ICHARM
Activity
Report

FY2022

For the 7th ICHARM Governing Board Meeting

On 6 September 2023

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

Contents

Abbreviation

ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AOGEO	Asia-Oceania Group on Earth Observations
AOP	Annual Operating Plan
APWF	Asia-Pacific Water Forum
APWS	Asia-Pacific Water Summit
Area-BCM	Area- Business Continuity Management
AWCI	Asian Water Cycle Initiative
CLVDAS	Couple Land and Vegetation Data Assimilation System
COVID-19	COVID-19
d4PDF	database for Policy Decision making for Future climate change
DHM	Distributed Hydrological Model
DIAS	Data Integration and Analysis System
DOST	Department of Science and Technology, Republic of the Philippines
DPWH	Department of Public Works and Highways, Republic of the Philippines
DRR	Disaster Risk Reduction
GRIPS	National Graduate Institute for Policy Studies
GSMaP	Global Satellite Mapping of Precipitation
GUI	Graphical User Interface
GWP	Global Water Partnership
HCP	Hydrological Coordination Panel
HELP	High-level Experts and Leaders Panel on Water and Disasters
HyDEPP	a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change in the Republic of the Philippines
HydroSOS	Global Hydrological Status and Outlook System
IAHS	International Association of Hydrological Sciences
ICFM	International Conference on Flood Management
ICHARM	International Centre for Water Hazard and Risk Management under the auspices of UNESCO

IDRIS	ICHARM Disaster Risk Information System
IFI	International Flood Initiative
IFM	Integrated Flood Management
IRDR	Integrated Research on Disaster Risk
ISC	International Science Council
IWRM	Integrated Water Resources Management
JAXA	Japan Aerospace Exploration Agency
JCC	Joint Coordinating Committee
JFRM	Journal of Flood Risk Management
JHoP	Japan Hub of Disaster Resilience Partners
JICA	Japan International Cooperation Agency
JMA	Japan Meteorological Agency
JST	Japan Science and Technology Agency
LETKF	Local Ensemble Transform Kalman Filter
LLDA	Laguna Lake Development Authority, Republic of the Philippines
LOC	Local Committee
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MMDA	Metropolitan Manila Development Authority
MOFA	Ministry of Foreign Affairs
MoU	Memorandum of Understanding
NIED	National Research Institute for Earth Sciences and Disaster Resilience
NILIM	National Institute for Land and Infrastructure Management
NoWNET	Northern Water Network
OCD	Office of Civil Defense, Republic of the Philippines
OSS-SR	Online Synthesis System for Sustainability and Resilience
PaaS	Platform as a Service
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PRISM	Public/Private R&D Investment Strategic Expansion Program
PTC	Panel on Tropical Cyclones
PWRI	Public Works Research Institute

R&D Seminar	Research and Development Seminar
RRI	Rainfall-Runoff-Inundation
RSR model	Rainfall-Sediment-Runoff model
SAR	Synthetic Aperture Radar
SATREPS	Science and Technology Research Partnership for Sustainable Development
SCE-UA	Shuffled Complex Evolution algorithm developed in University of Arizona
SDGs	Sustainable Development Goals
SIMRIW	Simulation Model for Rice-Weather Relationships
SWWW	Stockholm World Water Week
TC	Typhoon Committee
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-IHP	UNESCO- Intergovernmental Hydrological Programme
UNSTSWD	United Nations Special Thematic Session on Water and Disasters
UPLB	University of the Philippines Los Banos
VFES	Virtual Flood Experience System
VM	Virtual Machine
VR	Virtual Reality
WEB-DHM	Water and Energy Budget-based Distributed Hydrological Model
WEB-RRI	Water and Energy Balance-based Rainfall Runoff Inundation
WGH	Working Group on Hydrology
WGM	Working Group on Meteorology
WMO	World Meteorological Organization
WRF model	Weather Research and Forecasting model

1. Summary

This Activity Report summarizes the main activities carried out by International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM) in FY2022 (April 2022 to March 2023), the 17th year of ICHARM.

FY2022 is the first year of the 5th Medium- and Long-Term Plan (2022-2027) of Public Works Research Institute (PWRI), to which ICHARM belongs, and also UNESCO-IHP-IX (2022-2029). In light of these plans, the ICHARM Programme, including its missions, long- and medium-term programmes, and work plan, was revised and adopted at the 6th ICHARM Governing Board Meeting held on June 21, 2022.

In FY2022, as the first year of the revised ICHARM Programme, we conducted various activities, including research, capacity building, and information networking.

Regarding research, based on the revised ICHARM Programme, we conducted various studies in Japan and overseas using the end-to-end approach (from data acquisition to the clarification, evaluation, and prediction of natural phenomena and to the assessment of their socioeconomic impact). The research activities were funded with the operating grants from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and external funds from UNESCO, the World Bank, Kyoto University, the Cabinet Office, Japan International Cooperation Agency (JICA), and other organizations.

Capacity building is centered around master's and doctoral programs as it was in FY2021. In addition, we held the Follow-up Seminar at ICHARM with 17 graduates who were invited to the 9th International Conference on Flood Management (ICFM9).

As information networking activities, ICHARM hosted major international conferences and their sessions and side events, such as the 4th Asia-Pacific Water Summit (APWS4), ICFM9, and the United Nations (UN) 2023 Water Conference. Through these events, the concepts of promoting water cycle consilience, fostering “facilitators” (catalytic individuals who can lead the way toward resolving problems by providing professional advice on-site using a broad range of scientific and indigenous knowledge), and taking an end-to-end approach, which ICHARM has been promoting, were proposed and disseminated around the world together with our research results and achievements. These concepts were reported in the plenary session on the last day of the UN 2023 Water Conference. ICHARM also made consistent contribution to UNESCO-IHP; Executive Director Koike chaired one of the cross-cutting working themes of UNESCO-IHP-IX (2022-2029). We continued working on the establishment of a "Platform on Water Resilience and Disasters" in various countries as a central member of the International Flood Initiative (IFI) and demonstrated the presence of Japan and ICHARM to the participating countries through the activities of the Typhoon Committee Working Group of Hydrology.

The outcomes of these activities were widely publicized as soon as possible through our website and quarterly newsletters (about 5,000 subscribers) to share useful information and knowledge with as many people as possible.

FY2022, in particular, saw several awards presented to ICHARM and its staff for their outstanding

activities. We received the Excellence Award of the Good Digital Award 2022 from the Digital Agency of Japan along with the University of Tokyo for the development of a water-level forecasting system for small and medium rivers. Executive Director Koike received the "AGU Ambassador Award." Still, two papers by ICHARM researchers were commended by the Japan Society of Civil Engineers.

Details of each activity are described on the following pages.

2． Special topics

2.1 Revision of the ICHARM Programme

As described in Section 1, the ICHARM Programme was revised when PWRI formulated the 5th Medium- and Long-Term Plan (2022-2027). It was then discussed and adopted at the 6th ICHARM Governing Board Meeting. The following is a summary of the programme.

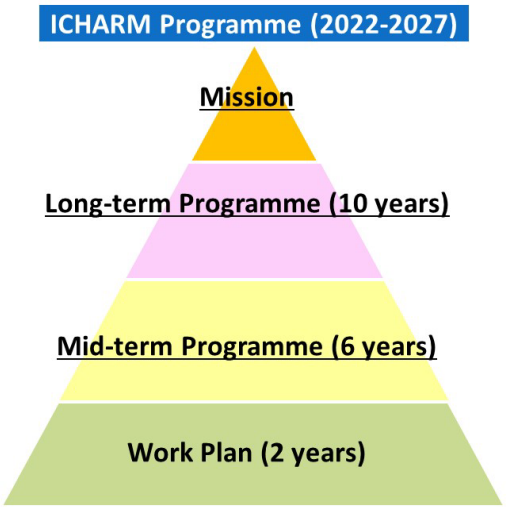

Fig. 2-1 The structure of the ICHARM Programme

The ICHARM Programme consists of four parts: "Mission," "Long-Term Programme (10 years)," "Mid-Term Programme (6 years)," which is aligned with PWRI's Medium- to Long-Term Plan, and "Work Plan (2 years)," which is more detailed descriptions of individual projects. The following summarizes the Mission and the Long-Term Programme.

The Mission states "innovative research," "effective capacity building," and "efficient information networking" as the three pillars of ICHARM's activities, and declares: "Based on these three pillars, ICHARM will globally serve as a knowledge hub for best national and local practices and a policy-making advisor, keeping in mind respect for diversity and inclusion of all stakeholders."

The Long-Term Programme aims to implement the plans of the five priority areas set in UNESCO-IHP-IX (2022-2029), thereby achieving the Sustainable Development Goals 2030 (SDGs) and the Sendai Framework for Disaster Risk Reduction 2015-2030. It also aims to contribute to promoting Japan's new flood management policy, "River Basin Disaster Resilience and Sustainability by All," which has been developed based on the 2020 report submitted by the River Subcommittee of the Council for Social Infrastructure Development in Japan. The report recommends shifting to a new flood management approach that encourages basin-wide efforts involving all stakeholders in the basin to manage floods considering climate change impacts and social changes.

Of the three primary activity areas, research will be conducted by employing the end-to-end approach, which covers the entire research process from data acquisition to the clarification, evaluation, and prediction of natural phenomena to the evaluation of their socio-economic impacts. This approach can contribute to strengthening the resilience of society to water disasters and integrating scientific knowledge for building a sustainable society.

In capacity building, in addition to the graduate education, ICHARM will put more effort into fostering facilitators who can provide advice based on interdisciplinary scientific knowledge for local practitioners engaged in initiatives to improve water-related disaster resilience and sustainability.

In information networking, we will update our action plans as needed by visualizing and mapping issues regarding water-related disaster resilience and sustainability in terms of SDGs, the Sendai

Framework for Disaster Risk Reduction, UNESCO-IHP-IX, and Japan's flood management improvement policies. Furthermore, taking advantage of the IFI framework, we will continue promoting the implementation of our projects in societies and communities by combining research and capacity building.

2.2 Contribution to mainstreaming disaster risk reduction in science, technology, and education

2.2.1 Recent status of water-related disaster risk reduction in international discussions on water issues

Water-related disasters are not explicitly included in Goal 6 "Ensure availability and sustainable management of water and sanitation for all" of the Sustainable Development Goals (SDGs), adopted by UN in 2015, but are mentioned in Target 5 "Significantly reduce the number of deaths and the number of people affected by disasters" of Goal 11 "Make cities and human settlements inclusive, safe, resilient and sustainable." There was an argument that water disasters should be included in Goal 6 and that water issues should be addressed in an integrated manner, but the claim was not supported as argued.

A reference to water-related disasters was also debated at the Budapest Water Summit in November 2016 in the summit's declaration drafting committee. Some opposed mentioning water-related disasters in the declaration, arguing that 1.8 million children continued dying annually due to lack of clean water and that the situation defied comparison with water-related disasters and consequently denying referring to water-related disasters in the declaration. After much discussion, the committee agreed to include the phrase "water-related disasters intensified by climate change" in the draft text of the declaration, but this important phrase was deleted from the final version compiled by the organizers.

Around the time when such discussions were taking place in international forums, Japan experienced catastrophic disasters: the Kanto Tohoku heavy rains in 2015, which caused the Kinugawa River to burst its banks, and the Hokkaido Tohoku heavy rains in 2016, which caused extensive damage to rural areas. The significant damage prompted the country to introduce a new disaster management policy aimed at "rebuilding a risk-conscious and well-prepared society against water-related disasters." Even since then, water-related disasters have become more frequent and intense worldwide as the climate changes. Preparation for such disasters should be recognized as an urgent issue to be addressed globally, and disaster risk reduction must be mainstreamed throughout the world. The four international conferences held during FY2022 were excellent opportunities to accelerate the mainstreaming process.

2.2.2 Fourth Asia-Pacific Water Summit (APWS4)

APWS has been held to promote a comprehensive understanding of and find practical solutions to water issues by demonstrating high-level leadership over various sectors and mobilizing adequate resources. The first summit took place in Beppu, Japan, in 2007, subsequently held in Chiang Mai, Thailand, in 2013 and Yangon, Myanmar, in 2017. The fourth meeting was held in Kumamoto City,

Japan, on April 23-24, 2022.

The Kumamoto Summit was opened by His Majesty the Emperor of Japan, who gave a speech entitled "Hearts, Minds and Water: Touching Water in People's Beliefs." Prime Minister Kishida announced the Kumamoto Water Initiative to promote efforts to accelerate climate change adaptation and mitigation and improve basic living conditions. The summit concluded with the unanimous adoption of the Kumamoto Declaration, which encourages commitment to transforming into a high-quality society that is resilient, sustainable, and inclusive.

At the summit, ICHARM planned, organized, and coordinated a parallel session, "Water and Disaster/Climate Change," a special session, "Showcase," and an integration session, "Science and Technology." In addition, ICHARM drafted the three key proposals, i.e., “promoting water-cycle consilience,” “fostering facilitators,” and “taking an end-to-end approach,” in response to the leaders’ question on the role of science and technology in cross-sectoral decision-making, and contributed to their inclusion in the Chair’s Summary.

2.2.3 Ninth International Conference on Flood Management (ICFM9)

ICFM is a unique international conference proposed by the hydraulics community to discuss floods in Europe, where severe floods are not frequent, in a multidisciplinary manner, including not only academic but also practical and social aspects. ICHARM was asked by Professor Slobodan Simonovic, the chair of the ICFM Ad Hoc Committee, to host an ICFM in Japan. We accepted his request and made an official announcement at an ICFM webinar in August 2021 to hold ICFM9 as an in-person conference in February 2023, one month before the UN 2023 Water Conference, in Tsukuba, Japan, under the overarching theme “River Basin Disaster Resilience and Sustainability by All: Integrated Flood Management in the Post COVID-19 Era.” The decision was welcomed by the webinar participants in Japan and overseas.

A total of 394 flood experts from 41 countries and regions (212 from Japan, 100 from Asia, 78 from other parts of the world, and 4 unknown) participated in the conference held from February 18 to 22, 2023. The number of participants was almost double the expected number, even though the COVID-19 pandemic had not completely ended; all events, including high-level symposiums, expert meetings, public events, and field tours, were attended by many in-person participants. Through these events, the participants shared the latest scientific findings on the increasing frequency and severity of floods and experiences accumulated in various regions, as well as identified scientific and social issues through exchanges of questions and answers. The results are scheduled to be published online in the Proceedings of the International Association of Hydrological Sciences (PIAHS) and in a special issue of the Journal of Flood Risk Management Science (JFRM) in late 2023 and April 2024, respectively.

The ICFM9 statement was also issued. Advocating the mainstreaming of flood risk management, the statement calls for all stakeholders to take bold, transformative action while recognizing resilience to flood disasters as a prerequisite for achieving sustainable development based on a holistic, quantitative understanding of the impact of floods on human and economic factors, including its

changes, and the impact of the COVID-19 pandemic. To achieve this goal, the statement also positively proposes adopting the end-to-end approach to cross-sectionally link the latest science with on-site decision-making and action, strengthening the collection, archiving, and sharing of data and information, improving models to analyze increasingly severe floods and their economic impact, promoting knowledge integration, fostering facilitators, and coordinating flood control measures in consideration of social inequalities and the fundamental rights of indigenous people.

2.2.4 Sixth UN Special Thematic Session on Water and Disasters (STSWD6) and UN 2023 Water Conference

While preparations for the UN 2023 Water Conference were underway based on the outcomes of APWS4, ICFM9 and STSWD6 were held one month and one day, respectively, before the conference. These meetings were very effective in building the international consensus on establishing the framework for water-related disaster management based on the key concepts presented at APWS4.

At STSWD6, His Majesty the Emperor of Japan, through his keynote lecture, introduced Japan's social development through the water cycle to the world, using Edo as an example. ICHARM hosted a showcase at the Science and Technology Session to highlight the importance of integrated scientific knowledge and human resource development to the international community, inviting one panelist each from Honduras in Central America, Malawi in Africa, and Kumamoto City in Asia, as well as a young expert in water issues. Special Envoy of the Prime Minister of Japan KAMIKAWA, who co-chaired the UN Water Conference's interactive dialogue on "Water for Climate, Resilience, and Environment," concluded her speech by saying, "Open science policies, facilitation between science and decision makers, the end-to-end approach, and integration of the water cycle are the keys to breakthroughs." ICHARM’s contribution to mainstreaming water-related disaster management in the discussions on water issues at the United Nations is evidenced by the outcomes of APWS4, ICFM9, and STSWD6, as well as by how they helped to build the international consensus on the matter.

2.2.5 ICHARM’s achievements from the series of conferences

Hosting ICFM9 provided ICHARM with an excellent opportunity to collect and sort out the latest wide-ranging scientific knowledge in Japan and abroad through the planning and operational processes. It also made us reflect on the direction and role that ICHARM should strive for. We were also able to strengthen ties with graduates from our master’s and doctoral programs, thereby enhancing our capacity to carry out international collaborative projects. In addition, through the involvement in showcases and the compilation of outcome documents at APWS4 and STSWD6, we were able to step up our capabilities of conducting our three principal activities: research and development, capacity building, and international networking.

Among those positive outcomes, particularly educational, was the meeting with Mr. Csaba Kőrösi, the president of the UN General Assembly. When we asked him to meet with our doctoral and master's students during his visit to Japan to attend the ICFM9 High-Level Symposium, he kindly accepted

our request. The students asked various questions, including those about the UN's efforts in flood forecasting and warning systems, effective resource allocation to cope with climate change-related disasters, and water resources management in international rivers. President Kőrösi gave detailed and insightful answers to these questions, which made the meeting an extremely valuable and meaningful human resource development opportunity.

As part of our contribution to the UN 2023 Water Conference, ICHARM proposed, among the conference's water action agenda, the promotion of the Water Cycle Integrator (WCI), which consists of three elements: promoting water cycle consilience, fostering "facilitators," and taking an end-to-end approach. To our great honor, our idea of WCI was quoted directly in the conference summary compiled by the president of the UN General Assembly.

Through the above international activities aimed at promoting the mainstreaming of water-related disaster management, ICHARM has achieved fruitful results in the areas of research, education, and international cooperation.

2.3 Development of a simple, low-cost flood forecasting system for small and medium rivers

In Japan, severe floods have occurred frequently in recent years, and many people have become victims due to delays in evacuating when small and medium-sized rivers flood. One reason for this is a lack of important information, particularly water level forecasts. Water level forecasts are essential for making critical decisions, such as whether or not to issue an evacuation order. However, of the approximately 21,000 rivers across the country, water level forecasts are issued for only about 400 rivers, most of which are large rivers. For approximately 1,500 small and medium-sized rivers nationwide, water level forecasting has yet to be conducted, although large populations reside in high-flood-risk areas along them. Therefore, MLIT has started promoting the installation of "crisis-management-type water level gauges." Gauges of this type are designed to be smaller and use less expensive communication devices. In small and medium river basins, the flood arrival time from the onset of heavy rainfall is often short. To ensure safe evacuation, it is important to predict water levels as far in advance as possible and provide them to support municipal offices and residents in making decisions and starting actions as early as possible. Therefore, this project aims to develop a water level forecasting system capable of predicting when the water level will reach the high water level at least two hours in advance. The system is also designed to be low-cost, simple, accurate, time-efficient in computation, and easily installed in small and medium-sized rivers.

The main results are as follows:

- Selected the RRI model[1] as the runoff analysis model for its low cost, simplicity, and high

[1] The RRI model is a distributed model designed to conduct basin-scale computation of the process from channel flow to flooding, taking into account surface runoff and intermediate runoff with rainfall as the input. The RRI model uses mesh elevation data to represent surface topography and analyzes rainfall runoff as a plane two-dimensional flow. Therefore, rainfall-runoff characteristics can be expressed mesh by mesh, and the influence of the spatiotemporal distribution of rainfall can also be taken into account.

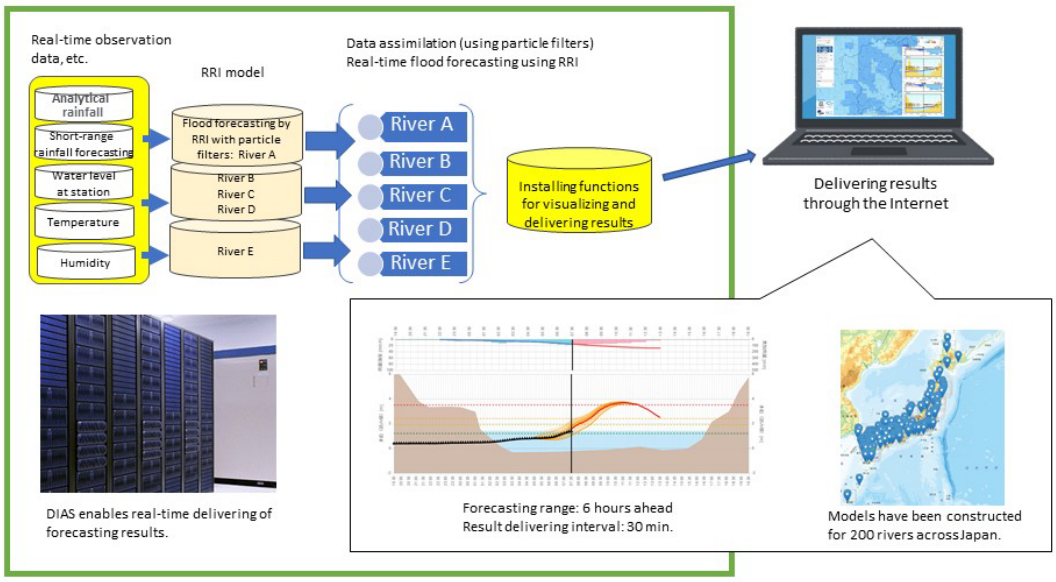

Fig. 2-2 Outline of flood forecasting system for small and medium rivers

reproducibility.

- Developed the method to select and use a highly flexible particle filter[2] for the RRI model, for the filter is applicable to state quantities and parameters, such as the flow rate. This method with a particle filter continuously calibrates the water-level forecasting model using real-time water-level observation data, thereby capable of improving forecasting accuracy.
- Improved RRI-GUI [3], a base model construction support unit, and developed the method to apply to the RRI model the SCE-UA method [4], an automatic parameter adjustment function, in order to reduce the workload required for model construction.
- Constructed a prototype of a real-time automatic

Fig. 2-3 A map of 200 rivers across Japan, for which river models have been constructed.

[2] Particle filters are used for state-space models with non-linearity or non-Gaussianity to sequentially assimilate numerical simulation models and observed data. Compared to the Kalman filter and the ensemble Kalman filter, particle filters can be applied to a wider range of state-space models, but the number of particles required to properly approximate the probability distribution increases dramatically with the increase in the number of dimensions of the state space.

[3] The GUI for model building (RRI_BUILDER) is equipped with the Japan Flow Direction Map and the detailed land-use mesh data as national-land numerical data and thus automatically creates topographical and land-use data for the basin located upstream of the site selected by the user. GUI is capable of generating rainfall data for the RRI model from rainfall products of analytical rainfall (regular and preliminary), short-time rainfall forecasts (regular and preliminary), high-resolution precipitation nowcasts, and ground rainfall. The GUI for displaying the calculation results (RRI_VIEWER) allows the user to view the calculated channel flow and channel water depth, slope flow, and slope water depth in time and space.

[4] The SCE-UA method is an optimization method that combines the concepts of competitive evolution and population mixing, which are similar to those employed for genetic algorithms. The method divides multiple candidate parameter sites into groups and updates itself to find the optimal parameters within each group. It then re-divides the candidate parameter sites into new groups using the revised version of the method and updates itself to find the optimal parameters within the new groups. The SCE-UA method repeats this process.

information delivery system using Data Integration Analysis System (DIAS). The system is designed to analyze data and visualize and disseminate the results. We also tested the system for information delivery.

- Constructed river models for roughly 200 selected rivers to understand and reflect the characteristics of small and medium-sized rivers in analyses and then incorporated them in the real-time automatic information delivery system. All the models were tested for forecasting accuracy using past flood data from 291 events in total. The results showed that the models were capable of accurately predicting when the water level would reach the flood risk level in 159 events (55%) with a lead time of more than 2 hours. For 60 of the remaining 132 events, the models performed successfully when the prediction margin was set within a range of ±50 cm. For the remaining 72 flood events, which occurred in small rivers, where floodwaters flow down in a shorter time, the models were tested to see if they could predict when the water level would reach the flood risk level, i.e., the lead time to possible flooding, within a prediction margin of ±50 cm. The results showed that the models could make required predictions for 39 events. Of the remaining 33 events, the project team has been testing possible solutions for 13 events.
- Created a manual for constructing flood forecasting models for small and medium-sized rivers by compiling the model construction procedures that ICHARM developed to reduce the workload of river managers in this process. During the model construction and verification for about 200 small and medium-sized rivers, we checked their standard data and solved issues arising when setting river channels and model parameters. We accumulated, analyzed, and structured the knowledge gained through these experiences and consequently succeeded in eliminating bottlenecks in the model construction, thereby enabling many engineers to develop systems required for their purposes. We also added the flow chart, sample cases, glossary, and FAQ regarding model construction.
- Developed a database of basin area, land use percentage, and post-calibration parameters for each of the 200 rivers for which a model was constructed. We also developed a method to extract parameters for rivers with no flood data by using this database and applying principal component analysis.

This project was conducted in collaboration with the Cabinet Office-led Public/Private R&D Investment Strategic Expansion Program (PRISM).

2.4 HyDEPP-SATREPS in the Philippines

ICHARM represents the Japanese side of the joint research project under the “Science and Technology Research Partnership for Sustainable Development: SATREPS” program supported by Japan Science and Technology Agency (JST) and JICA. The joint research project is named “a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change in the Republic of the Philippines: HyDEPP-SATREPS.” Senior Researcher OHARA has been serving as the project leader on the Japanese side, and ICHARM, as the

principal implementing agency, has been leading various activities with joint research institutes in Japan and the Philippines.

The joint research institutes in Japan are the University of Tokyo, Tohoku University, University of Shiga Prefecture, Nagoya University, and Kyoto University. The representative research institute on the Philippine side is the University of the Philippines Los Banos, the joint research institutes are the University of the Philippines Diliman and Mindanao, and the collaborative institutions are the Department of Science and Technology (DOST), the Department of Public Works and Highways (DPWH), the Metropolitan Manila Development Authority (MMDA), and the Laguna Lake Development Authority (LLDA).

The research activities in Japan supported by JST started in Japan on April 1, 2020, On the other hand, the research activities in the Philippines supported by JICA were postponed due to COVID-19. The activities finally started on June 3, 2021.

In FY2022, two Joint Coordinating Committee (JCC) were held attended by the joint research institutes, the collaborative administrative institutions, JICA, and JST. The second JCC was held on June 10 as an online meeting. The third JCC was held on November 16, 2022, in Quezon City, which locates in Metro Manila as a hybrid meeting. The third JCC was held as the first in-person meeting since the project started, as overseas travel restrictions placed due to the global spread of COVID-19 were finally lifted.

From July 28 to August 25, 2022, ICHARM conducted an e-learning training course for the staff of the joint research institutions and the collaborative institutions to learn about water-related disaster risk assessment technologies. Of the 93 registered participants, 63 completed Course 1 (Basic course on water-related disaster risk), 41 completed Course 2 (Hands-on training on inundation analysis, hazard and risk mapping), and 53 completed Course 3 (Advanced course on hydro-agriculture-economic models). Forty people completed all three courses. As far as the staff of the collaborative administrative institutes goes, 44 completed Course 1, 34 Course 2, 38 Course 3, and 33 all three courses. Large numbers of successful collaborative administrative institute staff can make a drastic acceleration forward the implementation of new technologies and policies.

On February 20, 2023, during the second training course while Filipino project members were vising Japan, the HyDEPP-SATREPS Special Session was convened as one of the ICFM9 special sessions. In the special session, UPLB professors, Fernando Chinte Sanchez, Jr. and Patricia Ann Asico Jaranilla-Sanchez, who is also the project manager on the Philippine side, made presentations on their research results, which was followed by the exchange of views and ideas with other participants. Attended by 50 people, 35 in person and 15 online, the session was a good opportunity for the project to gain wider publicity.

On March 10, 2023, ICHARM participated in the World Disaster Risk Reduction Forum at Sendai, Japan. In the session highlighting transdisciplinary approaches toward innovative recovery and disaster risk reduction, ICHARM delivered a presentation entitled “Collaborative Approach of DRR in the Philippines: HyDEPP-SATREPS Project,” explaining the joint project between Japan and the

Philippines as a good example employing a transdisciplinary approach.

The project will be carried until June 2026 in close collaboration between the two countries.

Photo 2-1 The 3rd JCC hybrid meeting in Manila, the Philippines

2.5 Follow-up Seminar for the graduate of the ICHARM master's program

ICHARM was established in March 2006. One and a half years later, the Disaster Management Policy Program (master's program) was launched in October 2007, followed by the Disaster Management Doctoral Program in October 2010. As of March 2023, 170 students completed the master's program, and 15 received a doctoral degree. On February 22, 2023, ICHARM held the Follow-up Seminar at ICHARM to help graduates brush up their skills and knowledge and to gain feedback to improve our programs. Seventeen graduates who were visiting Japan to attend ICFM9 participated in the seminar along with faculty members, current students, and other invited guests.

The morning part began with opening remarks by Ms. MUTSUYOSHI, the director general of JICA Tsukuba and Emeritus Professor TAKEUCHI of Yamanashi University, who was the founding Executive Director of ICHARM. Then, Executive Director KOIKE delivered the keynote address sharing five guiding principles that he keeps in mind as a scientist; he encouraged young scientists to keep scientific curiosity, respect diversity, cherish a reciprocal relationship with fellow scientists, work together, and be humble by always reflecting on one's actions. Relating to these principles, he conveyed valuable messages to the graduates, as well as to current students and researchers, who are actively playing a leading role as scientists or practitioners in addressing water-related issues.

The next session was set to listen to voices from the graduates. Comments were collected from the participants beforehand, and four selected alumni, Mr. Akshay Kowlesser from Mauritius, Mr. Rafael Silva Araujo from Brazil, Mr. Muhammad Masood from Bangladesh, and Mr. Roshan Kumara Jayasinghe from Sri Lanka, spoke about their work experiences, challenges they faced, and how they solved them using the knowledge gained at ICHARM.

The third session featured an interaction between former and current students. An enthusiastic discussion took place in response to questions raised by current students, which were mainly related to the experiences the graduates had in practicing what they had learned at ICHARM in their countries or organizations. Mr. Asif Naseer from Pakistan, Mr. Ravindra Vitthal Kale from India, Mr. Robin Kumar Biswas from Bangladesh, and Mr. Seenipellage Chaminda Sugeeshwara from Sri Lanka shared their

valuable ideas, suggestions, and experiences to help current students with future careers and studies at ICHARM.

In the afternoon, Emeritus Professor Takeuchi delivered a special lecture based on his recently-published book, “Integrated Flood Risk Management: Basic Concepts and the Japanese Experiences.”

The Follow-up Seminar was another excellent opportunity for the participants to gain valuable insights and advice and expand a professional network among themselves through extensive discussions on various issues.

Photo 2-2 Discussion during the Follow-up Seminar

Photo 2-3 Participants in the Follow-up Seminar

３． Research

ICHARM will conduct “R&D Program 1: Development of technologies to promote basin-wide flood control against severe water-related disasters" under “R&D Theme 1: Contribution to national land development to protect lives and livelihoods from natural disasters" in PWRI's 5th Medium- and Long-term Plan (2022-2027).

Specifically, we will conduct research focusing on the following four areas in order to address increasingly severe water-related disasters in consideration of climate change impacts by developing technologies to support basin-wide flood control and thereby contribute to national land development for the purpose of protecting lives and livelihoods from natural disasters.

1. Predict water-related disaster hazards accurately.
   ・Develop and improve technology to predict future water-related disaster hazards.
2. Minimize as much flood risk as possible.
   ・Develop a method to accurately evaluate and implement projects by “River Basin Disaster Resilience and Sustainability by All.”
3. Reduce exposure to water hazards.
   ・Develop an accurate flood inundation risk assessment method.
4. Strengthen society’s disaster preparedness and resilience
   ・Develop technology to help strengthen society’s disaster preparedness and resilience against water disasters.

In addition, the ICHARM Programme, which was revised based on PWRI's 5th Medium- and Long-term Plan, stipulates the following policy for research activities:

ICHARM will step up innovative research by taking the “end-to-end” approach, which covers the entire research process from data collection to the analysis, assessment and prediction of natural phenomena to their socio-economic impact assessment, thereby creating a scientific knowledge base, which helps increase communities’ water-related disaster resilience and sustainability. We will conduct more advanced research by collecting data on both water hazards and disaster risks, assessing and predicting risks and their changes, including those related to socio-economy, and establishing methods and applications to support policy studies and implementations. We will promote interdisciplinarity by collaborating with a broad range of areas, including water use, public health, climate science, urban planning, ecology, biodiversity, agriculture, energy, and infectious disease control, as well as by considering new lifestyles and national land development.

In these contexts, ICHARM has been conducting research on the following five themes using the end-to-end approach:

1.	Data collection, storage, sharing, and statistics on water-related disasters
2.	Risk assessment on water-related disasters
3.	Monitoring and prediction of changes in water-related disaster risk
4.	Proposal, evaluation, and application of policy ideas for water-related risk reduction
5.	Support in improving the applicability of water-related disaster management

The following sections describe the main research activities and achievements.

3.1 Data collection, storage, sharing, and statistics on water-related disasters

3.1.1 Development of a system for the integrated management of water resources and disasters in poorly gauged basins

a) Improving the reliability of rainfall data in poorly gauged basins

Near-real-time rainfall data with adequate resolutions are a prerequisite for effective water and disaster management. However, in many river basins in the world, near-real-time rainfall data is not available due to insufficient ground-based observation networks.

ICHARM is continuously collaborating with JAXA to maximize the near-real-time freely-available global satellite precipitation products (SPPs) for effective water resources management in poorly gauged basins (Fig 3-1.) ICHARM is also investigating a method for effective bias correction of SPPs incorporating ground-based observation data and for planning on optimal ground-based observation networks.

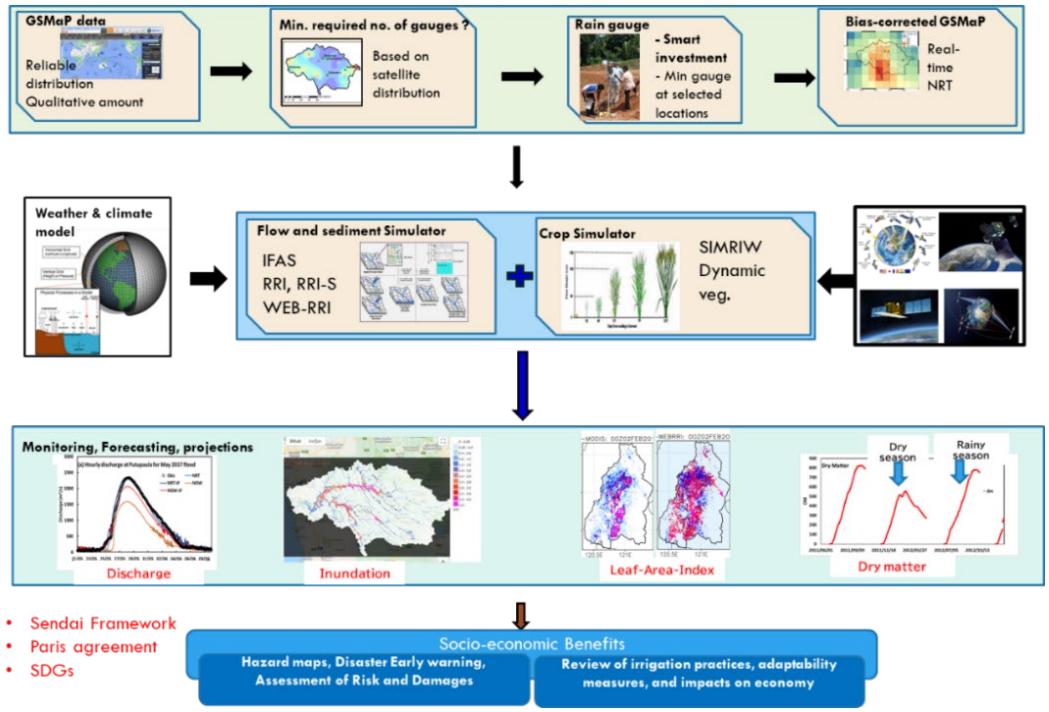

Fig. 3-1 A system for the integrated management of water resources and disasters in poorly gauged basins

3.1.2 Study on an RRI-estimated inundation area assessment method using satellite data

As part of the HyDEPP-SATREPS project (refer to 2.4), ICHARM has been conducting the monitoring of inundation status using the RRI model and satellite data in Candaba City, a flood-prone area in the Pampanga River basin, one of the major rivers of Luzon Island, the Philippines.

In FY2022, we conducted a case study on flood damage in late September 2022 due to Typhoon Karding, and compared the inundation area by RRI simulations and estimated inundation extents by satellite SAR images. As shown in Figure 3-2, satellite SAR images can only be acquired every few days to about 10 days, but the RRI model can perform simulations every moment according to precipitation data. However, since the inundated area estimated from satellite SAR images and the inundated area estimated from the RRI model both change greatly depending on the threshold, we examined how much influence this evaluation would have.

Estimated inundation area by satellite SAR image determines whether or not there is inundation at the spatial resolution of 10m of the original SAR image. On the other hand, the spatial resolution of the RRI model is several hundred meters, which is lower than that of satellite SAR images. Therefore, when judging whether or not the grids of the RRI model are flooded, it is considered that the extent to which grids judged to be flooded obtained from satellite SAR images are included is one of the judgment criteria. In addition, since the parameter output from the RRI model is the inundation depth, it is necessary to set the threshold of the inundation depth to determine that it is a flooded area. Using these thresholds, we examined the inundation-extent matching accuracy by testing various combinations of the two variables, as shown in Figure 3-3, with the horizontal axis indicating changes in SAR-based inundation extent (the occupied area ratio of SAR-based inundation grids per RRI grid, range: 0.0-0.9 at 0.1 increments) and the vertical axis indicating changes in RRI-based inundation extent (the water depth at which a grid is considered inundated, range: 0.0-0.3 at 0.1 increments). For each combination, the closer to 1, the higher the matching, but there is a wide range from 0.09 to 0.92, and it can be recognized that the matching varies greatly depending on the threshold.

These results confirmed that it is essential to factor in the effect of threshold settings in comparing RRI-based inundation and satellite-based inundation. Our next goal is to determine appropriate thresholds to reproduce actual inundation extents accurately and prepare necessary definitions to evaluate simulation results, based on past flood events whose inundation extents are identifiable with ground-observed data.

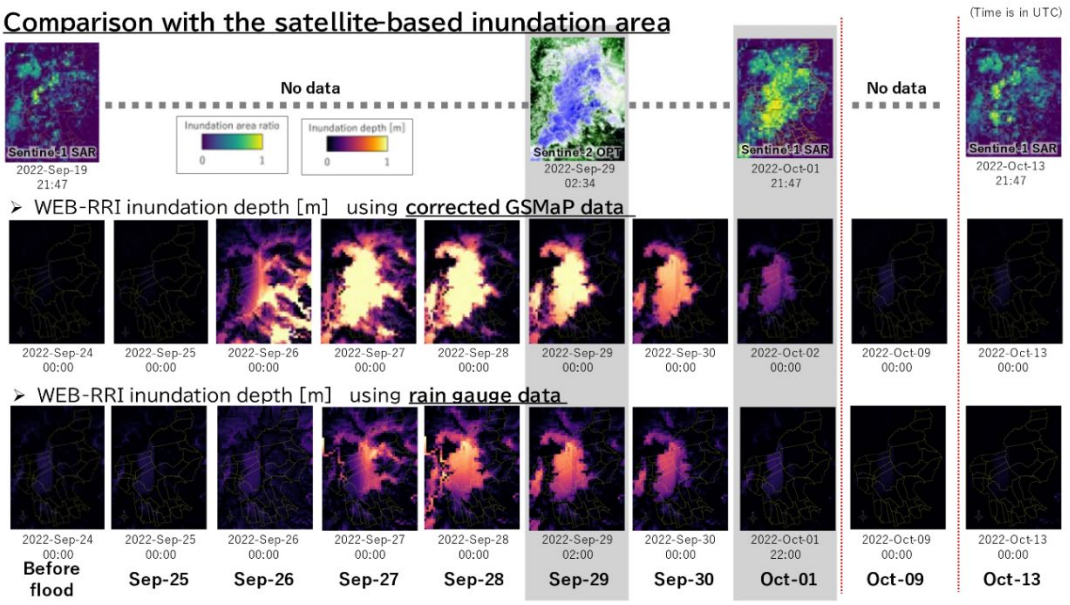

Fig. 3-2 Comparison between satellite-based and RRI-based inundation extent in Kandaba City, the Philippines

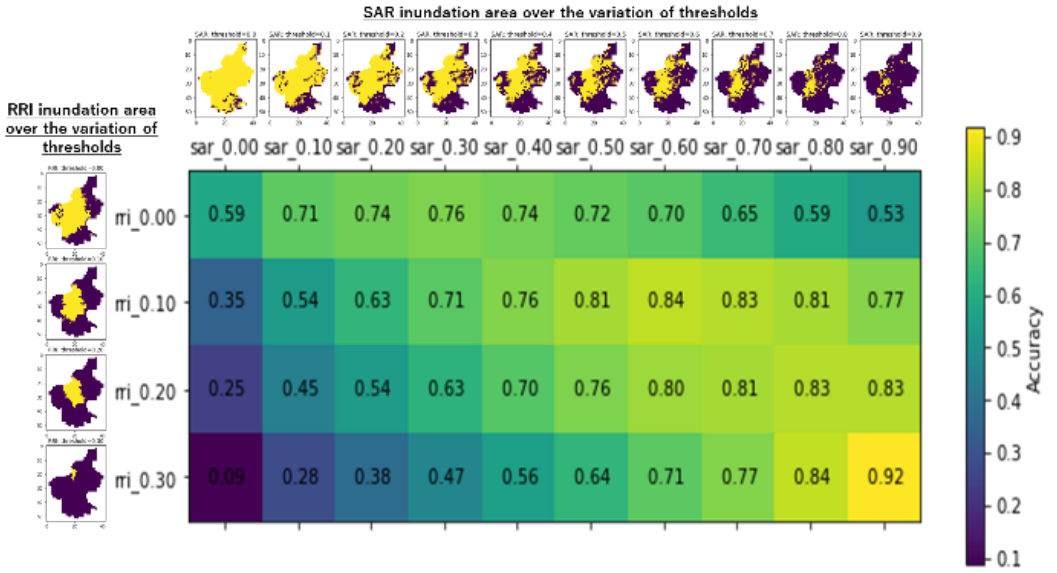

Fig. 3-3 The matching rates of satellite-based and RRI-based inundation extent, calculated using the confusion matrix (the horizontal axis: changes in SAR-based inundation extent, the vertical axis indicating changes in RRI-based inundation extent)

3.1.3 The development of OSS-SR and the training of facilitators in the Philippines

a) Support runoff inundation analysis using global observation data

ICHARM has developed the “Online Synthesis System for Sustainability and Resilience (OSS-SR)” for the Philippines, which provides the results of climate change impact assessment and risk information primarily about real-time flood forecasts (Fig. 3-4.) However, the system has often failed to monitor or forecast floods in real time because locally observed rainfall data are unavailable. To address this challenge, ICHARM started the development of a system capable of

robust, practical flood forecasting using all data available in FY2022. This system is designed to use not only ground-observed rainfall but also statistically corrected the Global Satellite Mapping of Precipitation (GSMaP) data implemented by JAXA when observed data are missing, so that it can incessantly provide flood forecasts. It can also display inundation information predicted using hydrologic models and images from Sentinel-1 and Sentinel-2 satellites, allowing users to compare and analyze inundation forecasts immediately. In the case of the flood due to Typhoon Noru, which hit Luzon Island on September 25, 2022, and victimized 40 people, the system could continue providing flood forecasts using statistically corrected GSMaP data even when ground-observed rainfall remained inaccessible.

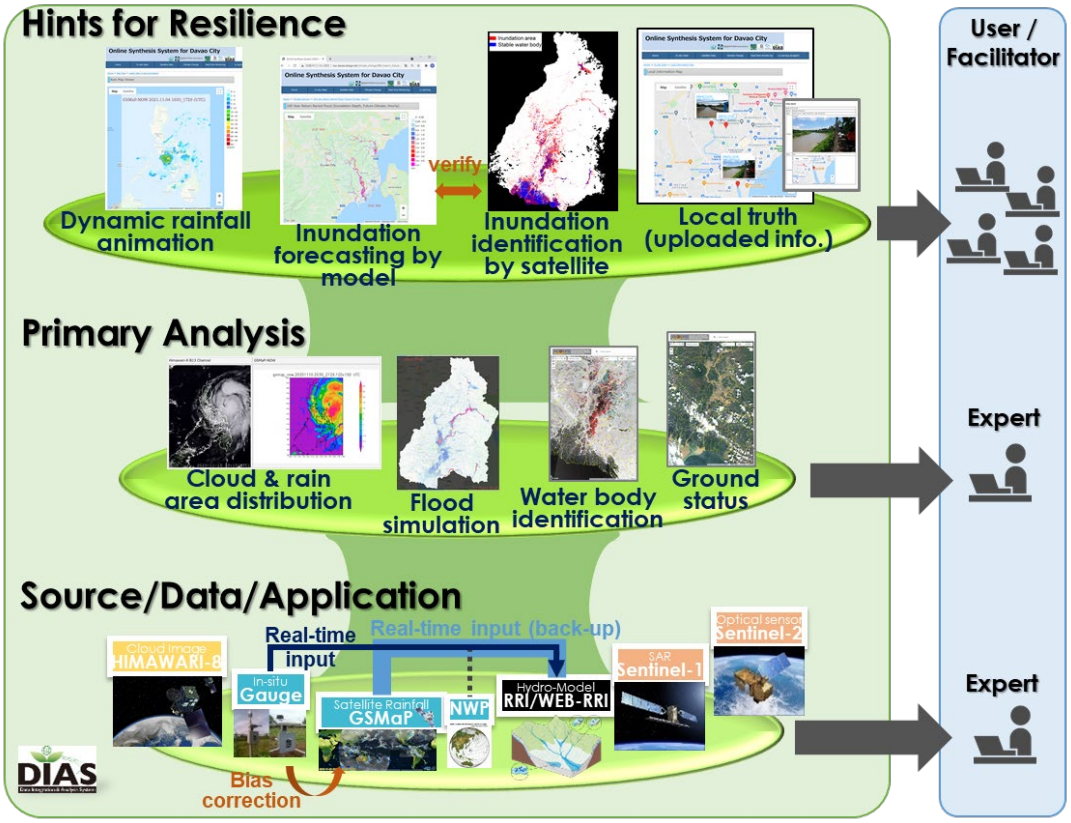

Fig. 3-4 The outline of OSS-SR-based real-time flood monitoring and forecasting

b) Fostering facilitators

ICHARM has also been strengthening collaboration with local stakeholders to further promote the practicality of OSS-SR and spread the information and use of the system through local facilitators as effective global warming adaptation measures. In November 2022, ICHARM held separate meetings in Davao City, the Philippines, with the Davao City Council, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Office of Civil Defence (OCD), and the University of Ateneo to share the latest developments of OSS-SR and to discuss the action plan of local facilitators. We also had meetings in Metro Manila with Dr. Renato

U. Solidum, Jr., the undersecretary of Department of Science and Technology (DOST), Dr. Vicente B. Malano, the director of PAGASA, and staff of DPWH and explained that the development of OSS-SR and the training of facilitators had made good progress with concerted support from various stakeholders in compliance with the framework of the platform of water resilience and disasters in the Philippines. In addition, 11 local facilitators visited Japan from Davao City on the occasion of ICFM9 in February 2023. They learned about flood resilience and benchmarked DIAS for their own OSS-SR development and operation.

Photo 3-1 ICHARM staff (left) reporting to Dr. Renato U. Solidum, Jr., the undersecretary of DOST

This project was conducted as an activity in the MEXT-Program for The Advanced Studies of Climate Change Projection (SENTAN).

3.1.4 Drought monitoring

a) Improvement of soil moisture observation resolution using global observation data

ICHARM developed "Coupled Land and Vegetation Data Assimilation System (CLVDAS)" for West Africa and WEB-RRI for the Volta River basin located in its southern region. We obtained 25-km grid soil moisture by assimilating microwave brightness temperatures using CLVDAS and converted the 25-km data to higher resolution data using the spatial distribution of 2-km grid soil moisture obtained using WEB-RRI.

b) Drought monitoring based on atmospheric analysis

In recent years, Panama has been experiencing severe drought impacts, such as the lowering of the Panama Canal's water level. In order to identify the cause of the drought, we tested drought monitoring based on atmospheric analysis. More specifically, we investigated the north-south vertical cross-sections of vertical wind speed (Figure 3-51A and 2A) and specific humidity (Figure 3-51B and 2B) in the atmosphere using the DIAS vertical cross-section analysis tool. As shown in panels 1A and 2A, focusing on the Northern Hemisphere, where the Panama Canal (81-79◦W) is located, an updraft occurs in the tropical convergence zone, followed by dry air moving down to the surface due to the Hadley circulation. In the case of a wet year (1B), thick moist air covers the ground surface including the Panama Canal, blocking dry air hanging over the area from reaching the ground, which prevents drought from occurring. On the other hand, in the case of a dry year (2B), no moist air covers the ground surface, consequently allowing dry air to descend to the ground and cause drought.

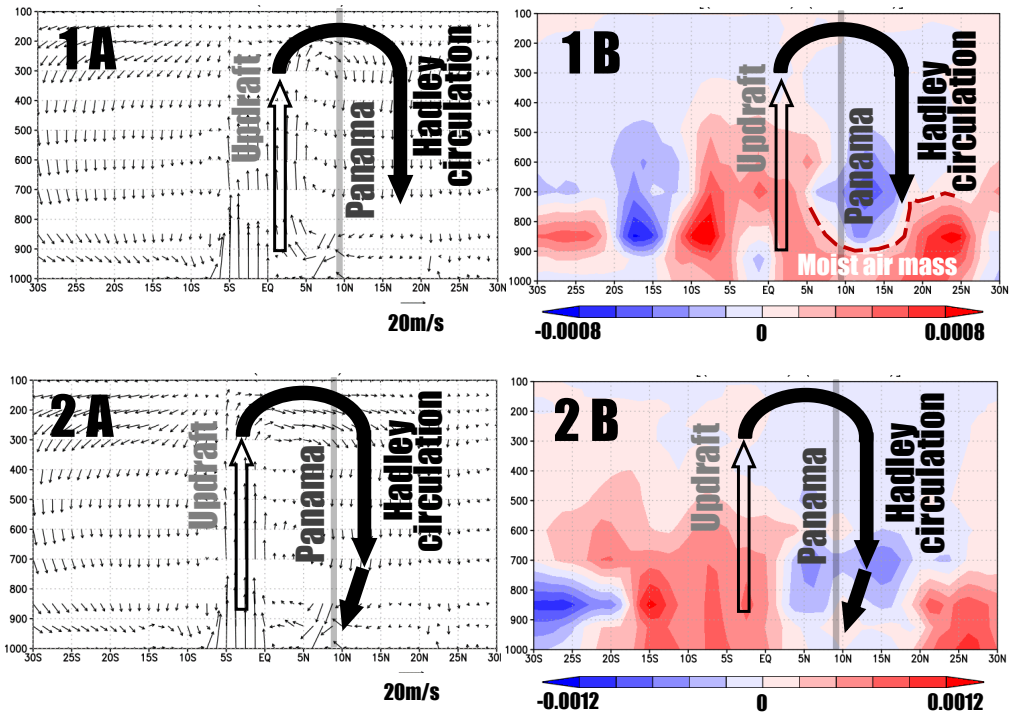

Fig. 3-5 The north-south vertical cross-sections, created using the DIAS vertical cross-section analysis tool, exhibiting the difference in vertical wind speed (A) and specific humidity in the atmosphere between their 20-year average and the wet-year average (1A&B) and the drought year (2A&B)

c) Improvement of capacity for drought monitoring

Pakistan has installed drought monitoring systems based on drought indices and satellite data to address increasingly severe droughts. In order to improve the performance of the systems, ICHARM has been proposing solutions, including directions and strategies for investigations, to increase the country's drought management capacity under the World Bank project "Capacity Building for Drought Monitoring and Planning in Pakistan."

In FY2022, a questionnaire survey about Pakistan's drought monitoring systems was conducted for both drought information providers and recipients (organizations in agriculture, irrigation, and drainage). The results found that the providers tend to evaluate the current drought management framework highly, whereas the recipients do otherwise, revealing a clear gap between the two sides. Based on these findings, ICHARM recommended that Pakistan's drought management agencies should act as facilitators to improve the nation's drought management framework by filling the gap and supporting cross-sectoral cooperation at various levels through the end-to-end approach.

3.2 Risk assessment on water-related disasters

3.2.1 Development of an analysis model for sediment and driftwood laden floods

ICHARM has been developing a technology to simulate sediment and driftwood laden floods using sediment hydraulic models. In FY2022, we worked on the development of a rainfall sediment-runoff

(RSR) model to assess the amount of sediment and driftwood discharged from a basin during a heavy rainfall event. This model combines rainfall-runoff analysis with slope stability analysis, debris tracking using equations for a system of particles, and sediment and driftwood runoff analysis using a unit channel model to analyze water, sediment, and driftwood runoff at any point in a basin. The model was applied to the 2017 Akatani River flood disaster to calculate the discharge of water, sediment, and driftwood. Figure 3-6 shows the calculation results. Using these results, a planar two-dimensional analysis was conducted for the flooded area, and the results are shown in Figure 3-7. The analyses found that the flooded area can be more accurately calculated by considering sediment and driftwood, indicating that these methods are useful for creating hazard maps and evacuation plans.

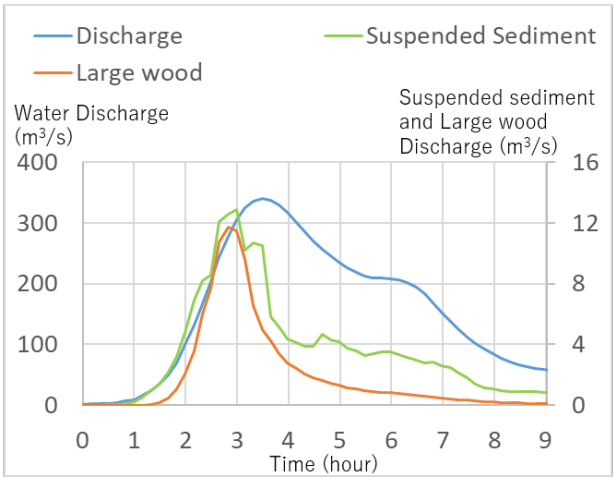

Fig. 3-6 The estimated discharges of water, sediment, and driftwood in the 2017 Akatani River flood

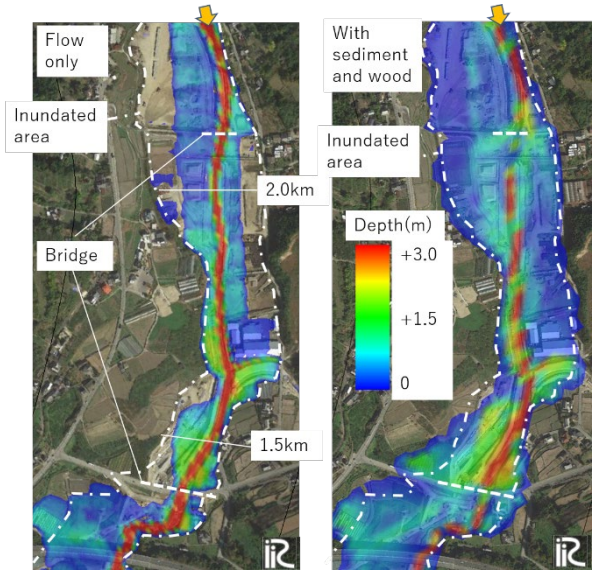

Fig. 3-7 A comparison in the water depth the peak discharge between water only (left) and water with sediment and driftwood (right)
(The white dotted line indicates the flooded area interpreted from aerial photos)

3.2.2 Development and application of hydrology and a crop coupled model

Distributed hydrological models (DHMs) capable of simulating water and energy budgets and rainfall-runoff-inundation processes are essential tools for integrated water resources management, as well as water-related disaster risk reduction under a changing climate.

ICHARM has developed the Water and Energy Budget-based RRI (WEB-RRI) model to improve the accuracy of low flow estimation, flood onset timing, peak flood discharge, and inundation characteristics under various climatic conditions and projection scenarios. The model has been applied to several projects at ICHARM (e.g., flood forecasting and climate change impact assessment in different parts of the world).

To expand the model applicability and simulate vegetation growth and crop yield, the WEB-RRI model was coupled with the dynamic vegetation model and the Simulation Model for Rice-

Weather Relations (SIMRIW). The applicability of the coupled model is under verification in the Philippines and Indonesia for generating useful socio-economic information to support and implement three major global agendas (i.e., Sendai Framework for Disaster Risk Reduction, Paris Agreement on climate change, and Sustainable Development Goals).

3.3 Monitoring and prediction of changes in water-related disaster risk

3.3.1 Improvement of an ensemble rainfall forecasting method

Rainfall prediction models currently in use have not been so successful in predicting linear precipitation systems, which have caused large-scale water-related disasters in recent years. Therefore, ICHARM has been developing to improve a method for reproducing rainfall distribution (creation of initial values) using a weather forecasting model (Weather Research and Forecasting (WRF)) and Local Ensemble Transform Kalman Filter (LETKF) which is one of data assimilation methods.

Specifically, we increased the number of ensemble members, which significantly affects the performance of the ensemble Kalman filter, from 33 to 51. We also introduced a new method for handling the ensemble spread. Conventionally, we increased the ensemble spread by 10% after each set of calculations but changed this procedure by mixing the ensemble spreads before and after a set of calculations at a certain rate to keep the spread value at a certain level. We then experimentally applied the new method to the case of the linear precipitation system over northern Kyushu in July 2022, as shown in Figure 3-8. The current method reproduced the precipitation system over the sea north of Kyushu, while the new approach placed it approximately in the same area as observed by Japan Meteorological Agency (JMA). The new method also improved the time series of precipitation.

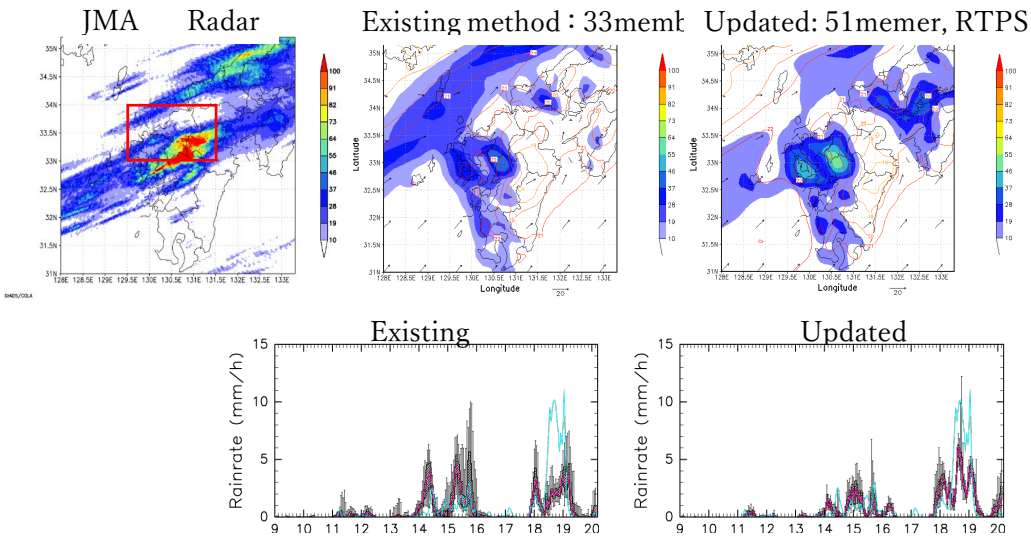

Fig. 3-8 Comparison of reproduction results using existing and new methods

The upper panels show rainfall distribution at the onset of a linear precipitation system on July 19, 2022, observed by JMA (left) and reproduced using the existing method (center) and the new method (right).
The lower panels show temporal changes in rainfall in the red-boxed area indicated in the JMA-observed rainfall distribution map; the blue line is observed rainfall, the black line ensemble analysis results, and the red line ensemble average.

3.4 Proposal, evaluation, and application of policy ideas for water-related risk reduction

3.4.1 Regional resilience enhancement through the establishment of Area-BCM for industry complexes in Thailand

ICHARM is involved in the SATREPS program on "Regional resilience enhancement through establishment of Area-Business Continuity Management (Area-BCM) at industry complexes in Thailand," to assist the country in continuing substantial socio-economic development. To date, we have completed an extreme flood scenario analysis by assuming rainfall events of longer return periods based on two past rainfall patterns: the rainfall that caused the 2011 flood and the historical maximum rainfall. The analysis models of different resolutions were also created using a 1 km resolution for the basin and a 40 m resolution for Rojana, Hi-Tech, and Bang Pa-In industrial complexes. In the scenario analysis, we investigated the onset and retreat of a flood event, inundation depth and duration, the effect and limitation of flood walls, and estimated inundation risks for business sites, residential areas, commuting routes, and other possible subjects. The results revealed that if a rainfall event of the historical maximum scale occurs over the basin every month, the inundation depth at location A, where the maximum depth of flooding occurs, is likely to reach the top of the flood retaining walls (Figure 3-9).

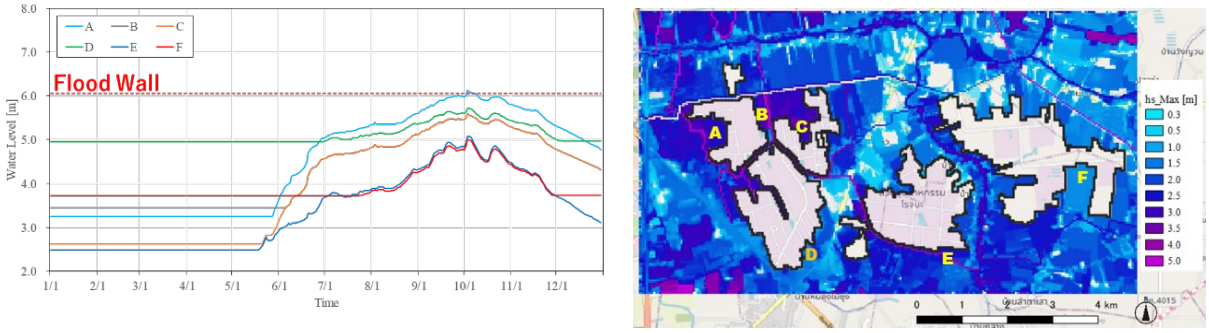

Fig. 3-9 Inundation depths at six locations when a rainfall event of the historical maximum scale occurs over the basin every month

3.5 Support in improving the applicability of water-related disaster management

3.5.1 Real time water level forecasting system for small and medium rivers

(Refer to 2.3)

3.5.2 Develop optimal operation methods for existing dams and other structures that contribute to flood control and support their implementation in target locations

a) Investigation on the optimization of dam operation based on inflow prediction

Simulations were conducted for the Oi Hatanagi 1 Dam for the study period of March 2020-February 2021 by concurrently running both short-term inflow prediction (39 hours, 33 ensembles) and long-term inflow prediction (3 months, 13 ensembles). The simulation results were used to

investigate the optimization of dam operation for better flood control and more power generation.

Short-term prediction was used for flood control. Based on hourly inflow prediction, the top 8 ensemble inflows (equivalent to 25%) were used if the "water level" was higher than the operational water level (Href) at the time of prediction or the top 24 ensemble inflows (equivalent to 75%) if lower. The "Href" is the water level to determine which ensemble predicted inflows to use. After reviewing the annual operation of the dam, this study set the Href at 910 m for January and February and 935 m for March through December.

Long-term prediction was used to investigate more effective dam operations to generate more hydro power. This type of forecasting is effective for planning drought risk management and more power generation due to a long lead time, but not very practical to predict the inflow timing and amount accurately. Therefore, this study used the average inflow, which was acquired by dividing the total inflow from the predicting start time to N days later by the number of days (i.e., N). We also used different numbers of days to calculate the average inflow and calculated the average during the warm season and the cold season separately. The analyses were conducted by selecting ensemble inflows based on the Href at the time of prediction. The highest ensemble inflow (rank 1) was used if the "storage volume" was higher than the Href, or the lowest ensemble inflow (rank 13) if lower.

Since the short-term and long-term prediction ran concurrently, the larger dam water release volume used for either type of prediction (the sum of water used for power generation and the dam water release from the gates) was used as the dam water release volume for the next hour.

Figure 3-10 shows the simulation results. The results of the long-term prediction cases show that case 2 (orange dotted line; N=10 for the warm season and N=30 for the cold season) can achieve a 6.0% increase in power generation compared with the actual power generated during the study period. The results suggest that our approach can offer practical information for more power generation and better flood control by running short-term and long-term forecasting simultaneously. Our next step would be to investigate for other times of the year and other dams.

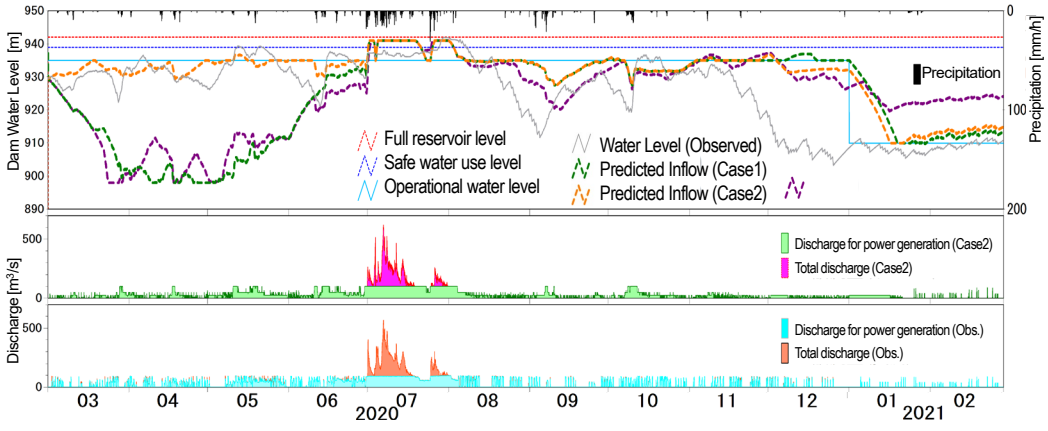

Fig. 3-10 The simulation results of the annual operation of the Oi Hatanagi 1 Dam for the period of March 2020 - February 2021

b) Participation in a World Bank workshop and in Kerala, India

Kerala State is located in the westernmost part of India. Its rivers have similar characteristics to those of Japan, which are mostly short and very steep. The state experienced severe floods in 2018 and 2019, and the state government and the World Bank are currently working together to plan effective flood control measures. Since sharing similar topographical features with Kerala State, Japan is considered suitable for assisting the state in planning flood control measures by providing practical knowledge. For this reason, the World Bank organized a workshop on January 23-25 in Thiruvananthapuram City, Kerala State, India, inviting experts from Japan. It was attended by the officials of the state government, the World Bank, and the Japan Water Agency, as well as a research team from ICHARM led by Executive Director KOIKE. In the workshop, some participants asked many questions about data required for analysis, model reliability, integrated dam operation, and so on. And ICHARM team conducted a field survey at the Moonzhiyar dam for power generation and the Maniyar barrage for irrigation on the Kakkad River, a tributary of the Pamba River, to which Kerala State has recently paid a great deal of attention in the context of flood control.

Photo 3-2 Attendees of workshop

3.5.3 The possibility of VR-driven risk communication as a water-related disaster education tool

In order to reduce evacuation delays and local residents' encounters with danger during water disasters, it is necessary to develop a risk communication method that shares the extraordinary danger of water disasters with the government and local residents and leads them to appropriate evacuation actions. On the other hand, in recent years, virtual reality technology (VR) has been developed to experience a space created virtually by a computer.

ICHARM has been developing the Virtual Flood Experience System (VFES) for this purpose by introducing VR technology, which enables people to have a virtual experience in a space created by computers. VFES is programmed to accurately reproduce hills, rivers, buildings, urban topography, and other features, using 3D survey data, and overlay a flood image that is either reproduced or simulated on top of the previously created geographic image. The system then allows people to experience a virtual flood situation through an avatar, or a “virtual self” created in cyberspace. In this way, VFES enables people to virtually experience flooding that may occur in their residential area before it actually does. The system also allows people to put themselves in other people’s shoes. For example, by setting the avatar to walk as slowly as the elderly, younger people can virtually experience the difficulties the elderly are likely to face during flooding, including evacuation.

Taking advantage of ICFM9, held in February 19, 2023, ICHARM hosted "e-sport@KasenBousai," an esport-like competition to promote VFES by inviting students from local junior high and high schools and a university in Tsukuba City. As part of the preparation for this event, a pre-learning opportunity was provided for students to learn about possible flood situations and safe evacuation. At each school, students were divided into two groups: when one group operated avatars on VFES, the other cheered on the operators while watching the progress on the display (Figure 3-11). Taking turns in the operator position, they tried out a virtual evacuation drill in a simulated flood situation created for a high flood-risk area in Tsukuba City (Photo 3-3). After learning how to operate VFES, the students gathered for the e-sport@ KasenBousai event on February 19, 2023, to learn about flooding while having fun competing with each other. The purpose of the competition is to reach a designated shelter as quickly as possible while gathering disaster-related information and choosing evacuation routes along the way. The teams were also expected to earn as many points as possible that were given to their choices of actions during the evacuation (Photo 3-4).

Because the event incorporated a game-like factor, the students seemed to be more motivated to join a learning opportunity using VFES and thus learned what to do in the event of a flood effectively while having fun. The preparation at each school before the main event also helped increase the students' understanding of the proper actions for safe evacuation. Overall, the e-sport@KasenBousai event successfully demonstrated that VFES can be an excellent tool for educating people about flood disasters.

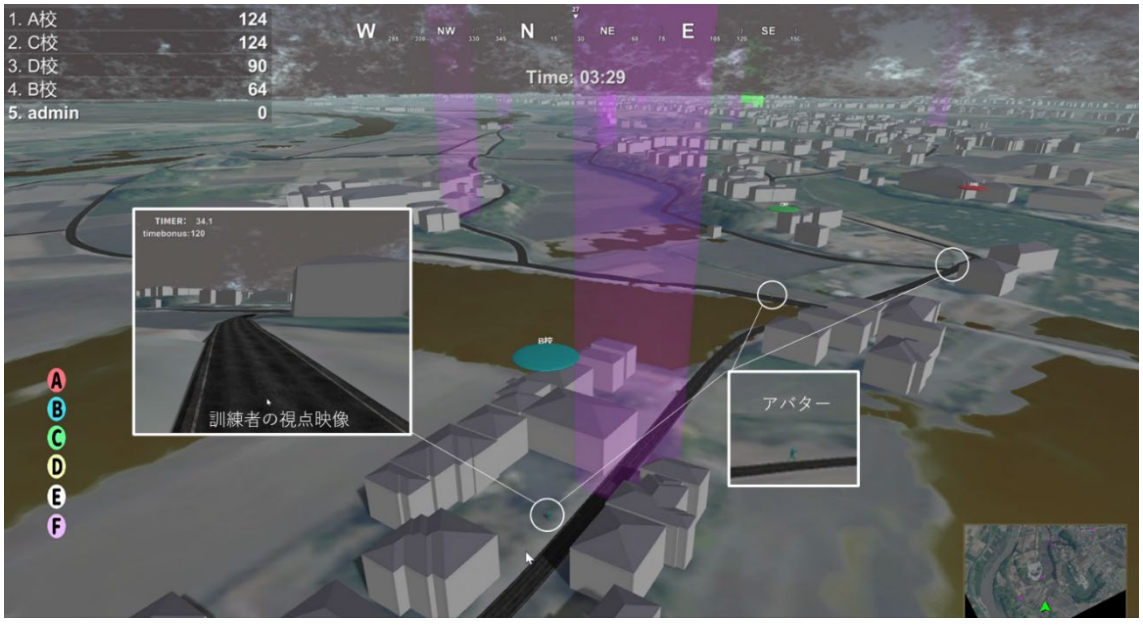

Fig. 3-11 A simulated view of Kamigo District of Tsukuba City in the Kokai River basin. The view displayed on the VFES operator's monitor is shown to participants
(The small green structure in the far background is the designated evacuation shelter, Kamigo Elementary School (the goal of the competition).


Photo 3-3, 3-4 Scenes from a pre-learning session and the e-sport@KasenBousai event

3.5.4 Support for improving the capacities of local governments to respond to floods

ICHARM has posted the “Collection of Critical Situations during Flood Emergency Response” on its website since June 2020, aiming to help improve the emergency response capacities of local governments for more effective management of flood disasters, which frequently occur across Japan in recent years.

Photo 3-5 Lecture for local government officials

Defining critical situations in which local government officers have a hard time making sensible decisions because they panic, don’t know what to do, are confused or in dilemma, etc., during an emergency response effort, we collected typical critical situations from the review reports of past flood disasters and summarized as a booklet. Also provided with the booklet is the “Appendix for local government response under COVID-19,” which lists possible critical situations and necessary countermeasures during flood emergency response under COVID-19.

In FY2022, training seminars and lectures were provided by senior researcher OHARA for local government officials as follows:

- June 1, 2022: "Key Points for Evacuation Information Issuance: When to Release What Information” for municipal heads at an annual nation-wide seminar on disaster prevention and crisis management, Fire and Disaster Management Agency
- July 14, 2022: "Possible Critical Cases You Should Know to Avoid Troubles in Response to Flooding" as a training course for disaster response officials of Sayama City, Saitama Prefecture
- October 18, 2022: "Key Points for Disaster Response Learned from Case Studies" as a training course for disaster response officials of Saijo City, Ehime Prefecture

- December 27, 2022: "Key Points of Disaster Response Learned from Case Studies" as part of the 5th Municipal Disaster Prevention Lecture Series for Municipal Officials, Fire and Disaster Prevention Science Center
- January 19, 2023: "Learning from Case Studies: Response to Water-related Disasters by Municipalities that Prepared for Disasters," National Construction Training Center

3.5.5 Introduction of PaaS into IDRIS for its promotion of widespread use and a trial in collaboration with Tsuruoka City

In FY2022, to promote the widespread use of the ICHARM Disaster Risk Information System (IDRIS), ICHARM strived to reduce its installation and maintenance costs by the Platform as a Service (PaaS) and tested a preliminary IDRIS management system with Tsuruoka City of Yamagata Pref. in collaboration with a local technical college.

Up to FY2021, IDRIS was constructed on the Virtual Machine operating on a cloud system. The Virtual Machine is equipped with a network, storage, operating system, and application layer, as well as data. However, since IDRIS only requires an application layer and data, it can still work sufficiently using the remaining elements from a cloud system. By taking advantage of this design, we modified IDRIS by introducing PaaS for an application layer and data, thereby reducing its operation cost down to a fifth of the initial cost.

PaaS-based IDRIS is more suitable for dissemination than the Virtual Machine type, because installing the latter type of IDRIS requires a wide range of information and communication technology skills in networking, storage, operating system, and applications and thus requires competent staff and a substantial cost. Local municipalities often have trouble finding such experts and appropriating adequate funds. In contrast, PaaS-based IDRIS has significantly simplified the installation process, merely requiring technical skills related to applications. This led us to experimentally duplicate PaaS-based IDRIS on a cloud server and transmit it to a technical college in Tsuruoka City. Our attempt was successful in implementing IDRIS without any major problems, and the technical college is currently working on the customization of the content, suggesting a step forward to the widespread use of the system in local municipalities.

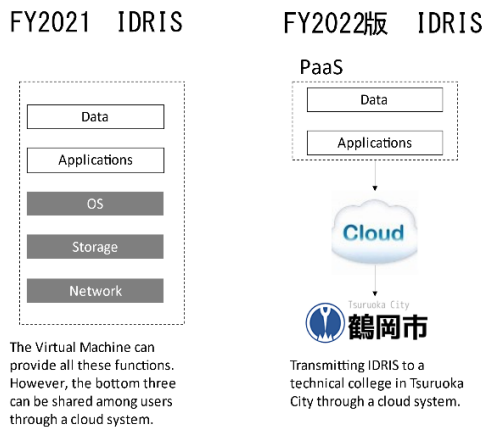

Fig. 3-12 Comparison of two versions of IDRIS

3.6 ICHARM joins MEXT-Program for The Advanced Studies of Climate Change Prediction

ICHARM has participated in MEXT-Program for The Advanced Studies of Climate Change Prediction (SENTAN) from FY2022 and has been conducting research on climate change in collaboration with Kyoto University and other organizations. The program is built on the achievements of the Integrated Research Program for Advancing Climate Models (2017-2021) and the Program for Risk Information on Climate Change (2012-2016). Research projects aim to reduce the uncertainty in future predictions by improving climate-change prediction simulation technologies, to increase the understanding of the climate change mechanism, and to advance the integrated research and development of systems for better quality and more effective use of climate prediction data, thereby creating and providing scientific evidence essential to plan adaptation measures and mitigation measures that help realize a decarbonized society.

ICHARM has been assigned to the task D “Evaluation of hazards and associated risks in the Asia-Pacific regions and the promotion of international cooperation” led by Prof. TACHIKAWA Yasuto, Kyoto University, of the research area No.4 “Development of integrated hazard prediction models.” ICHARM begins to develop a water cycle model in the Philippines and OSS-SR tailored to their local needs and conditions.

In FY2022, ICHARM has started a dynamic downscaling of the database for Policy Decision making for Future climate change (d4PDF) to improve the reliability of flood risk assessment by obtaining data for a sufficiently long period compared to the recurrence period even in dynamic downscaling. In addition, using OSS-SR, ICHARM trained local facilitators, developed a robust and practical flood prediction system using all kinds of data, and disseminated climate change impact assessment results and real-time flood forecast information considering local needs.

3.7 Field Surveys

So many factors are involved in flood hazards. Rainfall and sediment runoff are among them, and ICHARM has been conducting field surveys in the Abira River basin, Hokkaido, Japan, which features a gently sloping volcanic topography, in order to establish a prediction method for rainfall and sediment runoff. On the field, we investigate elementary processes that affect the sediment runoff phenomenon, specifically looking into sediment sources, rainfall runoff, flood and sediment transport observation, channel microtopography, and bed materials. We also work on tasks related to the verification of a sediment runoff model (a mathematical model) built by combining element models.

Our sediment runoff model is designed to evaluate discharge, sediment volume, and sediment particle size distribution during a flood at any point in a river channel of a basin. To test its generality and applicability, we observe flood discharge and suspended load at a cross-section of the Abira River channel. We also investigate the elementary process of sediment transport in the river channel. These field surveys provide valuable data on artificial river channels that cannot be obtained from flume experiments, including river bed fluctuations, classification of suspended load and bed materials, and

the shape and grain size distribution of natural levees formed on a flood plain. Photos 3-6 and 3-7 show a microtopography survey in an artificial channel section of the Abira River.


Photo 3-6 and 3-7 A survey in an artificial channel section of the Abira River (photos taken in October 2022)

3.8 Research Meeting

The Research Meeting has been held roughly once a month since March 2008 for researchers to introduce each research topic in order to upgrade their research skills, learn different perspectives, and practice interaction with other researchers.

In FY 2022, the meeting was held 23 times, and 26 people delivered a presentation in total.

４． Training

ICHARM conducts various education and training programs with the aim of not only improving individual problem-solving skills, but also improving organizational disaster management capabilities. We also continue providing support for students and trainees who return home after completing programs by holding follow-up seminars, through which we also gain feedback to improve our programs.

The following reports the main training activities in FY2022. ANNEX 1 shows the number of trainees by country.

4.1 Master's program: Water-related Risk Management Course of Disaster Management Policy Program (JICA Knowledge Co-Creation Program "Flood Disaster Risk Reduction")

Since 2007, ICHARM has provided a one-year master's program, "Water-related Risk Management Course of Disaster Management Policy Program (JICA Knowledge Co-Creation Program "Flood Disaster Risk Reduction"), as a joint effort with JICA and National Graduate Institute for Policy Studies (GRIPS). This program is targeted at officials of administrative organizations and designed for them to obtain a master's degree within a single year. In the first half of the course, from October to March, the classes consist mostly of lectures; in the second half, from April to the end, students work on research and graduation theses. In addition, several study trips are conducted during the program for students to visit dam, river, and other management offices around Japan, where they can learn firsthand knowledge and experience in current flood management in Japan from experts of MLIT and other organizations.

Between 2007 and March 2023, 170 students from 36 countries graduated from the master's program.

In September 2022, the 15th batch of 13 students from 8 countries (Bangladesh, Bhutan, Indonesia, Malawi, Malaysia, Nepal, the Philippines, and Sri Lanka), who entered the program in October 2021, graduated with a master's degree. In the following month, the 16th batch of 13 students from 6 countries (Bhutan, Pakistan, the Philippines, Sri Lanka, East Timor, and Tunisia) enrolled in the program.

Photo 4-1 Students working on a flume experiment to verify hydraulic theories learned in class

Photo 4-2 Master's and doctoral students posed for photos after the graduation ceremony at GRIPS in September 2022

4.2 Doctoral program: Disaster Management Program

ICHARM started a doctoral program, "Disaster Management Program," in 2010 in collaboration with GRIPS to produce experts who are capable of developing policies on water-related disaster risk management and taking the leadership in implementing them. By March 2023, 15 students from seven countries graduated from this program.

Photo 4-3 Participants in the hybrid entrance ceremony for the 12 batch of doctoral students in October 2022

In September 2022, the 12th batch of four students enrolled in the program. As of March 2023, a total of 9 students are in the program; two in the third year, three in the second year, and four in the first year.

Disaster risk reduction has been one of the most debated water issues worldwide and demands closer collaboration between policymaking and science. In response to this need, JICA has started a new scholarship program for foreign students named "Disaster Risk Reduction Leaders Capacity Development for the Sendai Framework Implementation." ICHARM and GRIPS also cooperate in implementing this program by providing doctoral education to the scholarship recipients. As of March 2023, six out of the nine doctoral students are using this scheme; one in the third year, two in the second year, and three in the first year.

4.3 Follow-up Seminar for ICHARM alumni

ICHARM has held the Follow-up Seminar once a year since 2007 in a country of graduates from ICHARM educational and training programs to provide additional assistance and visit rivers and other places with water-related problems. This annual meeting is a great opportunity for ICHARM to see how graduates are using the knowledge and skills they learned at ICHARM and to share issues they face in their practices. Such information is used to improve ICHARM's training programs and research activities.

Since ICHARM hosted ICFM9 in Tsukuba in February 2023, the Follow-up Seminar for FY2022 was held at ICHARM in February 22, 2023, for the following purposes:

1. Strengthen the network between ICHARM staff and graduates, as well as among graduates themselves;
2. Share the current status and issues related to water-related disaster risk management in each country and discuss solutions;
3. Collect comments and suggestions about ICHARM's educational programs and approaches to improve and plan future activities of ICHARM and PWRI.

Seventeen graduates, who made a presentation in collaboration with researchers of ICHARM at

ICFM9, participated in the seminar with current students. Please refer to section 2.5 for more information.

4.4 Internship

ICHARM has accepted interns from both Japan and overseas since its establishment in 2006. In FY2022, ICHARM accepted eight interns: one from the National Scientific and Technical Research Council of Argentina, one from the Malaysia-Japan International Institute of Technology of Malaysia, two from the University of Nagoya, Japan, two from the University of Tokyo, Japan, one from Fukushima University, Japan, and one from Tokyo Institute of Technology, Japan. From two weeks to several months, they studied their research themes while getting supervision from ICHARM researchers about hydraulic and hydrologic analysis, sediment transport analysis, disaster risk analysis, and other topics. Figure 4-1 shows the number of internship days by institution. Interns stay at ICHARM.

ICHARM has held the Follow-up Seminar once a year since 2007 in a country of graduates from ICHARM educational and training programs to provide additional assistance and visit rivers and other places with water-related problems. This annual meeting is a great opportunity for ICHARM to see how graduates are using the knowledge and skills they learned at ICHARM and to share issues they face in their practices. Such information is used to improve ICHARM's training programs and research activities.

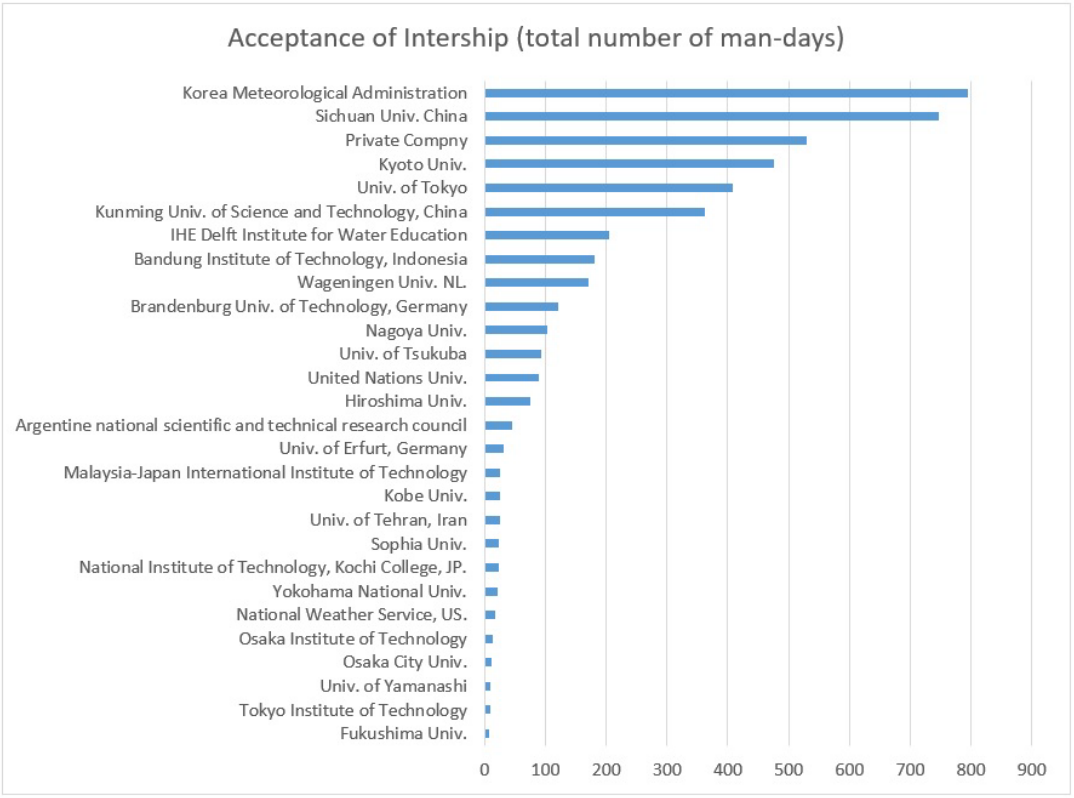

Fig. 4-1 The number of internship days by institution between 2006 and 2022

５． Information Networking

ICHARM has been consistently strengthening its information network on various occasions. In this past year, it hosted major international conferences and side events as part of networking activity, including the 4th Asia-Pacific Water Summit, the 9th International Conference on Flood Management, and the UN Water Conference 2023. Through these events, ICHARM disseminated its advocated concepts of knowledge integration, capacity integration, and process integration to the world, together with the achievements of its research and projects.

In addition, ICHARM continued working closely with the International Flood Initiative (IFI) to build a "Platform on Water Resilience and Disasters" in individual countries, as well as with the Typhoon Committee, particularly by playing a leading role in its Working Group of Hydrology, thereby adequately demonstrating the presence of the institute and Japan to the member countries.

5.1 International conferences

5.1.1 Fourth Asia-Pacific Water Summit

The 4th Asia-Pacific Water Summit (APWS4) was held in Kumamoto City, Japan, on April 23-24, 2022, to gain a holistic understanding of and discuss practical solutions to water-related issues based on strong leadership and effective resource mobilization exerted by the Heads of States and Governments (HSG).

ICHARM played a vital role in planning and operating this international conference. It co-hosted Parallel Thematic Session I “Water and Disaster/Climate Change” with other domestic and overseas organizations and organized a special session named “Showcase.” It also co-hosted an integration session on “Science and Technology” with UNESCO.

The Showcase session invited H.E. Dr. Basuki Hadimuljono, the minister for Public Works and Public Housing, Indonesia, and Dr. Salles, the regional director of the Department of Science and Technology Region XI, the Philippines, to speak about the projects that ICHARM has supported in their countries: the e-learning program for facilitator training in Indonesia and the OSS-SR implemented in the Philippines.

Photo 5-1 Panelists discussing at the integration session


Photo 5-2 Participants in the special session

To prepare the Kumamoto Declaration, ICHARM contributed to developing the three key proposals, i.e., “promoting water cycle consilience,” “fostering facilitators,” and “taking an end-to-end approach,” as answers to the HSG’s question asking what role science and technology should play to support leaders in making cross-sectoral decisions and including them

in the Chair's Summary, which provides the overview of all the discussion results from the summit.

5.1.2 Nineth International Conference on Flood Management (ICFM9)

On February 18-22, 2023, GRIPS and ICHARM co-hosted ICFM9. The conference was convened in Japan for the first time in 12 years since ICHARM hosted the 5th meeting in Tokyo, Japan, in 2011. It is held every three years, providing a forum for researchers and practitioners with different backgrounds to gather and discuss various issues related to floods and share the latest knowledge, information, and experience with fellow experts in order to achieve significant academic and cross-disciplinary changes.

a) Preparation

After proposing hosting ICFM9 at the ICFM webinar in August 2021, ICHARM discussed the goals that we should aim for as the host institution. As a result, we set the two goals. Our first goal was to gather and sort out diverse knowledge and use it to redefine ICHARM's activities, including its direction and role, in water-related disaster management, as necessary. We regarded ICFM9 as an excellent opportunity for this purpose since it would allow us to overview flood-related research, education, and policies from an international perspective and expose us to up-to-date, wide-ranged, scientific knowledge in Japan and overseas through the planning and operation of ICFM9. Our second goal was to strengthen the connection with and among the graduates of our master's and doctoral programs and thus enhance our capacity to organize international cooperation.

Also, as explained in Chapter 2, in order for ICFM9 to be a bridge from APWS4 to the United Nations Water Conference, we deemed it necessary to ensure proper coordination between the core topics of ICFM9, i.e., science, technology, education, and capacity development, and domestic policies in Japan. To address this issue, we consulted with Director General INOUE of the Water Management and Land Conservation Bureau of MLIT and Professor HIROKI of GRIPS, who is also the executive director of HELP, and decided, with their agreement, that they and Executive Director KOIKE would co-chair the ICFM9 Local Organizing Committee (LOC), and also invite experts from industry, government, and academia to join LOC and provide advice on the planning and operation of ICFM9.

The overall theme of ICFM9 was set as "River Basin Disaster Resilience and Sustainability by All - Integrated Flood Management in the Post COVID-19 Era." The main part of the theme, "River Basin Disaster Resilience and Sustainability by All," is the official English translation of the new flood management policy addressed by MLIT of Japan. The new policy was developed to cope with the impacts of climate change, and the related budget plans were passed in April 2021, though some projects had started earlier in FY2020 to meet the urgent need to strengthen flood resilience in some parts of the country.

We expected that ICFM9, planned to be held in Japan, would be a unique opportunity to discuss Japan's new flood control policy internationally from the perspective of science and technology.

However, we also decided that the title, "River Basin Disaster Resilience and Sustainability by All," would not be used to refer to Japan's new policy at ICFM9, but rather to mean "enhancing water disaster resilience and sustainability by all stakeholders in the basin."

ICHARM staff then discussed the composition of the sessions, considering the overall theme and the first goal. Several "theme teams," each consisting of three or four staff members, were formed to propose, plan, and manage the sessions. After organizing the session concepts and plans, we contacted leading international experts in each research area and requested them to serve as session chairs. The representative of each theme team also served as co-chair for each session.

In addition, in order to achieve the second goal, ICHARM held an online seminar on February 25, 2022, with 80 participants, about half of the graduates from ICHARM's graduate-level programs. The Follow-up Seminar was also held on February 22, 2023, and 17 graduates who were in Japan for ICFM9 joined the meeting along with many other participants. (described in section 2.5)

In addition, a subsidy from the Tsukuba Tourism and Convention Association was used for the operating expenses of the site visits. With the support of UNESCO, participation fees and domestic travel expenses were supported for 10 young researchers from developing countries.

b) Conference

On February 18, 2023, a high-level symposium, "Integrated Water Cycle Management in the Post COVID-19 Era," was held at GRIPS, attended by His Majesty the Emperor of Japan.

Photo 5-3 The high-level panel in the symposium (Photo: GRIPS)

The morning session opened with greetings from Dr. Han Seung-soo, the chair of HELP and the former prime minister of the Republic of Korea. The session continued with keynote lectures: H.E. Ambassador Csaba Kőrösi, the president of the 77th Session of the UN General Asse mbly, on game changers that should be adopted at the UN Water Conference; Professor Petteri Taalas, the secretary-general of WMO, on an early warning initiative; and Mr. Pablo Bereciartua, the chair of the Global Water Partnership on resident-participatory water management. ICFM Chair Slobodan P. Simonovic followed, speaking about decision making based on scientific evidence.

In the afternoon session, GRIPS Professor Hiroki moderated a high-level panel entitled "Integrated Flood Management in the Post-Corona Era," with expert panelists in various fields, including Dr. Johannes Cullmann, the director for SDGs of the Office of the 77th President of the UN General Assembly, and Executive Director Koike.

The plenary session, held at the Tsukuba International Conference Center from the 19th to the 21st, was attended by 394 flood experts from 41 countries and regions, including Japan. Under its grand theme, presentations and discussions took place on important issues to be addressed in the

post-corona era, including how to rebuild a flood-resilient society and how to transform the current flood management into comprehensive and multi-layered water-related disaster risk reduction that combines hard and soft measures and takes climate change impacts into account. Despite the lingering effects of the corona crisis, the number of participants was almost double the expected number, and each session and project was successful.

At the opening ceremony, ICFM Chair Simonovic and PWRI President FUJITA made opening remarks on behalf of the organizers. Mr. OKUMURA, the director-general of NILIM, and Mr. IGARASHI, the mayor of Tsukuba City, also greeted the participants. After the greetings, Professor Emeritus of Yamanashi University TAKEUCHI was awarded the ICFM Lifetime Achievement Award by ICFM. Professor KOTANI, the executive vice president for research of Tohoku University and the vice president of the International Science Council, delivered the keynote speech online entitled “The responsibility of science, entrusted to us by society.”

Four plenary sessions included panel discussions on coordinated activities, lectures on integrated flood management and response to changes, and showcases to share best practices from Asia, Africa and Latin America. Ultimately, a total of 24 sessions were held, with nine parallel sessions, and 143 oral presentations were given. There were 48 poster presentations, and after the review, four poster presentations were awarded at the closing ceremony.

ICHARM researchers co-chaired all 24 sessions and delivered presentations on research projects using the end-to-end approach, such as the development of a method for creating a sediment and driftwood hazard map, a real-time water level forecasting system for small and medium-sized rivers, and a virtual flood experience system.

There were also five special sessions on cross-cutting themes and eight technology exhibition booths to showcase private companies' flood-related technologies. As a side event, ICHARM hosted a public symposium entitled "Can You Survive an Unexpected Flood?" with the support of the River Foundation (described later in section 6.7).

At the closing ceremony, Mr. KUSANO, the assistant vice-minister for Disaster Prevention and Risk Communication of MLIT delivered a presentation entitled “Japan’s New DRR Policy – River Basin Disaster Resilience and Sustainability by All –,” followed by the presentation of the Statement of ICFM9. Finally, Professor Paul Kovacs, the executive director of the Institute for Catastrophic Loss Reduction (ICLR), announced that ICLR will host ICFM10 in summer 2026.

The final ICFM9 statement calls for:

- Utilizing the end-to-end approach that links cutting-edge science with on-site cross-disciplinary decision-making and action;
- Promoting the collecting, archiving, and sharing of data and information;
- Improving models of increasingly intense floods and their economic impacts;
- Accelerating knowledge integration
- Enhancing the fostering of facilitators; and
- Conducting flood management based on an understanding of social inequalities and

indigenous peoples' rights.

On the afternoons of the 21st and 22nd, site visits, conducted in cooperation with JAXA and MLIT's river offices, were offered to those who wished to participate.

Details can be found in the report posted on the ICHARM website.

Fig. 5-4 Participants in ICFM9

5.1.3 UN 2023 Water Conference

The UN 2023 Water Conference was held on March 21-24, 2023, at the UN Headquarters in New York, the U.S.A., attended by about 10,000 participants, including those online. It was the first meeting in 46 years held to exclusively discuss global water issues.

As part of the 6th UN Special Thematic Session on Water and Disasters, held on the 21st prior to the plenary session, the Science and Technology panel was held, where Executive Director KOIKE Toshio served as moderator and ICHARM introduced its international projects in terms of knowledge integration, capacity integration, and process integration. These three concepts were also mentioned in the Co-Chair's Key Messages that were adopted after "Interactive Dialogue 3: Water for Climate, Resilience and Environment: Source to Sea, Biodiversity, Climate, Resilience and DRR," which Japan co-chaired with Egypt on the 23rd. The concepts advocated by ICHARM were also included in the "Water Action Agenda," the primary outcome of the plenary session, as "Water Cycle Integrator" among the commitments proposed by numerous organizations.

Photo 5-5 Speakers of the Science and Technology panel of the 6th UN Special Thematic Session on Water and Disasters

5.2 International Flood Initiative (IFI)

IFI, implemented in collaboration with UNESCO and other UN agencies, has been working with government agencies and relevant organizations in the Philippines, Sri Lanka, Indonesia, and other countries to establish "platforms on water resilience and disasters." ICHARM has been supporting these projects as the secretariat of IFI.

Photo 5-6 Dr. Anthony C. Sales speaks about the Platform on Water Resilience and Disasters at Davao City, the Philippines at a parallel session of ICFM9

In FY2022, in addition to presentations at international conferences about the projects in different countries, as described in section 5.1, ICHARM had meetings with principal members of relevant organizations, such as Dr. Renato U. Solidum, Jr., the undersecretary of DOST, and Dr. Vicente B. Malano, the director of PAGASA, to report and discuss the progress in the development of OSS-SR, which is a primary outcome of the platform project, and the results of the facilitator training workshops. ICHARM also hosted an online session of Asian Water Cycle Initiative (AWCI) as a pre-event meeting before the 15th Asia-Oceania Group on Earth Observations (AOGEO), which was scheduled for September 21, 2022, and shared information and exchanged opinions about the platform projects with the participating countries' stakeholders and the Asian Development Bank (ADB), and the World Water Partnership.

5.3 UNESCAP/WMO Typhoon Committee (TC)

TC is an intergovernmental community jointly organized in 1968 by the Economic and Social Commission for Asia and the Pacific (ESCAP) and WMO to promote and coordinate the development and implementation of plans to minimize human and physical damage caused by typhoons in the Asia-Pacific region. Senior Researcher MIYAMOTO of ICHARM currently chairs the Working Group of Hydrology (WGH), leading its activities with support from MLIT.

On October 18, 2022, the 11th annual WGH meeting was held in Tokyo, Japan, in a hybrid format. The members reported on the typhoon events and damage in 2022, and each leader of the seven Annual Operating Plans (AOPs) presented the results and progress of their efforts. They also discussed the future operation structure of WGH and proposed that Japan continue to chair WGH and that WGH maintain a chair and vice-chair for its management.

The 55th TC Annual Session was held online on March 7-9, 2023. About 90 participants attended the meeting from 13 nations and territories (China, Democratic People's Republic of Korea, Hong Kong, Macau, Japan, Lao PDR, Malaysia, the Philippines, Republic of Korea, Singapore, Thailand, Vietnam, and the United States), UNESCAP, WMO, and the TC Secretariat. From the government of Japan, representatives of MLIT and JMA participated. From ICHARM, two researchers participated: Senior

Researcher Miyamoto, the current chair of WGH, and Researcher KAKINUMA. Miyamoto reviewed the AOPs of WGH for 2022 and proposed new AOPs for 2023. The meeting also agreed that he would continue to serve as chair and vice-chair of WGH for the next term from 2023 to 2025 (the chair is supposed to assume the vice-chair position).


Photo 5-7, 5-8 Participants in the 11th WGH annual meeting (left: in person, right: online)

5.4 International contribution in hydrology

5.4.1 UNESCO Intergovernmental Hydrological Programme (IHP)

UNESCO-IHP, established in 1975, is UN's only intergovernmental program dedicated to water-related issues, including science, management, education and capacity building.

IHP sets a mid-term plan every eight years and is currently in the midst of its ninth plan (UNESCO-IHP-IX: 2022-2029). Under the theme of "Science for a Water Secure World in a Changing Environment," the plan aims to help member countries complete the goals set to achieve by 2030, including the 2030 Agenda, SDGs, especially its water-related ones, and water-related global goals, such as the Paris Agreement and the Sendai Framework for Disaster Risk Reduction. IHP has addressed the following five key water priority areas:

1. Scientific Research and innovation
2. Water education in the Fourth Industrial Revolution including Sustainability
3. Bridging the data-knowledge gap
4. Integrated water management under conditions of global change
5. Water governance based on science for mitigation, adaptation, and resilience

UNESCO-IHP-IX has three cross-cutting working themes, and the ICHARM executive director chairs one of them: "Hydrological systems, rivers, climate risk and water-food-energy nexus."

5.4.2 Relationship with WMO

The 1st face-to-face meeting of the WMO Regional Association II (RAII) Hydrological Coordination Panel (HCP) was held in Vientiane, Lao PDR, from October 31 to November 1, 2022. Senior Researcher MIYAMOTO participated from ICHARM. At the meeting, experts in hydrology and water resources from WMO RAII discussed work plans and milestones for activities related to hydrology and made a consensus on the implementation plans. Miyamoto confirmed that he would lead two themes: the enhancement of flood resilience through a platform on water resilience and disasters and the expansion of the helpdesk for integrated flood management to include IWRM. In addition, the HydroSOS (Global Hydrological Status and Outlook System) implementation workshop was held and discussed plans to implement HydroSOS in four sub-regions in Asia (Central Asia, East Asia, South/Southeast Asia, and West Asia), which is WMO's system for monitoring and predicting global hydrological status. The workshop also proposed that Miyamoto would take the lead in the implementation project in East Asia.

Photo 5-9 The 1st face-to-face meeting of the WMO Regional Association II Hydrological Coordination Panel

5.5 Other international networking activities

5.5.1 Stockholm World Water Week (SWWW) 2022

SWWW 2022 took place from August 23 to September 2, 2022, with more than 300 sessions and over 5,400 participants from 160 countries. ICHARM actively contributed to the event by co-hosting sessions with partner organizations and giving presentations on its activities. On August 24, Executive Director KOIKE participated as a panelist in a session, "Water Security Data: going beyond collection to making impact," which Asia-Pacific Water Forum (APWF) and ADB co-hosted with some other organizations. On the 25th, ICHARM co-organized a session, "End-to-end Approach for Valuing Water on Climate Actions," with its partners, including APWF and the Global Water Partnership (GWP). Director for Special Research MORI made a presentation. On the same day, Deputy Director MATSUKI attended a session, "NBS for Climate Action with Sound Watershed Management," organized by the Northern Water Network (NoWNET), and spoke about Japan's traditional river engineering.

5.5.2 Asian Water Cycle Initiative (AWCI) Session of the 15th Asia-Oceania Group on Earth Observations (AOGEO) Symposium

The AWCI Session was convened online on September 21, 2022, as a sectional meeting of the 15th AOGEO Symposium. More than 50 people participated from the Philippines, Sri Lanka, and Indonesia, UNESCO-IHP, GRIPS, JAXA, Global Water Partnership (GWP), ADB, and ADB Institute (ADBI).

Photo 5-10 Participants in an AWCI session

The participants shared the latest progress of the IFI platform project and discussed the direction of AWCI activities towards the UN Water Conference 2023 in the context of the Kumamoto Initiative for Water and other important statements, which were adopted at APWS4, held in April 2022 in Kumamoto City, Japan. Thematic presentations were also delivered, showcasing cutting-edge research and development in science, governance, and finance. The results of the session were presented at the 15th AOGEO Symposium from September 28 to 30.

5.6 Other domestic networking activities

5.6.1 The Integrated Research on Disaster Risk (IRDR) Subcommittee of the Civil Engineering and Architecture Committee of the Science Council of Japan

The IRDR subcommittee aims to strengthen interaction with stakeholders and practitioners and aid, academic, and other organizations both in Japan and overseas, including the United Nations; encourage open and profound discussions on IRDR plans for the next term; and lead the initial-phase activities set in the next-term plans of IRDR. Executive Director KOIKE Toshio is a member of the Civil Engineering and Architecture Committee and the IRDR subcommittee. In addition, a group for the promotion of IRDR activities has been created under the subcommittee, of which a chief researcher of ICHARM serves as a member.

5.6.2 Japan Hub of Disaster Resilience Partners (JHoP)

JHoP was established in March 2019 with support from the IRDR Japan National Committee and the Subcommittee for IRDR of SCJ, with NIED serving as its secretariat. Currently, 17 organizations, including ICHARM, participate in this project.

JHoP, according to its terms and conditions, aims to form a network of various organizations that cooperate to build science-based, disaster-resilient societies in Japan and overseas. To achieve this goal, JHoP promotes interdisciplinary and trans-disciplinary collaboration by inviting universities, research institutes, and administrative organizations involved in disaster management efforts from various disciplines of physics, engineering, agriculture, social science, psychology, health science,

and medicine and encouraging them to actively demonstrate their research, educational, and practical expertise. JHoP also seeks to develop OSS-SR and foster facilitators as tools that can be effectively applied to DRR, CCA, and SDGs, as proposed in the 2020 recommendation of SCJ regarding the realization of a sustainable international community by strengthening disaster resilience.

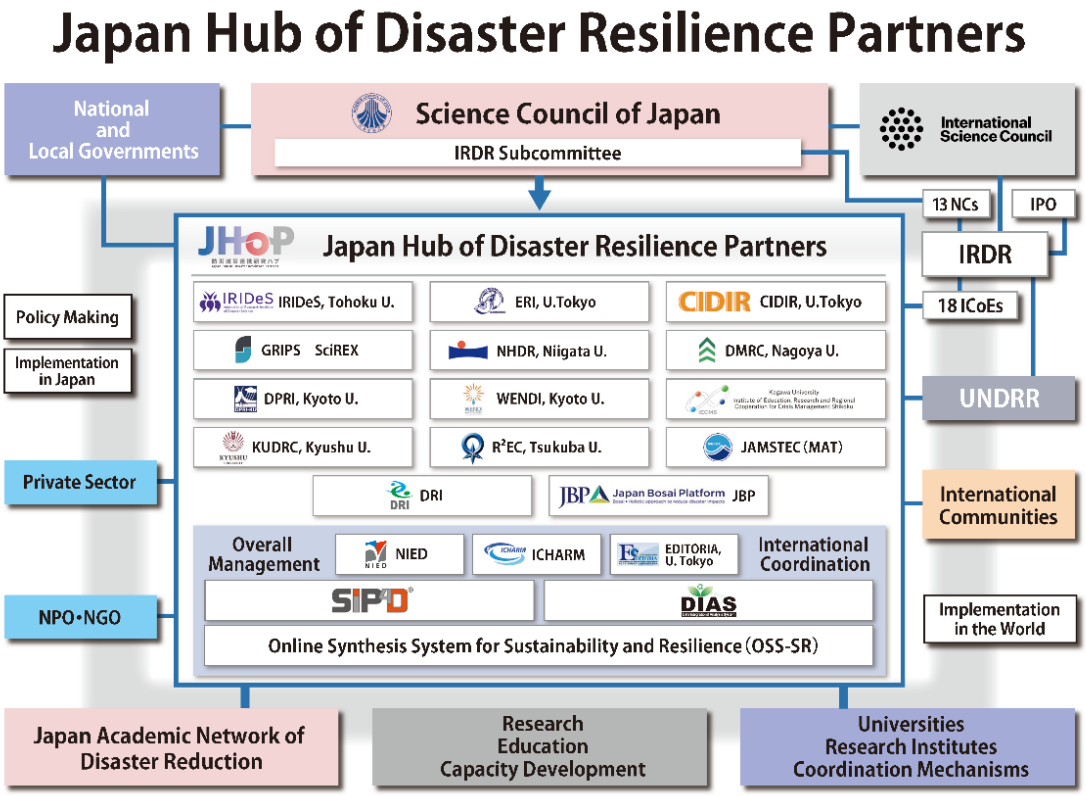

Fig. 5-1 A conceptual image of a network for promoting research and capacity development with JHoP at the core of the industry-government-academia-private collaboration (source: https://www.bosai.go.jp/jhop/en/)

5.7 Memorandum of Understanding

As part of its international networking activities, ICHARM signed a Memorandum of Understanding (MoU) with the Mayor de San Simón University (UMSS) of Bolivia on June 23, 2022, aiming to enhance cooperation in research and development on resilience to natural disasters.

Photo 5-11 Participants in the online signing ceremony

5.8 Visitors

ICHARM continued to receive many visitors in FY2022.

Among the visitors were Mr. Kwacha Chisiza, the ambassador of the Embassy of the Republic of Malawi in Japan, on June 17, 2022, and H.E. Mr. Csaba Kőrösi, the president of the United Nations General Assembly, on February 16, 2023. They had a meeting with the executive director and other ICHARM staff. In particular, the ambassador also met with a Malawian student presently enrolled in the master's program. ANNEX 2 shows the list of visitors to ICHARM.

Photo 5-12 Ambassador Chisiza (left), shaking hands with a Malawian student

Photo 5-13 Mr. Kőrösi, the president of the UN General Assembly

6． Public Relations

6.1 Newsletter

ICHARM Newsletter has been published four times a year since March 2006 to publicize ICHARM's activities in research, education and training, and local practice projects, as well as a list of published papers. In recent years, in addition to articles written by ICHARM staff, the newsletter includes ones contributed by master's program graduates and other experts at international organizations, such as the United Nations, in an attempt to gather news from diverse perspectives.

In FY2022, we published four issues of newsletter from No. 64 to No. 67. The number of readers has reached about 5,000 worldwide. ANNEX 3 lists the articles published in the four issues.

For easy access to the more than 1,000 articles that have appeared in our newsletter since 2006, we have created and posted a list of all the articles and added a search function to our website.


Newsletter
Volume 17 No. 1
Issue No. 64
April 2022
ICHARM
Message from Executive Director
Quality-oriented Society

Fig. 6-1 ICHARM Newsletter No. 64

6.2 Website

We use the website to provide the public with the latest information on research and project progress, as well as notices of upcoming events.

ANNEX 4 provides a list of major updates for FY2022.

6.3 Brochure

The ICHARM brochure has been updated to reflect the content of the ICHARM Programme, which was adopted by the 6th ICHARM Governing Board Meeting on June 21, 2022. In addition to the executive director's comments, the new brochure exhibits how the ICHARM Programme relates to the global and national plans. It is also visually organized to help readers understand how ICHARM practices the end-to-end approach in its research projects.

6.4 Open Day

The ICHARM Open Day is held every year during the Science and Technology Week in April as one of ICHARM's community contribution activities, inviting students from local schools and providing them with international exchange opportunities. The Open Day 2022 was held as a webinar, just like the last year's, to prevent the spread of the COVID-19 infection. A total of 91 students joined this online event from Ibaraki Prefectural Takezono High School and Ibaraki Prefectural Namiki Secondary School.

The executive director made a keynote lecture titled "Water-related Disasters Intensified by Climate

Change and Sustainable Development Goals (SDGs)," and 16 master's and doctoral students spoke about life, culture, and some issues regarding water-related disasters in their nations.

Photo 6-1 Participants in the ICHARM Open Day

6.5 R&D Seminar

The ICHARM R&D Seminar is held on an irregular basis to provide an opportunity for researchers to keep up with the latest knowledge and information by inviting domestic and international experts in the field of hydrology and water-related disasters. In FY2022, two seminars were held, as shown in the table below, attended by many participants, including those from PWRI and NILIM.

Table 6-1 ICHARM R&D Seminar held in FY2022

No.	Date	Speaker	Affiliation (at the time of seminar)	Title
68	Apr. 26, 2022	Dr. Anthony C. Sales	Regional Director, DOST, Regional Office No. XI, Philippines	Advanced Activities for Flood Resilience in Davao City, Philippines
69	Oct. 11, 2022	Prof. András Szöllősi-Nagy	National University of Public Service, Budapest, Hungary	The Global Changes and their Impacts on the Hydrological Cycle

Photo 6-2 Dr. Anthony C. Sales at the 68th ICHARM R&D Seminar

Photo 6-3 Prof. András Szöllősi-Nagy at the 69th ICHARM R&D Seminar

6.6 Flood Workshops for junior high and high school students

ICHARM conducted first workshops about floods at six junior high and high schools in the Tsukuba area in January and February in cooperation with the Shimodate River Office of the Kanto Regional Development Bureau of MLIT. Using the virtual flood experience system developed by ICHARM in recent years, students first experienced information gathering and evacuation during a flood event. They then listened to MLIT staff explain “My Timeline” and tried out the “My Timeline” tool designed specifically for children to plan what to do when notified of a possible flood.

Photo 6-4 A flood workshop at a local school using a virtual flood experience system

6.7 Public symposium

On February 19, 2023, coinciding with ICFM9, a public symposium, “Can you survive unexpected floods?: e-sports@KasenBosai,” was held at ICHARM, attended by about 70 people, including students from five local schools, who had received a flood workshop in advance, and from Tsukuba University. After Professor OKI Taikan of the Graduate School of Engineering of the University of Tokyo, who is also the special advisor to the university president, delivered a keynote lecture titled “Climate Change and Floods,” the students competed with each other by demonstrating their knowledge and skills in a game-like event using a virtual flood experience system.

Photo 6-5 A scene from the “e-sports@KasenBosai” event

This symposium is subsidized by the River Foundation of Japan.

6.8 Visit by high school students

On November 1-2, 2022, 38 first-year students of the Disaster Science Department of Miyagi Prefecture Tagajo High School and their teachers visited ICHARM. The prefecture was severely affected by the Great East Japan Earthquake and subsequent tsunamis. They listened to presentations by researchers on their research projects, such as the development of a water level forecasting system for small and medium-sized rivers and a method for predicting future hazards under climate change. They also listened to presentations on other ICHARM’s activities, such as efforts to expand a network worldwide and provide technical assistance in the Philippines.

Photo 6-6 Students listening to a lecture about international networking

6.9 Publication

ANNEX 5 shows the list of research papers, articles published by ICHARM staff.

7. Awards

7.1 Awards

The following table is a list of the awards received by ICHARM staffers for their high quality research, presentations and academic papers in FY2022.

Photo 7-1 Executive Director Koike (center, right), receiving the AGU Ambassador Award

On December 14, Executive Director Koike received the American Geophysical Union (AGU) Ambassador Award at the Honors Ceremony of the AGU Fall Meeting 2022. In addition to his scientific activities, the award recognized his dedication to educating the new generation of scientists in many developing countries, such as Bangladesh and the Philippines.

Table 7-1 The list of awards in FY2022

Recipient, position	Award	Achievement, paper, etc.	Awarding organization	Date
KOIKE Toshio, executive director	Fellow	Outstanding achievements, experience, and insight in engineering and industry	Japan Federation of Engineering Societies	2022/6
HARADA Daisuke, research specialist	Best Presentation Award, Symposium on River Engineering, JSCE, 2022	METHODS TO ANALYZE FLOOD FLOW WITH A HUGE AMOUNT OF SEDIMENT AND DRIFTWOOD	River Group, Japan Society of Civil Engineering (JSCE)	2022/6/16
KAKINUMA Daiki, researcher	Best Paper Award, Symposium on River Engineering, JSCE, 2022	DEVELOPMENT OF REAL-TIME FLOOD FORECASTING SYSTEM FOR THE SMALL AND MEDIUM RIVERS	River Group, Japan Society of Civil Engineering (JSCE)	2022/6/16
PWRI, The University of Tokyo	the Excellence Award of the Good Digital Award 2022	Development of a system to conduct data assimilation method using observed water levels and provide predicted water levels using forecast rainfall data for small and medium-sized rivers	Digital Agency	2022/12
KOIKE Toshio, executive director	AGU Ambassador Award	Lifetime commitment to scientific developments and outstanding contributions to social impact, service to the Earth and space community, scientific leadership, and promotion of talent/career pool	AGU	2022/12/14

7.2 ICHARM Best Paper Award

ICHARM established the ICHARM Best Paper Award in 2009 to select and honor the best paper of the year among peer-reviewed papers whose first author is an ICHARM staffer.

In FY2022, the following paper was selected for the award, and the ceremony was held on February 20, 2023, together with the co-author who was in Japan to attend ICFM9.

Title: Co-design for enhancing flood resilience in Davao City, Philippines Authors: M. Miyamoto, D. Kakinuma, T. Ushiyama, A. W. M. Rasmy, M. Yasukawa, D. G. Bacatos, A. C. Sales, T. Koike and M. Kitsuregawa Journal: Water 2022, 14, 978

Photo 7-2 Ceremony of the ICHARM Best Paper Award

8. Management

8.1 ICHARM Governing Board

ICHARM holds a Governing Board meeting once a year in accordance with Article 6 of the Agreement between UNESCO and the Government of Japan on the Continuation of ICHARM, revised and signed on February 13, 2020.

Photo 8-1 (top) Meeting in session
Photo 8-2 Participants in the board meeting

The 6th Governing Board meeting was held on Tuesday, June 21, 2022, from 16:00 to 18:00 at the TKP Ichigaya Conference Center in a hybrid format, attended by a total of eight members from Japan and abroad, including PWRI President Koichi Fujita, who chaired the meeting, as shown in Table 8-1.

The board members discussed and unanimously adopted the ICHARM Programme, which had been revised in line with the PWRI Mid- and Long-Term Plans, whose implementation began in FY2022, and the Work Plan, which is the action plan for the next two years.

The board members also expressed their expectations for ICHARM's contribution to the mid-term review of the International Decade for Water Action and the Sendai Framework for Disaster Risk Reduction, scheduled for 2023, as well as to the implementation of the Kumamoto Declaration and the further promotion of research, capacity building, and international networking.

Table 8-1 The list of participants in the 6th ICHARM Governing Board Meeting
(The names are listed in affiliation's alphabetical order)

Board member	Position & affiliation
Nobuhiro HOSOE	Vice President, GRIPS
Eiji IWASAKI	Director General of Global Environment Department, JICA, on behalf of Mr. Akihiko TANAKA, President, JICA
Mikio YOSHIOKA	Vice Minister for Engineering Affairs, MLIT
Koichi FUJITA	President, PWRI
Yuki MATSUOKA	Head of the UNDRR Office in Japan, on behalf of Ms. Paola ALBRITO, Chief of Branch, Intergovernmental Processes, Interagency Cooperation and Partnerships, UNDRR
Anil MISHRA	Chief of Section, Hydrological Systems, Climate Change and Adaptation (HSA), IHP Secretariat, UNESCO, on behalf of Ms. Audrey AZOULAY, Director-General, UNESCO
Kaoru TAKARA	Professor, Kyoto University, on behalf of Mr. Yasuto TACHIKAWA, Chair Holder, Research and Educational Unit of UNESCO Chair on Water, Energy and Disaster Management (WENDI)
Johannes CULLMANN	Director, Water and Cryosphere, on behalf of Ms. Elena MANAENKOVA, Deputy Secretary-General, WMO

8.2 Organization

The number of ICHARM staff was 47 as of April 2022, and 48 as of March 2023 shown in Table 8-2. Since ICHARM is a research center of PWRI, which is under the management of MLIT, many of its staff are seconded from MLIT. In addition, as an international center, ICHARM employs foreign researchers mainly as research specialists. As of April 2022, there were seven of them at ICHARM.

The main responsibilities of each position are described below, with reference to PWRI's organizational regulations, circulars, and administrative instructions:

The executive director of ICHARM is in charge of the overall management of ICHARM.

The deputy director of ICHARM assists the executive director in fulfilling its responsibilities. In addition, the deputy director, since also assuming the director of Water Hazard and Risk Management Research Group, oversees the research and other activities of the group. The Water Hazard and Risk Management Research Group is defined to conduct investigation, testing, research, training, and development and guidance of civil engineering technologies related to the following matters:

1. International dissemination of technologies for the prevention and mitigation of water-related disasters
2. Risks posed by water-related disasters
3. Management of water-related disaster risks

The director for special research manages affairs related to particularly important research that do not belong to the scope of the group.

The research and training advisor provides necessary guidance to researchers and trainees.

The deputy general counsellor and the chief staff manage the administrative work of ICHARM.

Chief researchers, under the direction of the deputy director, conduct the work that belongs to the scope of the group, including investigation, testing, research, and the development and guidance of civil engineering technologies.

Senior researchers and researchers conduct their respective duties under the direction of chief researchers.

Research specialists support research work requiring a high level of expertise under the guidance and supervision of the deputy director or chief searchers.

Collaborating researchers are those accepted by PWRI from private companies (consultants, contractors, manufacturers), public corporations, local governments, and other entities. Their compensation and expenses, such as travel expenses, are generally covered by their organizations.

Research assistants are employed from students enrolled in the "Doctoral Program in Disaster Prevention", a joint program of PWRI and GRIPS, and work under the guidance and supervision of the deputy director or chief researchers to support research and training projects that require a high level of expertise and advanced English language skills necessary to carry out the projects.

Assistants provide support to researchers and administrative staff in the performance of their duties.

Table 8-2 The list of ICHARM staff

Position	No. of staff (as of Apr. 2022)	No. of foreign/female staff	No. of staff (as of March 2023)	No. of foreign/female staff
Executive Director of ICHARM	1		1	
Deputy Director of ICHARM (Director of Water Hazard and Risk Management Research Group)	1		1	
Director for Special Research	1		1	
Research and Training Advisor	1		1	
Deputy Head (administrative staff)	2		2	
Chief Staff (administrative staff)	2	Female:1	2	Female:1
Chief Researcher	3 (4 since July)		4	
Senior Researcher	9 (8 since May)	Foreign: 1, Female: 1	8	Foreign: 1, Female: 1
Researcher	2		2	
Research Specialist	10	Foreign: 4, Female: 3	10	Foreign: 4, Female: 3
Collaborating Researcher	1		1	
Research Assistant	2 (3 since Oct.)	Foreign: 2 (3 since Oct.)	3	Foreign: 3
Assistant	12	Female: 10	12	Female:10
Total	47	Foreign: 7, Female: 15	48	Foreign: 8, Female: 15

*Foreign female employees are duplicated in both “Foreign” and “Female.”

ANNEX 1

Number of Alumni of ICHARM training program

Ph.D. Program "Disaster Management" (as of September 2022)

Year \ Country	Afghanistan	Bangladesh	Bhutan	Bosnia-Herzegovina	Brazil	Cambodia	China	Colombia	El Salvador	Ethiopia	Djibouti	Fiji	Guatemala	India	Indonesia	Japan	Kenya	Laos	Malaysia	Malawi	Maldives	Mauritius	Mozambique	Myanmar	Nepal	Netherland	Nigeria	Pakistan	Papua New Guinea	Philippines	Republic of Albania	Serbia	Sri Lanka	Tajikistan	Tanzania	Thailand	Timor-Leste	Tonga	Tunisia	Venezuela	Vietnam	Zimbabwe	Liberia	Total
2010-2013																1																												1
2011-2014																										1																		1
2012-2015		1											1																															2
2013-2016		2											1																															3
2014-2017																																												0
2015-2018		1																										1																2
2016-2019		1																										1																2
2017-2020		1																																										1
2018-2021																1																1										1			3
Total	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**		**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**		**0**	**0**	**1**	**0**	**0**	**15**

Master's. Program "Water-related Disaster Management Course of Disaster Management Policy Program" (as of September 2022)

2007-2008		2					3							1		3									1																		10
2008-2009		2					2			1					1										1																		7
2009-2010		2					1			1					3	1								1					1			1			1							12
2010-2011		2					2	1					1		1									1	3			1															12
2011-2012		2					2					1			2										2			6		1			1					1		1			19
2012-2013		2						1											2					1	1		1				1	1	1						1				12
2013-2014		2					1		1							1								1				1		2			2						1				12
2014-2015		1						1				1		2			3							1				2					2										13
2015-2016		2			1																1			1	1			2		1			2				1				1		13
2016-2017					1															1			1	1					1								1				2			8
2017-2018		2			1							1		1											2			2		1			2		1						1			14
2018-2019		1												1											1			1		1			1										1	7
2019-2020		2	2		2																			2	2			1															11
2020-2021		1	2																1			1		1														1						7
2021-2022		2	1												1				2	1					1				2			3											13
Total	**0**	**25**	**5**	**0**	**5**	**0**	**11**	**3**	**1**	**2**	**0**	**3**	**1**	**5**	**8**	**4**	**4**	**0**	**5**	**2**	**1**	**1**	**1**	**10**	**15**	**0**	**1**	**16**	**1**	**9**	**1**	**1**	**15**	**0**	**1**	**1**	**2**	**1**	**1**	**2**	**4**	**1**	**1**	**170**

Number of countries with DM & DMP graduates

0 31 5 0 5 0 11 3 1 2 0 3 3 5 8 6 4 0 5 2 1 1 1 10 15 1 1 18 1 9 1 1 16 0 1 1 2 1 1 2 5 1 1 37

JICA training program "Flood Hazard Mapping"

2004						2	2								2			3	2										2					2						1			16
2005						2	2								2			2	2										3					1						2			16
2006						2	2								2			2	2										2					2						2			16
2007						2	2								3			2	3										2			1		3						2			20
2008						1	2											2	2										1					1						1			10
Total						**9**	**10**								**9**			**11**	**11**										**10**			**1**		**9**						**8**			**78**

JICA training program "Local Emergency Operation Plan with Flood Hazard Map"

2009		1	1												2			1							1			1					1	1									10
2010		1	2												2			1							1	1			1					1	1									12
2011		1	2												2			2							1				1					1	1									11
Total		**3**	**5**												**6**			**4**							**3**	**1**			**3**					**3**	**3**		**2**							**33**

JICA training program "Capacity Development for Flood Risk Management with IFAS"

2012(A)		3															3										2			2						3								13
2012(B)																																									7			7
2013		3															3										2			3						2						3			16
2014		3	3														3										3			3						3						2			20
2015			1	2							1						2							4			2			4			2			2								20
2016			2	1										1			4							2			2			4			2											18
2017				1										1			2							2						2			2											10
Total		**9**	**6**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**17**	**0**	**0**	**0**	**0**		**0**	**8**	**0**	**0**	**11**	**0**	**0**	**18**	**0**	**0**	**6**	**0**	**0**	**10**	**0**		**0**	**0**	**12**	**0**	**0**	**104**

JICA training program "Capacity Development for Adaptation to Climate Change"

2010		**1**													**3**														**1**						**1**						**1**			**7**

UN/ISDR Training course "Comprehensive Tsunami Disaster Prevention"

2008														**2**	**4**						**2**											**3**												**11**

UNESCO Pakistan Project workshop

2012																												6																6
2013																												5																5
2016	2																											2																4
2017	2																											2																4
Total	**4**																											**15**																**19**

Year \ Country	Afghanistan	Bangladesh	Bhutan	Bosnia-	Brazil	Cambodia	China	Colombia	El Salvador	Ethiopia	Djibouti	Fiji	Guatemala	India	Indonesia	Japan	Kenya	Laos	Malaysia	Malawei	Maldives	Mauritius	Mozambique	Myanmar	Nepal	Netherland	Nigeria	Pakistan	Papua New Guinea	Philippines	Republic of Albania	Serbia	Sri Lanka	Tajikistan	Tanzania	Thailand	Timor-Leste	Tonga	Tunisia	Venezuela	Vietnam	Zimbabwe	Liberia	Total
Total	**4**	**44**	**16**	**4**	**5**	**9**	**21**	**3**	**1**	**2**	**1**	**3**	**3**	**9**	**30**	**6**	**21**	**15**	**16**	**2**	**3**	**1**	**1**	**21**	**16**	**1**	**12**	**36**	**1**	**38**	**1**	**1**	**29**	**3**	**1**	**23**	**2**	**1**	**1**	**2**	**26**	**1**	**1**	**437**

ANNEX 2

List of Visitors to ICHARM

Date	Name	Purpose
April 26, 2022	Dr. Anthony C. Sales,	Invited speaker for the 68th ICHARM R&D Seminar
June 17, 2022	Mr. Kwacha CHISIZA	Purpose: to interview with one master's student of Malawi
August 25, 2022	Delegate from Malaysia-Japan International Institute of Technology (MJIIT)	As part of course work "MJIIT Master of Disaster Risk Management Japan Attachment"
October 4, 2022	Prof. Zhongbo Su and Dr. UENO Kenichi	To deliver a special lecture
October 11, 2022	Prof. András Szöllösi-Nagy	Invited speaker for the 69th ICHARM R&D Seminar
October 11, 2022	Dr. Manuel Antonetti	To lecture on research into flood forecasting and to share information on research
February 16, 2023	H.E. Mr. Csaba Kőrösi, the president of the United Nations General Assembly and members of Office of the PGA, UN	To discuss water and climate change
March 13, 2023	DR. KHAMARRUL AZAHARI BIN RAZAK and 4 members of Disaster Preparedness and Prevention Center (DPPC), Malaysia-Japan International Institute of Technology (MJIIT), and Universiti Teknologi Malaysia (UTM)	To survey studies on sediment-related disasters and to discuss its future research

ANNEX 3

List of ICHARM Newsletter articles

Volume17, No.1, Issue No.64, April 2022

Category	Author	Position	Page	Contents
Message from Executive Director	KOIKE Toshio	Executive Director	1	Quality-oriented Society
Special Topics	FUJITA Koichi	President	3	Greeting from new PWRI President FUJITA Koichi
	KAWAMOTO Takatoshi	Senior Researcher	4	Commemorative lectures of PWRI former president
	YOSHINO Hirosato	Senior Researcher	5	ICHARM's research projects under the next medium- to long-term plans of PWRI
	MIYAMOTO Mamoru	Senior Researcher	7	Follow-up seminar for ICHARM graduates
Research	KAWAMOTO Takatoshi	Senior Researcher	9	"Integrated Research Program for Advancing Climate Models (TOUGOU)" research report of ICHARM
	NAITO Kensuke	Researcher	11	HyDEPP-SATREPS project updates: UAV training
	OKADA Tomoyuki	United Nations Department of Economic and Social Affairs	12	〈Special contribution〉 Progress and actions towards achieving SDGs
	Maksym Gusyev	Research Specialist	14	〈Introduction of ICHARM research projects〉 Combining hydrologic modeling with environmental isotopes to improve assessment of present and future water-related disasters in Asia
Training & Education	MIYAZAKI Ryosuke	Chief Staff	16	Educational program updates
	Md Khairul Islam	Chief Staff Officer (CSO) to Director General, Bangladesh Water Development Board	18	Action Reports from ICHARM Graduates: Md Khairul Islam
Information Networking	IKEDA Tetsuya	Director for Special Research	20	Pre-sessions for the thematic session "Water and disasters/Climate change" at the 4th Asia-Pacific Water Summit
	KAWAMOTO Takatoshi	Senior Researcher	21	The 54th Annual Session of Typhoon Committee
Coming Events	KAWAMOTO Takatoshi	Senior Researcher	21	Introduction of the 9th International Conference on Flood Management
Miscellaneous	NAITO Kensuke	Researcher	23	Results of Newsletter surveys (No. 60 – No.63)
Editor's Note	MIYAZAKI Ryosuke	Chief Staff	26	Editor's Note

Volume17, No.2, Issue No.65, July 2022

Volume17, No.2, Issue No.65, July 2022

Volume17, No.3, Issue No.66, October 2022

Volume17, No.3, Issue No.66, October 2022

Volume17, No.4, Issue No.67, January 2023

Volume17, No.4, Issue No.67, January 2023

ANNEX 4

Major updates on ICHARM Website

Apr.	25	ICHARM Open Day 2022 on Zoom Online discussion with Takezono High School and Namiki Secondary School
	28	ICHARM's contribution to the 4th Asia-Pacific Water Summit
	28	ICHARM Newsletter Volume 17 No.1 (Issue No.64) is now available
	28	Message from Executive Director updated.
May	12	ICHARM held the 68th R&D Seminar
Jun.	22	Malawian Ambassador to Japan visited ICHARM
	28	6th ICHARM Governing Board meeting was held
Jul.	29	ICHARM Newsletter Volume 17 No.2 (Issue No.65) is now available
	29	Message from Executive Director updated.
Sep.	14	MJIIT visited ICHARM
Oct.	3	ICHARM hosted the AWCI Session prior to the 15th AOGEO Symposium
	24	Accepting applicants for Ph.D. Disaster Management Program 2023
	31	ICHARM Newsletter Volume 17 No.3 (Issue No.66) is now available
	31	Message from Executive Director updated.
Dec.	27	Executive Director received the AGU Ambassador Award
Jan.	31	ICHARM Newsletter Volume 17 No.4 (Issue No.67) is now available
	31	Message from Executive Director updated.
Feb.	14	ICHARM Brochure is updated.
Mar.	1	UN General Assembly President visits ICHARM to discuss water issues
	16	The report on the 9th International Conference on Flood management (ICFM9) is updated

ANNEX 5

ICHARM Publication List (April 2022 ~ March 2023)

A. Peer Reviewed Papers

- 南雲直子、大原美保、藤兼雅和、井上卓也、平松裕基、ジャラニラ　サンチェズ　パトリシア　アン、フィリピン共和国の洪水常襲地を対象とした3D浸水ハザードマップの作成と技術の普及、E-journal GEO、2022，Vol.17、No.1、pp.123-136
- Li Zhou, Toshio Koike, Kuniyoshi Takeuchi, Mohamed Rasmy, and Katsuhiro Onuma, A study on availability of ground observations and its impacts on bias correction of satellite precipitation products and hydrologic simulation efficiency, Journal of Hydrology, July 2022, Vol.610, pp.1-20
- NAGUMO Naoko and EGASHIRA Shinji, Multi-decadal Landform Evolution in the Sittaung River Estuary, Myanmar、地学雑誌、東京地学協会、Vol.131、pp.427-445、2022年8月25日
- HARADA Daisuke, EGASHIRA Shinji, Tanjir Saif Ahmed and ITO Hiroyuki, Entrainment of bed sediment composed of very fine material、Earth Surface Process and Landforms (ESPL)、Vol.47, Issue13, pp.3051-3061, October 2022
- Daiki Kakinuma, Mamoru Miyamoto, Yosuke Nakamura, Anurak Sriariyawat and Supattra Visessri, Development of an Inundation Model for Creating Industrial Park-Scale Risk Information for Area-BCM, Journal of Disaster Research (JDR), Vol.17, Issue6, pp.877-888, October 1, 2022
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