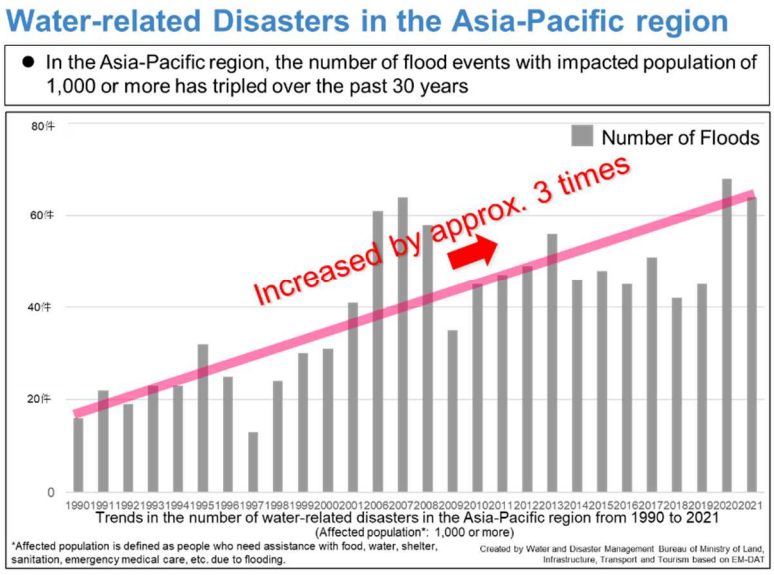
Supplementary materials for the Kumamoto Initiative for Water

Ministry of Land, Infrastructure, Transport and Tourism

Quality Infrastructure against Climate Change in Asia-Pacific Region
Transfer of Hybrid Technology for Climate Change Adaptation and Mitigation by Improving Dam Reservoir Control and Promoting Dam Renewal

1. Present and future of water disasters in the Asia-Pacific region

In the Asia-Pacific region, where large cities are located in low-lying land along rivers and in coastal areas, serious damage could be caused by a water disaster, such as a flood or a storm surge. In fact, in the region, the frequency of water disasters that have impacts on large populations has been increasing in recent years. In the future, due to further increase in population, some people might have no choice but to live in areas with high water disaster risks in the region. Furthermore, since many countries have yet to establish early warning systems against floods and storm surges, a water disaster could threaten the lives of local people and give serious hindrance to local economic activities. In order to prevent and mitigate water disasters, it is necessary to foster flood control measures in a strong manner. The impacts of climate change have already become apparent in the form of water-related disasters and will further expand. In response, flood control measures need to be accelerated as part of climate change adaptation measures. To meet this requirement, it is important to make smart investments in flood control measures at a faster pace, thereby bringing about the effect of investments as early as possible.



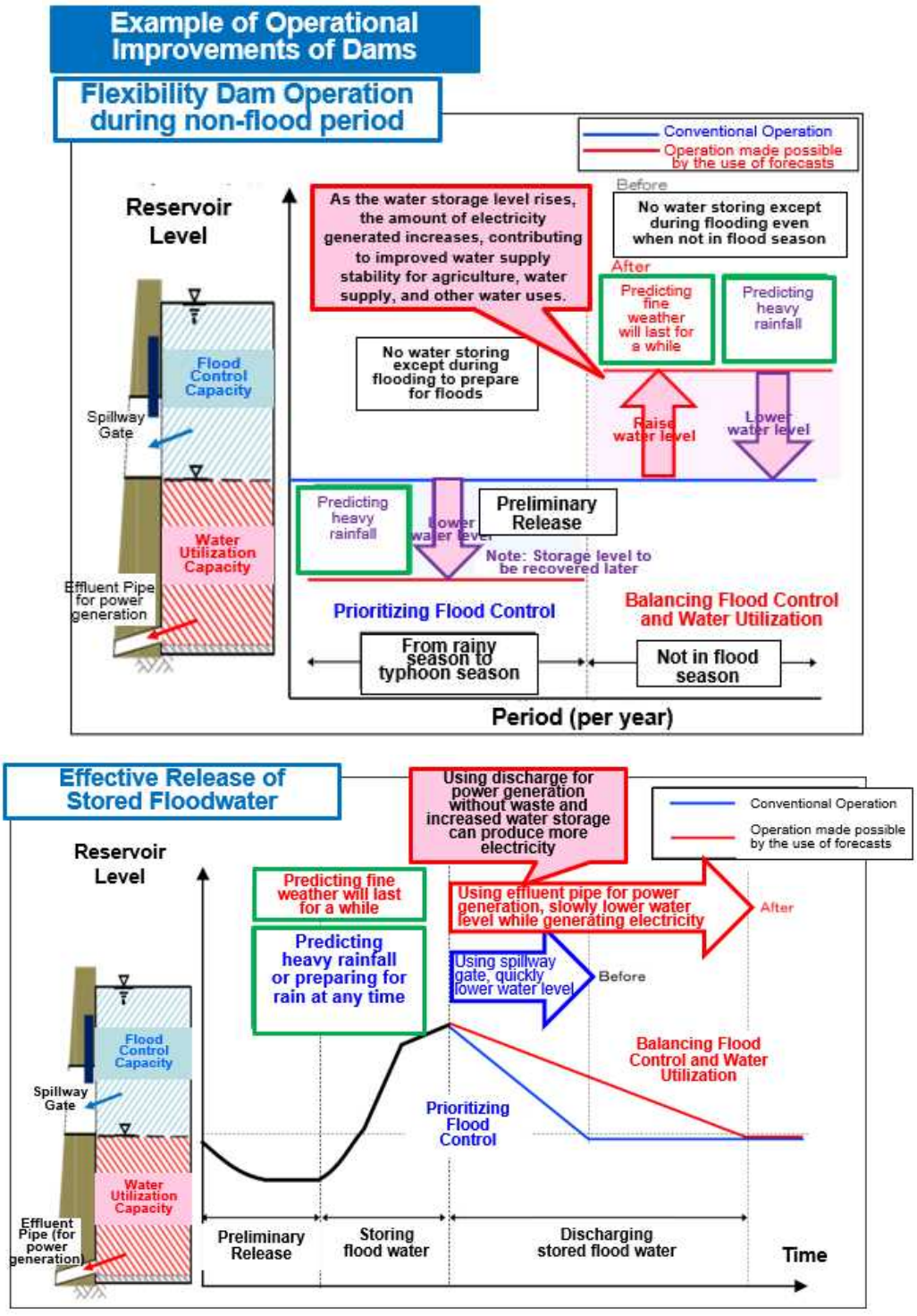
2. Making effective use of existing dams to deal with climate change

A multipurpose dam, used for the supply of agricultural water, hydroelectric power generation, flood control, etc. can bring about a range of business effects. However, it costs a lot to build a new dam, for which it is also necessary to give due consideration to its impact on the environment and consider how to compensate local inhabitants for the loss of their land or homes, which will be covered by the dam's reservoir. It will therefore take a long time to build a dam and for its effect to become measurable. It would therefore be a better option to look to existing dams and improve them in reference to local climate change forecast information for the maximum use of their infrastructure functions.

In a basin area that has a dam, it is possible to strengthen the flood control function of the dam in an effective manner within a relatively short period of time by urgently lowering the dam's reservoir level based on precipitation forecasts, thereby securing its flood control capacity during the flood season. It is indeed an extremely effective climate change adaptation measure. For existing multipurpose dams equipped with flood control and hydroelectric power generation functions, it is also possible to gradually lower the water level

raised by a heavy rain event by using the water for hydroelectric power generation, if it is predicted that there will be no rainfall for the time being, thereby preventing the water from being released without being used for power generation, which will help increase the power generation capacity and also contribute to the mitigation of climate change.

On the other hand, during the non-flood period, the reservoir level of an existing dam can be raised at a certain level until a sufficient amount of rainfall is predicted, thereby ensuring the stable supply of agricultural water, demand for which will surge in the dry season, in linkage with irrigation facilities located in the downstream area, such as an agricultural dam. It can therefore help reduce drought damage and contribute to climate change adaptation. Raising the dam's reservoir level will also help increase the power generation capacity during the non-flood period and could therefore be a climate change mitigation measure.



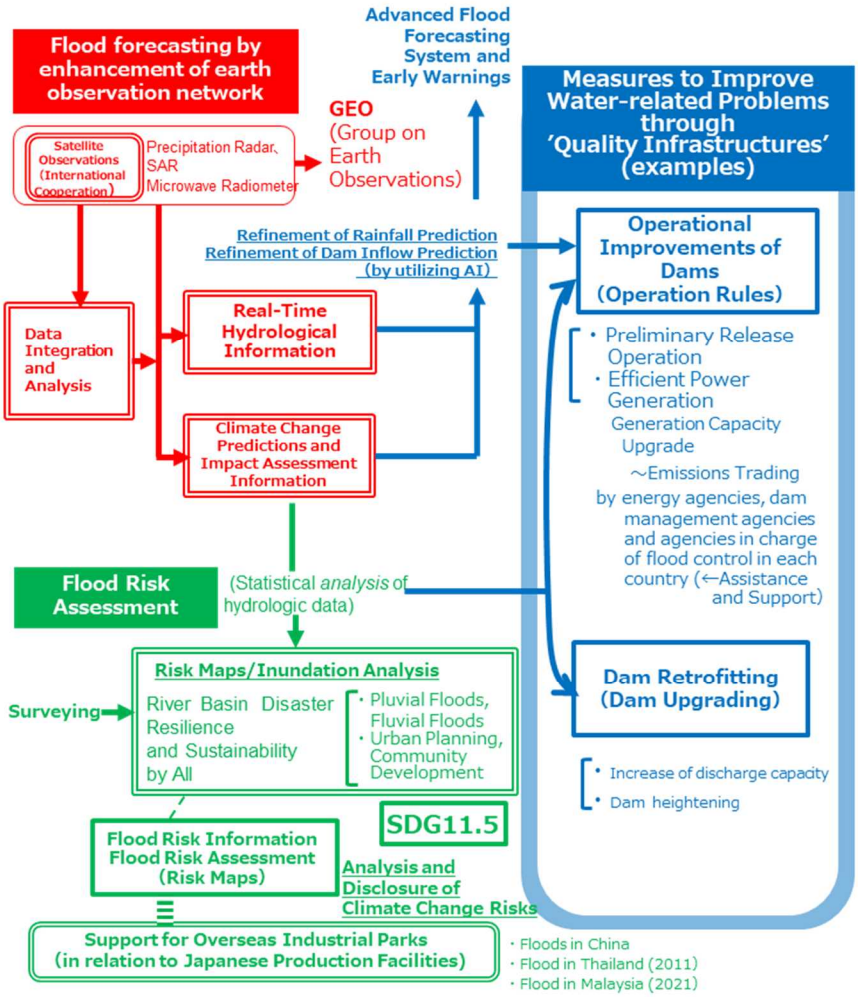
3. Scientific technologies required for the effective use of existing dams

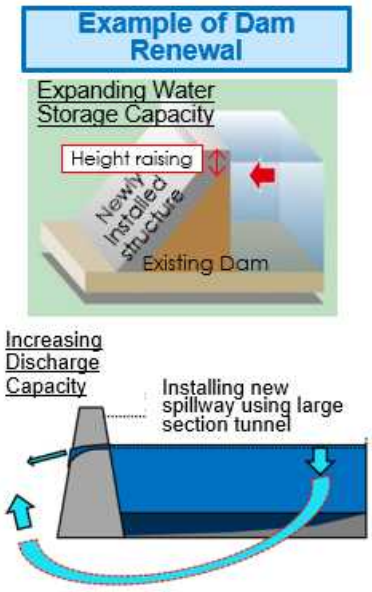
In order to lower/raise the dam's reservoir level in an effective manner, it is necessary to make use of precipitation forecasts and to precisely predict, over a period that is as long as possible, the amount of water that will flow into the dam based on the precipitation in the upstream area.

For precipitation and the inflow of water into dams, the precision of forecasts depends on the availability of meteorological and hydrological data, including data about rainfall and the dam's reservoir level. If an abundance of data is available for the past period, it will help build an even more precise weather forecast model, and if real-time observation data are sufficiently available, the precision of precipitation forecasts will further increase.

If the capacity of an existing dam is not large enough, it is necessary to raise the dam height and if the agricultural water supply and hydroelectric power generation facilities of an existing dam are not large enough, it is necessary to retrofit the dam, including adding water discharge facilities to effectively lower the reservoir level.

Moreover, before retrofitting a dam, it is necessary to make detailed examinations about the retrofitting purpose, the magnitude of targeted floods and the appropriateness of making an investment in the project and then formulate a flood control plan. For the formulation of the plan, it is important to make effective use of scientific technologies and meteorological and hydrological data in order to make science-based decisions, including deciding whether or not it is appropriate to invest in the project in consideration of the impact of climate change and in terms of the possibility of reducing water disaster risks, such as the frequency of flooding.





4. Japan's contribution measures

In Japan, measures to make effective use of the hybrid technology to implement both climate change adaptation and mitigation measures are being implemented targeting the dams managed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Japan Water Agency (JWA). Moreover, for further improvement of dam operation, the Ministry and Agency are pressing forward with R&D.

Following the organization of the 4th Asia-Pacific Water Summit, Japan will support the use of the hybrid technology that will enable the implementation of both climate change adaptation and mitigation measures targeting the dams in the Asia-Pacific region to which such technology can be effectively applied and for which the national governments and dam administrators are willing to work with Japan. Japan will choose such dams from among about 30,000 dams existing in the region (excluding those in Japan) in consideration of the needs of each country and the expected results. Japan will thereby help reduce flood damage, foster stable water supply and enhance hydroelectric power generation toward contributing to the development of smart infrastructure in the region. Moreover, Japan will make use of the database for Policy Decision making for Future climate change (d4PDF) etc., which the country has developed ahead of others for the assessment of the impact of climate change.

【Reference】

- In order to improve the operation of dams, preliminary release operation is conducted for flood control at about 1,500 dams in Japan, including dams for water utilization. For larger hydroelectric power generation capacity, measures will be implemented at 29 dams managed by the MLIT as well as at two dams managed by the JWA by the end of fiscal year 2022.

Compared with the construction of a new dam, retrofitting of a dam will not have a serious impact on the surrounding environment. However, in order to do it without suspending the operation of the dam in use, advanced construction technologies are needed. Japanese construction companies have extensive expertise in this field and can therefore contribute to the retrofitting of dams in the Asia-Pacific region by capitalizing on their experience and technologies.

【Reference】

- Dams that were and are being retrofitted: 34 dams managed by the MLIT and two dams managed by the JWA.
- The JWA has been supporting the inspection of aged existing dams and proposes the methods to improve their flood control and water supply functions as part of the support activity.

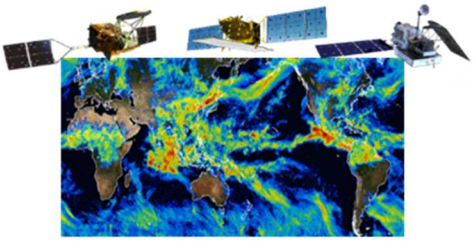
In Japan, which has built up a ground observation network, it is possible to make precipitation forecasts for the efficient operation of dams. In the Asia-Pacific region, however, there are some areas where such a network has not yet been fully developed.

Based on this recognition, Japan will cooperate with Europe, the United States, Australia and India to enhance the earth observation network through satellite observation, specifically by supplementing the lack of ground observation data in some areas with satellite observation data. Japan will also help the meteorological and hydrological bureaus of each country in the region to enhance their operational abilities and develop personnel who can foster climate change adaptation measures by using the observation and forecast data, thereby promoting technology transfer for precipitation forecasts. Moreover, Japan will conduct R&D by using AI to further raise the forecast accuracy.

【Reference】

- International sharing of satellite observation data and knowledge held by the Japan Aerospace Exploration Agency (JAXA), Europe, the United States, Australia, and India through the framework of the Group on Earth Observations (GEO).
- Earth observation data, including satellite and ground observations, will be used by the Data Integration & Analysis System (DIAS) of the Ministry of Education, Culture, Sports, Science and Technology. So far, 17 countries, including the Philippines, have implemented initiatives to improve dam operations, and these initiatives will be expanded in the future according to the needs of each country.
- Provision of flood forecast data created based on the Global Flood Alert System (GFAS) using JAXA Global Rainfall Watch (GSMaP) to the meteorological and hydrological agencies of each country by the Infrastructure Development Institute - Japan in partnership with JAXA.
- Operational improvement technologies under development for dams by the JWA and the Disaster Prevention Research Institute of Kyoto University under the framework of the Cross-ministerial Strategic Innovation Promotion Program (SIP) fostered by the Cabinet Office.

Strengthening Earth Observation Network



Promoting utilization of satellite observation data for blank area of ground observation
- Support disaster response by sharing weather and precipitation data.
- Improving accuracy of weather and flood prediction
- Formulation of flood control plans considering future changes in climate

<Observation and prediction technology by Japanese universities, JAXA and Japan Meteorological Agency>

For the formulation of plans to retrofit/improve the operation of a dam, Japan will make use of observation data, climate change forecast data, etc. obtained from the global earth observation networks and clearly show the changes to be made to the water disaster risk of an area based on the analysis of the present and future floods in the area and support the visualization of the effects to be brought about by the implementation of the planned measures. Provision of such support will contribute to decision-making on investment appropriateness, appropriate locating of communities by the development bureaus, and ESG investment and business continuity planning (BCP) by companies. Moreover, Japan will foster the evaluation of water disaster risks and spread the use of the evaluation method under international cooperation frameworks including international organizations.

【Reference】

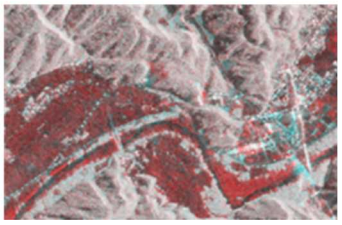
- Evaluation of flood risks based on the use of the Integrated Flood Analysis System (IFAS) possessed by the Public Works Research Institute's International Center for Water Hazard and Risk Management (ICHARM).
- Promotion of flood risk evaluation based on cooperation with the Ministry of the Environment for the Task Force on Climate-Related Financial Disclosures (TCFD).

Conducting and Disseminating Water-related Disaster Evaluations

Promoting River Basin Disaster Resilience and Sustainability by All utilizing flood risk map showing flood frequency and depth

- Visualizing the effects of flood control projects
- Adjusting residential and business locations
- Promoting ESG investment

<Evaluation technology by MLIT and consulting firms in Japan>



For the comprehensive implementation of these measures, it is important for Japan to foster policy dialogues in the Asia-Pacific region and to give support for the following: development of human resources by the relevant agencies of the countries that wish to adopt Japan's measures; acquisition of know-how to expand the financial bases of the public and private sector for the development and management of infrastructure facilities; and the establishment of desirable systems and organizations for water cycle management in each basin area. To this end, it is necessary to promote bilateral cooperation and enhance measures under multilateral cooperation frameworks.

Specifically, it is important to understand the present situation concerning each basin and local dams, examine optimal measures by making use of scientific technologies, and foster projects to implement the measures in society. To meet the requirement, Japan will conduct examinations to build a system for the related Japanese governmental agencies, universities, research institutes and other organizations to cooperate under an international cooperation framework while collaborating with international aid organizations and to make effective use of PPP/PFI and the Joint Crediting Mechanisms (JCM) for greenhouse gas emission reduction.

【Reference】

- The MLIT is promoting bilateral cooperation with eight countries to foster dialogue about the measures to prevent water-related disasters.
- The JWA is cooperating with 19 countries to share good examples and foster capacity building through the Network of Asian River Basin Organizations (NARBO) for which the JWA serves as secretariat in collaboration with the Asian Development Bank.
- The MLIT and the Japan Meteorological Agency are helping the meteorological and hydrological bureaus of member countries improve their abilities through the Typhoon Committee.
- Japan's related agencies are promoting the enhancement of disaster control abilities of ASEAN countries in line with Disaster Management Network for the ASEAN Region.
- Cooperation with the WMO, UNESCO and UNDRR through the International Flood Initiative (IFI), for which ICHARM serves as secretariat. Human resource development and capacity building using the Data Integration and Analysis System (DIAS) under the framework of the AOGEO/Asian Water Cycle Initiative (AWCI).

5. Conclusion

In order to deal with climate change across the world including the Asia-Pacific region and to reduce the risk of water disasters, it is important to make infrastructure investments in a planned manner on a medium- to long-term basis. To this end, it is necessary to make effective use of scientific technologies, while promoting cooperation between those engaged in the water sector in Japan and other countries toward implementing necessary measures while narrowing financial gaps.

The Ministry of Land, Infrastructure, Transport and Tourism will support the development of 'Quality Infrastructure' based on its water management-related expertise and experience, thereby contributing to the 'Quality Growth' of the Asia-Pacific region.