

## Global & National Plans

- UN 2030 Agenda (SDGs)**
- UN Sendai Framework for Disaster Risk Reduction (Build Back Better)**
- UNESCO Intergovernmental Hydrological Programme IHP-9 (2022-29)**  
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 Resources Management under conditions of Global Change
  5. Water governance based on science for mitigation, adaptation, and resilience

- National Land Development Plan (2015-25)**
- 5th Priority Plan for Social Infrastructure Development (2021-25)**  
Priority goal 1: Realize a disaster prevention/mitigation focused society  
Priority goal 5: Achieve DX in infrastructure development and management

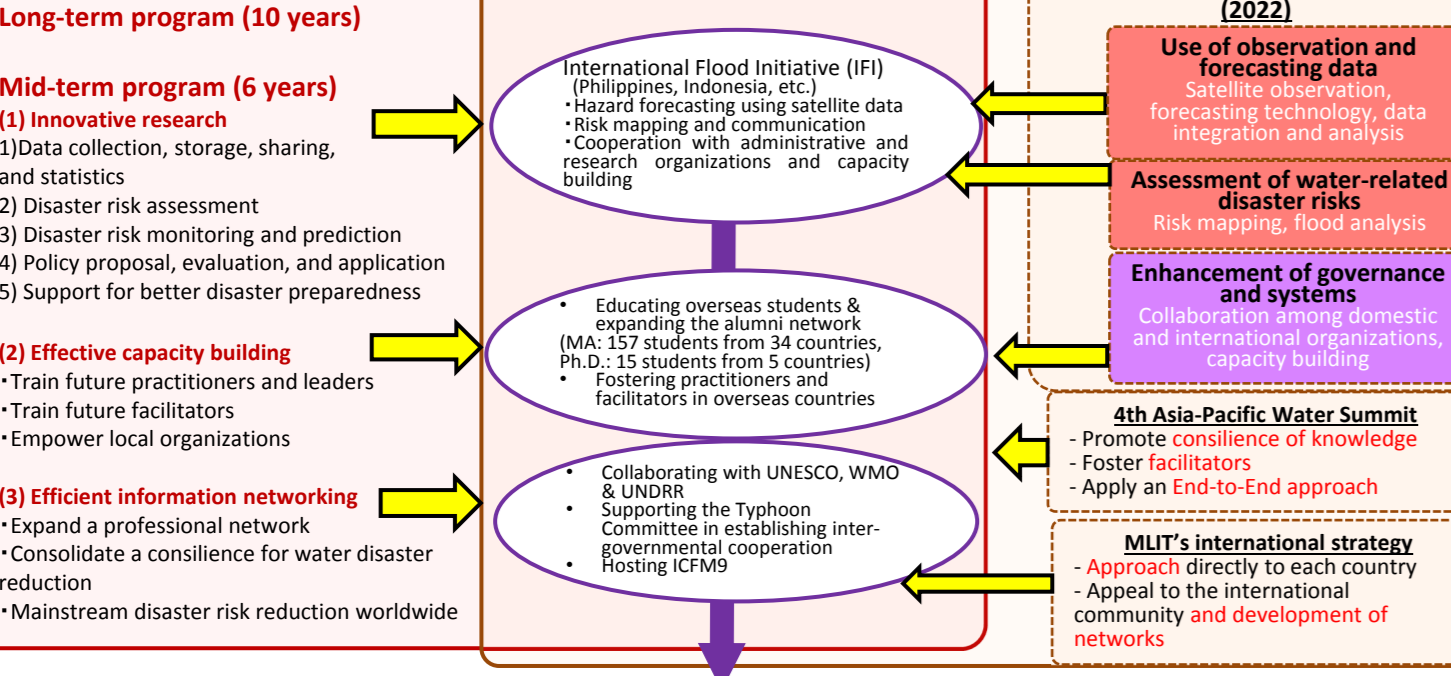
- 5th PWRI Mid- and Long-Term Plans (2022-27)**  
**R&D program: Technological development to implement "River Basin Disaster Resilience and Sustainability by All," the new flood control policy to fight intensified water-related disasters.**  
Purpose: To contribute to preventing and mitigating water-related disasters by promoting Japan's new flood control policy through technological development aiming to assess future water-related hazards, implement and evaluate the efforts driven by the new policy, provide quality flood risk information, and strengthen the society's disaster resilience.

## ICHARM Program (2022-2027)

**Mission of ICHARM**

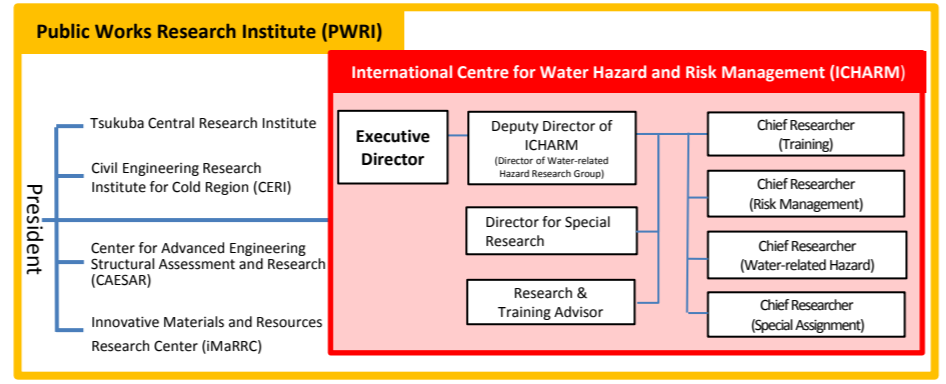
The mission of ICHARM is to serve as the Global Centre of Excellence for Water Hazard and Risk Management by, inter alia, observing and analyzing natural and social phenomena, developing methodologies and tools, building capacities, creating knowledge networks, and disseminating lessons and information in order to assist governments and all stakeholders in managing risks of water-related hazards at global, national, and community levels. The hazards to be addressed include floods, droughts, landslides, debris flows, tsunamis, storm surges, water contamination, and snow and ice disasters.

We envision a Center of Excellence housing a group of leading experts, superior facilities, and an excellent knowledge base, which conducts (1) innovative research, (2) effective capacity building, and (3) efficient information networking. 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 the diversity and inclusion of all stakeholders.

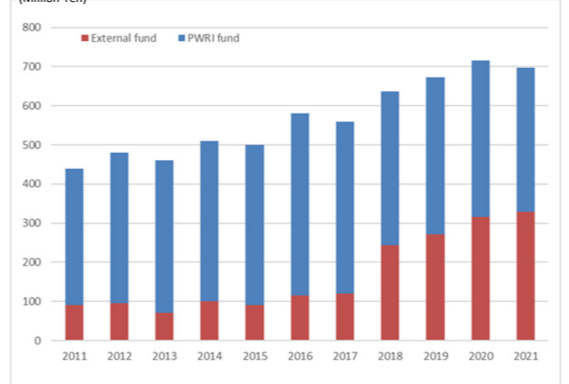


- ◆ Support partner countries in developing "systems" and "human resources."
- ◆ Accelerate "the mainstreaming of water-related disaster risk reduction" worldwide.
- ◆ Promote "the implementation of scientific knowledge in society" and "the development of quality infrastructure."

## Organization



## Budget



## Achievements & Contributions

- 2003 March: Proposal was made to establish a UNESCO water center in Japan at the 3rd World Water Forum.
- 2004 Apr.1: Established "Secretariat for Preparatory Activities of UNESCO-PWRI Centre".
- 2006 Mar.6: ICHARM was officially established with Prof. Kuniyoshi Takeuchi as the first director.
- 2007 Sep.14: Held ICHARM inaugural ceremony & commemorative symposium. (a)
- 2007 Oct.4: Started an M. Sc. program on water-related risk management with JICA and GRIPS. (b)
- 2008 Jun.2- Jul.11: Held a training course, "Comprehensive Tsunami Disaster Prevention," with UNISDR.
- 2009 Nov.13: Started an ADB joint project, "Capacity Development Technical Assistance (TA7276-REG)". (c)
- 2010 Oct.: Held a doctoral program on disaster management with GRIPS.
- 2011 Sep.27- 29: Hosted the 5th International Conference on Flood Management (ICFMS) in Tokyo.
- 2012 Jan.: Started the UNESCO Pakistan Project.
- 2012 Jul.10- Aug.7: Started a capacity development training on flood risk management with IFAS. (d)
- 2013 Mar.5- 6: Hosted a side event at the UN Special Thematic Session on Water & Disasters. (New York)
- 2013 Jul.23: The agreement on ICHARM between Japan and UNESCO was renewed.
- 2014 Feb.25: Held the first ICHARM Governing Board meeting.
- 2014 Jul.: Held the first ICHARM Governing Board meeting.
- 2014 Oct.1: Started an ADD joint project, "Capacity Development Technical Assistance (TA8456-MVA)".
- 2015 Mar.14- 18: 3rd UN World Conference on Disaster Risk Reduction. (Sendai) (e)
- 2015 Apr.12- 17: 7th World Water Forum (Daegu) (f)
- 2016 Mar.1- 2: Held the Asian Water Cycle Symposium (AWCS) 2016. (Tokyo)
- 2016 Oct.31: International Flood Initiative (IFI) "Jakarta declaration".
- 2017 Jan.30: 9th GEOS Asia-Pacific Symposium - implementation Planning Workshop on IFI (Tokyo).
- 2017 Jun.: Sent a researcher as a member of the Japan Disaster Relief Expert Team dispatched by the Japanese government to Sri Lanka.
- 2017 Jul.20: 3rd United Nations Special Thematic Session on Water and Disasters. (New York).
- 2017 Dec.11- 12: 3rd Asia-Pacific Water Summit (Yangon) (g)
- 2018 Mar.17- 23: 8th World Water Forum (Brasilia)
- 2018 Oct.24- 26: 11th GEOS Asia-Pacific Symposium (Kyoto)
- 2019 Jun.24: 4th United Nations Special Thematic Session on Water and Disasters. (New York)
- 2019 Sep.30: Executive Director Toshio Koike received the International Science Cooperation Award 2018 from the Chinese Academy of Science
- 2020 Nov.2- 4: 12th Asia-Oceania Group on Earth Observations (Canberra)
- 2020 Feb.13: The agreement on ICHARM between Japan and UNESCO was revised.
- 2020 Apr.1: Started SATREPS program, collaborative research with the Philippines.
- 2021 Feb.23: ICHARM was given the "Dr. Roman L. Kintanar Award" by Typhoon Committee. (Jointly with JAXA\*IDI).
- 2021 Jun.11: Executive Director KOIKE Toshio received FY2020 JSC International Lifetime Contribution Award.
- 2021 Jun.25: Science and Technology Panel at the 5th UN Special Thematic Sessions on Water and Disasters
- 2021 Dec.1: Held WADIRE-Africa Information session
- 2022 Feb.25: Follow-up seminar for ICHARM graduates
- 2022 Apr.23, 24: 4th Asia-Pacific Water Summit in Kumamoto (h)
- 2023 Feb.19- 21: Hosted the 9th International Conference on Flood Management (ICFM9) in Tsukuba.

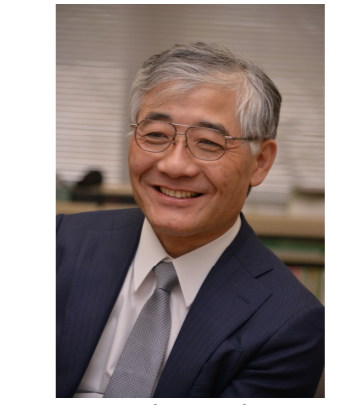
## Access



**International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM)**  
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Revised on 2023.1



## Greeting from Executive Director



**Toshio Koike**  
Professor Emeritus of the University of Tokyo, Council Member of Japan Science Council, Cabinet Office, Fellow of the Japan Federation of Engineering Societies, "International Contribution Award", Japan Water Prize, "Science Award" by the Japan Society of Hydrology and Water Resources

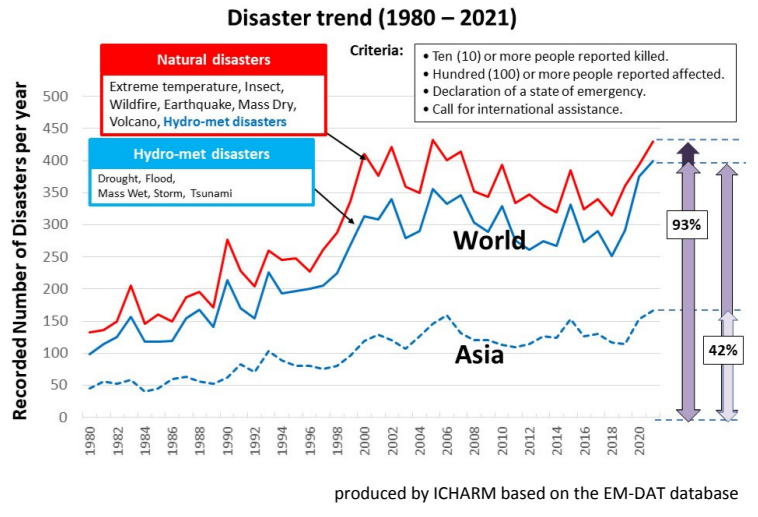
## Background

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has been promoting water sciences and technologies and, as part of its effort, encouraging the activities of the Intergovernmental Hydrological Programme (IHP) and the establishment of UNESCO water centers.

In fact, the world has been struggling with water-related disasters, such as floods, droughts and windstorms. They have been a primary source of disaster damage worldwide in recent decades and have been reported to become increasingly frequent and intense in recent years. Today, water-related disasters account for about 90% of all natural disasters in the world, and about 40% of all water-related disasters occur in Asia alone.

In the meantime, Japan has a long history of fighting and overcoming water-related disasters and consequently has a wealth of knowledge and experience, as well as sophisticated technology, in the field. Leveraging this expertise, Japan has been taking the initiative in addressing water-related disasters by participating in the activities of IHP and the World Water Assessment Programme (WWAP) and demonstrating global leadership by hosting the 3rd World Water Forum in 2003 in Kyoto, Japan.

With its growing presence in the water arena, Japan has further realized international expectations that it should share its long-accumulated expertise with other countries in consideration of their needs and conditions in order to help reduce disaster damage.



## Launch of ICHARM under the auspices of UNESCO

To respond to global expectations to fight against water-related disasters, a proposal was made to establish a UNESCO water center in Japan at the 3rd World Water Forum in March 2003. The proposal received widespread support from member countries and UN organizations at the IHP intergovernmental board meeting in September 2004 and was adopted at the UNESCO general meeting in October 2005.

Finally, on March 6, 2006, the International Centre for Water Hazard and Risk Management (ICHARM) was officially established as a UNESCO category II center and part of the Public Works Research Institute of Japan.

The agreement between UNESCO and the Government of Japan was revised and renewed on February 13, 2020. based on the agreement, the ICHARM Governing Board meeting was held every year.



ICHARM will contribute to the mitigation of water disaster damage around the world by combining research activities, capacity building activities, and information network activities with keywords such as "climate change," "sustainability," and "food and energy."

# Innovative Research

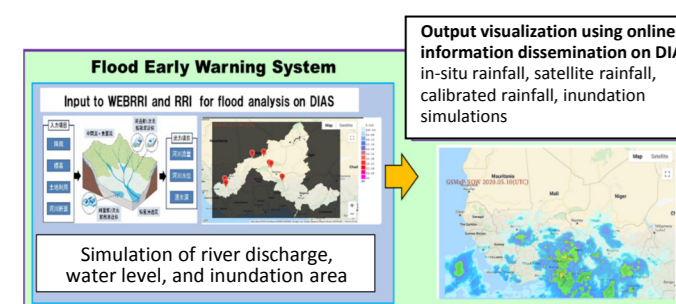
End-to-End approach (from data collection to the analysis, assessment and prediction of natural phenomena to socio-economic impact assessment)

ICHARM conducts research and practical activities worldwide in cooperation with various domestic and international organizations and has produced many award-winning papers and technologies.

## (1) Data collection, storage, sharing, and statistics on water-related disasters

### Development of a flood early warning system (FEWS) for West Africa

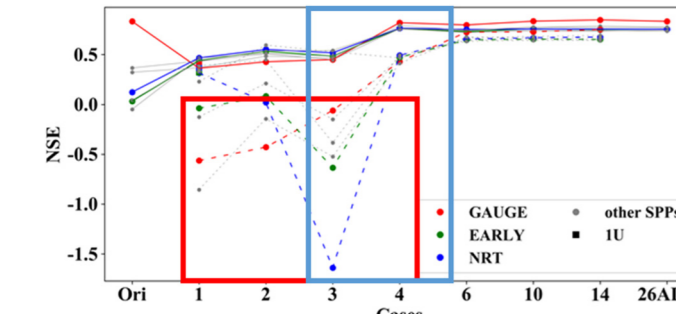
ICHARM developed the flood early warning system (FEWS) for the Niger and Volta River Basins in West Africa using the WEB-RR1 model, a model capable of computing the water and heat budget at the ground surface and simulating rainfall, runoff, and inundation. The system has been made publicly available to 11 west African countries and relevant organizations in the basin, helping them share information.



The outline of West Africa's FEWS

### Utilization of satellite rainfall products in data-scarce areas

ICHARM studied the optimal density and placement pattern of ground rain gauges for bias correction by taking the Fuji River basin in Japan as an example. The results showed that a certain number of ground rain gauges in a basin can provide enough ground rainfall data to correct real-time satellite rainfall products, making it possible to perform sufficiently accurate runoff analysis.



The relationship between the estimation accuracy of the hydrologic model using the bias-corrected satellite rainfall products (vertical axis, Nash coefficient) and the number of rain gauges installed in the basin to collect data for bias correction (horizontal axis).

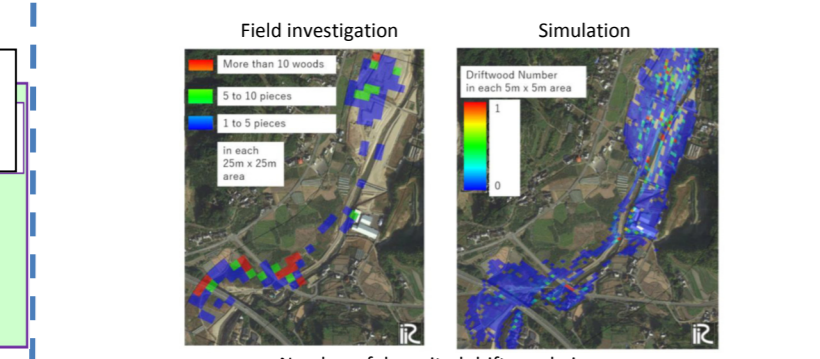
### Field investigation

ICHARM researches how flooding and flood-related sediment and driftwood change the landform of an area extending from a river's upper reach to its mouth by conducting field investigations, sample analyses, and numerical analyses, and also studies applications of the research results to assess disaster risks.

## (2) Risk assessment on water-related disasters

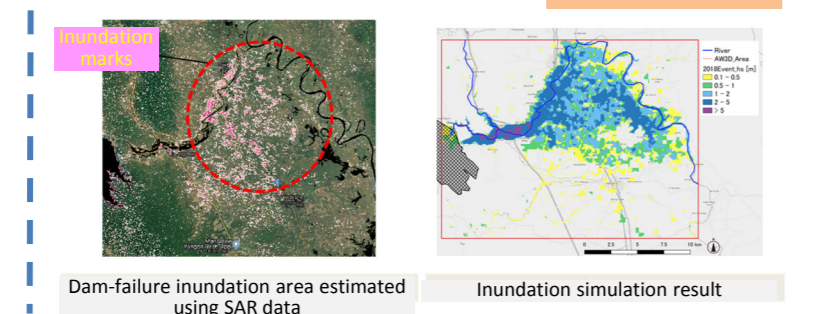
### Development of models to reproduce and predict flood inundation with sediment

ICHARM developed the Rainfall-Sediment-Runoff (RSR) model, capable of analyzing the behavior of water, sediment, and driftwood produced in a basin during a heavy rainfall event in an integrated manner. The model was tested on past floods and verified for its capability. Studies have also revealed that the model can be used for hazard mapping and evacuation forecasting and warning.



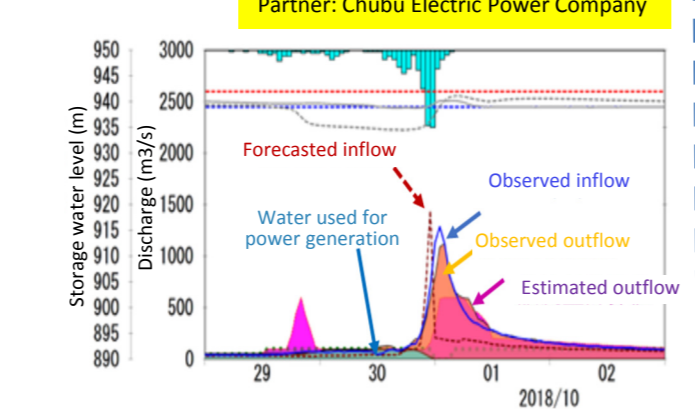
### Estimation of rainfall and inundation area using satellite data (Myanmar agriculture development support project: technical support for flood simulation of areas downstream of the Swaung Dam)

ICHARM created rainfall data whose temporal and spatial resolutions were increased by using GSMaP data bias-corrected with ground rainfall. The rainfall data with improved resolutions were applied to a runoff-inundation model to simulate an earth dam failure in Myanmar. The inundation area was identified by comparing SAR images before and after a flood and detecting changes in vegetation surface due to flood flow. The identified inundation area was used to verify inundation models.



### Development of optimized dam operation based on dam inflow prediction

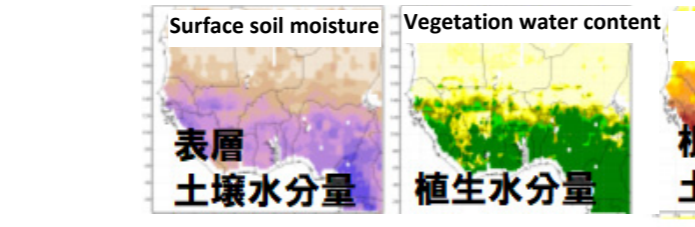
ICHARM jointly developed a dam operation method with an electric power company to increase dams' flood control capacity and power generation efficiency using dam inflow forecasts. This development has shown that dam operation can be modified to improve the capacity of hydroelectric dams for power generation and flood control simultaneously.



Simulation results (October 2018): the simulation was conducted using the top 25% time-series discharge while aiming more at flood control than at power generation (i.e., by assuming dam water releases before an event) due to a high storage level at the time of dam inflow forecasting.

### Development of a CLVDAS-based drought monitoring system for West Africa

ICHARM developed CLVDAS on DIAS for West Africa. CLVDAS is a system consisting of passive microwave remote sensing techniques, a land surface model, a dynamic vegetation model, and a data assimilation scheme. ICHARM investigated agricultural droughts that occurred in the area from 2003 to 2018 using CLVDAS to calculate soil moisture and vegetation water content from the ground surface to the root layer.



## The Science and Technology Research Partnership for Sustainable Development Program (SATREPS)

- The Project for Development of 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)
  - Principal organization: ICHARM
  - Partner organizations: The University of Tokyo, Tohoku University, Shiga Prefectural University, Nagoya University, Kyoto University, Philippine organizations (University of the Philippines, Department of Science and Technology, etc.)
  - Funding: JST, JICA

- Joint projects:
- Regional Resilience Enhancement through Establishment of Area-BCM at Industry Complexes in Thailand
  - Research for the development of a real-time flood forecasting system using rainfall forecasts for Argentina

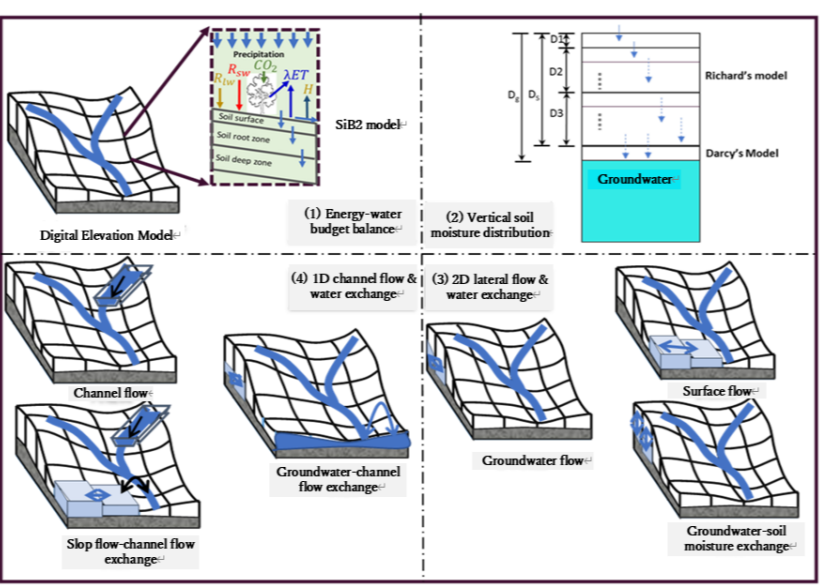
## (3) Monitoring and prediction of changes in water-related disaster risks

### Prediction of water-related disaster risks (floods, droughts) due to climate change (Solo and Davao River basins)

Funding: Integrated Research Program for Advancing Climate Models by the Ministry of Education, Culture, Sports, Science and Technology

Partners: Kyoto University Disaster Prevention Research Institute, organizations of Indonesia and the Philippines

ICHARM developed the Water-Energy-Budget Rainfall-Runoff-Inundation (WEB-RR1) model by combining a water-energy budget model capable of representing the transport of water and energy (heat and radiation) in the atmosphere-vegetation-soil system and an RRI model capable of simultaneously calculating river runoff and flooding in a basin. ICHARM has applied this model to the Solo River basin of Indonesia and the Davao River basin of the Philippines to study the impact of global warming on precipitation, flood runoff inundation, and water resources.



## (4) Proposal, evaluation, and application of policy ideas for water-related risk reduction

### Development of a water-level prediction system for small and medium rivers

Partner: Cabinet Office PRISM

Award: River Symposium River Technology Paper Award, JSCE

Collecting water levels, channel conditions, etc., is essential to reduce flood disaster risks. Prefectures are usually responsible for carrying out this task for small and medium rivers, but they often have difficulty performing it because there are so many. To help them with the task, ICHARM has developed a simple, low-cost system capable of predicting water levels with adequate accuracy and short computation time.

### (5) Support in improving the applicability of water-related disaster management

#### IDRIS: one-stop disaster information system

Partners: Awa of Niigata Prefecture, Iwazumi of Iwate Prefecture, Tsuruoka of Yamagata Prefecture

Award: 2019 Institute of Social Safety Science Technology Award

ICHARM developed the ICHARM Disaster Risk Information System (IDRIS) for municipalities in mountainous areas with little evacuation information. This basic system is designed to help operate a portal site that works as a one-stop flood disaster information center for residents to use in emergencies and to improve their disaster preparedness in normal times. The system has been modified to accommodate the needs of smartphone users.

#### Collection of critical situations during flood emergency response

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, ICHARM collected typical critical situations from past flood disaster reports and published as the "Collection of Critical Situations during Flood Emergency Response."

PWRI Priority Technology for Dissemination: Collection of Critical Situations during Flood Emergency Response (local government version)

Award: 2021 MLIT National Land and Infrastructure Technology Research Group Outstanding Research Award

#### Development of OSS-SR and "Facilitators" for Davao City

ICHARM developed the Online Synthesis System for Sustainability and Resilience (OSS-SR) and has been using it in e-learning programs to foster "Facilitators." The OSS-SR for Davao City, the Philippines, integrates knowledge and information on real-time flood forecasting and climate change impact assessment and allows local stakeholders to learn about them through e-learning programs.

## Effective capacity building



- Master's program (one year):** This one-year master's program, officially titled "Water-related Risk Management Course of Disaster Management Policy Program (JICA Training Program: Training for Expert on Flood-Related Disaster Mitigation)," has been provided since 2007 as a joint effort with JICA and GRIPS, mainly targeted at officials of administrative organizations. The first half of the course consists mostly of lectures and hands-on practices, while the second half requires the students to work on graduation theses. In addition, several study trips are conducted during the program. As of September 2022, a total of 170 students graduated with a master's degree.
- Doctoral program (three years):** The doctoral program, officially titled "Disaster Management Program," has been provided since 2010 in collaboration with GRIPS. By September 2020, 15 students had earned a doctoral degree, and nine from Bangladesh, Sri Lanka, Ethiopia, Nepal, the Philippines, and Pakistan were enrolled as of October 2022.
- Short-term training (several days):** Short-term training programs are conducted for participants to learn technology and knowledge about water-related disaster management. ICHARM has conducted part of a JICA-led program on water-related disaster risk reduction since 2019, when 12 participants from nine countries attended the first-year program.
- Follow-up activities:** Seminars and other events have been held to support program graduates in activities in which they are involved after they return home.

### Follow-up seminars

ICHARM has held a follow-up seminar, including site visits, once a year since 2007 in a country of graduates from ICHARM educational and training programs. This annual meeting is an excellent opportunity for ICHARM to see how graduates are applying the knowledge and skills they learned through the programs, as well as to share issues they face in their practices. Such information is used to improve the programs and research activities. On February 25, 2022, despite the COVID-19 pandemic, we decided to hold a seminar online for the first time, in which two special speakers and 69 master's and doctoral graduates participated.

### Creating an infection-resistant educational environment

To continue educational programs amid the spread of the new coronavirus infection, ICHARM introduced devices, such as electronic blackboards, and systems that allowed students to attend lectures online in real time even when they were unable to come to Japan. We took thorough infection control measures when in-person classes became possible, for example, by setting up partitions and introducing flexible class management in which classes were conducted face-to-face, remotely, or in combination, depending on infection status.

## Efficient information networking

### International Flood Initiative (IFI)

The International Flood Initiative (IFI) is a framework for international organizations, such as UNESCO, the World Meteorological Organization, the United Nations University, and the United Nations Office for Disaster Risk Reduction, to cooperate in promoting global flood management. ICHARM has been its secretariat since its foundation. On October 31, 2016, the Jakarta Declaration was adopted for interdisciplinary cooperation to further promote flood risk reduction and sustainable development. In response, ICHARM, in collaboration with the IFI partners, has been conducting a project to establish a "Platform on Water and Disasters" in flood-prone countries to reduce water-related disaster risks.

### Typhoon Committee

Award: 2020 Dr. Roman L. Kintanar Award, with the Japan Aerospace Exploration Agency (JAXA) and the Infrastructure Development Institute (IDI)

The Typhoon Committee is an intergovernmental community formed in 1968 to promote and coordinate planning and implementation measures to minimize human and property damage from typhoons in the Asia-Pacific region. As chairman of the Hydrology Subcommittee, ICHARM will lead the discussions together with the MLIT. ICHARM has contributed greatly to support Committee's flood hazard mapping project and improving flood forecasting and management capabilities in the area through the use of satellite products developed and provided by JAXA.

ICHARM Webinar is held once a year to disseminate ICHARM's research activities to master's and doctoral students and young researchers in universities and research institutes in Japan and abroad