Central Asia Climate Knowledge Forum
- Moving Towards Regional Climate Resilience -

Flood Management System in Japan

YOICHI IWAMI
Chief Researcher

International Centre for Water Hazard and Risk Management
under the auspices of UNESCO (ICHARM), PWRI, Japan

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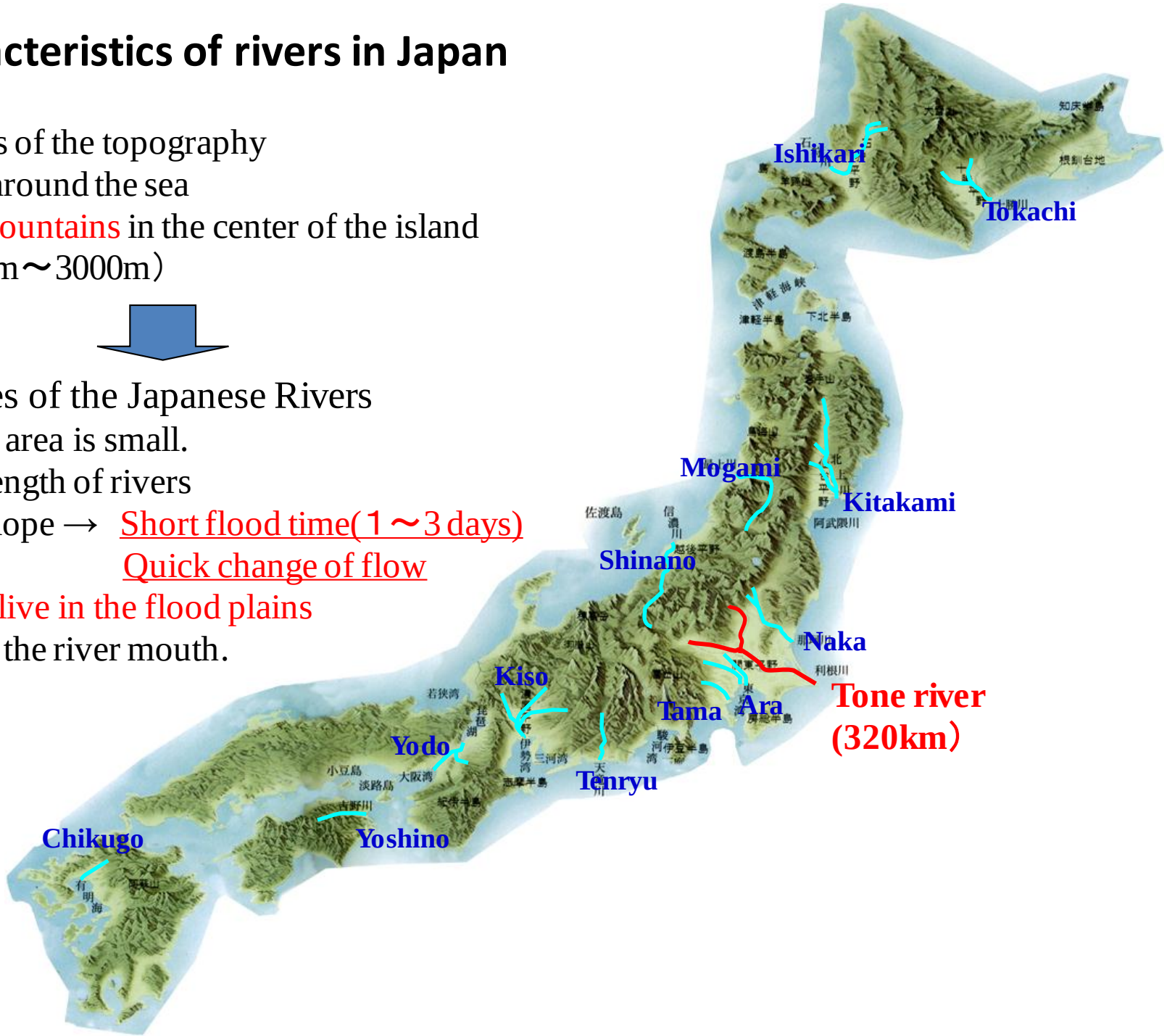
Contents

1) Characteristics of rivers in Japan

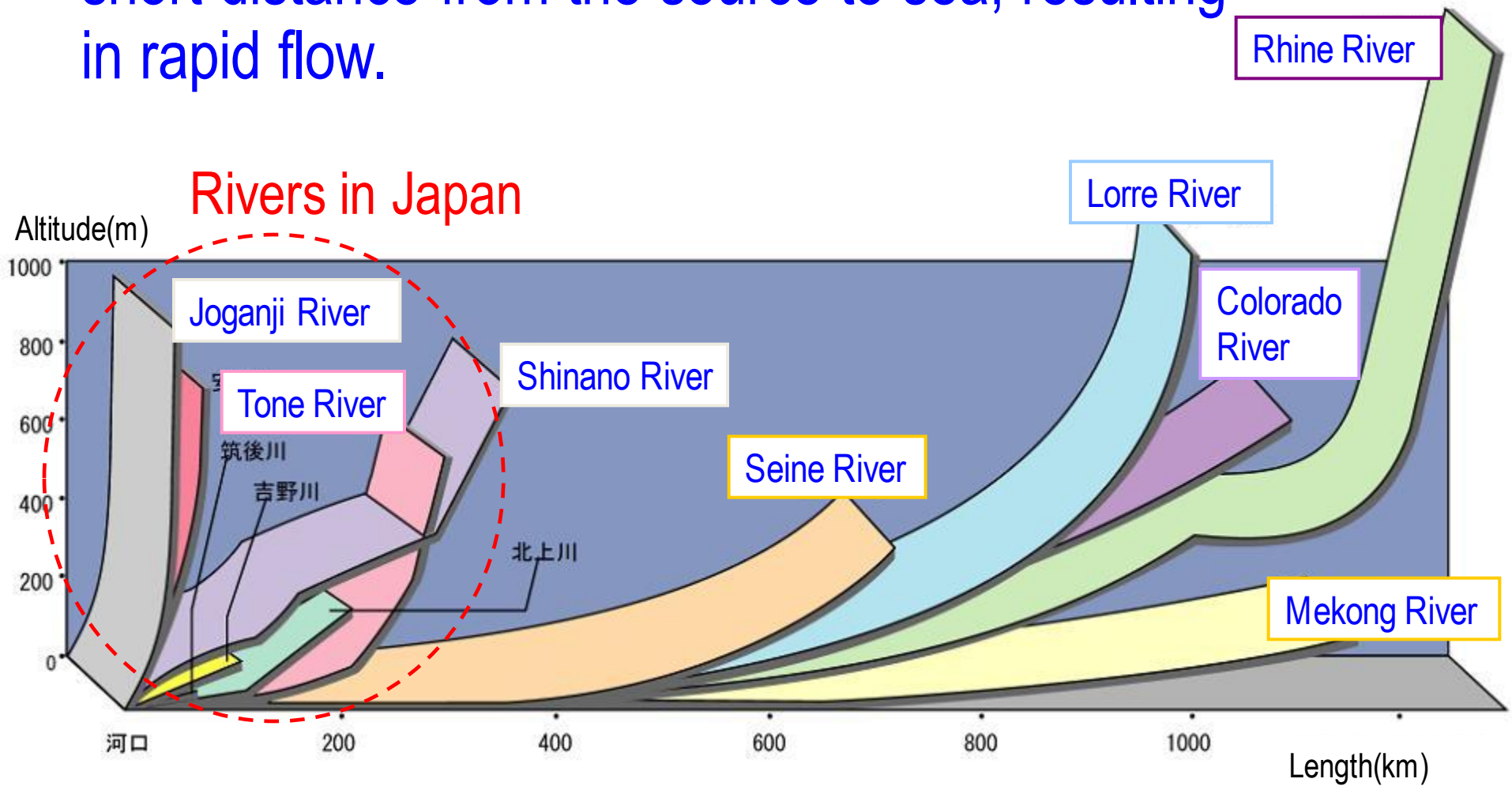
■ Features of the topography
- Island around the sea
- High mountains in the center of the island
  （2000m～3000m）

■ Features of the Japanese Rivers
- A basin area is small.
- Short length of rivers
- Steep slope → Short flood time(1～3 days)
  Quick change of flow
- People live in the flood plains
  around the river mouth.



Very steep rivers in Japan

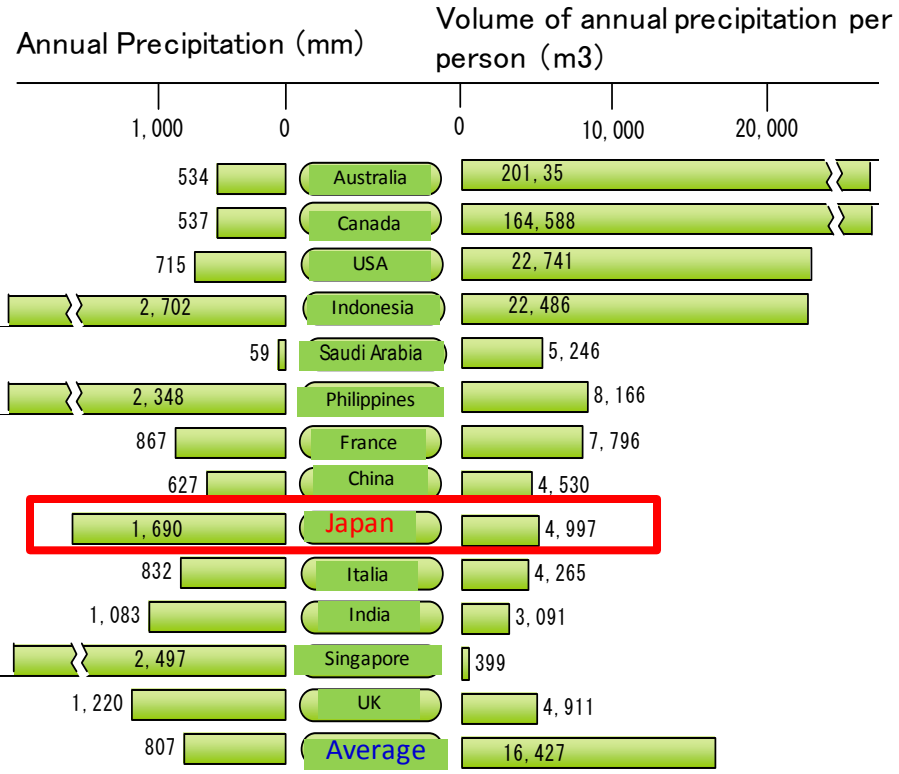
Many rivers in Japan are very steep with a short distance from the source to sea, resulting in rapid flow.



Rainfall of Japan and the World

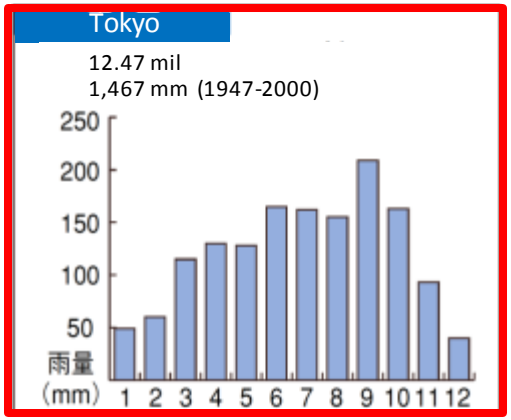
Annual rainfall of Japan is approximately twice as much as the world average, 800mm.
Its volume per person of Japan is a third of the world average because of population and area.
Volume of the precipitation of Japan is concentrated in early summer and Typhoon season

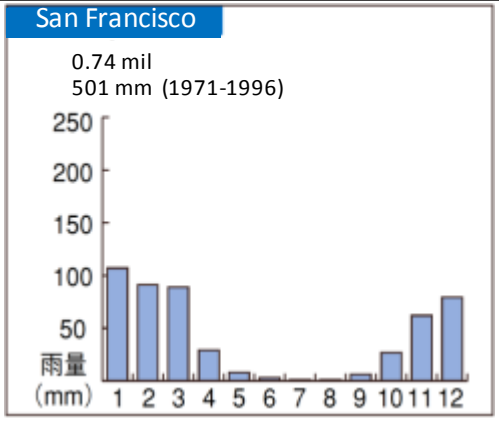
Rainfall

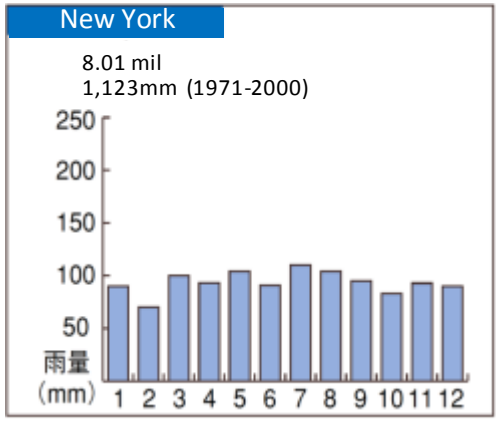


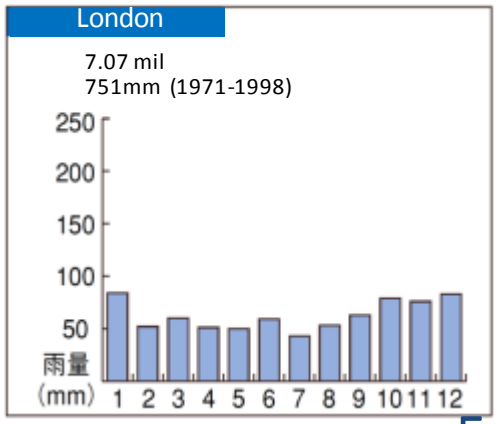
Source : Water resource in Japan , 2009 MLIT

Population and annual precipitation of Metropolitan Cities



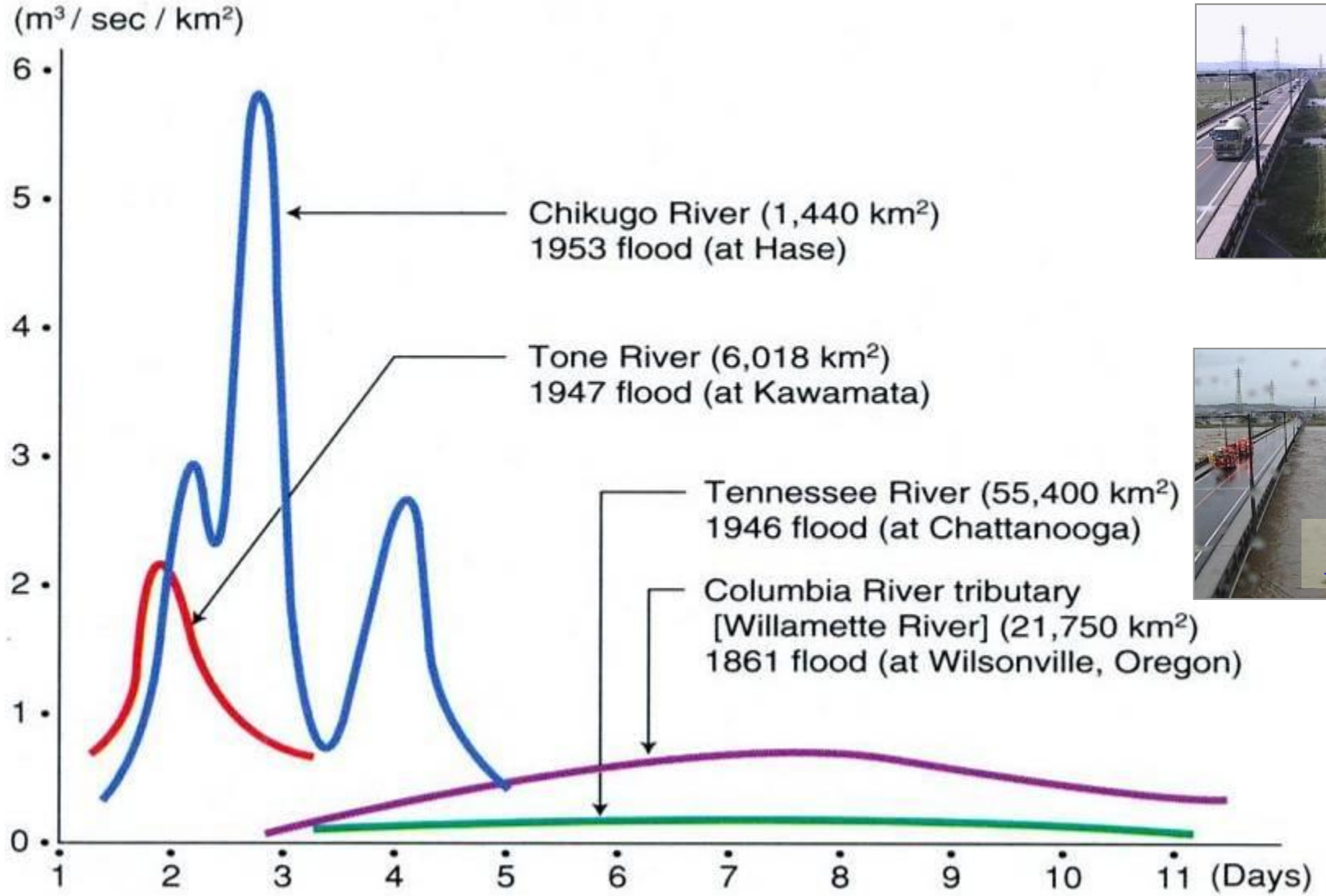


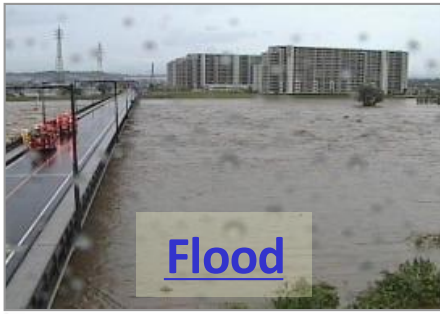




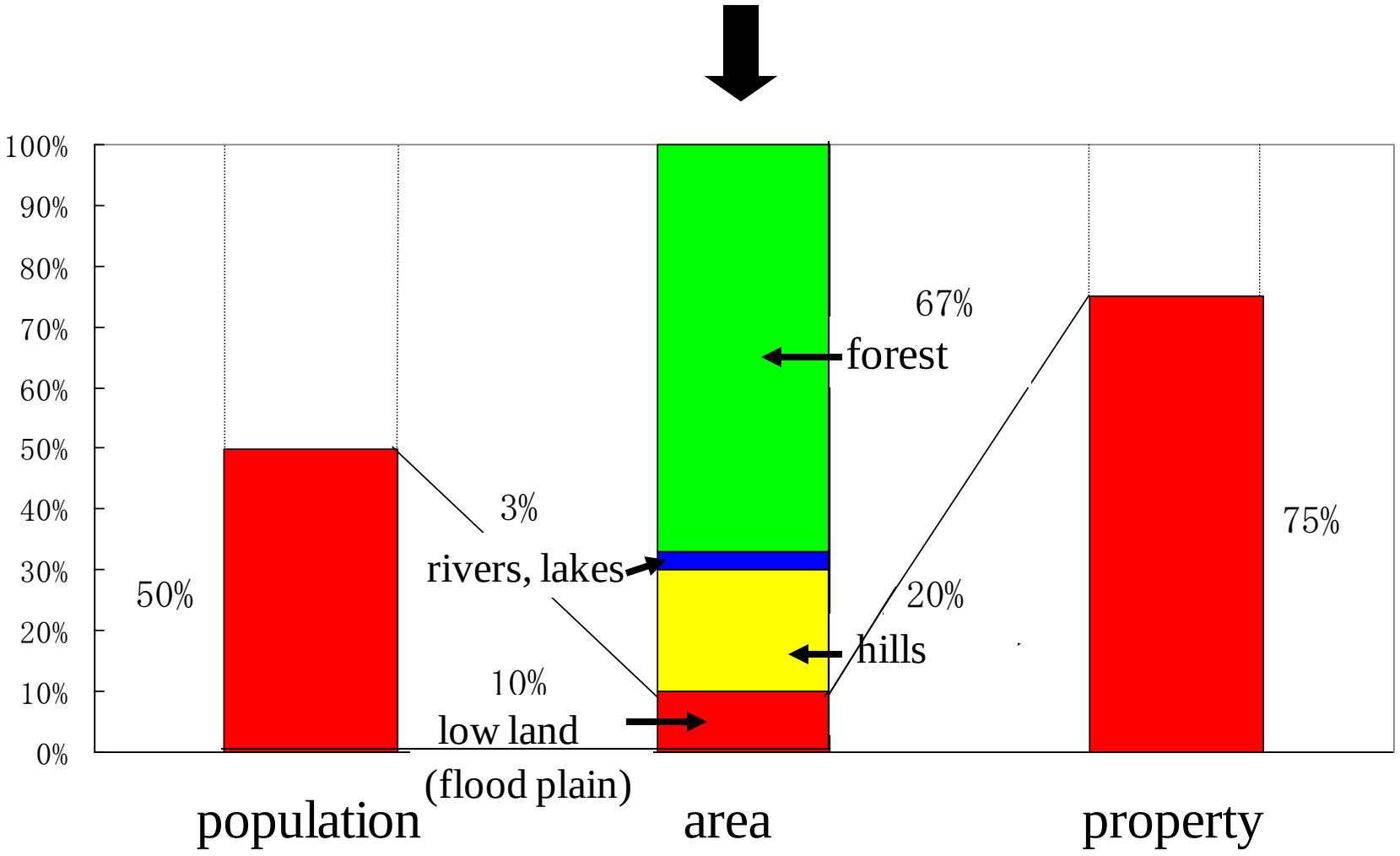
Rapid water level increase

Relation between flood discharge per unit catchment area ($m^3/sec/km^2$) and flood duration (days)





Land use in Japan

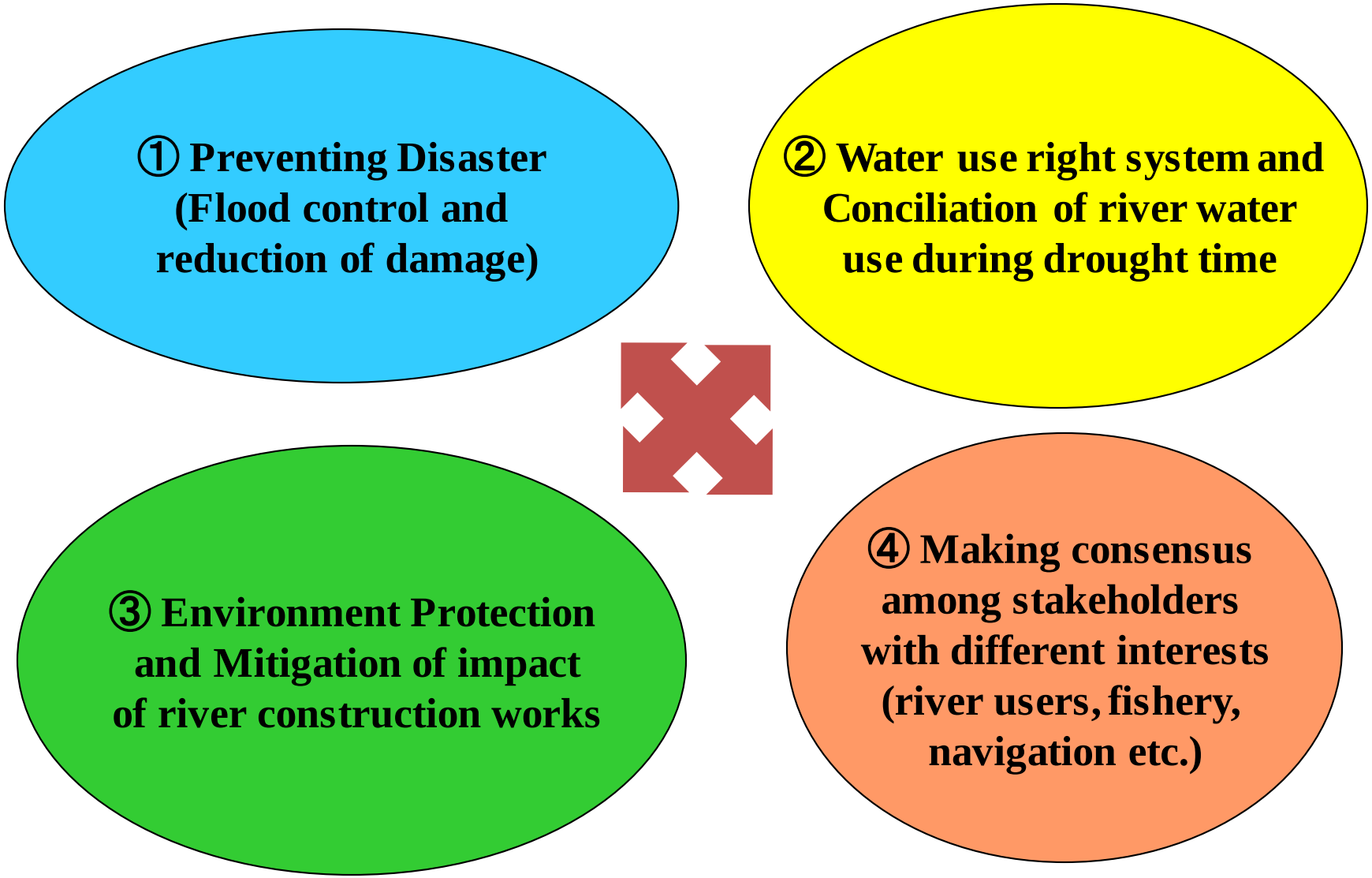


Flood threatens peoples' lives

Usual time

Flooded area after bank breach

2) Challenges of river management



3) Comprehensive flood management

(1)Structural measures along the river

- River channel improvement
- Construction of dams, retarding basins and diversion channels etc.

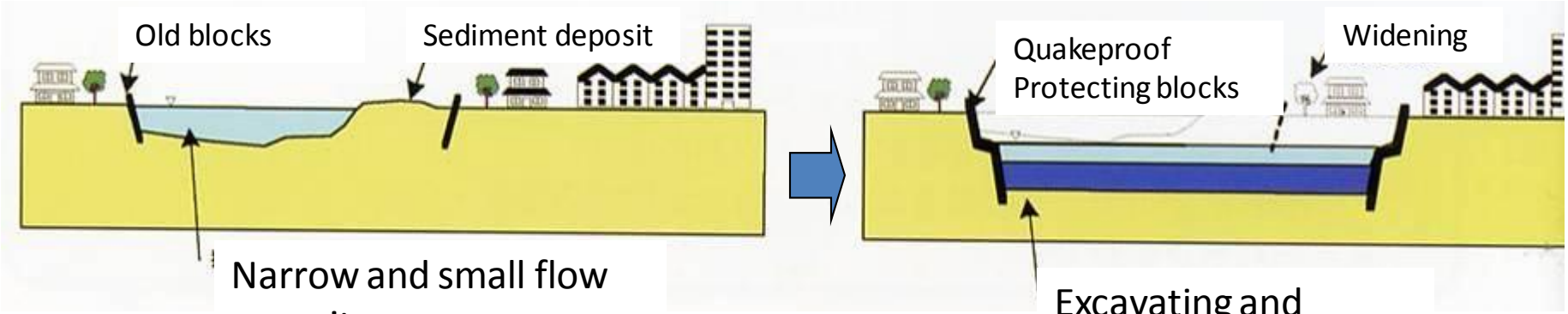
(2)Retaining water in the basins (land use plan)

- Conservation of farmlands to prevent from rapid runoff
- Constructing retention ponds
- Constructing rainwater tanks
- Constructing permeable pavements and seepage pits

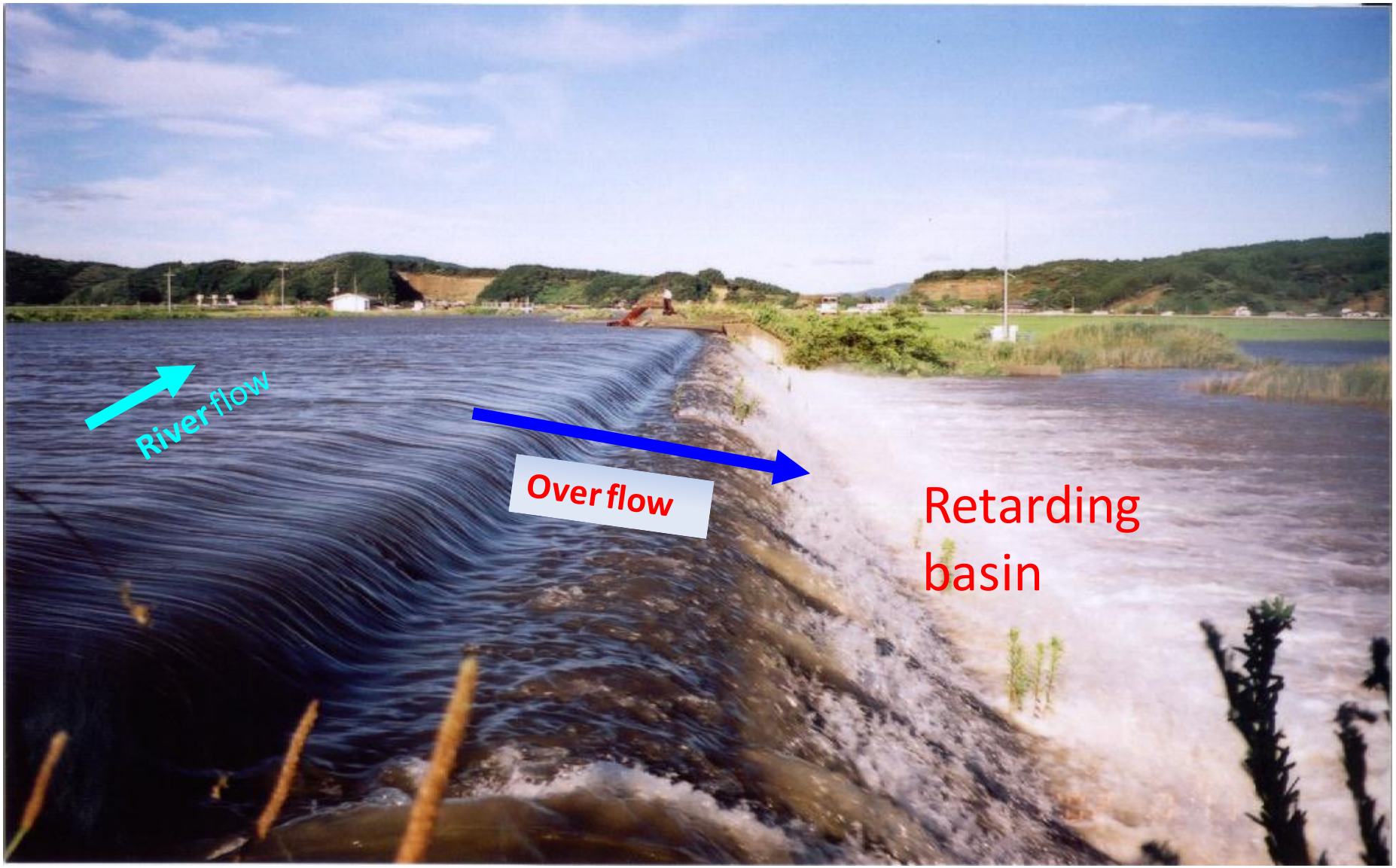
(3)Non-structural measures to alleviate damage

- Establishing flood alert and evacuation warning systems
- Flood fighting and urgent response activities
- Promoting awareness of local residents

Structural measures - River channel improvement -

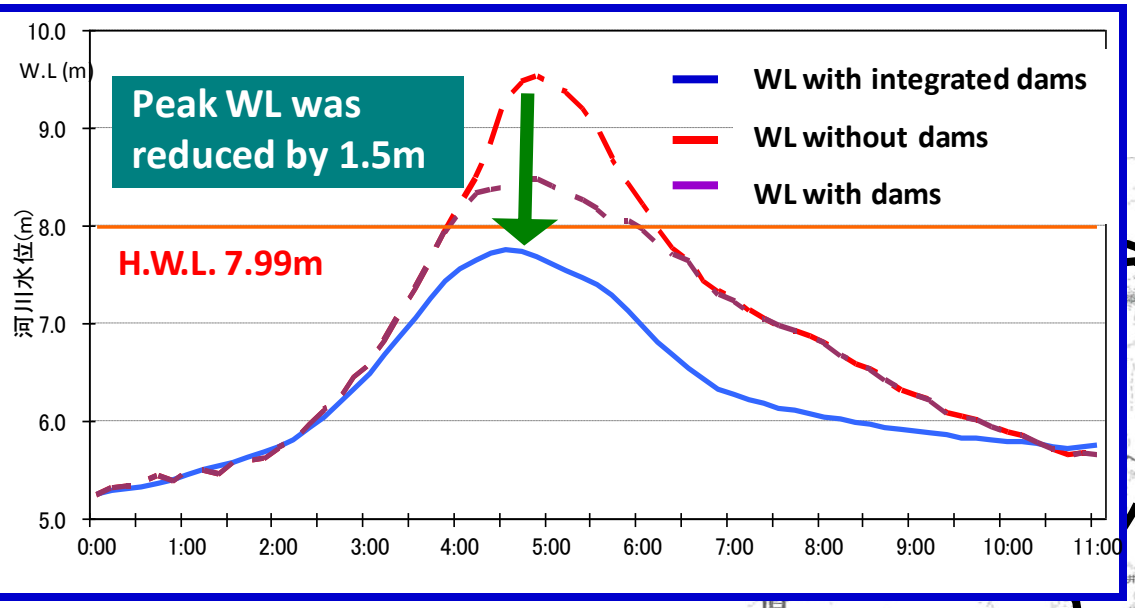


Structural measures – Retarding basin –
Nabirenuma retarding basin cut flood peak of Deki river (Miyagi pref.)

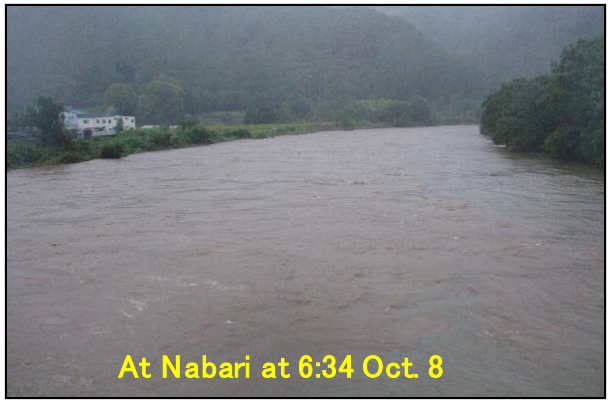


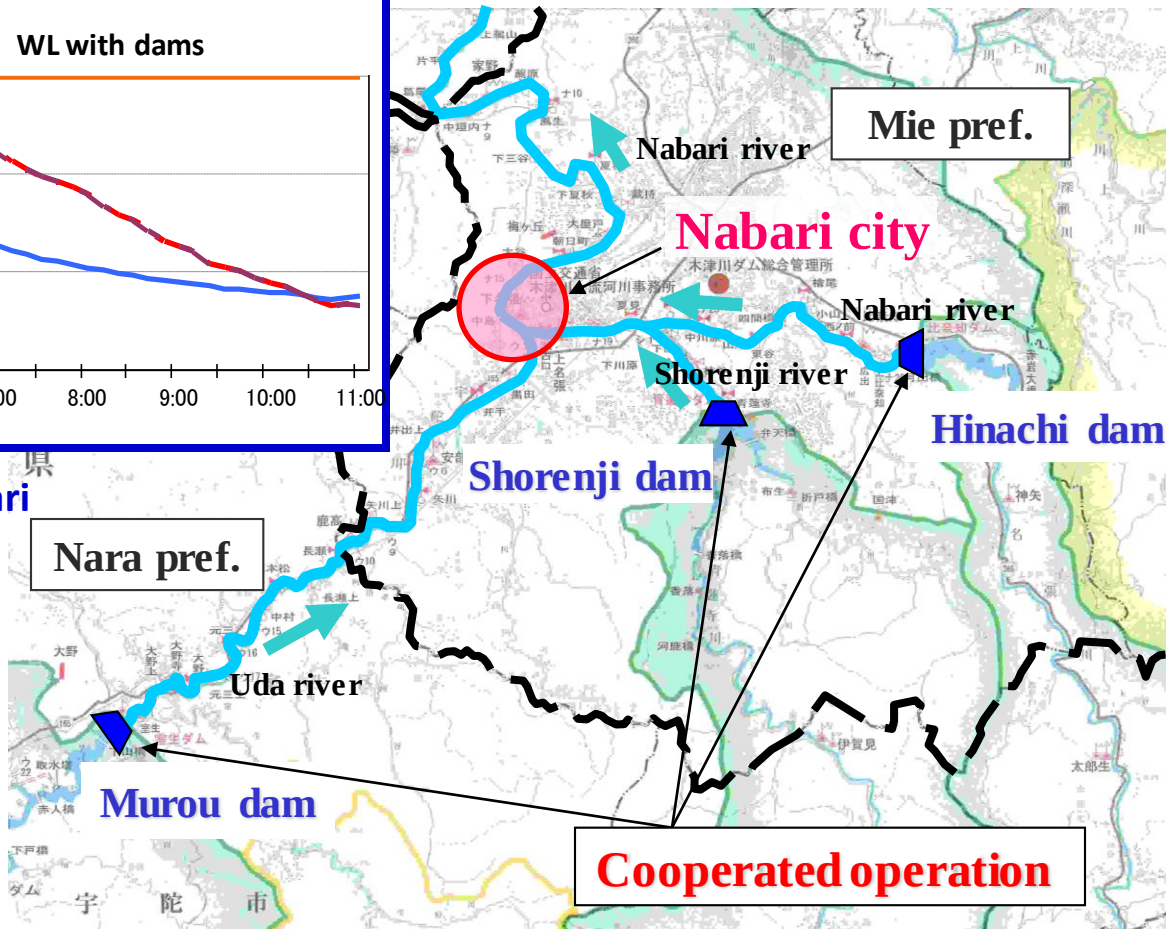
Structural measures - Cooperated operation of dams -

The operation was done to cooperate among the three dams effectively while observing forecasted rainfall in Kizu river during the typhoon No. 18 in 2009 and reduced 1.5 m water level below H.W.L. to avoid inundation in the area of 1,180 households.



Water level (WL) change at Nabari

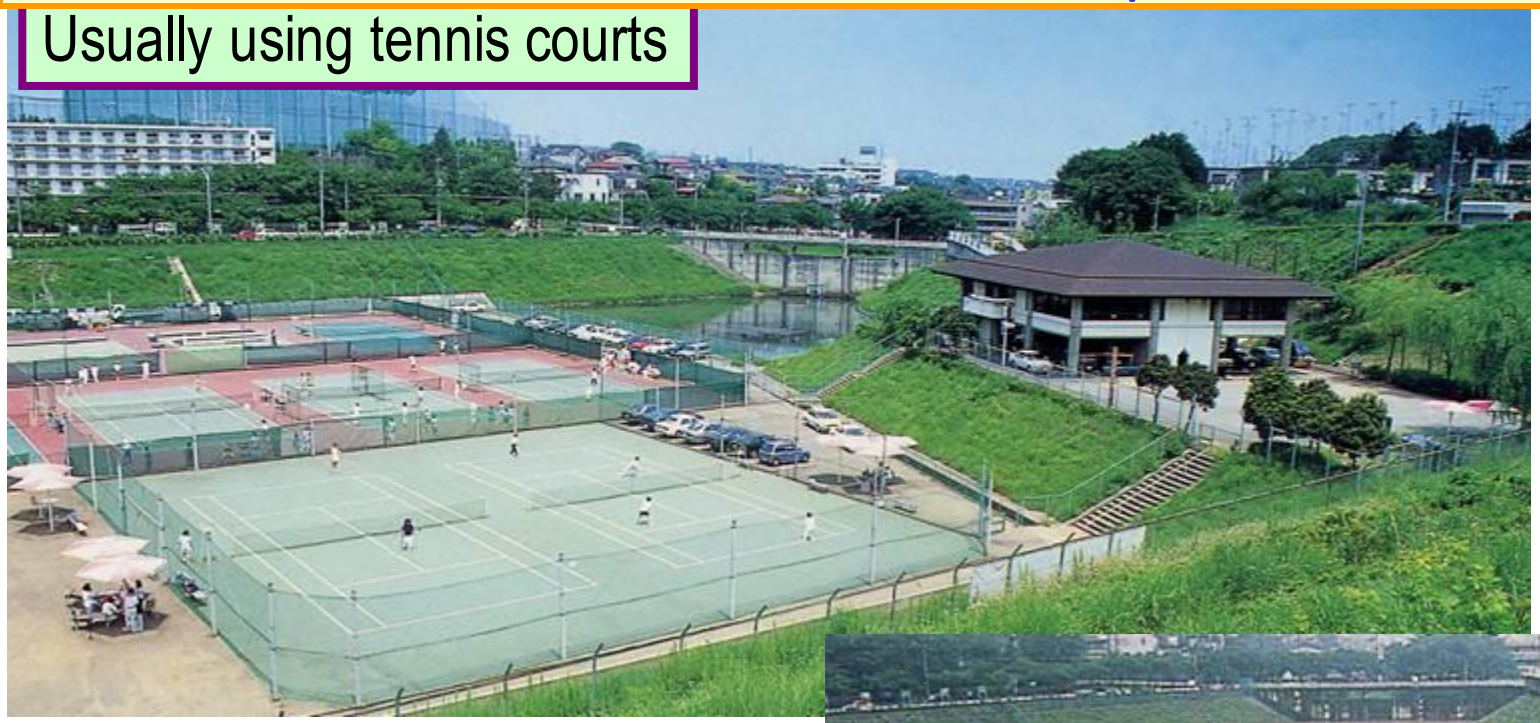




Reprinted Map of Geographical Survey Institute (平18総複、第58号))

Retaining water in the basins
- Flood retention pond -

Usually using tennis courts

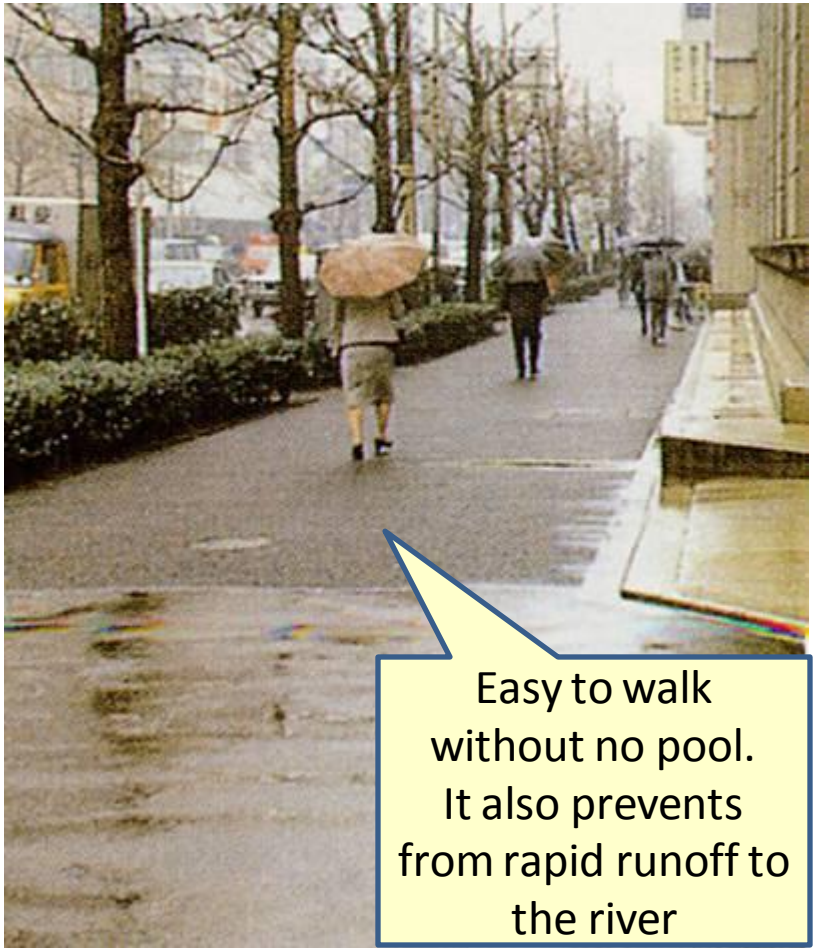


Kirigaoka reservoir
(Tsurumi river)

Function as a pond during heavy rain

Retaining water in the basins
- Permeable pavements in urban area -

permeable pavement



permeable tile pavement

Tokyo

Non-structural measures
- Flood Alert & Evacuation Warning systems -

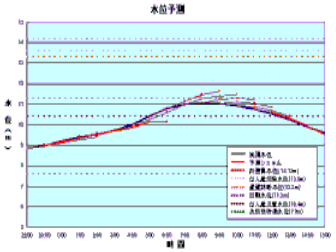
River Management Office, MLIT (Ministry of Infrastructure)

Collecting information

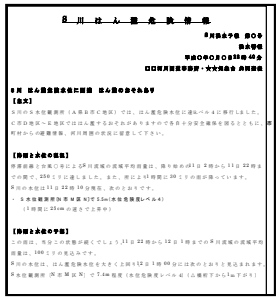
River patrol

CCTV Camera

Forecast water level



Information dissemination



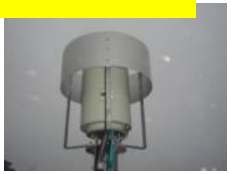
Send alert by display and speaker

Sending information to head of municipality for evacuation warning

Emergency alarm mail

Auto Observation

Rainfall Radar



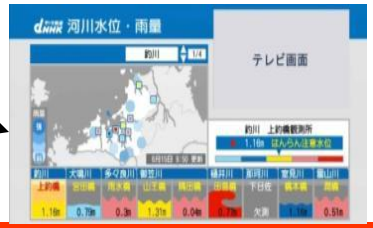
Rainfall gauge

Water level and flood discharge

Processing and providing information in a unified manner

Regional Development Bureau, MLIT

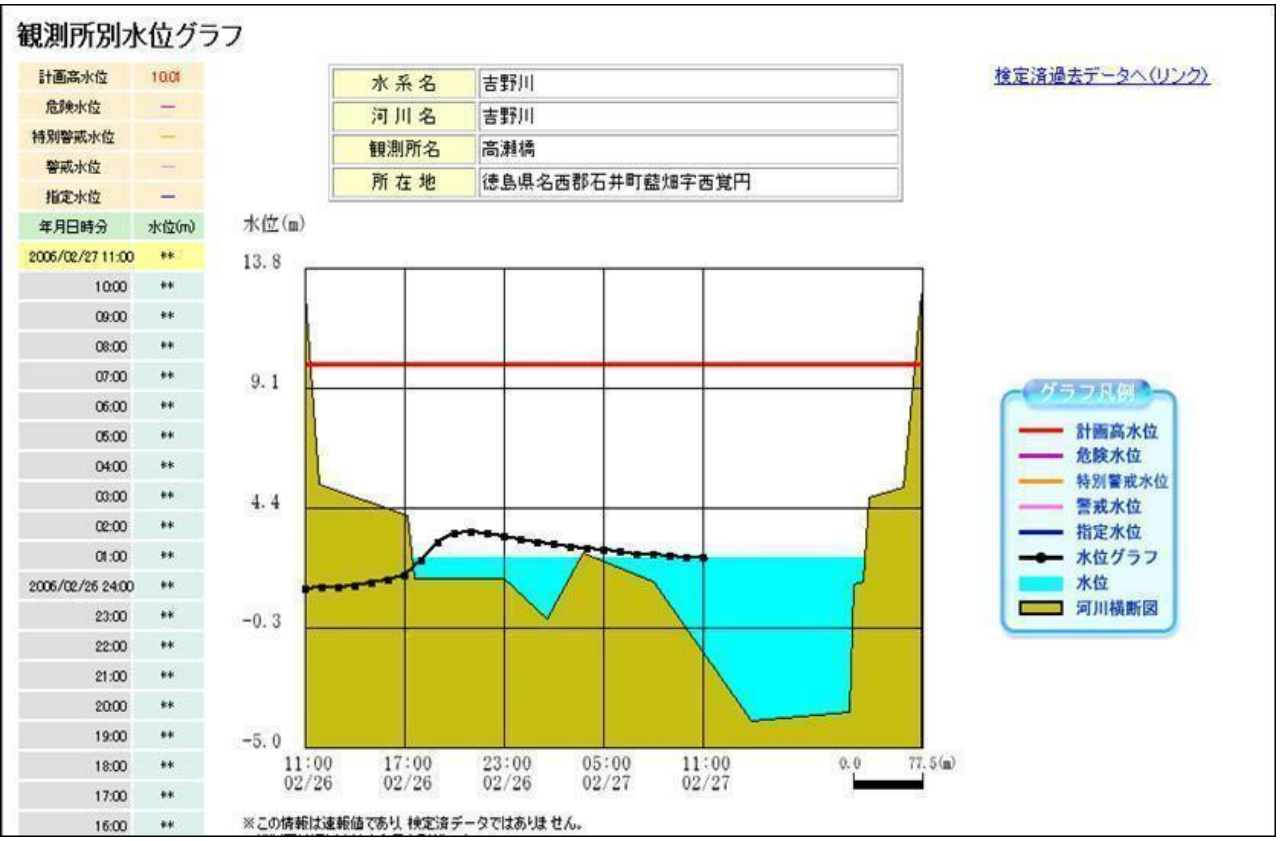
Send information to disaster management organizations (Prefecture etc.)



Provide information to Ground Digital Broadcasting (Public broadcasting stations and commercial broadcasting)

Non-structural measures
- Providing river observation and related information -

Water level graph at observation station by internet



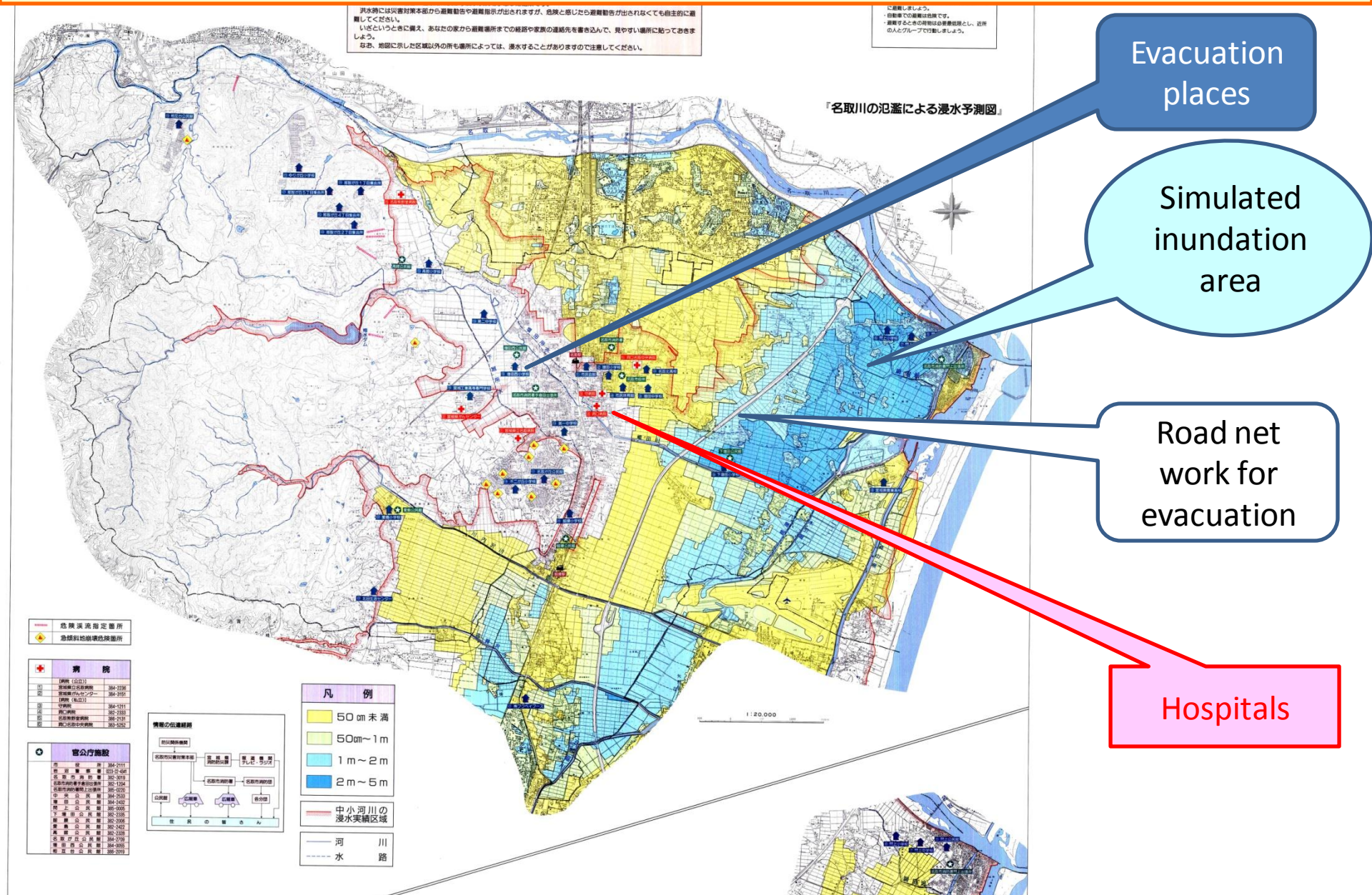
- Precipitation by hyeto meter
- Precipitation by radar rain gauges
- Water levels etc.

Non-structural measures
- Flood Fighting and Urgent Response activities -


Assisting flood fighting activities


Mitigate damages (pumping up flooded water)

Non-structural measures
- Promoting awareness of local residents (**Flood Hazard Map**) -



Non-structural measures
- Promoting awareness of local residents (Indication of assumed flood water depth and other information in town) -

[Flood-related symbols]

JIS Z8210:2006

[Flood]

This symbol indicates that the area concerned may be affected by floods.

[Evacuation site (building)]

This symbol shows a safe building that provides a shelter when a disaster occurs.

Examples of flood-related signs installed

Information on the assumed flood water depth, evacuation sites, etc. is indicated on electric poles and the walls of public facilities.

4) Observation systems

Why observation system is so important ?

- Flood forecasting → Evacuation warning, Preventing and alleviating damages
- Drought forecasting → Conciliation of water use
- Making river improvement plan and land use plan
  - To understand river basin features
  - To know effects of various kinds of measures for flood management
  - To know climate change impact
  - Education and promoting people's awareness
  - Training for responsible staff for flood management

4) Observation systems

■Number of rainfall and water level observatory stations with telemetry system (as of 2012)

Jurisdiction	Rainfall	Water level
Water and Disaster Management Bureau, MLIT	2,401	2,263
Prefectures	4,722	4,175
Japan Meteorological Agency	1,291	0
Total	8,414	6,438

※ Based on the standard of river management, one rain gauge should be installed at least in 50 km^2 in the area of river basin.

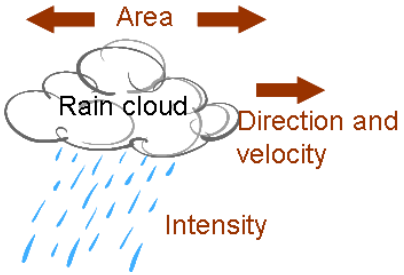
※ Discharge is also observed by calculating from observed water depth and velocity.

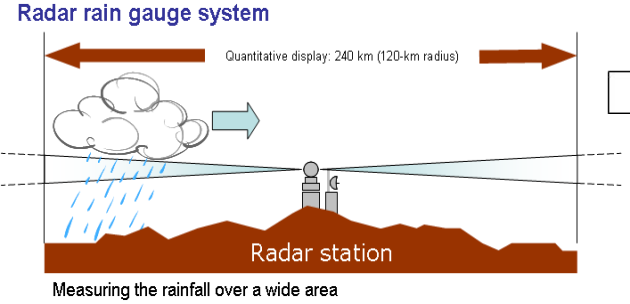
26 Rainfall radars (C band: 4-8GHz) installed by MLIT

Radar rain gauges have been installed at **26** locations throughout the country.

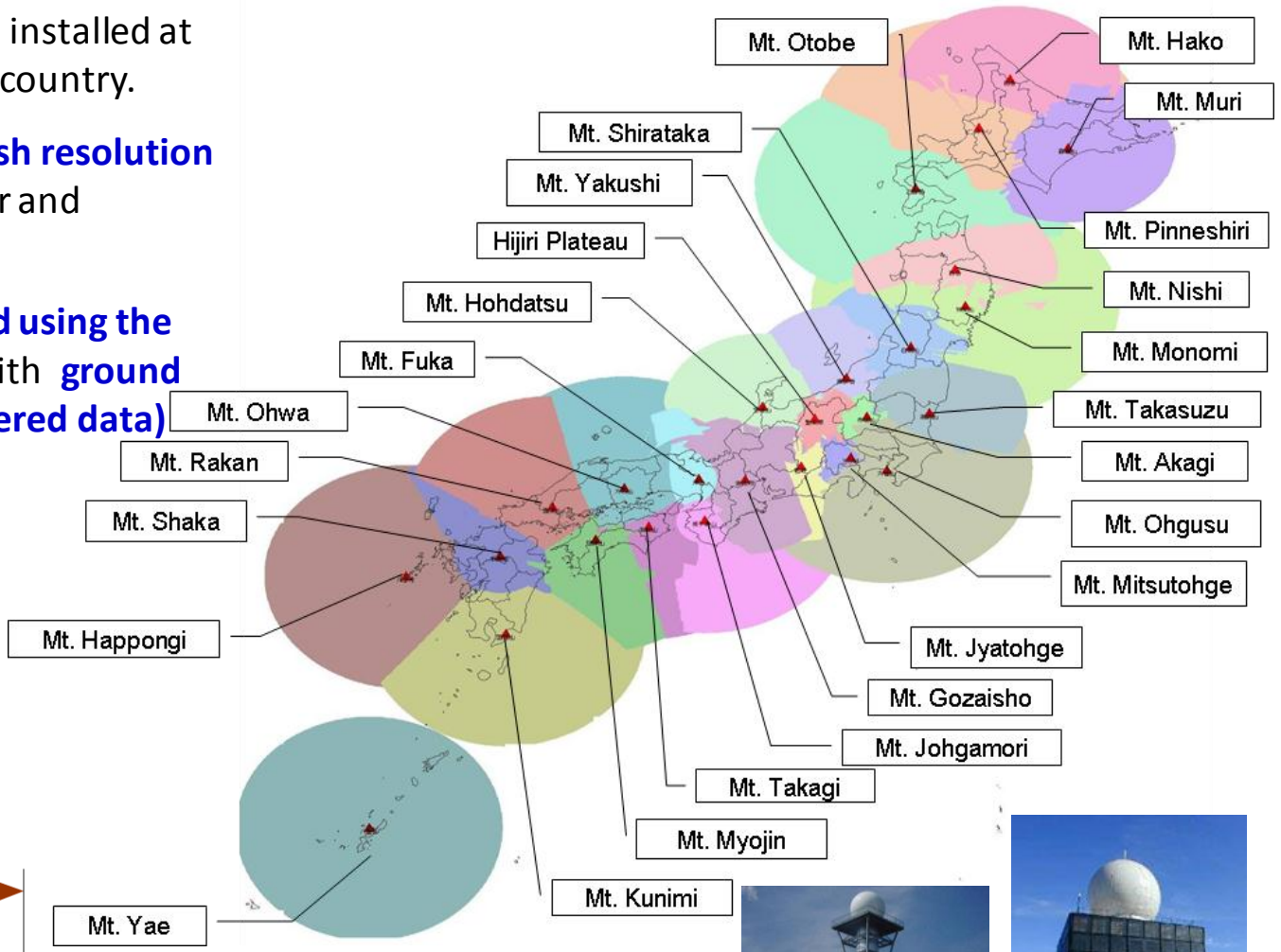
The information of **1-km mesh resolution** is updated every half an hour and available on the Internet.

The radar data are **calibrated using the dynamic window method** with **ground rain guges (10-min. telemetered data)**



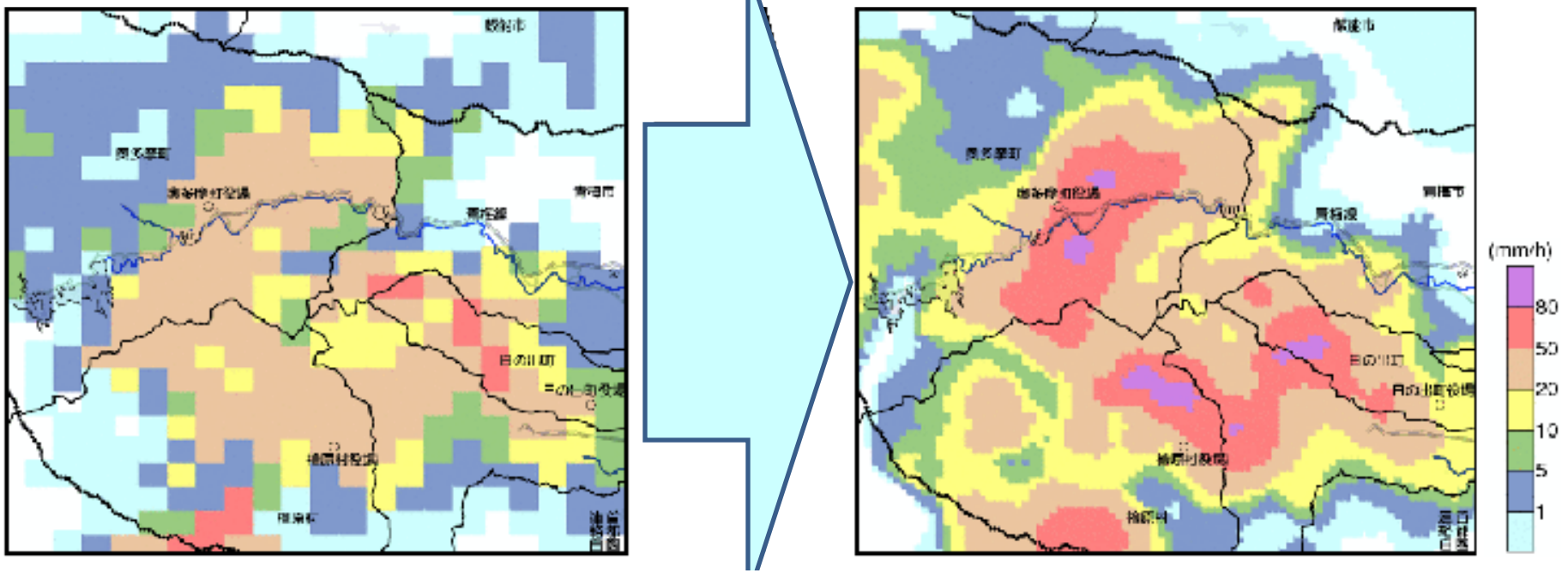


Measuring the rainfall over a wide area



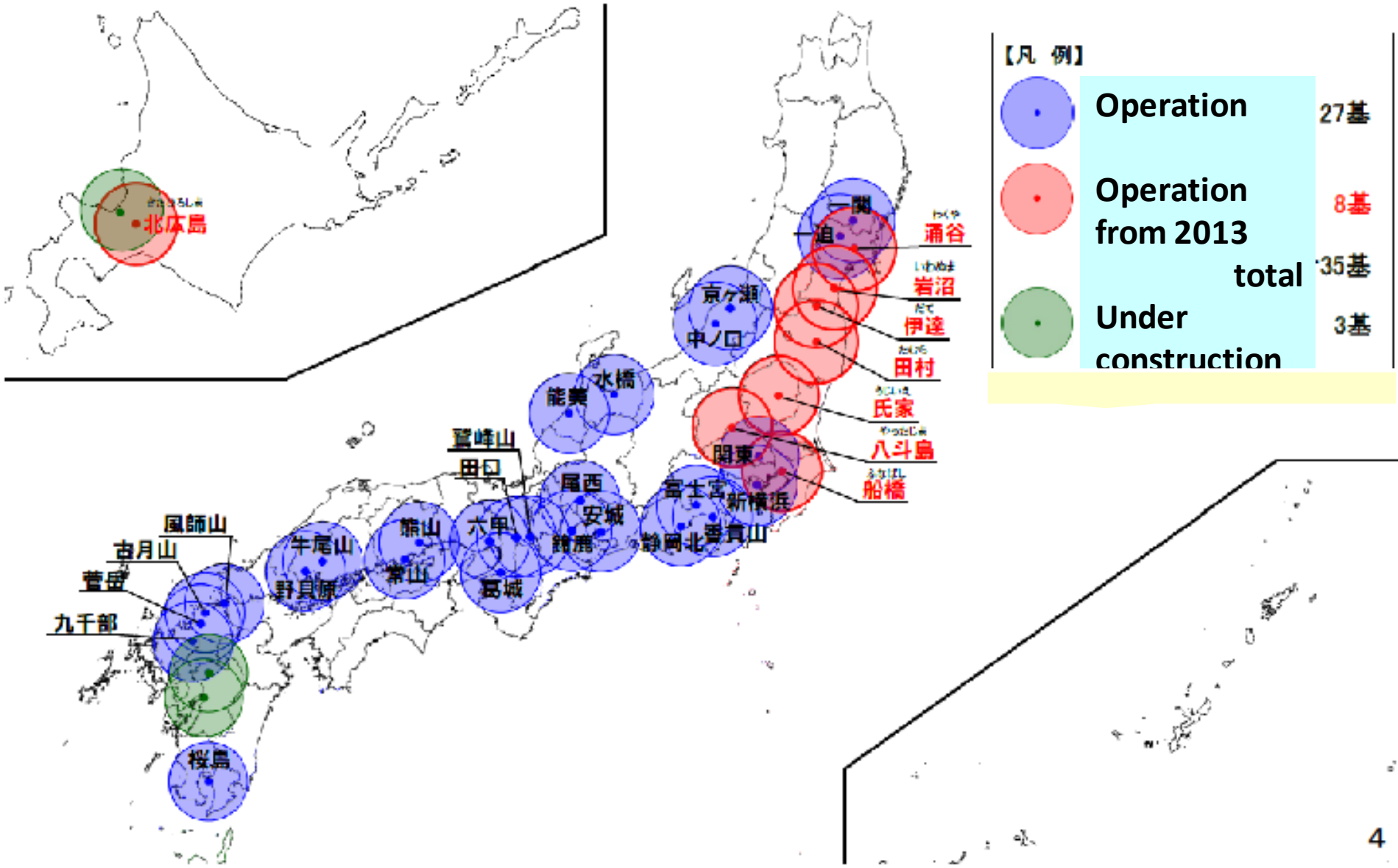
C band (4-8GHz) radar:
1km resolution
every 5 minutes delivery
(Real time calibration with ground gauges)

X band (8-12GHz) multi parameter radar: 250m resolution
every 1 minute delivery
(V-H polarized waves identify rainfall intensity: No need calibration)

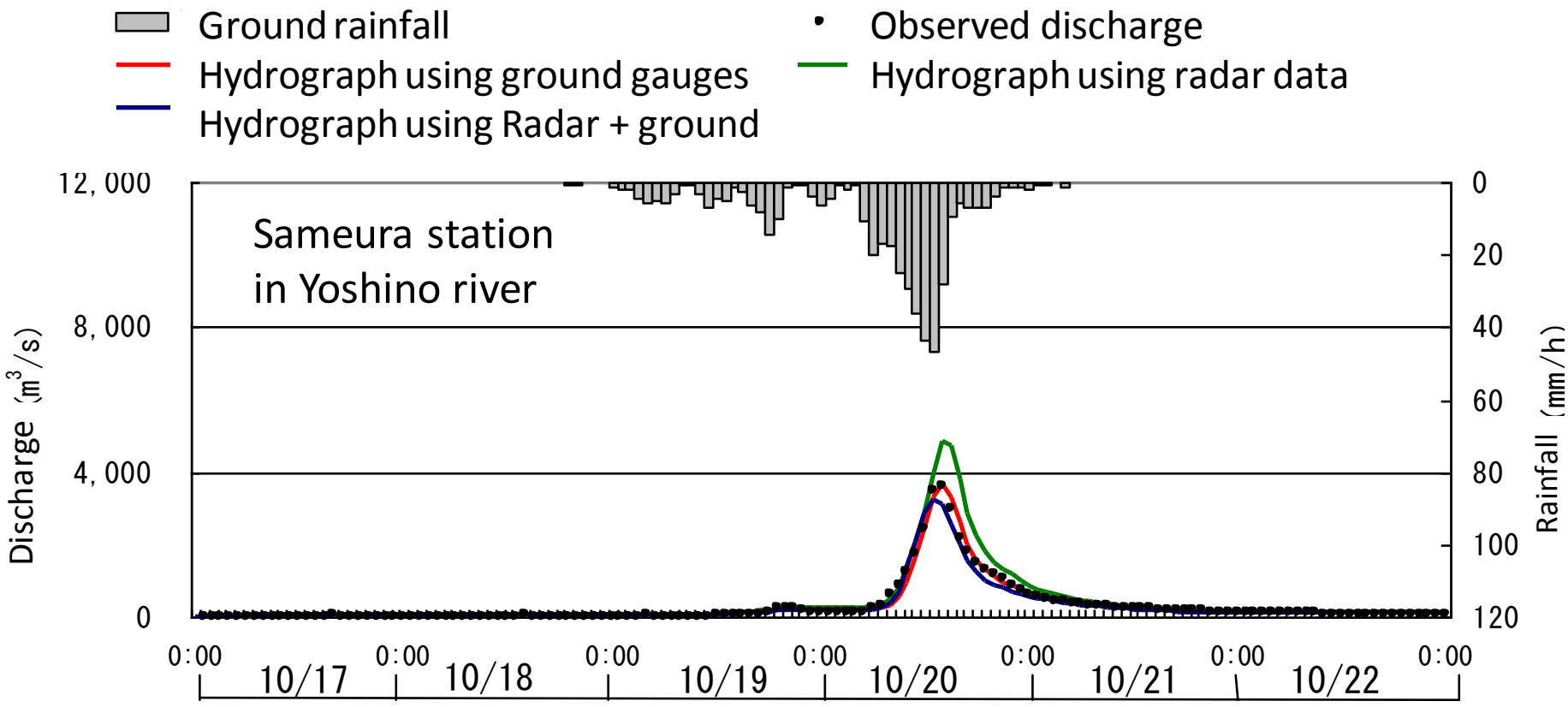


However, X band radar cannot observe behind intense rain area due to echo attenuation .
Therefore, we need a lot of X band radars to observe very intense rain.

X band (8-12GHz) multi parameter radar stations (total 35)



Parameters of hydrological simulation models should be calibrated and validated by in-situ observed data



Summary

- There are various flood prevention and damage reduction measures including structural measures, retaining water in the basins and non-structural measures.

- We should consider features of the river based on the basic data and take comprehensive measures to prevent / mitigate flood damages effectively in the basin.

- Observation systems are very important to store and analyze basic data such as rainfall, water level, water discharge as well as topography, soil data in the basin. These data are useful to use hydrological simulation model to predict flood occurrence for early evacuation and flood fighting activities and also make a comprehensive river management plan.


Thank you very much