Technology Transfer of Climate Change Adaptation in Water Sector

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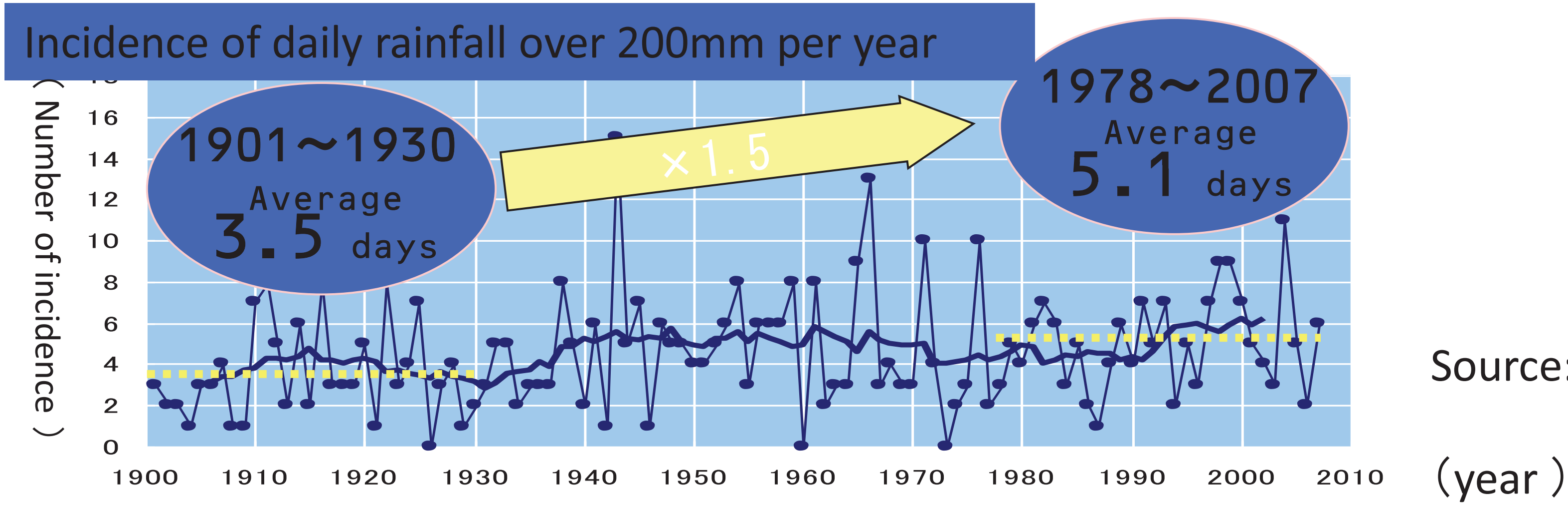
1. What’s happened in Japan?
How to adapt?

Recent change on Climate in Japan

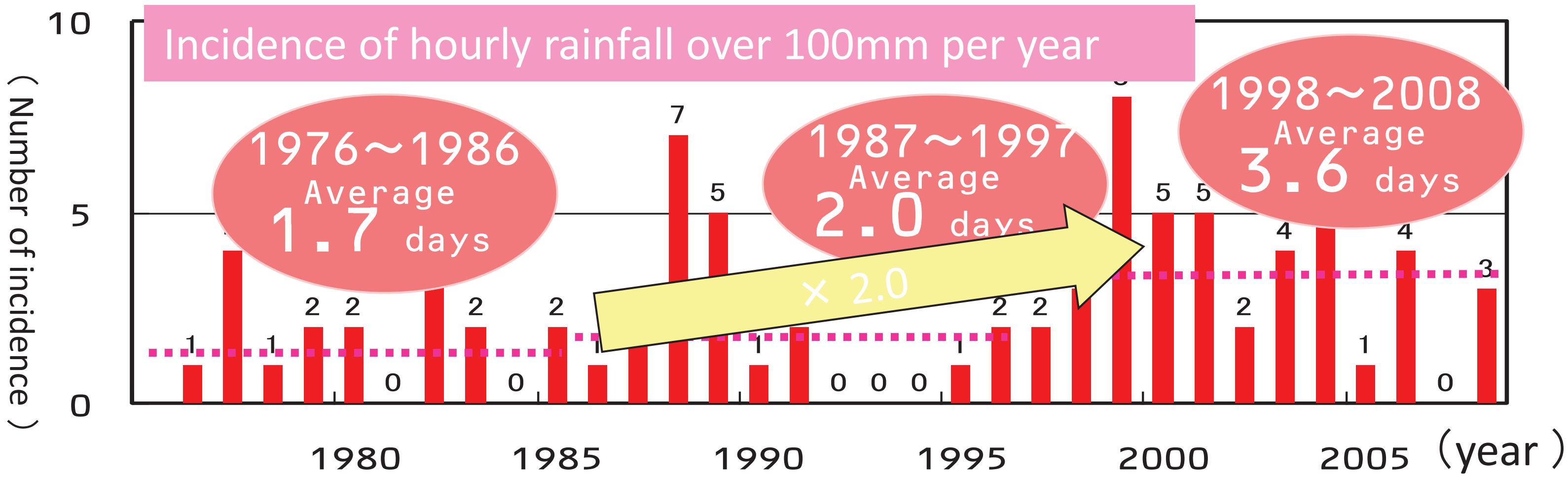
国土交通省

Daily rainfall over 200mm is significantly increasing



Source: JMA

Hourly rainfall over 100mm is increasing



Projection of future Climate

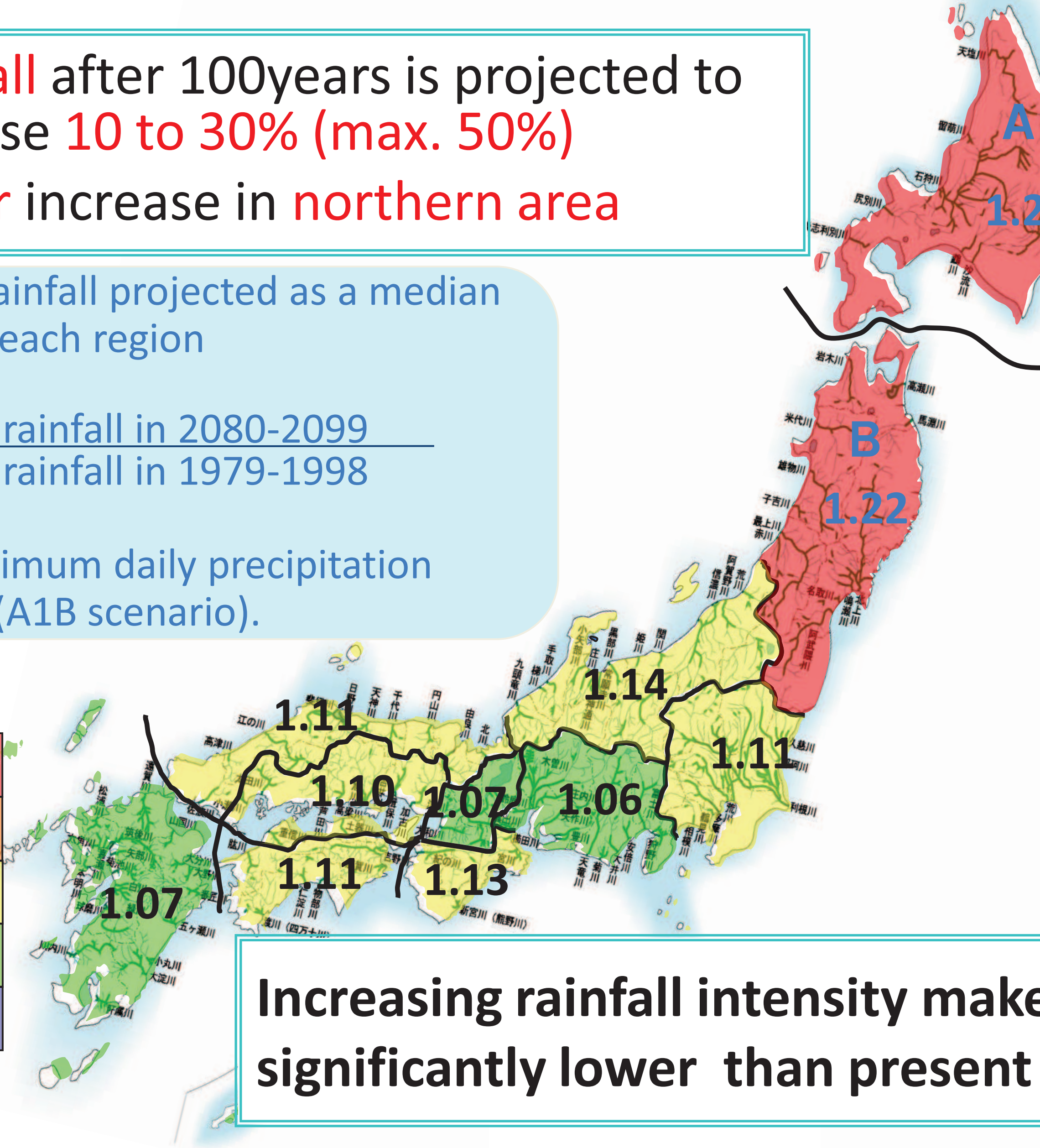
国土交通省

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

Future rainfall projected as a median value in each region

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

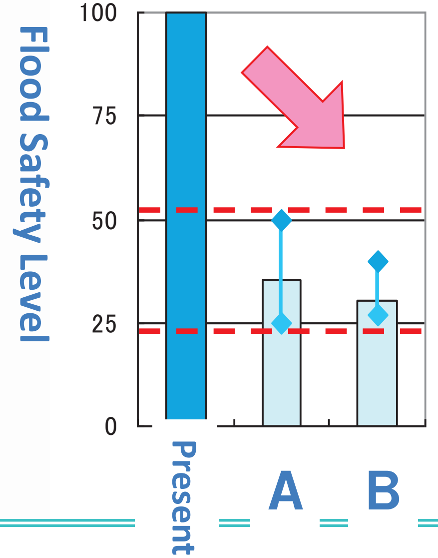
The maximum daily precipitation GCM20 (A1B scenario).



Legend

1.20～1.25
1.15～1.20
1.10～1.15
1.05～1.10
1.00～1.05

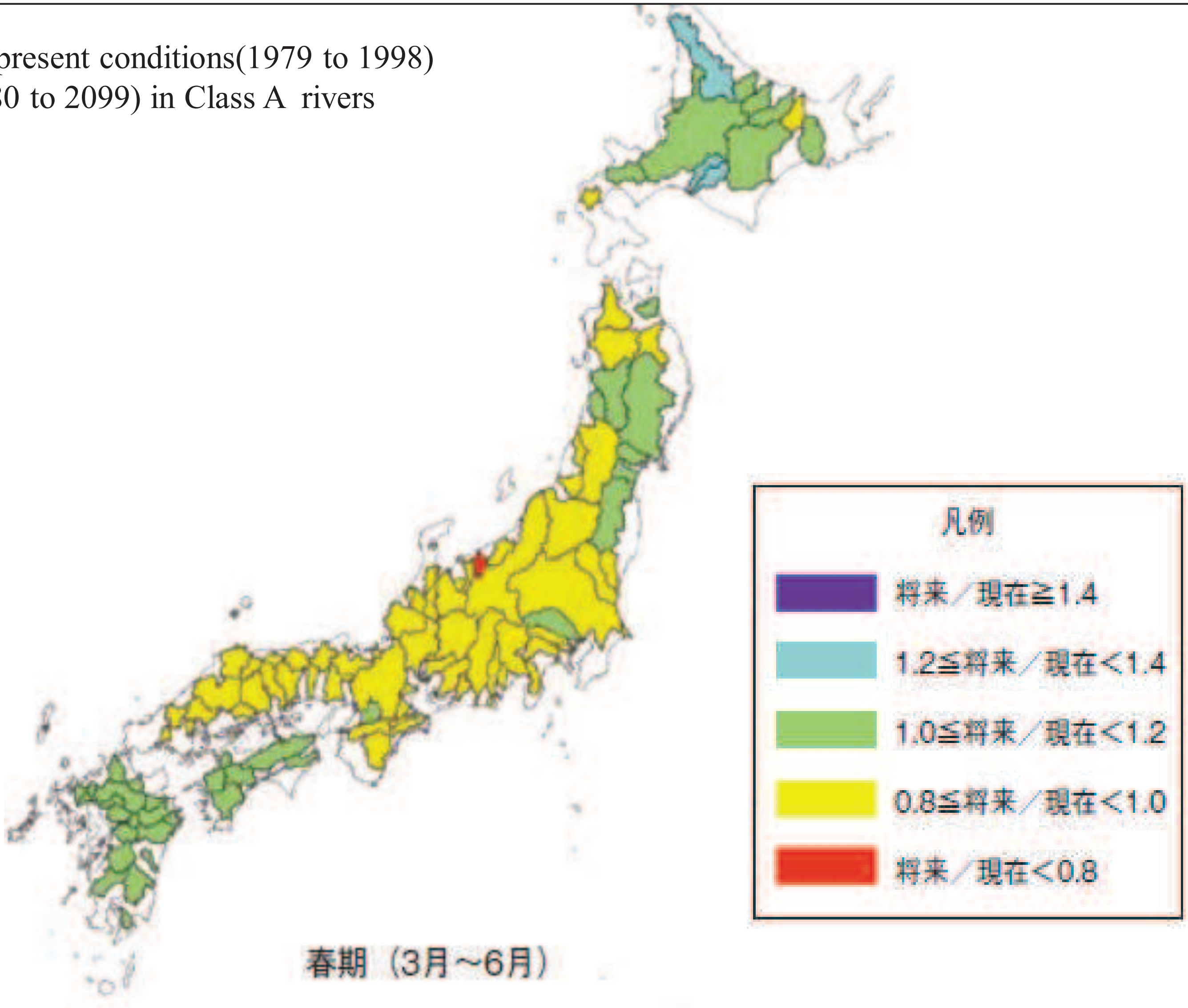
Decline of flood safety level



Increasing rainfall intensity make flood safety level significantly lower than present

After 100 years, rainfall decrease in March - June

Comparison between present conditions(1979 to 1998)
and future rainfall(2080 to 2099) in Class A rivers

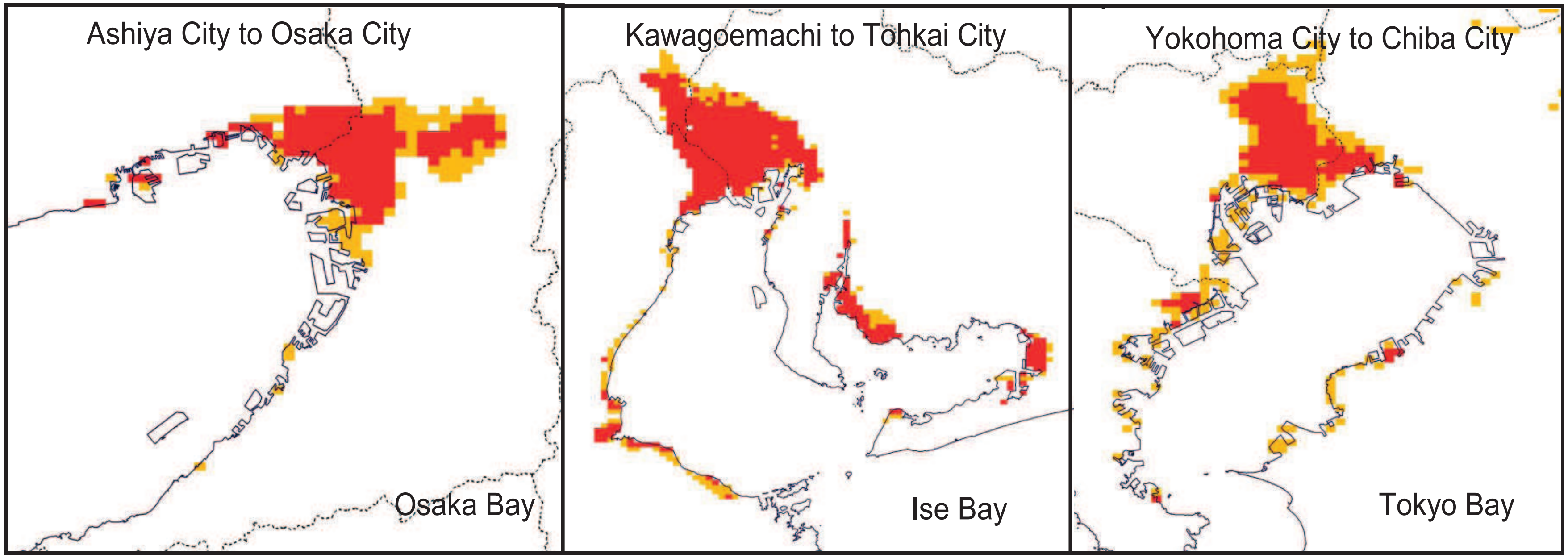


Source: Water Resources in Japan 2007, Land and Water Bureau, Ministry of Land, Infrastructure and Transport

Increase of areas below sea level, and of inundation risks　沿岸災害リスク

Increases of below-sea-level areas in three large metropolitan areas (Tokyo-Yokohama, Nagoya, and Osaka-Kobe)

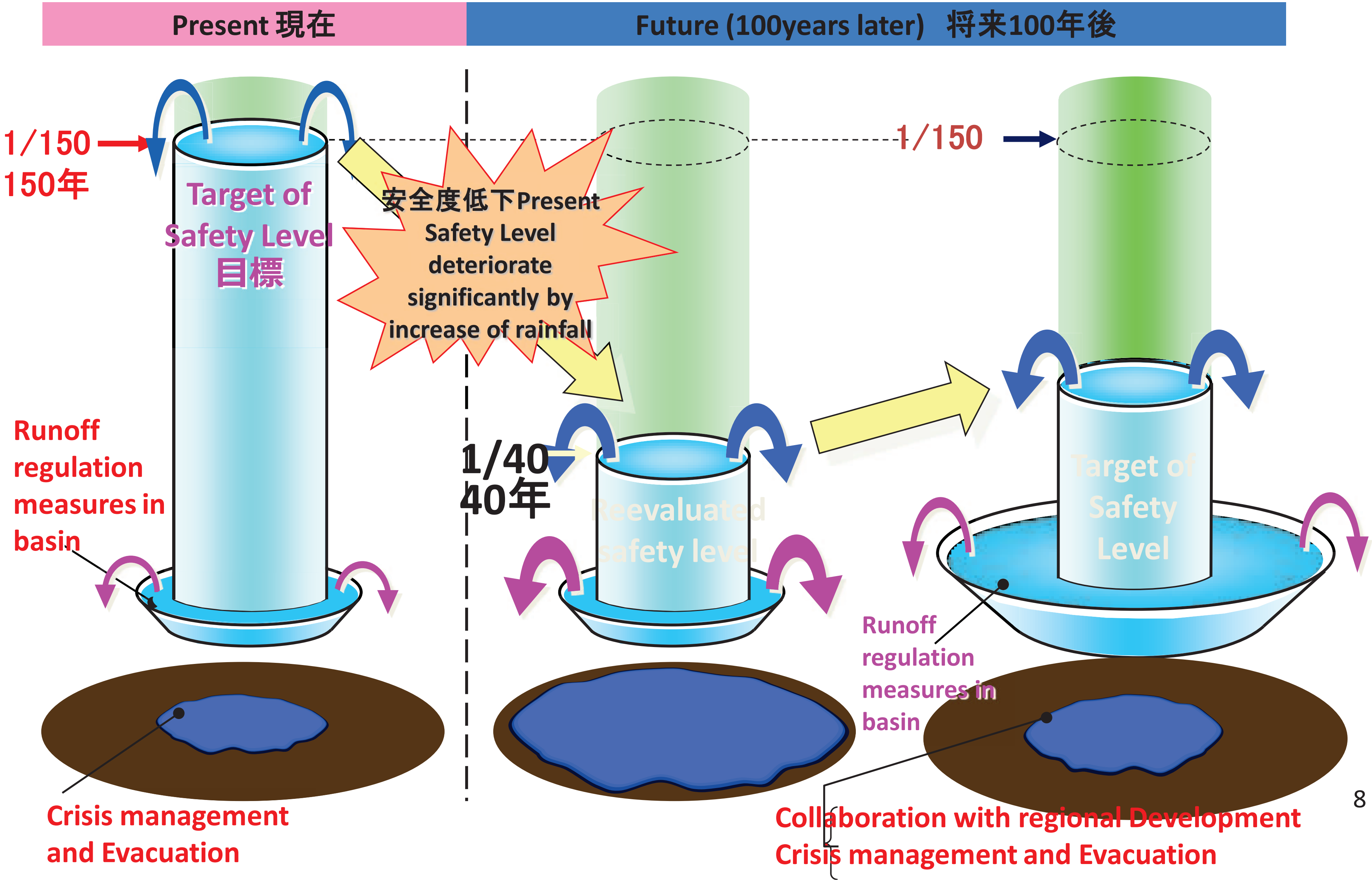
Increasing areas with flood risks



	Current	Prediction	X
Area (km²)	577	879	1.5
Population (,000)	40.4	59.3	1.5

*Prepared by the River Bureau based on the national land-use digital information.
*Shown are the areas at elevations lower than sea level shown in a three-dimensional mesh (1 km x 1 km). Total area and population are based on three-dimensional data.
*No areas of surfaces of rivers or lakes are included.
*A premium of 60% is applied to the potential flood risk area and to the population vulnerable to flood risk in the case with a one-meter rise of sea level.

Basic concept for managing increasing risks
- Multiple measures in flood management -



Recommendations

沿岸や低地では
in coastal and low-lying areas:

-豪雨と巨大台風の頻発　More frequent heavy rains and more intense typhoons

⇨ 水害の増加　Frequent and serious flood and sediment disasters

-海面上昇と台風　Sea level rise and more intense typhoons

⇨ 高潮、沿岸災害　Frequent and serious high tides and coastal erosions

-降雨と河川流量の変化　Wider range of variation of rainfall intensity and change of river flow

⇨ 渇水　Frequent and serious droughts

Recommendation Basic policy

1. 「犠牲者ゼロ」　Adaptation measures to achieve "zero casualty"
   「これまでは被害ゼロ」　Paradigm shift from "Zero damage"

2. 国家機能の麻痺を回避：　Keeping national functions
   首都圏など中枢機能
   In strategic centers, such as the Tokyo Metropolitan area,

2. What is adaptation in water sector?

Issues: “Stationarity is Dead”

(Milly et al., 2008)

☺ Conventional Method of Water Planning

Assumption: rainfall pattern fluctuate within unchanging envelope of variability

☹ Under changing and uncertain climate

✓ Climate is changing

Return period (ex. 100-year flood or 10-year drought) is never foundation of planning

✓ Prediction possible, but with uncertainty

New Designing methods of water infrastructures are needed

River bank heights, reserve capacity, bridge heights etc.

Furthermore……

“Stationarity is Dead”

Is flood Control Philosophy Dead, as well?

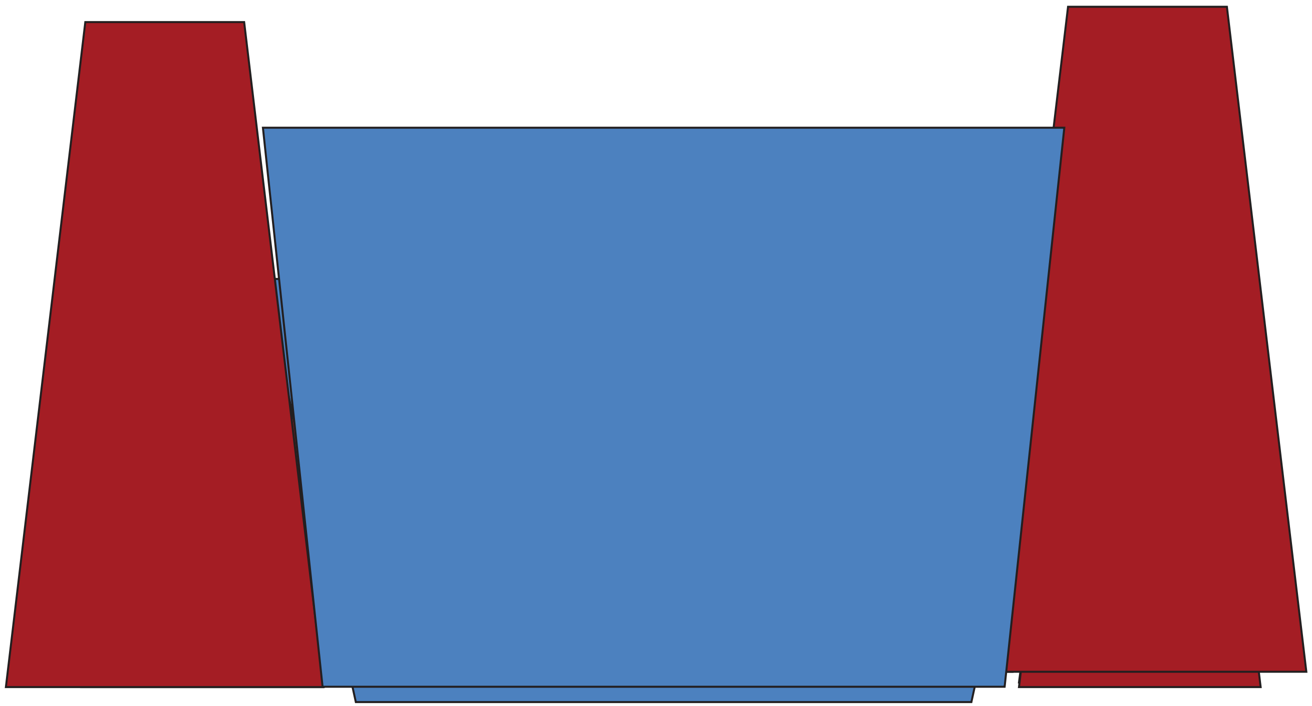
Source: MLIT

Can we continue to construct higher dykes according to increasing flood scale?

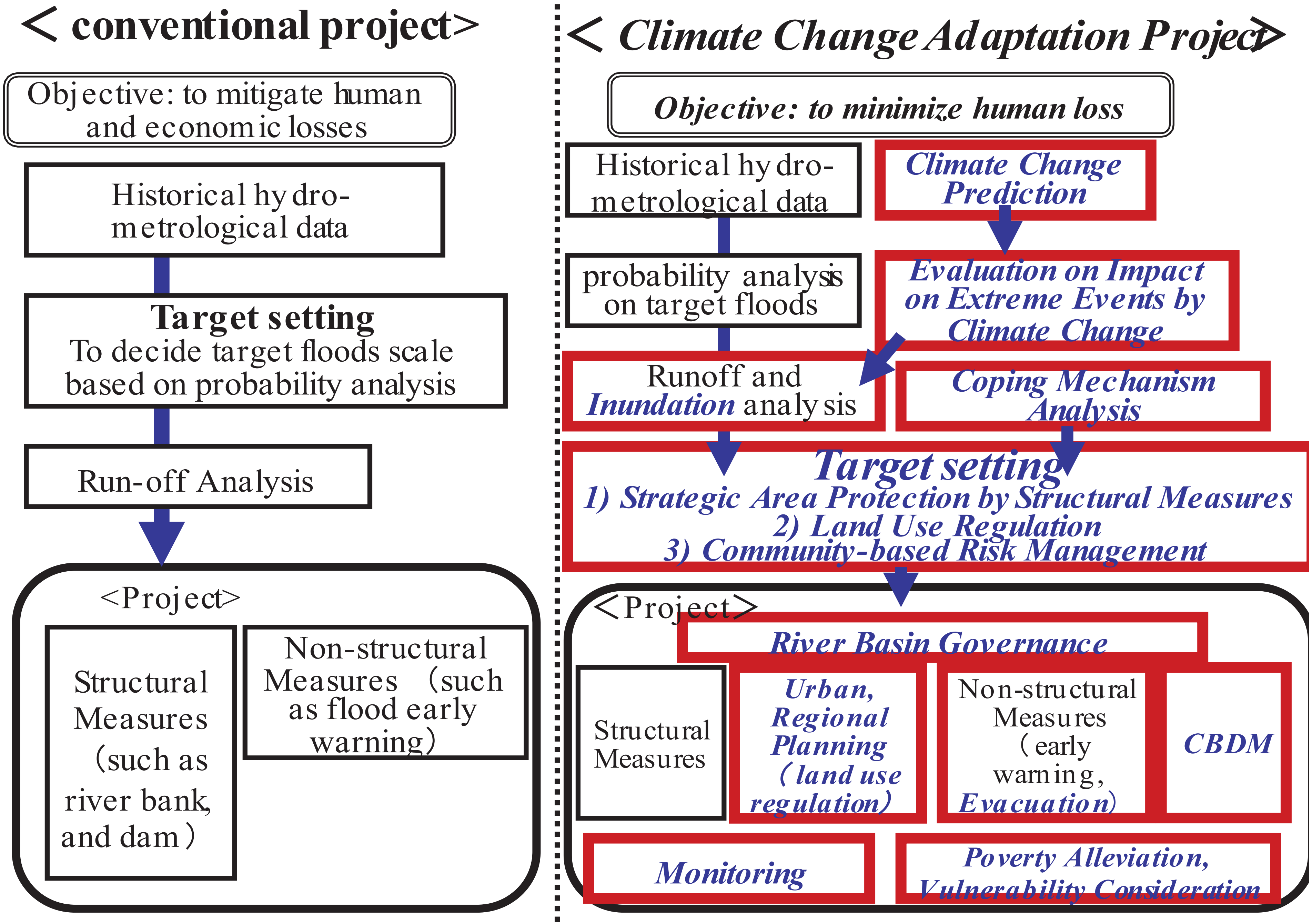
“Stationarity is Dead”

Is flood Control Philosophy Dead, as well?

Can we continue to construct higher dykes according to increasing flood scale?

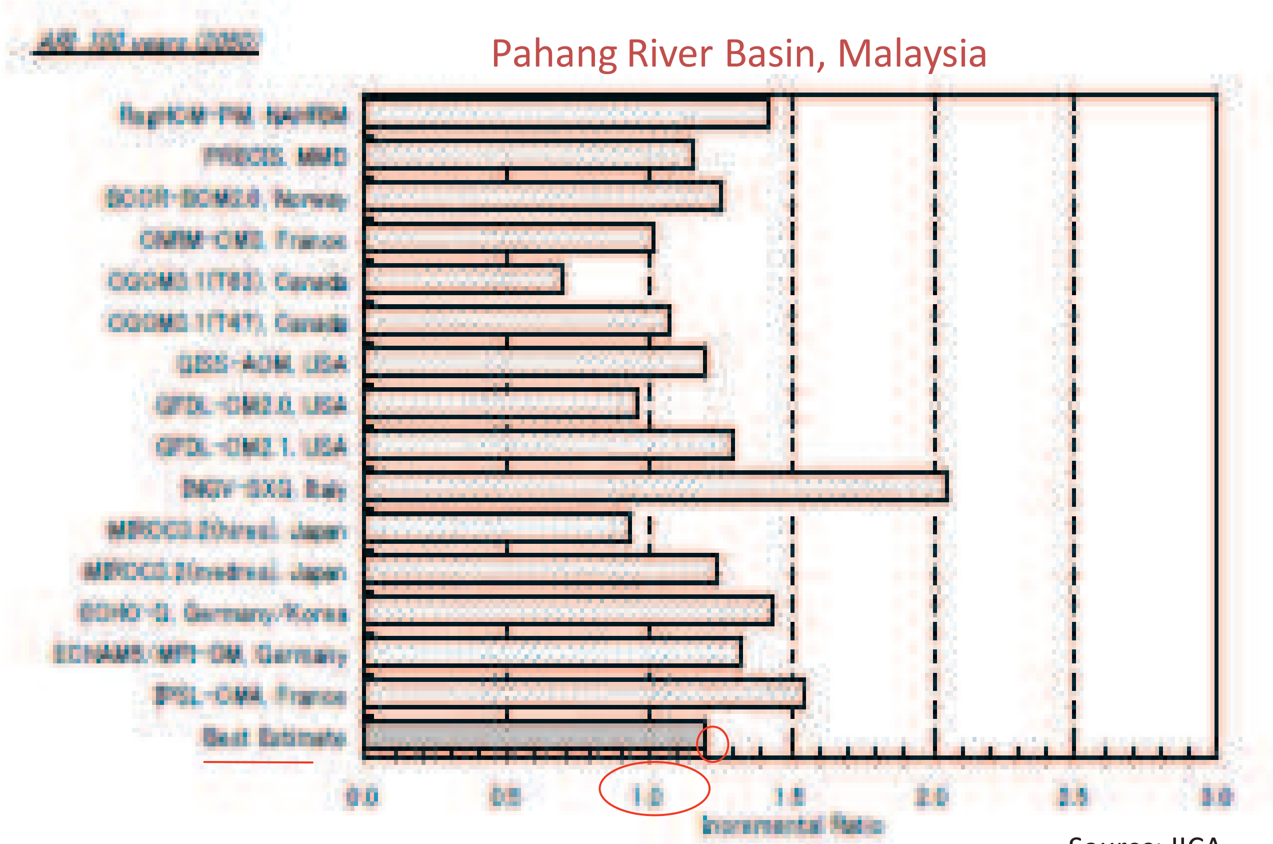


Proposed Method for CCA Planning



Climate change prediction
Impact on Extreme Event

- Once in 100 year rainfall in 2050
- Multi-model ensemble of GCM



Source: JICA

Case Study Tagoloan River Basin, the Philippines

- Catchments 1,778km2
- Precipitation 1,500-2,000mm

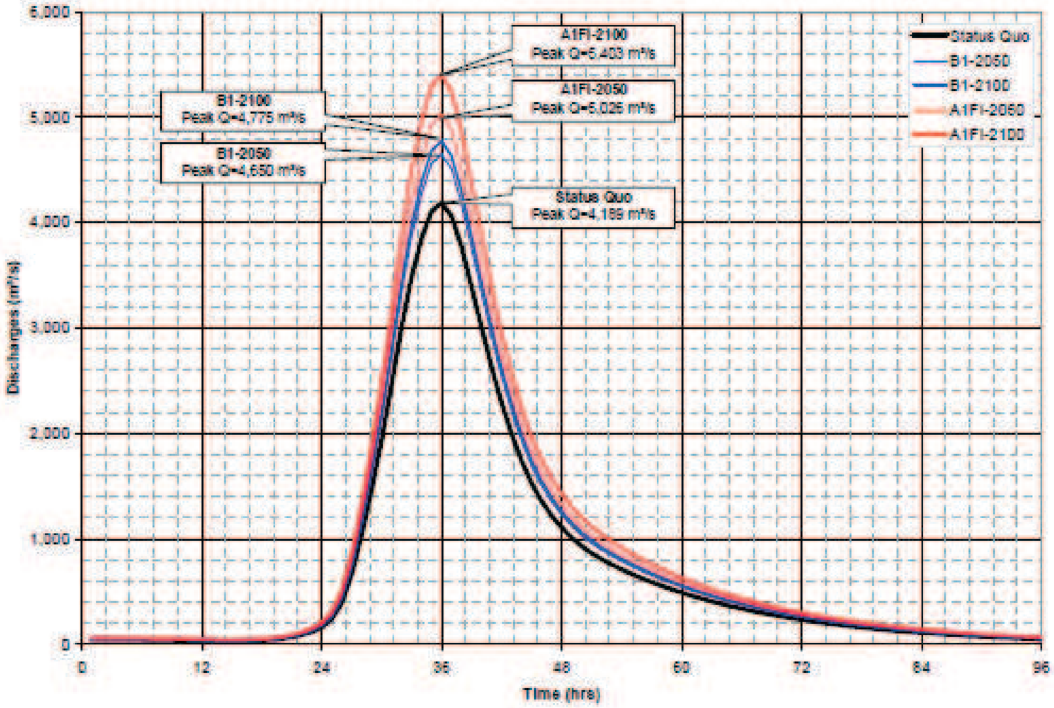
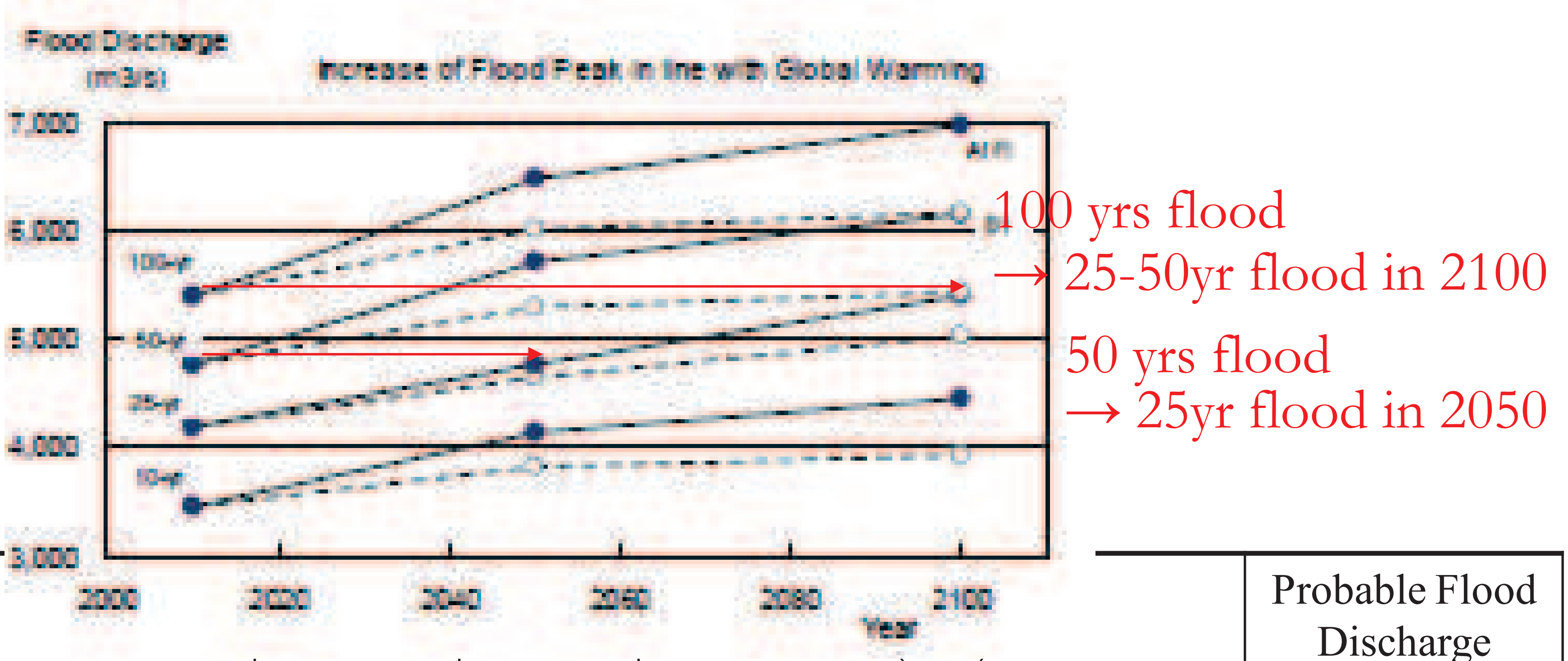


Figure R 10.16 Future 25-yr Probable Design Hydrographs

25-yr return period
4,200 in present
4,650-4,800 in 2050
5,000-5,300 in 2100

Source: JICA



	Scenario		rainfall intensity (%)	Return period (year)	5yr	10yr	25yr	50yr	100yr	Probable Flood Discharge (m3/s) 25yr	Probable Flood Discharge (m3/s) 50yr
	Status quo		-		125	142	164	181	198	4190	4770
	A1F1	2050	11		150	170	197	217	237	4780	5720
		2100	14		161	183	211	233	255	5400	6150
	B1	2050	20		138	157	182	200	219	4650	5290
		2100	29		142	162	187	206	225	5030	5430

Source: JICA

Revising Plan

Original MP

Revised MP

Source: JICA

Framework Document on
Water and Climate change Adaptation
For Leaders and Policy-makers in the Asia-Pacific Region

Asia-Pacific Water Forum

Steering Group on Water and Climate Change

Source: ADB

Principle 1 - Usable Knowledge

We must support to scientists and practitioners to work together and develop knowledge that leads effective actions and increases public awareness:

Action

Develop data infrastructure and networking for sharing data, information and knowledge to support decision-making and to raise public awareness

Action

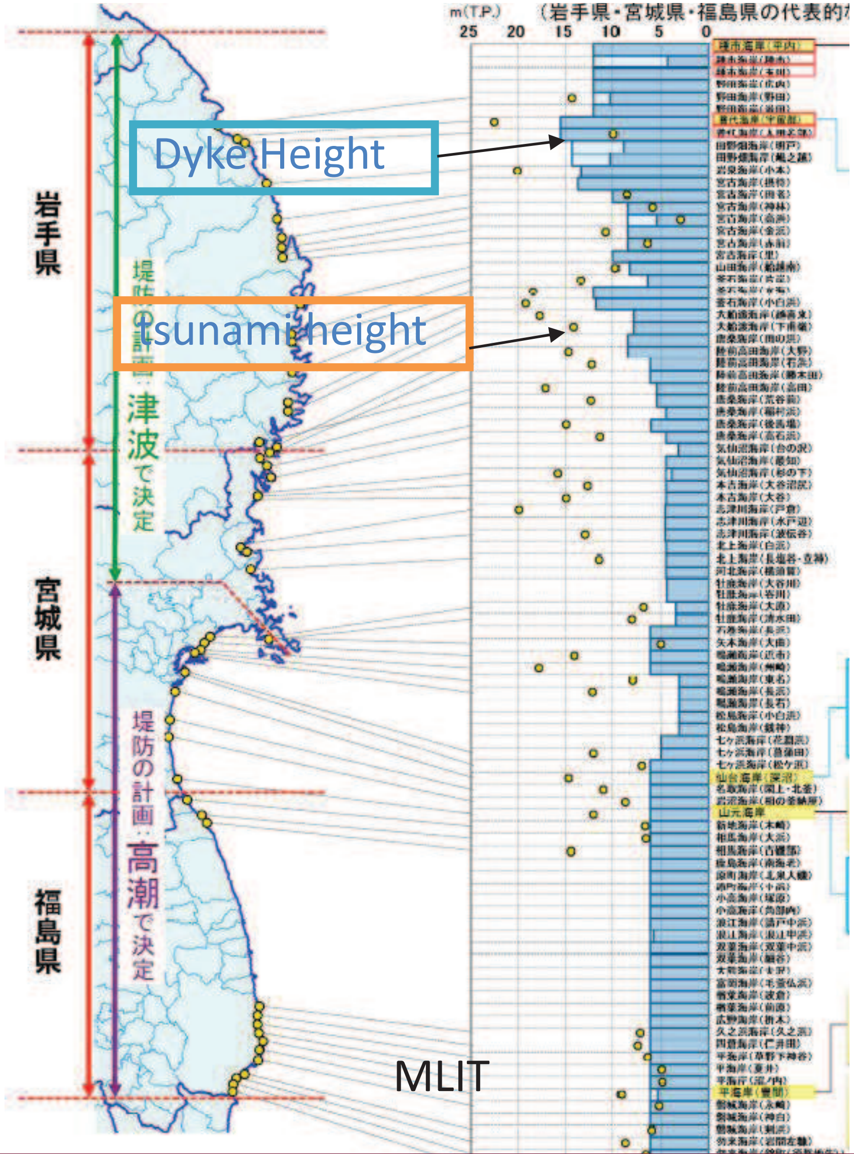
Accelerate scientific efforts to improve use of climate projections for countries, river basins and cities and to quantify and reduce the related uncertainty

3.Lessons from Great East Japan Earthquake: to prepare for unexpected (or uncertain) events

We cannot prevent disaster and have to prepare for unexpected

190km / 300km
damage / total

f



Lesson: Integrated approach, putting evacuation at the center

"To take integrated approach, putting evacuation at the center of DRM system, and combining a wide range of measures"

20,000: not 500,000

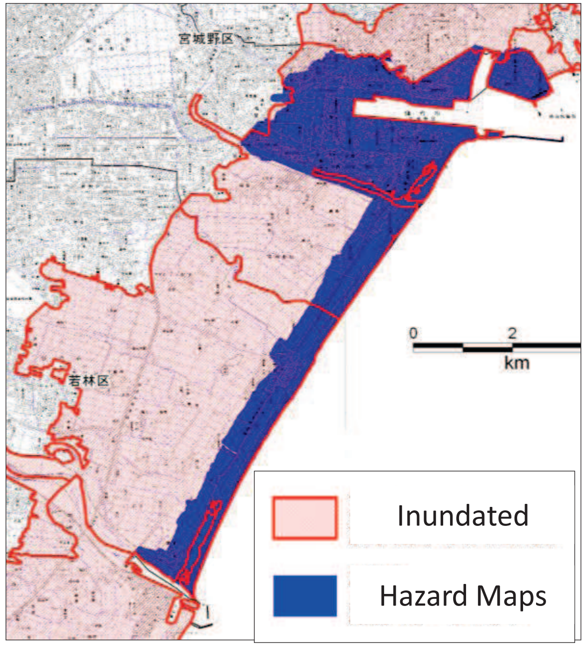
- DRM education: "Kamaishi Miracle"
- Community-based DRM

20,000: not 500 (Chile tsunami 2010)

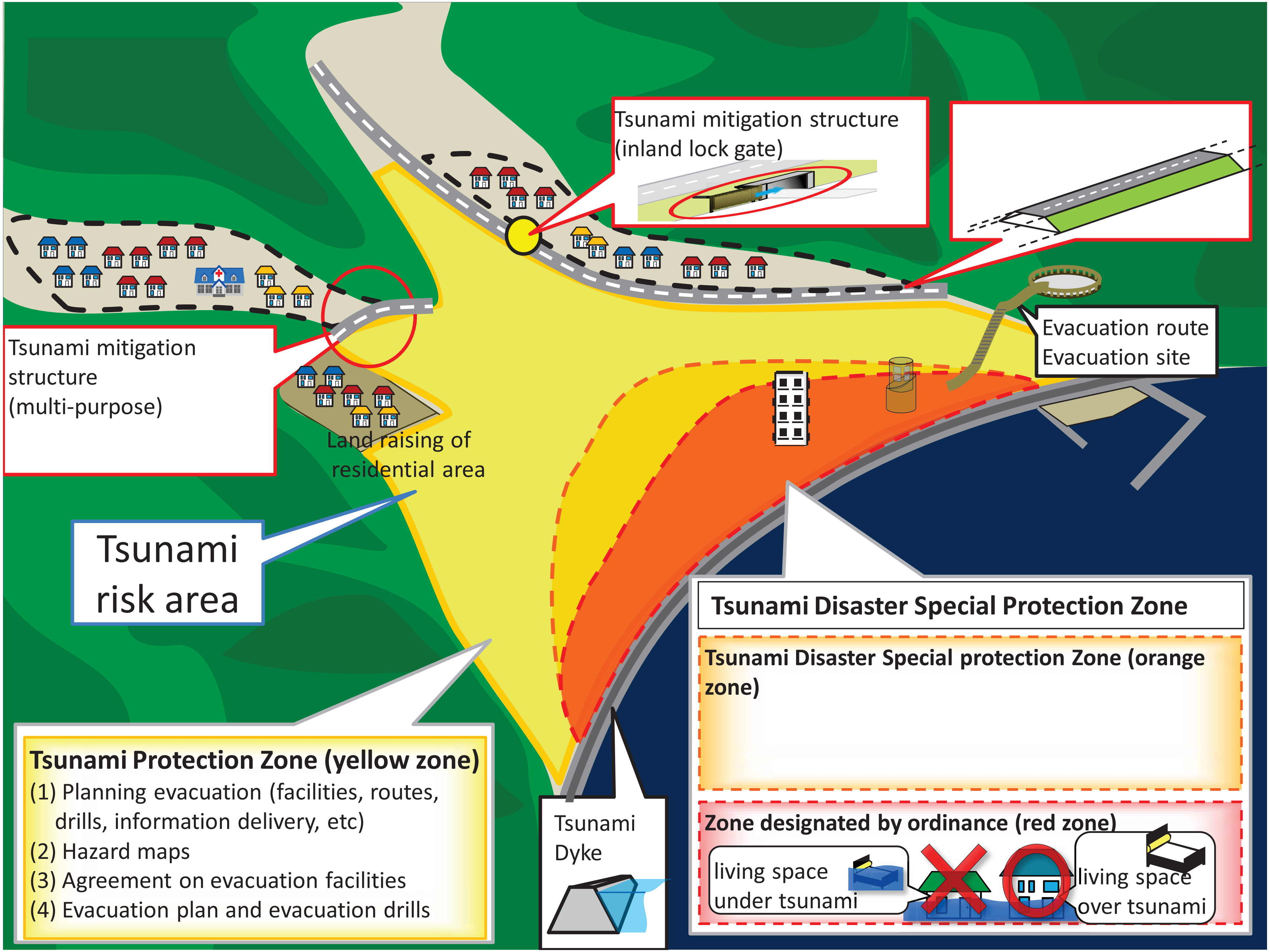
- **Hazard map showed limited risk area**
- **Tsunami Warning misled evacuation, increasing death toll**

Fire corps

Sendai City



Source: CAO



Tsunami mitigation structure
(inland lock gate)
Tsunami mitigation structure
(multi-purpose)
Land raising of
residential area
Evacuation route
Evacuation site
Tsunami
risk area
Tsunami Protection Zone (yellow zone)
(1) Planning evacuation (facilities, routes, drills, information delivery, etc)
(2) Hazard maps
(3) Agreement on evacuation facilities
(4) Evacuation plan and evacuation drills
Tsunami
Dyke
Tsunami Disaster Special Protection Zone
Tsunami Disaster Special protection Zone (orange zone)
Zone designated by ordinance (red zone)
living space
under tsunami
living space
over tsunami

4. Conclusion

Technology transfer to prepare for unexpected or uncertain events

1. Prediction and estimation technology (climate change and risk)
2. Understand uncertainty and limitation of technology
3. Integrated or cross-sector approach


Thank you
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