Flood Management in Japan

1. Comprehensive Flood Control Measures
2. Provision of River information
3. Responses to the Niigata Torrential Rain Disaster
4. About ICHARM
5. Responses to 2011 Thailand Floods
6. Outline of the Tsunami-Resilient City

Issues in Past Disasters

(1) Near small and medium-sized rivers with relatively small catchment area, when localized torrential rain occurs frequently, adequate steps were not taken for evacuation of residents due to the poor information provision structure.

(2) The elderly, small children and others needing assistance in a disaster were frequent victims, showing problems with the warning and evacuation system.

(3) Evacuation orders, etc. were slow in coming or were ignored by many residents, indicating the need for greater awareness of disaster information on both issuing and receiving ends.

(4) With more people using subways and underground shopping areas, etc., which frequently become inundated, the need arose for flood prevention measures and effective evacuation systems.

In light of these issues, the Flood Control Act was revised twice, in June 2001 and May 2005.

Overflowing of smaller rivers (Ikarashi River) (July 2004 Niigata-Fukushima Flood Disaster)

A junior high school cut off by flood waters (July 2004 Niigata-Fukushima Flood Disaster)
Source: Kyodo News

Residents who were slow to evacuate being rescued by SDF (Sept. 2000 Tokai Flood Disaster)

Bus stranded on highway after flooding along Yura River (Typhoon Tokage, Oct. 2004)
Source: Yomiuri Shimbun

Flooded underground passageway (Sept. 2000 Tokai Flood Disaster)

Hakata subway flooding (Fukuoka flood of July 2003)

Elaboration of Information Dissemination during Floods

The Governors of each prefecture shall conduct forecasting of floods in rivers with large scale catchments except those designated by the Minister of MLIT which are vulnerable to large scale of flood damage (Article 11 of “Flood Fighting Act”).

Before Amendment

The Minister of MLIT designates the rivers, which likely bring about serious damage by floods to people’s livelihood, and conduct flood forecasting.

After Amendment

In addition to the Minster of MLIT, the Governors of Prefectures newly designate the rivers, which likely bring about serious damage by floods and conduct flood forecasting.

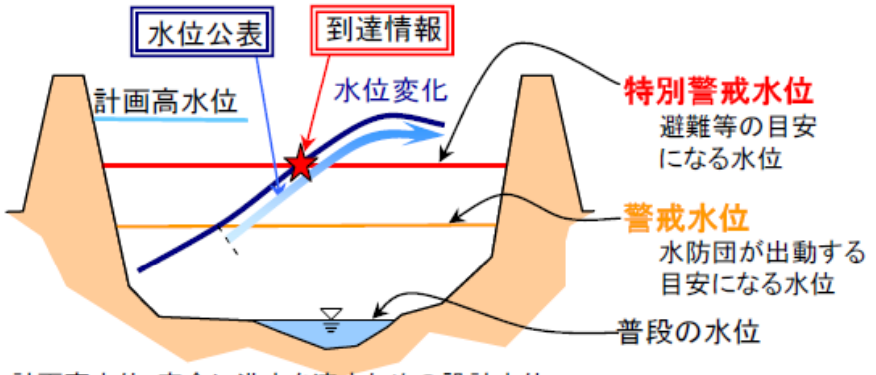
As for the major rivers except those in which flood forecasting is to be conducted, the water levels for starting evacuation shall be decided and the rivers concerned shall be designated.

Before Amendment

- In the rivers having a large catchment area, flood forecasting shall be conducted.
- As the medium and small-sized rivers in which flood forecasting is difficult, essential water level information for evacuation has not been provided before.

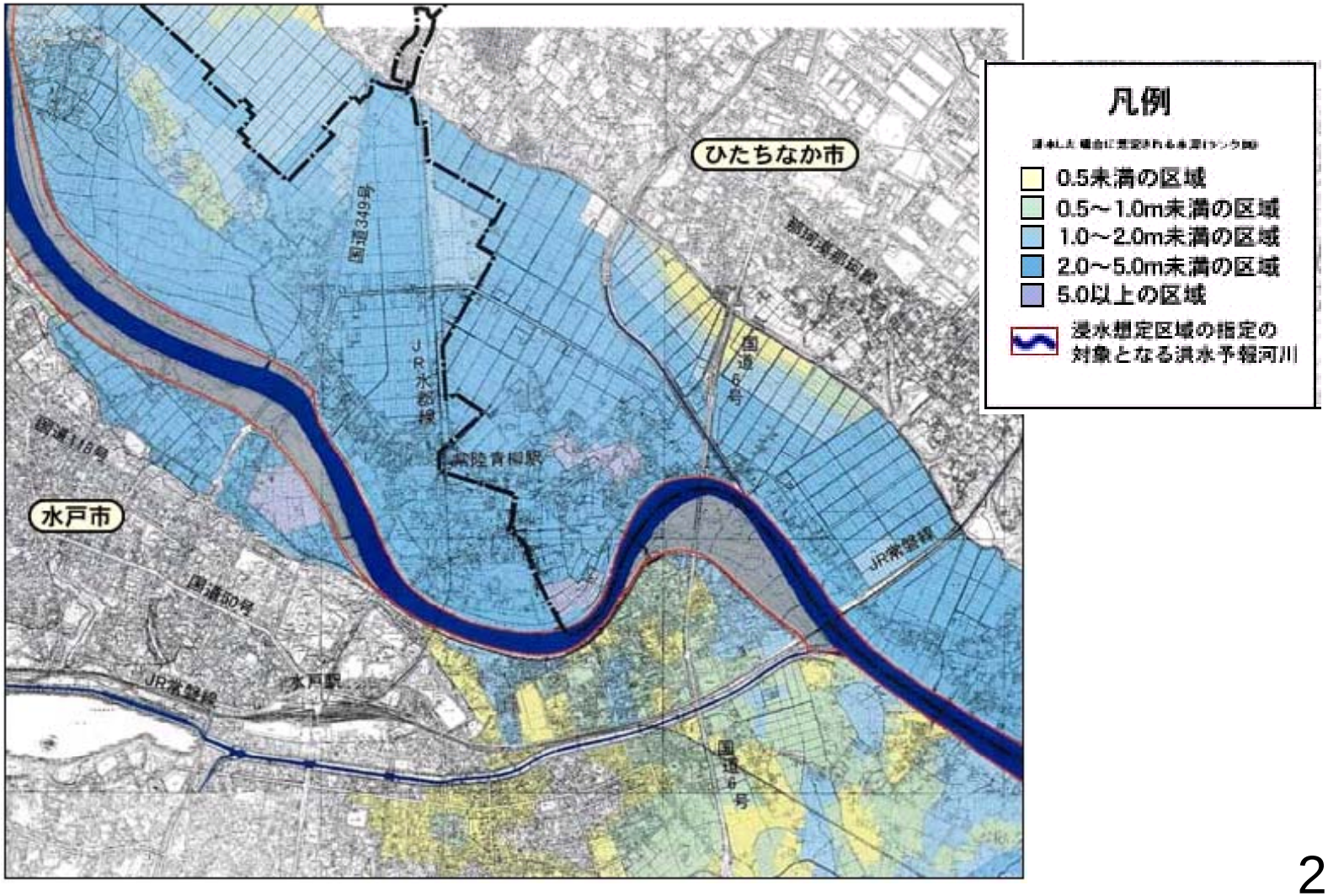
After Amendment

In the major medium and small sized river, the information that the water level has been reached to the concerned level for evacuation



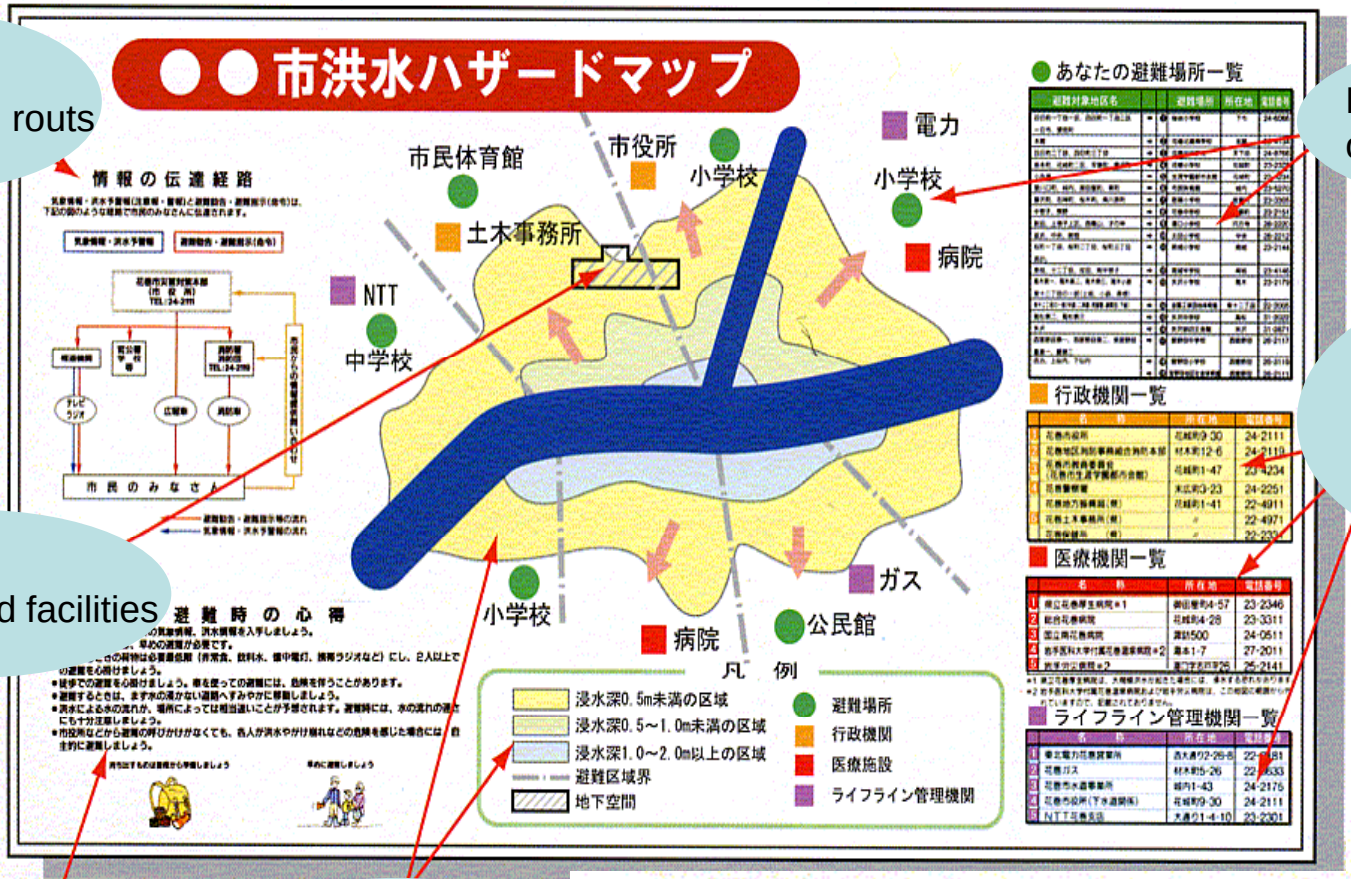
Designation and publication of flood inundation areas

Based of the article 14 of the flood-fighting Act, river administrators (MLIT and prefectural governments) designate areas that may be inundated in the event of flooding as flood inundation areas.



Preparation and dissemination of flood hazard maps

Based on the article 15 of the flood-fighting Act, municipalities prepare and disseminate flood hazard maps to residents on the basis of flood inundation area maps.



Information transmission routs

Names, locations of evacuation sites

Contact information (government offices, hospitals, public utilities)

Location of underground facilities

Tips, things to bring when evacuating

Designated flood inundation area and expected depth

Forecasting Flooding by Large Rivers

With regard to waterways running through two or more prefecture districts, the Minister of Land, Infrastructure and Transport must indicate the water level or flow rate after flooding, or the areas to be inundated after overflow and the depth, and must notify the situation to the local governors as well as to the general public with the cooperation of news media as necessary. (Article 10 (2) of Flood Control Act)

Before

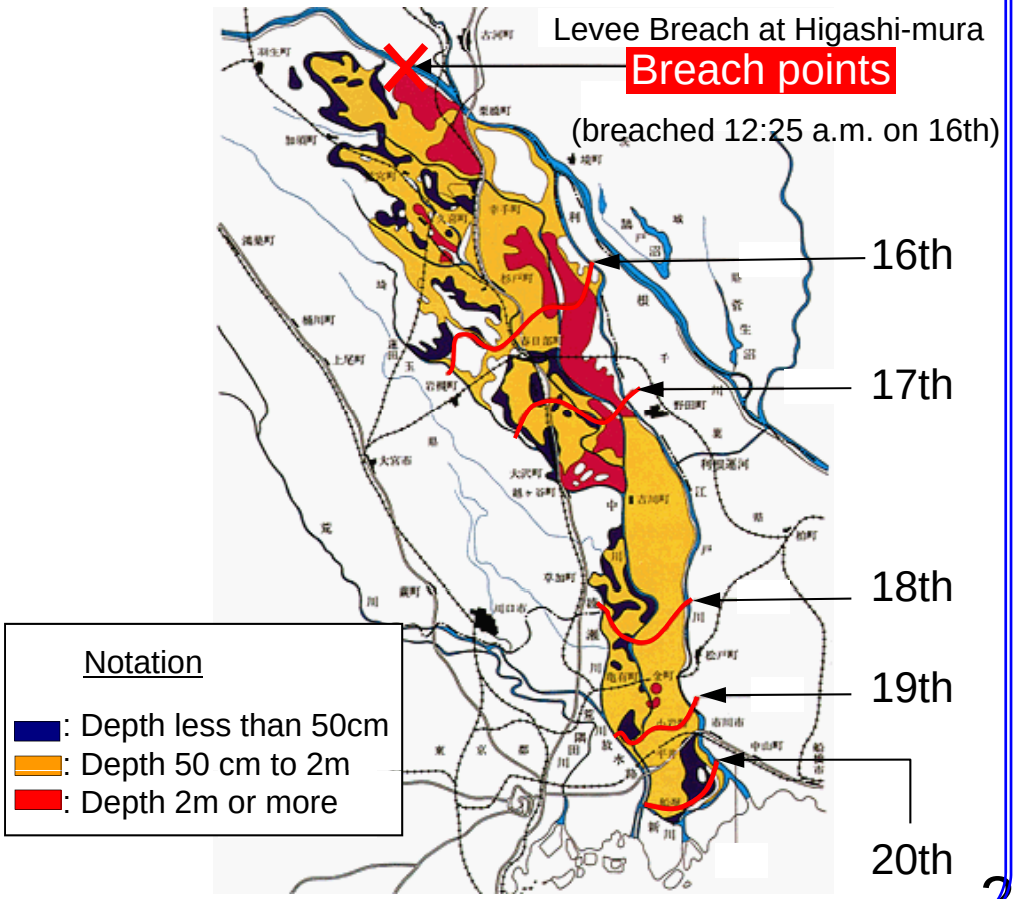
Flood forecasting based only on river water level and flow rate.

After revision

In addition to conventional flood forecasting data, also forecast the areas to be inundated after overflow and the depth so that residents can be evacuated properly.

*The waterways and districts are selected for forecasts of inundation levels considering the population and assets inside the area and the time flood waters are expected to reach the area.

Flooding of Tone Basin by Typhoon Kathleen (Sept. 1947)



Issuing Flood Forecasts (example for Tone River)

In floods, actual and forecast rainfall, water levels and other data are used to calculate inundation in real time, and the areas and depth of flooding are forecast based on the results.

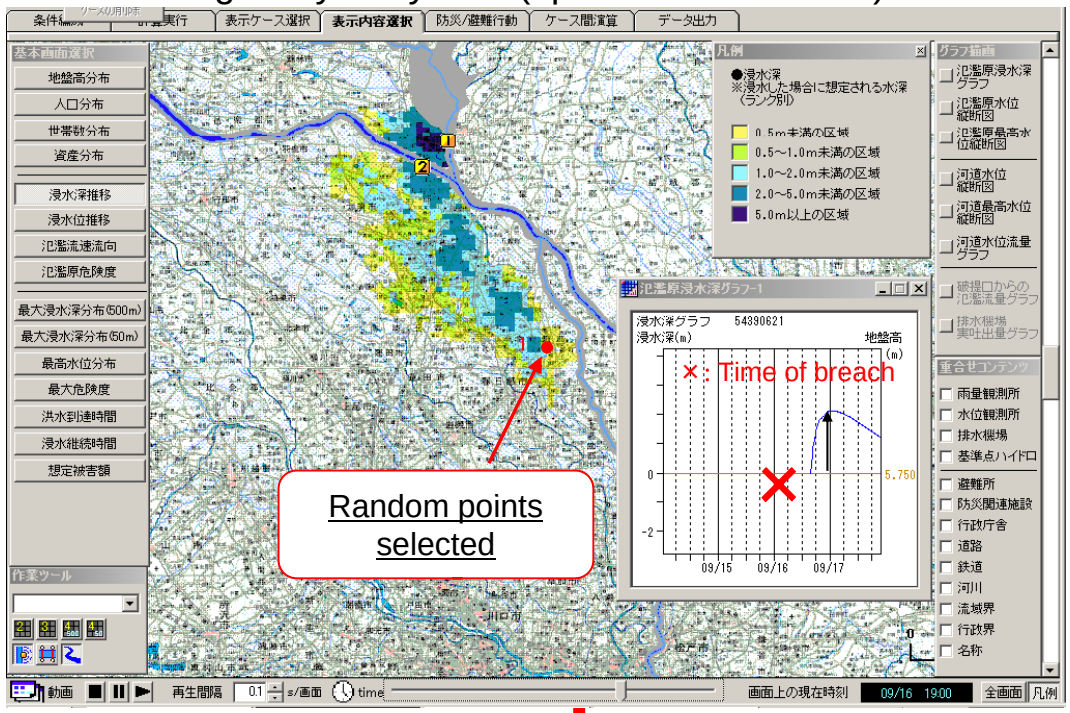
Flood forecasting steps (guidelines)

(1) Collect and exchange data

(2) Forecast flooding

(3) Forecast flood levels

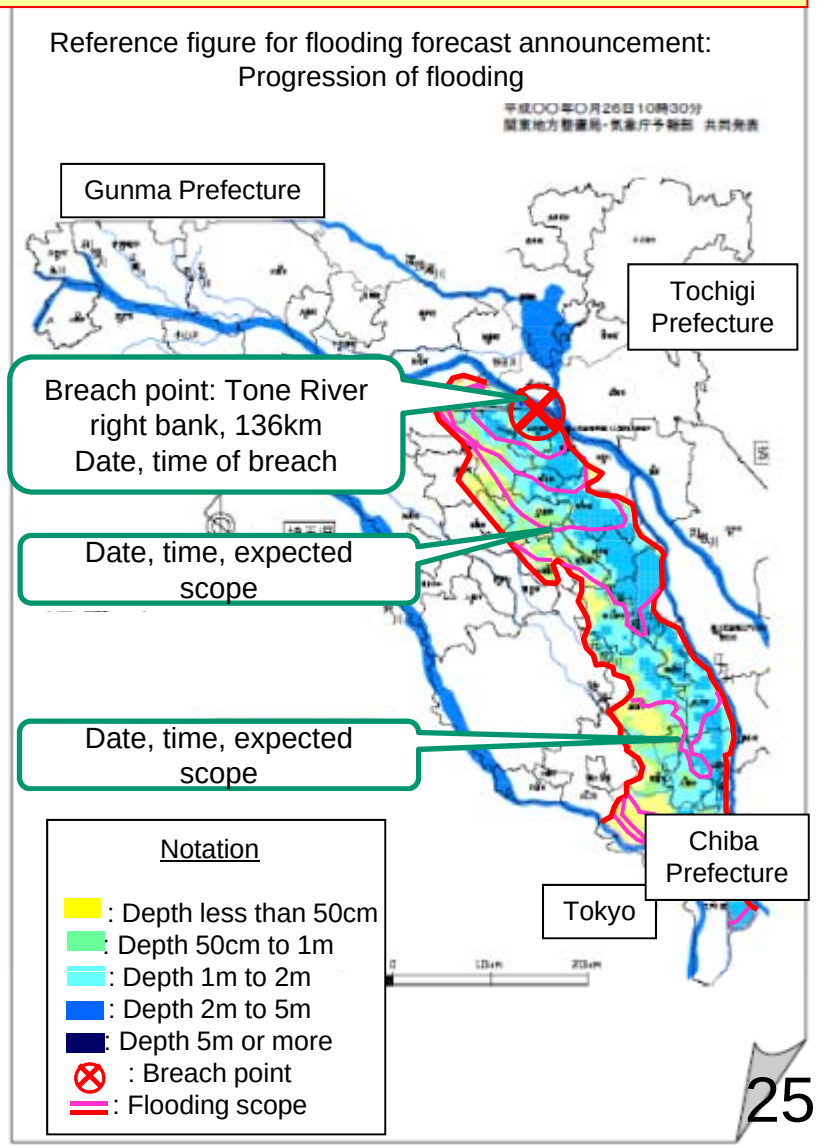
Flooding analysis system (upstream Tone River)



(4) Write up announcement

(5) Issue forecast

Reference figure for flooding forecast announcement:
Progression of flooding

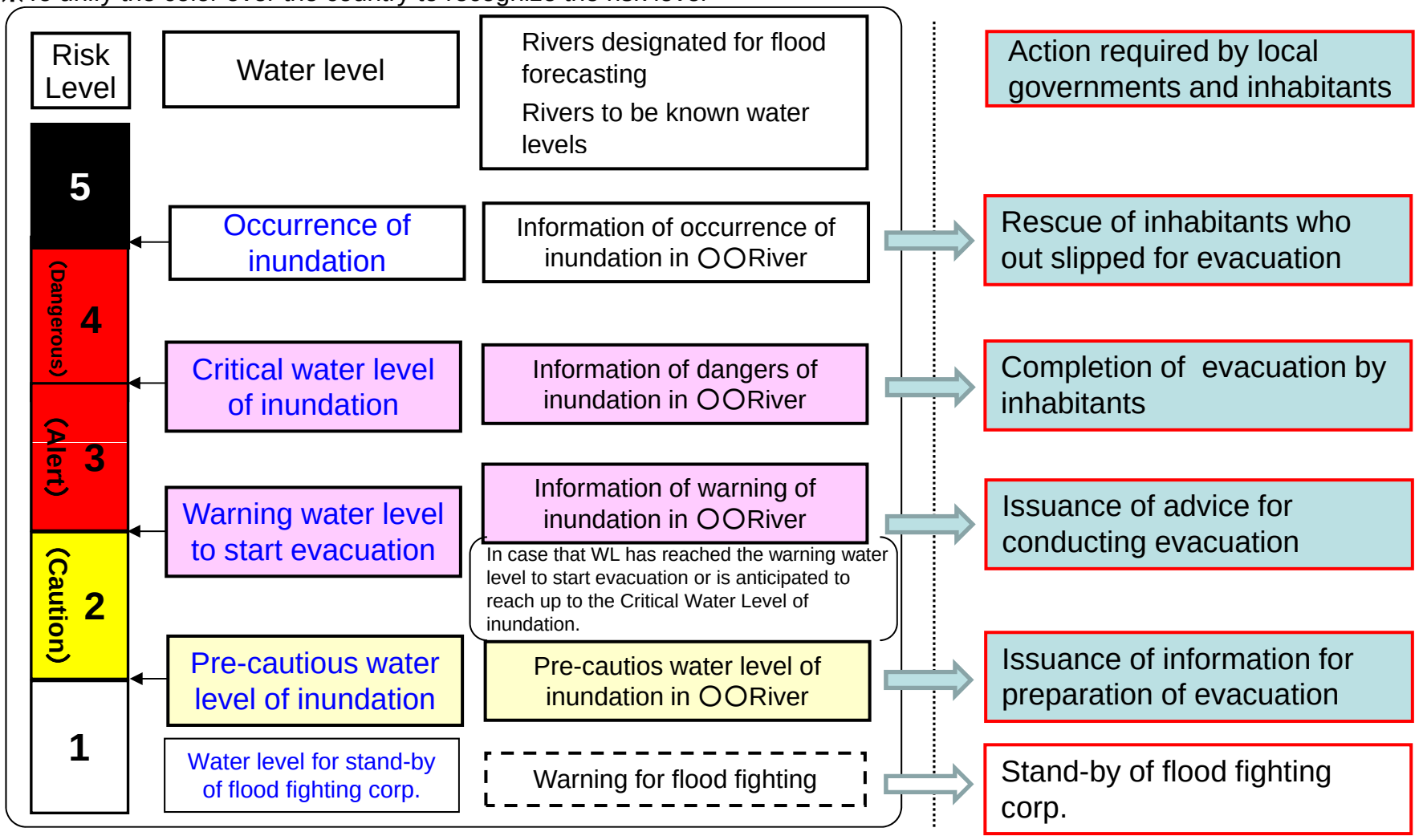


Improvement of Technical Terms for Disaster Management of Floods, etc.

To provide understandable disaster information aiming to lead appropriate judgment and actions by receivers, following improvements are conducted:

- Setting-up of water levels: To set-up risk level of water levels considering extent of

※To unify the color over the country to recognize the risk level

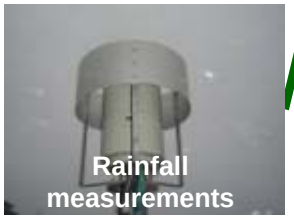


Provision of river information

Routinely measured river information* is provided in real-time (24hours a day, 365 days a year) to river managers, municipal supervisors, and other state departments.
*Includes various data from radar, rainfall measurement stations, river water level meter stations, dams

The Ministry of Land, Infrastructure, Transport and Tourism provides river information in real time, 24hours a day, 365 days a year throughout Japan to help protect lives and property from rainfall-induced river and land-based hazards

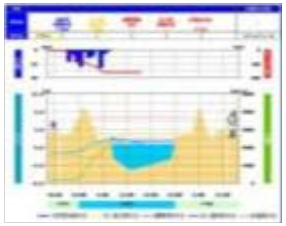
Nationwide data on radar-measured rainfall, river water level/flow rate, ground-level rainfall, dam influx/discharge etc. is measured and sent by telemetry



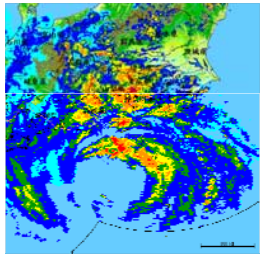
Data is collected, processed and edited into an easy-to-use form and transmitted

Collection
Data is acquired from 17,300 stations nationwide every 10 minutes.

Processing • Editing
Collected data is processed and edited into easily understood tables, graphs, maps, diagrams etc.



Transmission
Data is provided to each user in an easy-to-use form depending on their needs.
(information by time/location provided as needed)



Sent to river managers, municipalities, state depts. etc. via Internet and cell phone

River manager

Municipalities

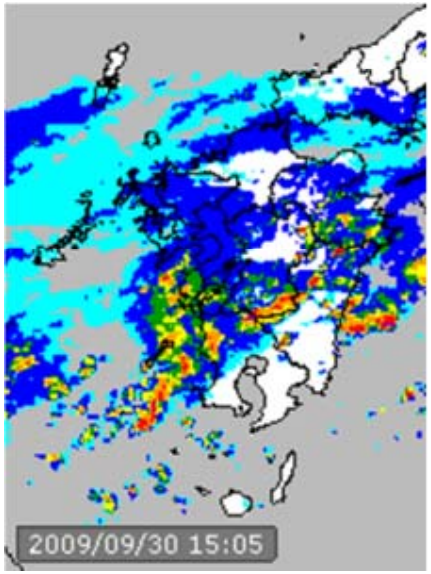
State depts.

Provision of River Information

River information that are provided

Radar rainfall

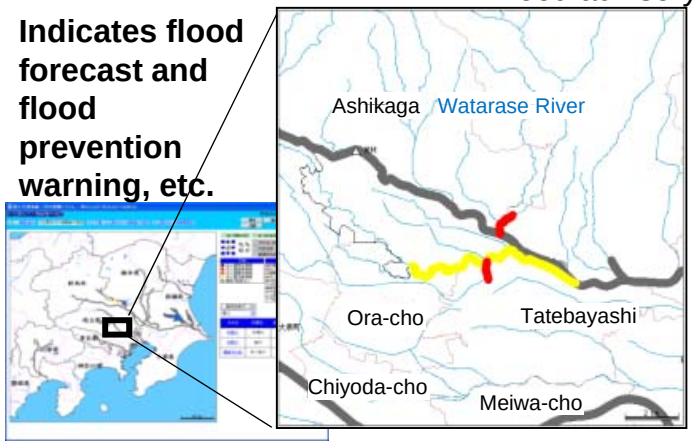
Rainfall distribution, rainfall intensity can be viewed in time series in the transition of rain area



Warning information

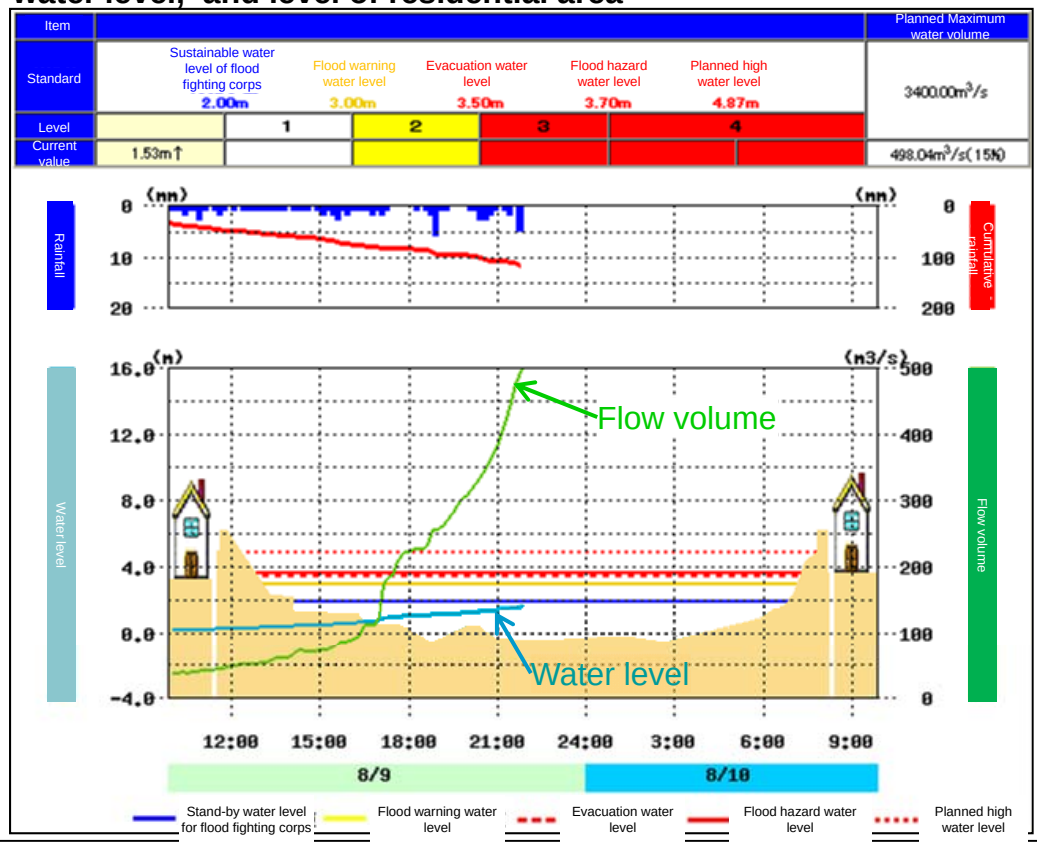
Flood warning
Flood advisory

Indicates flood forecast and flood prevention warning, etc.



Rainfall/water level/flow volume

Indicates relation between water level of the river etc. or standard water level, and level of residential area



List of water level above the standard

Lists water level observation stations that indicate a level above the standard, such as flood hazard etc.

Observation station name	Water system	River name	Water level (m)	Time of observation	Standard water level (m)					Location	Management
					Stand-by for flood fighting	Flood warning	Evacuation	Flood hazard	Planned high		
Ashinoko Lake	Kanto, others	Ashinoko lake	2.47	13:40	2.35	2.50	2.60	—	—	—	Municipality
Mt. Makio	Yodo River	Uji River	2.17→	13:50	2.00	3.00	3.50	3.60	—	Left bank 51.90k	National river

Provision of River information by mobile phone

Information provided to mobile phones

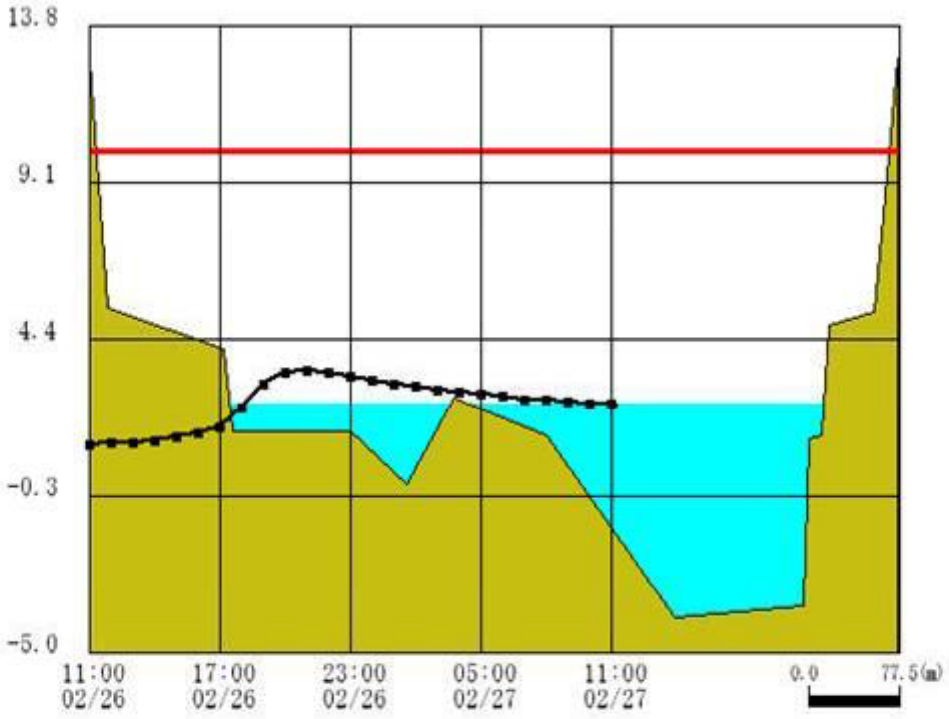
Information provided on the internet

Contents
- Precipitaion by hyeto meter
- Precipitaion by rader rain gages
- Water level etc.

計画高水位	10.01
危険水位	—
特別警戒水位	—
警戒水位	—
指定水位	—

水系名	吉野川
河川名	吉野川
観測所名	高瀬橋
所在地	徳島県名西郡石井町藍畑

年月日時分	水位(m)
2006/02/27 11:00	**
10:00	**
09:00	**
08:00	**
07:00	**
06:00	**
05:00	**
04:00	**
03:00	**
02:00	**
01:00	**
2006/02/26 24:00	**
23:00	**
22:00	**
21:00	**
20:00	**
19:00	**
18:00	**
17:00	**
16:00	**



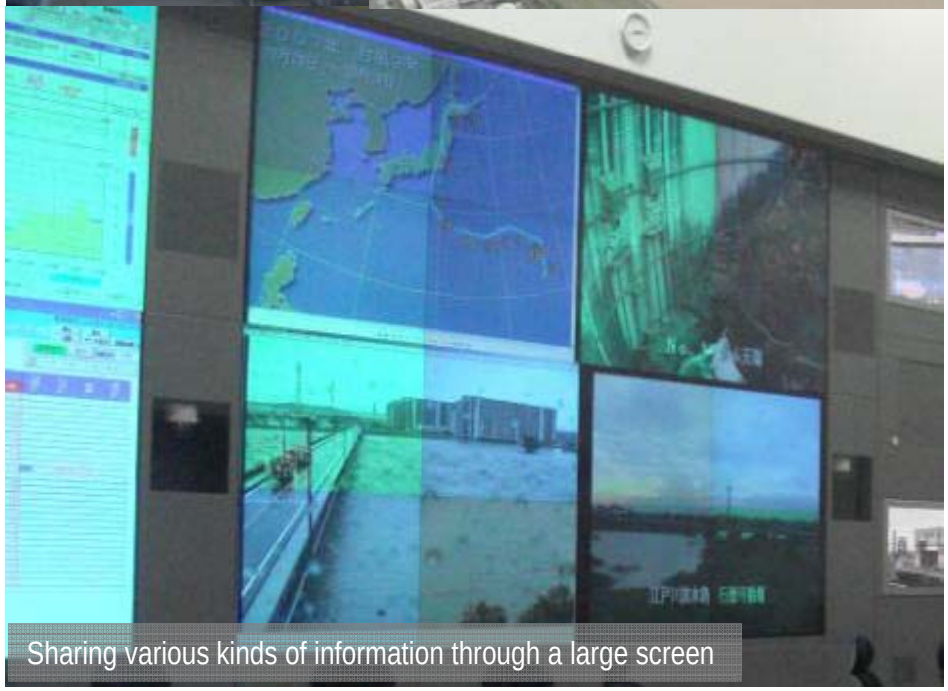
※この情報は速報値であり 検定済データではありません。

Improvement of information systems for gathering and analyzing

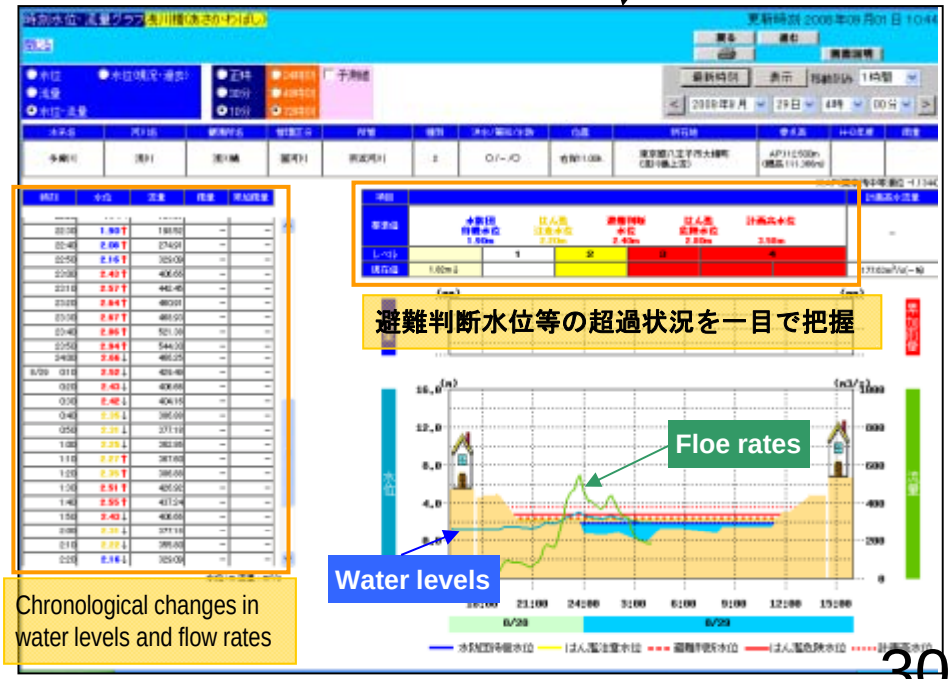
○When a disaster occurs, bases are established to collect information and respond to the disaster.
○It is necessary to establish systems to gather, analyze, and share various kinds of information such as water levels, flow rates, and precipitation.


Response to disaster

Images of affected areas sent by helicopters


Sharing various kinds of information through a large screen


River information system

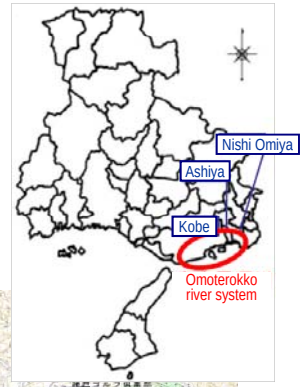


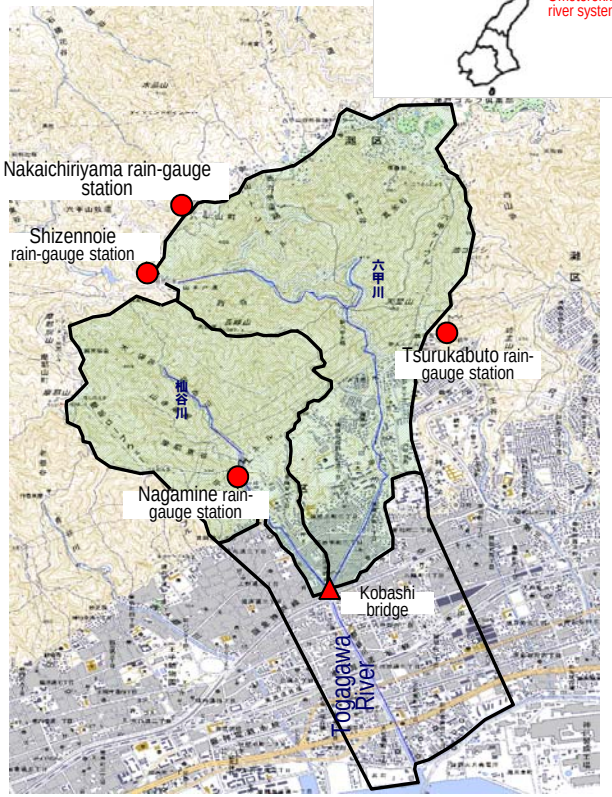
Chronological changes in water levels and flow rates

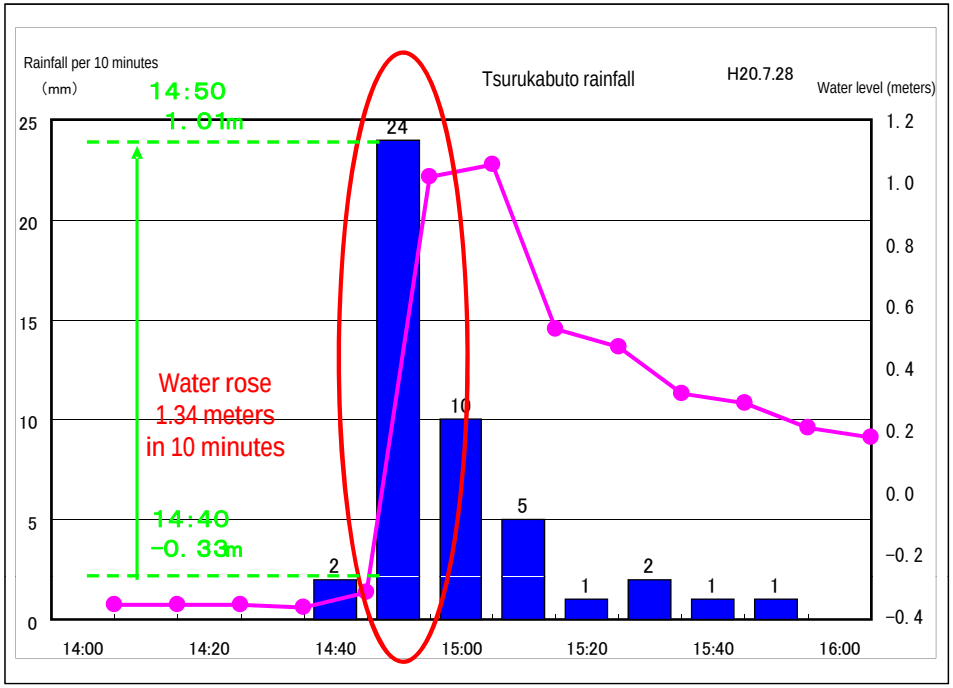
写真：国土交通省関東地方整備局

Water levels and rainfall at the Kobashi Bridge on the Togagawa River, July 28, 2008

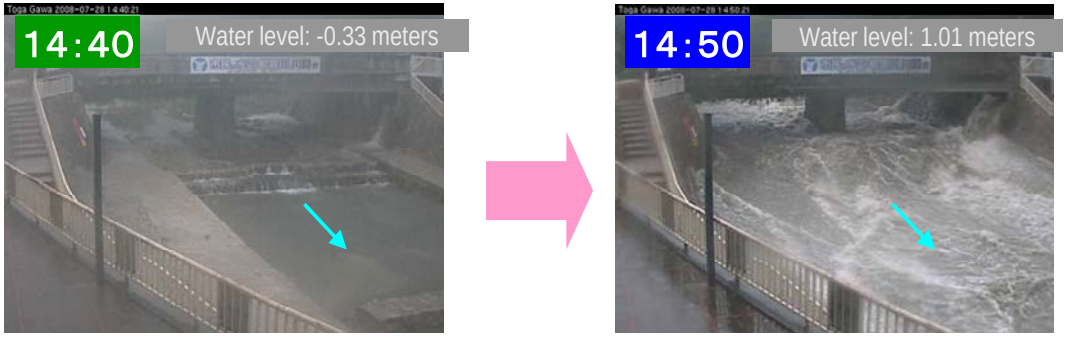
- An intense rainstorm hit the Togagawa River basin from 2:30 to 3 p.m. A 10-minute period was particular intense in Nagamine and Tsurukabuto starting at 2:40 p.m.
- At the Kobashi water-level station, the water level rose 1.34 meters in 10 minutes between 2:40 and 2:50, almost simultaneously with the downpour
- Five people were killed, including 3 children, 11 people rescued, and 41 people evacuated







Rising water levels at the Kobashi bridge (photos from a Kobe monitoring camera)

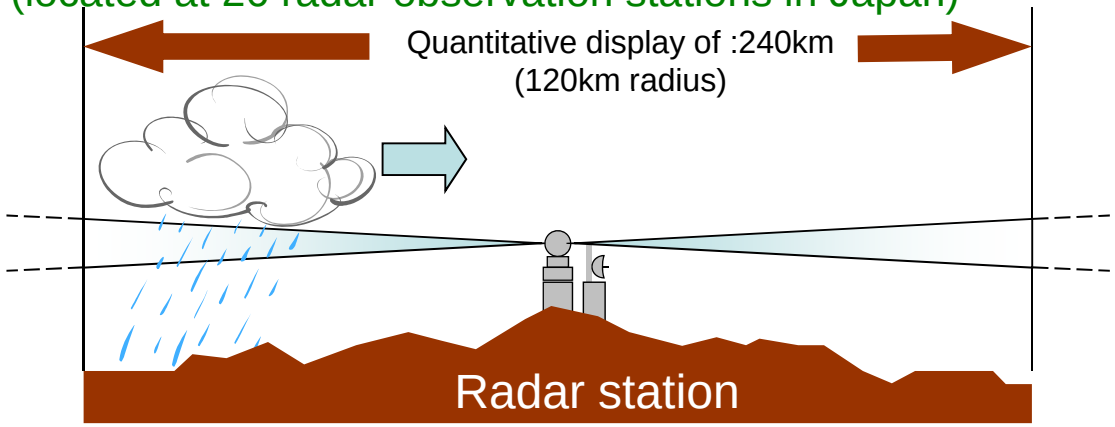


From a Hyogo Prefecture report by the First Small and Mid-Sized River Water Damage Prevention Study WG

Rainfall Observation in the Past

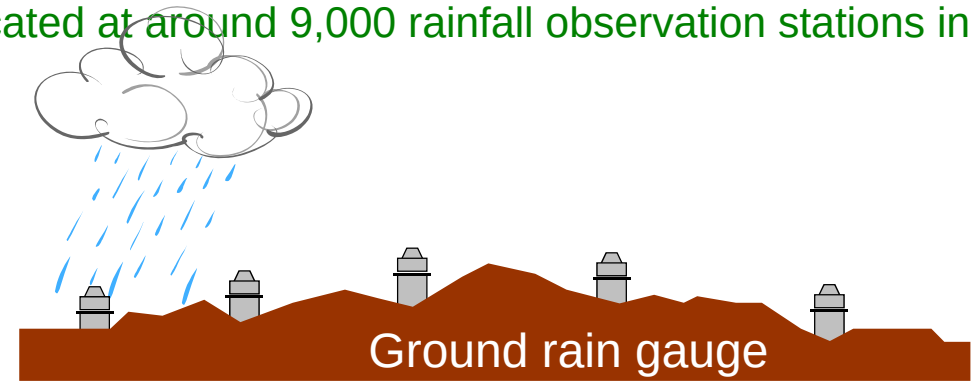
- 26 units of C-band radars monitor across Japan as well as the conventional ground rain gauge, for monitoring the rainfall in a wide-area.
- Although effective for observing frontal heavy rain in a wide-area, detecting sudden intense rainfall in details may be difficult.

Radar rain gauge system
(located at 26 radar observation stations in Japan)

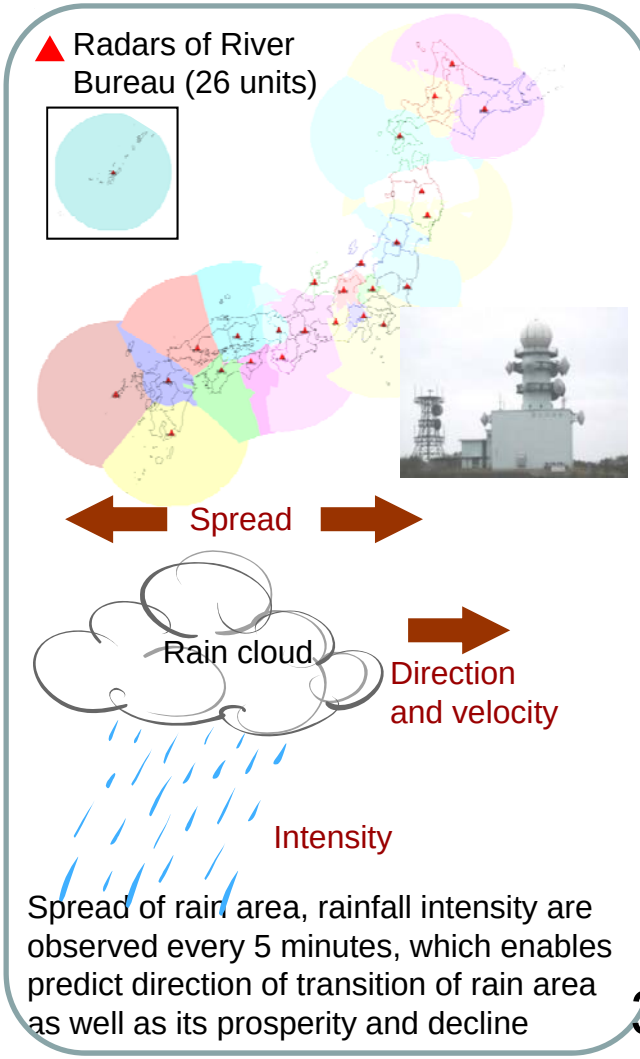


Detects rainfall in a wide-area

Conventional rain gauge system
(located at around 9,000 rainfall observation stations in Japan)



Detects rainfall only at the observation point

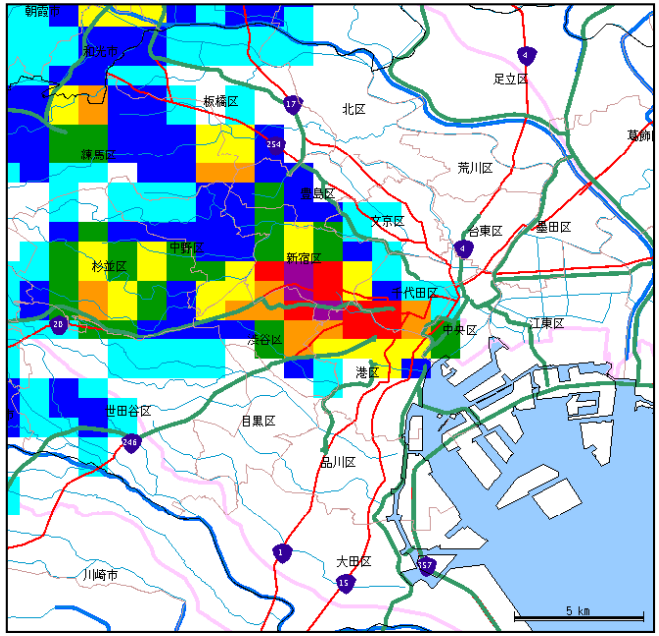


Spread of rain area, rainfall intensity are observed every 5 minutes, which enables predict direction of transition of rain area as well as its prosperity and decline

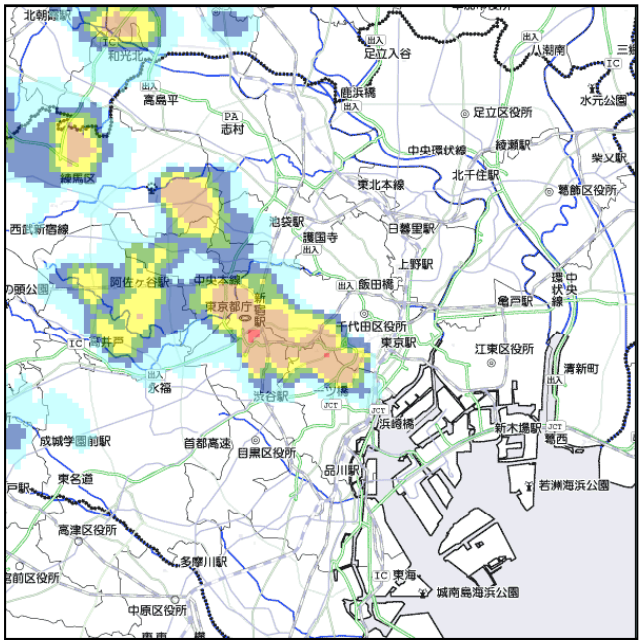
X-band multi-parameter rain radar for torrential rain

Existing radar (C-band radar)
- Min. observation area: 1 km mesh
- Observation interval: 5 minutes
- Time to end user: 5 to 10 minutes
- Obs. Radius: 120 km

X-band MP radar
- Min observation area: 250 m mesh
- Observation interval: 1 minute
- Time to end user: 1 to 2 minutes
- Obs. Radius: 60 km



High frequency (5-fold) High resolution (16-fold)

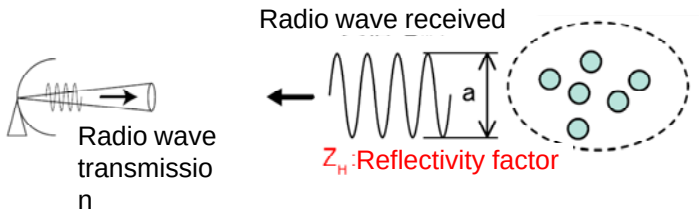


*In contrast to C-band radar (observation radius of 120 km), which is suited for broad-area precipitation observations, with X-band radar (observation radius of 60 km), detailed and real-time observation of local heavy rain is possible though the observable area is small.

Characteristics of the X Band MP Radar

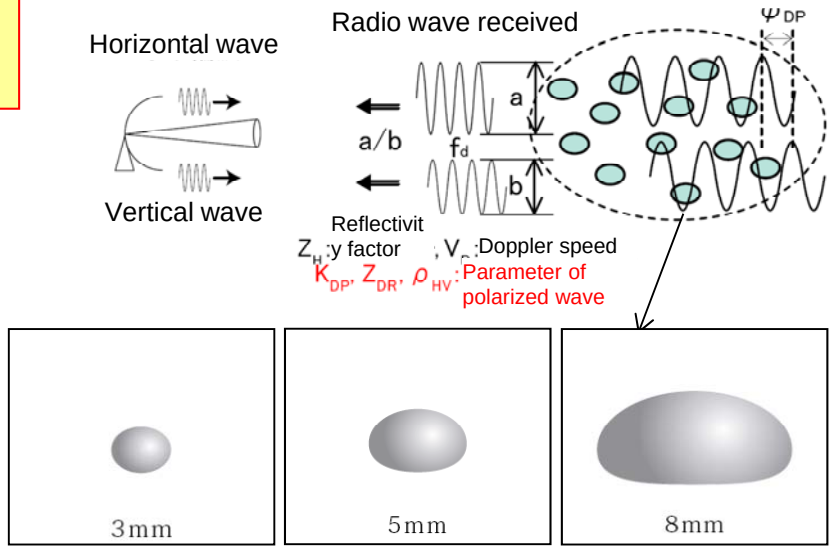
1. High resolution (characteristic of X band)

- Wavelength of X band radar is shorter compared to C band radar, and enables observation of high resolution.



2. High real-time performance (characteristic of MP radar)

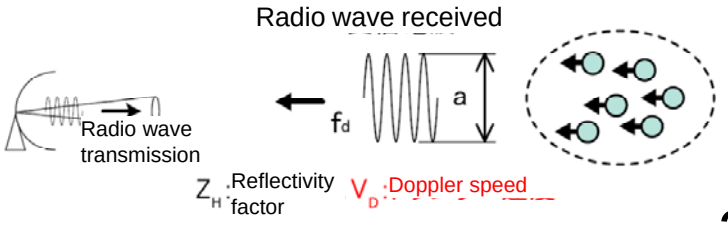
- By transmitting 2 types of polarized waves (horizontal and vertical), the shape of the raindrops are detected, and from the ellipticity of the raindrops, the rainfall quantity can be estimated.
- A highly accurate rainfall observation data can be transmitted almost at real-time without correction made by the ground rain gauge.



Detect and analyze transformation of raindrops

3. Wind observation (Doppler function)

- Wind observation by measuring the raindrop speed using the Doppler function.



Difference between Conventional Radars and X-Band MP Radars

[Comparison between X-band MP radar and existing radar]

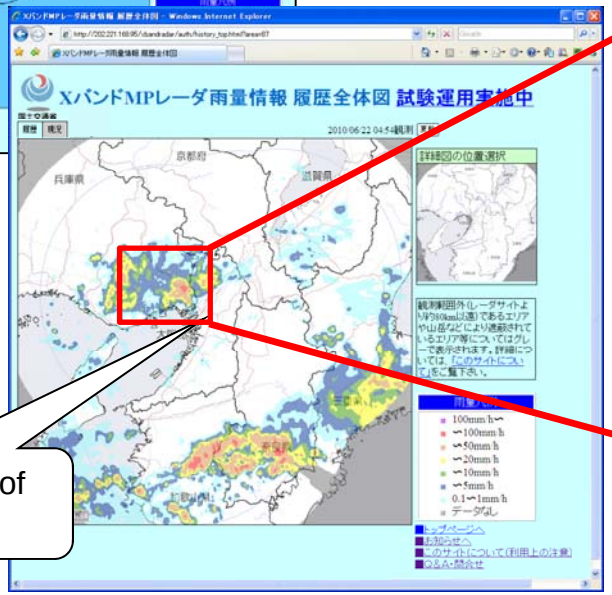
Radar type	**C-band radar (existing)**	**X-band radar (new)**
Frequency and wavelength	4 to 8 GHz, about 5 centimeters	8 to 12 GHz, about 3 centimeters
Measurement application	Measure rainfall (broad area)	• Measure rainfall (narrow area, detailed) • Measure occurrence of rainy area and movement path
Measurement interval	Five minutes	One minute (target)
Time lag to data announcement	Five to 10 minutes	One to two minutes (target)
Resolution of provided data	1 kilometer	250 to 500 meters
Doppler measurements (wind measurements)	Partial (possible at some stations)	Available
Scan directionality	Planar scan	3D scan (ascertain the raindrop formation process)
Dual polarization radar (determine state of raindrops)	Partial (possible at some stations)	Available

Delivery of X-band MP radar（Lanch on 7.2010）

- Observation information that is acquired based on test operation is delivered as Web images.
- The observation areas for which information delivery implemented at this time are the 4 areas of Kanto Chubu, Kinki and Hokuriku.
- 2 types—current rainfall images (updated every minute) and historical images (from 30 minutes beforehand to current state).
- Delivery of observation information is carried out through the following URL. http://www.river.go.jp/xbandradar/

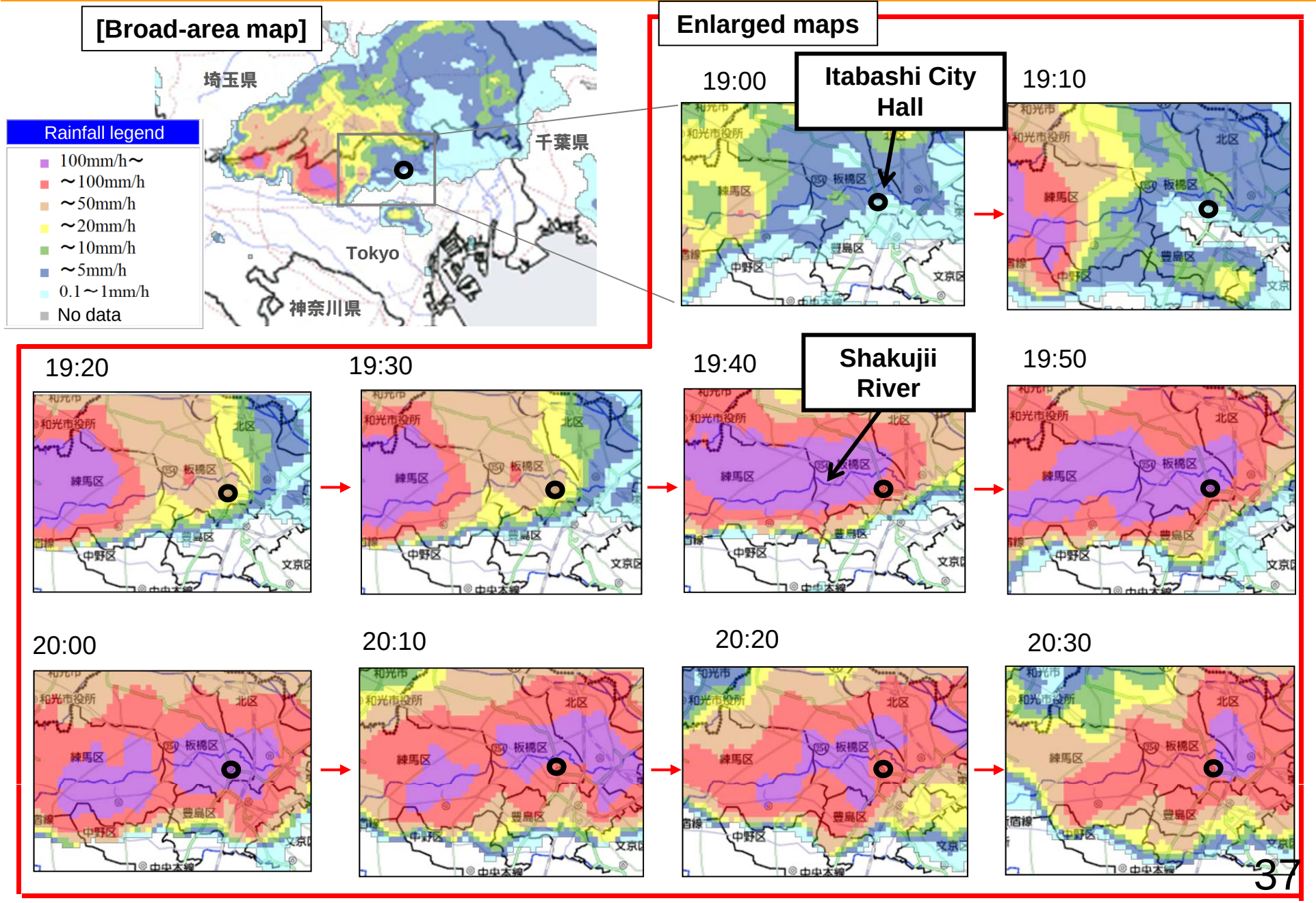
[X-band MP radar delivery image (Nationwide version)]

[X-band MP radar delivery image (Detailed map)]



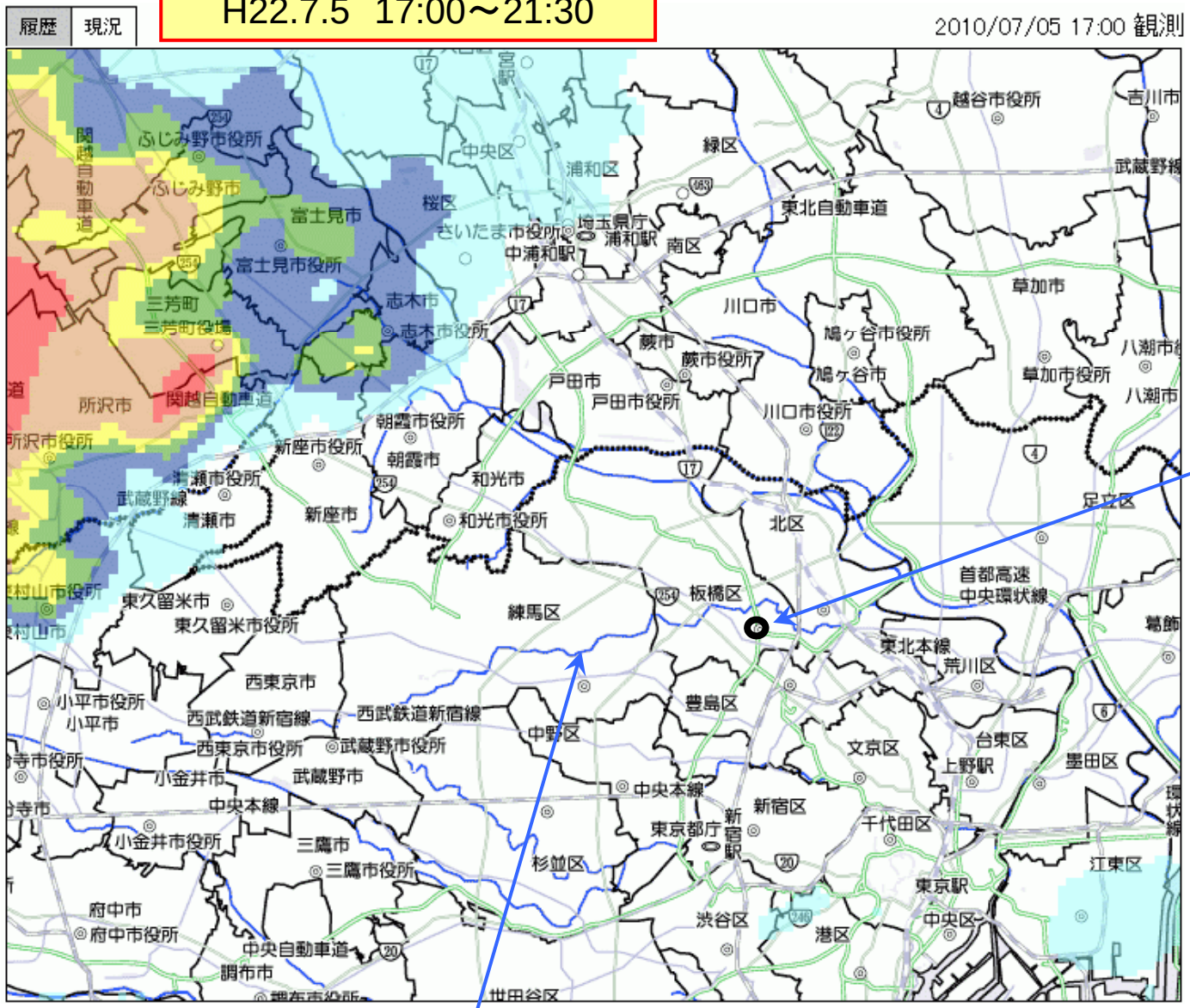
[X-band MP radar delivery image (Wide-area map)]

Actual Observation Samples with X-Band MP Radar (Heavy Rain in Itabashi on July 5, 2010)

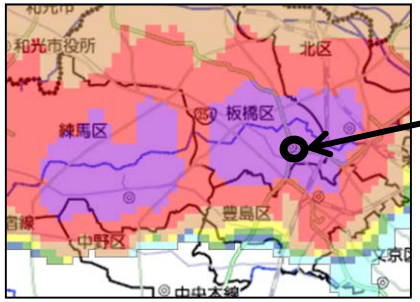


Actual Observation Samples with X-Band MP Radar (17:00 to 21:30)

H22.7.5 17:00～21:30



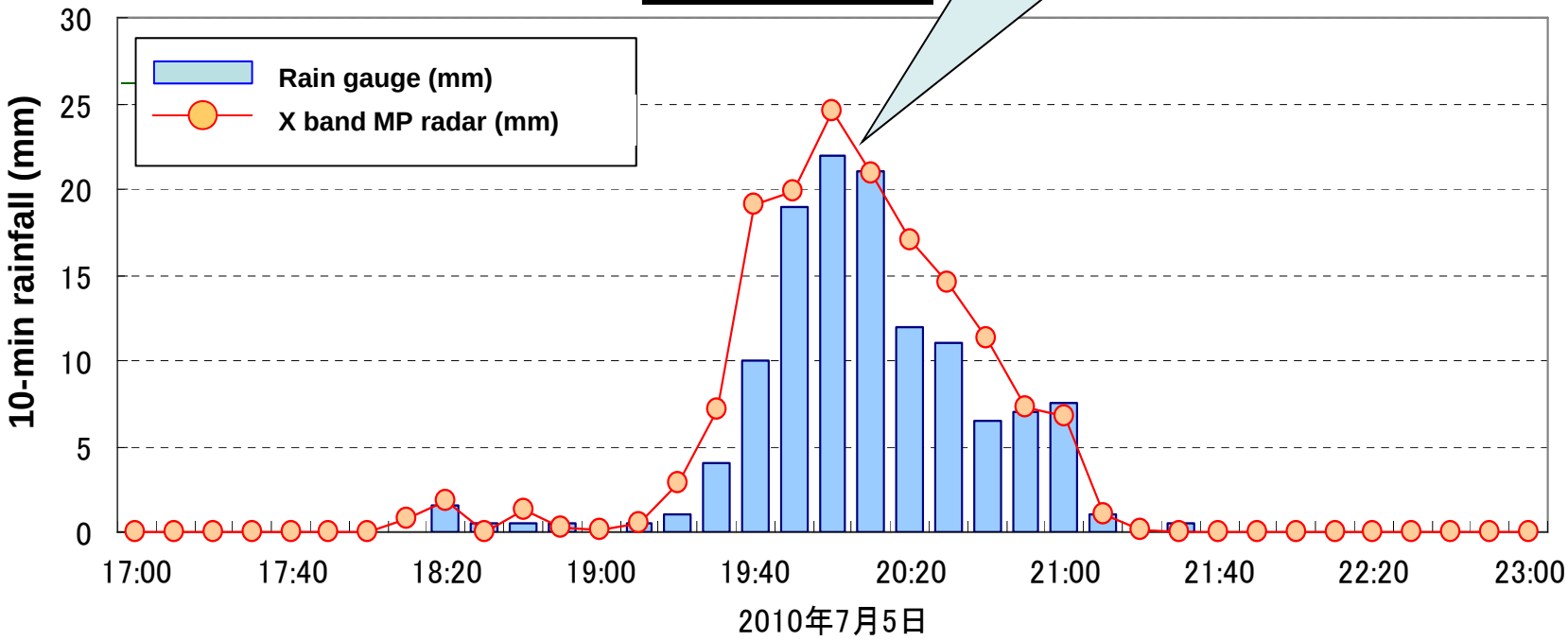
Comparison with rain gauge (Tokyo, July 5, 2010)



Itabashi, Tokyo

X band MP radar provides accurate and quasi-realtime rain data without rain gauge calibration.

Itabashi



Terrestrial Digital Broadcasting in Kyushu Region (July 20, 2010)

Approximately 4 to 6 screens created for each prefecture. Screens can be switched arbitrarily using a remote control.

For rainfall, the four shades as represented by the circles express the intensity of rain, and the maximum number of observation locations is 9 locations.

The squares on the map are water level observation locations. For selected observation locations, the color flashes. Information for the selected observation location (changes in water level), and the current level, etc. are displayed.