The 7th International Coordination Group (ICG) Meeting
GEOSS Asian Water Cycle Initiative (AWCI)
Tokyo, Japan, 6, October 2010

Practical Guidelines on Strategic Climate Change Adaptation Planning - Flood Disasters -

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Director for international river management coordination,
River Bureau, MLIT, GOJ

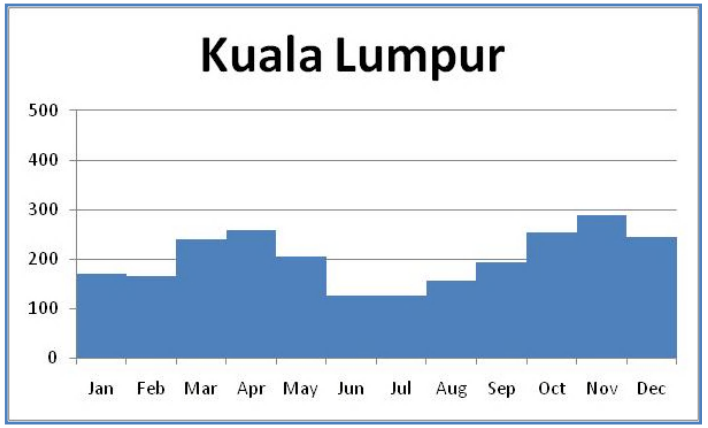
Background of the Guideline

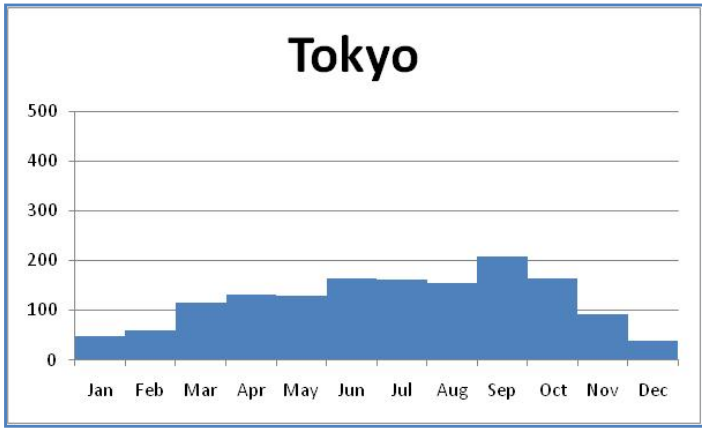
- We have common issues, regarding flood management, to be solved in Asia-Pacific Region, such as
  - > rainfall intensity and seasonal maldistribution
  - > high density land use in flood prone area
  - > frequent huge flood disasters
  - > current safety level

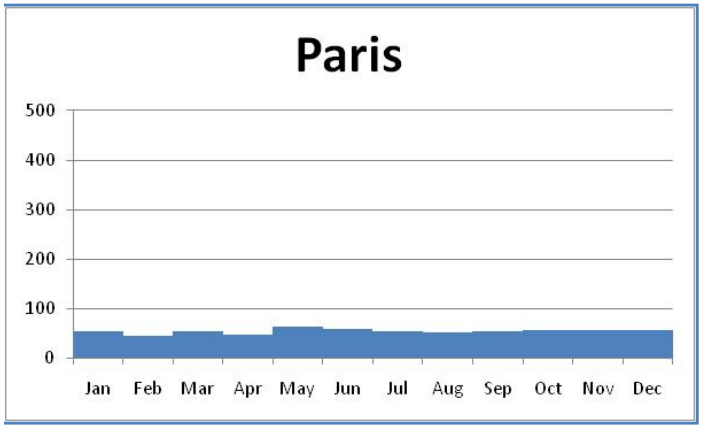
- It is necessary to overcome these severer conditions by selection and combination of measures based on accumulation of flood risk managements.

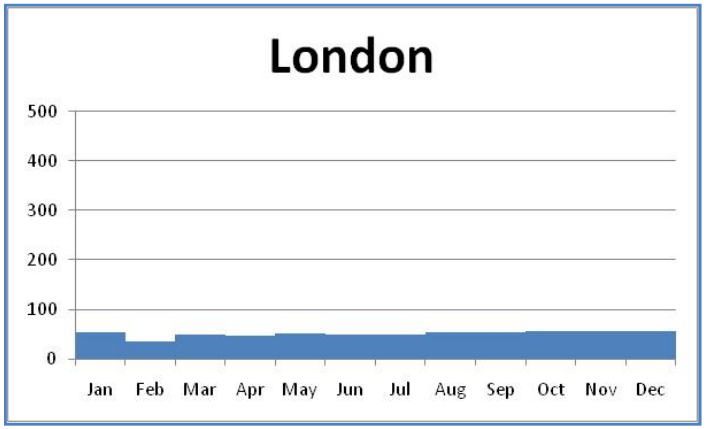
Common background in the Asia-Pacific Region(1)

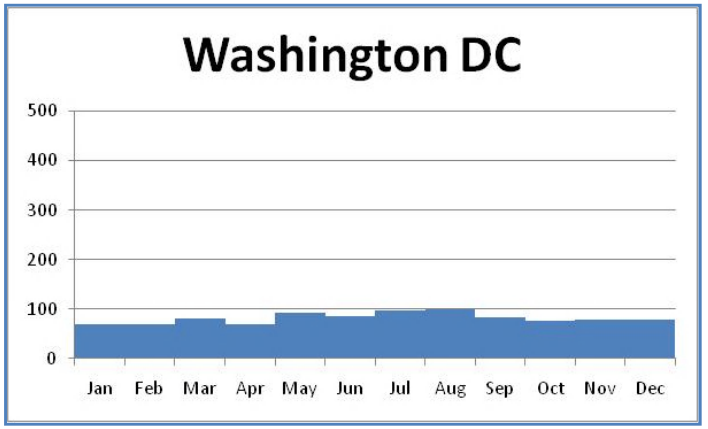
Seasonal maldistribution of Rainfall











Common background in the Asia-Pacific Region(2)

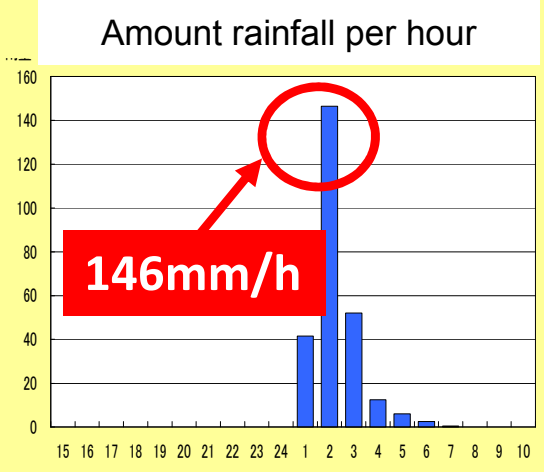
- Serious damages caused by high intensity rainfall

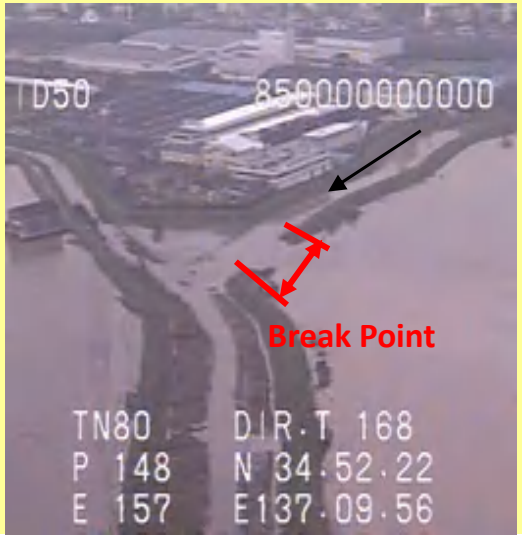
2008.7.28 Floods in Hyogo Pref.

Rapid water level rise of **134cm** in **10 minutes**

2008.8.29 Floods in Aichi Pref.

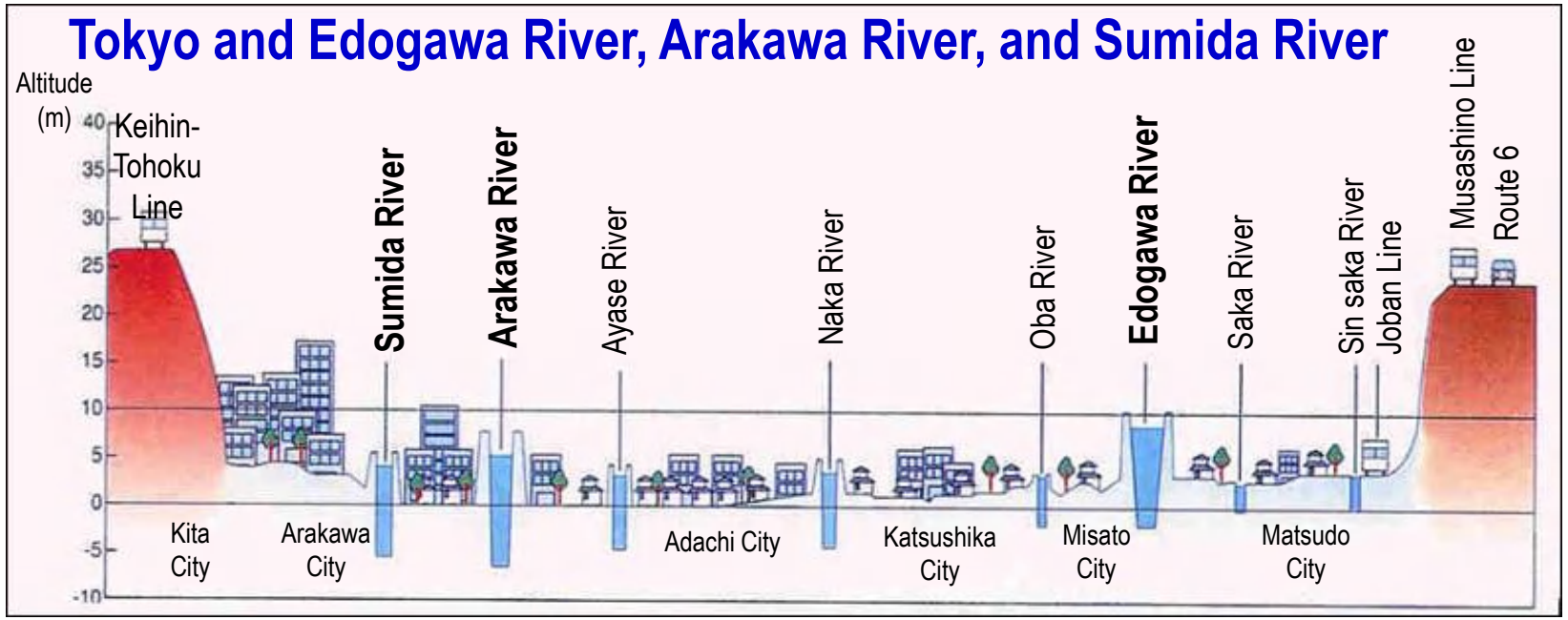
High intensity rainfall per hour

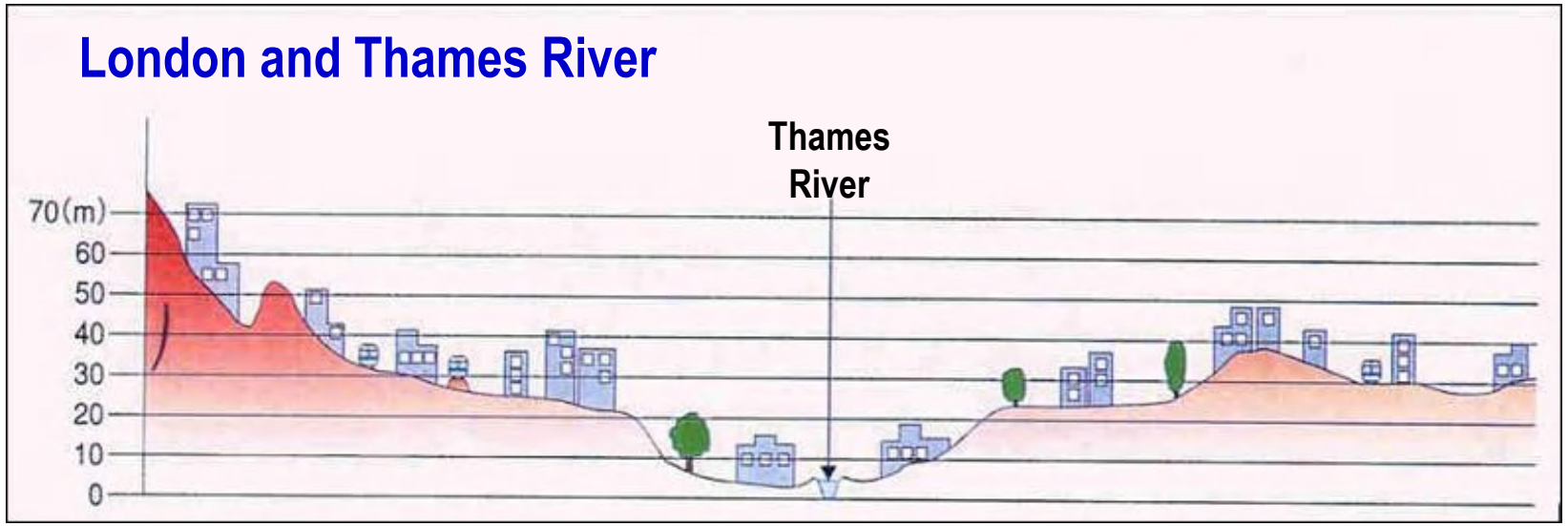




Common background in the Asia-Pacific Region(3)

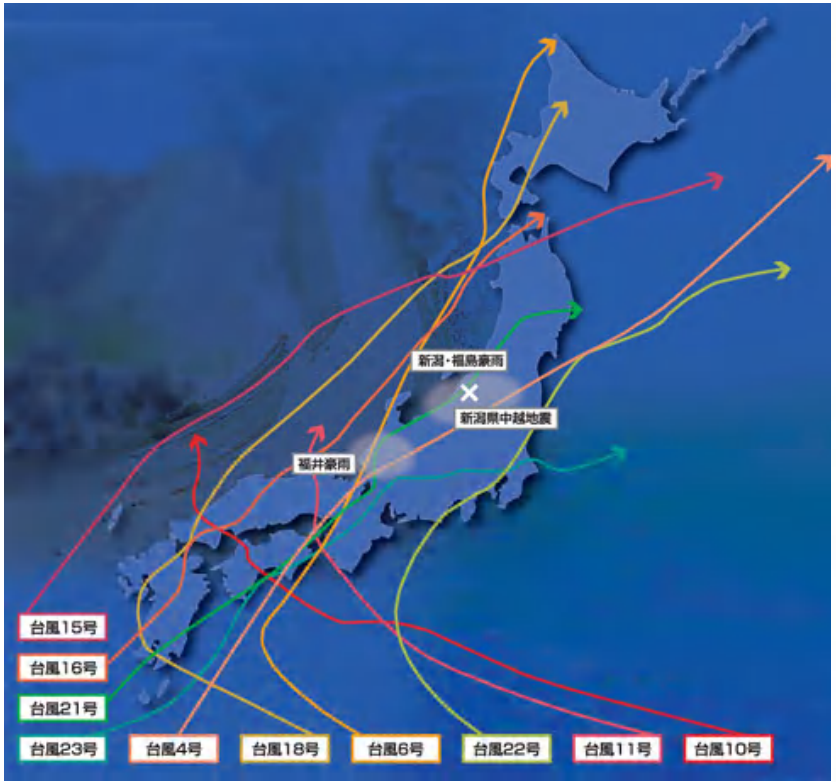
- High density urban development in flood prone low land area





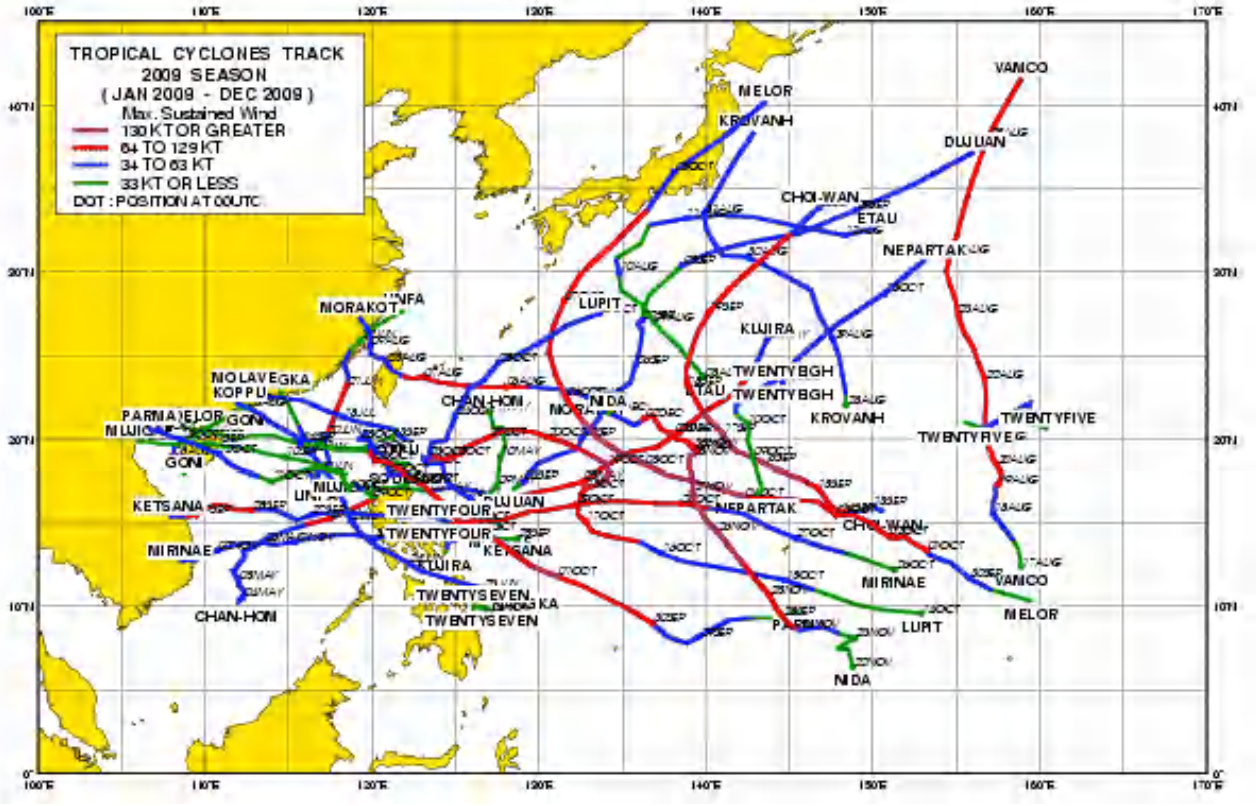
Common background in the Asia-Pacific Region(4)

- Typhoons / Cyclones Attack frequently



10 attacked Japan in 2004

Source: MLIT

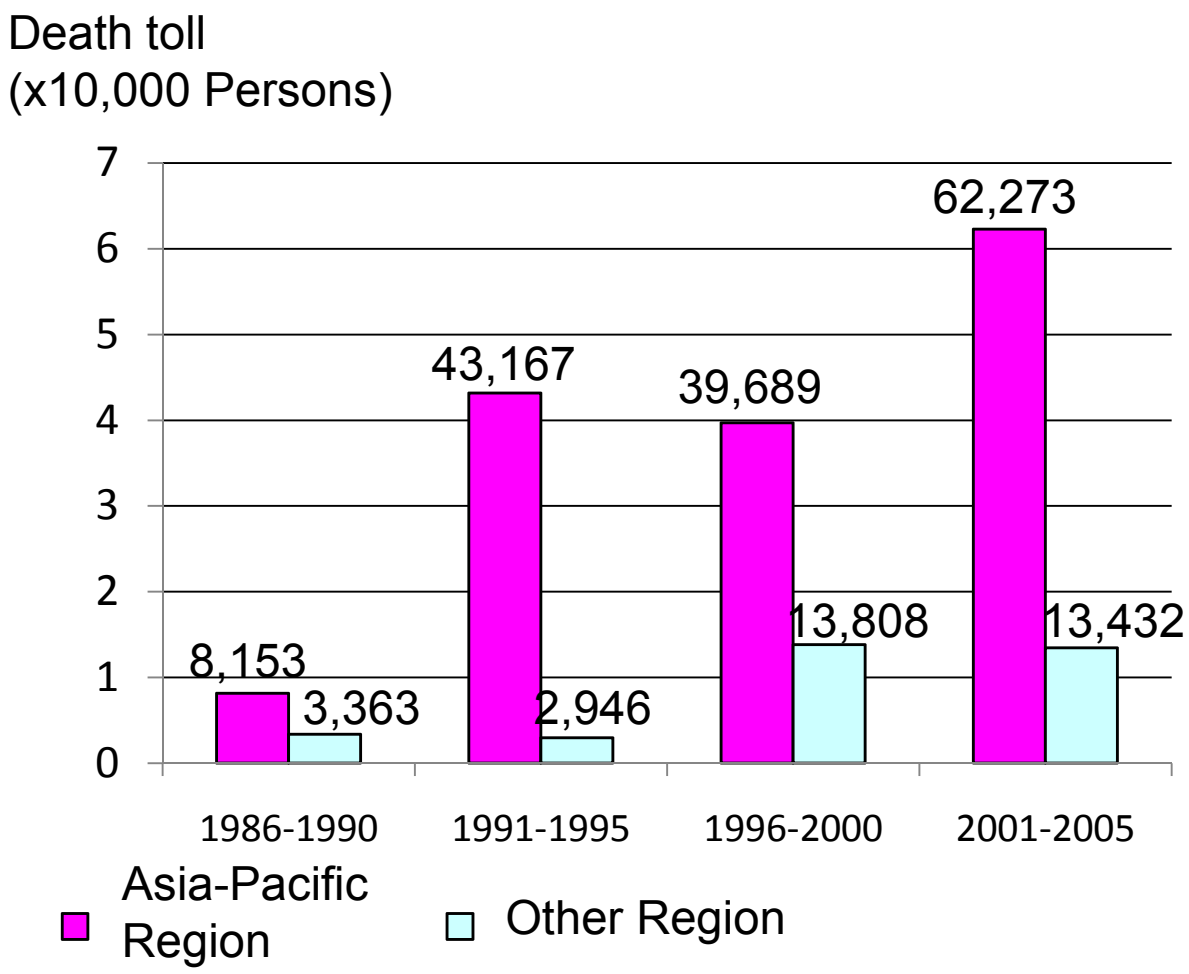


Several attacked the Philippines, The Vietnams and others in 2009

Source: Japan Aerospace Exploration Agency (JAXA)

Serious Damages of Flood Disasters in Asia-Pacific Region

- Approx. 50,000 persons / year has died recently and more than 80% of them are



Death toll by water-related disasters
(per year : every 5years average)

Reference：EM-DAT, THE OFDA/CRED International Disaster Database

Hue, Vietnam (2009)

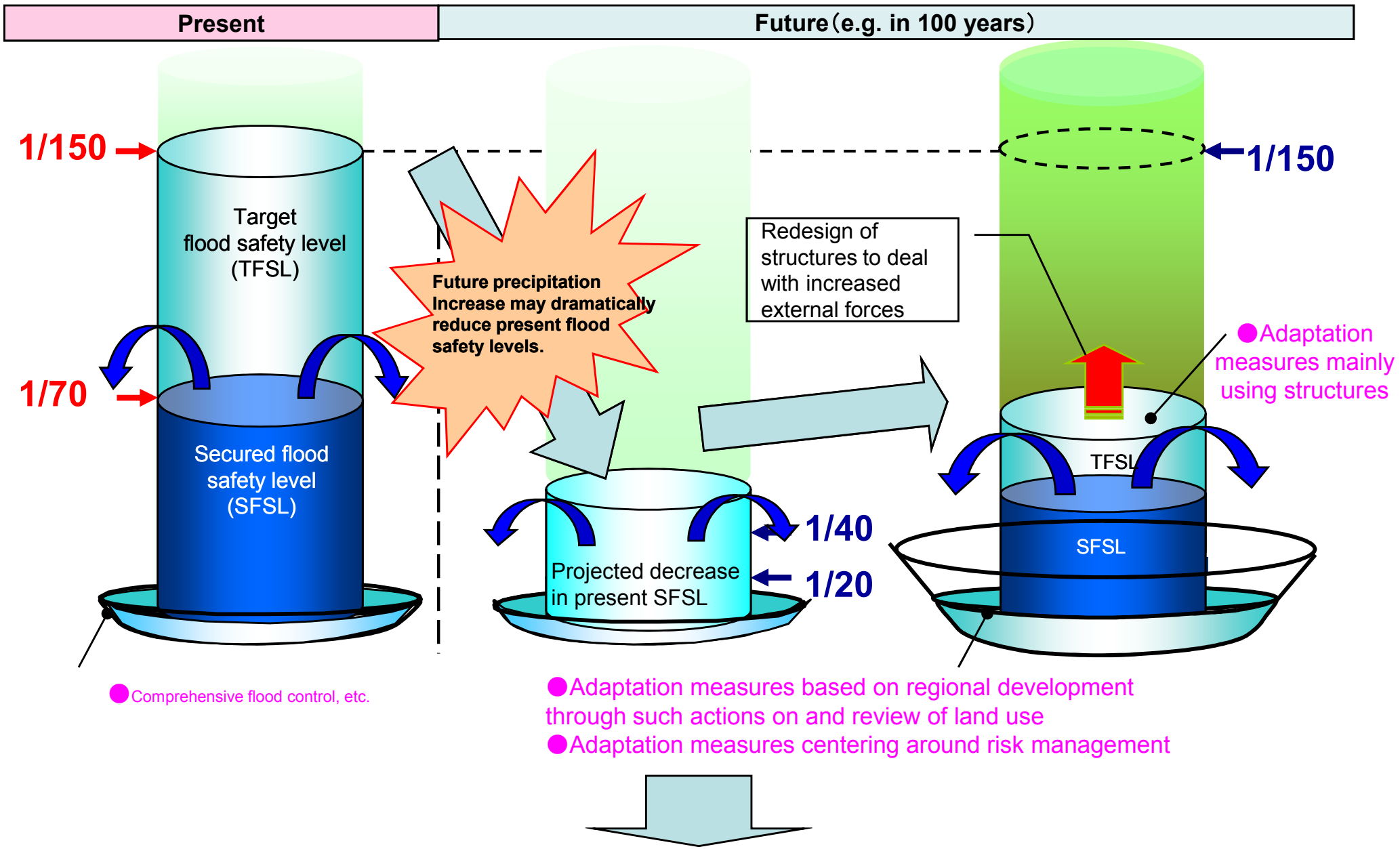
Manila, the Philippines (2009)

Common background in the Asia-Pacific Region(5)

Policy Report pp.26-45
III-1. Basic Directions of Adaptation

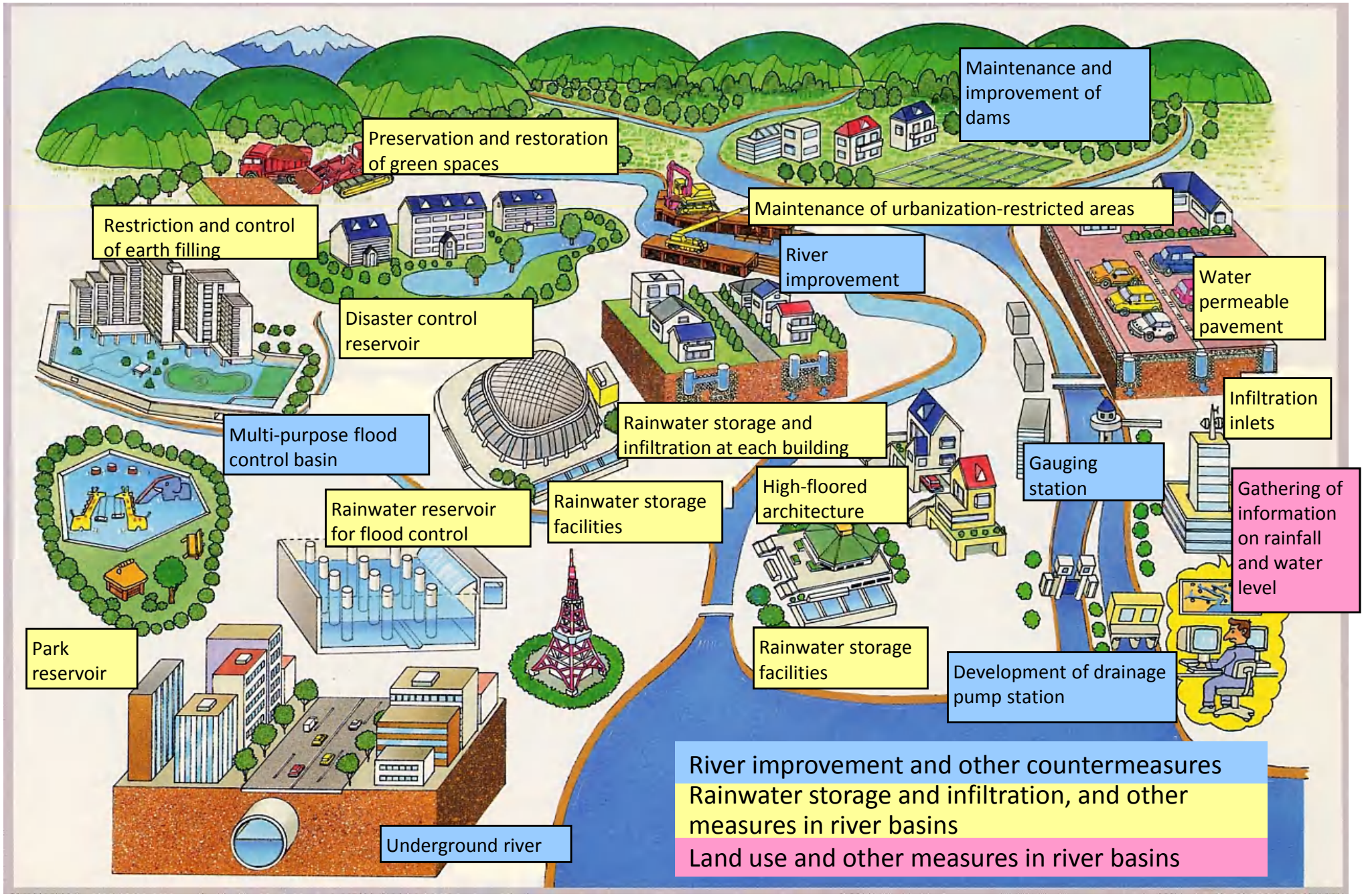
The red figures indicate present flood safety levels.

The blue figures indicate future flood safety levels.



Flexible measures should be taken at the basin levels to deal with all possible floods of different scales.

Appropriate combinations of measures
（Comprehensive Flood Control Measures）



Purpose of the Guidelines

- To describe a framework for procedures to develop adaptation measures against the increases in the intensity and frequency of floods caused by climate change.

⇒ To support the decision making to secure the sustainable development in the Asia-Pacific Region in overcoming the flood risks.

Special Advisory Board Member for the Guidelines

<Chair>

- Prof. KOIKE, Toshio; Univ. Tokyo

<Member>

- Mr. FUKAMI, Kazuhiko; ICHARM of PWRI
- Dr. ISHIWATARI, Mikio; JICA
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- Assoc. Prof. KANAE, Shinjiro; Tokyo Institute of Tech.
- Dr. NAKAEGAWA, Toshiyuki; MRI of JMA
- Assoc. Prof. TACHIKAWA, Yasuto; Kyoto Univ.
- Assist. Prof. TANIGUCHI Kenji; Kanazawa Univ.
- Dr. TSUKAHARA Kenji; JICA

Concept of Developing Adaptation Measures

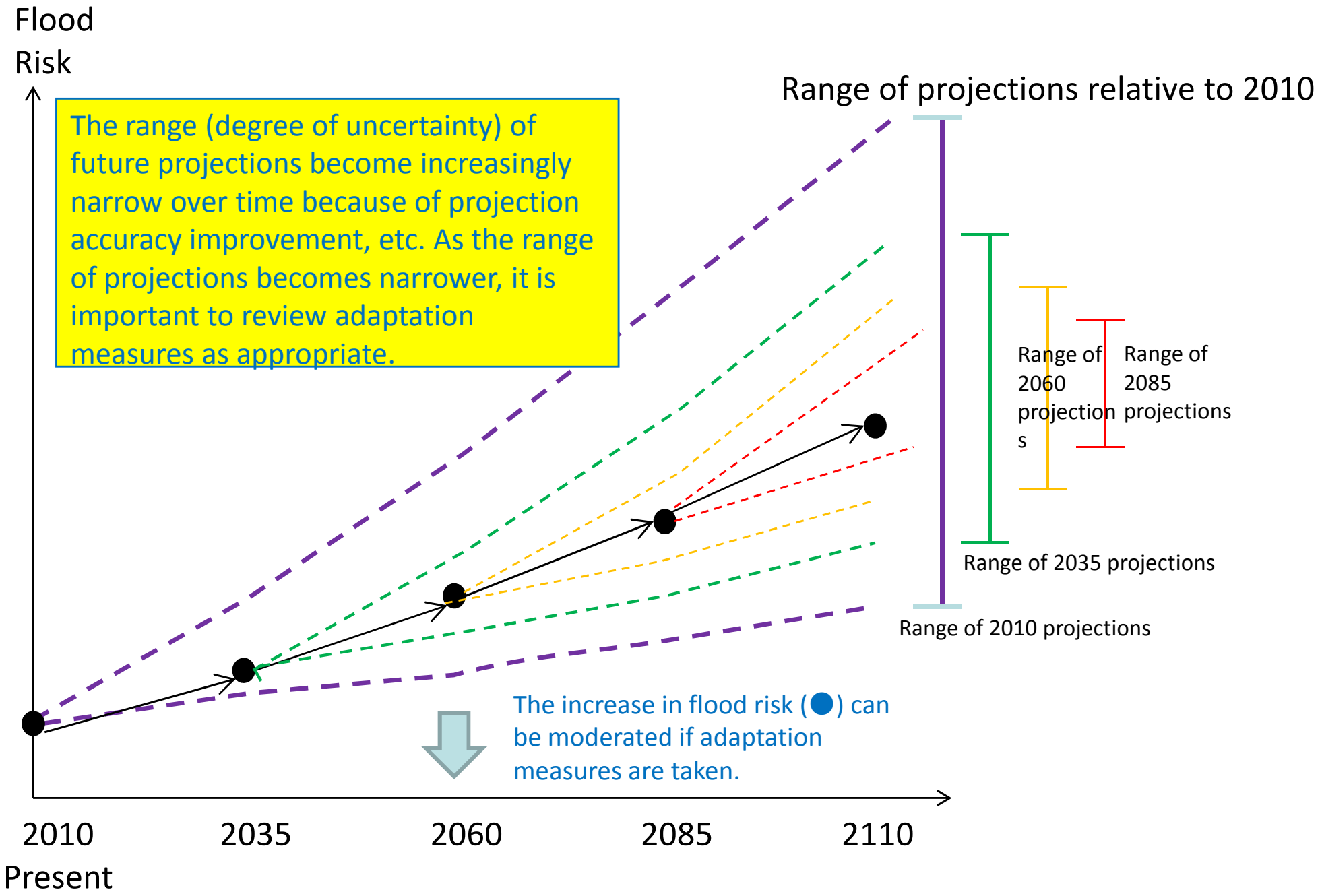
- Setting “target years” considering future uncertainty.
- Flexible Approach through the PDCA Cycle like as “Climbing-up spiral”

Setting “target years” (1)

- Consideration future “uncertainty”, such as changes of climate, economic, social and environmental conditions,

  … It is necessary to use a feedback system composed of visible/definite target, and to take a flexible approach.

Concept of treatment of uncertainty

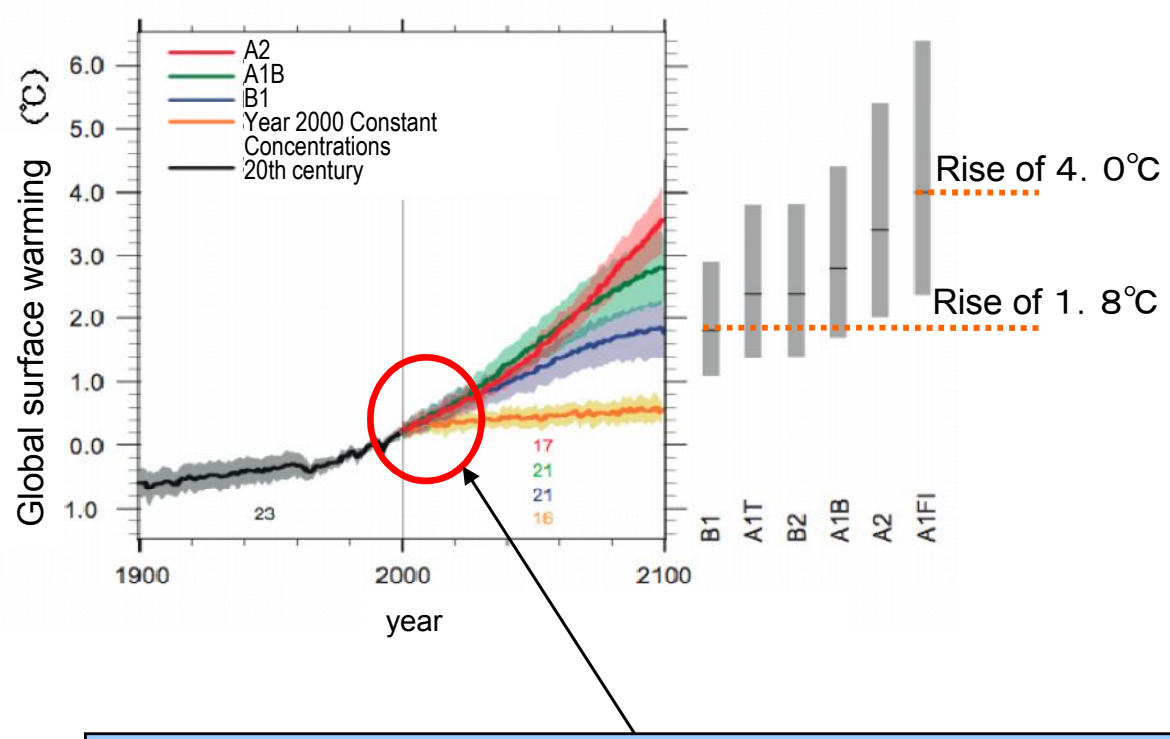


Setting “target years” (2)

- Based on the viewpoint of science,

  “target years” for adaptation planning can be projected, such as certain magnitude of temperature rise in 20 ~ 30 years with some certainty without scenario.

・Average Temperature



A1High-growth World Scenario”
A1FI：Emphasis on fossil fuels
A1T ： Emphasis on energy resources other than fossil
A1B ：Emphasis on a balance across all sources
A2. Heterogeneous Society Scenario
B1. Continuously Developing Society Scenario
B2 Regional Pluralism Society Scenario

Source: IPCC AR4 WG1 (Working Group 1) Summary for Policymakers
(Japan Meteorological Agency)
-Solid lines indicate rises of global average surface temperature in each scenario identified using multiple models.
-Shaded areas indicate the range of standard deviations of average annual temperature for each model.

Differences in 20 to 30 year projections under global warming scenarios are relatively small.
(It is thought likely that global average temperature will rise by 0.6 to 0.8° C over a period of 20 to 30 years from now even if greenhouse gas emissions are controlled.)

Target years for developing adaptation measures

It is projected that over a period of 20 years from now, global surface temperature will rise at a rate of 0.2° C in 10 years, and it will rise by 1.8 to 4.0° C in 100 years from now. It is also projected that temperature will rise by 0.6 to 0.8° C in 20 to 30 years. Differences, therefore, in projections among different global warming scenarios are relatively small.

In order to develop and implement adaptation measures to cope with the impacts for the moment, it is effective to consider adaptation measure to be taken over a period of 20 to 30 years.

Setting “target years” (3)

- “The period” of the target is determined to be 20 - 30 years, “a quarter century” as the shortest period of time.

  … The period could be lengthened, or the target could be more accurate if science & technology progress in the future.

  … It is also required to consider other periods of the plans simultaneously, such as Master Plan for regional development and individual project implementation.

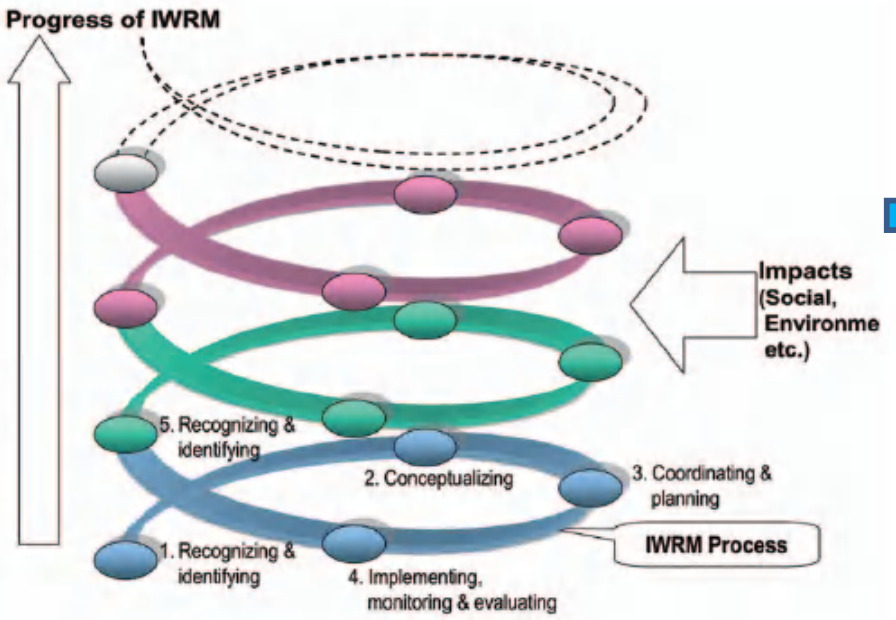
Flexible Approach (1)

- To optimize the combination of adaptation measures, considering the future climate change in 100 years, and setting the visible/definite target, a set / sets of the approaches every quarter century seem the climbing high mountain.

- It is necessary to use the feedback system to consider effects of future changes of climate / Economic / Social / Environmental conditions by utilizing the progress of science and technology.

Flexible Approach (2)

- “Spiral and Process” was recommended as the basic concept of the IWRM guideline of UNESCO.



IWRM Spiral and Process

Source : IWRM Guideline (UNESCO)

… Set the target years considering effects at the end of a certain period, such as a quarter century.

… Take cyclic procedure to feedback the progress and the results of mitigation constantly, and to modify or arrange the implementation of the adaptation measures.

Structure of the Flexible Approach (1)

- Adaptation Strategy with “Climbing-up Spiral Approach” is based on

  A. “End to End approach”

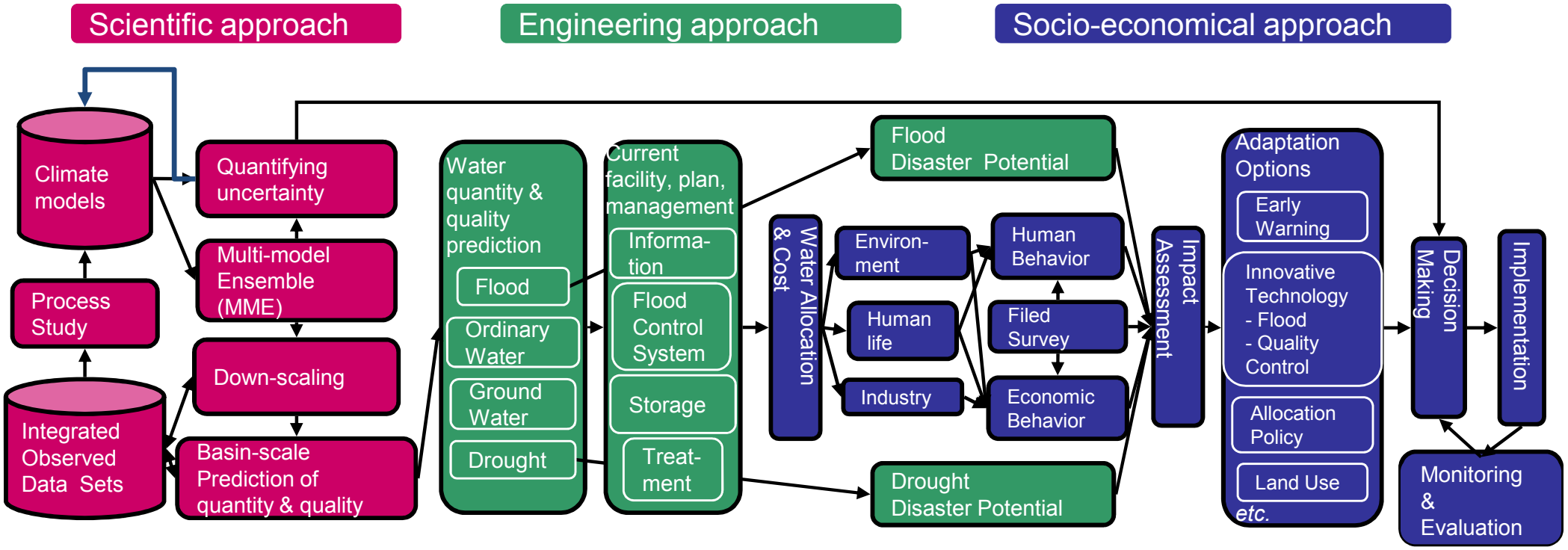
  B. Practical procedure for selection and combination of measures for flood management

  C. Common background of flood risk management experiences in the Asia Pacific Region

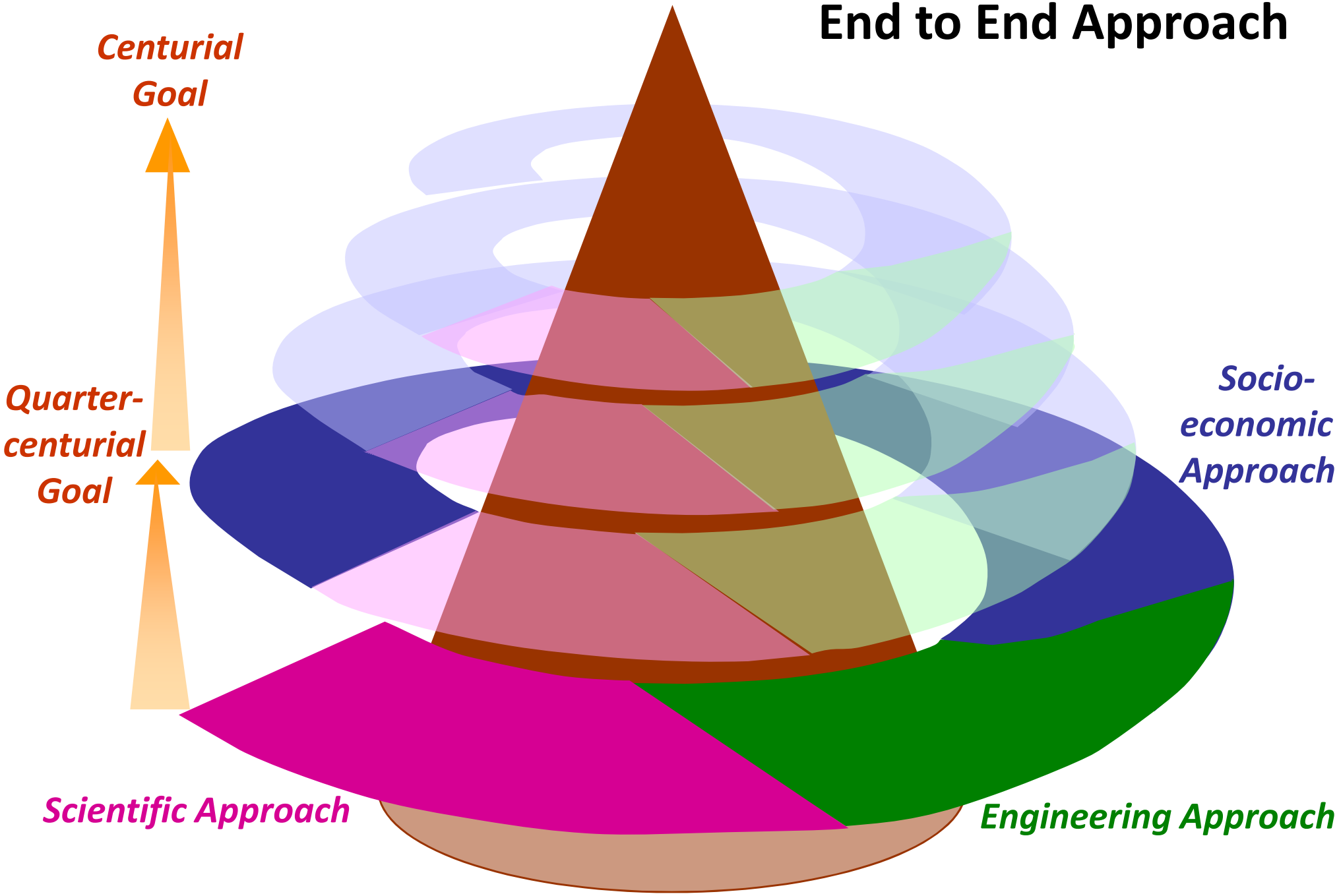
Structure of the Flexible Approach (2-1)

End to End Approach on Climate Change Adaptation

Source: Prof. Toshio KOIKE (University of Tokyo)



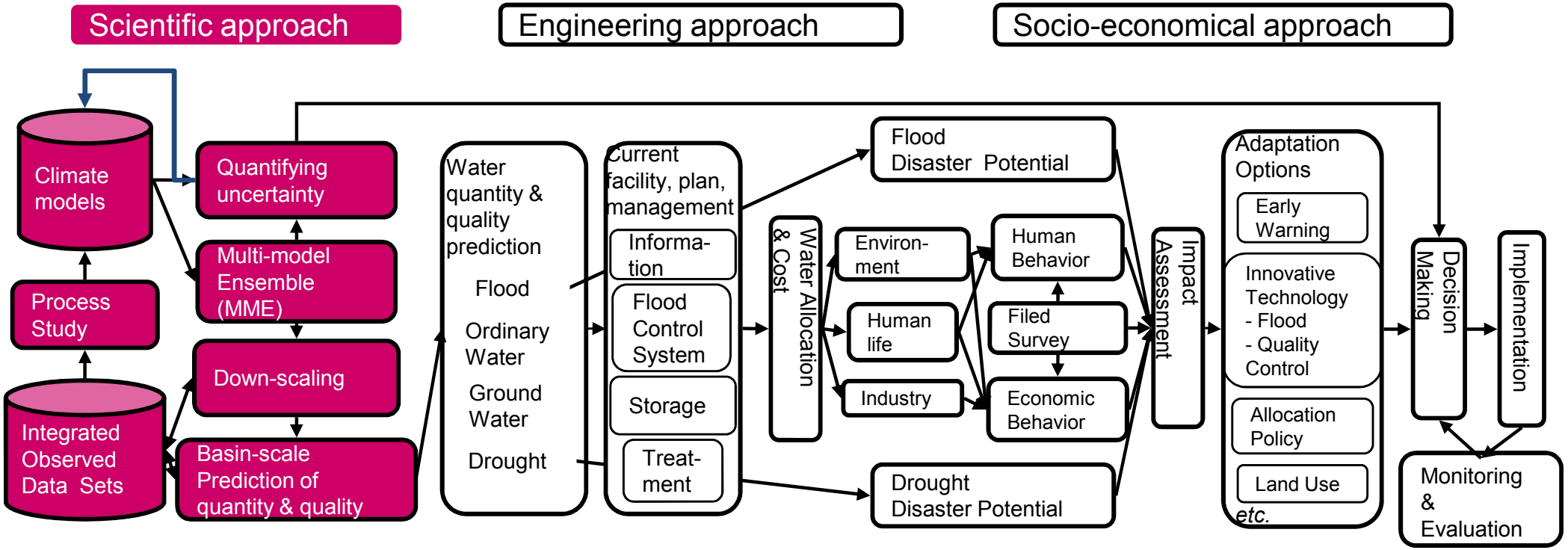
Climbing-up Spiral with End to End Approach



Structure of the Flexible Approach(2-2)

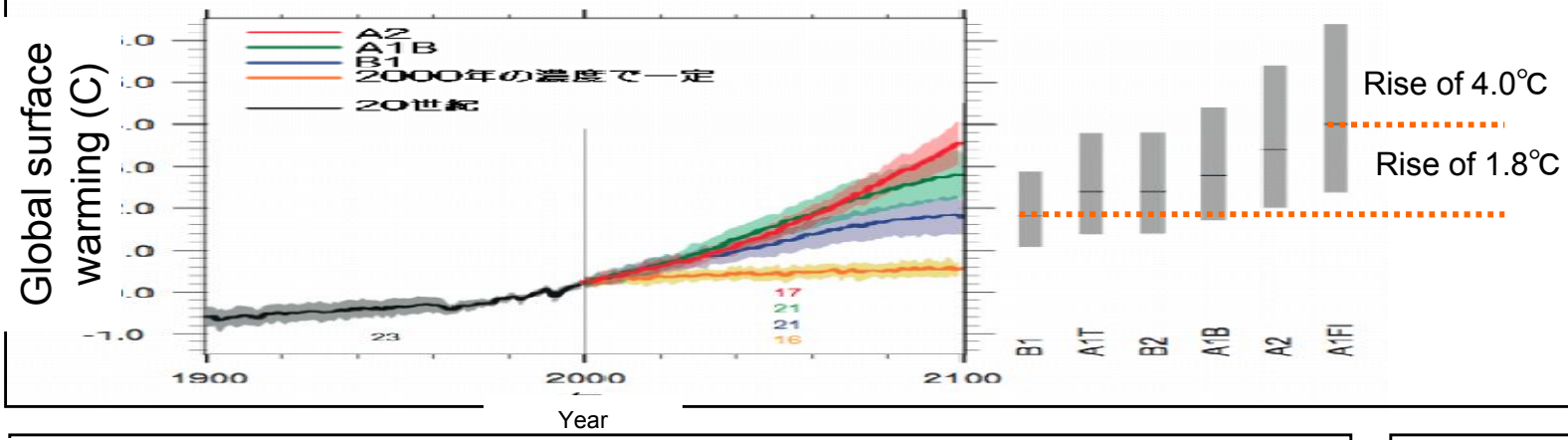
E to E Approach – Scientific approach -

Source: Prof. Toshio KOIKE (University of Tokyo)



Climate changes in IPCC AR4

-Global average surface temperature is expected to rise by 1.8 to 4.0℃ in 100 years' time from now.
-Global average sea level is expected to rise by 18 to 59 cm in 100years' time from now.
-Global warming and sea level rise will continue over several centuries even if green house gas emissions are controlled.



Source: IPCC AR4 WG1 (Working Group 1) Summary for Policymakers (Japan Meteorological Agency)
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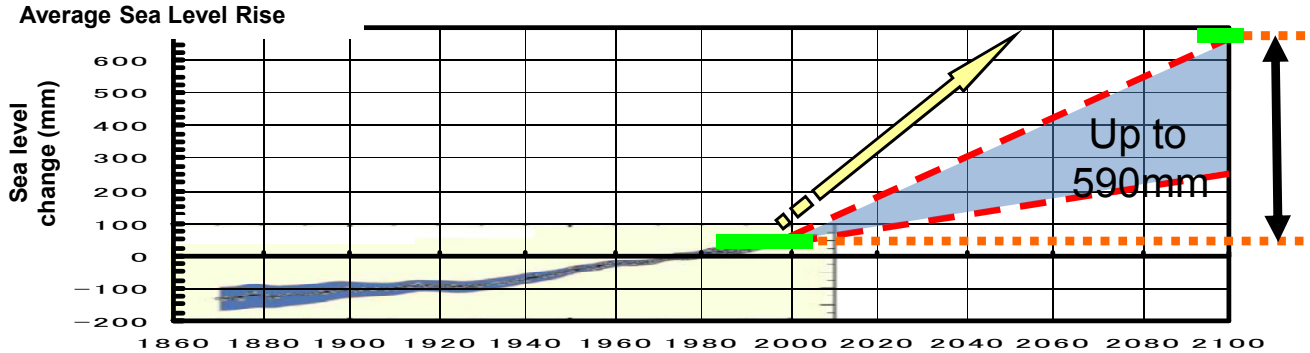


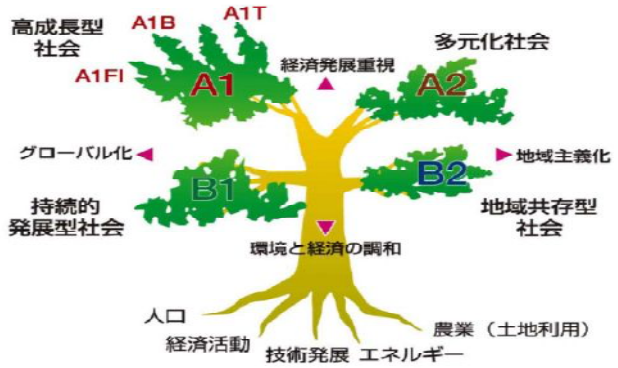
Source: The figure was created by MLIT River Bureau based on IPCC AR4 WG1 Report.

Rises of average temperature and sea level at the end of the 21st century

	Society achieving both global environmental protection and economic development	Society achieving high economic growth dependent on fossil energy sources
Temperature rise	**About 1.8℃** (from 1.1℃to2.9℃)	**About 4.0℃** (from2.4℃to6.4℃)
Sea level rise	**18 – 38 cm**	**26 – 59 cm**

Source: IPCC AR4 WG1 Report

Basic Concept of Emission Scenarios



A1High-growth World Scenario"
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B1. Continuously Developing Society Scenario
B2 Regional Pluralism Society Scenario

Source: IPCC AR4 Synthesis Report
As of Dec. 17, 2007

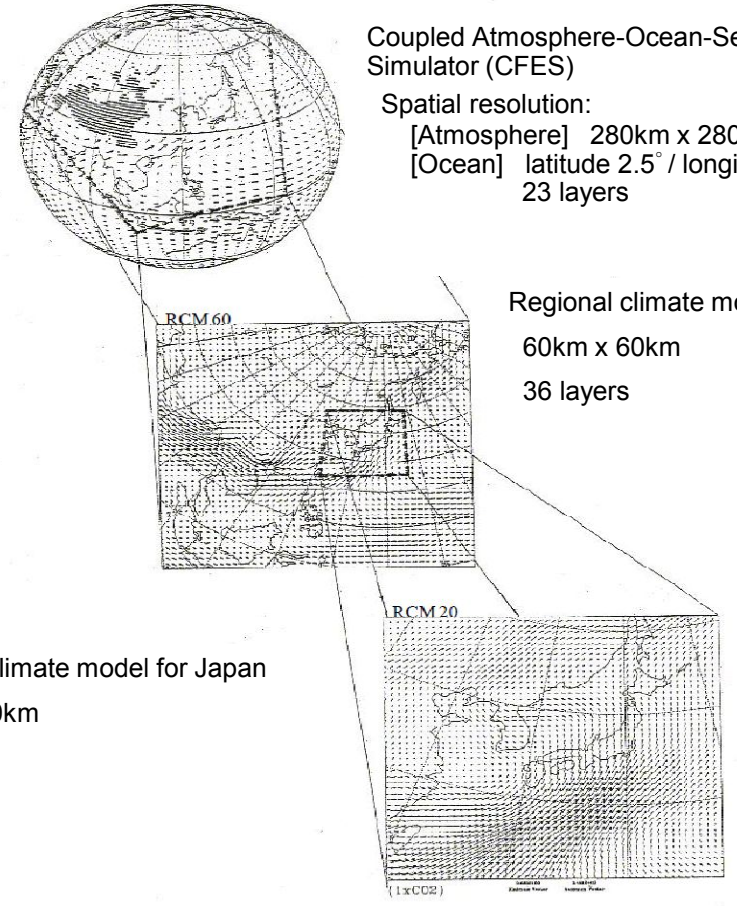
Regional Climate Models (RCM20 & GCM20)

Policy Report pp.17-22
II-3. Increased External Forces

Recently developed simulation models enable more detailed regional climate predictions.

Regional Climate Models

	GCM20 (General Circulation Model)	RCM20 (Regional Climate Model)
Areas to be Calculated	Entire globe	Japan and surrounding areas
Horizontal Resolution	About 20 km Number of meshes 1920 x 9960	About 20 km Number of meshes 129 x 129
Number of Vertical Layers	60 layers	36 layers
Lateral Boundary Conditions	N/A, as this is a global scale mode.	Climate model for Asia



Coupled Atmosphere-Ocean-Sea Ice Model for the Earth Simulator (CFES)

Spatial resolution:
[Atmosphere] 280km x 280km 30 layers
[Ocean] latitude 2.5° / longitude 0.5-2°
23 layers

Regional climate model for Asia
60km x 60km
36 layers

Regional climate model for Japan
20km x 20km
36 layers

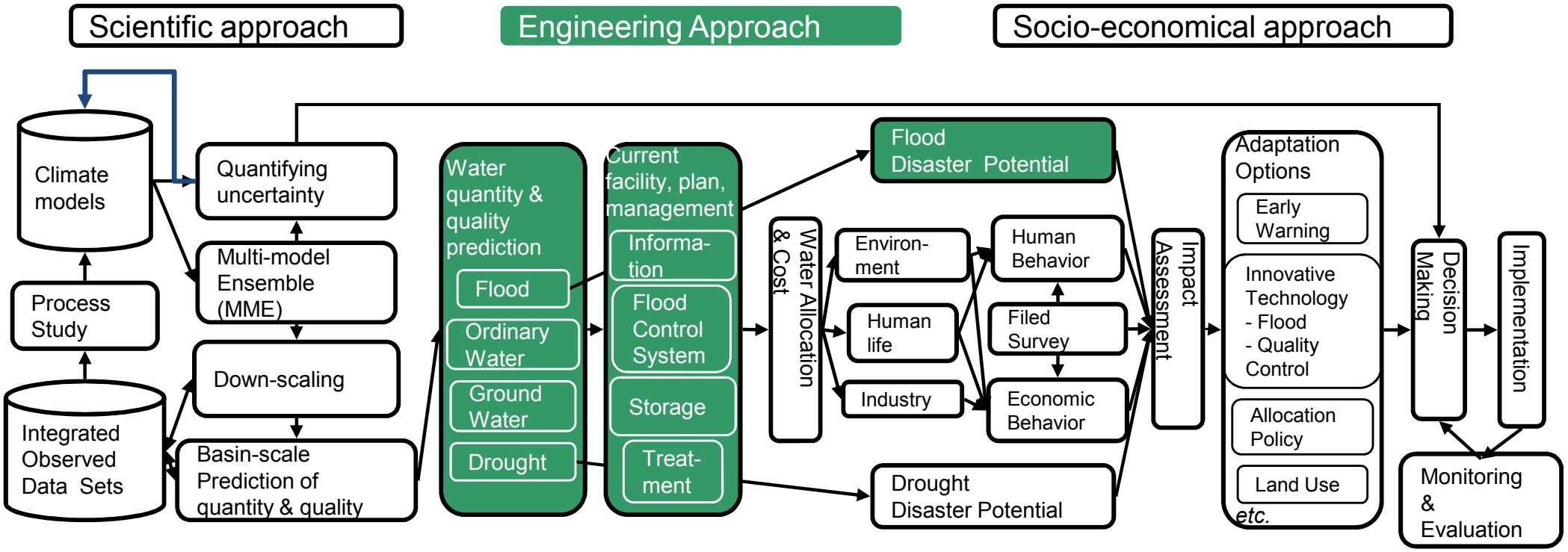
Concept of boundary conditions of RCM20

Source: The figure is created based on "*Ijo-kisho (Extreme Climate)* Report 2005" published by Japan Meteorological Agency.

Structure of the Flexible Approach (2-3)

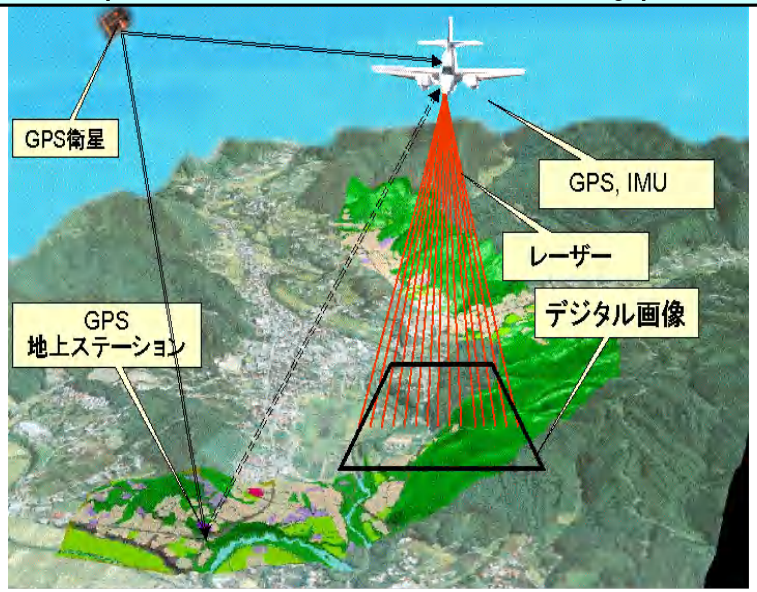
E to E Approach – Engineering Approach -

Source: Prof. Toshio KOIKE (University of Tokyo)

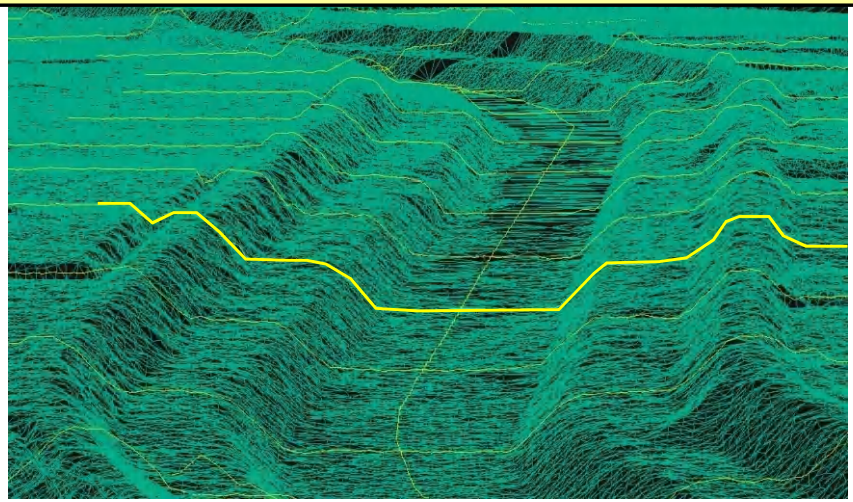


Data survey to risk assessment (with remote sensing)

3D topographic data acquisition (Airborne Laser Survey)

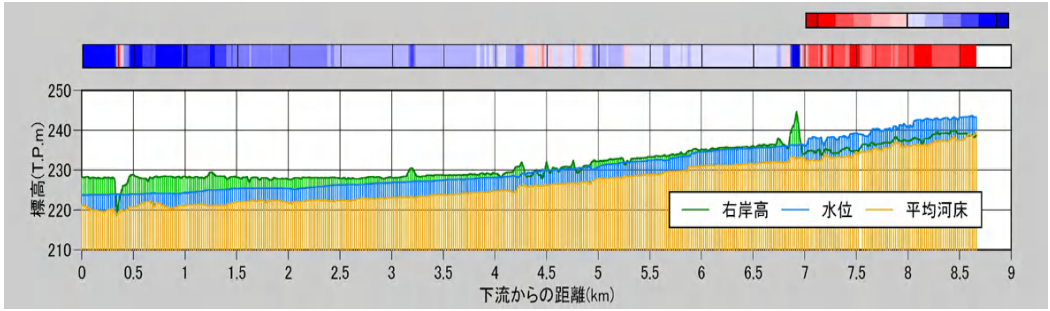


Delineation of cross sections of river channels

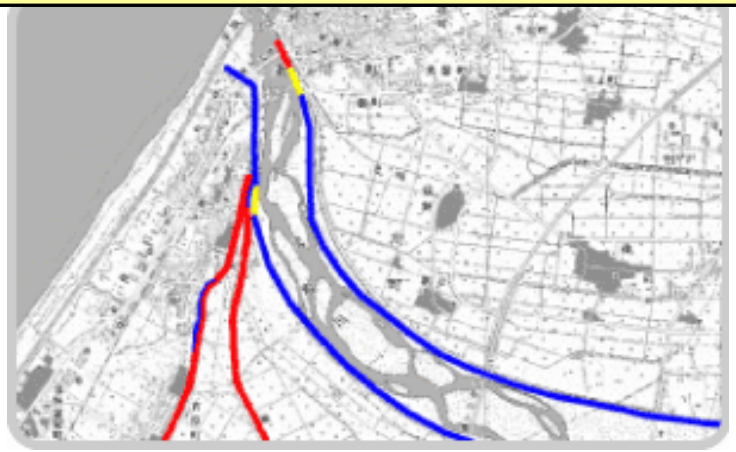


Hydrologic flood runoff calculation

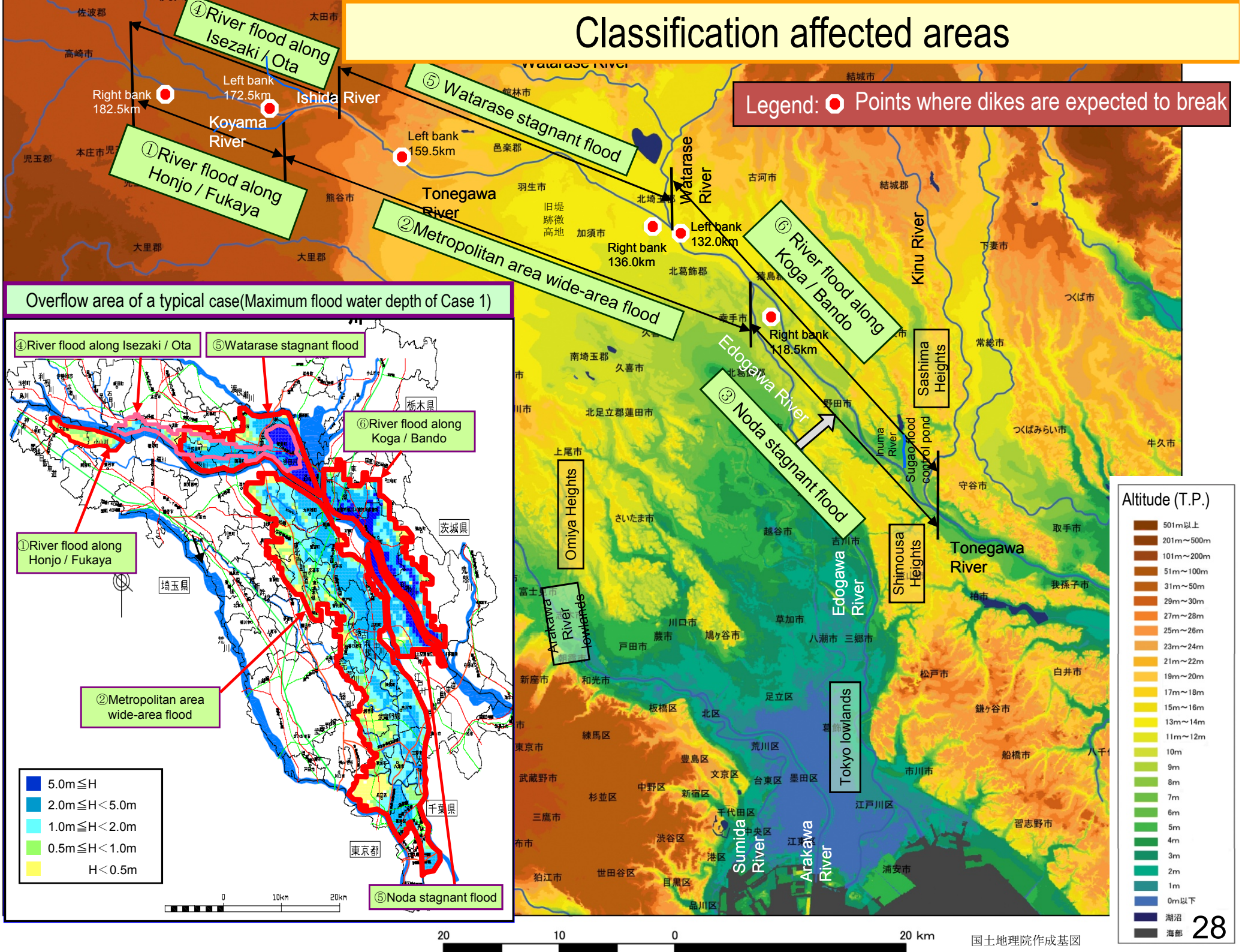
Hydraulic water level calculation



Evaluation of flow capacity of each section of small-and-medium-scale rivers



Classification affected areas



国土地理院作成基図

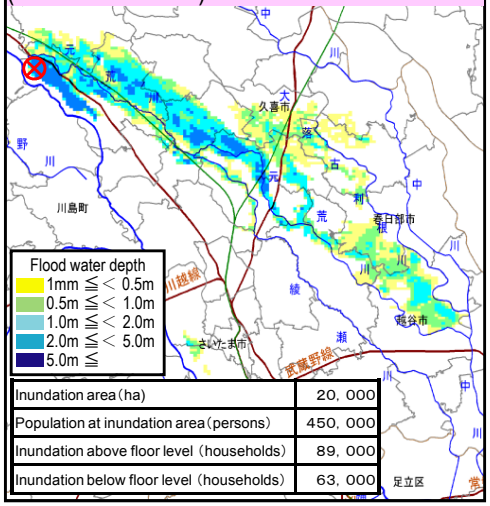
Case 1: Maximum flood water depth for each flood pattern

No pump operation; no fuel supply; no floodgate operation; no pumper truck available;

Once every 200 years

(1) Moto Arakawa River wide area flood

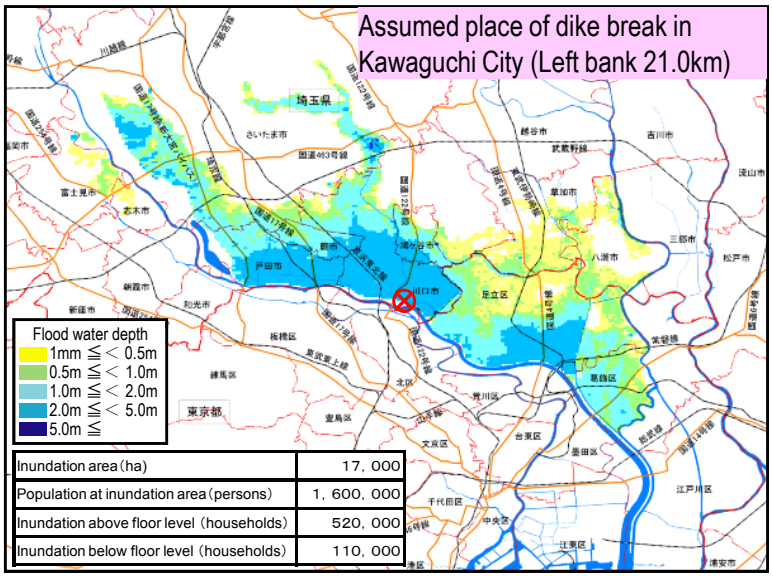
Assumed place of dike break:In Konosu City (Left bank 70.0km)



Inundation area (ha)	20, 000
Population at inundation area (persons)	450, 000
Inundation above floor level (households)	89, 000
Inundation below floor level (households)	63, 000

②-1 Arakawa River left bank lowlands flood (Highest water level for Naka and Ayase Rivers)

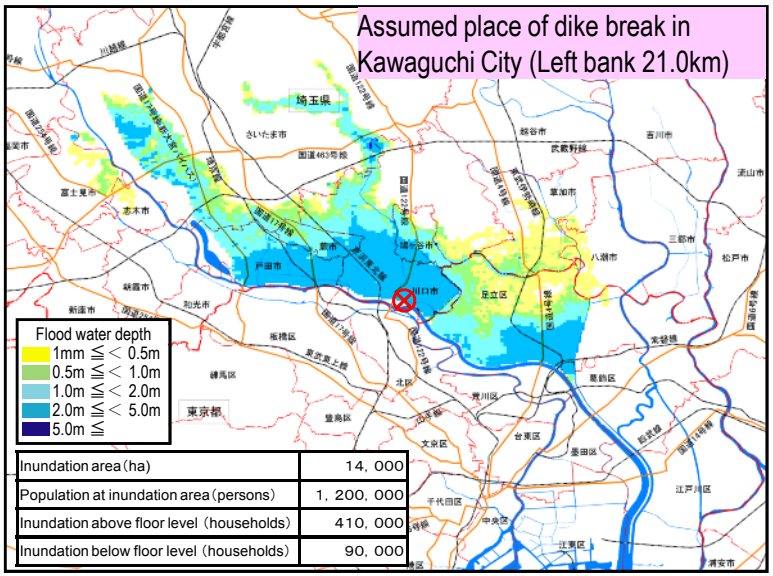
Assumed place of dike break in Kawaguchi City (Left bank 21.0km)



Inundation area (ha)	17, 000
Population at inundation area (persons)	1, 600, 000
Inundation above floor level (households)	520, 000
Inundation below floor level (households)	110, 000

②-2 Arakawa River left bank lowlands flood (Normal water level for Naka and Ayase Rivers)

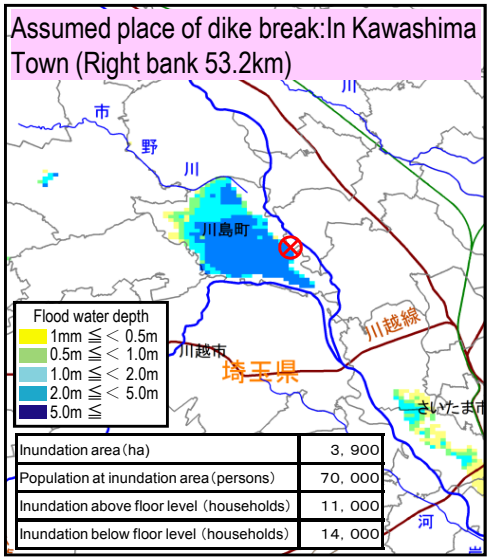
Assumed place of dike break in Kawaguchi City (Left bank 21.0km)



Inundation area (ha)	14, 000
Population at inundation area (persons)	1, 200, 000
Inundation above floor level (households)	410, 000
Inundation below floor level (households)	90, 000

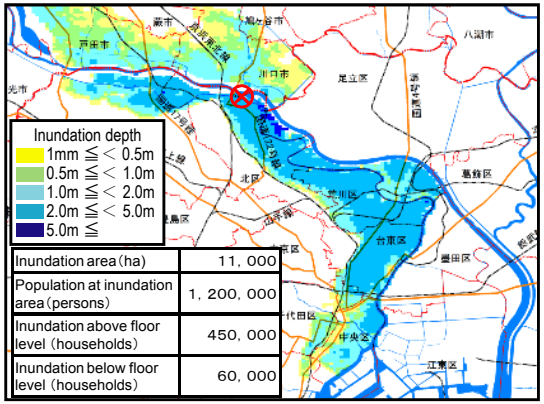
③ Iruma River confluence upstream flood

Assumed place of dike break:In Kawashima Town (Right bank 53.2km)



Inundation area (ha)	3, 900
Population at inundation area (persons)	70, 000
Inundation above floor level (households)	11, 000
Inundation below floor level (households)	14, 000

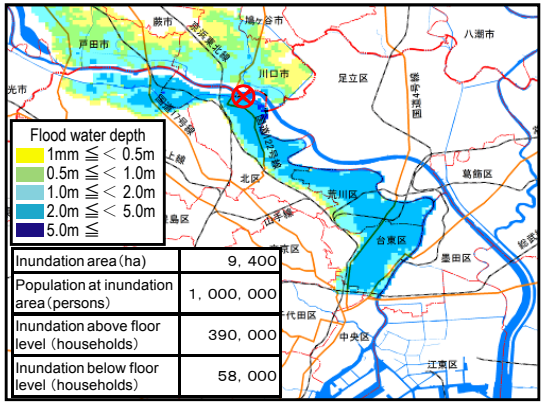
④-1 Arakawa River right bank lowlands flood (Highest water level for Sumida, Kanda, and Nihonbashi Rivers)



Inundation area (ha)	11, 000
Population at inundation area (persons)	1, 200, 000
Inundation above floor level (households)	450, 000
Inundation below floor level (households)	60, 000

Assumed place of dike break in Kita City (Right bank 21.0km)

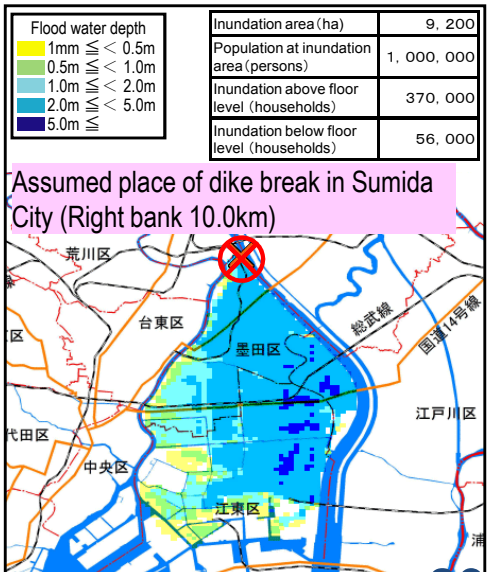
④-2 Arakawa River right bank lowlands flood (Normal water level for Sumida, Kanda, and Nihonbashi Rivers)



Inundation area (ha)	9, 400
Population at inundation area (persons)	1, 000, 000
Inundation above floor level (households)	390, 000
Inundation below floor level (households)	58, 000

Assumed place of dike break in Kita City (Right bank 21.0km)

⑤ Koto delta stagnant flood



Inundation area (ha)	9, 200
Population at inundation area (persons)	1, 000, 000
Inundation above floor level (households)	370, 000
Inundation below floor level (households)	56, 000

Assumed place of dike break in Sumida City (Right bank 10.0km)

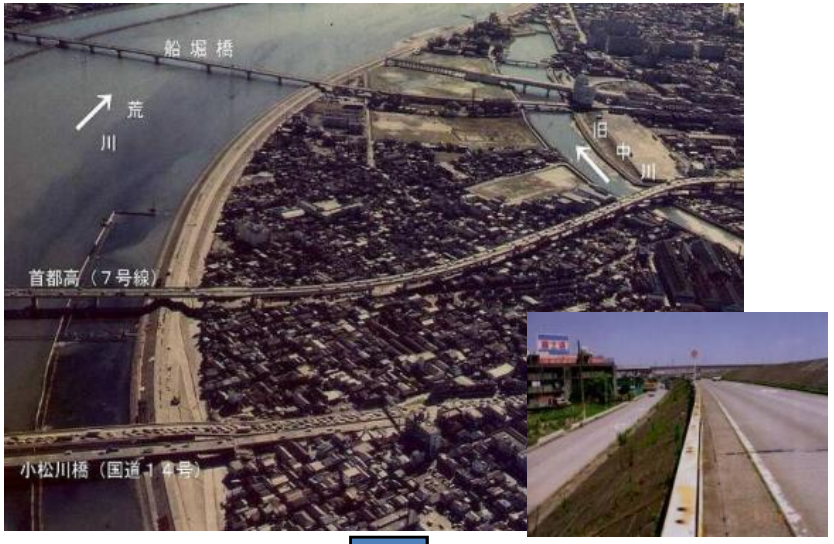
⊗ Points where dikes are expected to break

Adaptation measures : structure

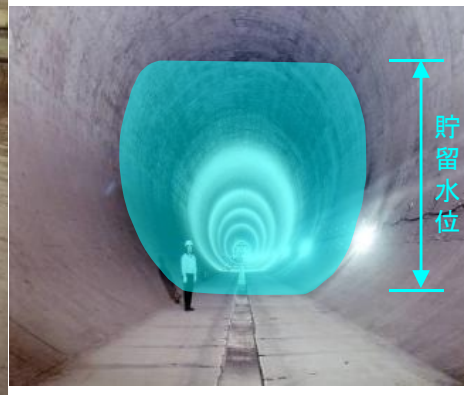
Development of storage capacity and river discharge

Storage capacity in watershed (Dam)

River discharge secured (Super Levee)



Storage capacity in flood prone area (Tunnel)

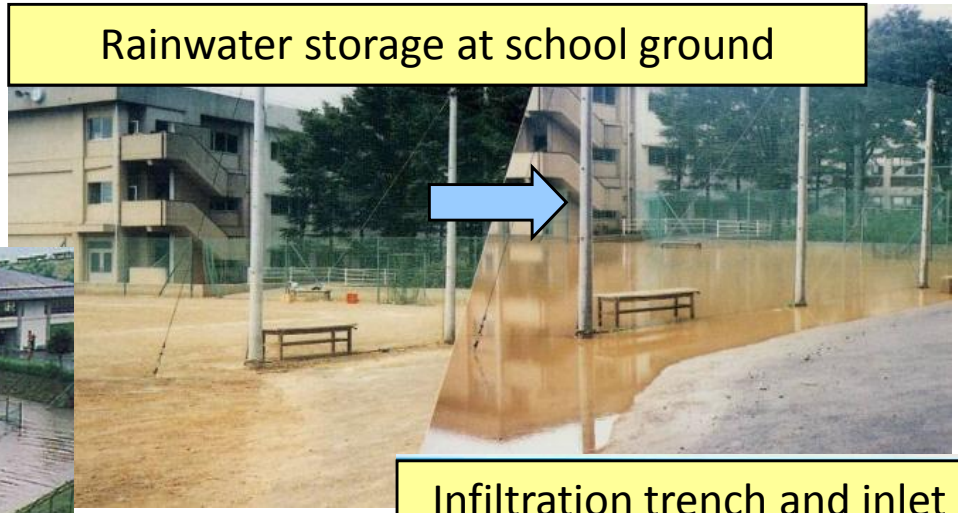


Adaptation measures : structure

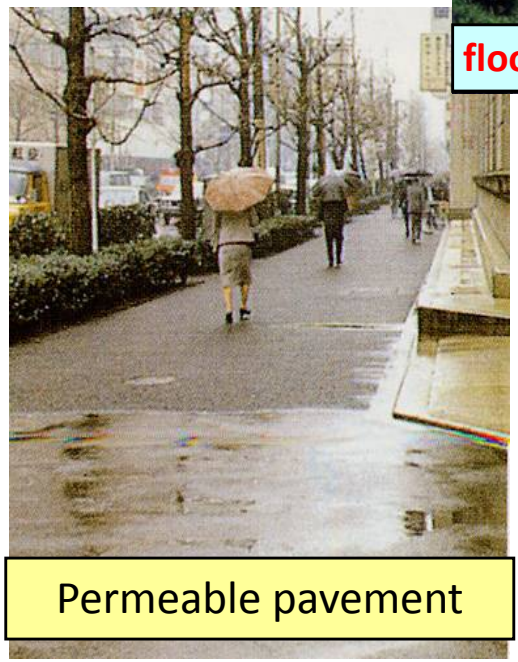
Reduction of runoff, with facilities in river basin

Storage facilities

Rainwater storage at school ground



Infiltration trench and inlet



Permeable pavement

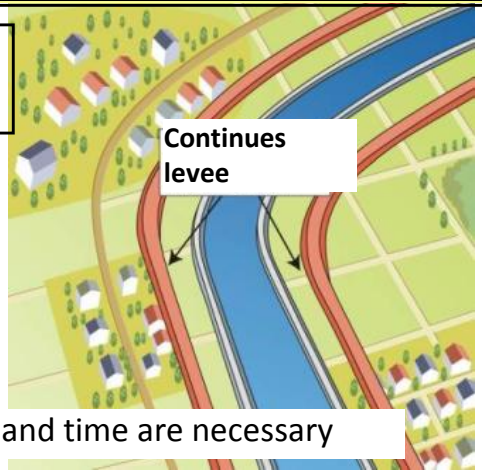
Rainwater storage at residential area

Adaptation measures : combination

Options of flood management measures in coping with land use regulation

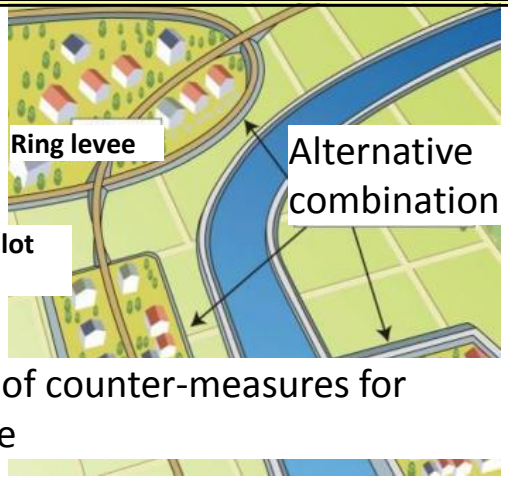
Option of land use and flood control stractures' combination

Conceptual Maps (A)



Cost and time are necessary

Conceptual Maps (B)



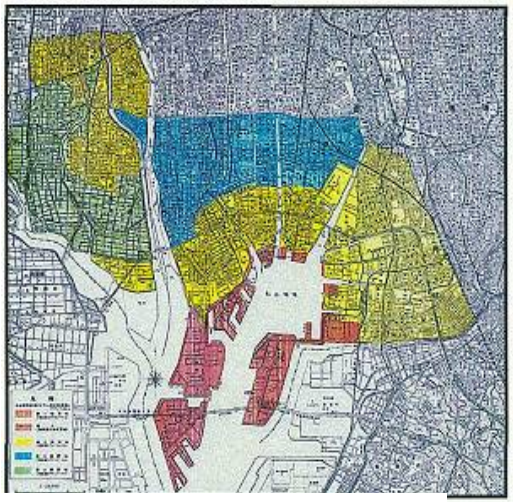
Configuration of counter-measures for climate change

Land use regulation: designation of disaster hazard areas (DHA)

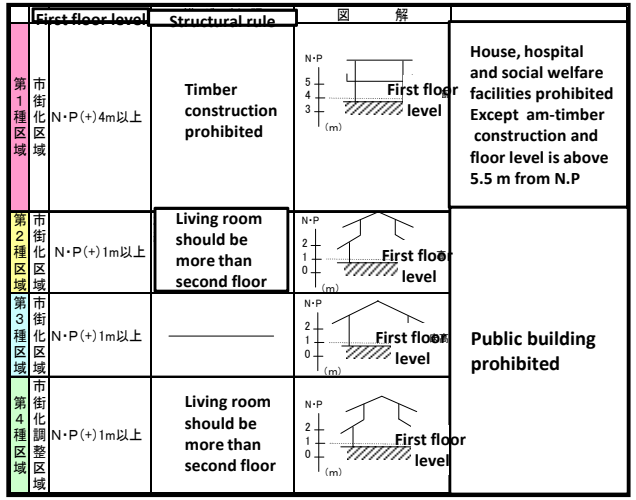
Building code in DHA

Article 39 A local government can, in an ordinance, designate an area prone to tsunami, storm surge, and flood as disaster hazard area.

2 Necessary conditions, such as prohibition of building houses or other restrictions in DHA should be specified under the previous item.



Hazard map in costal area, Nagoya city



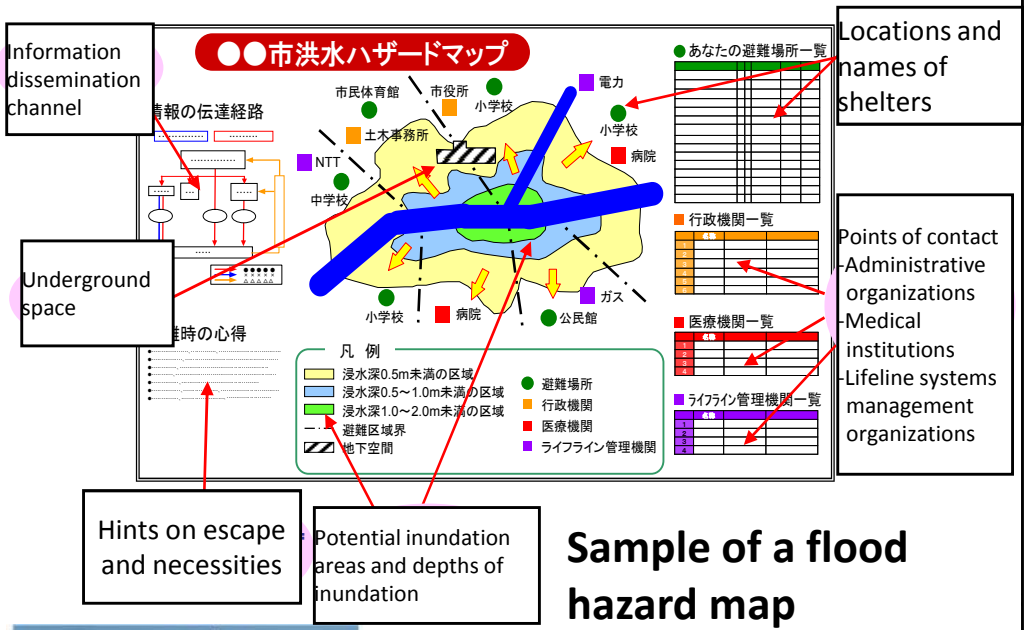
		First floor level	Structural rule	図 解	
第1種区域	市街化区域	N・P(+)4m以上	Timber construction prohibited	N・P 5 4 3 (m) First floor level	House, hospital and social welfare facilities prohibited Except am-timber construction and floor level is above 5.5 m from N.P
第2種区域	市街化区域	N・P(+)1m以上	Living room should be more than second floor	N・P 2 1 0 (m) First floor level	
第3種区域	市街化区域	N・P(+)1m以上		N・P 2 1 0 (m) First floor level	Public building prohibited
第4種区域	市街化調整区域	N・P(+)1m以上	Living room should be more than second floor	N・P 2 1 0 (m) First floor level	

Example of building code, Nagoya

Adaptation measures : non-structure

River Information in real-time and advance for crisis management

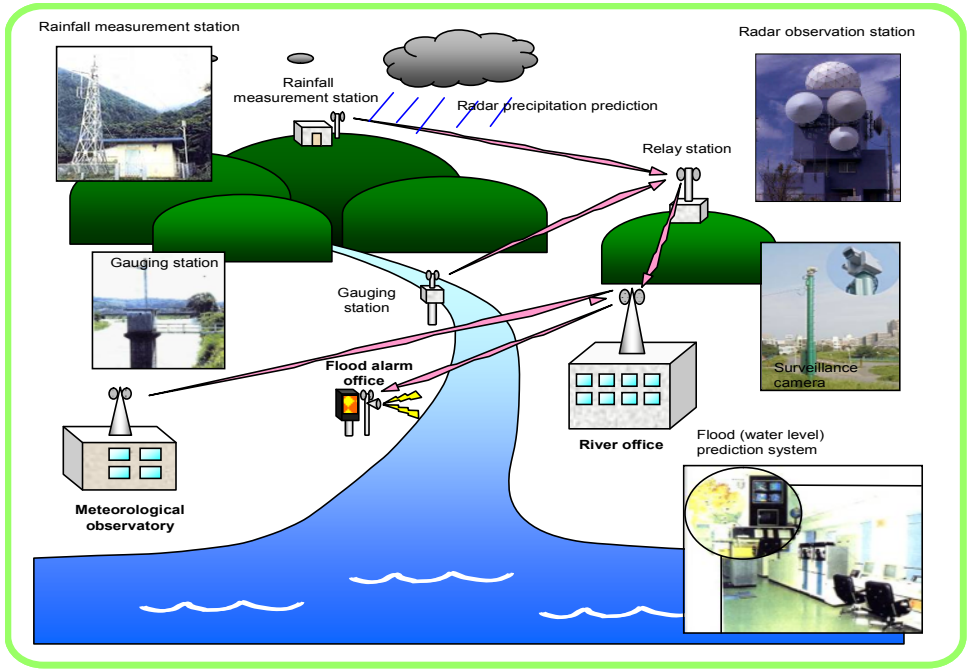
Flood information for preparedness



Sample of a flood hazard map

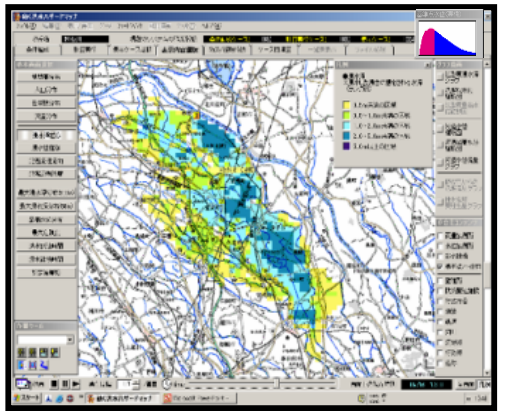
Flood universal signs

Share real-time information



Mobile Phone

TV

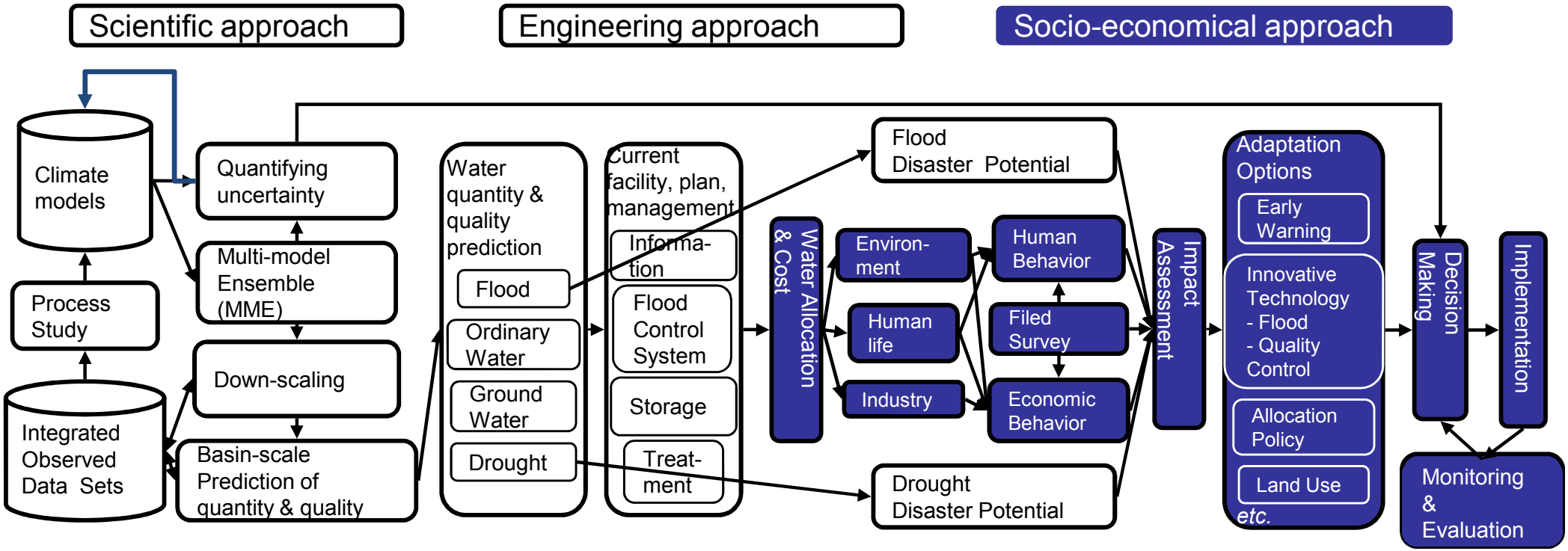


Internet

Structure of the Flexible Approach(2-4)

E to E Approach - Socio-economic approach -

Source: Prof. Toshio KOIKE (University of Tokyo)

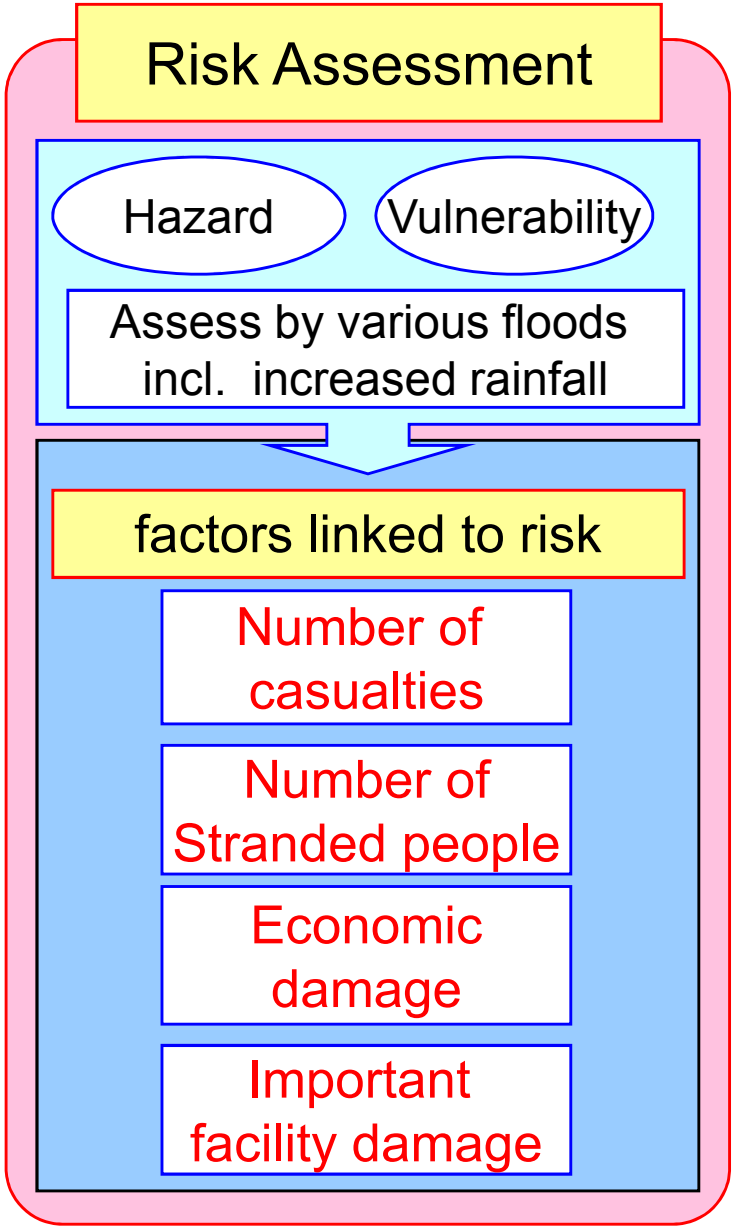


Evaluation of adaptation measures based on risk management

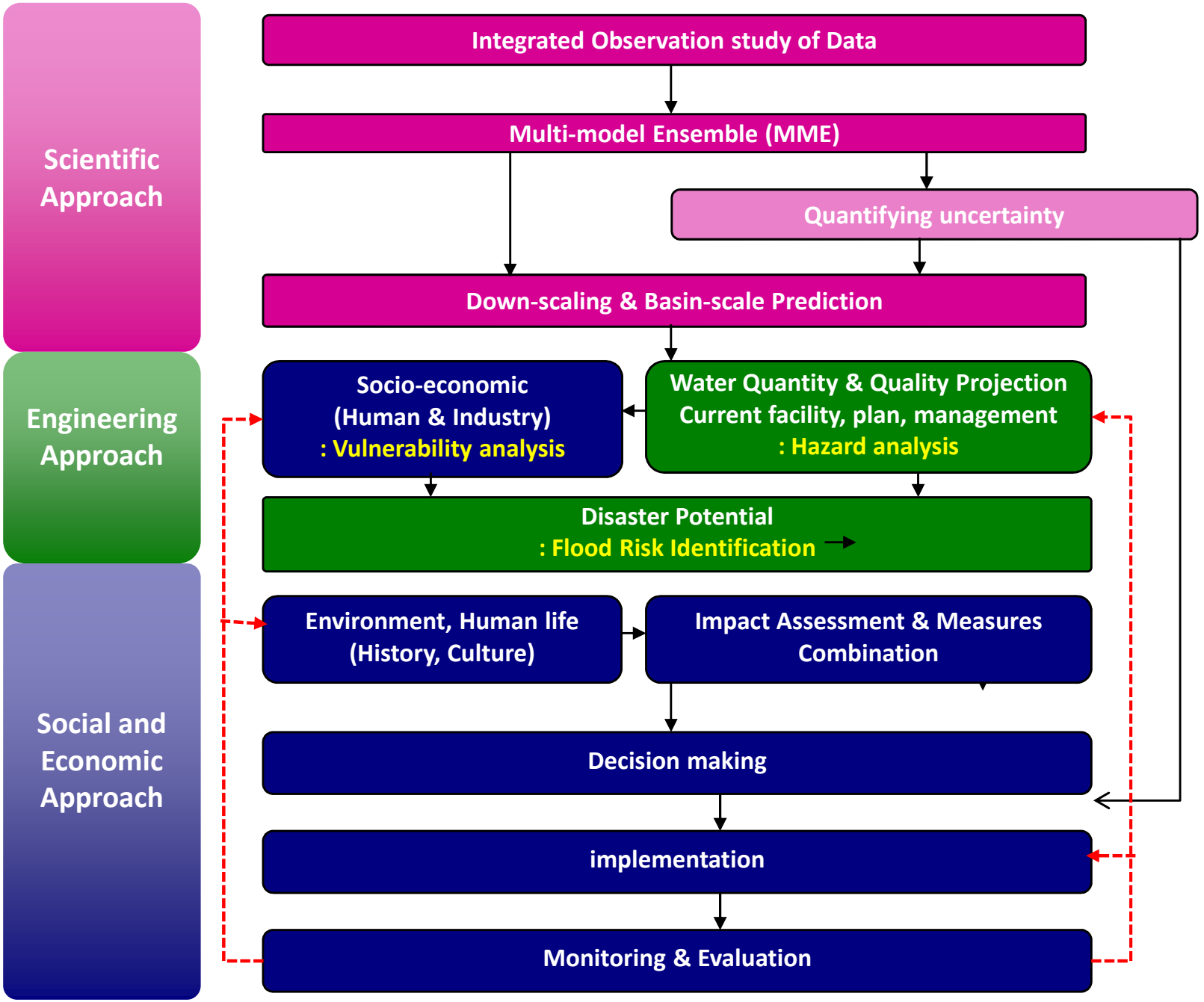
- Hazard; rainfall intensity, sea level raise and flood discharge and water level
- Vulnerability; current safety level, land use, population (elderly ratio) and important infrastructure in expected inundation area

Identification of flood risk based on damage factors considering flood damages by the hazards and with the vulnerabilities by various type & scale of floods

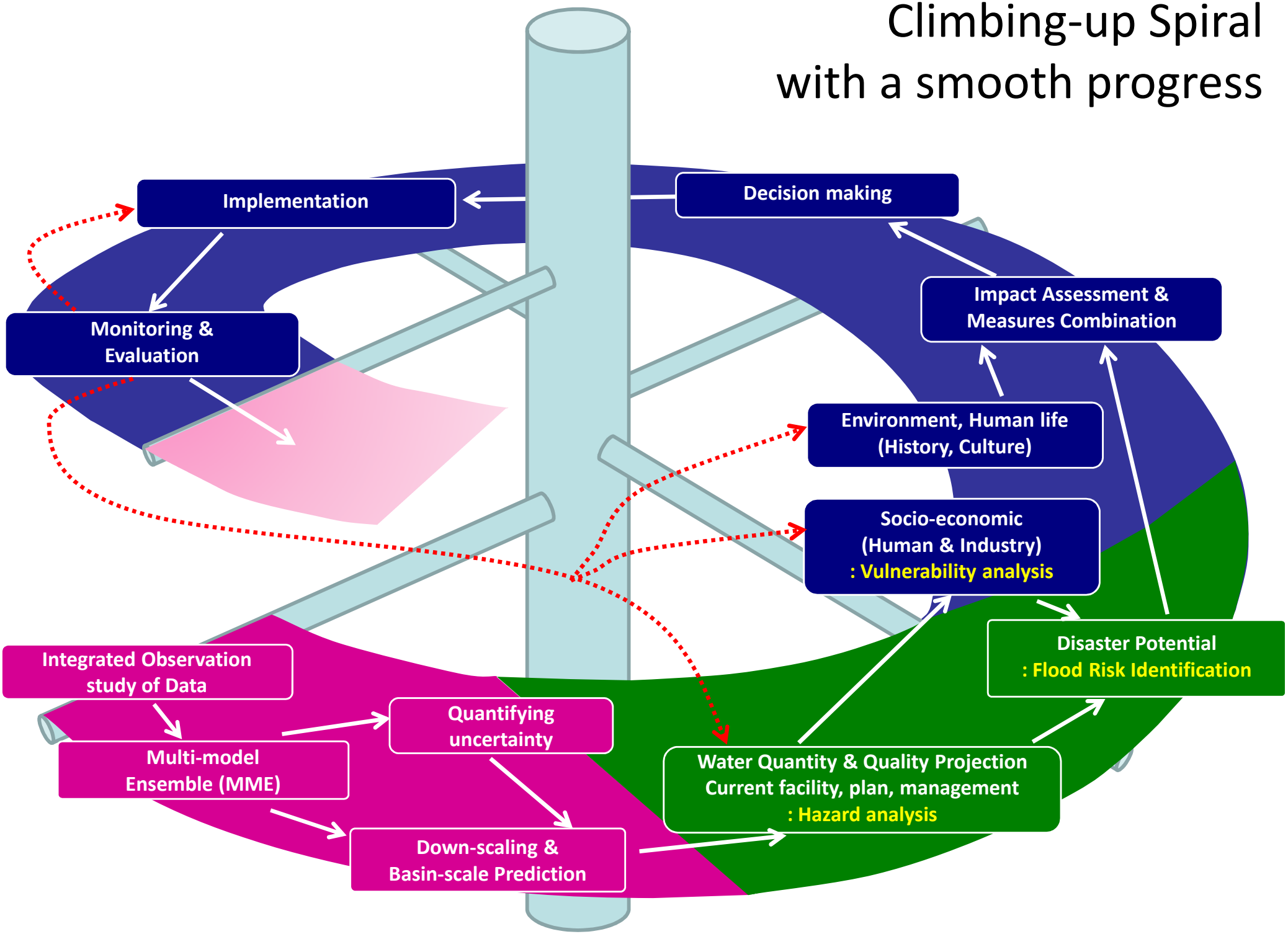
… for optimization selection and combination of adaptation measures



End to End Approach on Climate Change Adaptation Procedure for Flood Risk Management



Climbing-up Spiral with a smooth progress



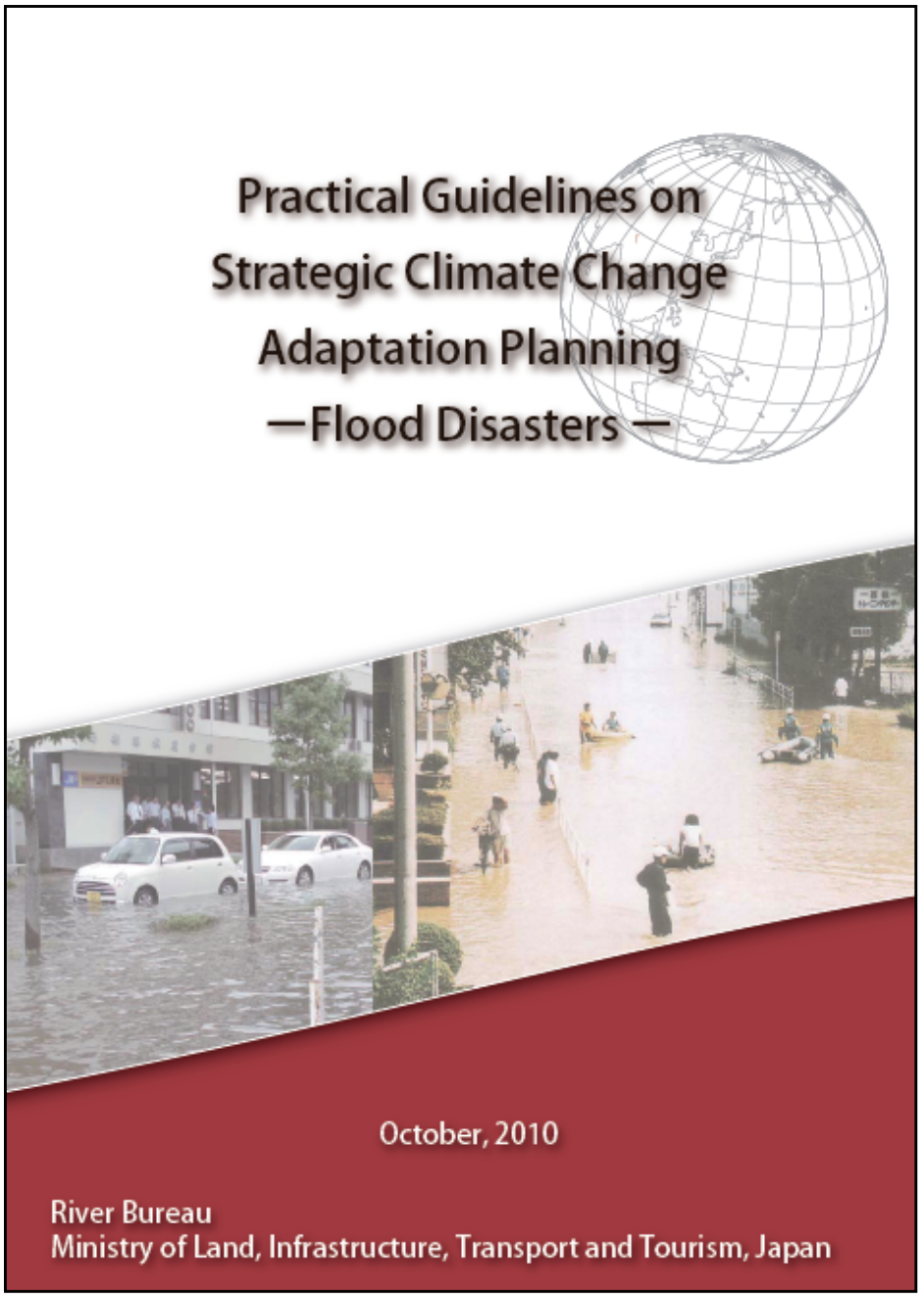
Approach on Climate Change Adaptation Procedure for Flood Risk Management based on the experiences in Japan

Scientific Approach

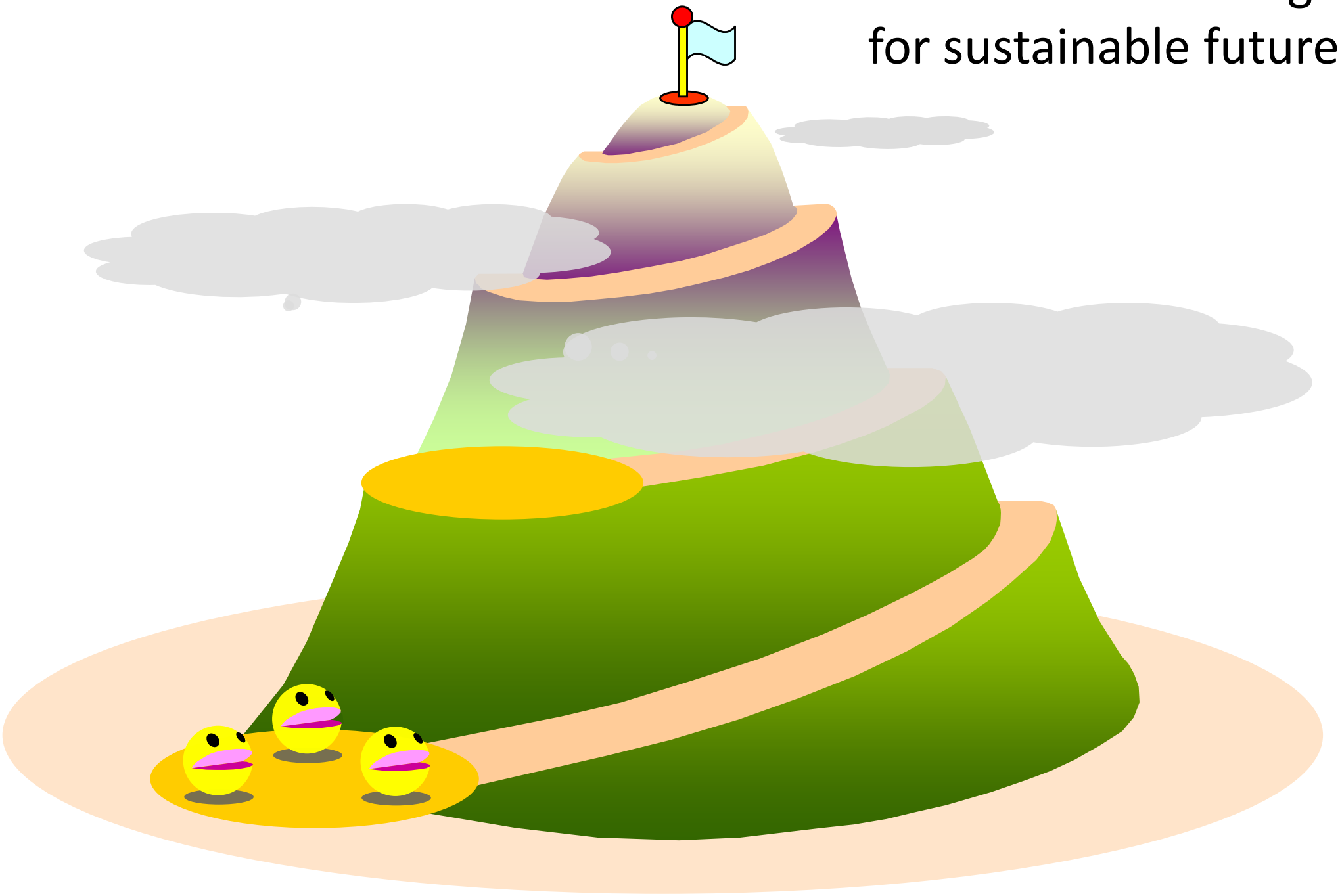
Engineering Approach

Social and Economic Approach

Contents of the Guidelines



Overcoming uncertainty of the Climate Change for sustainable future



Thank you very much for your attention!!

Visit our WEB site:

<Guideline :>

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

(to be updated soon)

<Policy Report for

Climate Change Adaptation Strategies to Cope with Water-related Disasters due to Global Warming>

[full report]

http://www.mlit.go.jp/river/basic_info/jigyo_keikaku/gaiyou/kikouhendou/pdf/draftpolicyreport.pdf

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