Conceptual advances in Risks and hydro-meteorological hazards analysis applied to environmental planning : pilot case flood in Japan

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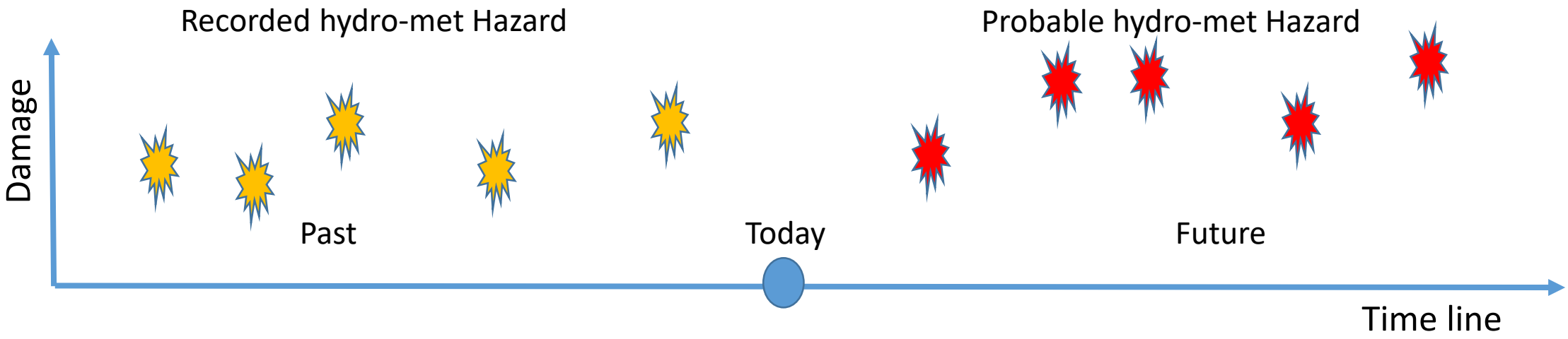
Which are you going to analyze, the Past or the Future?

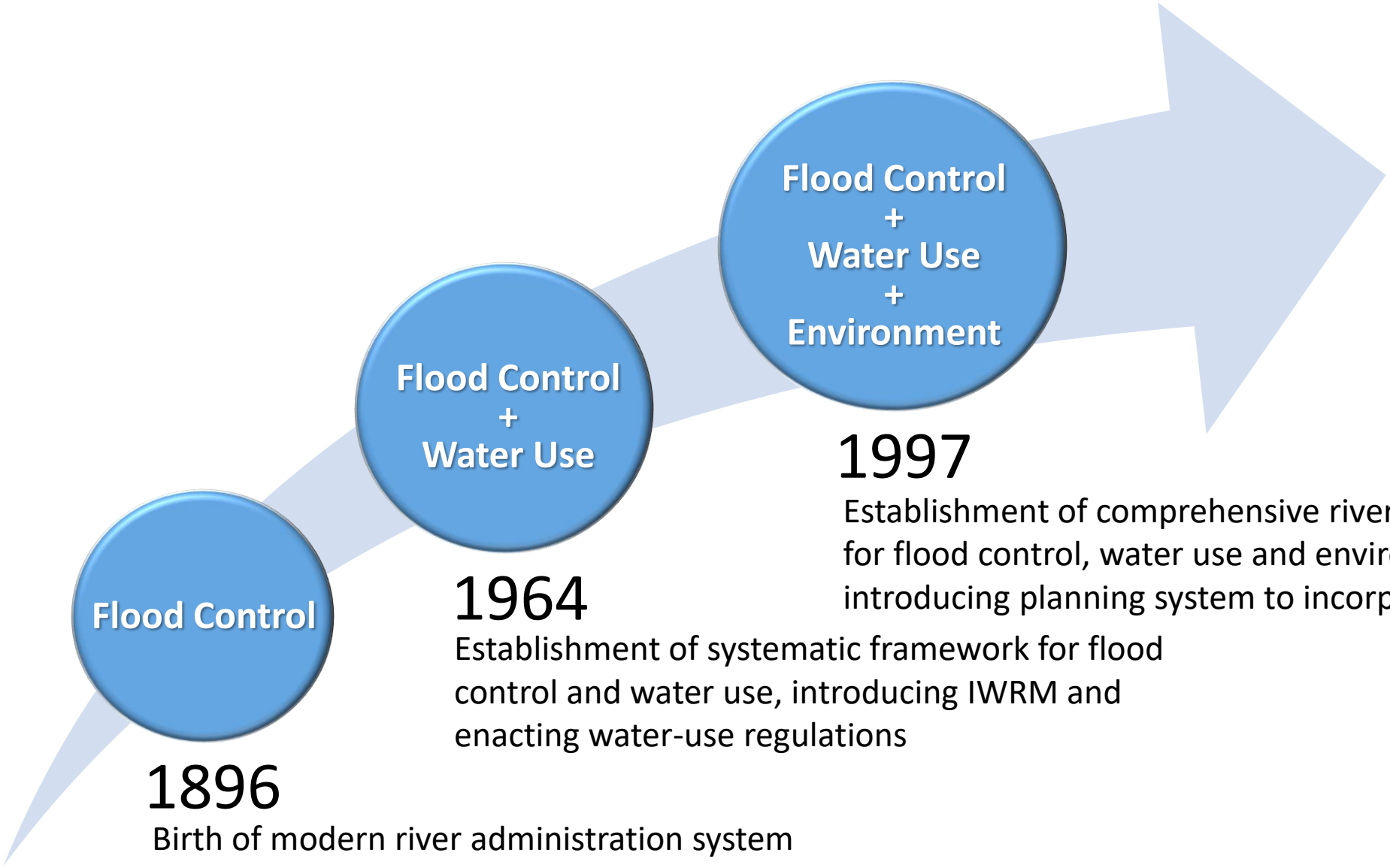
- Understanding “Risk” is the first step in environmental planning
- We need to analyze “Risk” which is defined as “The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society **<u>over some specified future time period</u>**.” (UNISDR)



Flood Risk Assessment, process in Japan

1. Definition of the River Law and relating guidelines
2. Processes of planning of flood risk management
   1) Scoping of flood probable areas to assess,
   2) setting of some scenarios of flood occurrence,
   3) flood hazard assessment through hydrological and hydraulic calculations,
   4) vulnerability assessment of the affected area, and
   5) comprehensive flood risk and impact assessment.
3. Typical case study in Yodo River Basin for example

The River Law of Japan, origin and amendments



1896
Birth of modern river administration system

1964
Establishment of systematic framework for flood control and water use, introducing IWRM and enacting water-use regulations

1997
Establishment of comprehensive river administration system for flood control, water use and environmental conservation, introducing planning system to incorporate local opinions

The River Improvement Plan is devided into two parts by the River Law.

“Fundamental river management policy” includes basic policy, unregulated peak discharge, design flood discharge, etc.

“River Improvement Plan” consists of river improving projects, details of river maintenance, etc.

The planning system includes procedures for incorporating local opinions

La política fundamental de gestión de los ríos

1. Política básica sobre la protección y uso integral de los ríos

・prevenir la ocurrencia de daños debidos a inundaciones, mareas altas, etc.

・utilizar ríos correctamente y mantener las funciones normales de las aguas del río

・mantener y conservar el medio ambiente fluvial

2. Ítems que deberían ser las bases de la gestión de los ríos

・Nivel planificado de creciente y distribución de las infraestructuras de ajuste de inundación y del cauce

・Caudal planificado de creciente en puntos importantes

・Caudal necesario para mantener las funciones normales de las aguas del río en puntos importantes

・El ancho del cauce en puntos importantes que tinene que ver con el nivel planificado de creciente y la sección planificada transversal

Plan de ordenación de ríos

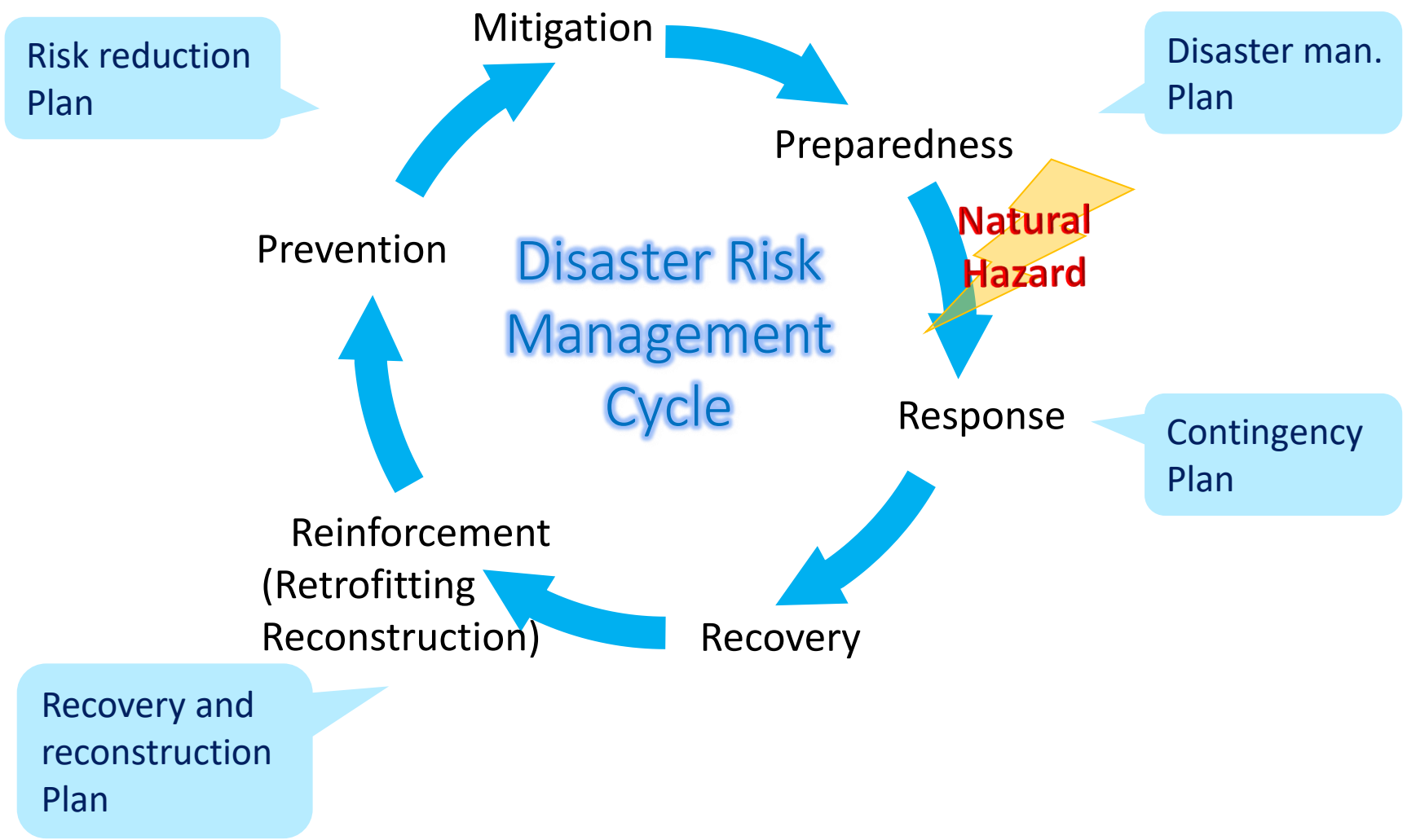
1. Objetivo de gestión de los ríos
2. Ítems relacionados a la implementación de la ordenación

・Objetivos, tipos y lugares de obras de los ríos

・Funciones de la infraestructura de administración de los ríos creada en la obra

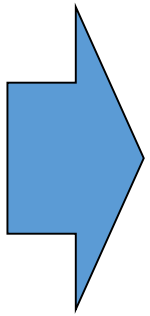
・Objetivos, tipos y lugares del mantenimiento de los ríos

Planned management of disaster risks



Damage potential and impact assessment

Magnitude of hazard	Damage potential and impact
Extreme (rare prob.)	Severe damage, need comprehensive works
Large (low prob.)	Heavy damage, must be controlled
Medium (mid prob.)	Damage on livelihood, no casualty
Small (high prob.)	Little damage, avoidable



Coping Strategy to make Adaptive Planning	Main selection
More emphasis on response side	Early Warning Evacuation
Combination of designed prevention and response	Mitigation Reconstruction
Preventive strategy with some response measures	Prevention Mitigation
Prevention by structure on site	Structural prevention

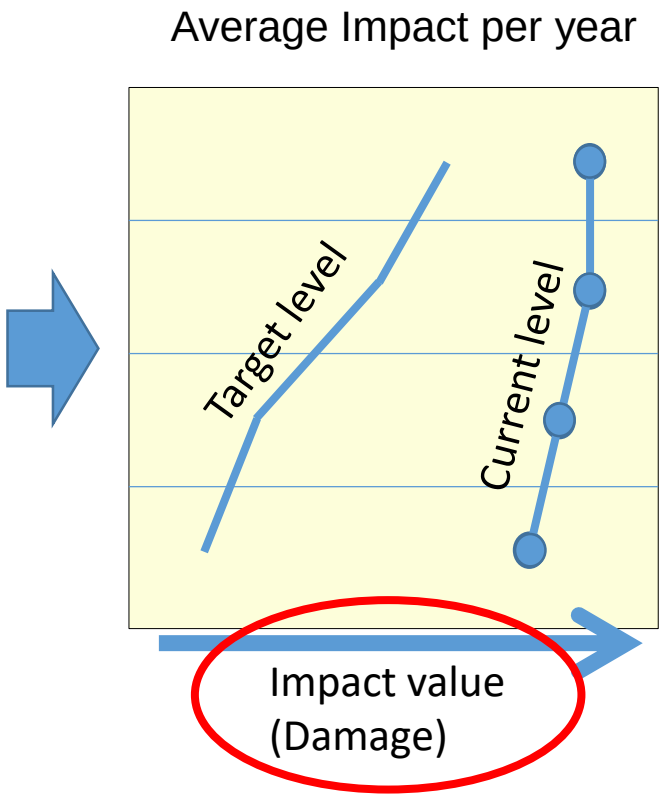
Impact assessment based on wide range of hazard projections

adaptive planning under multiple scenarios in local conditions

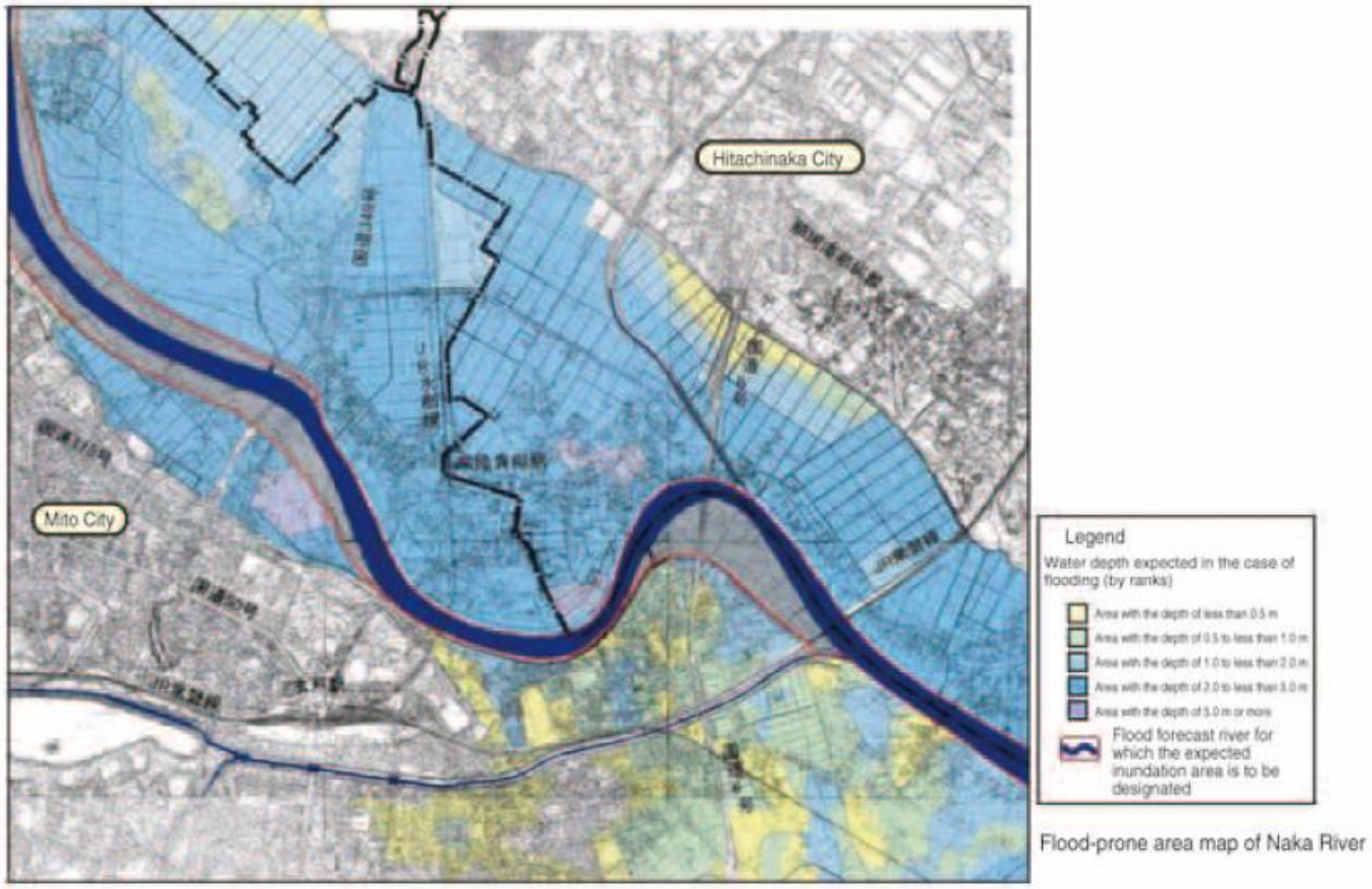
Damage potential and impact assessment

Magnitude of hazard	Damage potential and impact	Probability per year
Extreme	Severe damage, need comprehensive works	× 0.1%
Large	Heavy damage, must be controlled	× 1%
Medium	Damage on livelihood, no casualty	× 10%
Small	Little damage, avoidable	× 100%

Impact assessment based on wide range of hazard projections

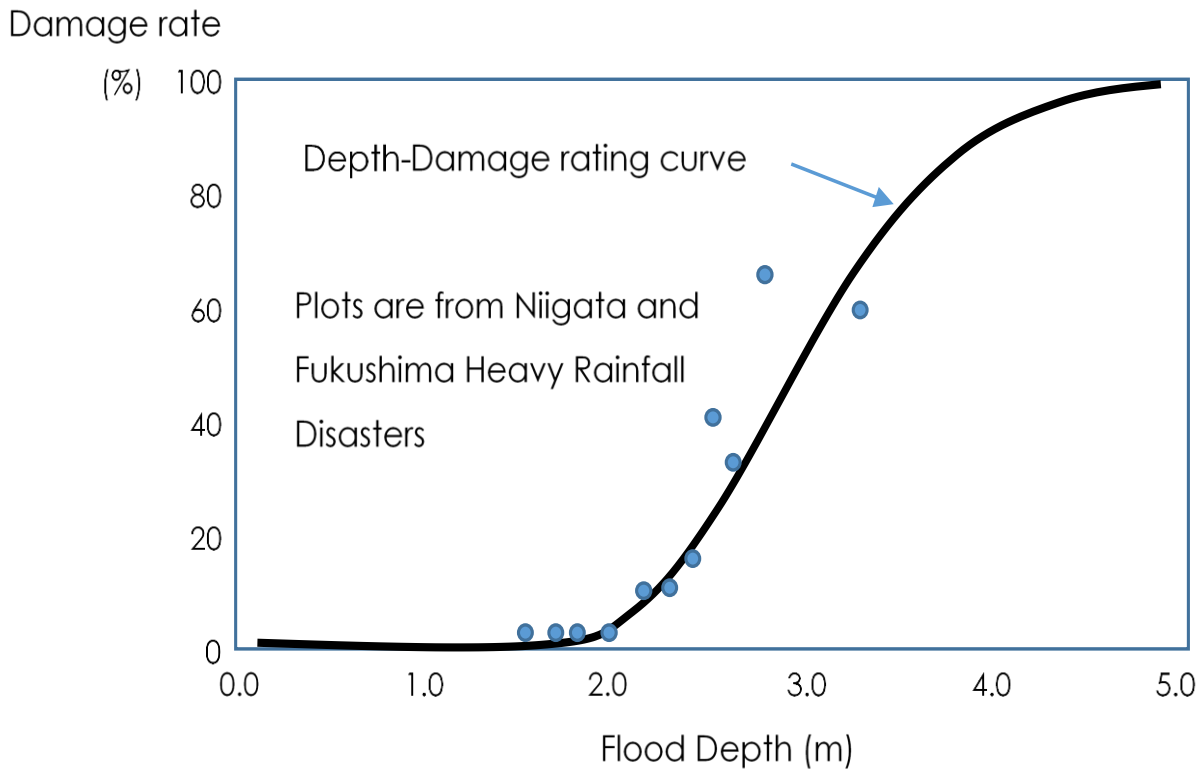


Example of simulated Flood-Depth map

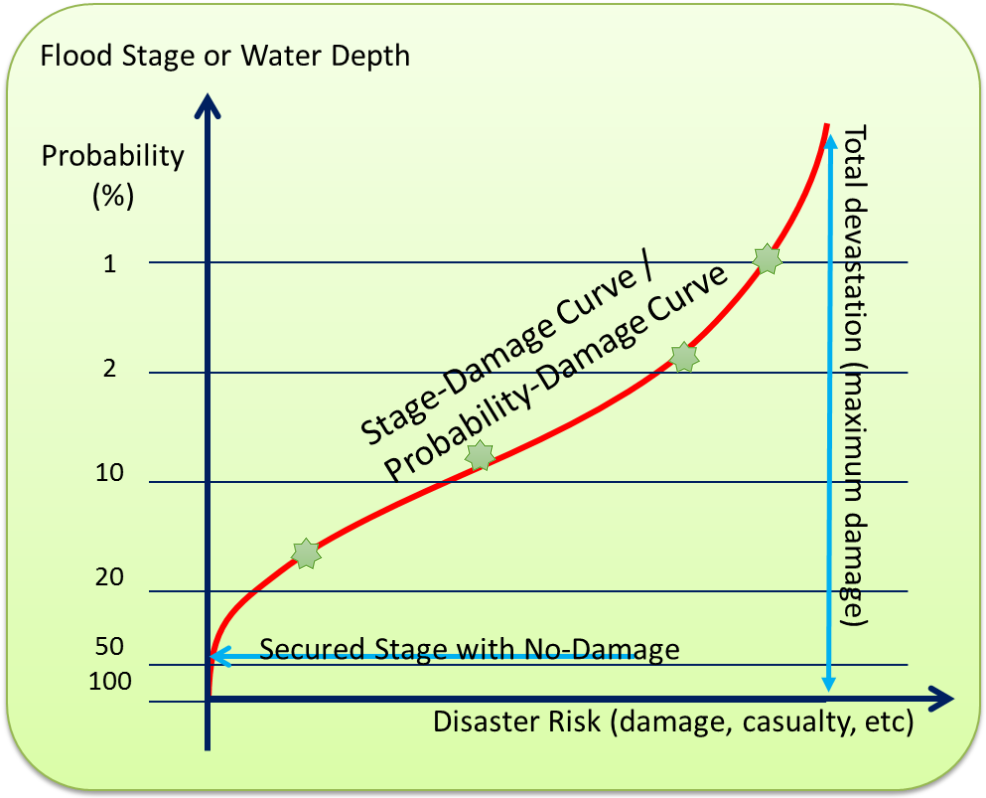


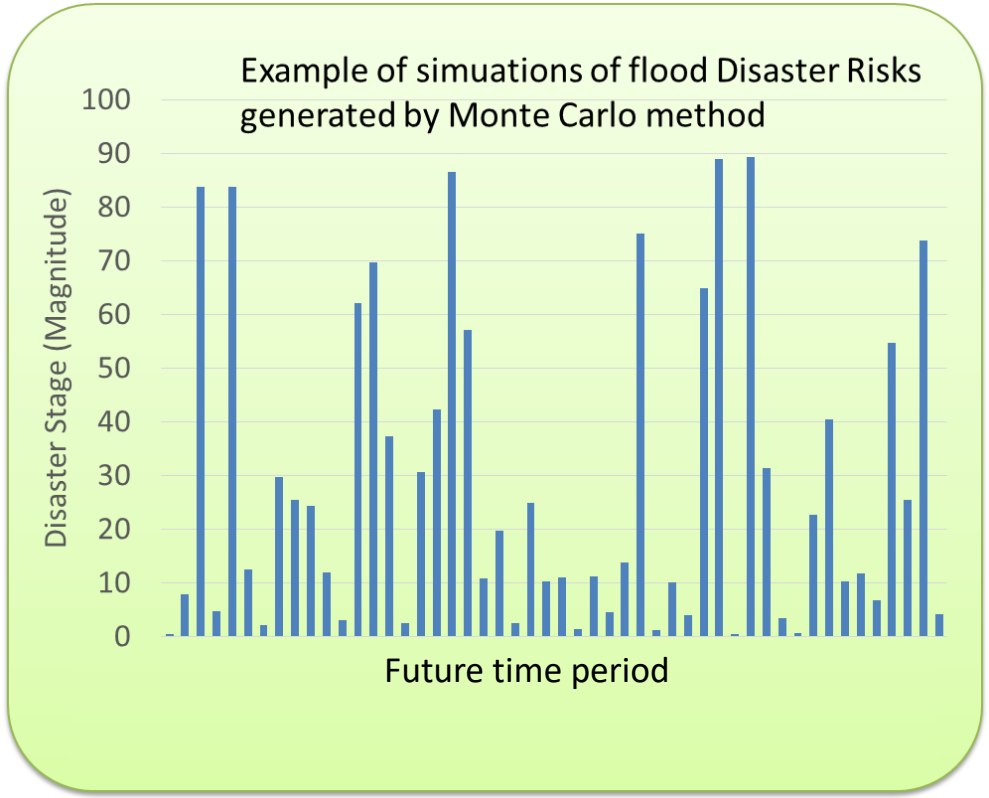
Flood-prone area map of Naka River

Example of Depth-Damage rating curve

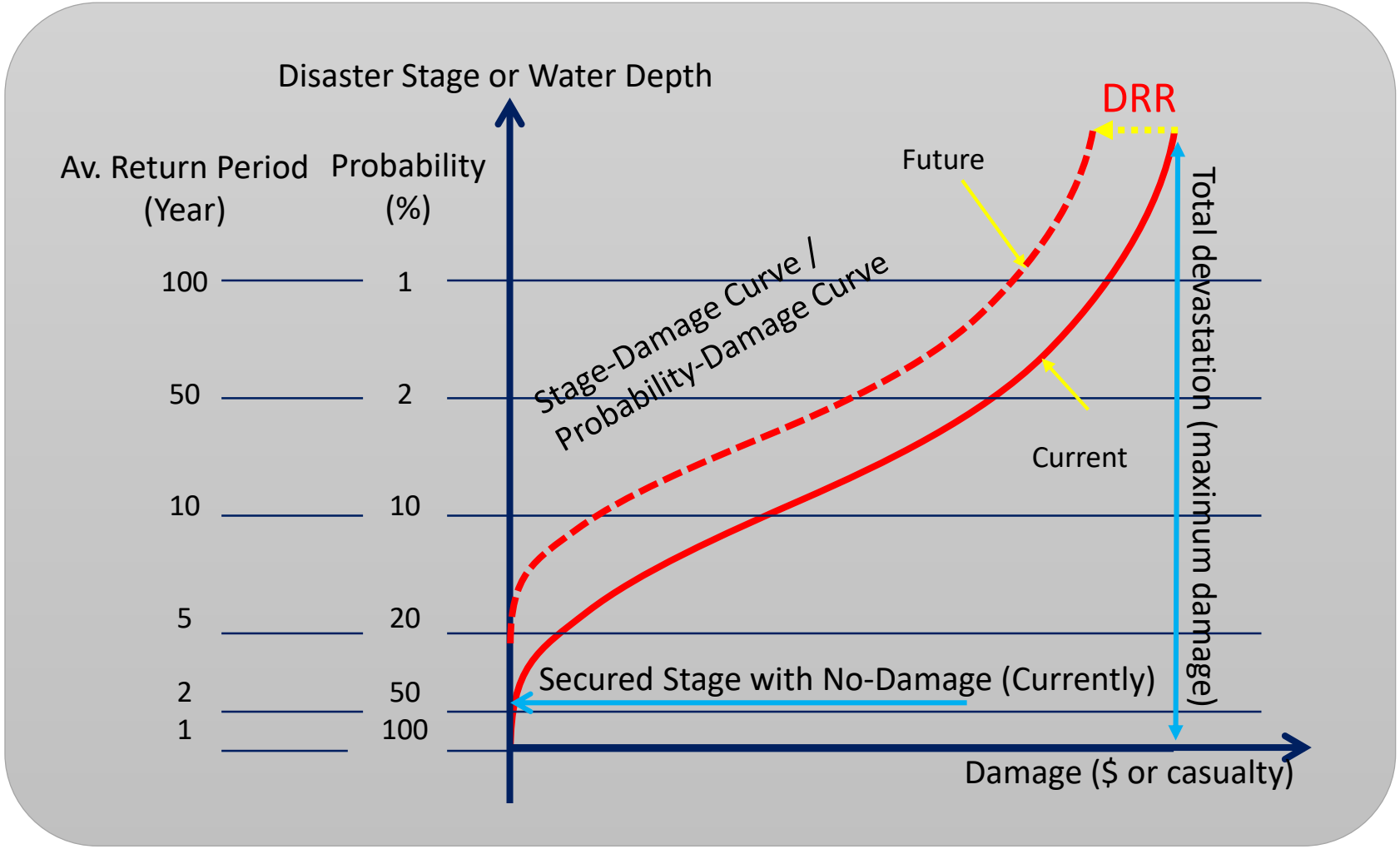


Accumulation of Disaster Risks





Stage-Damage Curve with probability



Typical case study in Yodo River Basin for example

Prob.	Aver. exceed	Damage Current	Prot	Damage Reduced	Damage Reduced	Weight	DRR total
1／10	0.1000	841,096	4,024	837,072	1,094,190	0.0500	54,709
1／20	0.0500	1,367,909	16,602	1,351,307	1,514,040	0.0167	25,234
1／30	0.0333	1,710,738	33,966	1,676,772	2,176,979	0.0133	29,026
1／50	0.0200	3,397,779	720,594	2,677,185	2,044,875	0.0075	15,337
1／80	0.0125	4,330,017	2,917,453	1,412,564	1,403,546	0.0025	3,509
1／100	0.0100	4,603,027	3,208,499	1,394,528	1,580,217	0.0033	5,267
1／150	0.0067	5,376,242	3,556,772	1,819,470			

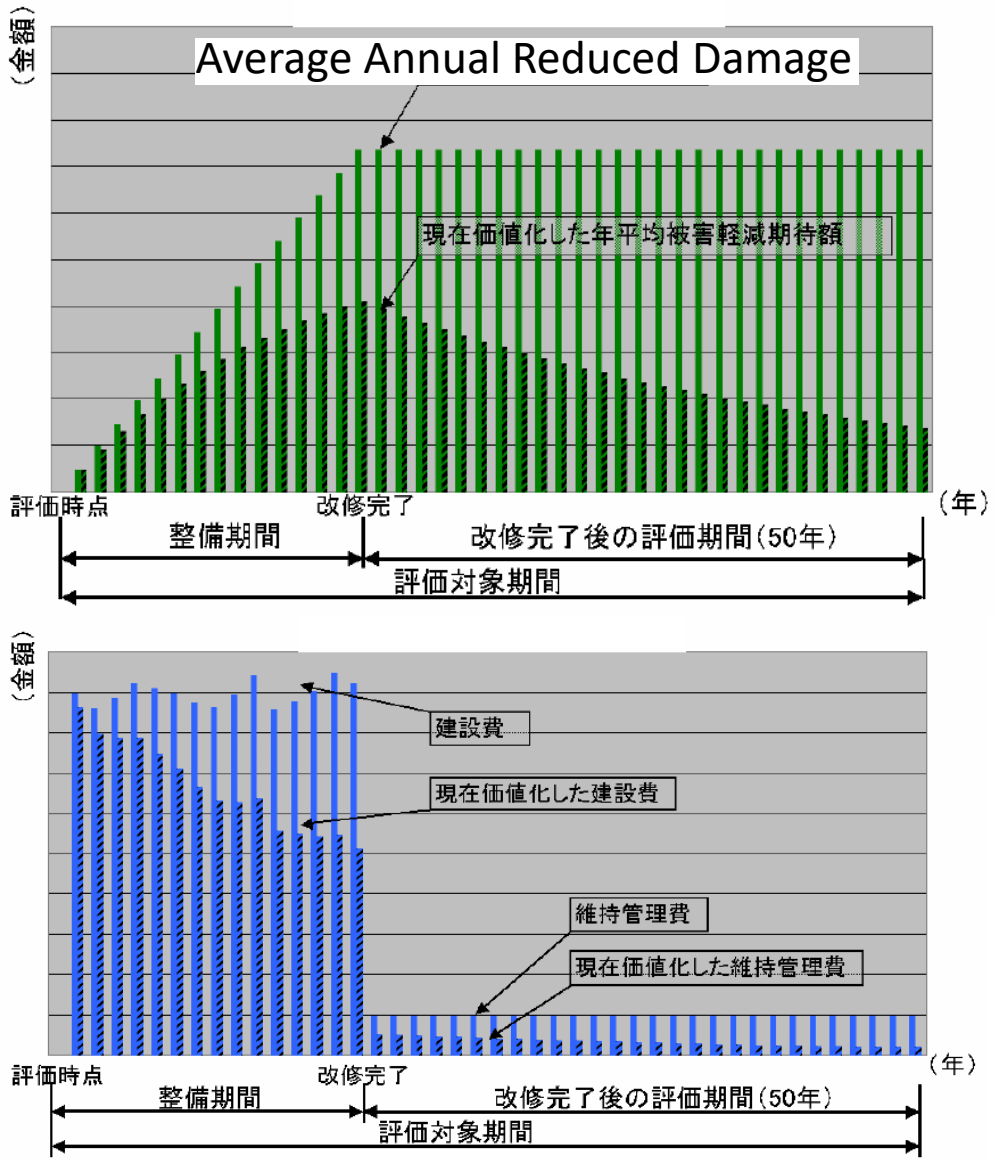
Average Annual Reduced Damage
= 133,082 million Yen/year

Typical case study in Yodo River Basin for example

- The annual average damage reduction expected amount calculated for each development stage to present value by using a discount rate of 4%, with accumulated in the evaluation period (evaluation period after the maintenance period + repair completion (50 years)), also residual value addition to calculating the total benefit:
- Total benefit: about 1 trillion 420 billion yen

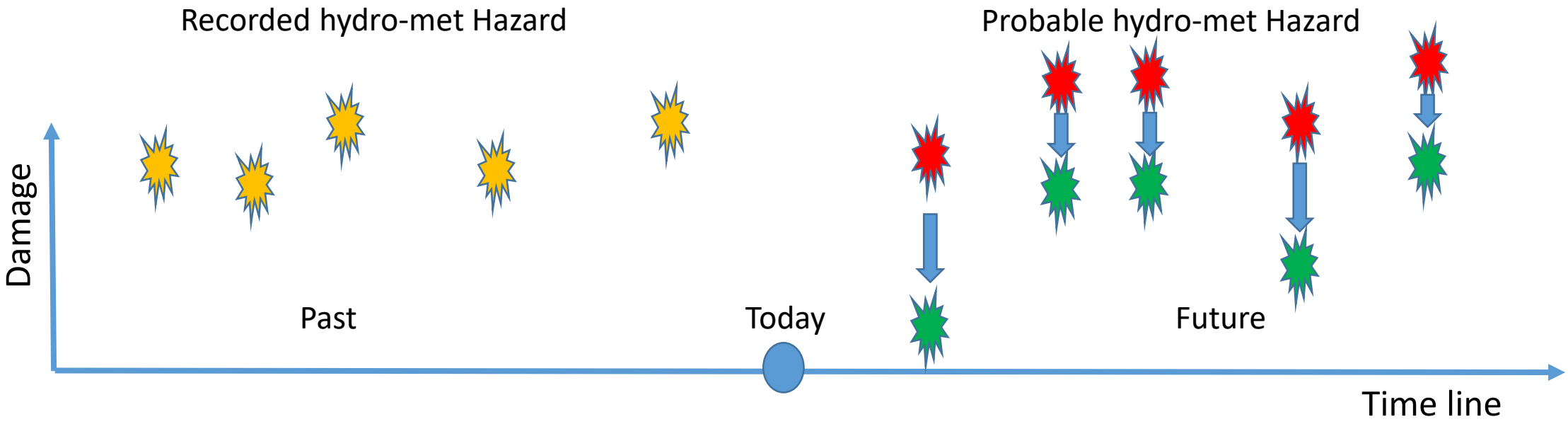
- In Yodogawa and each tributary (excluding the Inagawa), accumulating the maintenance costs of maintenance cost and maintenance completed after 50 years in the case of performing the business of flood control purposes that you are to be carried out in the river improvement plan draft did on the present value of , and calculate the total cost:
- Total cost: about 370 billion yen

- Cost-benefit ratio (B / C) = total benefit / total cost = 3.8



You need to analyze the future cost of disaster (probable damage) and the benefit of environmental improvement (DRR investment)

- Assessing “Risk” for the environmental planning
- Evaluating the benefit that indicate reduced risk by improvement investment



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 Strategy

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

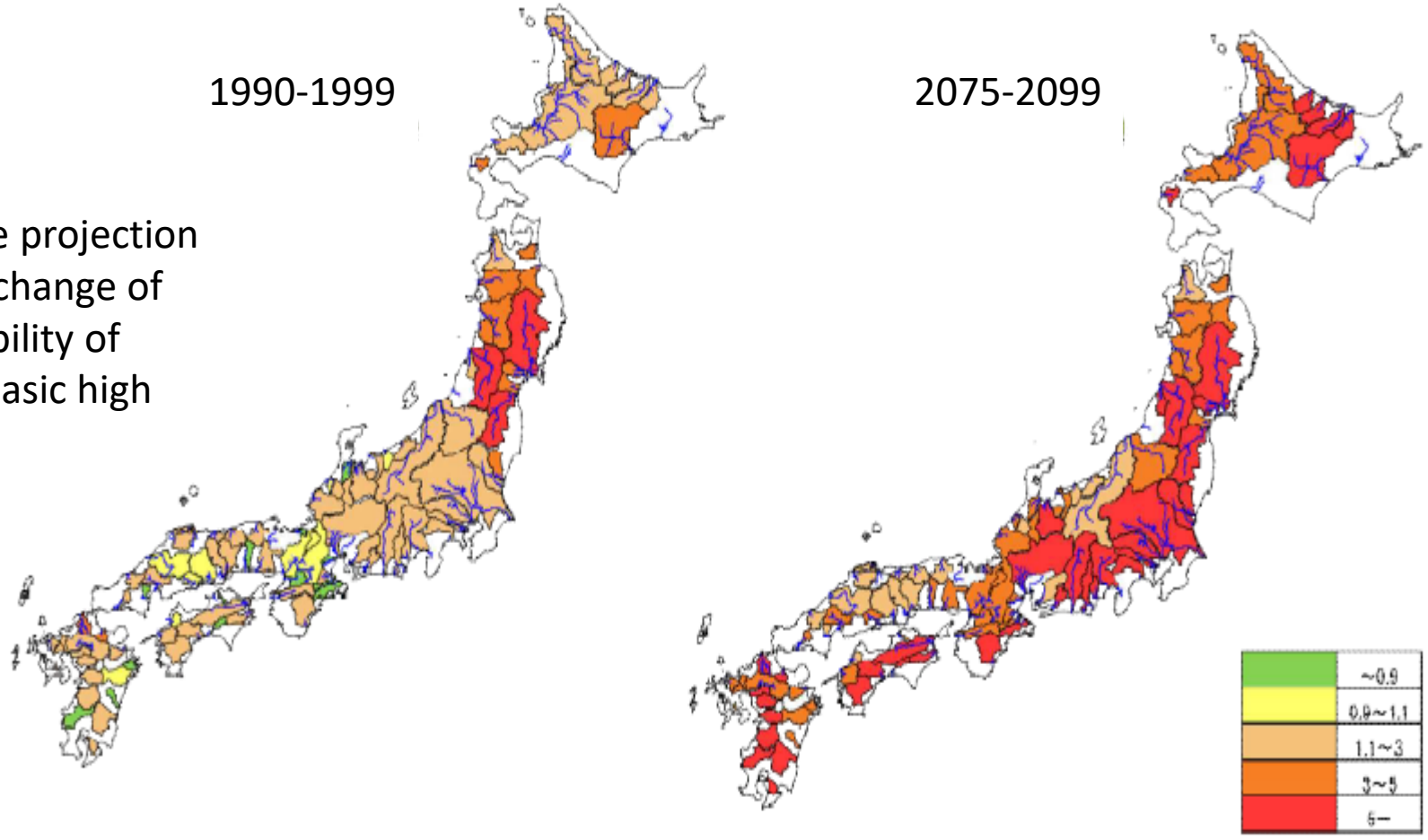
Impacts: e.g. Damage to infrastructure and critical services

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 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)



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

Adaptation Criteria specific for Flood Risk Management

Technical Guides

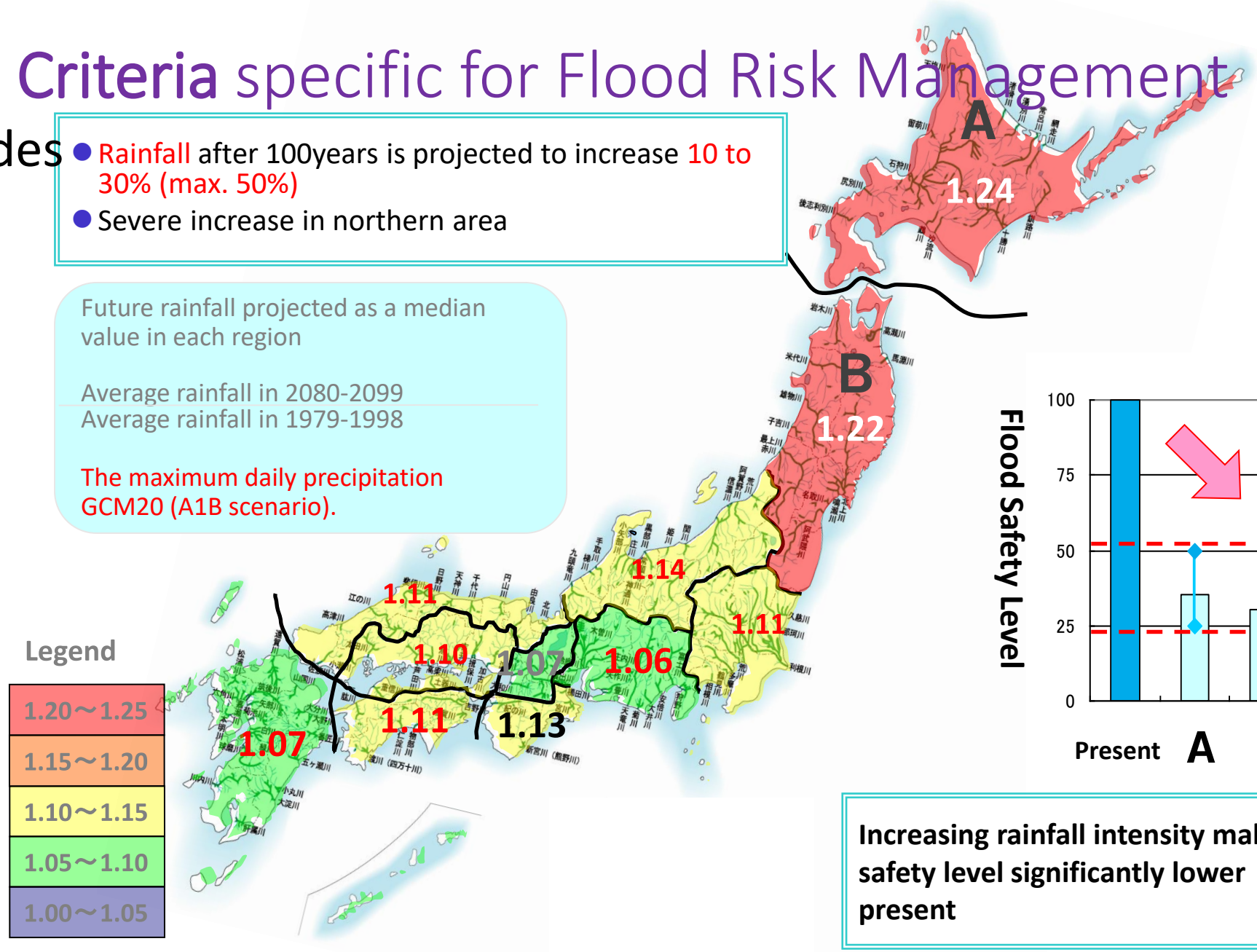
- Rainfall after 100years is projected to increase 10 to 30% (max. 50%)
- Severe increase in northern area

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

Future rainfall projected as a median value in each region

Average rainfall in 2080-2099
Average rainfall in 1979-1998

The maximum daily precipitation GCM20 (A1B scenario).

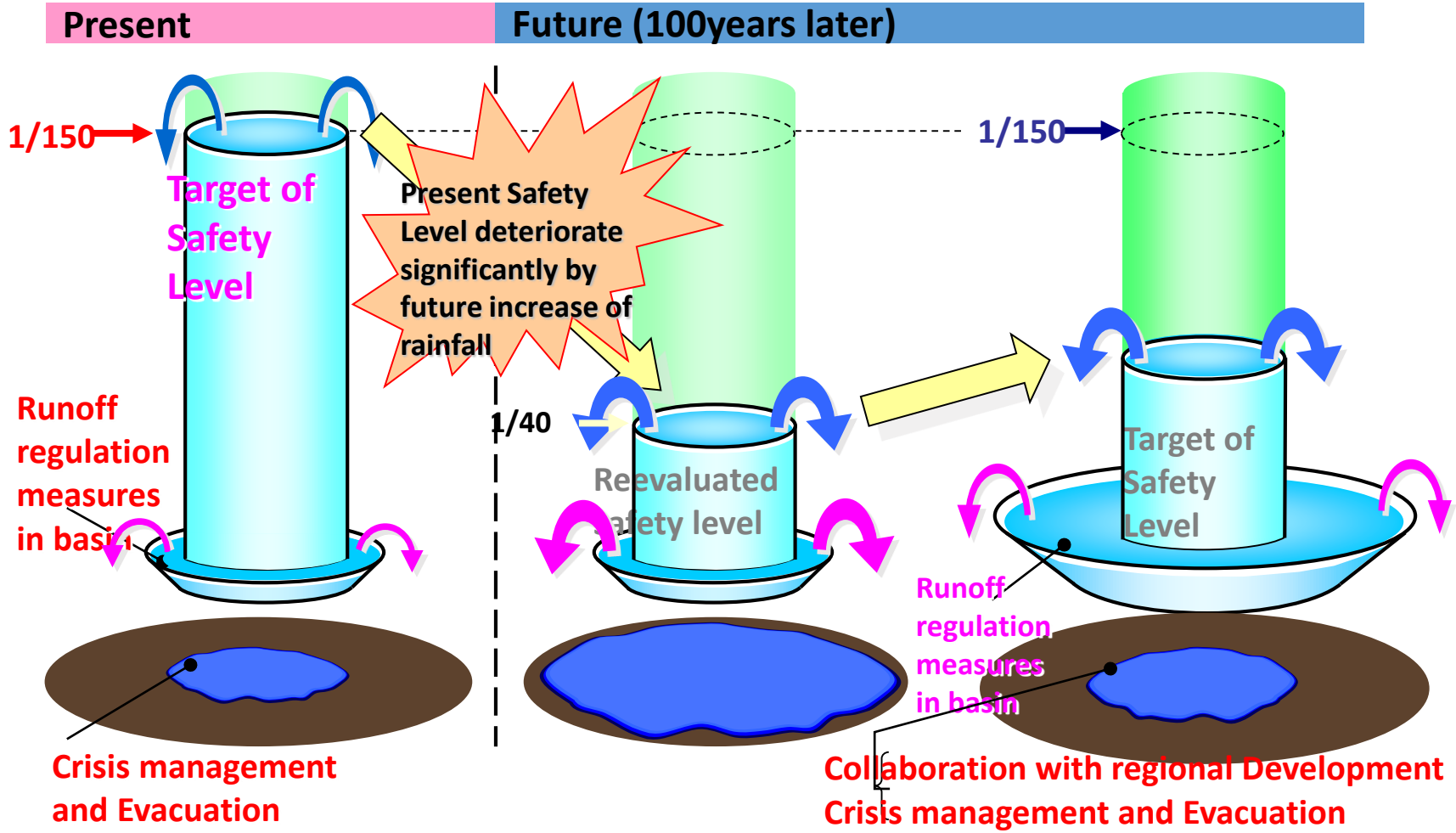


Increasing rainfall intensity make flood safety level significantly lower than present

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.



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