



International Centre for Water Hazard and Risk Management under the auspices of UNESCO

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

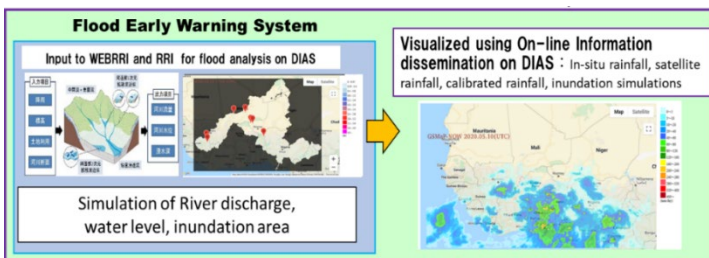
End-to-End approach (from data collection to the analysis, assessment and prediction of natural phenomena to socio-economic impact assessment)

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

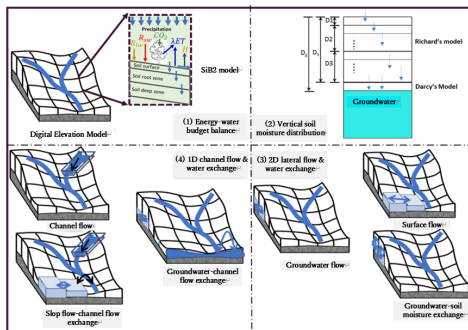
Partners: The University of Tokyo Earth Observation Data Integration and Fusion Research Initiative (EDITORIA), West Africa Center for agriculture, meteorology, and hydrology



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.

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

Prediction of water-related disaster risks (floods, droughts) due to climate change

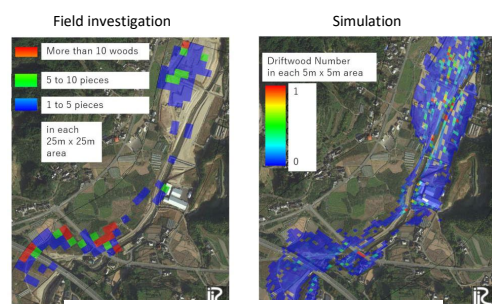


Partners: Kyoto University Disaster Prevention Research Institute, organizations of Indonesia and the Philippines

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.

(2) Risk assessment on water-related disasters

Development of models to reproduce and predict flood inundation with sediment



PWRI Priority Dissemination Technology: Rainfall-Runoff-Inundation Analysis Model

Award: Best Presentation Award of river engineering, JSCE

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.

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

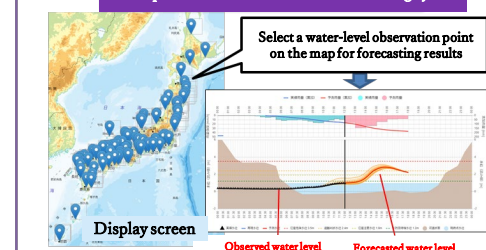
Development of a water-level prediction system for small and medium rivers

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.

Development of a real-time flood forecasting system



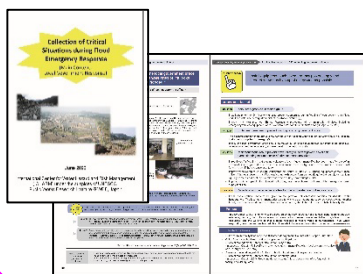
Forecasting period: up to 6 hours ahead
Information update interval: 30 minutes
ICHARM has created models for 200 rivers nationwide and has been trying to incorporate them into the flood forecasting system.

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

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



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."

VR-driven flood experience system

Partner: Aka of Niigata Prefecture, Kumamoto of Kumamoto Prefecture

ICHARM developed a virtual flood experience system using VR technology. The system reproduces a flood event using the RRI model and a flood inundation model that are fed with spatial information collected by means of UAVs, ground laser surveys, and photogrammetry. It also allows users to play an avatar and virtually try out evacuation during flooding.

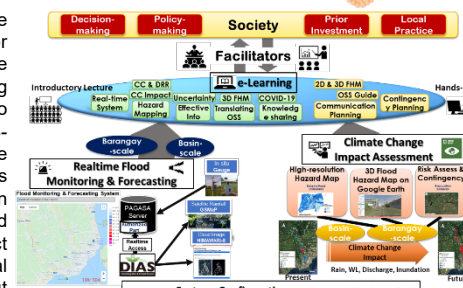


The system can accurately reproduce rain clouds, rainfall, flooding, etc. It allows people to play an avatar and virtually experience flooding, as well as evacuation and rescue efforts during flooding.

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

Partners: The Philippine's Department of Science and Technology, etc.

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

ICHARM provides various educational and training programs to improve individuals' problem-solving skills and disaster management organizations' disaster response capabilities. ICHARM also holds follow-up seminars and other activities to help trainees better understand the issues they face even after they return home, as well as to get feedback to improve the training programs further.

Partner: JICA, GRIPS



Master's and doctoral students after the graduation ceremony (Sep. 2022)

- 1. 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.
- 2. 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.
- 3. 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.
- 4. 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.

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.



Partners: UNESCO, WMO, UNU, UNDRR, etc.

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.