Multi-layered Water-related Disaster Risk Reduction toward Early Warning for All

- Japan-

November 20, 2024

ESCAP/WMO TYPHOON COMMITTEE

19th Integrated Workshop / AP-TCRC FORUM

TECHNICAL PRESENTATIONS (PLENARY)

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MLIT Ministry of Land, Infrastructure, Transport and Tourism

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4. Flood Risk Mapping Project
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Hydrological observatory network in Japan

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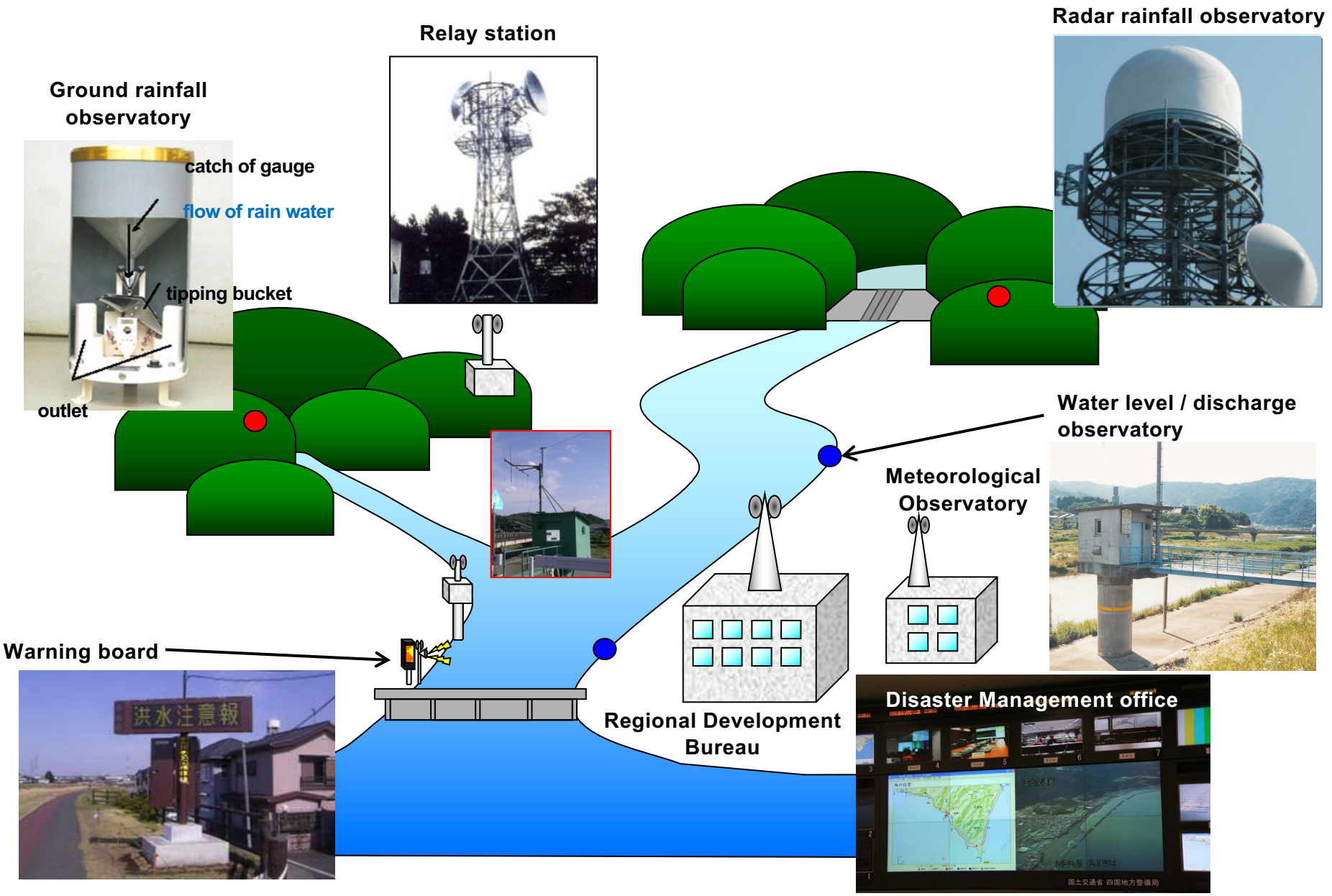

Hydrological observatory network in Japan

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Number of observation posts distributing data via automatic data transfer units (as of Feb. 2024)

Administrator	Rain gauge station	Water gauge station
River and disaster management bureau, MLIT	2404	2,078
Japan Meteorological Agency	1,286	—
Prefectures and Japan Water Agency	5,039	4,892
Total	8,721	6,970

Frequency of observations

Type	Frequency
Ground rainfall observation	・hourly ・10 min (flood time, etc.)
Rader rainfall observation	・C-band：5 min to 10 min ・X-band：1 min to 2 min
Water level observation	・hourly ・10 min (flood time, etc.)
Discharge observation	・Low flow measurement: 36+ times / yr ・Flood flow measurement: 10 floods / yr

Flood risk information

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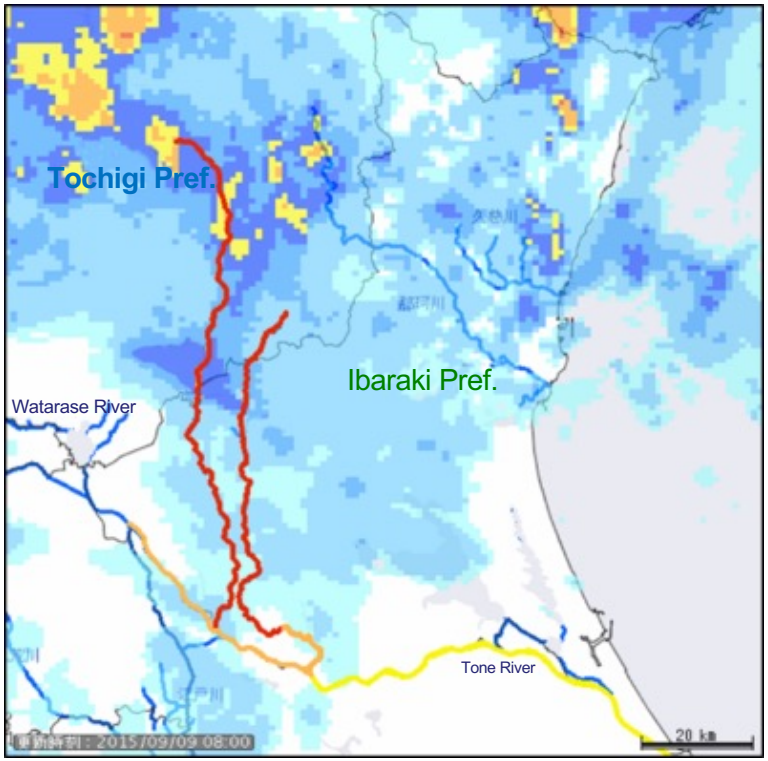
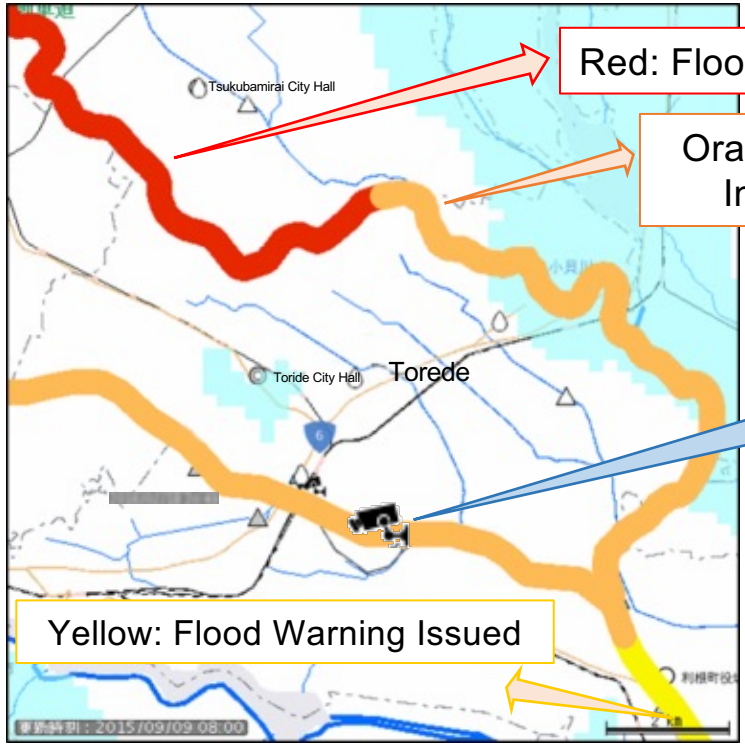
Learn the current state of river water levels and rainfall.

- Forecasts and warnings are issued in response to changes in water level, and the color of the river displayed will also change.
- Click on the camera icon to check a live image showing the current condition of the river.
- Learn the current rainfall status from radar.



Prefecture View



Municipality View

Camera Image

Flood risk information

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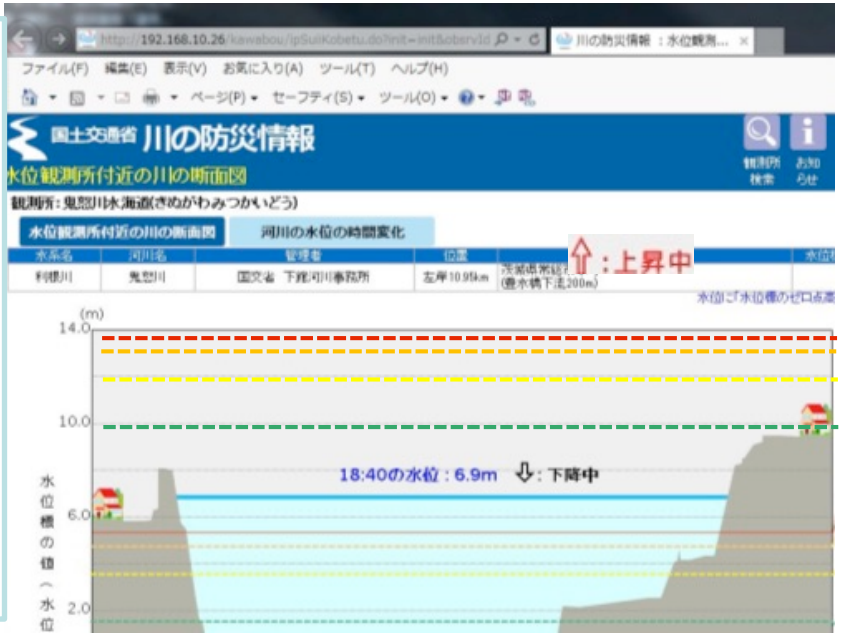
Understand the current risk of flooding based on the river water level.

- When the river water level is rising, the mark ⇧:上昇中(rising) will be displayed together with the water level information.
- The higher the water level of nearby rivers, the greater the likelihood of flooding in your area.
- For nearby rivers with a high risk of flooding, please ensure that you are safe and take appropriate disaster prevention action.



River Water Level Legend	
Flood Danger Level	Level at which there is a danger of river flooding
Evacuation Decision Level	Level which provides the basis for issuing an evacuation order
Flood Warning Level	Level at which caution should be exercised for the river flooding
Flood Fighters Alert Level	Level at which flood fighters are placed on stand-by

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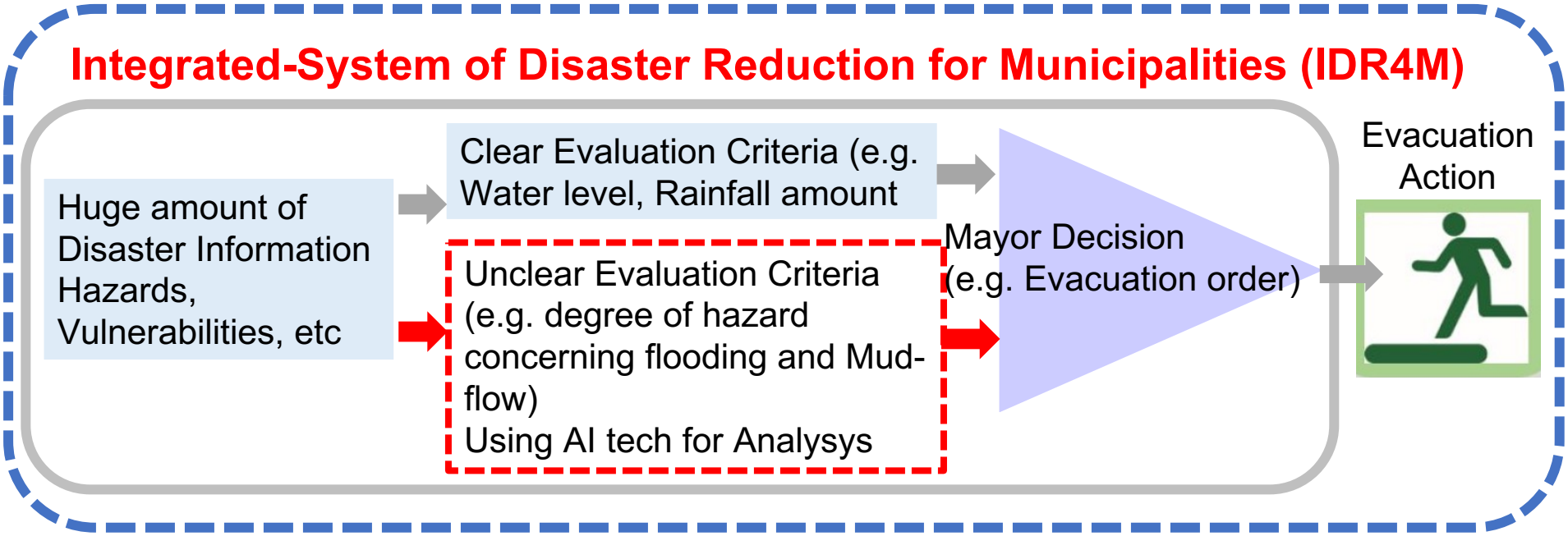
Integrated Water-Related Disaster Information System for Municipalities (IDR4M)

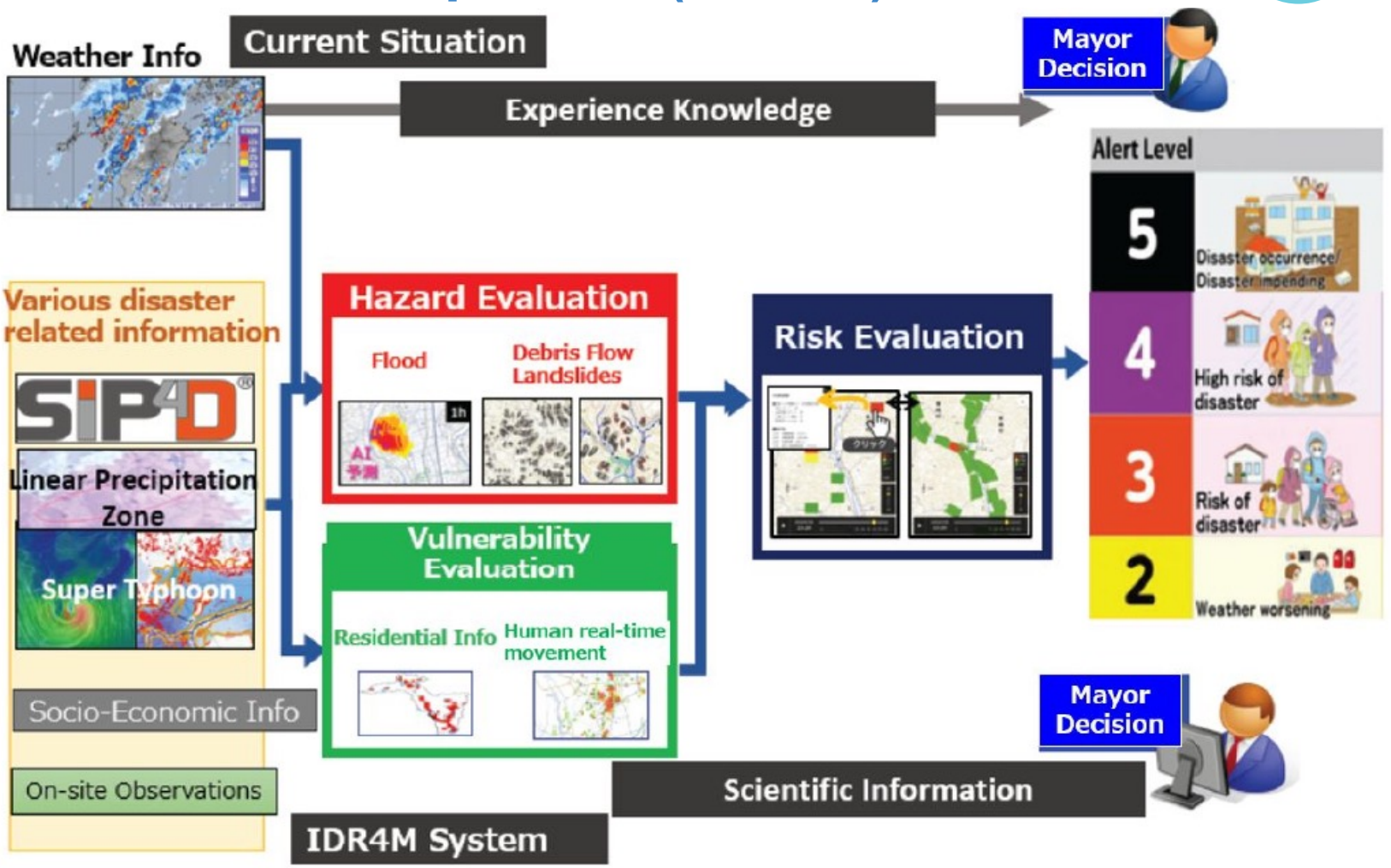


Problems at municipalities

- Limited officials and lack of experience for disaster response
- Huge amount of disaster related information to check in a short amount of time

IDR4M aims to provide disaster risk information to municipalities for science-based decision-making in disaster response operations, such as issuing evacuation order

Integrated Water-Related Disaster Information System for Municipalities (IDR4M)



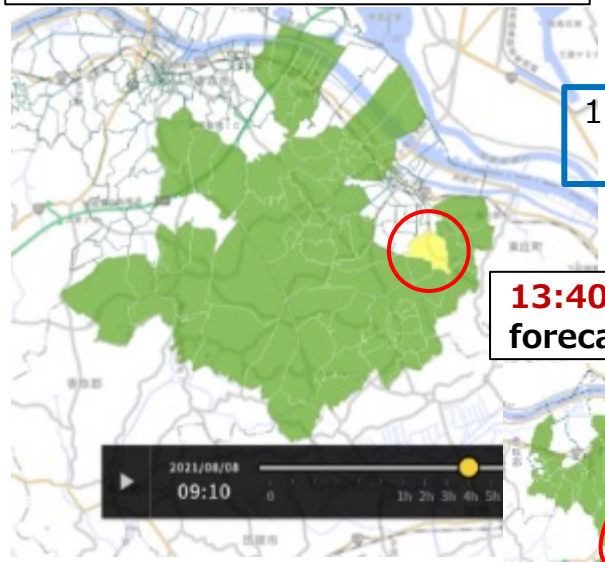
1) Integrate disaster information and deliver them to municipalities in a usable manner,
2) Develop an integrated hazards/vulnerabilities risk information system, and
3) Provide real-time/pinpoint risk information to residents.

Integrated Water-Related Disaster Information System for Municipalities (IDR4M)

	Municipality	Event
July 2021	Katori City	Day 3, 07:20, Evacuation instruction released
	Takahashi City	No action (judged not necessary)
August 2021	Katori City	Day 8, 14:50, Evacuation of the elderly released
	Toho Village	Day 12, 17:30, Evacuation of the elderly released
		Day 13, 17:30, Evacuation instruction released
		Day 16, 18:13, Evacuation of the elderly released
	Takahashi City	Day 13, 17:45, Evacuation of the elderly released
		Day 14, 10:30, Evacuation Instruction released
	Katori City	Day 15, 05:10, Evacuation instruction released
	Kakogawa City	No action (judged not necessary)
	Maizuru City	No action (judged not necessary)
	Adachi Ward	No action (judged not necessary)
	Joso City	No action (judged not necessary)
Sept. 2021	Katori City	Day 30, 16:00, Evacuation of the elderly released
July 2022	Toho Village	No action (judged not necessary)
	Takahashi City	No action (judged not necessary)
Sept. 2022	Toho Village	Day 18, 10:00, Evacuation of the elderly released
		Day 18, 15:00, Evacuation instruction released
	Joso City	No action (judged not necessary)

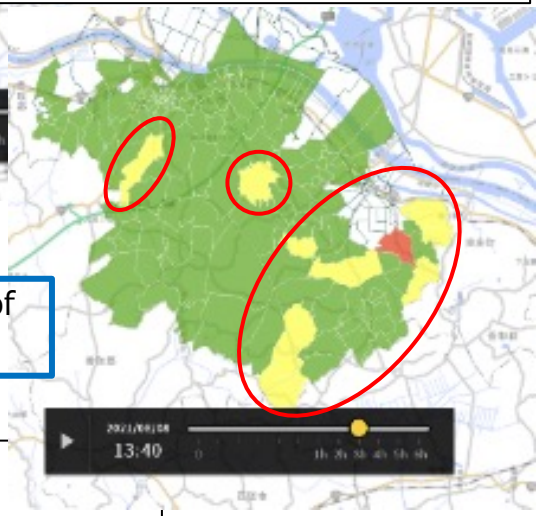
【Usage example: IDR4M Disaster risk of Katori city affected by Typhoon No.8, on August 8, 2021】

9:10 Disaster risk forecast after 4 hours; 13:10



13:36 issued "Heavy rain warning"

13:40 Disaster risk forecast after 3 hours; 16:40



14:50 issued "Evacuation of the elderly, etc"

Legend: Disaster risk
- Evacuation (Evacuation Instruction)
- Preparation (Evacuation of the Elderly, Etc)
- Advisory

Integrated Water-Related Disaster Information System for Municipalities (IDR4M)

- Selected 18 municipalities from whole Japan in terms of different topography and characteristics.
- Conducted demonstration experiment in the model municipalities.

Kakogawa City, Hyogo

Himi City, Toyama

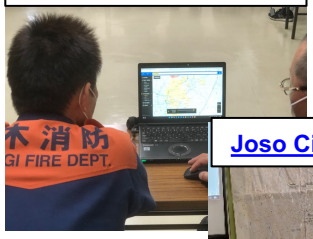
Ngaoka Citym Niigata

Obihiro City, Shintoku Town, Sikaoi Town and Memuro Town, Hokkaido

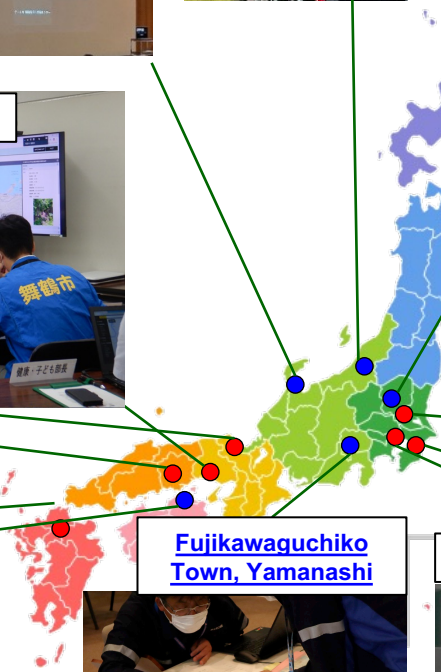
Takahashi City, Okayama

Maizuru City, Kyoto

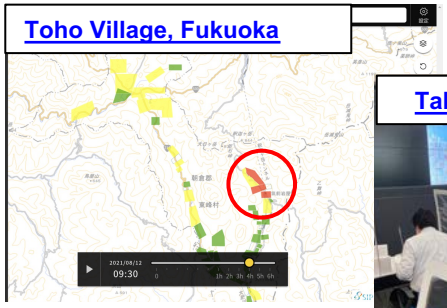
Tochigi City, Tochigi



Joso Citym Ibaraki

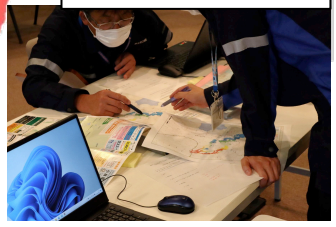


Toho Village, Fukuoka

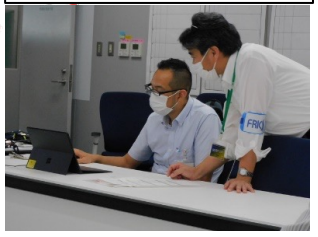


Takamatsu City, Kagawa

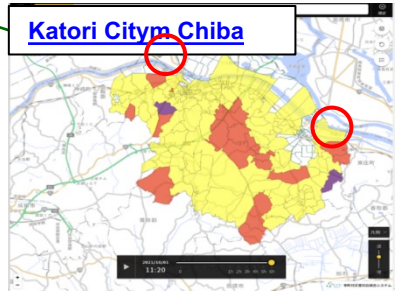
Fujikawaguchiko Town, Yamanashi



Adachi Ward, Tokyo



Katori Citym Chiba



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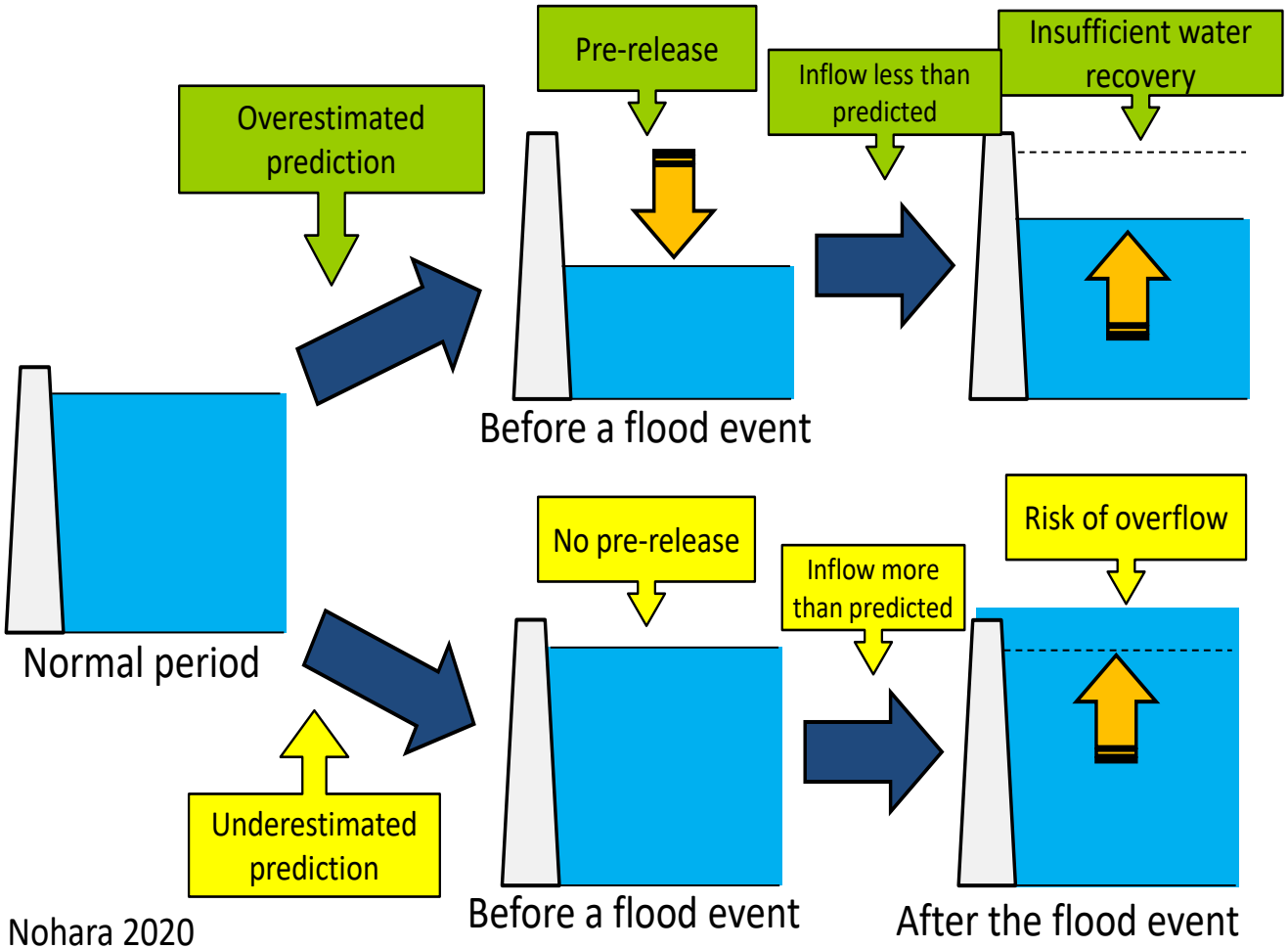
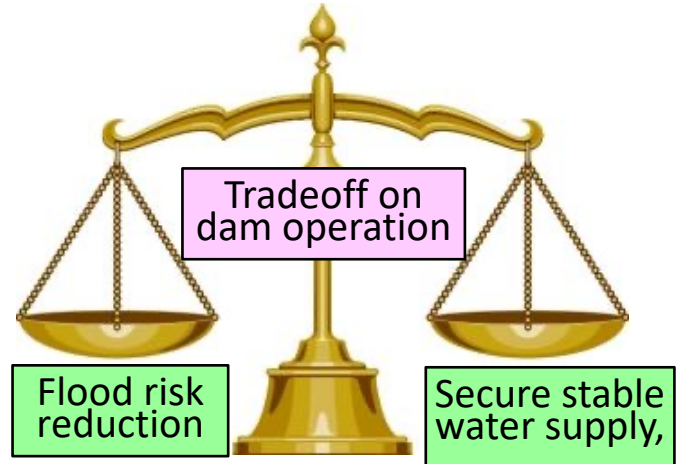
Long-term rainfall prediction and decision support system for the Integrated dam operation

Handling uncertainty contained in the predictions has been issues.



Nohara 2020

It is difficult to know suitable amount of preliminary release volume because of rainfall prediction uncertainty.



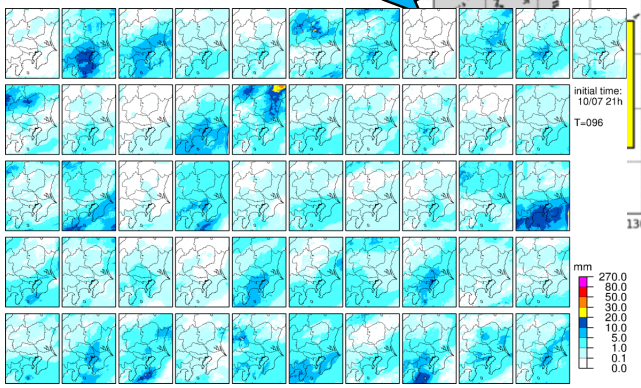
SIP 戦略的イノベーション創造プログラム
Cross-ministerial Strategic Innovation Promotion Program

Cross-ministerial Strategic Innovation Promotion Program

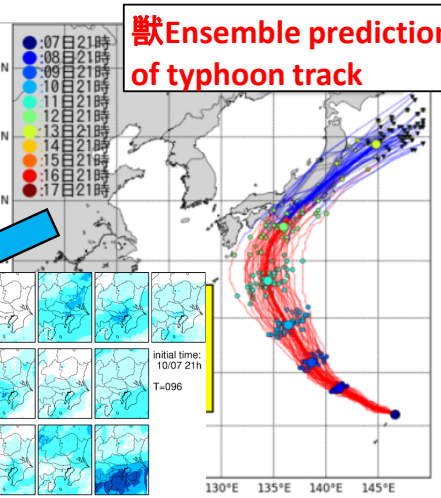
Long-term rainfall prediction and decision support system for the Integrated dam operation

獲Ensemble rainfall prediction

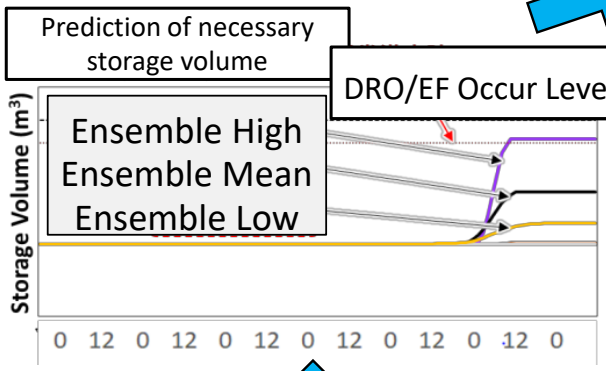
ECMWF, 51 Ensemble,
15 days advance,
Downscaling 1km, 1hr



獣Ensemble prediction of typhoon track



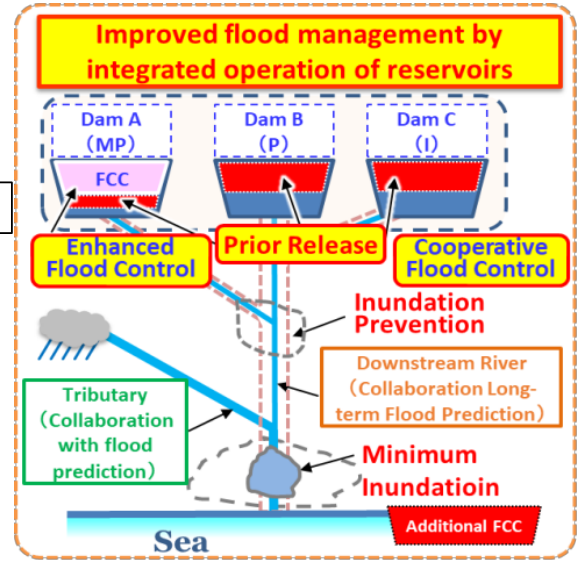
獵Ensemble accumulated storage volume (3 representatives)



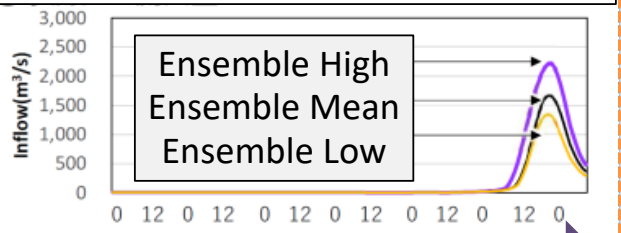
猪Optimization of dam flood mitigation operation

Triggered by Ensemble High but storage volume is defined by Ensemble Low for secure storage recovery.

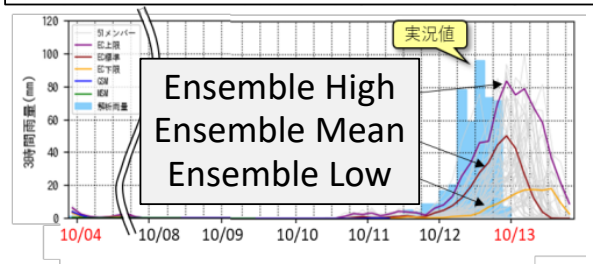
猿Integrated Operation of Reservoir Systems



獨Ensemble inflow discharge (3 representatives)



猥Ensemble rainfall prediction (51 ensemble)



Rainfall-Runoff Modelling

ECMWF（15Days）

GSM（84hrs）

Long-term rainfall prediction and decision support system for the Integrated dam operation

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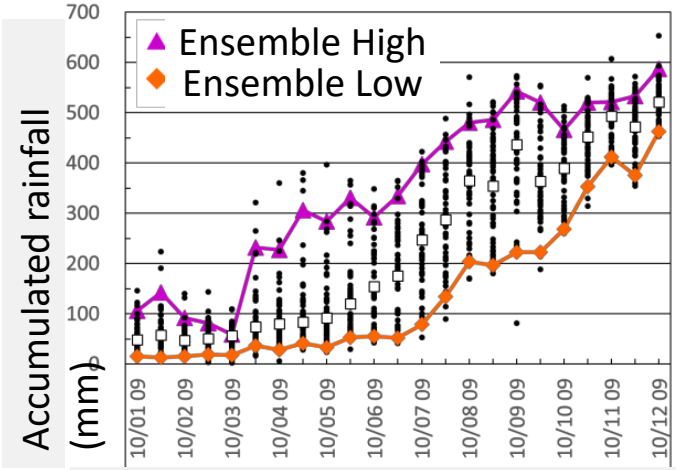
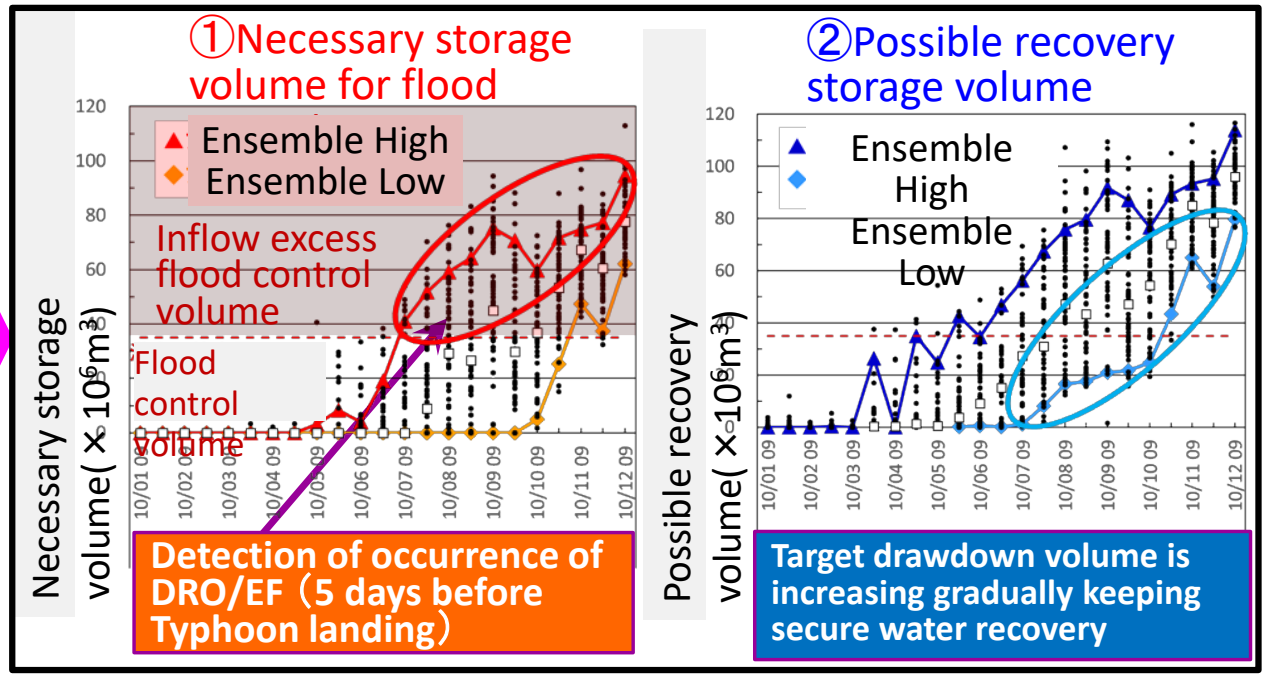
Rainfall Prediction in Reservoir Catchment Area



Ensemble High: Mean value of No.1-5
Ensemble Low : Mean value of No.47-51

(Kido et. al. 2020)

Dam Inflow Prediction



SIP Ensemble pre-release operation (SIP-EPRO)

Using Long-term Ensemble rainfall prediction, optimum drawdown storage volume is obtained by adaptive pre-release under prediction uncertainty.

Balancing both flood and water security risks.

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Overview of Flood Risk Mapping

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Background

- ✓ Japan presented the “Kumamoto Initiative for Water” at the 4th Asia-Pacific Water Summit in 2022.
- ✓ Based on this initiative, Japan is working on Flood Risk Mapping project.
- ✓ Last year, Japan proposed to implement “Flood Risk Mapping with Ground/Satellite Observation Data” in AOP6, and it was approved at the 56th TC Session in Malaysia in February 2024.
- ✓ This activity has been carried out in cooperation/collaboration with Thailand.

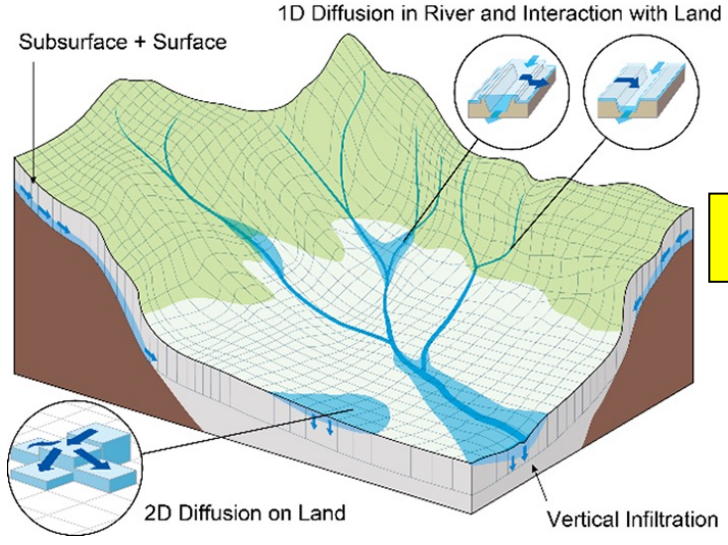
Elevation data

Land use data

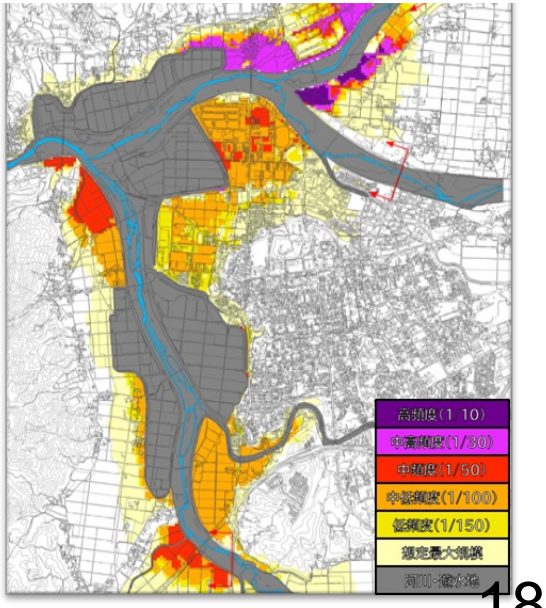
Precipitation data

Other data

Combining satellite and ground observation data



Flood simulation



Risk mapping

Procedures

Data Collection

- ✓ Collect and organize necessary data for model development, including rainfall (ground-based), water level and discharge, elevation, land use, flood control facility.

Selection of data to be used / Calculation of probable rainfall

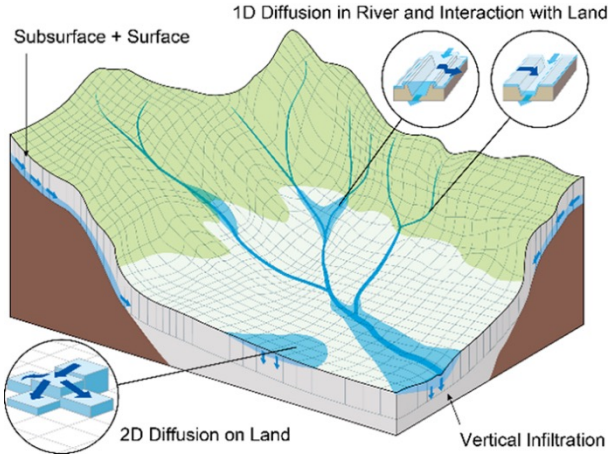
- ✓ After evaluating the quality of collected data, including accuracy and missing data rates, the selection of data to be used for analysis and validation is determined.
- ✓ Additionally, probable rainfall intensity levels are set. (1/2year,1/5years,1/10years….)

Development of Model and Validation

- ✓ Develop **RRI model** for runoff analysis and inundation analysis
- ✓ Parameter tuning and validation using flood record

Rainfall-Runoff-Inundation (RRI) Model

- Simultaneous analysis for rainfall, runoff, river flow and inundation
- Easy to incorporate satellite data and/or global data (complements ground data)
- Developed and provided by ICHARM



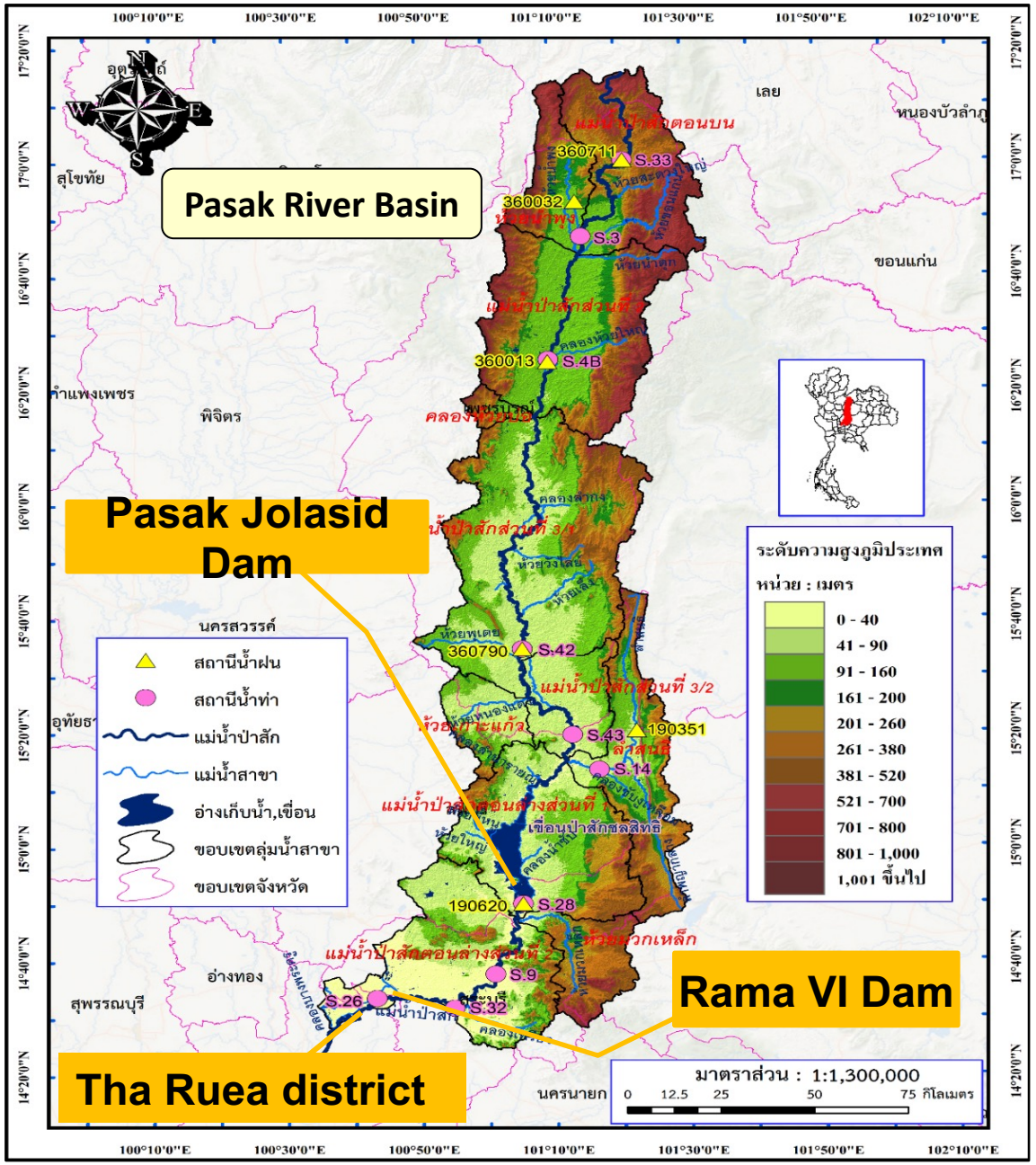
Creation of the Flood Risk Map

- ✓ Calculate inundation area with some probable floods
- ✓ Create a prototype flood risk map

Drafting the Guideline

- ✓ Summarize a procedure, necessary data, key point for flood risk assessment and flood risk mapping, and its utilization.

Pilot River Basin



Pasak River basin

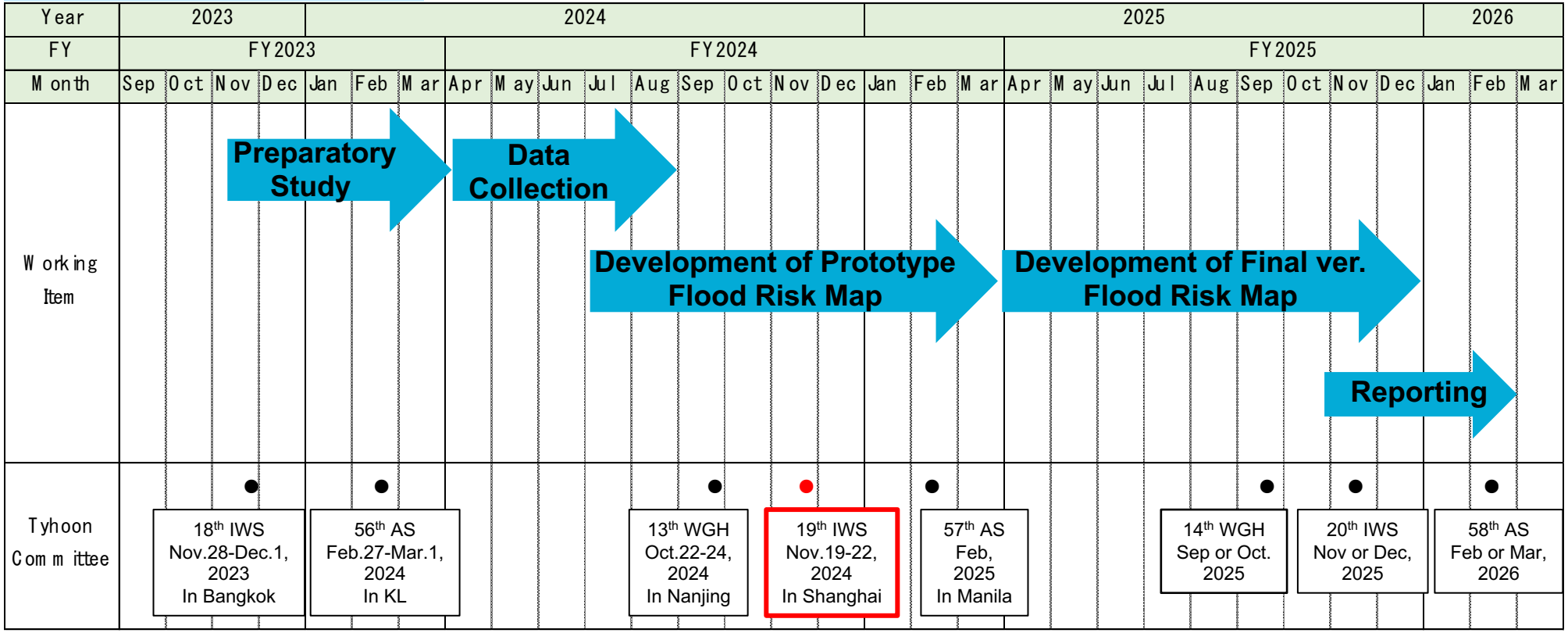
- ✓ Agreed upon at the February 2024 meeting.
- ✓ Site visit was conducted with RID (Tha Ruea district and Rama VI Dam).
- ✓ Tha Ruea district is one of the flood prone and damaged area in the basin.
- ✓ Effect of water level of Chaophraya River is a major factor on the flooding in the Pasak River (backwater).
- ✓ Pasak Jolasid Dam has a capacity for flood control.

Basic Data

Basin area: 15,000 km^2
Pasak Dam RB area: 12,500 km^2
Lower Pasak RB Area: 2,500 km^2
Length of mainstream: 1,040 km
Mean annual precipitation: ca. 1,200 mm

AOP6 Schedule

Schedule of Activity



Activities in FY2024

- ✓ Model development and validation
- ✓ Interim discussion with RID
- ✓ Flood mapping by flow scale based on the validated model
- ✓ Final discussion with RID in February 2025


ありがとうございました。
Thank you for your kind attention.