Seminar series of SAPI

(Strategic Analysis of Policy Implementation under Colombia Japan Cooperation)

Target audience group: D = Decision maker, P = Practitioner of DRM, T = Technician of particular areas

1. Seminar on Disaster Risk Management in Japan: Target = D, P
   - introduction of geological background, history of DRM, system, rolls and responsibilities of entities
   - discussion about advantages and disadvantages of the both systems in Japan and Colombia
2. Seminar on Disaster Risk Reduction in Japan: Target = D, P
   - Investment in measures to reduce various types of disaster risks
   - Emergency response and preparations
   - Rehabilitation and reconstruction
3. Seminar on Societal Resilience to Disaster: Target = D, P
   - Risk awareness raising
   - Civic participation on DRR
   - Private sector participation, BCM
   - Area BCM
4. Workshop on SFDRR: Target = D, P
   - Outline and difference from HFA
   - Target and Indicators
   - Implementation and challenges
5. Seminar on River Law of Japan: Target = D, P, T
   - Outlines of the law
   - Essential features
   - Relevant law on urban flood prevention
6. Seminar on climate change adaptation in Japan: Target = D, P, T
   - Basic concept of CCA
   - Adaptation Strategy
   - Adaptation Criteria
   - International Cooperation in Mitigation and Adaptation of Climate Change
   - Case study of assisting developing countries, Indonesia
   - Mainstreaming Approaches of DRR under various uncertainties
7. Workshop on flood risk assessment: Target = P, T
   - Introduction of Integrated Flood Management
   - Open source and open data
   - Process of flood risk assessment
   - Tutorial of the process
     - Scoping
     - DEM
     - Scenario flood hydrograph
     - Flood hazard simulation
     - Risk assessment
8. Seminar on construction regulation: Target = P, T
   - Building code
   - Restriction in disaster zones
9. Seminar on sediment disaster prevention law: Target = D, P
10. Seminar on active volcanic zones law: Target = D, P
11. Seminar on Space Technology for DRM: Target = P, T
12. Workshop on Open Data for Resilience Initiative: Target = P, T
13. ..and more

Climate Change Adaptation

Basic concept of CCA
Adaptation Strategy
Adaptation Criteria
International Cooperation in Mitigation and Adaptation of Climate Change
Case study of assisting developing countries, Indonesia
Mainstreaming Approaches of DRR under various uncertainties

Basic Concept of CCA in Japan

National Plan for Adaptation to the Impacts of Climate Change, Cabinet Decision on 27 November 2015

◆ **Vision of society**

By promoting adaptation measures to climate change impacts, to build a secure, safe and sustainable society that is able to minimizing and avoiding damage for life of citizens, properties, economics, and natural environment due to its impacts, and to be resilient against damage.

◆ **Period**

Considered with long-term perspective till the end of 21st century, showing the basic direction in about coming 10 years.

◆ **Basic strategy**

1.Mainstreaming adaptation into government policy

2.Enhancement of scientific findings

3.Promotion of understanding and cooperation through sharing and providing information about climate-related risks

4.Promotion of adaptation in region

5.Promotion of international cooperation and contribution

◆ **Basic approach**

Adaptation will be promoted by using an adaptive approach that involves a repeated cycle of conducting ongoing observation, monitoring, and projection of climate change and its impacts, implementing regular assessments of impacts, considering and implementing adaptation measures, monitoring the state of progress, and making revisions as required.

An assessment of climate change impacts is to be implemented and formulated approximately every five years, and the Plan is to be revised as required.

Basic International Measures

National Plan for Adaptation to the Impacts of Climate Change, Cabinet Decision on 27 November 2015

◆ **Observation and Monitoring, Research and Studies**

Enhancement of observation systems (e.g. ground observation, ships, aviation, and satellites)

Advancement of modeling technologies and simulation technologies

◆ **Sharing and providing information related to climate risk**

e.g. Climate change adaptation information platform

◆ **Promotion of adaptation in region**

e.g. Implementation of model projects that assist the formulation of adaptation plans in local governments; Development of obtained results to other local governments

◆ **International measures**

Support for developing countries (e.g. assistance of climate change impact assessments and formulation of adaptation plans)

e.g. Contribution to human resource development through international networks such as the Asia Pacific Adaptation Network (APAN)

Sector Measures to be taken (1)

National Plan for Adaptation to the Impacts of Climate Change, Cabinet Decision on 27 November 2015

◆ Agriculture, Forests/Forestry, Fisheries

Impacts: e.g. Declining ratio of first- class rice due to high temperature ; Poor coloring of apples and other fruits

Adaptation: e.g. Development and diffusion of high-temperature-resistant varieties of rice; Switch to superior colored varieties of fruit

◆ Water Environment / Water Resources

Impacts: e.g. Changes in water temperatures, water quality; Increases in drought due to increases in the number of rainless days and decrease in the total amount of snowfall

Adaptation： e.g. To promote measures to reduce the loads flowing into lakes and marshes ; To promote efforts to formulate drought response timelines

◆ Natural Ecosystems

Impacts ： e.g. Changes in vegetation distribution and expansion of wildlife distribution due to increase in temperature and shift in days of snow-melting earlier

Adaptation： e.g. To ascertain the changes in ecosystems and species by using monitoring ; To conserve and restore healthy ecosystems with high climate change resilience

Sector Measures to be taken (2)

National Plan for Adaptation to the Impacts of Climate Change, Cabinet Decision on 27 November 2015

◆ **Natural Disasters / Coastal Areas**

○Impacts: e.g. Increasing frequency and intensity of water disasters, sediment-related disasters, and storm surge disasters due to increasing heavy rainfall and typhoons

Adaptation: e.g. Steady **facility improvements and maintenance**; Promotion of urban development with consideration of disaster risks; Formulation of hazard maps and evacuation plans

◆ **Human Health**

○Impacts: e.g. Increases in heat stroke; Expansion of the suitable habitat for vectors of infectious diseases

Adaptation: e.g. Awareness raising regarding prevention and treatment

◆ **Industrial / Economic Activity**

Impacts: e.g. Impacts on business production activities and leisure; Increasing insured losses

Adaptation: e.g. To promote efforts by businesses in collaboration between public and private sectors ; Development of adaptation technologies

◆ **Life of Citizenry and Urban Life**

Impacts: e.g. Damage to infrastructure and critical services

Adaptation: e.g. To enhance disaster prevention functions of distribution/logistics, ports and harbors, railways, airports, roads, water supply infrastructure, waste treatment facilities, and traffic safety facilities

Adaptation Strategy

in Natural Disaster Prevention and Mitigation
by the Ministry of Land, Infrastructure, Transportation and Tourism (MLIT)

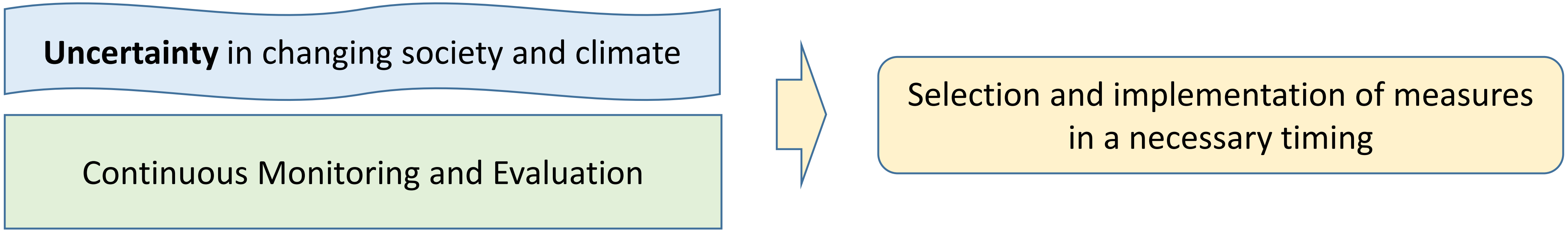
Considering of the impact of climate change on public infrastructure and transport sector, MLIT aims to;
Minimize damages caused by the currently occurring of may occur in the future of impact of climate change, by various entities who have the appropriate roles of the measures, based on as much as possible scientific knowledge by planning to take it at the right time, effectively and efficiently in order to
1) protect the people's lives and property,
2) support the social and economic activities by the continuity of function of infrastructure and societal systems,
3) strive to maintain the quality of people's lives and properly,
4) taking advantage of the change of circumstances that may arise,
With the basic strategy consisting of;

- **Adaptive management in light of the uncertainty**
- **Measures to reduce the existing risks**
- **Consideration of the future impact**
- **Comprehensive measures from the both sides of structural and non-structural**
- **Reflection of climate change risks in various development plans and renovation processes**
- **Coexistence and harmony with the natural environment**
- **Consideration of regional characteristics, promotion of efforts of each layer (local governments, businesses, residents, etc.)**

Adaptation Strategy 1: **Adaptive management** in light of the uncertainty

In general, it is difficult to accurately predict the future changes in the social and economic conditions including population, economic trends, level of technology and lifestyle. Global greenhouse gas emissions in the future, which is required for prediction of future climate, and socio-economic situation of the region in the evaluation of the resulting impact and risks of climate change, is therefore set on the basis of certain assumptions. In addition, the prediction results are different by the climate model used. Therefore, the prediction of the impact of the future climate change (timing, location and extent) is to involve the uncertainty.

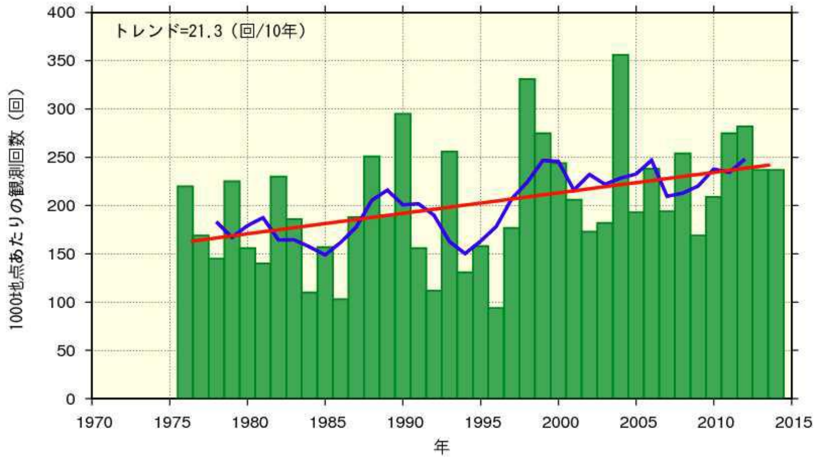
When promote adaptation measures, it is essential to perform the accommodative management, while continuously monitor climate change, the progress and the latest climate prediction data, changes in the socio-economic situation of the region, a history of measures and in light of the risk reduction effect by the new measures, proceed to be able to select the exact adaptation measures at the necessary timing.



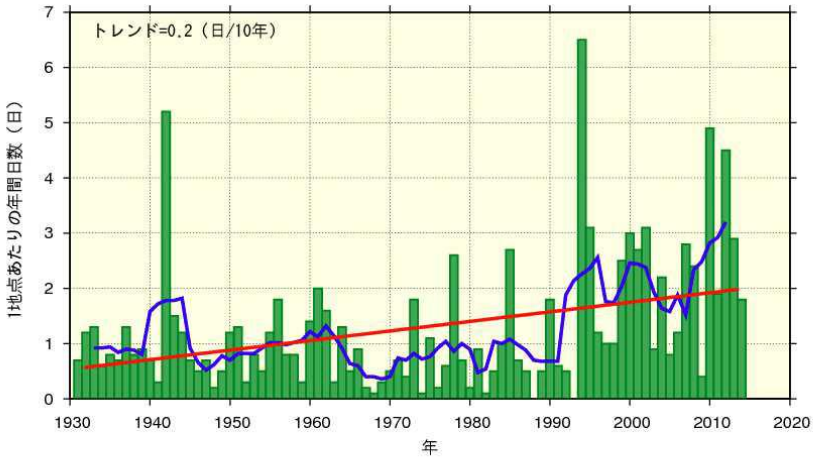
Adaptation Strategy 2: Measures to reduce the **existing risks**

The frequency of occurrence of heavy rain in a short period of time has increased along with the climate change. An increase in the number of extremely hot days has also been predicted. These events have already been observed in Japan.

For these <u>emerging threats</u>, the measures of <u>disaster prevention</u>, including what have been carried out, shall be further promoted as priority adaptation measures.



Number of annual days observed 50mm/h or more, per 1,000 stations



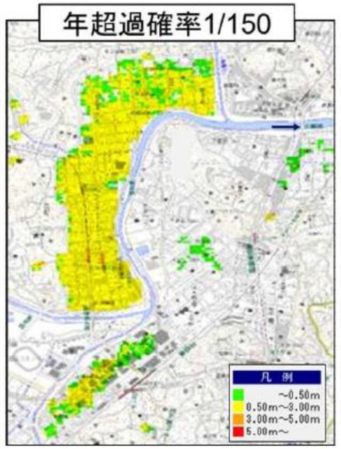
Number of annual days observed 35degree(C) or more, per one station

Source: Climate Change Monitoring Report, 2015, JMA

Adaptation Strategy 3: Consideration of the **future impact**

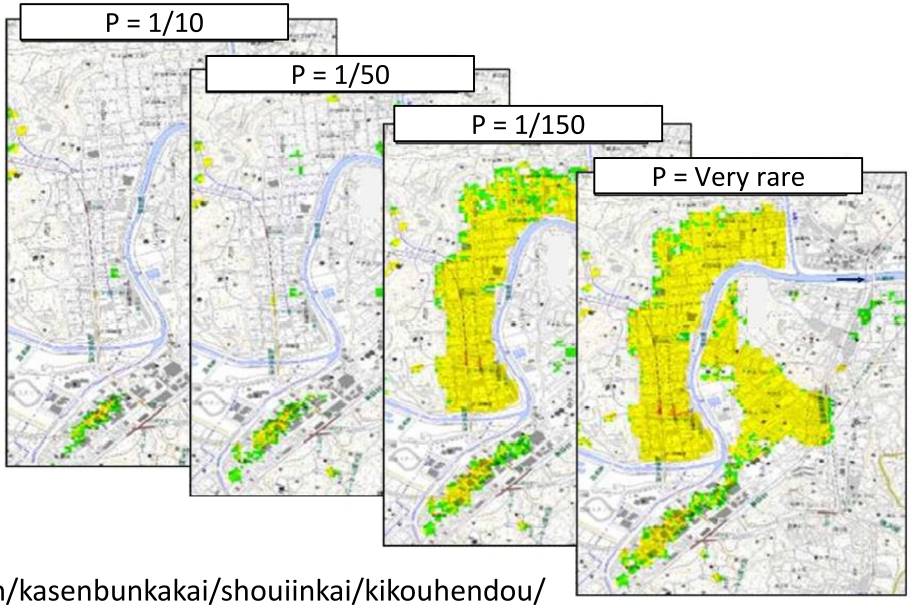
Although uncertainty about the extent and time of onset of the effects of climate change that will occur in the future is large, there is a possibility of occurring the events that have a significant impact on a society with the progress of climate change.

While considering the measures that take into account the effects of climate change, it should be noted that the frequency of occurrence of the event is changed by climate change. The basic concept we should have in this condition is to consider possibilities of various scales of events including those that have a low frequency but can result in a large-scale impact.



Previously, deterministic analysis based on single scenario was applied in considering the measures.

Multiple scenarios shall be considered to flexibly adapt against climate change.

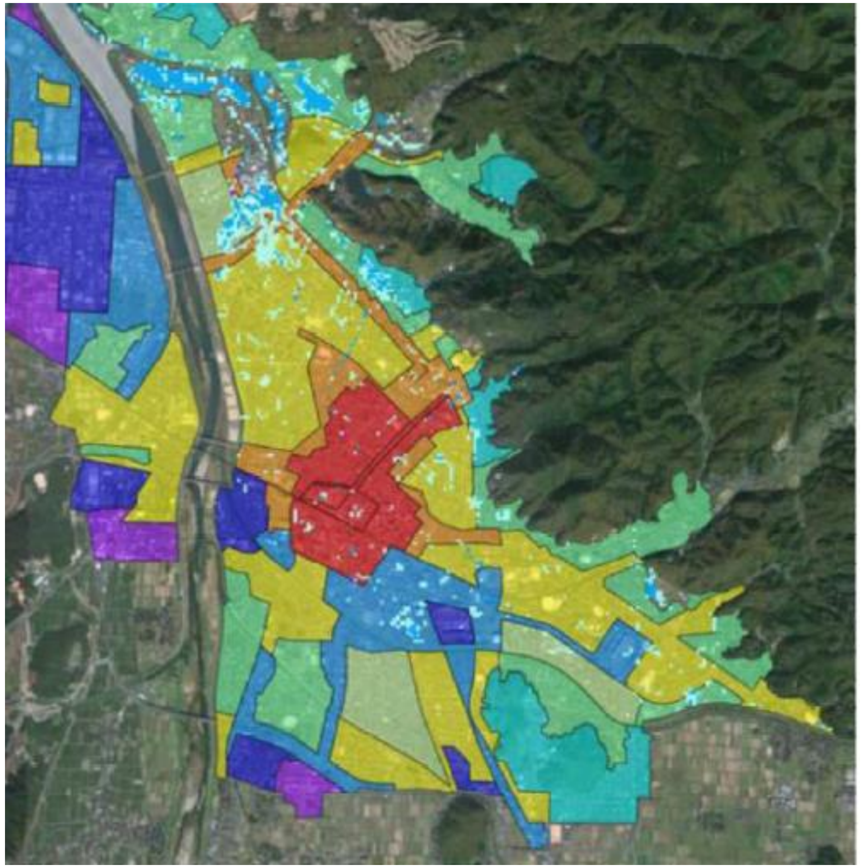


Source: http://www.mlit.go.jp/river/shinngikai_blog/shaseishin/kasenbunkakai/shouiinkai/kikouhendou/

Adaptation Strategy 4: **Comprehensive measures** from the both sides of structural and non-structural

Adaptation should be planned and implemented as a combination of variety of measures including structural and non-structural options such as public information, training of information transmission, evacuation, emergency activities, business continuity management, etc.. The comprehensive measures should be timely taken based on the impact and the extent of climate change as well as the characteristics of each region.

From a view point of reducing vulnerability and exposure, it is effective to promote city planning, community development and land use in consideration of increasing disaster risk due to the effects of climate change as well as to the existing disaster risk that has already been assumed. It should be conducted while taking opportunities of reorganization of the locality and the region in light of the population decline.



Map of City Planning overlaid with Risk Areas

Adaptation Strategy 5: Reflection of climate change risks in various **development plans and renovation processes**

In order to effectively and efficiently implement the adaptation measures, Government agencies incorporate the concept of adaptation to the impacts of climate change to a variety of development plans;

Such as: A new national land formation plan, Social capital improvement priority plan draft, Water circulation basic plan, etc.

The impact of future climate change should also be introduced in establishment and maintenance of infrastructure and systems renovation, among steadily process with the update, etc. as needed.

An example of coastal gate designed to allow easy renovation for the increase in future sea level rise

Adaptation Strategy 6: Coexistence and harmony with the **natural environment**

In social capital development, the MLIT has been working on measures to conservation and restoration and creation of the natural environment. It has been aimed at sustainable use of the functions of the nature in the local and regional characteristics, from the view point of biodiversity conservation, considering of the dynamics of nature.

Similarly, in the planning and implementation of adaptation measures, it is agreed to consider the conservation and restoration and creation of the natural environment.

In addition, depending on the purpose and regional characteristics, it should take advantages of providing a place for living and growth of the organism, good landscape formation, a variety of functions of the natural environment, such as suppression of temperature rise (green infrastructure).




Adaptation Strategy 7: Consideration of **regional characteristics**, promotion of efforts of each layer

Climate Risk Understanding

Hazard Mapping by Community

Response Capacity Development

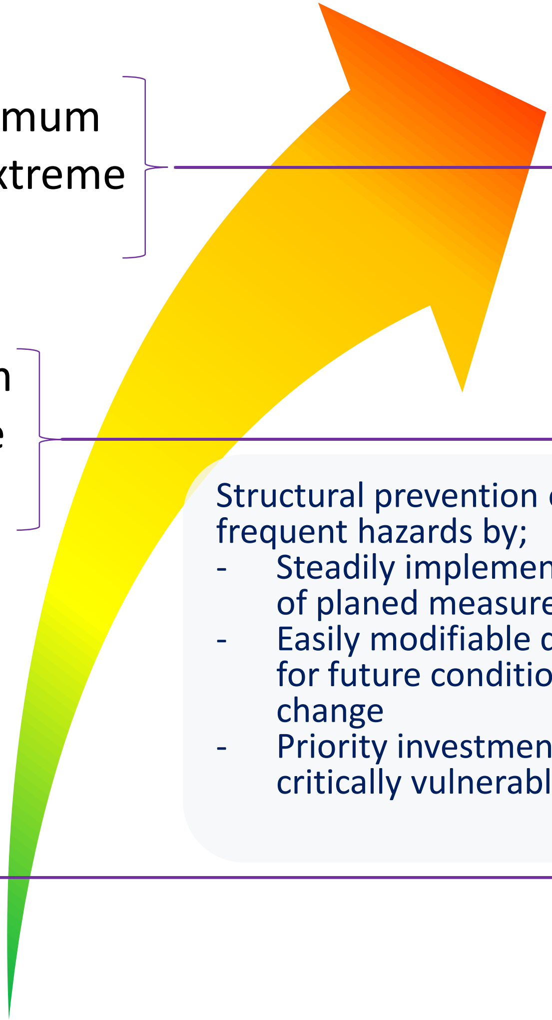
Exposure and vulnerability to the impacts of climate change will vary by region. In promoting adaptation measures, it is necessary to consider local and regional characteristics so that measures can be flexibly adaptable to the conditions.

In order to promote the efforts of various actors including local governments, business enterprises and residents in cooperation, it is effective to keep assuming one of the scenarios to implement any such measures in any such timing depending on the seriousness of the impact of climate change in advance.

With respect to the climate change impacts and adaptation measures, even as the national level it should have a possible support such as specifically indication of the immediate problem to the residents.

Adaptation Criteria specific for Flood Risk Management

Basic Concept of CCA in Flood Risk Management



Probable Maximum Flood Level (Extreme scenario)

Design Maximum Flood Level to be achieved (Plan)

Acceptable Maximum Flood Level at present condition

Structural prevention of frequent hazards by;

- Steadily implementation of planed measures
- Easily modifiable design for future condition change
- Priority investment in critically vulnerable areas

Reduction of damages by mobilizing as much as possible measures

- Devising effective methods of operation, construction, maintenance procedures, etc.
- Revised dam operation rules, improved drainage gates, flood proofing of pump facilities, revised river improvement plans in consideration of increasing risks
- Coordination with city planning to facilitate resilient land use and safer living style against increasing risks
- Introduction of 'Timeline' in emergency management
- Promotion of business continuity management for private enterprises and government organizations

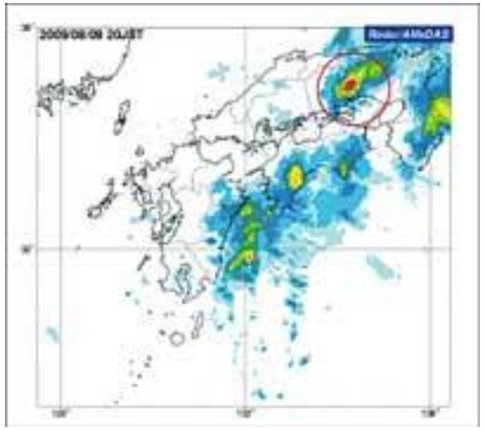
Avoidance of catastrophic damage to protect the life

- Promotion of proactive evacuation by site decision
- Wide-area evacuation system
- Integrated Timeline among multiple agencies

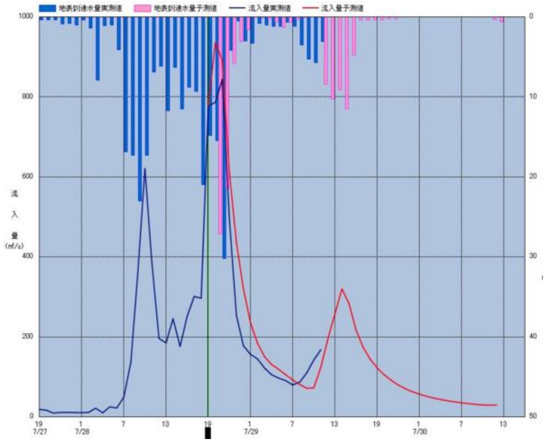
Adaptation Criteria specific for Flood Risk Management

Selectable Options for CCA in Flood Risk Management (examples)

Under a condition where technically capable to reliably forecast upcoming rainfall in particular catchment area of a dam reservoir, the efficiency of flood control could be further enhanced by pre-discharge operation to spare more storage capacity for flood retention and consequently enabling flood peak discharge reduction.



Precise and accurate rainfall observation and reliable forecast



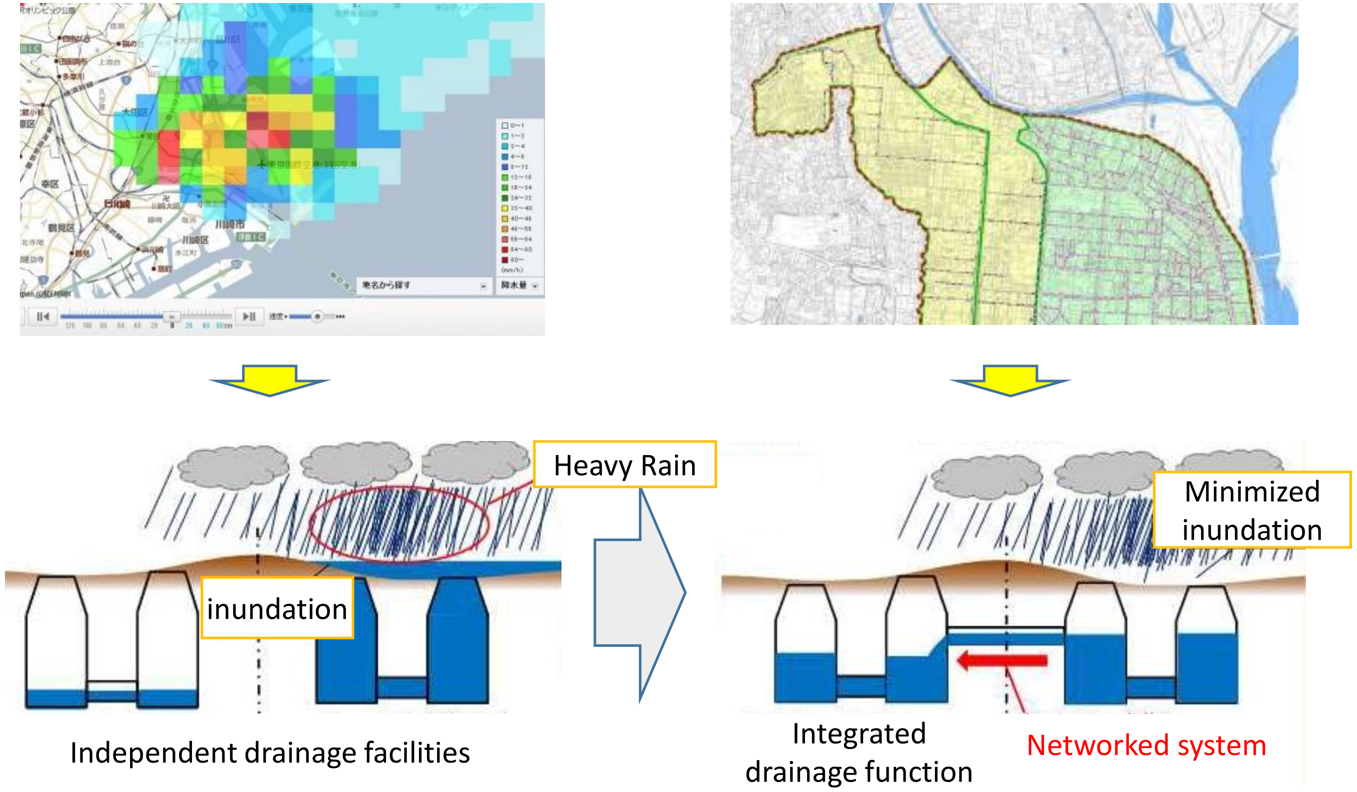
Real time forecast of inflows to the reservoir

Optimized Dam operation to spare storage capacity for flood intake in prior to the peak discharge period

Adaptation Criteria specific for Flood Risk Management

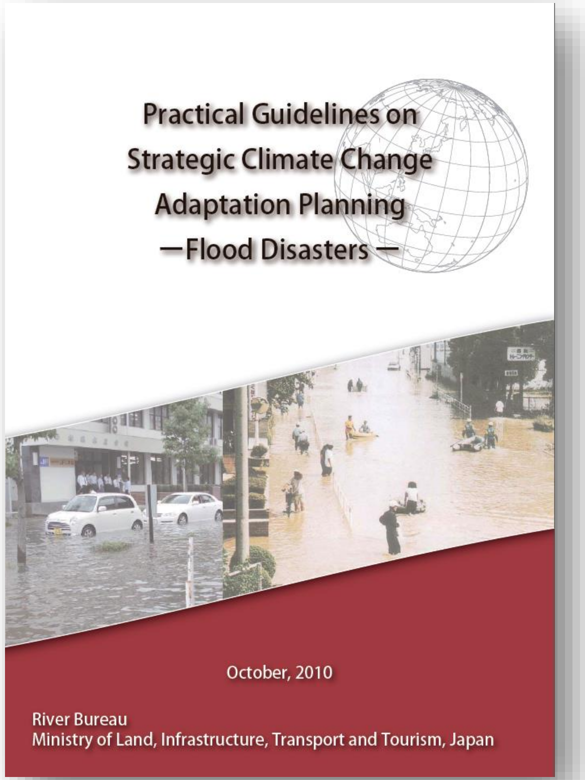
Selectable Options for CCA in Flood Risk Management (examples)

Heavy rainfall often hits a very limited zone of a city and causes severe inundation by overflowed water from a sewerage system.
If multiple sewerage systems are connected as a network, it could control flood by discharging water to a surplus area. This kind of networking of multiple facilities can make better backup functions and improve the resilience of the system against climate change and other risks of disruption.



Adaptation Criteria specific for Flood Risk Management

Technical Guides



MLIT published the "Practical Guidelines on Strategic Climate Change Adaptation Planning –Flood Disasters—" in October 2010, the contents of which includes method of projecting precipitation and sea level rise, analyzing hazards, vulnerability and risks, setting targets of flood management, and optimal combination of adaptation measures.

The guidelines contains many useful indexes and criteria that will be advantageous for making CCA planning and evaluation. However the research in this field is quite rapidly progressing and day by day new information are being accumulated.

National Institute for Land and Infrastructure Management, MLIT is the leading research institute of Japan in the area of flood risk management providing with the latest CCA criteria through the web.

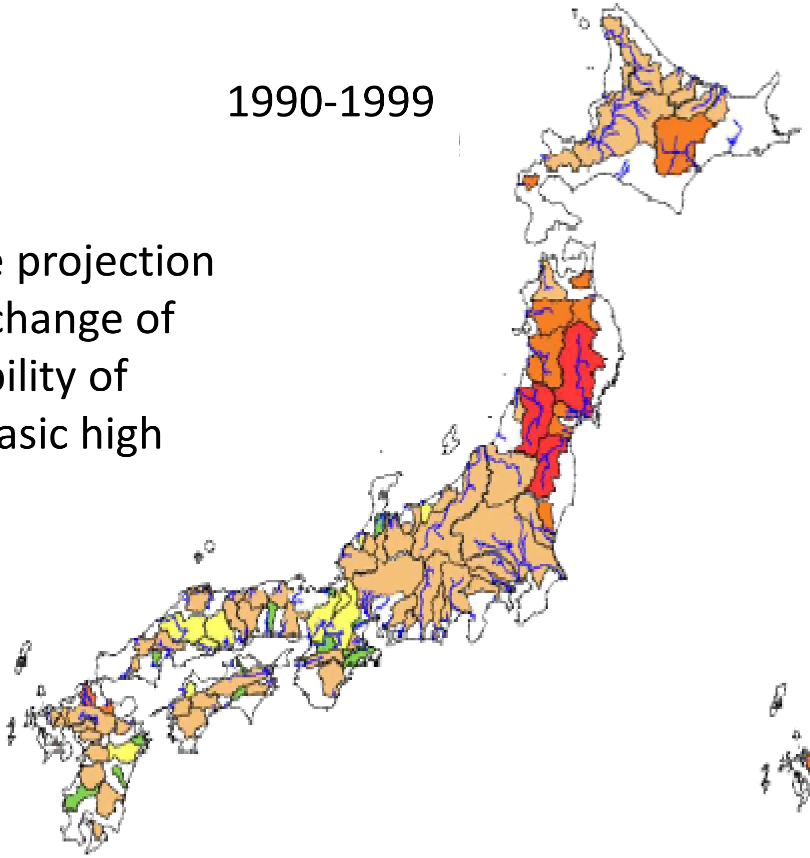
http://www.mlit.go.jp/river/basic_info/english/pdf/guigelines_eng.pdf

Adaptation Criteria specific for Flood Risk Management

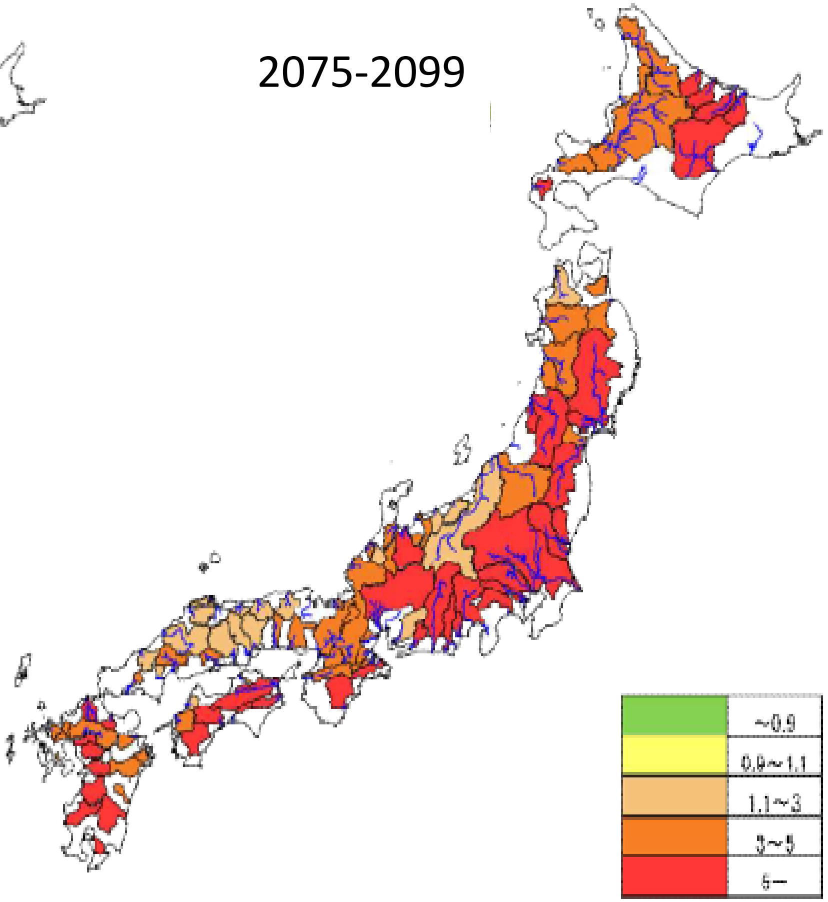
Technical Guides

Examples of climate change projection (mean value of the rate of change of the occurrence year probability of flooding that exceeds the basic high water peak flow)

1990-1999



2075-2099



http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0749pdf/

Adaptation Criteria specific for Flood Risk Management

Technical Guides

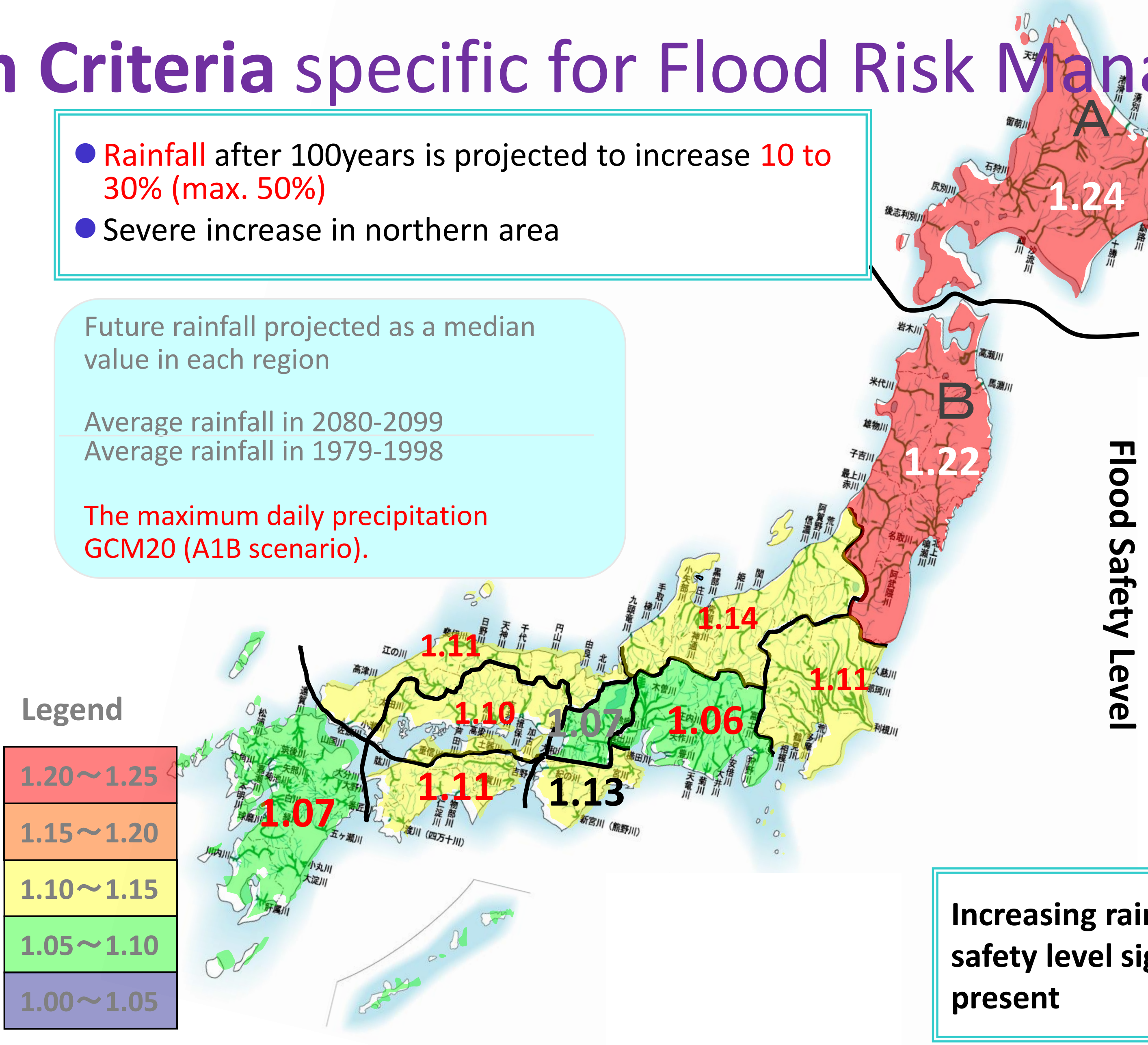
- Rainfall after 100years is projected to increase 10 to 30% (max. 50%)
- Severe increase in northern area

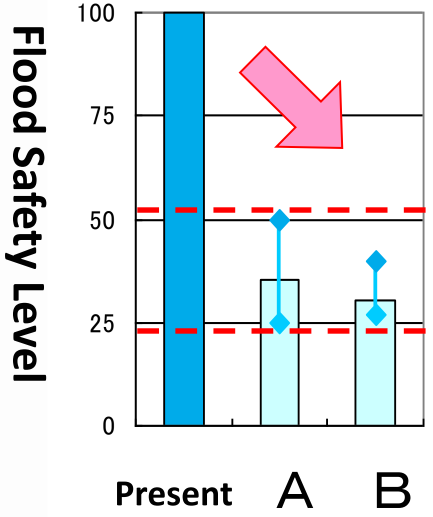
Future rainfall projected as a median value in each region

$$\frac{\text{Average rainfall in 2080-2099}}{\text{Average rainfall in 1979-1998}}$$

The maximum daily precipitation GCM20 (A1B scenario).

Examples of climate change projection (mean value of the rate of change of the maximum daily precipitation by a GCM20)



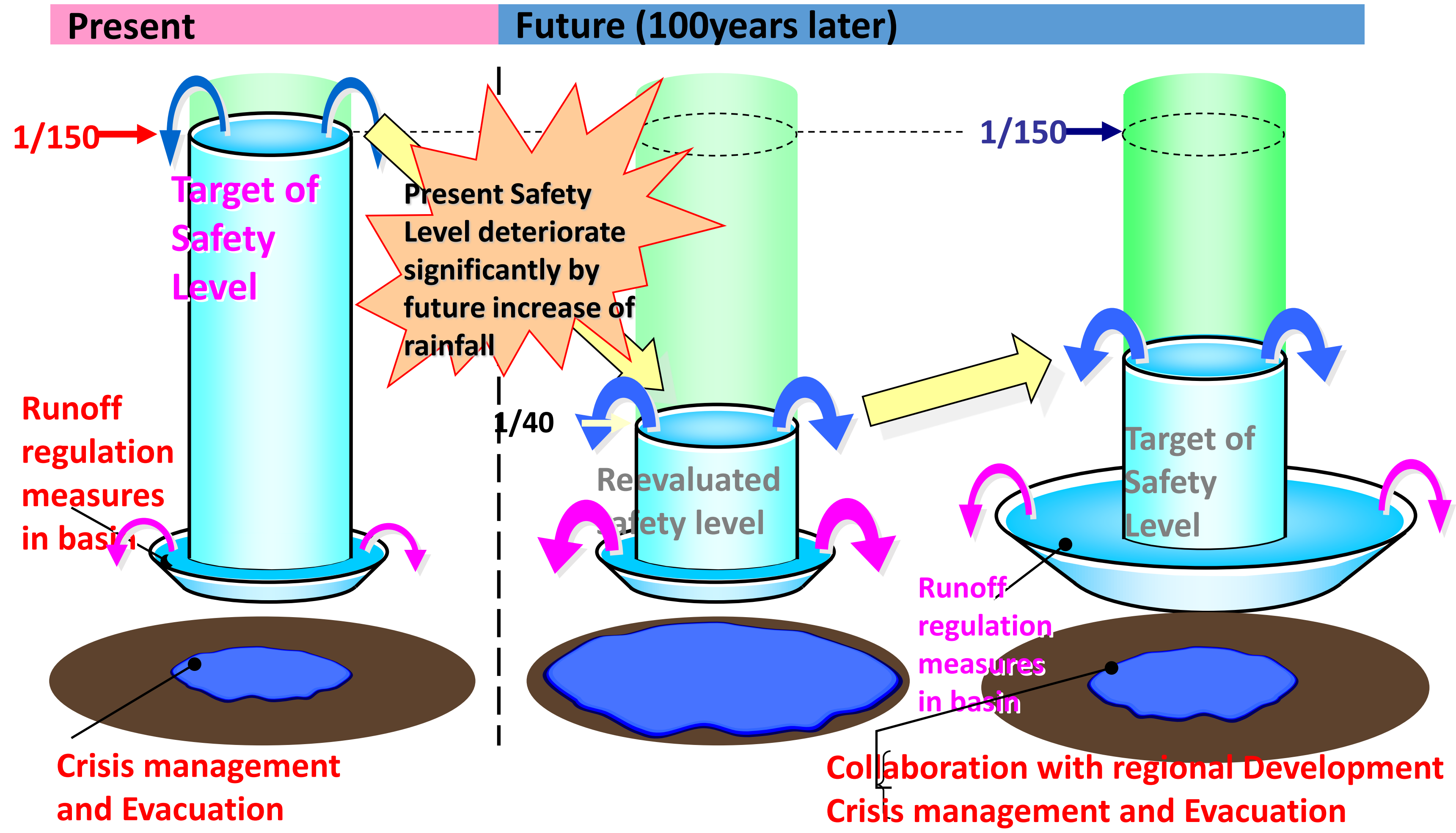


Increasing rainfall intensity make flood safety level significantly lower than present

Adaptation Criteria specific for Flood Risk Management

Technical Guides

Among others, the changing Safety Level regarding flood risks is the important factor that we need to assess and reflect to the concept of multilayered adaptation measures.



International Cooperation in Mitigation and Adaptation of Climate Change

Based on the policies adopted by the Government of Japan, JICA actively support measures regarding mitigation and adaptation to tackle climate change in developing countries according to the following principles by making the most of Japanese technology and the experiences and fruits accumulated in its support for developing countries.

Guiding Principles

- Climate Compatible Sustainable Development
- Comprehensive Assistance using an Array of Schemes
- Collaboration with Development and Climate Partners

Strategy

- Mitigation : “Towards a low carbon society”, formulating national plans and sector strategies, building efficient social and economic system, and developing and diffusing low carbon technologies
- Adaptation : “Towards a resilient society”, formulating national plans and sector strategies, enhancing adaptive capacity for climate related disasters, and developing resilient infrastructure
- Mechanisms to Accelerate Mitigation and Adaptation : policy and institutinla reform, finance mechanizm, and human resource development

Direction of Resilient Development Cooperation by JICA

Kyoto Initiative
(COP3 in 1997)

Environmental Conservation Initiative for Sustainable Development (EcoISD)
(WSSD in 2002)

Invitation to Cool Earth 50
("The Future of Asia" in 2007)

Cool Earth Partnership
(Davos Conference in 2008)

Hatoyama Initiative
(UN Summit on Climate Change in 2009)

Fast Start Finance

Japan has been scaling up its assistance to developing countries to foster sustainable development through climate change mitigation and adaptation since the announcement of the Kyoto Initiative, leading to the recent "Fast-Start Finance (FSF)."

Japan is the largest donor in the climate change field among OECD DAC donors.

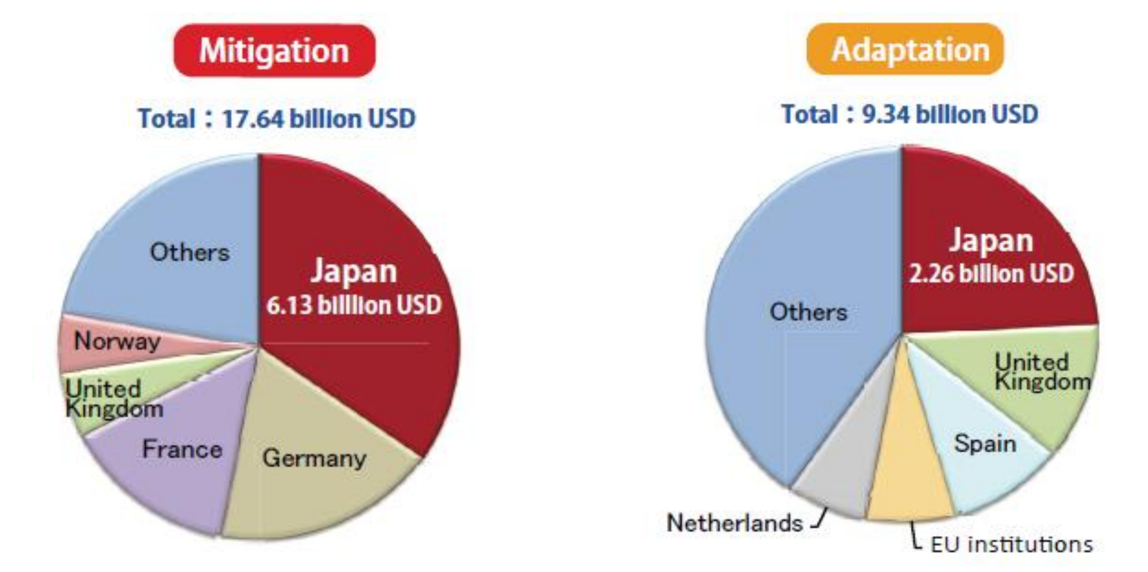


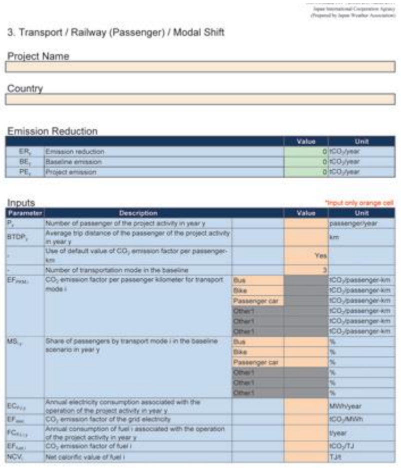
Figure: Bilateral climate change-related aid in 2010 (Source: OECD DAC Statistics 2011)

Climate Finance Impact Tool for Mitigation and Adaptation (JICA Climate-FIT)

JICA has prepared Climate Finance Impact Tool (JICA Climate-FIT) , a reference document which contains the following components in order to facilitate consideration of policies and formulation of projects for assisting climate change related measures in developing countries.

1. Methodologies for implementing measurement, reporting and verification (MRV) related to quantitative evaluation of mitigation projects that contribute to reduction or sequestration of greenhouse gases (GHG)
2. Concepts and guidelines for mainstreaming adaptation considerations into projects that contribute to reduction of vulnerability against climate change, and sustaining and increasing adaptive capacity and resilience

http://www.jica.go.jp/english/our_work/climate_change/overview.html



3. Transport / Railway (Passenger) / Modal Shift

Project Name

Country

Emission Reduction

		Value	Unit
ER_y	Emission reduction	0	tCO_2/year
BE_y	Baseline emission	0	tCO_2/year
PE_y	Project emission	0	tCO_2/year

Inputs *Input only orange cell

Parameter	Description		Value	Unit
P_y	Number of passenger of the project activity in year y			passenger/year
$BTDP_y$	Average trip distance of the passenger of the project activity in year y			km
-	Use of default value of CO_2 emission factor per passenger-km		Yes	
-	Number of transportation mode in the baseline		3	
$EF_{PKM,i}$	CO_2 emission factor per passenger kilometer for transport mode i	Bus		tCO_2/passenger-km
		Bike		tCO_2/passenger-km
		Passenger car		tCO_2/passenger-km
		Other1		tCO_2/passenger-km
		Other1		tCO_2/passenger-km
		Other1		tCO_2/passenger-km
$MS_{i,y}$	Share of passengers by transport mode i in the baseline scenario in year y	Bus		%
		Bike		%
		Passenger car		%
		Other1		%
		Other1		%
		Other1		%
$EC_{PJ,y}$	Annual electricity consumption associated with the operation of the project activity in year y			MWh/year
EF_{elec}	CO_2 emission factor of the grid electricity			tCO_2/MWh
$FC_{PJ,i,y}$	Annual consumption of fuel i associated with the operation of the project activity in year y			t/year
$EF_{fuel,i}$	CO_2 emission factor of fuel i			tCO_2/TJ
NCV_i	Net calorific value of fuel i			TJ/t

Examples of Adaptation Assistances

Ethiopia（Technical Cooperation）: Rural Resilience Enhancement Project

The southeast of Ethiopia is included in the "Horn of Africa" portion of the northeast of the African continent. This region is heavily prone to droughts and food crises, and in 2011 suffered drought damage thought to have been the worst for past 60 years. Given such situation, there are calls for medium- and long-term efforts that will strengthen endurance and resilience with regard to natural disasters. This project has been providing support, via implementation of surveys and verification operations, for strengthening resilience to climate change such as drought in the rural regions of Oromia and Somali Provinces.

Examples of Adaptation Assistances

Philippines and Peru（ODA Loan）: Stand-by Emergency Credit for Urgent Recovery ("SECURE")

Stand-by Emergency Credits for Urgent Recovery were established by the Japanese government in 2013. Known as "SECUREs", these are arrangements with particular countries in order to provide rapid support for their funding needs that arise in the recovery stage following a disaster. A loan ceiling is agreed in advance with the country concerned, so that funding can be implemented promptly in response to a request from the country when a disaster occurs. Thus far, SECUREs have been concluded with the Philippines and Peru. SECURE funding was supplied to the Philippines for recovery and reconstruction after Typhoon Yolanda, which struck the country in November 2013.

Examples of Adaptation Assistances

Chile（Third Country Training）: Adaptive Watershed Management with Emphasis in Environmental Services and Climate Change

JICA has been implementing assistance for Chile in the field of river basin management for 20 years. Putting the fruits of that to use, and in order to spread the insights built up in Chile across the Central and South American region, JICA is implementing training in this field for some 19 Central and South American countries. JICA aims to enhance the capabilities for climate change adaptation measures and comprehensive river basin management of the official agency staff responsible for forestry management, and environmental conservation in this region.

Examples of Adaptation Assistances

Indonesia Bali Beach Conservation Project

The project started in 1996 aiming to conserve four beaches in the island of Bali, the Republic of Indonesia, where coastal erosion is a growing concern due to the increasing impact of ocean waves caused by coral reef degradation.

The project is expected to counteract the current and future problems, thus inducing sound socio-economic development in the area.

It is also considered an effective adaptation measure to sea level rise due to climate change. The project was completed in 2009.

Examples of Adaptation Assistances

Bangladesh : Project for Construction of Multipurpose Cyclone Shelters, Emergency Disaster Damage Rehabilitation Project

Where 80% of national land is at an altitude of under 9 meters, they always suffer excessive loss due to flood in rainy season and cyclone.
The project constructed 91 two-story multi purpose cyclone shelters
by 5 phase-long cooperation period. Combining cyclone observation system such as Metrological Radar System, the cyclone shelters could work more effective to reduce damages from cyclones.

Case study of assisting developing countries, Indonesia

JICA, in cooperation with signifying institutions such as Tokyo University and top researchers in Japan, keenly assists developing countries while conducting climate change assessment and formulating strategies and plans to adapt socio-economic development against changing environment.

One of the recent CCA relating project is "The Project for Assessing and Integrating Climate Change Impacts into the Water Resources Management Plan for Brantas and Musi River Basins" in Indonesia. As a typical case of assisting developing countries in climate change impact assessment and hydrological simulation, it is briefly introduced through the following pages.

Since the process requires latest technologies and global datasets which are not acquainted nor standardized in most of the developing countries, JICA takes a role to mobilize the resource of "State-of-the-art techniques" of Japan.

The following information in pages are provided by Prof. Toshio Koike, Daikichi Ogawada and Akiko Matsumura, in cooperation with JICA Study Team of the Project, in May. 2014

Case study of climate change impact assessment and hydrological simulation in **Brantas River Basin**

C.A. 11,800km^2
Length 320km

1. Climate change impact assessment: GCMs Selection

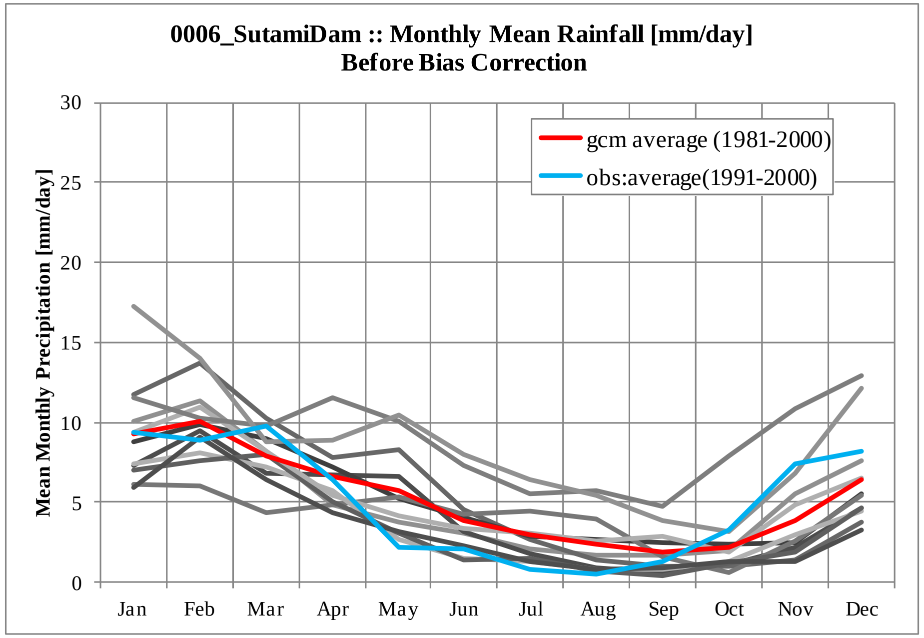
24 GCMs in CMIP3 → Daily data sets available for 17 GCMs → Evaluation by DIAS Scoring System → Finally, 11 GCMs were selected

GCM	Availability of daily data	Score of DIAS selection system	Selected GCMs which scores are 2 and over
gfdl_cm2_1	✓	4	✓
cccma_cgcm3_1	✓	3	✓
cccma_cgcm3_1_t63	✓	3	✓
giss_aom	✓	3	✓
mri_cgcm2_3_2a	✓	3	✓
csiro_mk3_0	✓	2	✓
csiro_mk3_5	✓	2	✓
gfdl_cm2_0	✓	2	✓
giss_model_e_r	✓	2	*Not selected
0miroc3_2_hires	✓	2	✓
miub_echo_g	✓	2	✓
mpi_echam5	✓	2	✓
cnrm_cm3	✓	1	
ipsl_cm4	✓	1	
miroc3_2_medres	✓	1	
iap_fgoals1_0_g	✓	0	
inmcm3_0	✓	-2	
ncar_ccsm3_0			
ukmo_hadgeml			
bccr_bcm2_0			
ingv_echam4			
ukmo_hadcm3			
giss_model_e_h			
ncar_pcml			

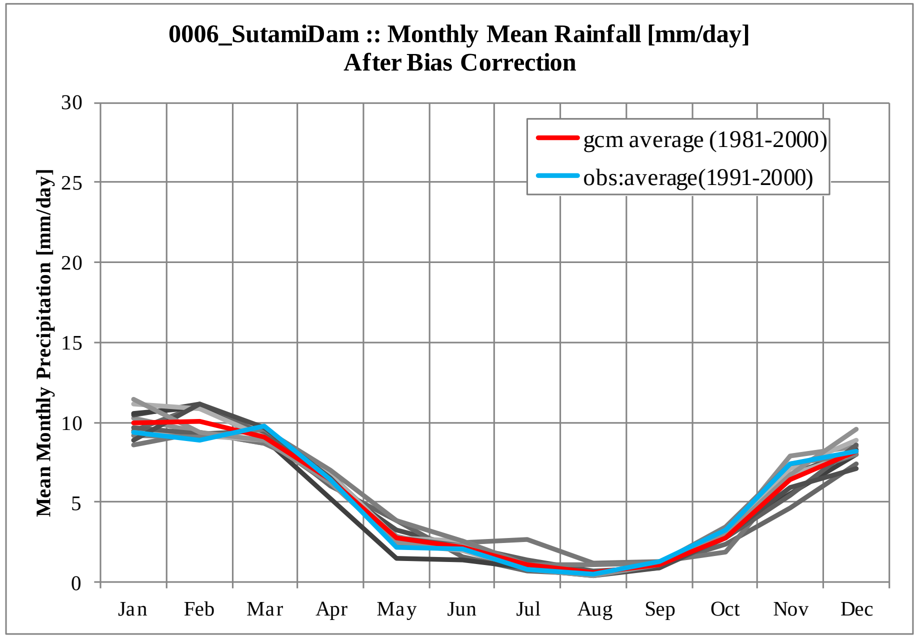
Daily rainfall data was suspiciously large

2. Climate change impact assessment: Bias correction for selected 11 GCMs

Validation check for seasonality

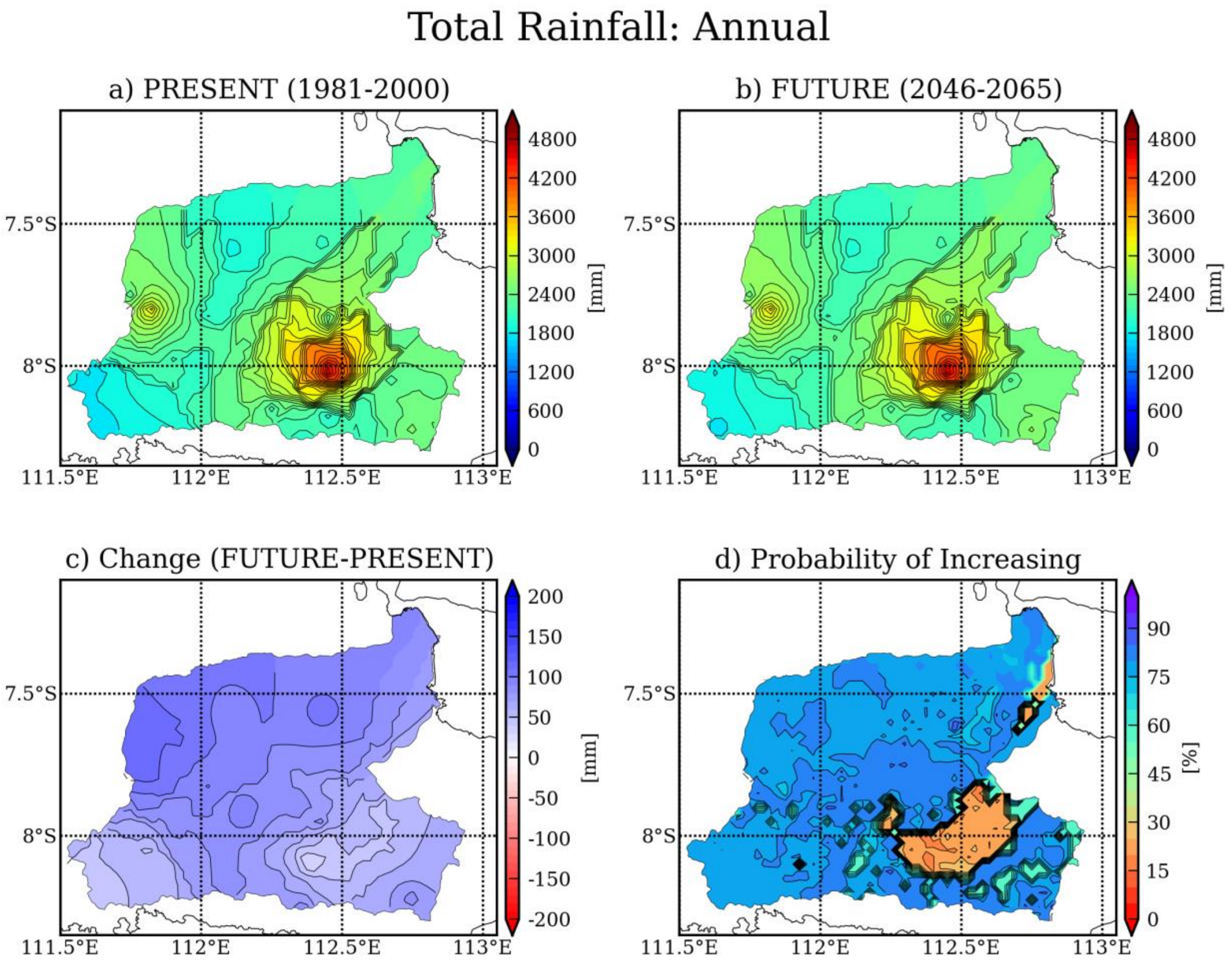


Raw mean monthly rainfall of GCMs



Bias corrected mean monthly rainfall

3. Climate change impact assessment: projection of changes in Annual Rainfall

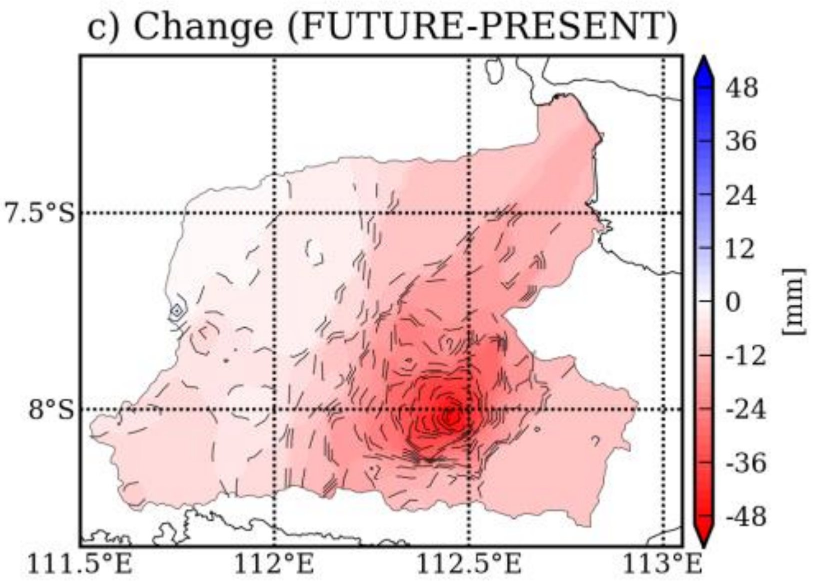


Annual rainfall will be increase slightly in the whole area.

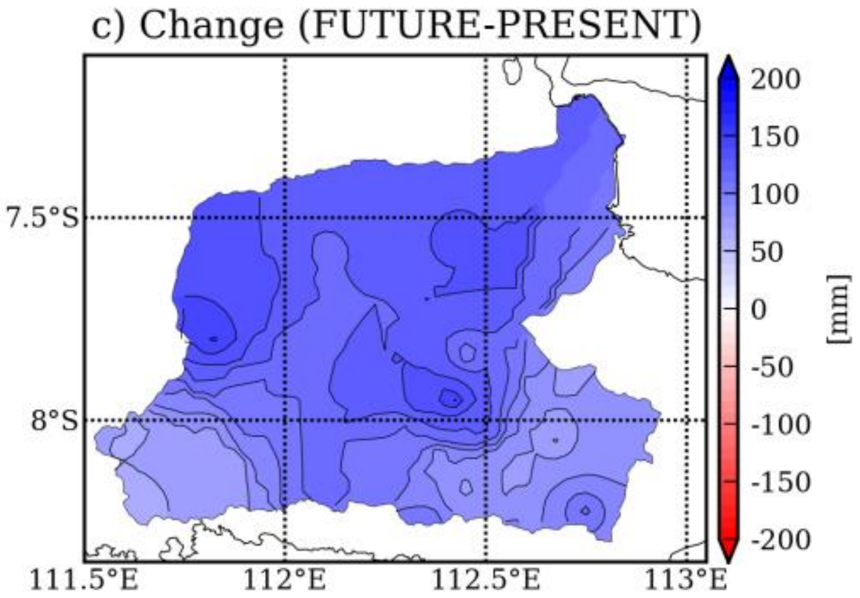
4. Climate change impact assessment: projection of changes in Seasonal Rainfall

Dry season will be drier, Wet season will be wetter

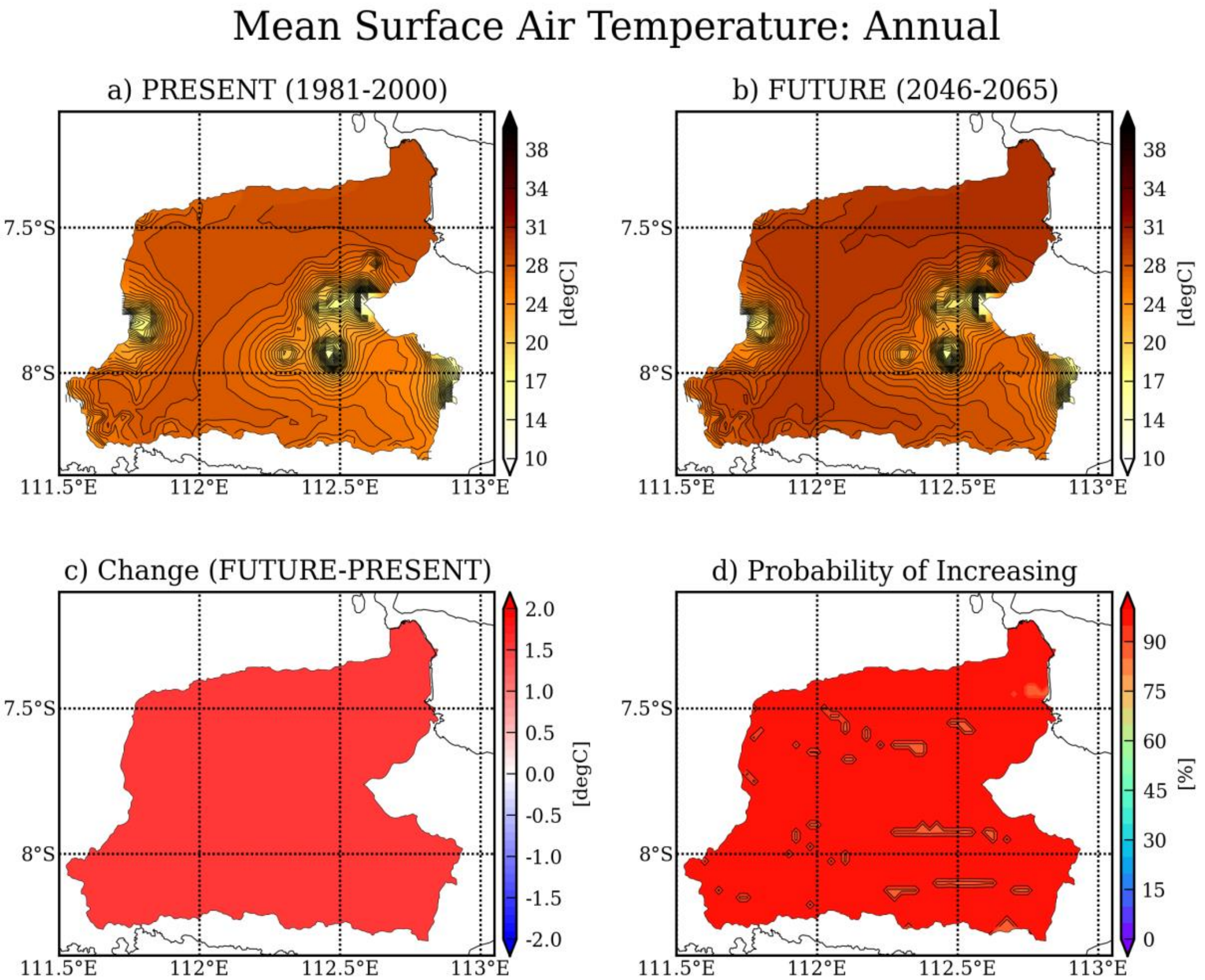
Dry Season



Wet Season



5. Climate change impact assessment: projection of changes in Surface Air Temperature



All GCMs predicts the air temperature will rise towards future.

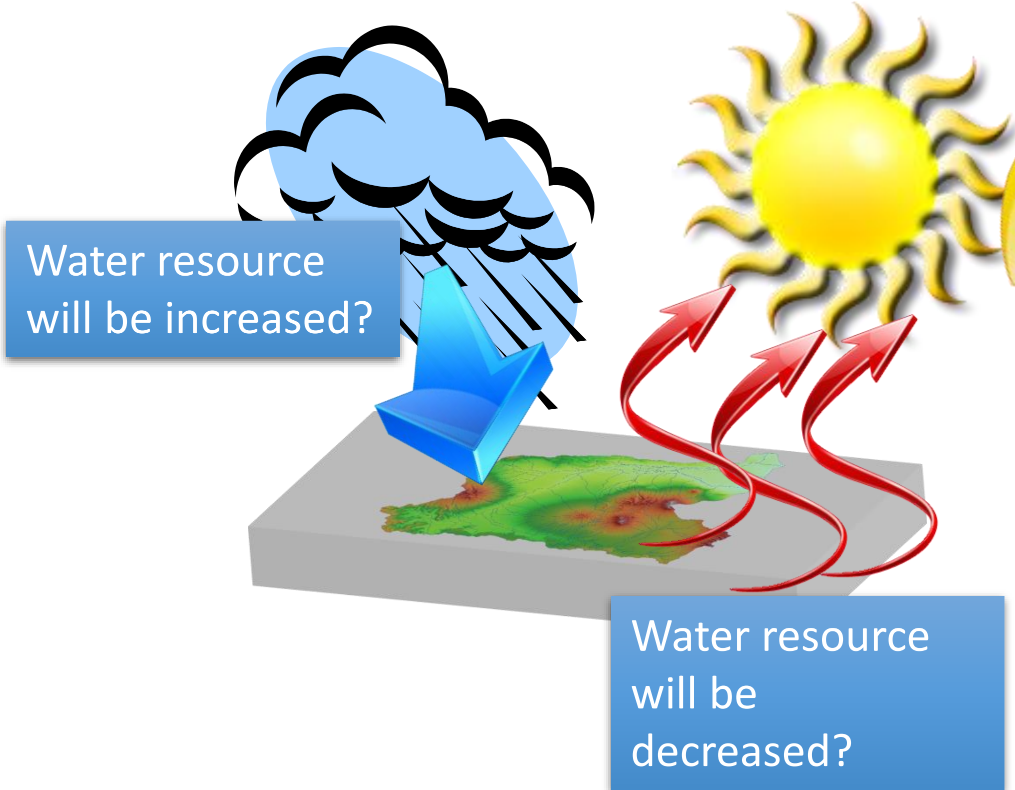
+1.5 °C

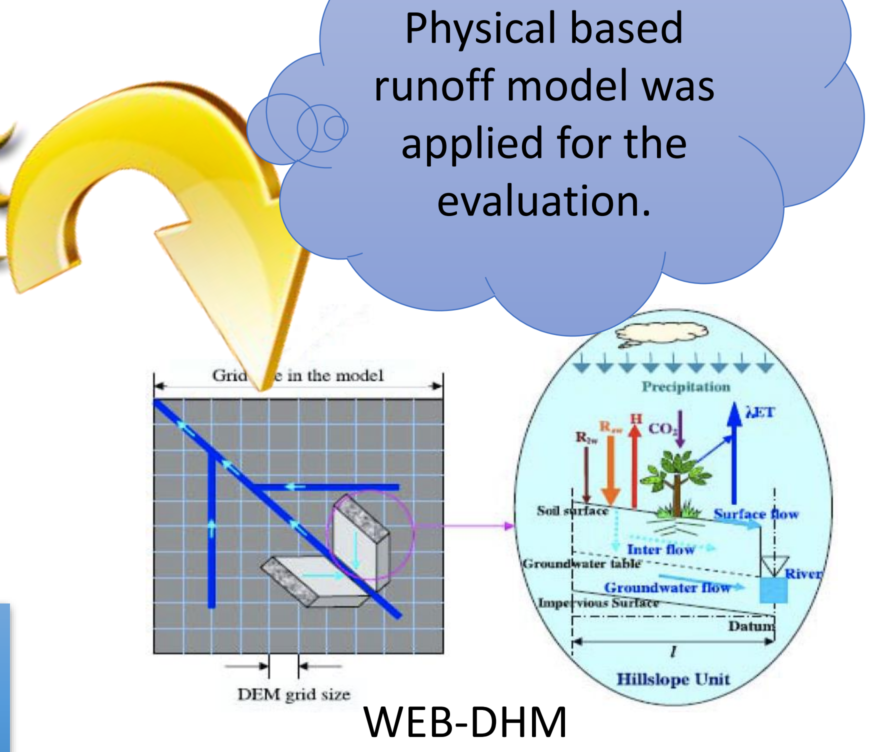
Evapotranspiration will be increase.

Negative impact on water resources

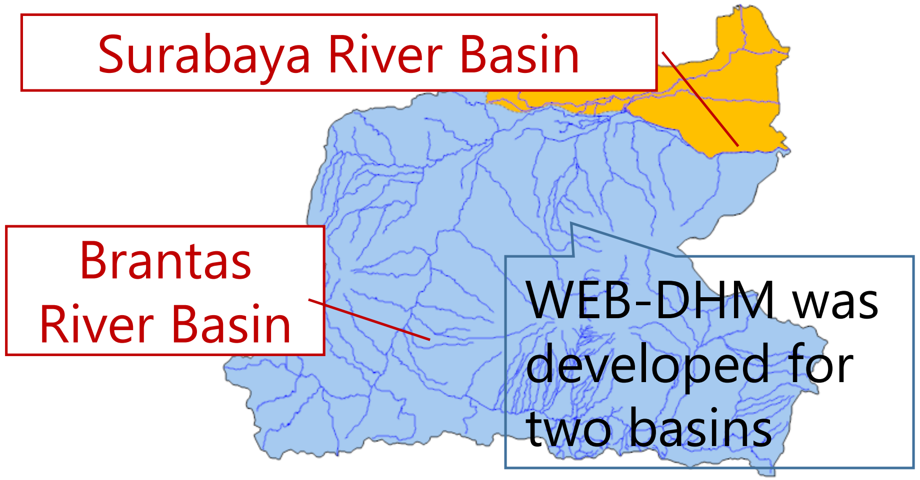
Summary of Part1: Projected Climate Change

- Surface Air Temperature will increase around1.5 degrees by 2050 with high confidence.
- Annual total rainfall will increase slightly, however, the trend is not consistent among GCMs.
- Extreme rainfall intensity will increase.

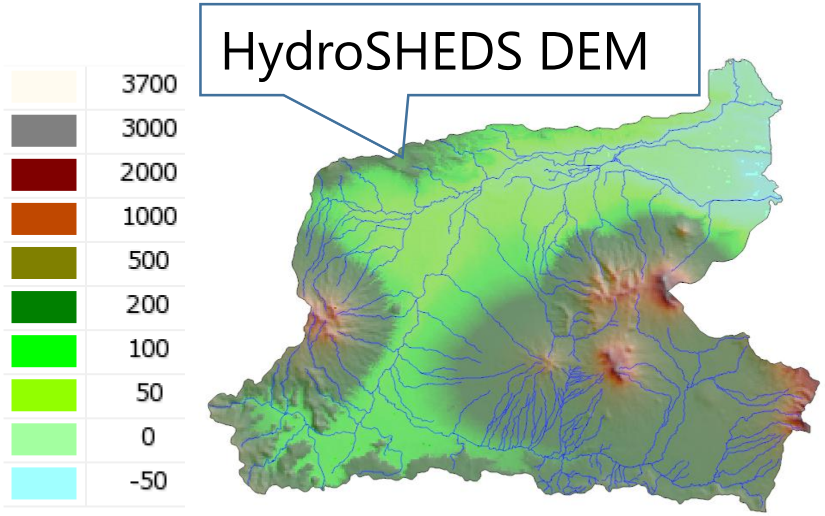




Development of WEB-DHM

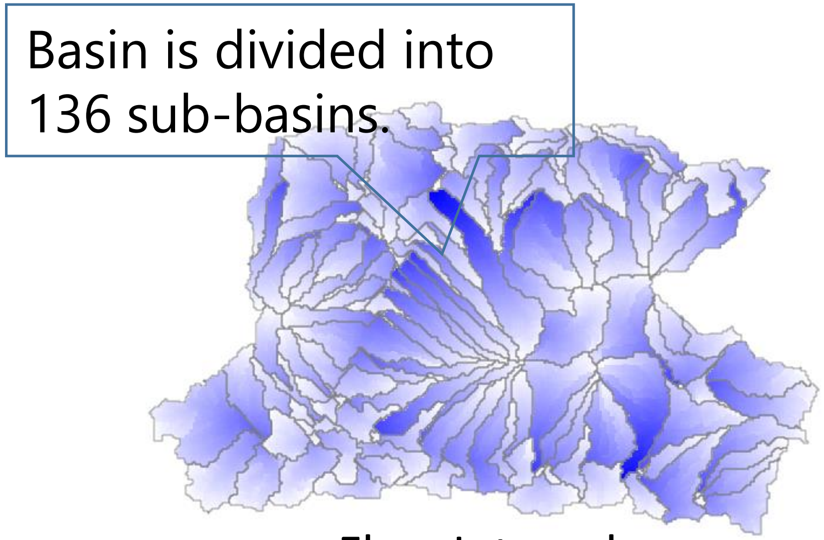


Modeled Area

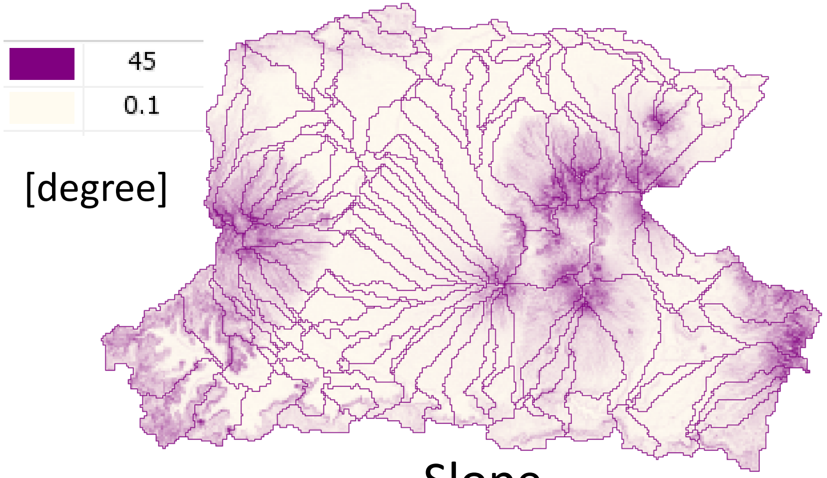


[m]

Elevation

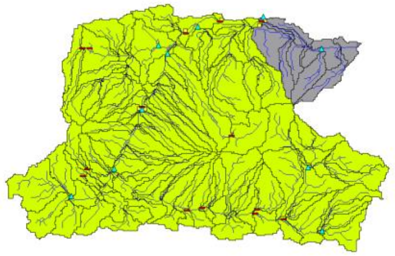


Flow Interval

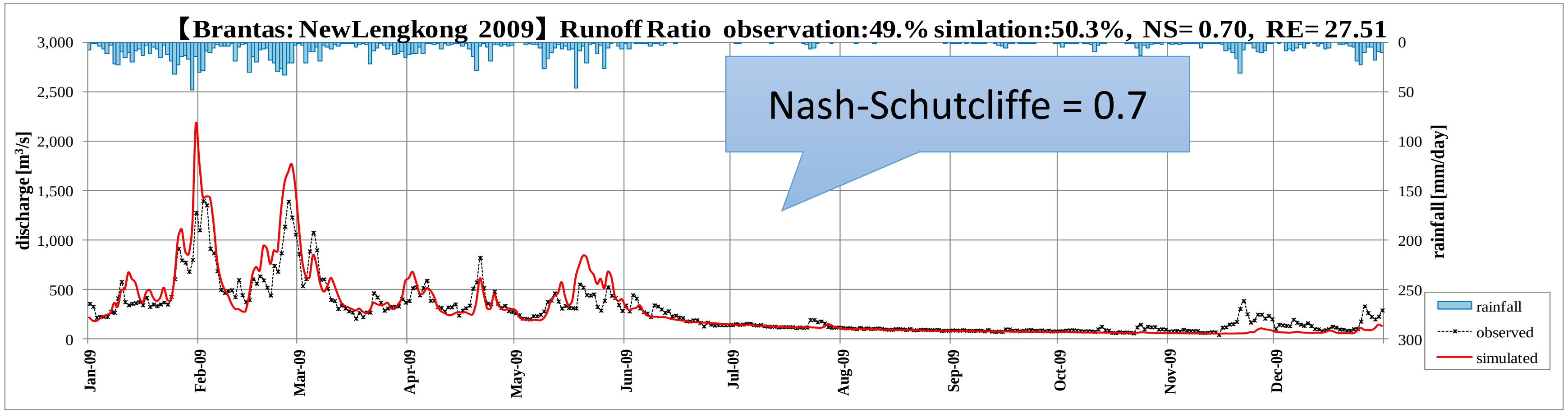


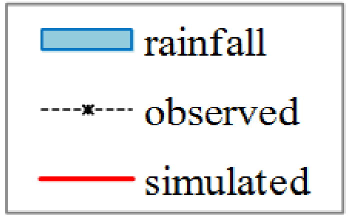
Slope

Validation at New Lengkong

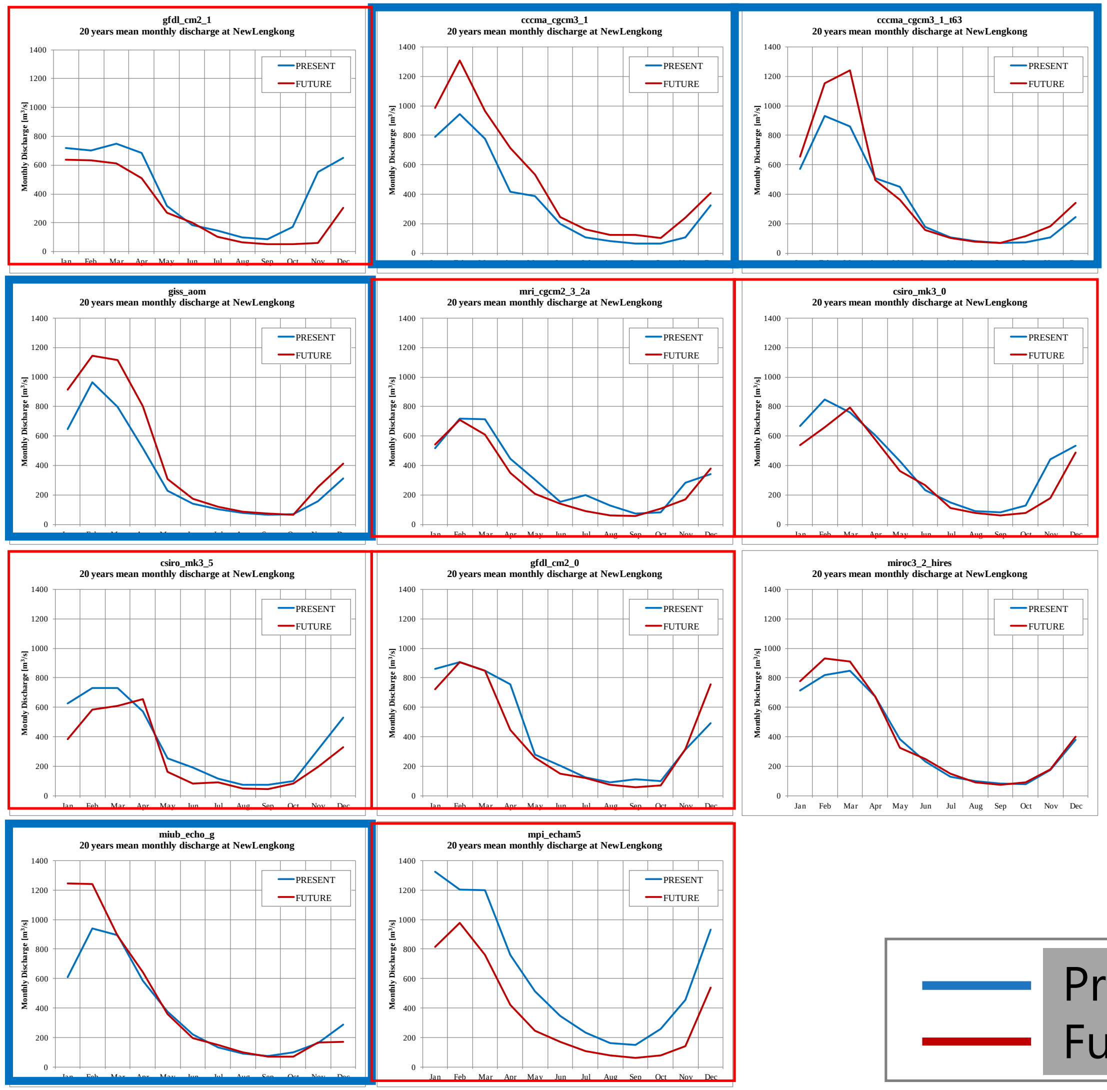


Comparison of the simulated discharge and observed Natural flow at New Lengkong for 2009.





Changes in Average Monthly River Flows

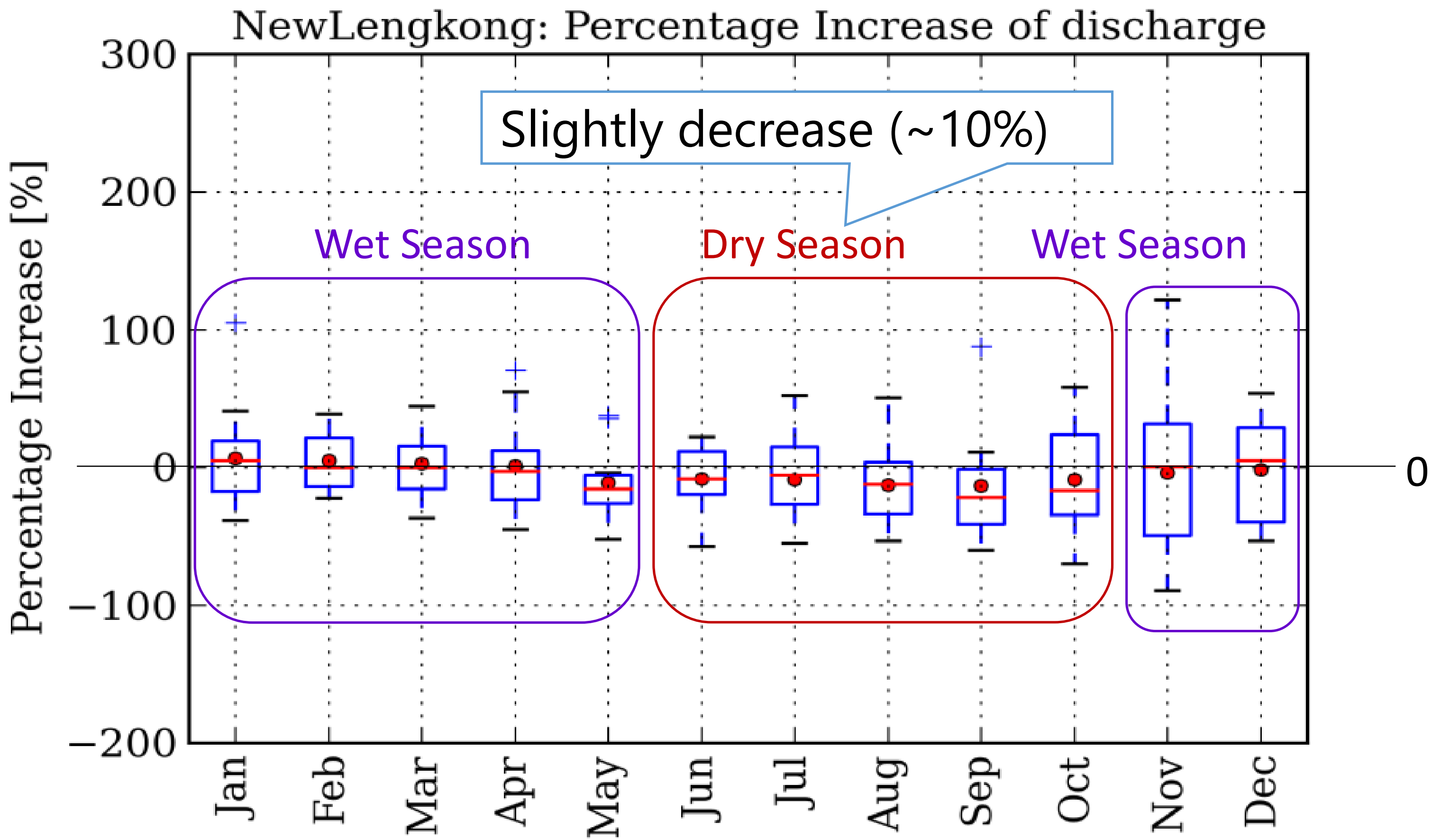


- 6/11 models showed increasing trend
- 4/11 models showed decreasing trend
- 1/11 model showed little change

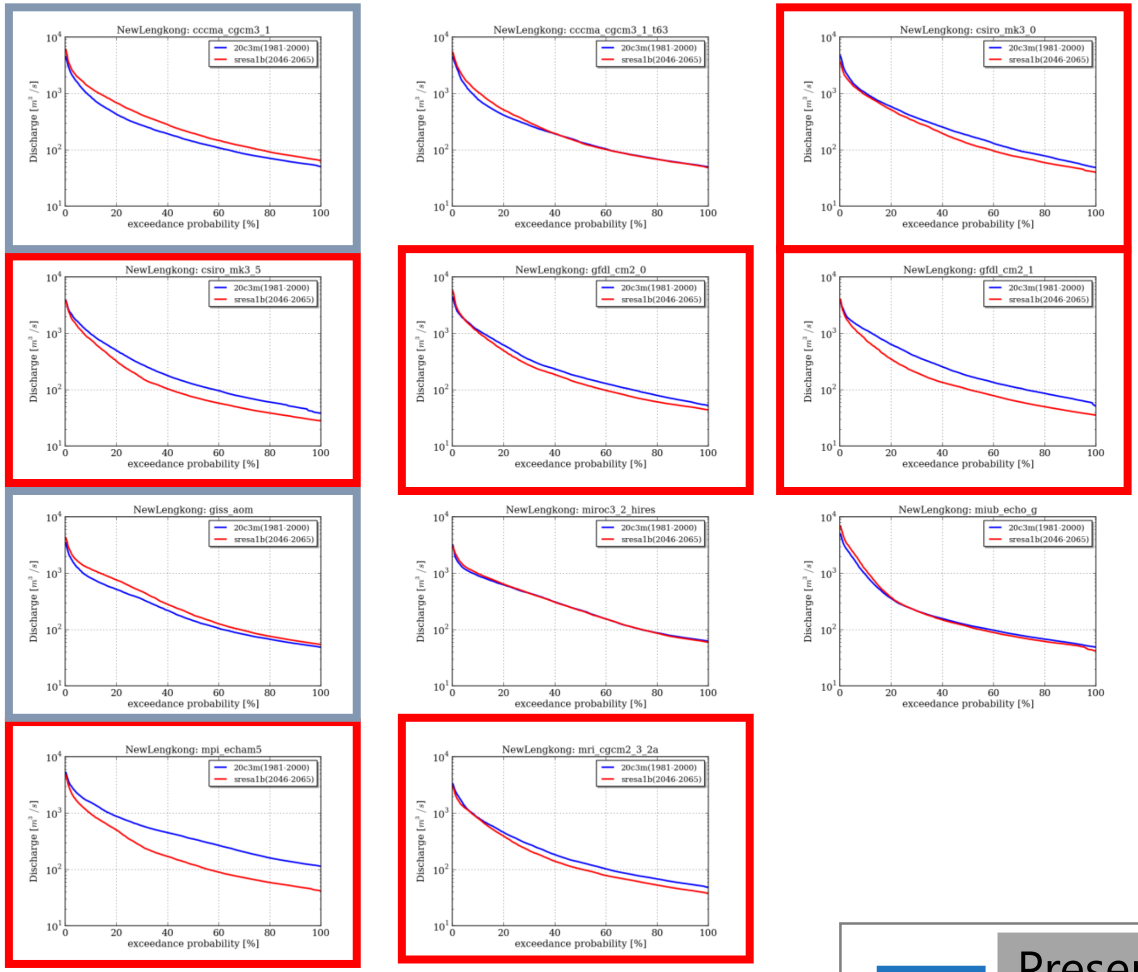
Present
Future

Percentage Increase of Monthly Flows

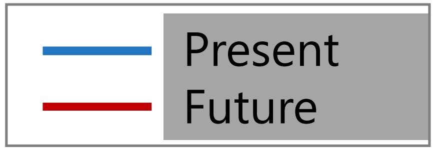
Percentage Increase [%] =
100 * (QFuture – QPresent) / QPresent



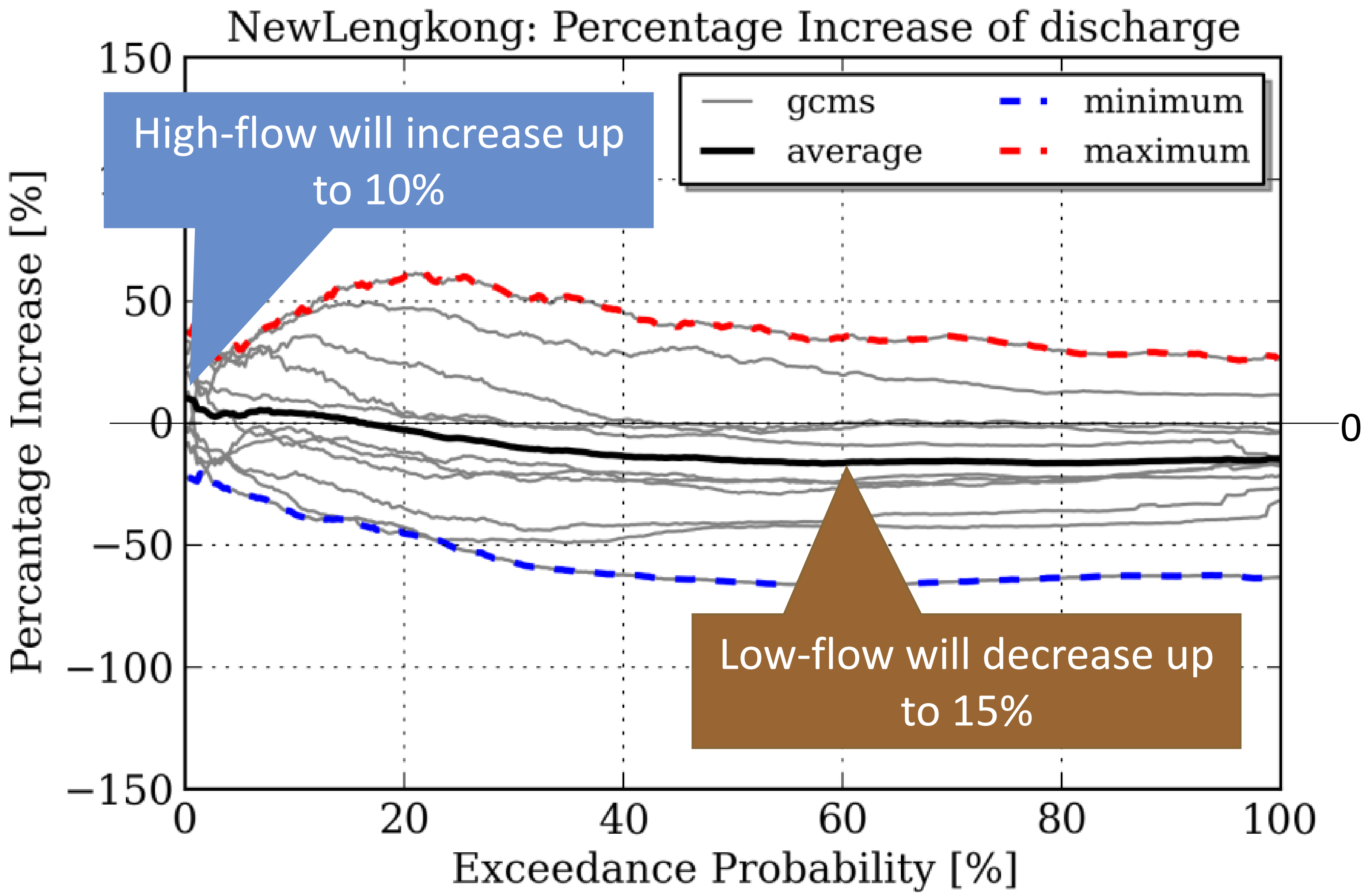
Changes in Flow Duration Curve



- 2/11 models showed increasing trend
- 6/11 models showed decreasing trend
- 3/11 model showed little change

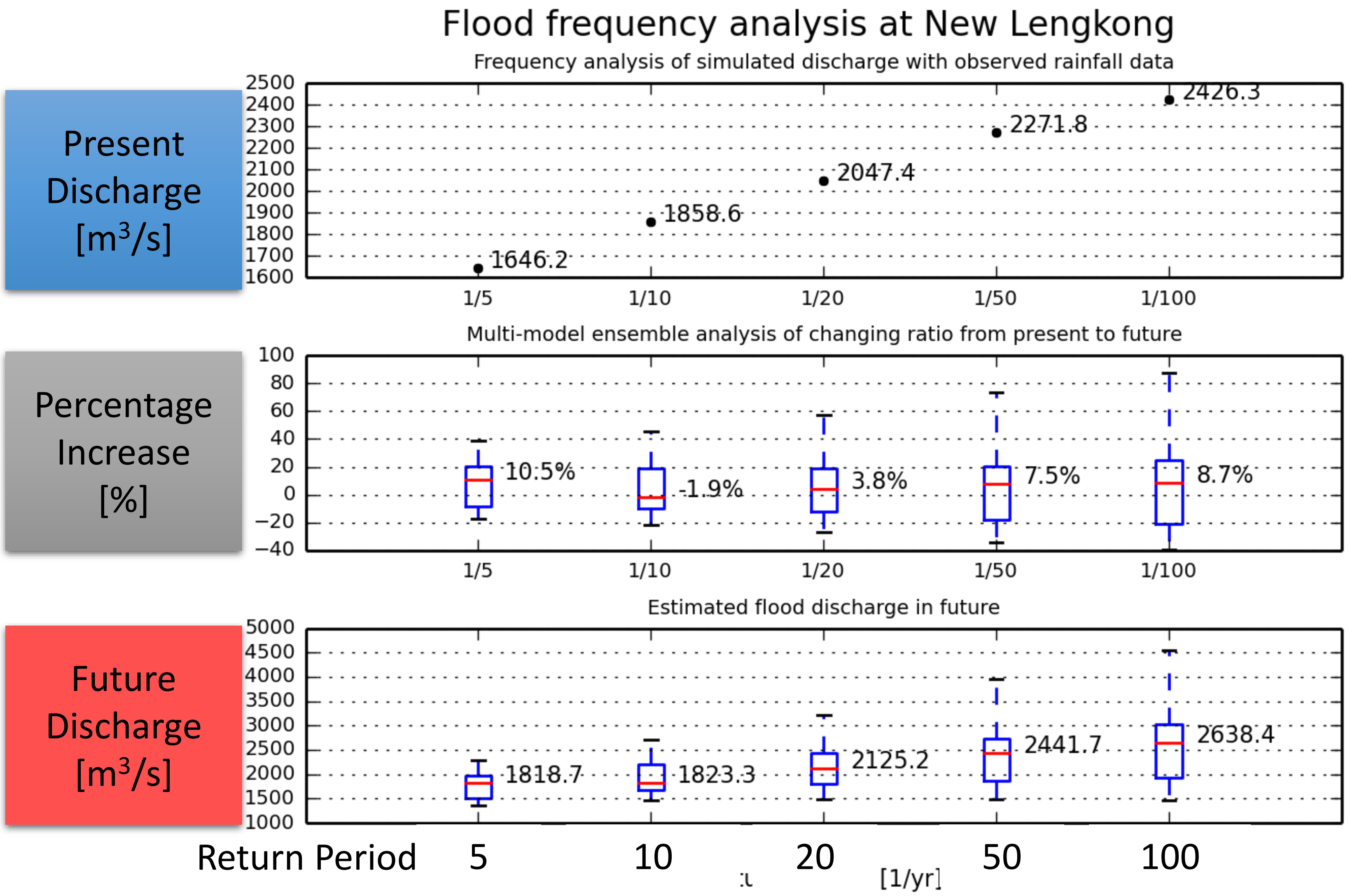


Percentage Increase of River Discharge at New Lengkong



Changes in Flood Discharge

Flood Discharge will increase about 10% or less

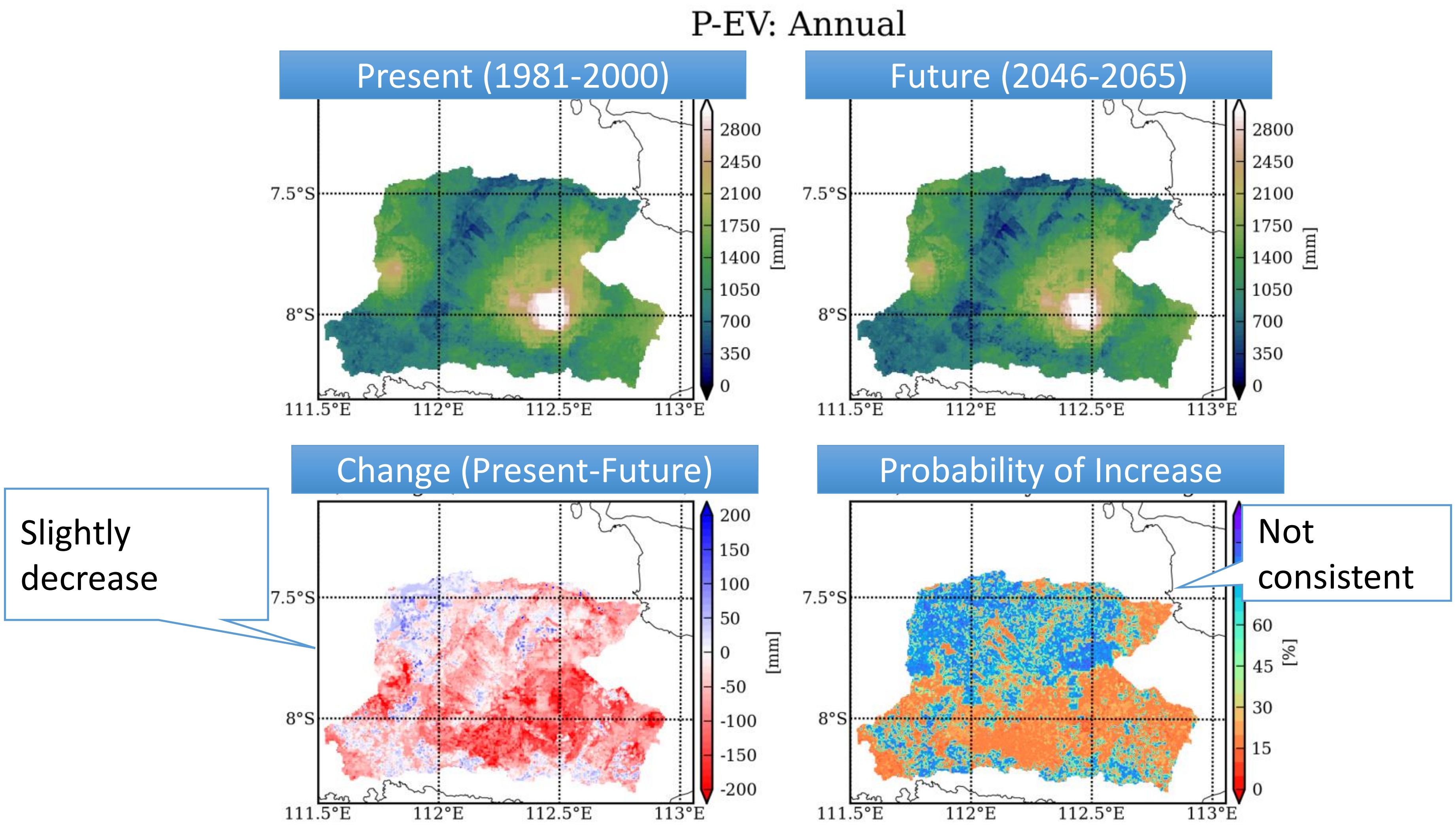


Changes in Drought Indexes

GCMs	Annual Drought Discharge [m^3/s] (average 355th rank)		# of days/year that baseflow < present drought discharge	
	Present	Future	Present	Future
gfdl_cm2_1	60.61	37.05	80	122
cccma_cgcm3_1	54.06	68.06	27	10
cccma_cgcm3_1_t63	52.48	51.70	37	37
giss_aom	51.09	57.05	25	3
mri_cgcm2_3_2a	51.25	39.91	41	73
csiro_mk3_0	51.64	42.20	49	71
csiro_mk3_5	41.21	29.17	49	102
gfdl_cm2_0	55.49	46.29	41	74
miroc3_2_hires	65.28	62.97	28	29
miub_echo_g	51.20	44.96	37	42
mpi_echam5	119.67	44.07	42	190

Red = drier in the future, Blue = wetter in the future

Changes in Annual P-E
(Precipitation – Evapotranspiration)



Summary of Part2
Projected Change on Water Resources

- Wet season discharge will not change significantly, while the dry season discharge will slightly decrease, however, the trend is not consistent among the GCMs.
- More than half of climate models predict severe drought/flood conditions in the future climate.
- Annual mean P-E will slightly decrease, however, the trend is not consistent among the GCMs.

Recommendation

- The water resources master plan should be flexible.
- Better to include several options considering the uncertainty range of the projections. The preparation of multi-scenario plan is recommended.
- Planner should consider the possible uncertainties of projected future conditions.
- Continuous monitoring of the rainfall and river flow is recommended.
- Plan should be re-evaluated after several years considering the progress of the science as well as future trend.

Mainstreaming Disaster Risk Reduction into Development

“The prevention of new risk and the reduction of existing risk through the implementation of integrated and inclusive measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthens resilience.” (SFDRR)

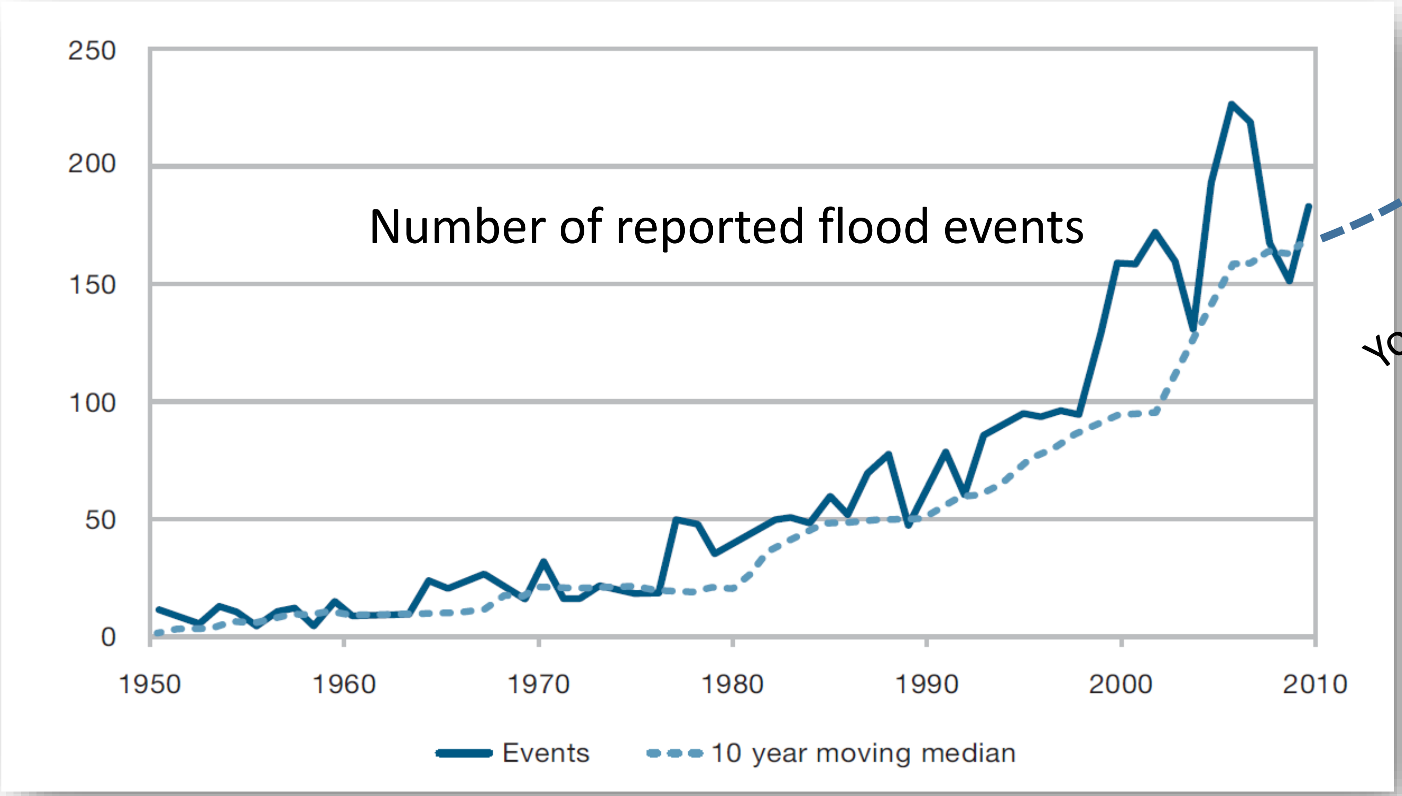
New risk: intensifying hazard by Climate Change, …

Existing risk: exposed population and assets, vulnerable urban state, …

Integrated and inclusive measures: the concept of Disaster Risk Reduction must be integrated with the concept of Sustainable Development so that all the development initiatives could be sustainably effective to make our society wealthy without being disrupted by any disaster intervention. The measures hence must be efficient to prevent and mitigate the hazard exposure and vulnerability, and be well prepared to effectively response and recovery from damages.

Mainstreaming DRR: is a systematic approach where we can scientifically assess the existing and newly arising risks and can quantitatively prospect future damages and impacts we will have, and then can strategically organize the resilient structure of society and economy that invest in sustainable development.

We can evaluate a record of disasters.
Can you prospect what will happen in your river basin?

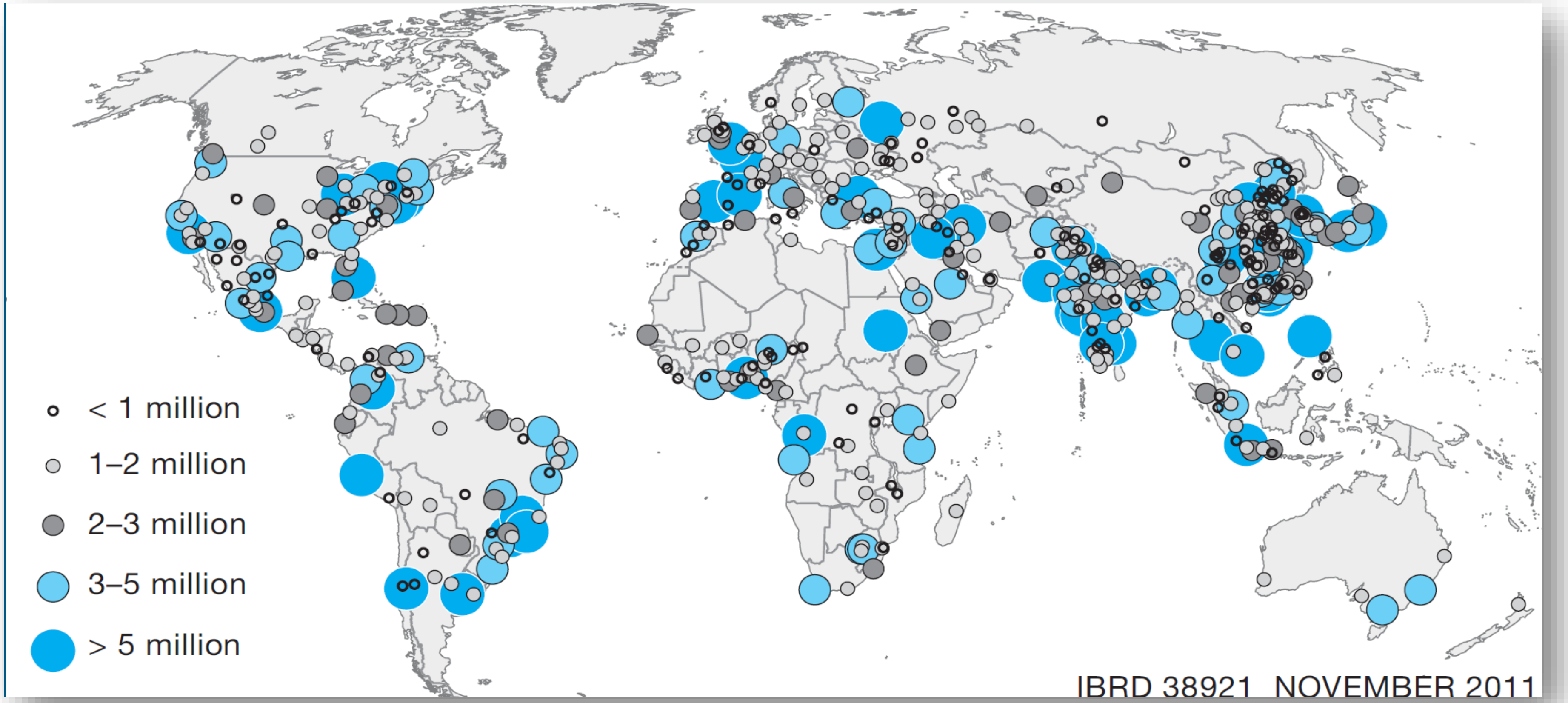


Source: based on EM-DAT/CRED

You need to assess the risk of your own locality, not only from the past trend but also considering the effects of human intervention (urbanization) and climate change.

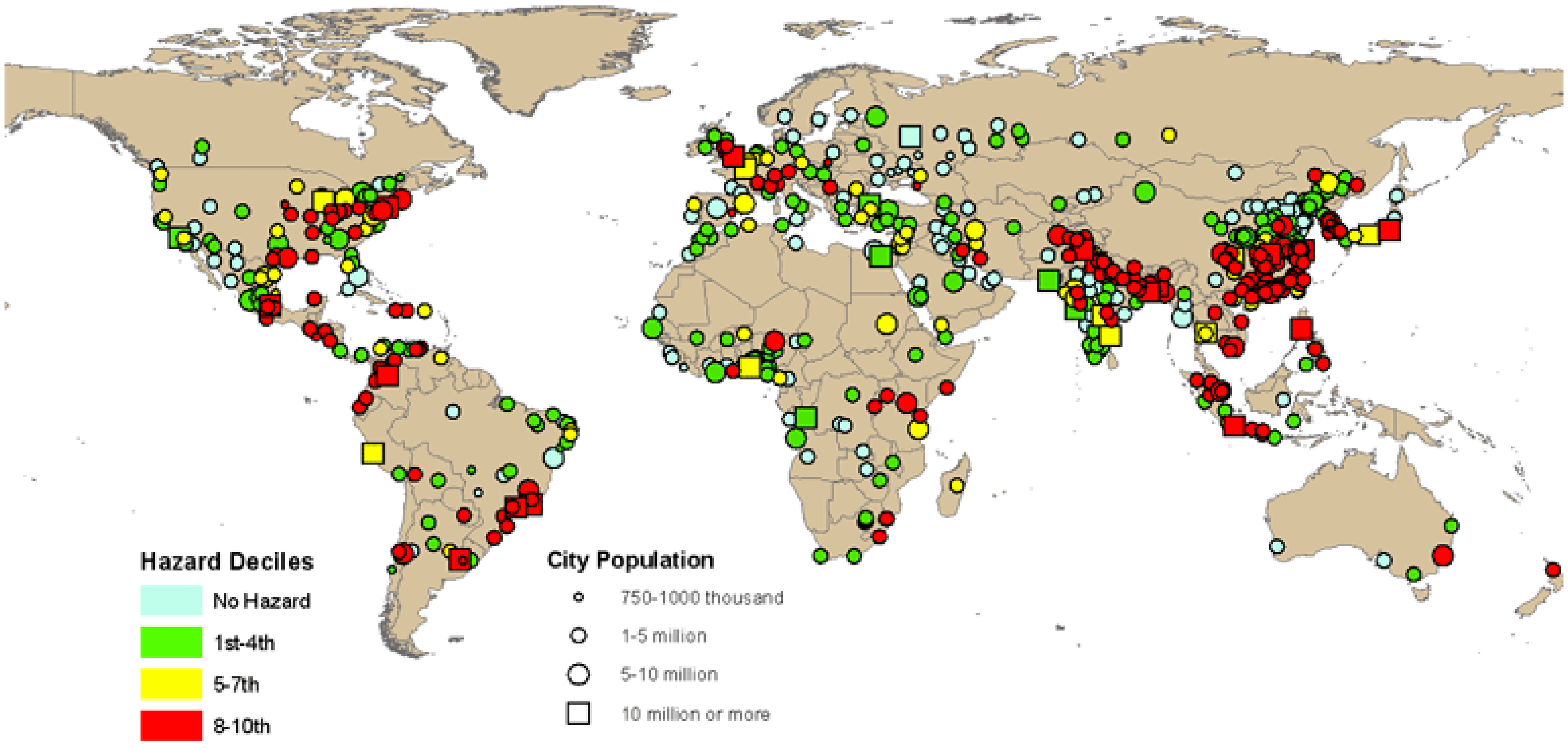
Urban agglomerations with more than 750,000 inhabitants, 2010.

One of the emerging and increasing risks we are facing with is the urban disaster.
From 1900 to 2005, urban areas have grown to accommodate 13% more people.
By 2030, this number is expected to rise to 60%. Ironically, urbanization itself is accelerating the urban disaster risks.
You need to have appropriate method of risk and impact assessment at national and local levels.



Source: United Nations, Department of Economic and Social Affairs, Population Division; World Urbanization Prospects: The 2009 Revision; File 12: Population of Urban Agglomerations with 750,000 Inhabitants or More in 20 Urban agglomerations with more than 750,000 inhabitants, 2010.

Urban agglomerations by size and potential risk of flooding, 2025 prospect



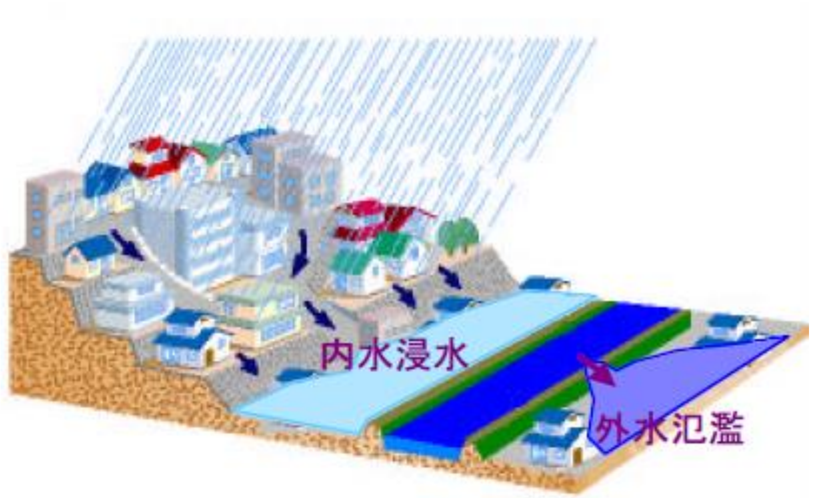
Source: World Urbanization Prospects, the 2011 Revision

Quantitative assessment of future damages and impacts is the basis of optimized investment of DRR measures.

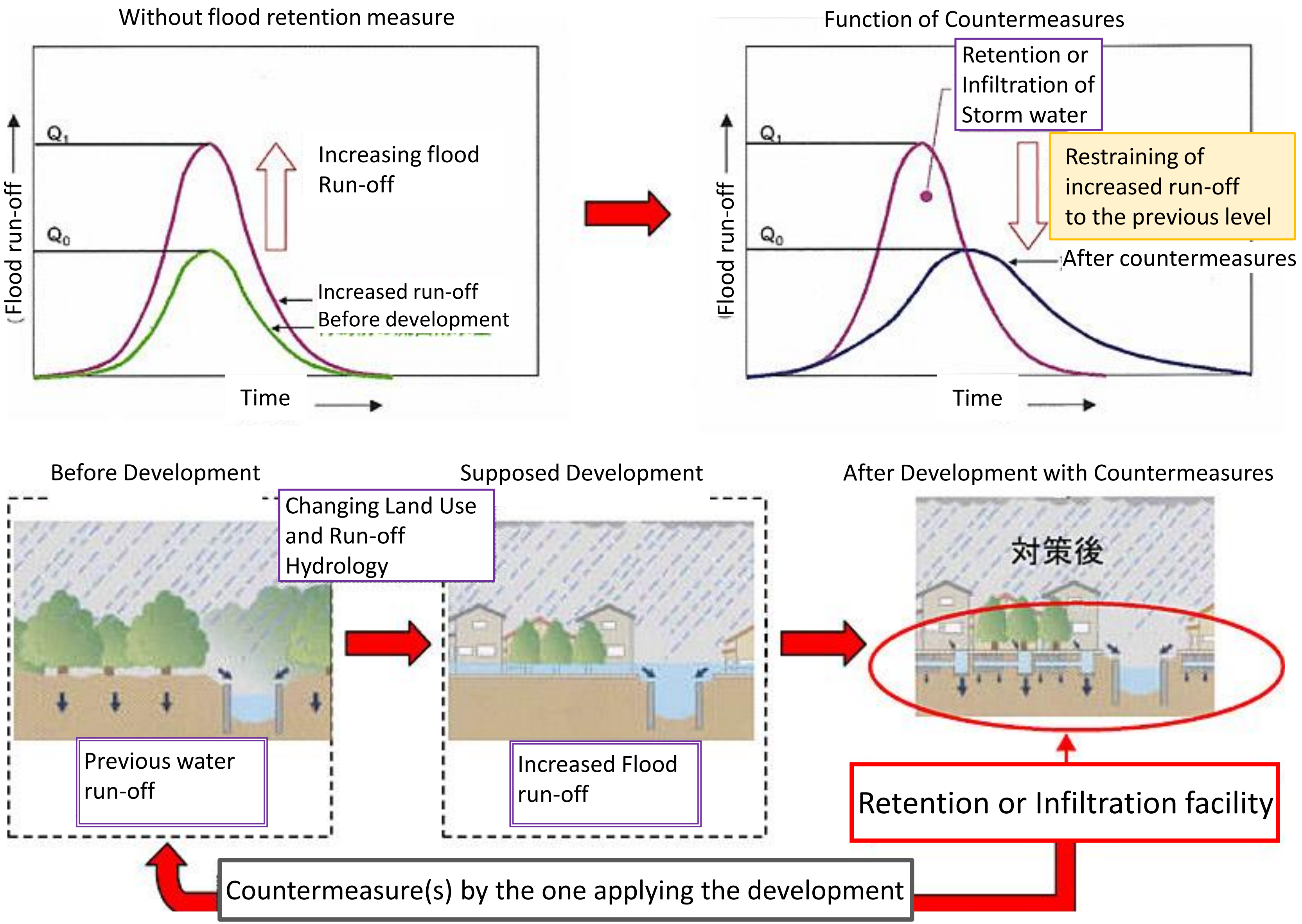
Can you estimate direct and indirect damages?
Probabilities of disaster occurrences?
Average annual losses in future?
Otherwise, how you can convince development side decision makers to invest today in DRR?

June 13, 2008 in Cedar Rapids, Iowa   The impact of projected increases in urbanization on ecosystem services. Source: Proceedings of the Royal Society B: Biological Sciences, online advance publication. Eigenbrod, F., Bell, V.A., Davies, H.N., Heinemeyer, A., Armsworth, P.R., and Gaston, K.J. 2011.

Sustainable development should be incorporated with the controlled watershed development, including planned measures to restore the impeded storm water infiltration to the ground and accelerated surface flow that may cause flashy and heavy flooding



Increasing inundation disaster
in urban river basins



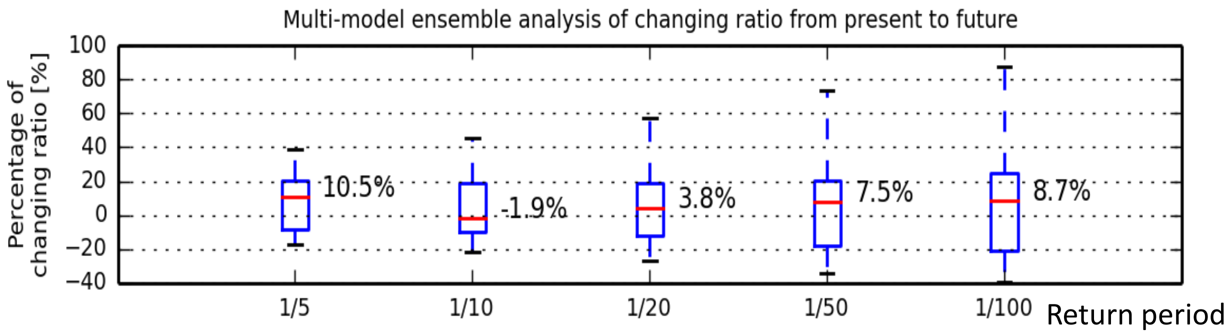
Each developer has to restrain the increased run-off to the level Before Development

- Monitoring of human intervention and climate change
- Probabilistic analysis of flood hazard
- Technical Standard to model the river system
- Obligated countermeasures to restrain the increased run-off
- Cost sharing and Administration system

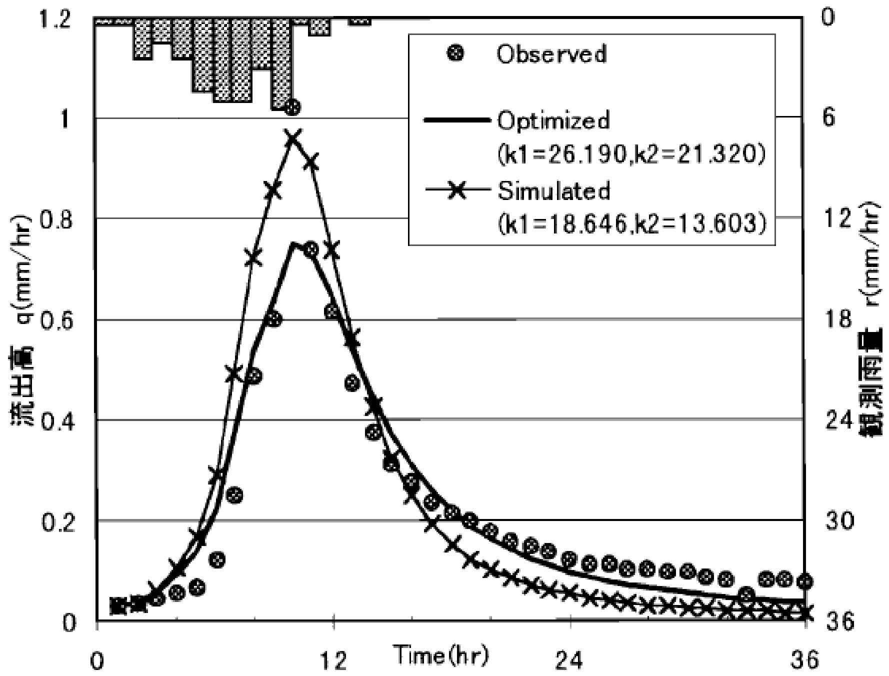
Good practice of urban flood risk management system in Tsurumi River, Kanagara, Japan

Which is the main cause of intensifying flood, Climate Change or Development?

Research shows that uncontrolled development is much more affective to intensifying flood hazard compared to the increase of heavy rainfalls by climate change and its impact on flood discharge.



Percentage increase of estimated flood discharge in future, by Multi-Model ensemble analysisof changing ratio from present (2009) to future (2050), New Lengkong monitoring station, Brantas River, Indonesia
"Flood Discharge will increase about <u>10% or less" in about 40 years</u>
Source: Prof. Koike, Tokyo University



Flood Peak Discharge Increase:
Run-off Parameters are optimized in 1975 and in 1996. Urbanization effect is simulated under the same metrological condition (increased peak discharge by <u>20% in about 20 years</u>)
Source: Kitahiroshima urban research, Hitoshi Baba,

Mainstreaming Approaches of DRR under various uncertainties including climate change and urbanization

Deterministic approach

Option A) Supplemental measures for extremes over the planned security level

Supplemental measures will be provided for the extreme flood or extreme drought which exceeds the originally planned rainfall or discharge based on past hydro-meteorological data. Water system shall basically be managed without changing the original plans but with consideration of future security level change due to climate change impacts.

Option B) Improving measures under periodical revision of planned security level

The planned rainfall and discharge will be periodically revised by reviewing the previous ones taking into account the observed and projected variation due to climate change impacts.

Multiple-scenario approach

Option C) Combination of measures for multiple security levels based on variation or uncertainty in climate change

Multiple safety levels of flood or drought, considering variation and uncertainty in climate change analysis, will be set up for potential options of scenarios for measures to be selected. The required measures are composed by a combination of various structural and non-structural measures. Optimization of those measures will be made taking into consideration of damage reduction benefit, cost, social and environmental impacts, etc.

EPILOGUE TO THE SEMINAR

CLIMATE CHANGE IS NOT THE DOMINANT CAUSE OF INCREASE OF FLOOD AND STORM DISASTERS. INSTEAD, THE URBANIZATION, POPULATION CONCENTRATION AND CONSEQUENT WATERSHED DEVELOPMENT IS THE CULPRIT WHO SHIFT THE REGIME OF THE WATER SYSTEM RATHER RAPIDLY THAN CHANGING CLIMATE.

HENCE WHAT WE NEED TO ESTABLISH IS THE RISK MINDED CONTROL SYSTEM OF SOCIETAL DEVELOPMENT INCLUDING ROBUST INFRASTRUCTURE AND RESILIENT SOCIO-ECONOMY TO DISASTERS.

CLIMATE CHANGE DOESN'T EXCUSE YOUR LATE CORRESPONDING TO INCREASING DISASTER DAMAGES. DON'T BLAME CLIMATE CHANGE FOR THE SUFFERINGS.

AS FAR AS WE DO APPROPRIATELY MAINSTREAM DISASTER RISK REDUCTION INTO ALL THE DEVELOPMENT INTERVENTIONS IN OUR SOCIETY, WE DON'T NEED TO WORRY ABUT CHANGING CLIMATE. RESILIENT PUBLIC INFRASTRUCTURE TO DISASTER CAN BE HEALTHY ENOUGH ALSO TO ANY UNCERTAIN CLIMATE AND ENVIRONMENT.

HITOSHI BABA

Thank you

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Senior Advisor, Japan International Cooperation Agency
email: Baba.Hitoshi@jica.go.jp