Guide to disaster management measures

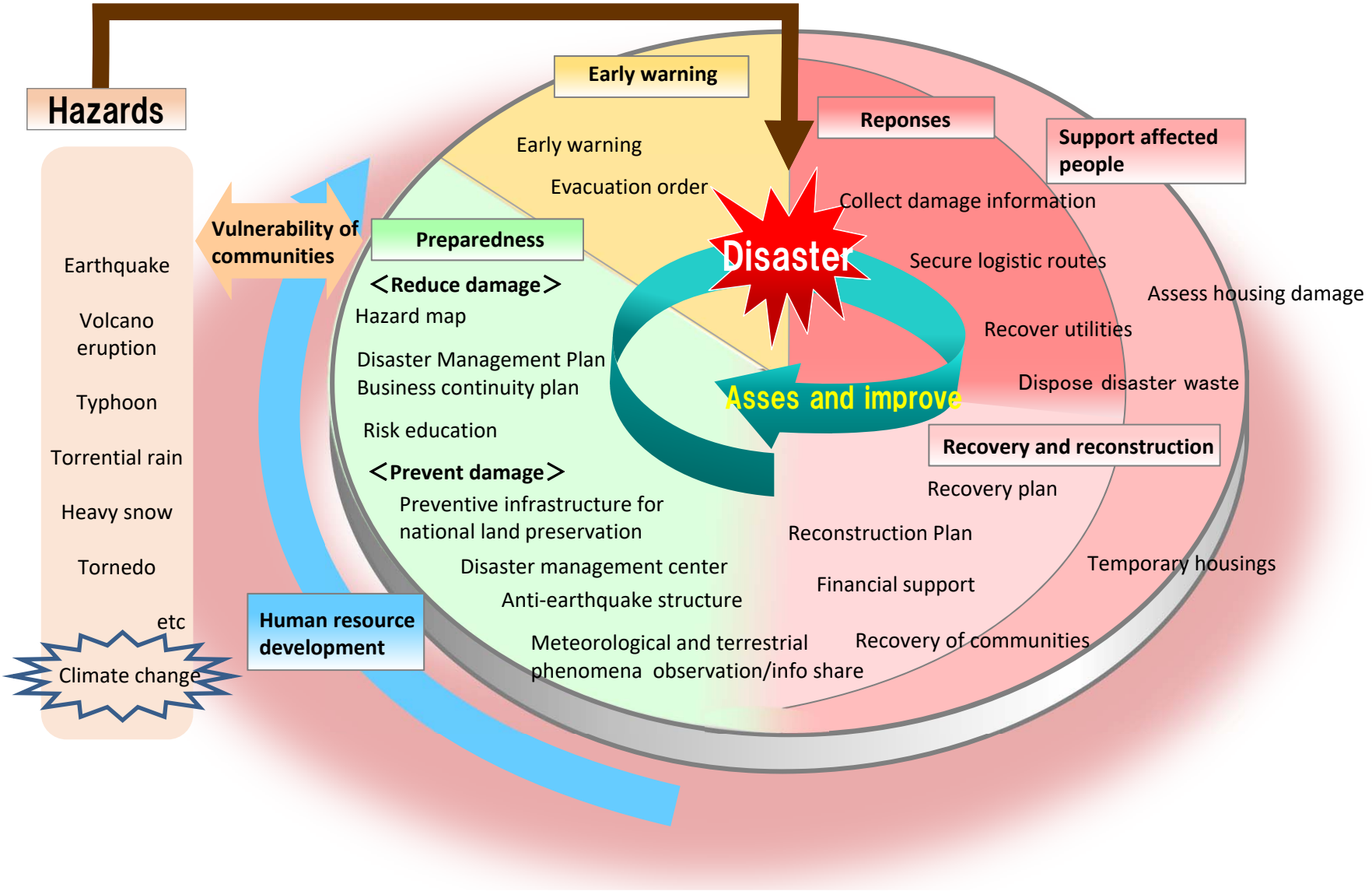
(technologies, know-how, infrastructure, institutions etc.)

in Japan

Structural and non-structural measures : Japanese solutions for disaster management challenges in your country

Cabinet Secretariat, Government of Japan
Disaster Management Bureau, Cabinet Office, Government of Japan

This guide describes experience and knowledge of Japan according to the process of disaster management, including preparedness, response, recovery and reconstruction, focusing on necessary actions for disaster risk reduction and possible technologies that Japan could provide. Please use this brochure for considering possible collaboration from Japan to enhance disaster management.



Disaster management measures in Japan

(technologies, know-how, infrastructure, institutions etc.)

<Notes>
Collaboration for:
- **Earthquake/Tsunami**
- **Meteorological disaster**
- **Any types of disasters**

【Challenges in each phrase】 【Examples of possible collaboration from Japan】

Preparedness

A. Planning

- **Develop comprehensive and long-term plans for disaster risk reduction**
- **Measures based on disaster risks and vulnerability of national land, and social and economical system**

→

A-1 Preparation of disaster risk reduction plans and business continuity plan
A-2 Introduce concepts of disaster risk reduction to master plans including city planning
A-3 Hazard mapping
A-4 Establishing a national resilience plan

B. Investment

- **Risk-resilient critical infrastructure**
- **Develop systems for constant monitoring/information service of earthquake and Tsunami**
- **Promote seismic reinforcement for houses/buildings and infrastructures**
- **Develop systems for constant monitoring/information service of weather and river level**
- **Promote improvement of infrastructures to protect lives/properties from flood due to typhoon/heavy rain or landslide disasters, etc.**

→

B-1 Risk-resilient critical infrastructure
B-2 Earthquake observation equipment
B-3 Seismic reinforcement/quake-proof technologies
B-4 Meteorological and hydrological observation instruments
B-5 Water and disaster management
B-6 Forest conservation works

C. Risk education

- **Raise awareness for disaster risk reduction and promote risk education**

→

C-1 Risk education materials, citizens empowerment, training and exercise
C-2 Human resources development

Disaster management measures in Japan

(technologies, know-how, infrastructure, institutions etc.)

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Collaboration for:
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【Challenges in each phrase】 【Examples of possible collaboration from Japan】

Early warning and Response

D. Emergency warning, evacuation support

・Sharing disaster information, communicate to relevant organizations and citizens, early warning

- D-1 Monitoring of Waves on Land and Seafloor (MOWLAS)
- D-2 Satellite observation data for emergency responses
- D-3 Early warning system (L-Alert)
- D-4 Flood forecasting software
- D-5 Urgent earthquake detection and alarm system
- D-6 Emergency warning broadcast system
- D-7 Disaster information management system (DIMS)

E. Emergency rescue activities

・Rescue/first-aid/emergency medical care for life saving, measures for evacuation sites, providing relief supplies

- E-1 ICT disaster management unit
- E-2 Transportable air traffic control (ATC) tower
- E-3 Drain pump car
- E-4 Remote-operated equipment, unmanned construction

Recovery and Reconstruction

F. Smooth recovery and reconstruction

・Assistance for formulation of rehabilitation and recovery plan, support for livelihood

- F-1 Assistance for formulation of rehabilitation and recovery master plan
- F-2 Disaster waste management
- F-3 『JOEN』～Salt removal work from farmland～
- F-4 Reconstruction of infrastructure -based on build back better（BBB）concept
- F-5 Support for house reconstruction -based on build back better（BBB） concept
- F-6 Support for livelihood recovery considering victims - based on build back better（BBB） concept

Any types of disasters

A Planning

Develop comprehensive and long-term plans for disaster risk reduction(DRR)

A-1 Preparation of DRR Plans and Business Continuity Plan(BCP)

Thailand·「Project on Capacity Development in Disaster Risk Reduction」(Technical Cooperation)

- Through strengthening the capacity and functions of the central DRR agencies, Japan supports formulation of the national and local DRR strategies and disaster risk maps, thereby improving their capacity to mitigate, prepare and respond to disaster.

-DRR White Paper
-National DRR Plans
-GIS for hazard information
-Materials for Trainers Training
-Guidebooks for Community based DRR
-Guidelines for DRR Education

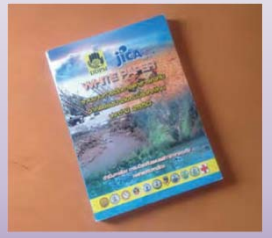
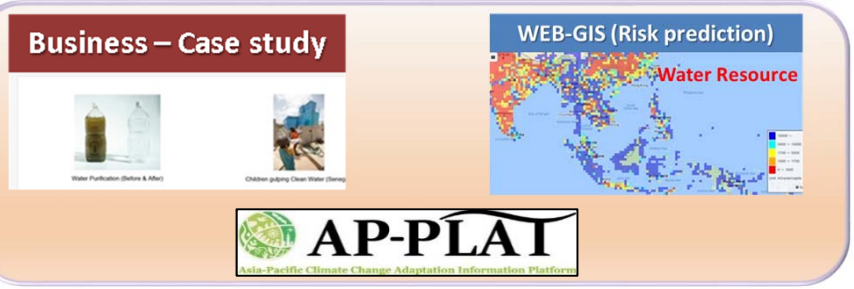


Photo: DRR White Paper in Thailand

Asia-Pacific Climate Change Adaptation Information Platform（AP-PLAT）

- Provide future climate-related risk data and adaptation information based on scientific knowledge
- Contribute for formulation of the DRR planning and BCP in developing countries.

* AP-PLAT has been developing aiming to completely establish by 2020.



Technical assistance for local communities to prepare flood disaster contingency plans (ICHARM)

- ICHARM provides technical assistance for Calumpit, a local town in the Pampanga River basin of the Philippines, to develop disaster contingency plans using flood hazard maps through participation of community members.

Any types of disasters

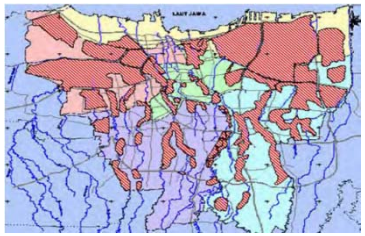
A Planning

Measures based on disaster risk and vulnerability of assessment of national land, and social and economical system

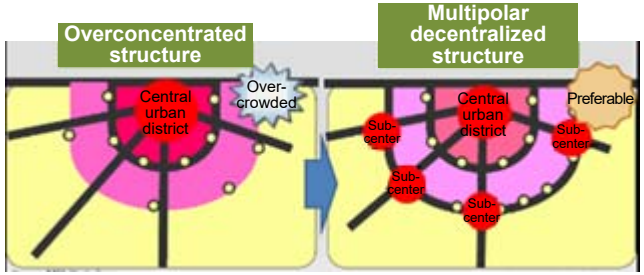
A-2 Introduce Concepts of DRR to Master Plans Including City Planning

Support for Planning Including Master Plans (Technical Cooperation)

- When supporting preparation of urban vision, in addition to analysis of disaster risks, propose reduction of risks caused by disaster in urban structure or improvement of drainage facilities.



Evaluation for area characteristics of flooding



- Too much concentration
- Vulnerability of transferring/transporting at a time of disaster

- Decentralize urban functions
- Secure redundancy for a traffic system

Propose **a multipolar decentralized urban structure** with high tolerance to disasters

A-3 Hazard Mapping

Support for Hazard Map Development (Technical Cooperation)

- Japan supports developing countries to be disaster-resistant societies through the development of hazard mapping based on damage estimation methodology and risk assessment.
- Technical assistance for Myanmar's major cities (e.g., Yangon) to create flood hazard maps (ICHARM)
- Technical assistance for Calumpit, the Philippines, to create flood risk maps by linking the height of structures and the propagation of floodwaters (ICHARM)

Good Practice of Developing Hazard Maps

- Based on the lessons from past tragedies such as Chile Tsunami in 1960 and the Great East Japan Earthquake in 2011, Japan has developed Tsunami damage estimation methodologies and risk assessment based hazard map, then support to develop Tsunami resilient societies in the world.

Tsunami Hazard Mapping

Tsunami Inundation in Chile in 2010

When the Tsunami occurred after M8.2 earthquake in Chile on April 2, 2014, the number of victims was minimized (6 persons) as a result of utilizing knowledge from past technical cooperation from Japan.

A Planning

Measures based on disaster risk and vulnerability of assessment of national land, and social and economical system

A-4 Establishing a National Resilience Plan

Support of Establishing National Resilience Plan, Including Regional Plan, such as Provide of Know-how
（ Seminars, Workshops, Training and etc. by the Cabinet Secretariat of Japan)

- Provide know-how on establishing plan to national or local government officials
  - Method of vulnerability assessment of national land, and social and economical system
  - Method of corresponding measures to risk and etc.

Based on the Fundamental Plan for the National Resilience, we are working on the medium- and long-term,
We also conducted emergency inspections of important infrastructure based on experience in natural disasters in recent years,
We compiled three-year emergency measures based on inspection results and others.

Any types of disasters

Risk-resilient critical infrastructure

B-1 Risk-Resilient Critical Infrastructure

Case example of Risk-Resilient Critical Infrastructure

➢The Blue Line subway that opened in 2004 was designed with help from Japan and includes many elements of disaster risk reduction. Since Bangkok is located in a flood-prone area, the subway entrance is located higher than the sidewalk to prevent water intrusion. Also the entrance is equipped with a water shield. Some ventilators are set at a higher position, and a drainage pump is installed.

Subway that is resistant to flood（Photo：Shinichi Kubo/JICA）

When the airports and roads were closed in the 2011 flood, The Blue Line was able to continue to operate even in flooded areas without intrusion.

Develop systems for constant monitoring/information service of earthquake and Tsunami

B-2 Earthquake Observation Equipment

Seafloor Observation System for Earthquakes and Tsunamis of Submarine Cable Type

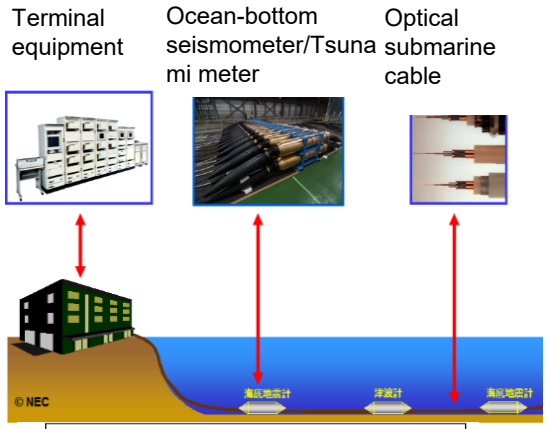
- The seafloor observation system for earthquakes and tsunamis of submarine cable type makes it possible to observe submarine earthquake activity and associated tsunami activity. Excellent evacuation effect is expected by combining it with an alarm system.

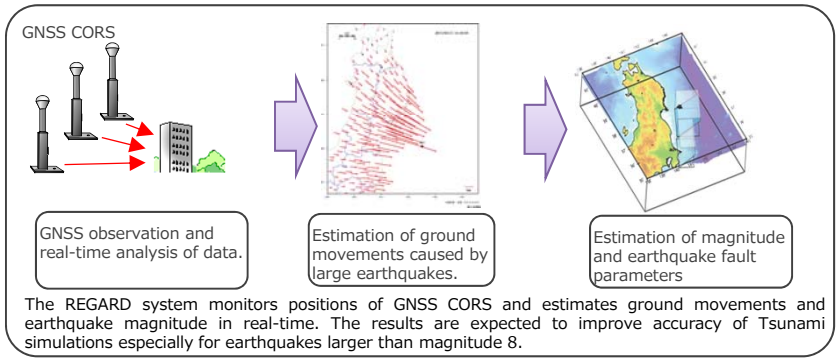
GPS Buoy System

- GPS-mounted buoys can measure offshore waves and tidal levels, including tsunamis, in real-time by using satellite positioning information.

Real-time Analysis System of GNSS CORS (REGARD System)

- The positons of GNSS Continuous Operating Reference Stations (CORS) are precisely calculated and monitored. The system estimates ground movements due to earthquakes, volcanic activities, and plate motions, and contributes to hazard mitigation.





The REGARD system monitors positions of GNSS CORS and estimates ground movements and earthquake magnitude in real-time. The results are expected to improve accuracy of Tsunami simulations especially for earthquakes larger than magnitude 8.

Promote seismic reinforcement for houses/buildings and infrastructures

B-3 Seismic Reinforcement/Quake-proof Technologies

Seismic Reinforcement / Quake-proof of Bridges

- As a result of damages on bridges in the Great Hanshin-Awaji Earthquake, measures have been promoted in Japan.

Condition of a bridge after the Great East Japan Earthquake (seismic reinforcement was completed)

There was no fall/collapse caused by earthquake vibration on seismic reinforced bridges in the Great East Japan Earthquake. Therefore, utilization of such technology is expected in overseas including know-how of architectural design.

Earthquake-Resistance Wharves (e.g. Jacket Method)

- Jacket pier is constructed by using the jacket type structure which is a space truss of steel pipes fixed to the seabed by steel pipe piles. It has high horizontal rigidity and high earthquake-resistance.

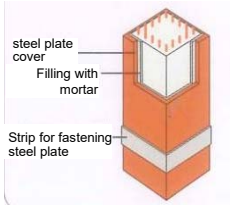
The image of Jacket Method

Thilawa Port, Myanmar (Photo:TOYO Construction Co.,Ltd.)

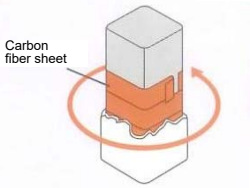
Seismic Strengthening / Isolation-system of Houses/Buildings

- Based on many experiences of disasters in the past, Japan has promoted seismic strengthening measures.

■ Reinforcement of columns

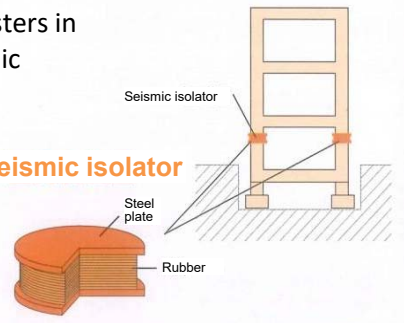


Reinforcement by covering with steel plates



Reinforcement by wrapping with continuous carbon fiber sheet

■ Seismic isolator



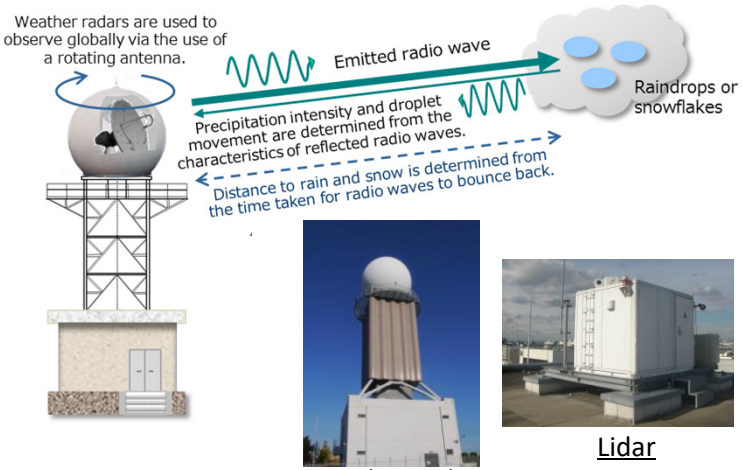
In the Great East Japan Earthquake, seismically isolated buildings didn't have damages to the structural frame caused by earthquake motion, and proved the effectiveness to the major earthquake.

Develop systems for constant monitoring/information service of weather and river level

B-4 Meteorological and Hydrological Observation Instruments

Solid-state Weather Radar

- Japanese radar manufacturers developed cutting-edge solid-state weather radar.
- Advantages of the solid-state weather radar are
  - Saving running cost,
  - Improving stability and maintainability of the system, and
  - Lessening the use of radio-frequency resource by narrower bandwidths.



Weather radar

Lidar

Radiosonde

- Advantages of Japanese radiosondes are
  - High observation accuracy,
  - Downsizing and lightening the instrument, and
  - Saving running cost.

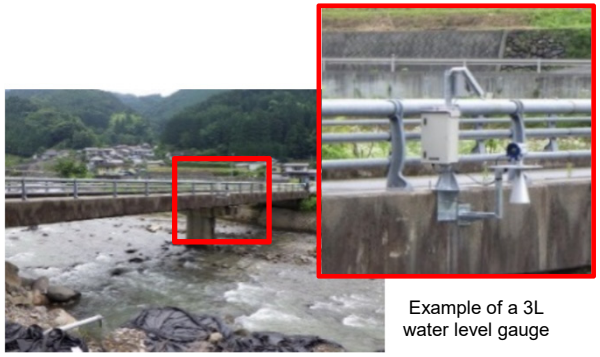
Radiosonde

A radiosonde observes upper atmospheric conditions (e.g., temperature, wind) up to altitudes of around 30 km lifted by a balloon.

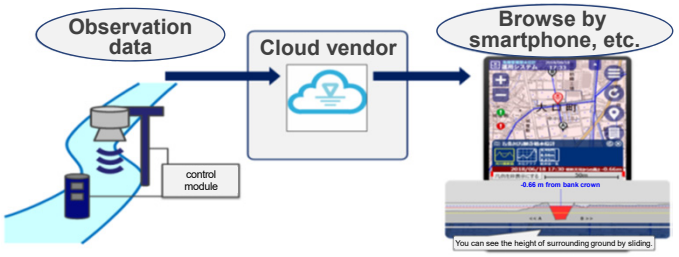
3L Water Level Gauge

- Low Cost (lower cost by 10% than conventional models)
- Long Life (maintenance free for a long term, operable for 5 years or more without power supply)
- Localized (Local river authorities are able to measure and monitor water level on their own)

- It is a lower price water gauge specializing on observation of flooding, which operation and maintenance are simple.
- Additionally, by unifying the central/local information of rivers with a cloud service, water level information service can be browsed by anyone from a smartphone, etc.



Example of a 3L water level gauge



Water level information service using a cloud service

This water gauge was developed as a crisis management type water gauge for small- and medium-sized rivers and mainly installed at areas with high risks of floods. It enables residents to be aware of risks and evacuate voluntarily, measures of software on residents' viewpoint was promoted.

B Investment

Meteorological disaster

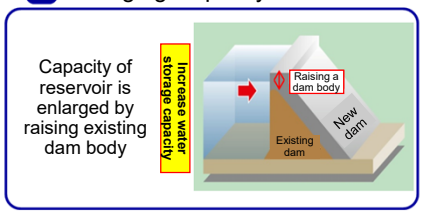
Promote improvement of infrastructures to protect lives/properties from flood due to typhoon/heavy rain or landslide disasters, etc.

B-5 Water and Disaster Management (Dam Upgrading under Operation, River Development, etc.)

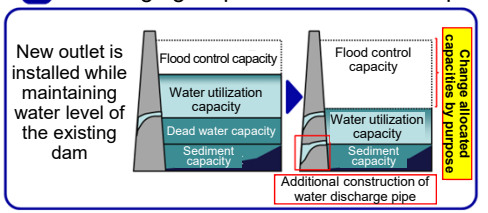
"Dam upgrading" to Effectively Use Existing Dams

- As a dam body is expected to be healthy almost permanently if it is appropriately constructed and operated/maintained, for existing dams, it is important to utilize effectively and sustainably for a long term.
- There are many actual achievements about dam upgrading which improves functions of existing dams while operating them, environmental and social impacts can be kept to a minimum.
- Understanding issues in watershed areas through dam inspections and sharing such issues with relevant countries, propose the dam upgrading business in combination with a dam inspection system (guidance, criteria, measuring instrument, etc.), as a solution.

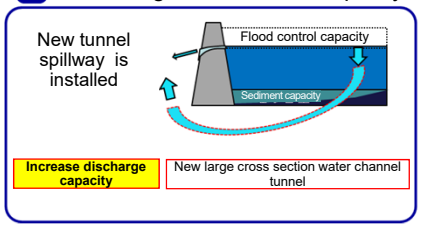
Enlarging Capacity



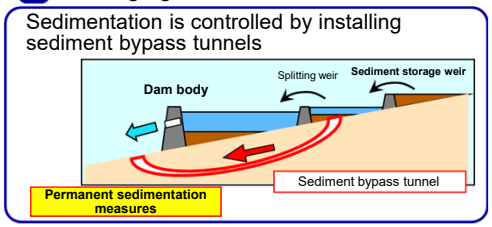
Exchanging Capacities between Purposes



Enhancing Flood Control Capacity



Prolonging Dam Life

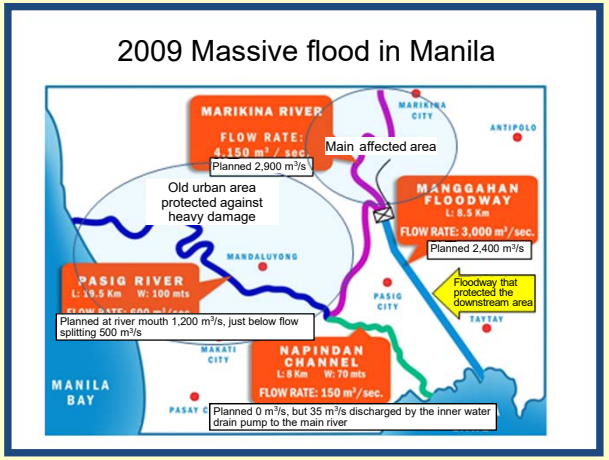


Successful Example of Water Control Business

Floodway that protected the Manila old urban area against a massive flood at Manila in 2009

- For the Philippine Pasig-Marikina River, the Manggahan floodway was constructed with supports from Japan based on disasters in the past. Because of typhoon Ondoy hitting Metro Manila on September 2009, over 500 people became victims around the upstream area in Metro Manila. However, around the downstream area, thanks to the Manggahan floodway, the flow rate was cut up to 3,000 m^3/s out of the planned flow rate of 2,400 m^3/s and the flow rate in the downstream area was successfully controlled to about 600 m^3/s that was almost same as the planned flow rate.

Manggahan floodway, Japan supported for its construction



If the floodway was not prepared, it was assumed that the old urban area, a downtown of Manila, was severely damaged

Promote improvement of infrastructures to protect lives/properties from flood due to typhoon/heavy rain or landslide disasters, etc.

B-6

Forest Conservation Works (Constructions and forest management for disaster risk reduction)

Forest Conservation Works: techniques for disaster risk reduction through forest management

(Forest conservation works had been developed as techniques to maintain and improve the function for disaster risk reduction by forest.)

- Restoration and prevention of damaged mountains by forest conservation works.
- Damage control of driftwoods occurred by hillside collapse by a driftwood catching check dam.
- Protection of hinterland from blown sand and wind, and attenuation of tsunami energy by a coastal forest for disaster risk reduction.

Occurrence of a disaster

Completion of restoration works

Situation 22 years after the restoration works

Driftwood Catching Check Dam

Coastal Forest for disaster prevention

C Risk education

Any types of disasters

Raise awareness for disaster risk reduction and promote risk education

C-1 Risk Education Materials, Citizens Empowerment, Training and Exercise

Risk Education Materials

- Risk education materials in many languages; The Tale of "Inamura-no-hi" tells the importance of evacuation from tsunami, based on the experience of tsunami evacuation after the Ansei Nankai Earthquake in Hirokawa Village, Wakayama Prefecture.

C-2 Human Resources Development

Training Programs "Knowledge Co-creation Programs"

- Japan invites trainees from developing countries to many programs in such fields as DRR governance and mainstreaming, earthquake, tsunami, flood, hydromet and so on. These programs are conducted with knowledge and experiences on DRR in Japan.

- Management of "International Training on Seismology and Earthquake Engineering (since 1960)" and "Disaster Management Policy Program: Water-Related Disaster Risk Management Course (since 2008)" in collaboration with the Japan International Cooperation Agency (JICA) and the National Graduate Institute for Policy Studies (GRIPS) (ICHARM)

- Management of "Visiting Researcher Program" (since 1960, ADRC)
- Management of "Comprehensive Disaster Risk Reduction (A)" (since 2019, ADRC/JICA)
- Management of "Promotion of Mainstreaming Disaster Risk Reduction" (since 2018, ADRC/JICA)

D Emergency warning, Evacuation support

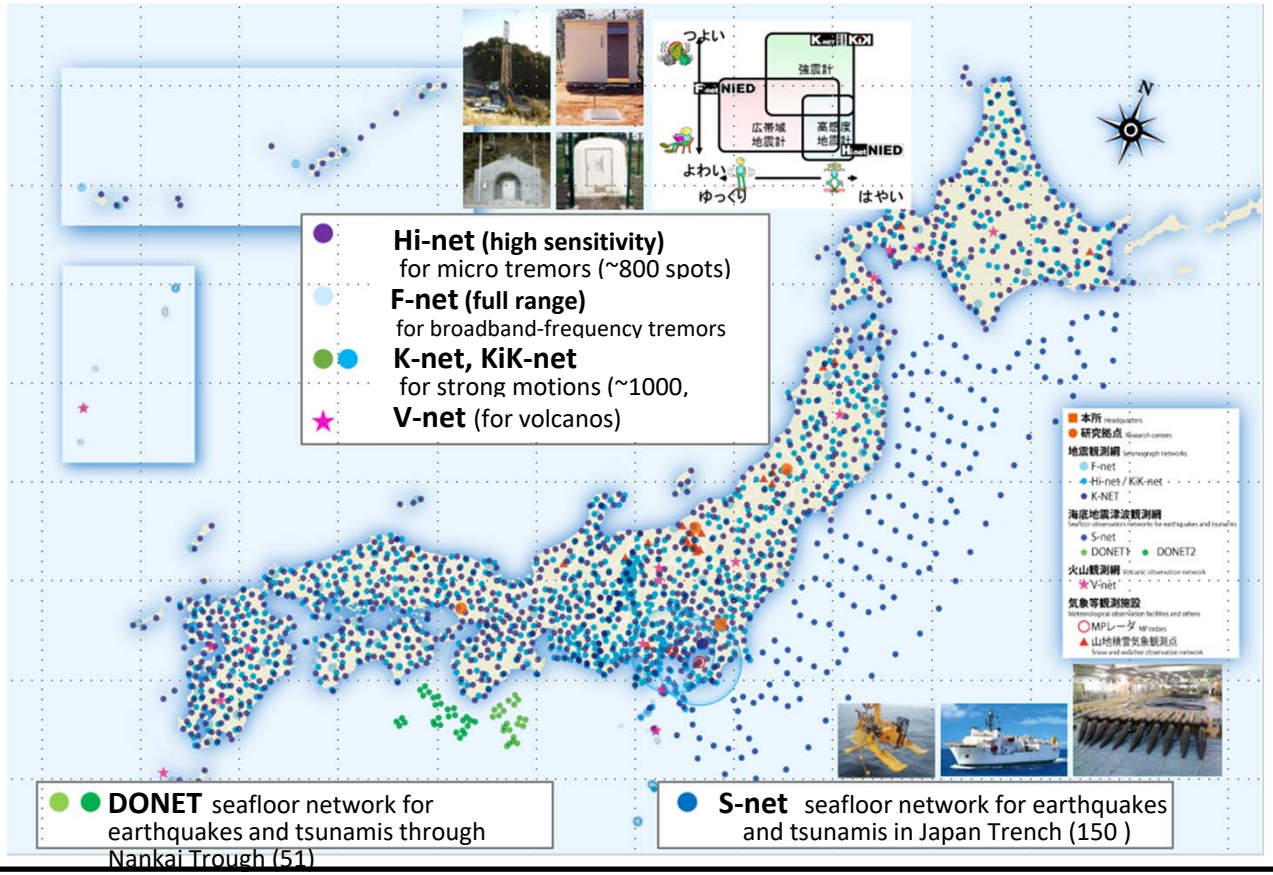
Any types of disasters (Earthquake, tsunami, volcano)

Sharing disaster information, communicate to relevant organizations and citizens, early warning

D-1

Monitoring of Waves on Land and Seafloor (MOWLAS)

- MOWLAS is a monitoring network that covers the lands and seafloors all over Japan, and can immediately and accurately observe hazard phenomenon of earthquakes, tsunamis and volcanic eruptions in Japan. The observed data is utilized not only for research on natural disaster mechanisms but also for disaster reduction as it is directly provided to central government, local governments and private companies.



D Emergency warning, Evacuation support

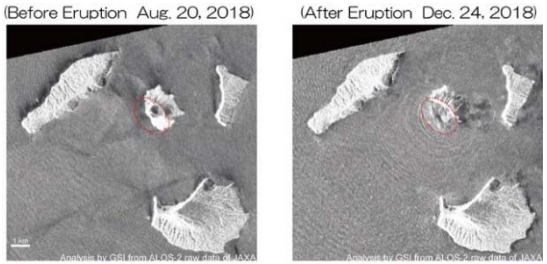
Meteorological disaster
Any types of disasters

Sharing disaster information, communicate to relevant organizations and citizens, early warning

D-2 Satellite Observation Data for Emergency Responses

Response to Natural Disasters - Earthquake, Eruption, Tsunami

- Emergency observation was performed by "ALOS-2" to detect damages caused by the eruption of Krakatau and Tsunami in Indonesia, 2018.



Analysis by GSI from ALOS-2 raw data of JAXA

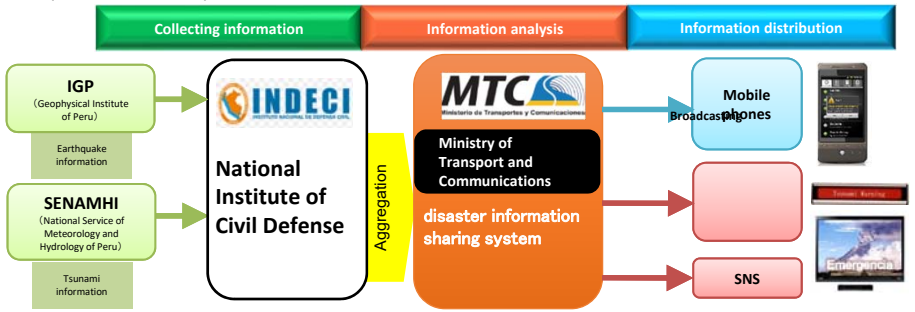
(Left) Before the eruption, (Right) after the eruption. The collapse of south–west part of the island is shown in the red circle (approx. 2km) in the right image.

The satellite data contributed to helping the Indonesian authorities to estimate damages and losses from the disasters.

D-3 Early Warning System (L-Alert)

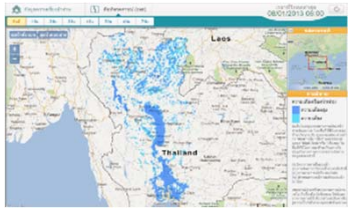
- A disaster information sharing system that utilizes the know-how of the L- Alert, a system that collects, analyzes, and distributes disaster information consistently and delivers disaster information quickly and reliably to residents.

(Model in Peru)



D-4 Flood Forecasting Software

Project for Comprehensive Flood Management Plan for the Chao Phraya River Basin in Thailand (Technical Cooperation for Development Planning)



Inundation forecasting map

Water level forecasting map

World's first technology that brought the full-scale system to forecast inundation area

- Flood forecasting system was developed for Chao Phraya river basin in Thailand where the great flood in 2011 caused huge damage.
- Development of a flood forecasting and early warning system for the Indus River basin of Pakistan as part of the UNESCO Pakistan project (ICHARM)
- Development of a flood forecasting system for the Philippines and Sri Lanka(ICHARM)
- Development of systems for agriculture drought monitoring and drought seasonal forecasting for Ceará, a northeastern state of Brazil, by using the Coupled Land and Vegetation Data Assimilation System (CLVDAS) backed by the second Advance Microwave Scanning Radiometer (AMSR2) on the Shizuku satellite (ICHARM)

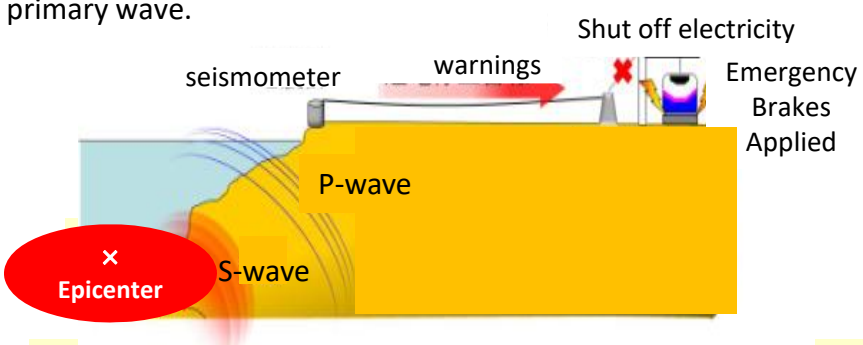
D Emergency warning, Evacuation support

Earthquake/Tsunami
Any types of disasters

Sharing disaster information, communicate to relevant organizations and citizens, early warning

D-5 Urgent Earthquake Detection and Alarm System

➢ Seismometers immediately determine the expected secondary wave and the damage of the earthquake and send out warnings to shut off the electricity supplied to the trains when they detect the primary wave.

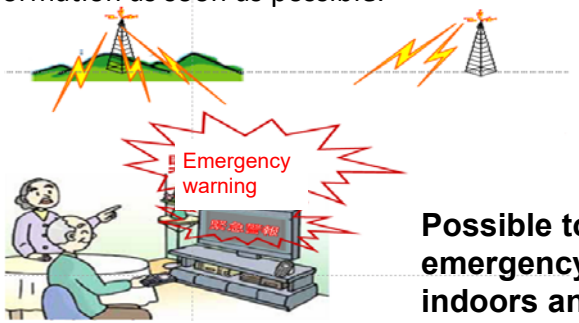


No train derailed and no passenger got injured due to 2011 Great East Japan Earthquake.

D-6 Emergency Warning Broadcast System

Infrastructure Development for Providing Disaster-related Information

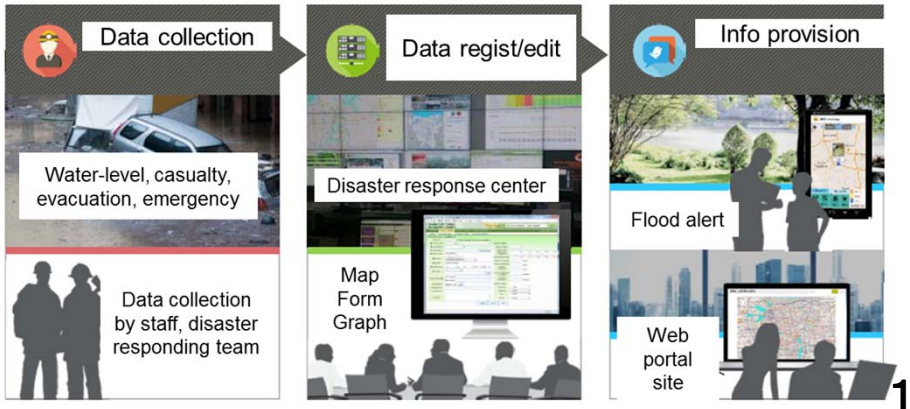
➢ Utilizing terrestrial digital television broadcasting network as the basis for informing the inhabitants of disaster-related information as soon as possible.



Possible to receive emergency information indoors and outdoors.

D-7 Disaster Information Management System (DIMS)

➢ Collecting real-time data from disaster areas, and managing collected data centrally, then supporting the decision making by administration to issue the alert automatically.



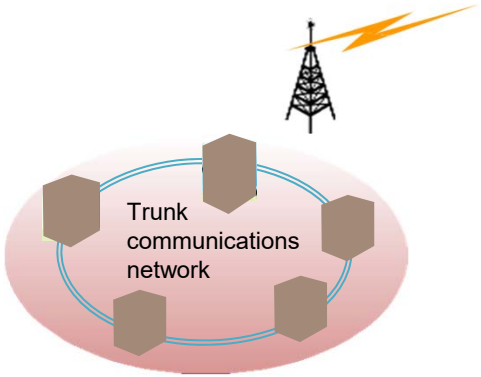
E Emergency rescue activities

Any types of disasters

Rescue/first-aid/emergency medical care for life saving, measures for evacuation sites, providing relief supplies

E-1 ICT Disaster Management Unit

- Incorporating communications equipment, including a power supply, battery, and radio equipment, to build a communications network with ease.
- Used as a communication infrastructure that provides a minimum ICT environment in times of disaster and quickly restores communications.



Miniaturized into a container type, a car type, or an attaché case type and applied to various forms and carried with ease.

Car type

Container type

Attaché case type

E-2 Transportable ATC (Air Traffic Control) Tower

- Used as alternative measures in case of damages of ATC tower caused by unexpected circumstances

Appearance

Inside of the operation room

E-3 Drain Pump Car

- It worked well for water drainage at the Great East Japan Earthquake.

Drain pump car

E-4 Remote-operated Equipment, Unmanned Construction

- During emergency recovery works, utilize remote-operated construction machineries to prevent secondary damages.

Any types of disasters

F Smooth recovery and reconstruction

Assistance for formulation of rehabilitation and recovery plan, support for livelihood

F-1 Assistance for Formulation of Rehabilitation and Recovery Master Plan

The Project on Rehabilitation and Recovery from Disaster

- Utilize ODA to support the formulation of a basic reconstruction plan with Build Back Better Concept including countermeasure to flood tide and land use plan.

Formulation of Community Recovery Plan

F-2 Disaster Waste Management

- Various kinds of waste which are generated in massive volume all at once delay recovery/ reconstruction. In terms of maintaining living environment, public hygiene and material cycles, swift removal of waste is required. Know-hows and technologies based on Japan's experiences of disaster waste management are able to utilize to solve these tasks.

Disaster waste caused by flood

Intermediate treatment facility of mixture (sorting and crushing)

F-3 『JOEN』 ～Salt removal work from farmland～

Restoration of Farmland from Sea Water Flood Damage by Tsunami

- In the Great East Japan Earthquake in 2011, many farmlands were flooded with sea water by tsunami. In order to remove salt content remaining in the soil, the salt removal "Joen" manual was created and salt removal works were carried out. These knowledge and methods can be utilized in the case of tsunami damage in foreign countries as well.

Farmlands flooded by tsunami.
(The Great East Japan Earthquake, Mar. 2011)

・Forming mole drains
・Scattering lime-based soil conditioner

・Filling & stirring with fresh water

Any types of disasters

F Smooth recovery and reconstruction

Assistance for formulation of rehabilitation and recovery plan, support for livelihood

F-4 Reconstruction of Infrastructure -Based on Build Back Better（BBB）Concept

- To implement Build Back Better concept, Japan's ODA assist rebuilding resilient infrastructure; school, hospital and dike.

The school is designed to be used for evacuation center in emergency (Phillippines)

Reconstructed elementary school by ODA Grant assistance

F-5 Support for House Reconstruction -Based on Build Back Better（BBB） Concept

- In reconstruction of earthquake damaged houses, Japanese ODA can support formulation of standards and guidelines, through the technical cooperation for enhancement of earthquake resistance.

In the disaster area of the Great Nepal earthquake of 2015, subsidies based on ODA loans were provided for house reconstruction that fulfill the earthquake resistance requirements which promoted reconstruction.

F-6 Support for Livelihood Recovery Considering Victims -Based on Build Back Better（BBB）Concept

- In the reconstruction from the Great East Japan Earthquake of 2011, various reconstruction projects were implemented with victim's consent. These experiences can be utilized in the recovery from disasters in other countries.

In the case of the Yolanda Typhoon of 2013, food processing facilities were reconstructed for the fishery industry, which is the major industry in the affected area.