water resources exploitation and cross-regional water resources cooperation**

- 283 water resources exploitation zones: low surface water resources development and utilization rate (<0.1), insufficient per capita water resources (<1000m3), medium population density (>25 persons/km2)
- 283 cross-regional cooperation zones: low surface water resources development and utilization rate (<0.1), abundant per capita water resources (>5000m3), medium population density (>25 persons/km2)
- Spatial distribution: Water resources exploitation zones are mainly distributed in Northeast China, northern India and parts of Africa;

  Cross-regional cooperation zones are widely distributed all over the world.
- Adaptation Stragegies:
  - ✓ Fully develop local water resources and save water;
  - ✓ Implement trans-regional water transfer, accurately assess natural environmental impact, formulate and implement effective measures to eliminate the impact;
  - ✓ Strengthen international coordination and cooperation in areas such as river technology, politics, law, economy and environment.



Thank You!

Your Comments are Welcome !

Climate Change and Water Infrastructure

Outline:

A. Past and Current Trend of Climate
B. Projection of future trend
C. Impact
D. Future Policy Actions and initiatives

By: Ewin Sofian Winata

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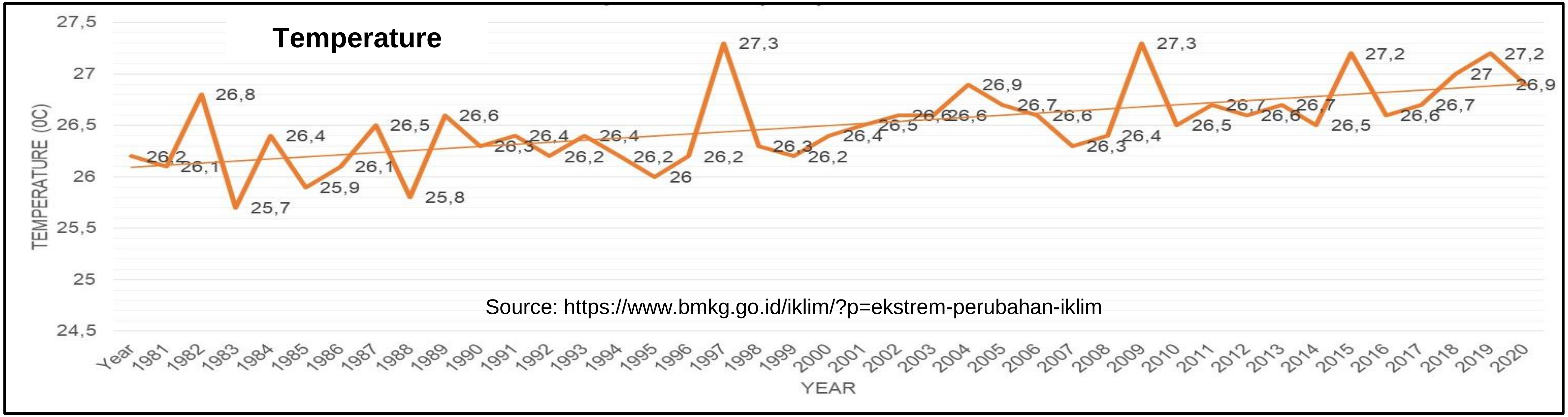
Ministry of National Development Planning / Bappenas, Republic of Indonesia

April 8, 2021

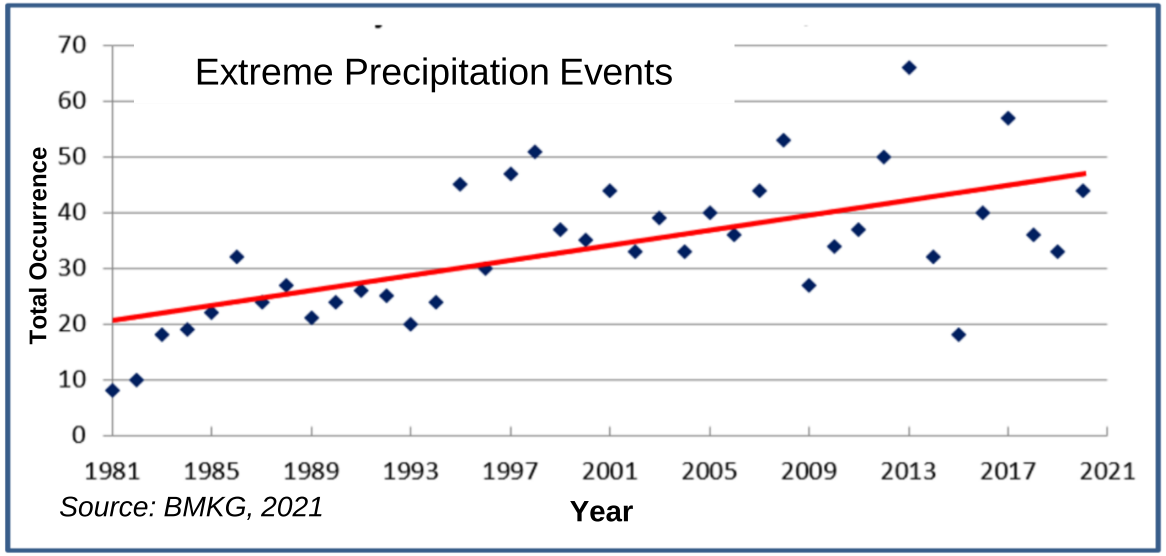
REPUBLIK INDONESIA

Kementerian PPN/ Bappenas

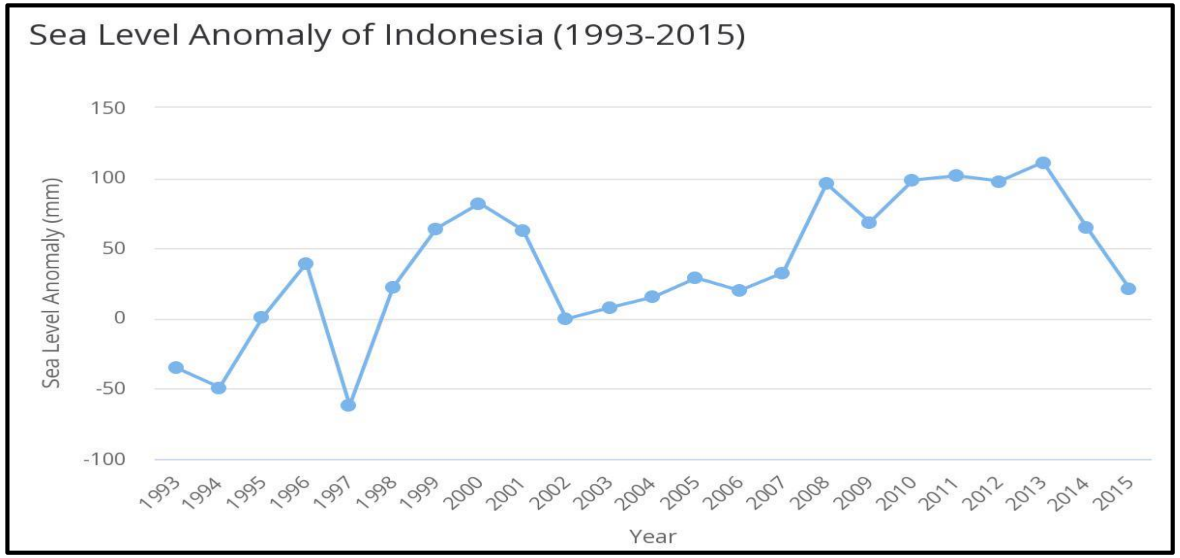
A. Past and Current Trend of Climate



Source: https://www.bmkg.go.id/iklim/?p=ekstrem-perubahan-iklim



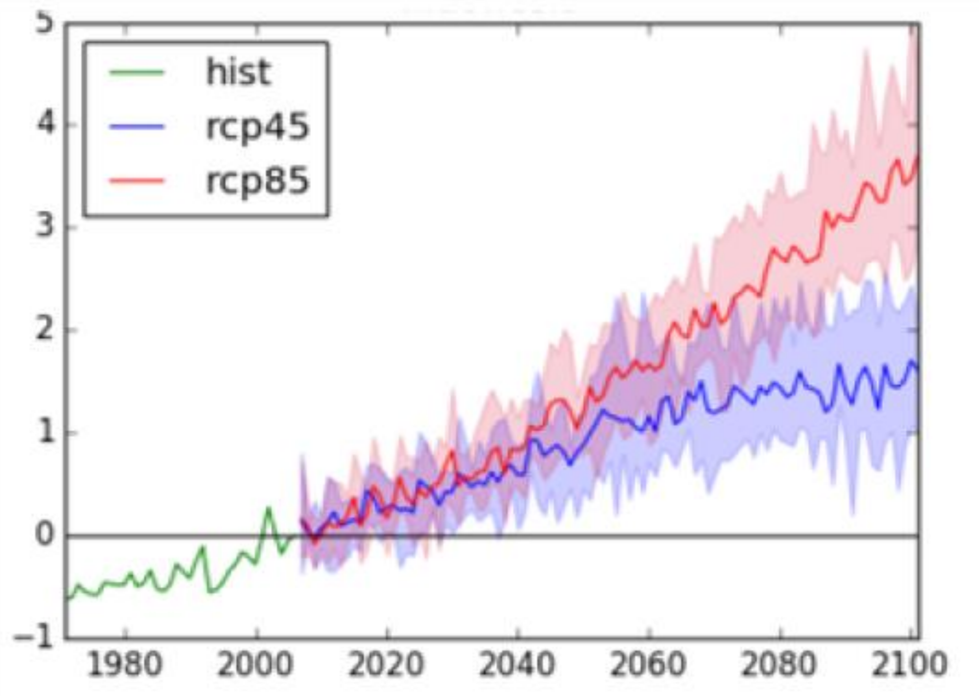
Source: BMKG, 2021



Source: https://climateknowledgeportal.worldbank.org/country/indonesia/impacts-sea-level-rise

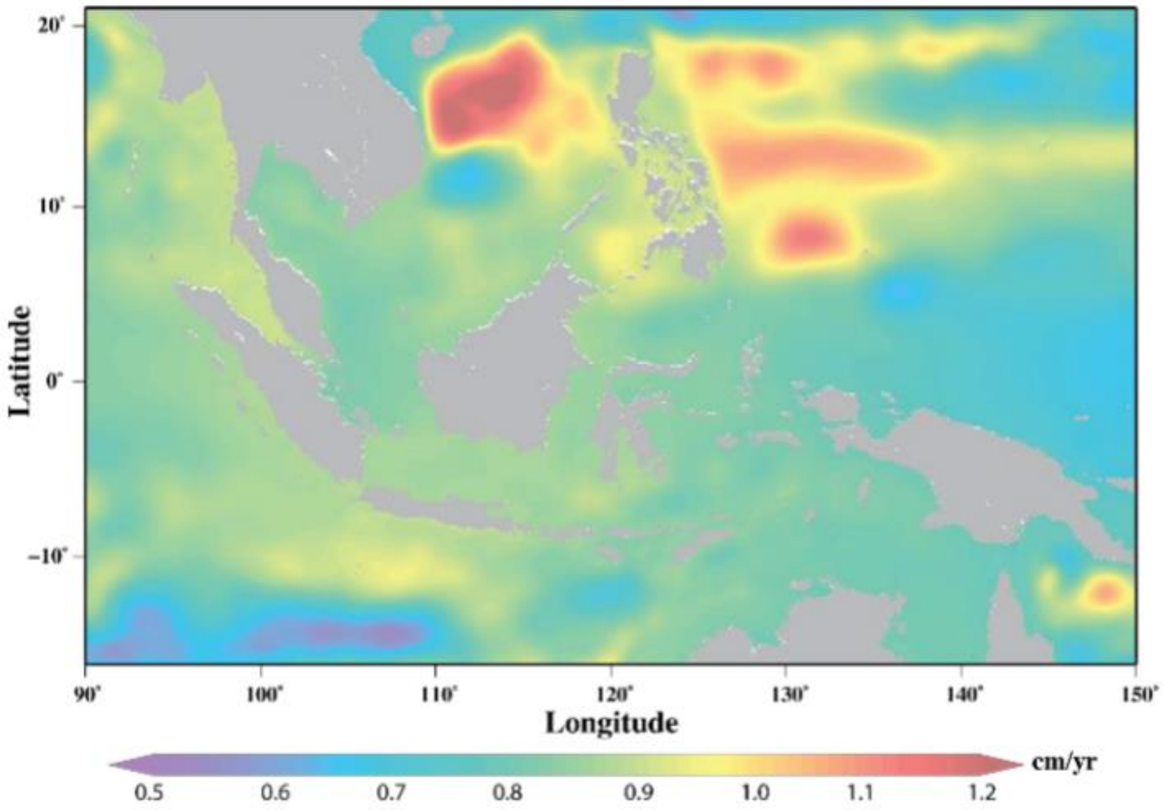
B. Projection of Future Trend

Temperature



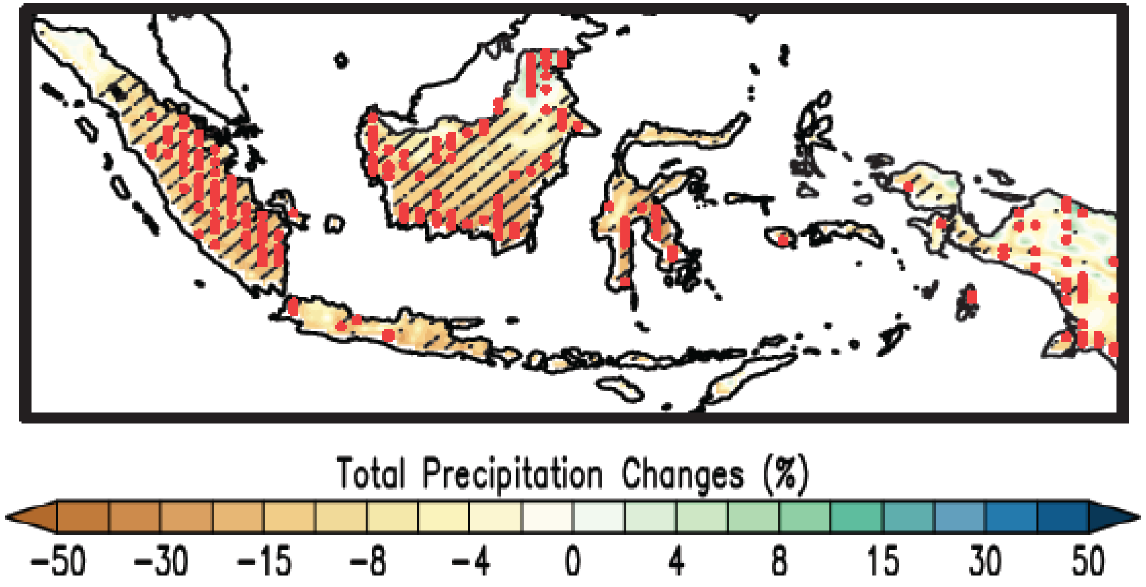
An increase in temperature ranging from 1.5°C (RCP 4.5) to 3.5°C (RCP 8.5) by the end of the 21st century

Sea Level Rise

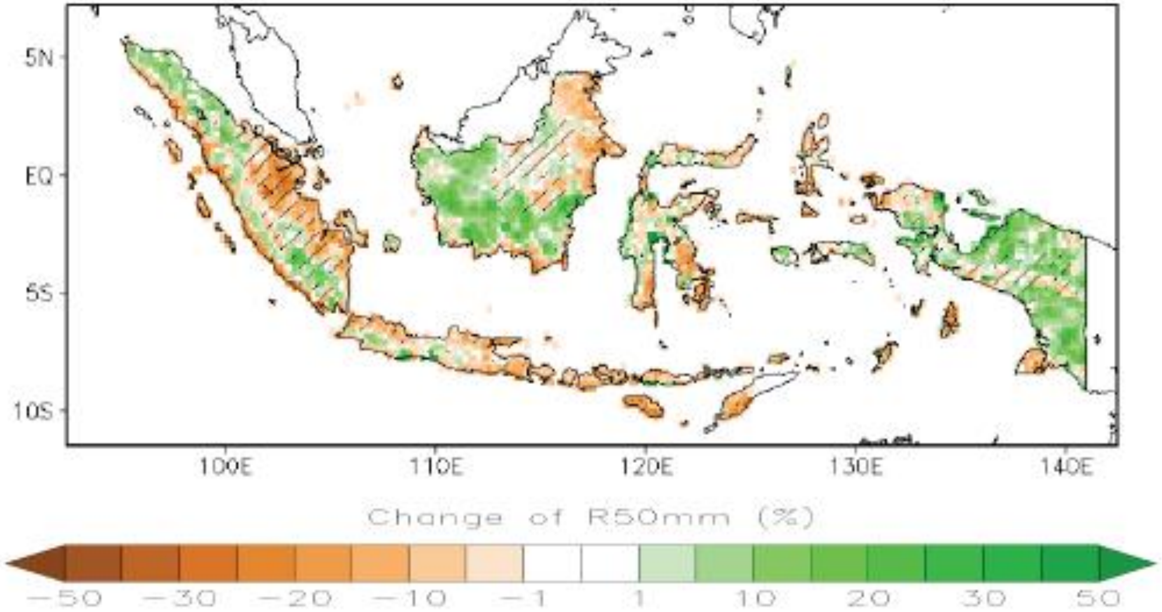


Sea level rise up to of 0,7 – 1,1 cm/year (RCP 4.5)

B. Projection of Future Trend



During the dry season, total rainfall tends to decrease in the majority of areas



During the rainy season, heavy rainfall (> 50mm/day) tends to increase

Source:
BMKG, 2021

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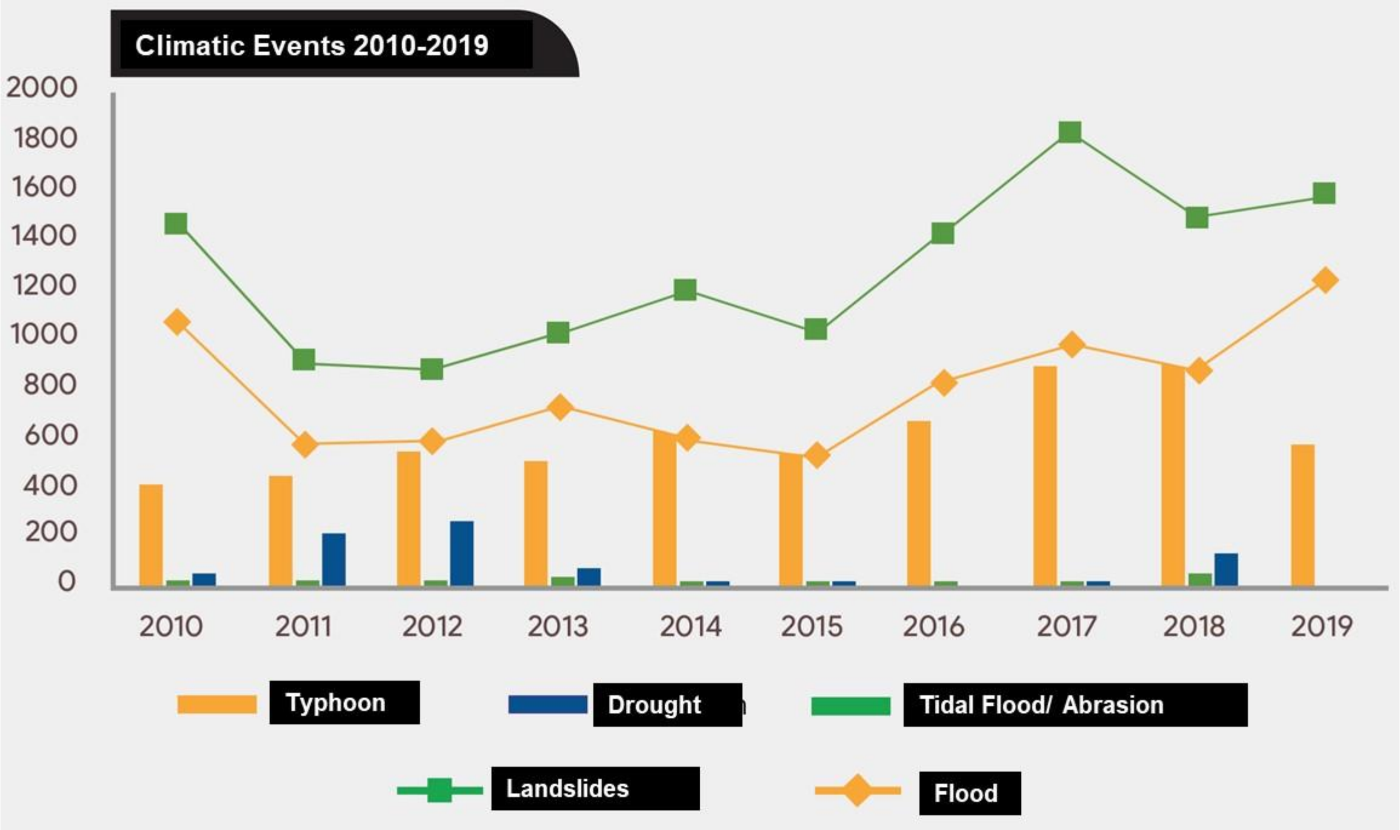
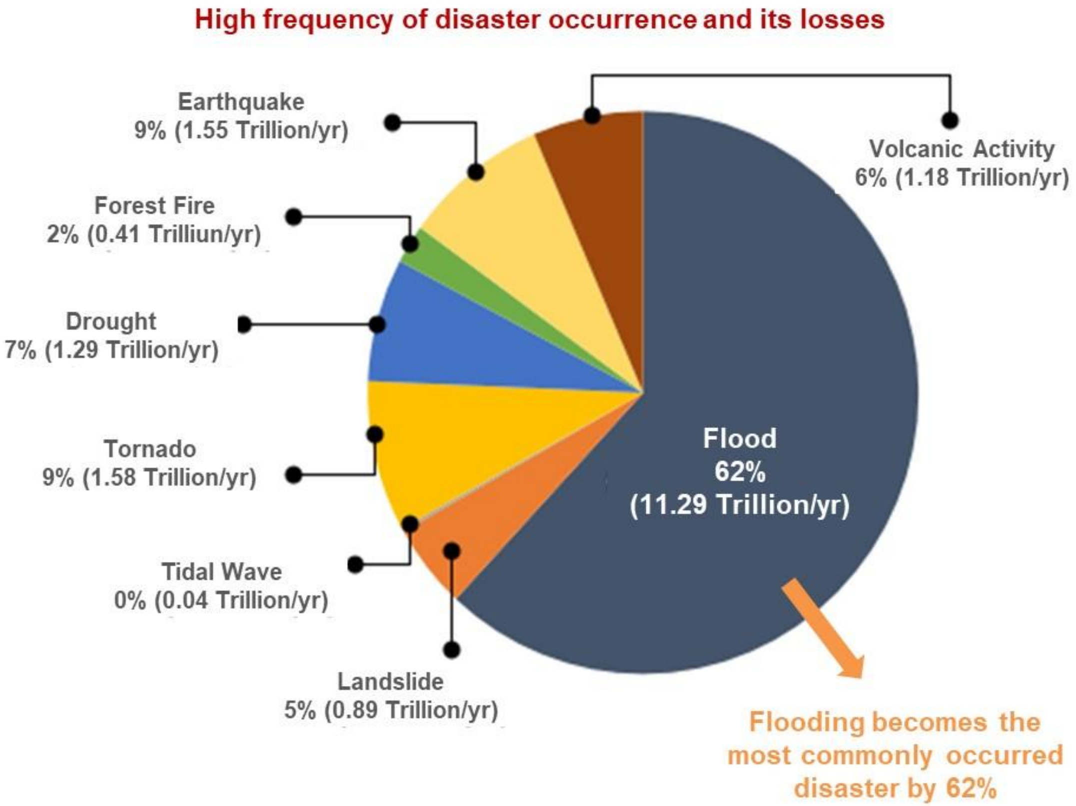
C. Impact - Climatic Events

Kementerian PPN/ Bappenas

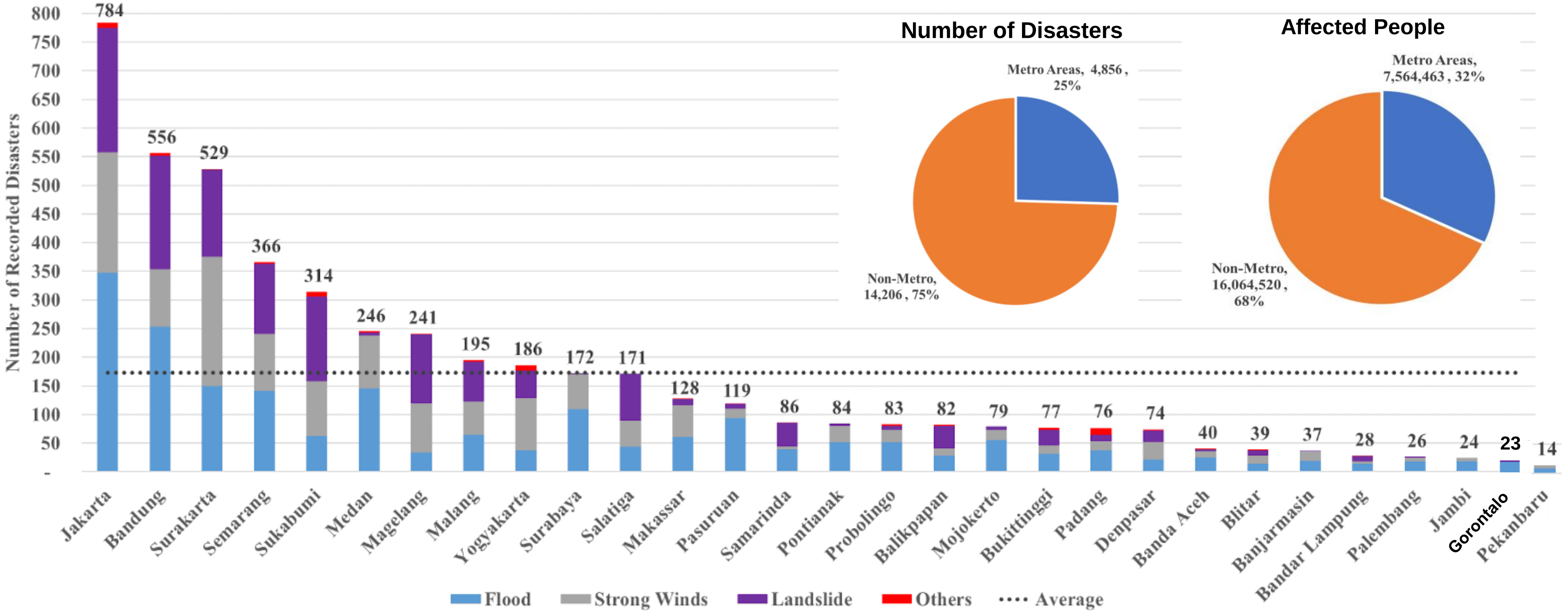


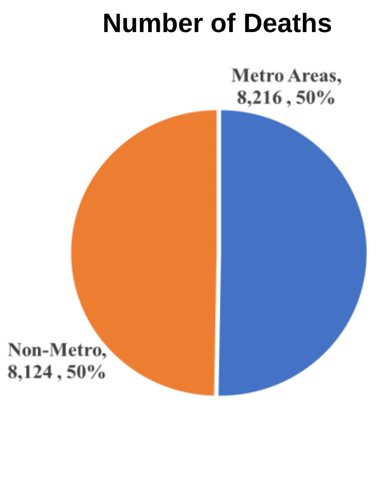


Source: Buku Kebijakan Pembangunan Berketahanan Iklim (PBI). Kementerian Perencanaan Pembangunan Nasional/Bappenas. 2021

C. Impact - Disproportionate Mortality Rate in Metropolitan Areas

Disasters Hitting Indonesian Metro Areas from 2003-2017





Metro areas representing **½ of all deaths** and **1/3 of the affected people**, despite **¼ occurrences** of all disaster events.

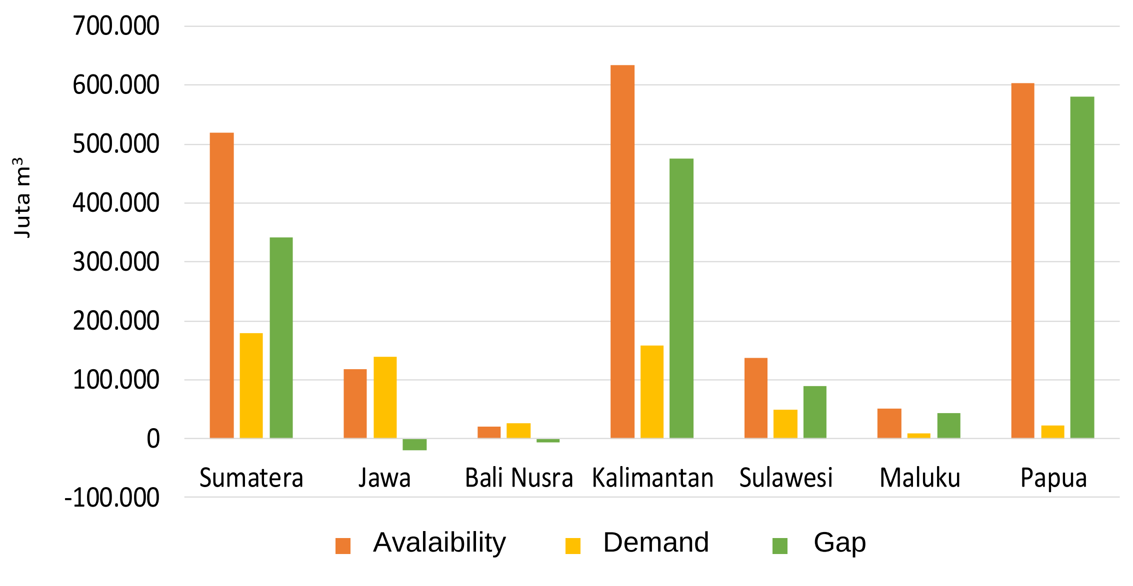
Source: BNPB (Database of DIBI)

Disasters in **Jakarta, Bandung dan Surakarta** metropolitan account for **39 percent** of all disasters happening in Indonesian metropolitan areas

Flood is the most commonly occurring threat in the vast majority of Indonesian **metropolitan areas; and most of the time representing half** of all disaster events.

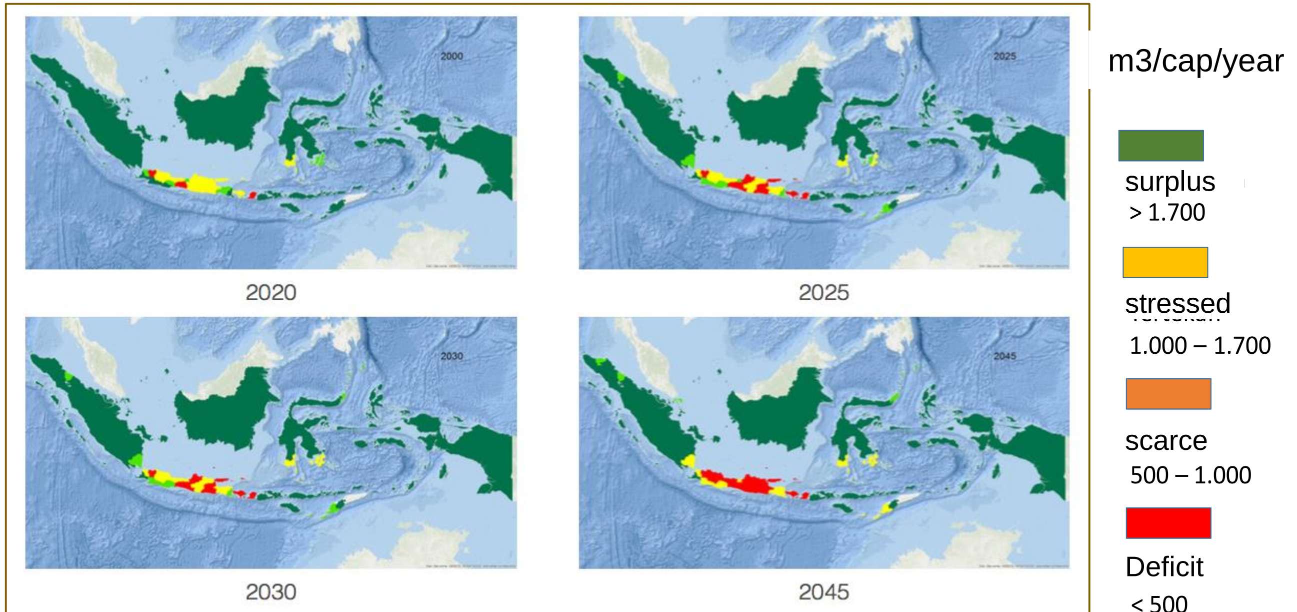
C. Impact - Water Availability

Water Availability in 2016



Sumber: Kajian *Background Study* RPJMN Bidang Kehutanan dan Konservasi Sumber Daya Air Bappenas 2018

Projection of water availability in 2045



Peta Baseline Ketersediaan Air (Sumber: Kajian Ilmiah Tim KLHS, 2018)

Java, Bali, dan Nusa Tenggara, are experiencing deficit and more areas in the future

D. Future Policy Actions and Initiatives

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Accelerate The Provision of Water Infrastructure as part of National Priority for Basic Services

Kementerian PPN/ Bappenas

INFRASTRUCTURE FOR BASIC SERVICE

70%
Household with access to adequate housing
[2018 : 54%]

100%
Household with Access to Decent Drinking Water
[2018 : 88%]

90%
Household with Decent Sanitation Access
[2018 : 75%]

24 Million
Household with access to piped water supply
[2018 : 14 million]

500 Thousand Ha
New irrigation Network
[2015-2018 : 1 Million ha]

50 m^3/sec
Additional Raw Water Supply for Industry and Domestic
[2015-2018 : 25 m^3 /sec]

63
Multipurpose Dam
[2015-2019 : 16 Dam)

3 m^3/kg
Water Productivity for Rice

20 provinces
High risk of disaster has increased disaster resilience

INFRASTRUCTURE TO SUPPORT ECONOMIC SECTOR

High Speed Train in Java Island
Jakarta-Semarang & Jakarta-Bandung

Railway of
Makassar - Parepare

Integrated Main Ports Network
Improve Standardized Performance and Integrated Port Management

43 Routes of Air Bridge
[2019: 124 Routes]

21 New Airports

2.500 km
New Toll Road
[2015-2019 : 1.461 km]

3.000 km
New National Road
[2015-2019 : 3.387 km]

97%
Great Condition of National Roads
[2019 : 94%]

1,9 hour/100 km
Travel Time on Main Island Cross Roads
[2019 : 2,3 hour/100 km]

27%
Connected Sailing Routes (loop)
[2019 : 23% Loop]

URBAN INFRASTRUCTURE

Urban Mass transportation System
6 Metropolitan Areas

Household with access to adequate waste management
80% Waste Handling
20% Waste Reduction

DIGITAL TRANSFORMATION

95% "Desa"
Mobile Broadband Coverage [2019 : 82%]

60% "Kecamatan"
Fibre Optic Coverage
[2019 : 35,7%]

80% Population
Affordable Digital Broadcast

3 "Next Unicorn"
Start Up

ENERGY AND ELECTRICITY

4 Million
House Connection for City Gas
[2019 : 0,5 million]

1.400 kWh
Electricity Consumption Per Capita
[2019 : 1.071 kWh]

~ 100%
Electrfication Rasio

6 Unit
Oil Refinery Development (2 GRR dan 4 RDMP)

...and Factor in Climate Change into the Strategy

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Kementerian PPN/ Bappenas

KP 1

Penyediaan Akses Perumahan dan Permukiman Layak, Aman dan Terjangkau

ProPN

- Fasilitasi Penyediaan Hunian Baru Layak
- Fasilitasi Pembiayaan Perumahan
- Fasilitasi Peningkatan Kualitas Rumah
- Penyediaan Infrastruktur Dasar Permukiman
- Fasilitasi Peningkatan Standar Keandalan Bangunan dan Keamanan Bermukim

KP 2

Penyediaan Akses Air Minum dan Sanitasi (Air Limbah dan Sampah) yang Layak dan Aman

ProPN

- Pengembangan Sistem Penyelenggaraan Air Minum dan Sanitasi Layak dan Aman
- Pembinaan Penyelenggaraan Air Minum dan Sanitasi Layak dan Aman
- Pengaturan Penyelenggaraan Air Minum dan Sanitasi Layak dan Aman
- Pengawasan Kualitas Air Minum dan Sanitasi

KP 3

Sustainable Groundwater and Raw Water Management

Priority Projects

- Provision and safeguarding of raw water and groundwater
- Arrangement of regulations and funding; strengthening of water resources institutions
- smart water management

KP 4

Keselamatan dan Keamanan Transportasi

ProPN

- Pemenuhan fasilitas keselamatan dan keamanan transportasi & SAR
- Peningkatan kompetensi SDM keselamatan dan keamanan transportasi & SAR
- Penataan regulasi dan kelembagaan keselamatan dan keamanan transportai dan SAR

KP 5

Disaster-Resilience Infrastructure

Priority

- Regional master plan policies and strengthening the resilience of critical infrastructure
- Construction and rehabilitation of disaster resilient infrastructure
- Provision of an integrated early warning and disaster emergency response system
- Restoration and conservation of natural infrastructure

KP 6

Multipurpose Reservoir and Irrigation Modernization

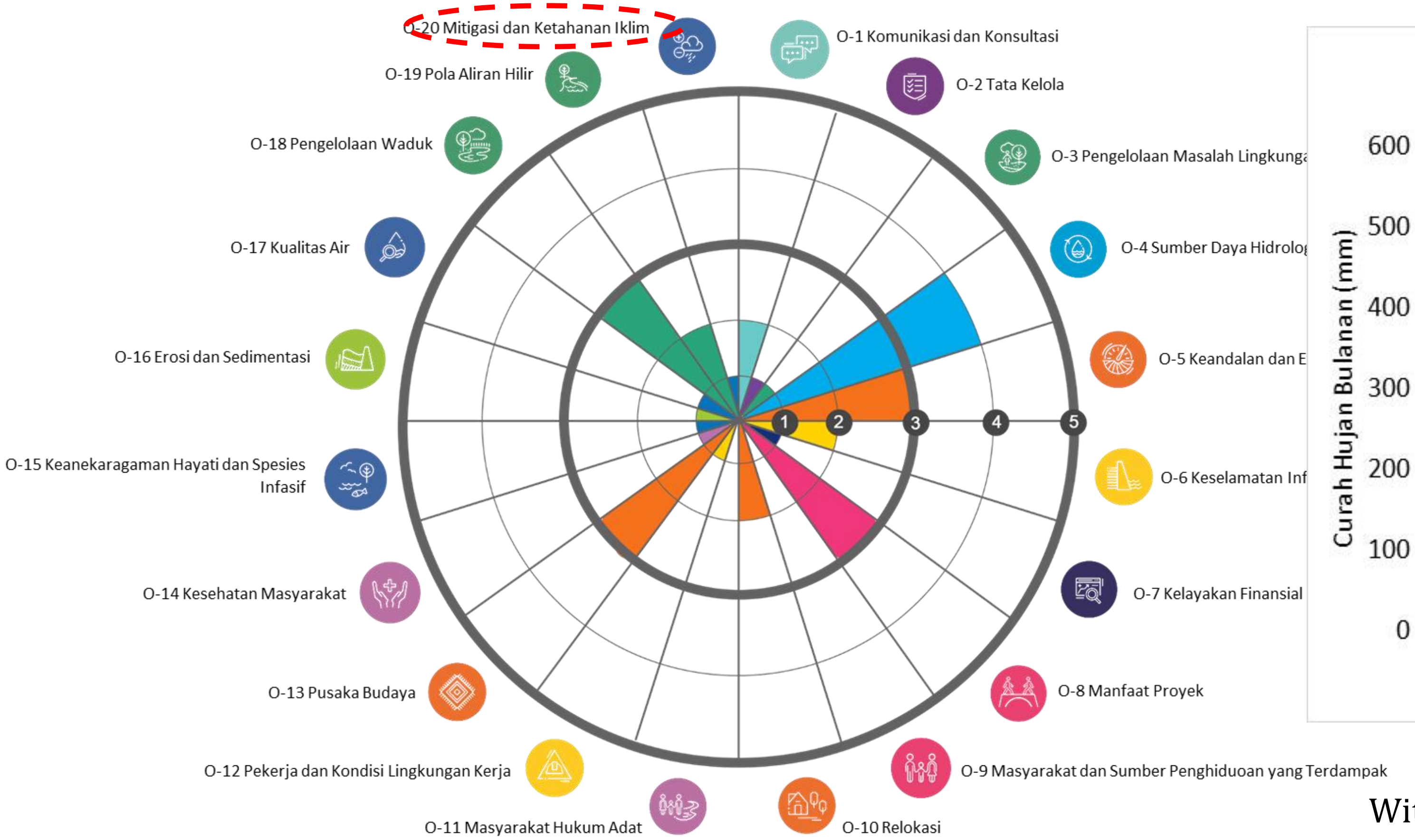
Priority

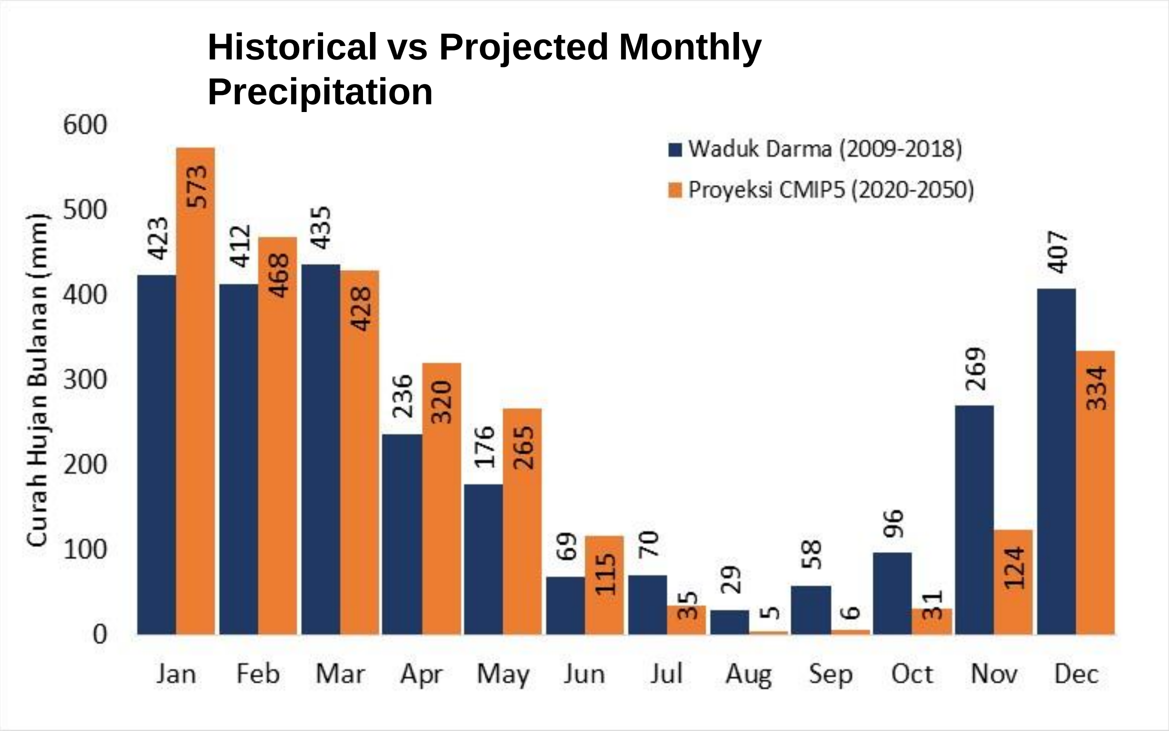
- Planning for multipurpose dam development and utilization of natural reservoirs
- Dam construction and rehabilitation
- Optimization and utilization of reservoirs
- Improvement of OM and dam safety
- Construction and Rehabilitation of Irrigation Networks
- Increasing the management of water allocation and the capacity of irrigation institutions
- Development of Non-Rice Commodity Water Supply System (high economic value)

Initiatives: Assess our Current Water Infrastructure O&M

Darma Dam

Climate change





With the projected changing inflow, SOP of the reservoir need to be adjusted

Application of HSAP for Assessment

Bappenas, 2019 and 2020

Initiatives: Improve Flood Risk Management

Governance

Risk Information

Limited information on flood risk
- Hydrometeorological data and models
- Long-term strategy
- Forecast system

Innovation

Lack of Innovation in Risk Reduction
- Domination of Grey Infrastructures
- Operation and Maintenance
- Private and Community Engagement

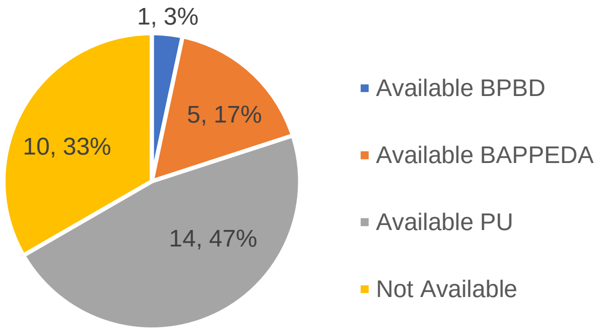
Institutional Arrangement

Non-optimal Institutional Arrangements
- Synergy with other programs and organizations
- Capacity and knowledge
- Enforcement of the rules

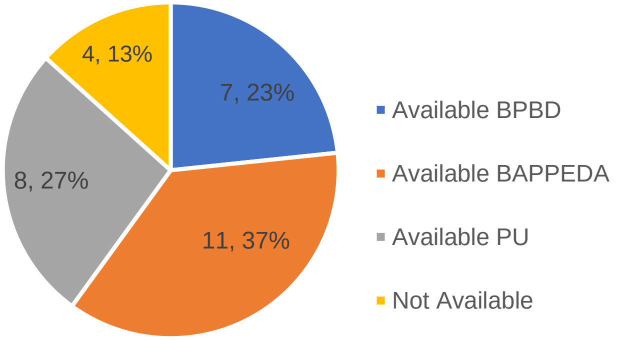
Budgeting

Insufficient Funding
- Domination of the State Budget
- The portion of the local funding in the OM is still low

Availability of Drainage Master Plan, Hydrological and Hydraulic Modelling, Current Condition of Drainage System



Availability of Urban Flood Control Plan



Source : Studi 30 Kota Program IDSUN

Lack of availability and synchronization of planning documents among stakeholders

Initiatives: explore the whole aspect of flood management and improve collaboration (case: Megapolitan Jakarta)

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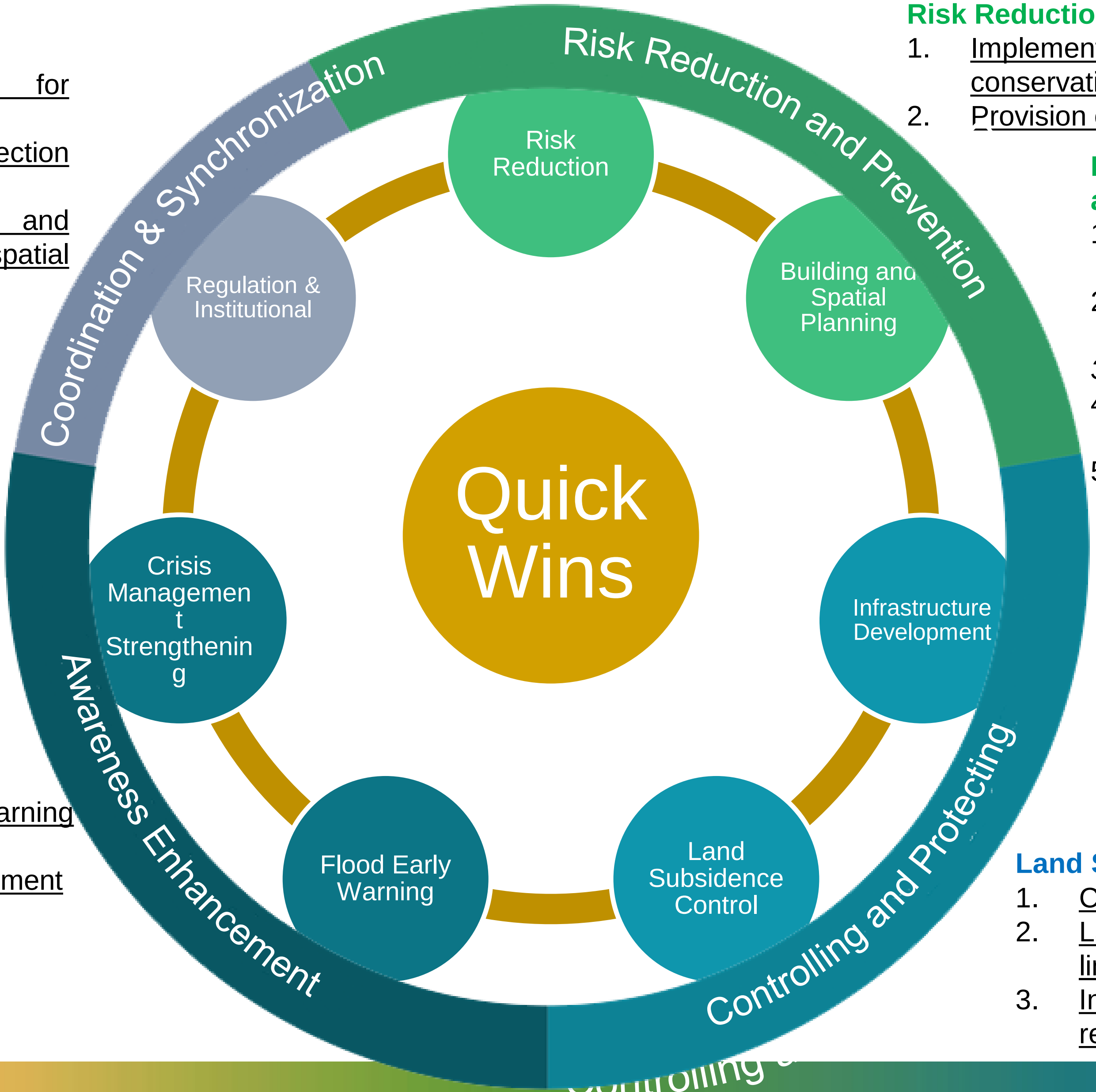
Kementerian PPN/ Bappenas



Regulation and Institutional

1. Establishment of task force for Jabodetabek flood risk reduction
2. Establishment of building inspection team and reviewer team for region
3. Implementation of incentive and disincentive on DRR-based spatial planning

Crisis Management

1. Optimizing the implementation of disaster management
2. Integrated control room development especially about water management operationalization

Flood Early Warning

1. System enhancement and early warning disemination process
2. Community understanding ehancement about evacuation process

Risk Reduction

1. Implementation of *zero delta runoff policy* based on conservation and reservoir
2. Provision of waste disposal facility along river bank

Building and Spatial Planning Based on DRR and Its Law Enforcement

1. Establishment and disemination of flood risk map
2. DRR-based spatial planning and its law enforcement
3. *Urban renewal* implementation
4. Risk-based building code and implementation of building rating
5. Flood sign installation and evacuation route

Infrastructure Development

1. Extreme weather drainage system masterplan adaptation, including implementation of *sustainable urban drainage system concept*
2. Finalization of drainage system masterplan development
3. Spatial designation and revitalization of situ, lake, reservoir (SDEW)

Land Subsidence Control

1. Clean water provision sourced from surface water
2. Law enforcement of groundwater extraction limitation
3. In case of continuation of land subsidence,offs hore reservoir is necessary

REPUBLIK INDONESIA

....and scaling up approach to other areas

Kementerian PPN/Bappenas

Target

20 Provinces — Enhancing disaster resilience in 20 Province with high disaster risk

Disaster Risk Reduction in 50 Cities

- Strengthening critical infrastructure that resilience to disaster
- Spatial planning and building code regulation
- Flood risk master plan
- Green infrastructure and early warning system

Coastal Protection in 5 cities of North Java Coast

- Monitoring and prevention of land subsidence in North Java Coastal
- Acceleration the construction of sea and river dikes, and pumping installation in coastal zone

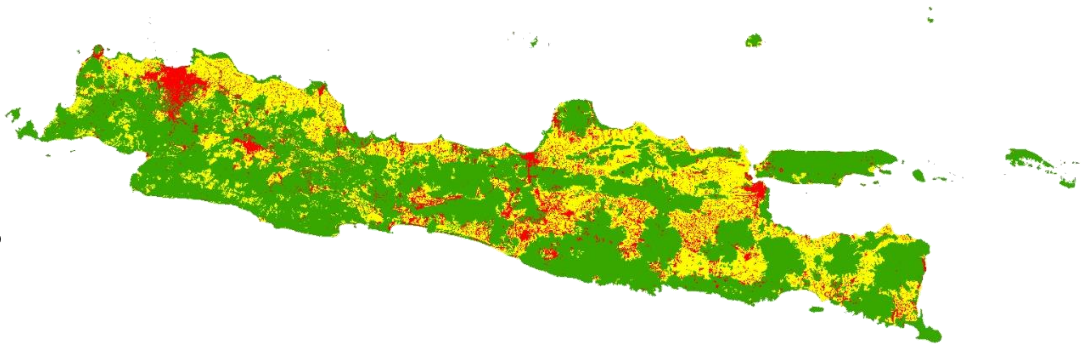
Restoration of 4 Critical Watershed

- Conservation in watershed area
- Improving the water quality
- Waste management

Initiatives: Explore the opportunity of current changes (Case: Reallocation of Irrigation Water for Other Purposes)

Potential Reallocation - Change of Rice Field

2013

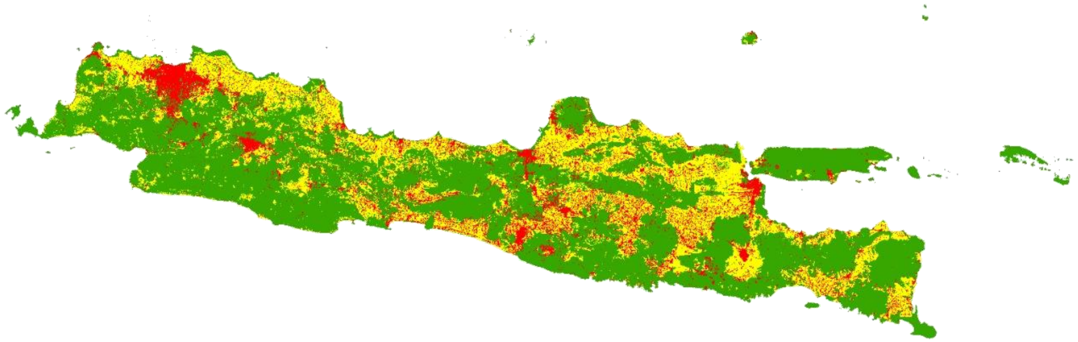


Legenda
- Lainnya

Keterangan
- Permukiman / Lahan terbangun
- Sawah

The total decrease in rice field area from 2013 to 2019 was 385 thousand hectares, with an average reduction rate of 64 thousand hectares per year

2019



Year	Rice Field Area (Ha)			
	Bekasi	Karawang	Subang	Purwakarta
2013	78.256,83	110.741,39	112.596,63	33.749,23
2016	74.537,33	106.714,30	100.297,20	24.047,61
2019	68.636,27	104.104,67	97.074,28	22.912,89

1.106,12 ha/year

1.603,43 ha/year

1.806,06 ha/year

2.581,06 ha/year

Potential Water Reallocation

- Bekasi Regency : 817.15 liters / second
- Karawang Regency : 646.37 liters / second
- Subang Regency : 1,373.84 liters / second
- Purwakarta Regency : 1,634.61 liters / second

REPUBLIK INDONESIA

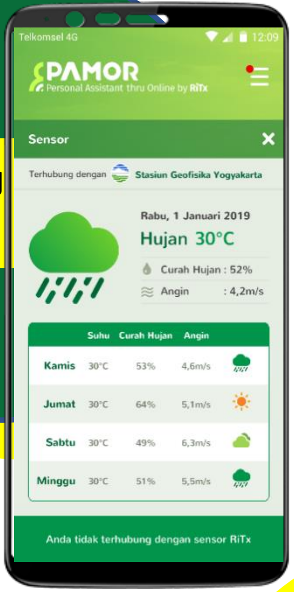
Initiatives: Promoting technology to inform decision

Kementerian PPN/ Bappenas

Collaboration between Bappenas and one of the partners (PT. MSMB) through the 'Leveraging ICT for Irrigated Agricultural Extension' with the RiTX Bertani application which provides monitoring features for the latest Soil and Weather Conditions

BMKG

Weather Monitoring Via **BMKG Satelite**



Soil & Weather Monitoring By RiTx Sensor

msmb

RiTX Prosperity in your hands

Monitoring of Current Soil and Weather Conditions

The importance of accurate weather prediction:

- To determine the planting schedule
- To measure water requirements
- To determine the best commodity to be cultivated.

The importance of knowing soil conditions:

- To determine the proper cultivation technique.
- To control the use of *saprodi* or *saprotan*.

Early Warning

Provides notification of the latest conditions related to soil and weather. From this warning, recommendations will appear on what farmers should do to minimize risks.

Real-time information

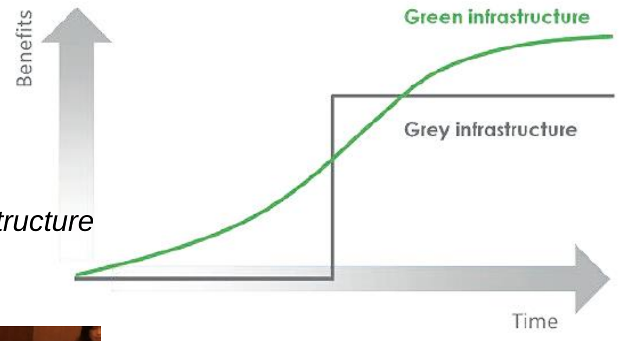
- Data is updated every 5 minutes.

Introducing Green Infrastructure for more co-benefit

Challenges

1. Land use changes into impermeable surface leads to increased run-off
2. High-cost grey infrastructure
3. Deteriorating eco-life
4. Unintegrated green approach into existing plans and managements

Phasing of Green Infrastructure and Grey Infrastructure Benefits

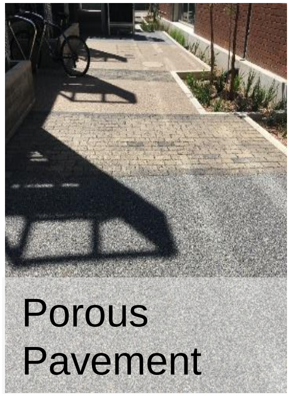


Source: New York City Green Infrastructure Plan

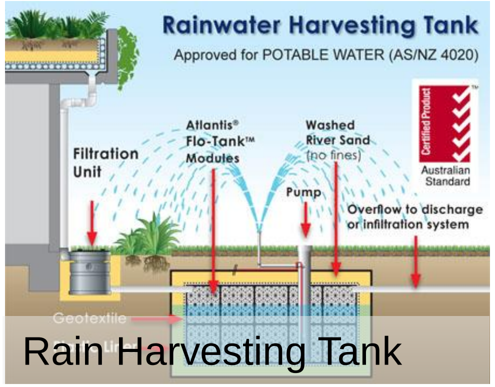
MoU Indonesia-European Investment Bank (EIB) on Green Infrastructure Development.
October, 13th 2018

Policy Direction

a. Lowland restoration
b. Reforestation through social forestry, public open space, and rehabilitation
c. Piloting green infrastructure approach for urban and coastal flooding management, drainage system, water quality management, and water conservation (groundwater recharge).
d. Water for renewable energy


Porous Pavement

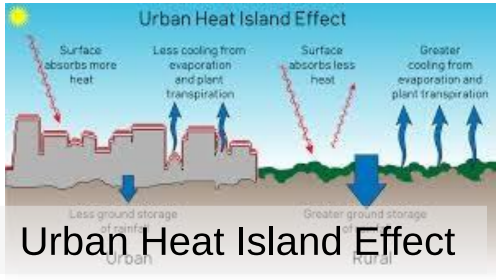

Sediment Pools



Rain Harvesting Tank


Constructed Wetland


Rain Garden

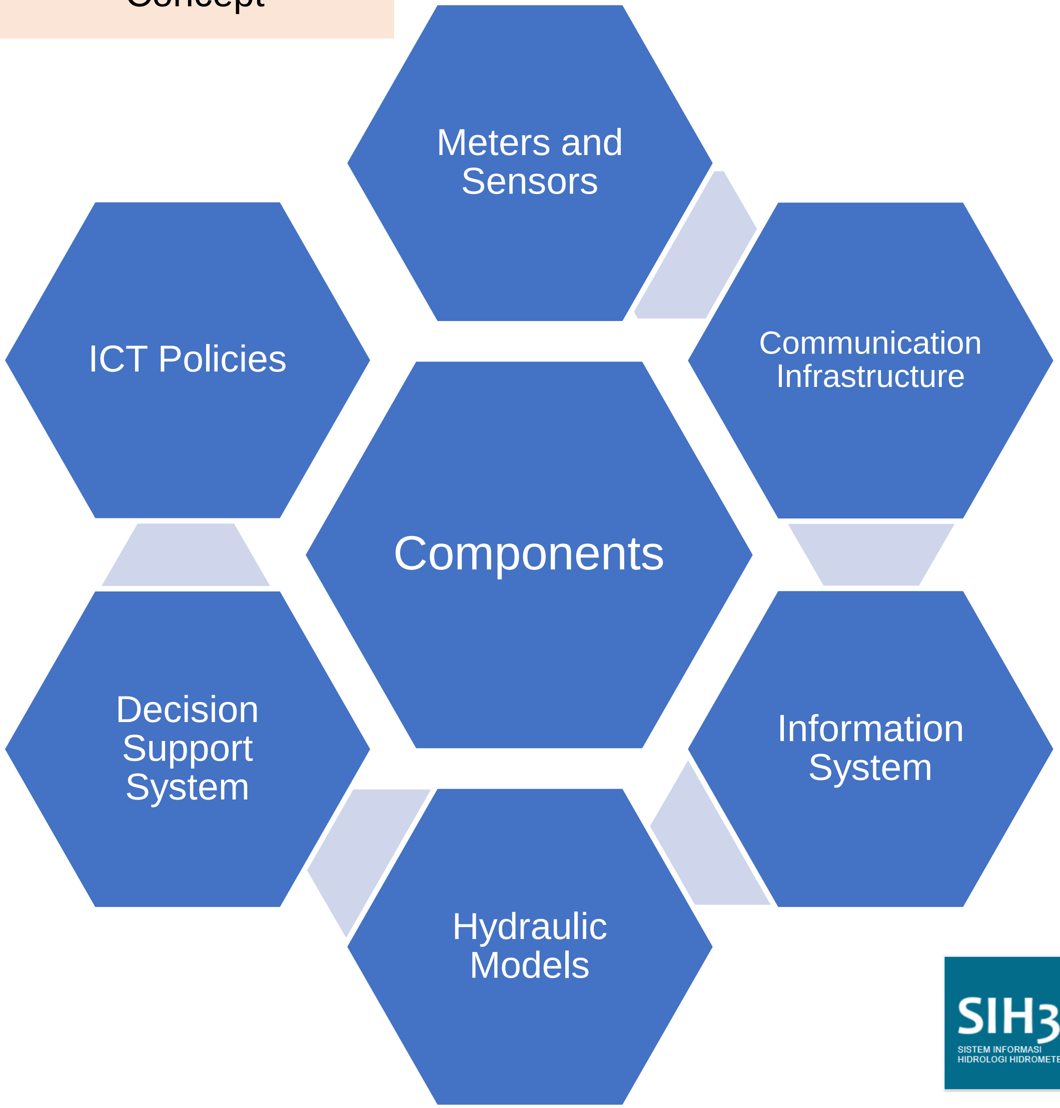


Urban Heat Island Effect

Source: Water Sensitive Urban Design, Public Health Notes, and Atlantis Rainwater Harvesting Tank

Improve efficiency through Smart Water Management

Concept



SIH3
SISTEM INFORMASI
HIDROLOGI HIDROMETEOROLOGI & HIDROGEOLOGI

Challenges

1. Unaccountable water usage
2. Unreliable and unavailable data
3. Partial data management
4. Inconsistency in application of new technology

Policy Direction

Efficiency improvement system on water supply and integrated water management through technology utilization.

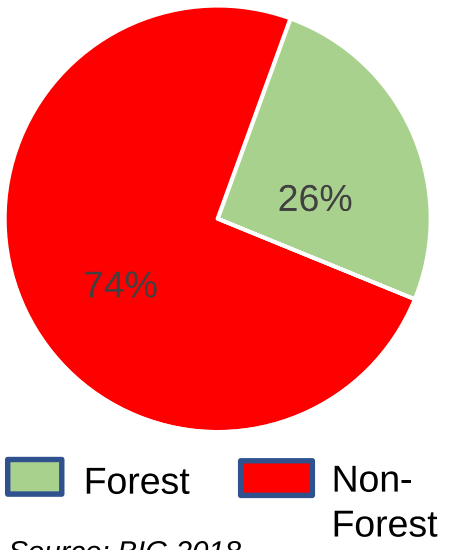
a. Advanced decision support system for water distribution and quality
b. Conservation, prevention, and law enforcement on water quality
c. Optimization of current information system for hydrology, hydrometeorology, and hydrogeology (SIH3)
d. Integrated early warning system for water related hazard

upgrade existing infrastructure and Plan for more purposes Infrastructure

Challenges

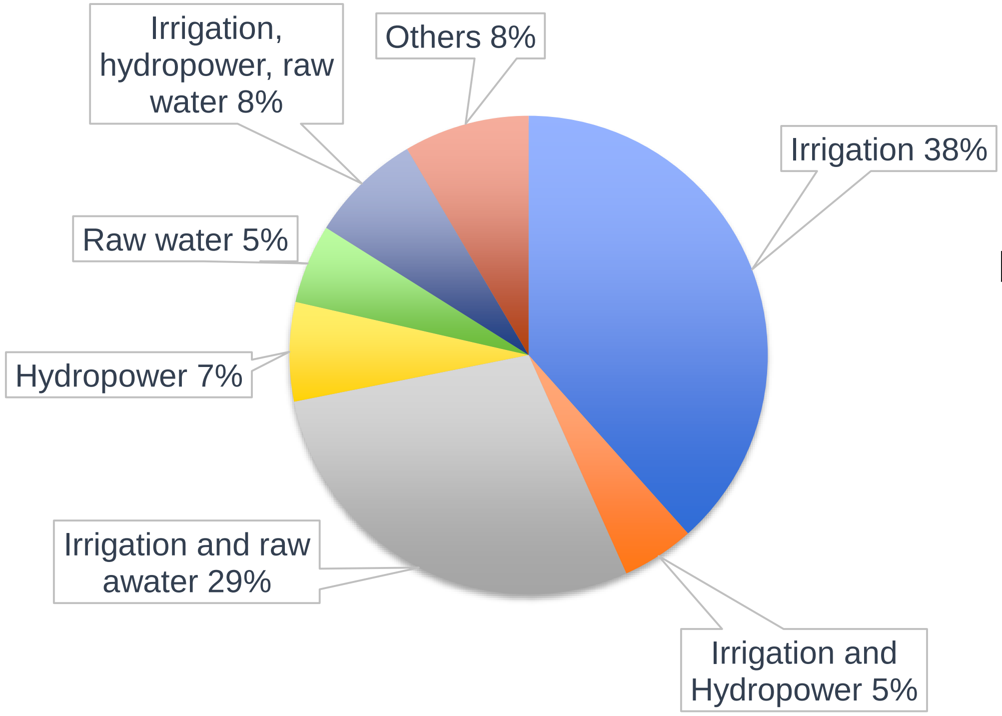
1. Around 50% dams are built only for single purpose
2. More than 50% of dam > 20 years old
3. Sedimentation problem

% of Forest Area in Reservoir Catchment in Indonesia



Source: BIG 2018

Existing Dam are Mostly Single Purpose



Source: MPWH 2018

Policy Direction

a. Existing Dams
   - Dam upgrading for new purposes and maintaining level of service
   - Innovative management scheme for O&M improvement
   - Community based catchment management
b. New Dams
   - Innovative financing scheme
   - **International protocol utilization for better preparation**
   - Multipurpose based

Thank You!!!

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4th Webinar (29 April 2021)

Date	Theme	Moderator	Presenters (3 presentations)
April 29	**④ Water-Energy-Food Nexus**		
4th Webinar	• Livelihoods and the WEF Nexus • Policy for Water Management based on WEF Nexus Approach • Water Use Balance and Micro-Grid Nexus Application • Progress in the Aral Sea Basin by Innovations and Nexus Approach	Federico Properzi (UN-Water) - TBC	Peter Mccornick (DWFI) – TBC Yongnan Zhu (IWHR) Reni Mayasari (PJT 2)

2nd Asia International Water Week ON AIR

4th Webinar

Water-Energy-Food Nexus

29 April 2021 (Thur) 16:00 (GMT+9)

PLEASE JOIN US!

Asia Water Council & Ministry of Public Works and Housing of Indonesia