Risk management research

ICHARM studies specific and practical risk reduction countermeasures by connecting hazard analysis conducted by the Water-related Disaster Team to disaster risk assessment by the Risk Management Team. The Risk Management Team has been conducting research activities on disaster risk assessment and disaster risk reduction methodologies using hydrological simulation models such as the RRI model.

In its initial stage from 2006 to 2010, ICHARM collected information on water related disasters, and then analyzed, arranged and introduced them to flood practitioners as reference for flood management activities. Since 2011, ICHARM has promoted activities for water-related disaster risk reduction in Japan and abroad by setting up the Risk Management Team.

The Risk Management Team conducts various research activities based on the following three pillars:

- **Evidence-based Activities**: Analyze local data and information, assess risks and formulate risk reduction countermeasures appropriate to local conditions and realities. External funding is also actively utilized.
- **Collaboration with other research institutions and governmental agencies**: Cooperate with universities, research institutes, and government agencies that are responsible for disaster risk reduction to comprehend the needs and promote research activities in Japan and abroad.**Active**
- **public relations**: Publicize research results actively by giving presentations at various international conferences and publishing literature in cooperation with international organizations.

Research activities on risk management conducted by ICHARM in the past decade are classified into the following 4 categories:

(1) Promote understanding of water-related disaster situations around the world and their generating mechanisms
(2) Share knowledge and experience of disasters and lessons learned that are collected, arranged and analyzed
(3) Assess water-related disaster risk using simulation models
(4) Propose water-related disaster risk reduction countermeasures based on risk assessment

In the past 10 years, ICHARM has widened its area of activities from (1) to (4). The following section describes the outline of each category.

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(1) Promote understanding of water-related disaster situations around the world and their generating mechanisms

To understand water-related disaster situations around the world, ICHARM used the global disaster database EM-DAT to conduct basic analysis regarding flood vulnerability of each country. Using the results, ICHARM identified countries that were considered to be the most vulnerable to water-related disasters and gathered as much detailed information as possible through local interviews, and arranged and classified the information into four categories of hazard, local characteristics, damage, and countermeasures.

In addition, based on the EM-DAT database, ICHARM analyzed disaster occurrence trends in perspective of disaster types and regions to prepare basic reference materials for policymakers. These results were summarized and published as a supplementary reading material of the UN 2009 World Water Assessment Programme (WWAP), entitled “Global Trend in Water-Related Disasters: an Insight for Policymakers” (Figure 1). To promote policymakers’ understanding on flood countermeasures, ICHARM asked the world’s flood experts to make reports on 10 large-scale floods in the world, which was published as Large-scale Floods Report in 2010 (Figure 2).

Figure 1 Global Trend in Water-Related Disasters: an Insight for Policymakers

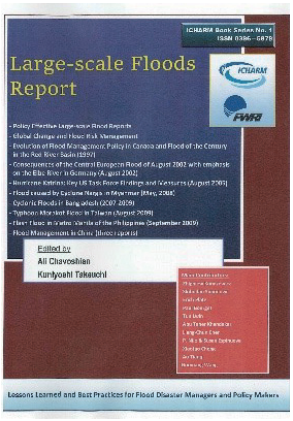

Figure 2 Large-scale Floods Report

(2) Share knowledge and experience of disasters and lessons learned that are collected, arranged and analyzed

On March 11, 2011, Japan experienced the Great East Japan Earthquake, which caused the devastating disaster by tsunamis. This tragedy highlighted the necessity of accumulation and transfer of disaster experiences in order to enhance preparedness for the reduction of disaster risks. As one of the activities to share knowledge of natural disasters around the world, including those by tsunamis, among people from children to the elderly, ICHARM published "World Handbook on Local Disaster Management Experiences" in 2013, a handbook with illustrations and photos to visualize disaster generation mechanisms, response measures, and disaster experiences (Figure 3). This handbook was distributed on the occasions of various international activities by ICHARM and welcomed with high regard.

In 2011, the same year as the Great East Japan Earthquake occurred, Thailand experienced a huge flood in the Chao Phraya River Basin, which caused a large impact on manufacturing supply chains, not only in Thailand but also around the world. In 2012, ICHARM started a investigation on the chain flood damage of industrial sector through literature research and several local questionnaire surveys. The collected information through the questionnaire surveys was sorted out into nine lessons and published as the PWRI Technical Note No. 4322 "Lessons Learned from the Flood Disaster in Industrial Estates/Parks/Zones in Thailand, in English and Thai," in 2016 (Figure 4). The survey findings and lessons were shared among Thailand Government officials (Ministry of Industry), offices of industrial estates, and the Japanese Chamber of Commerce and Industry in Bangkok. The reports were appreciated as valuable materials because the number of people who experienced the actual flood decreases year by year.

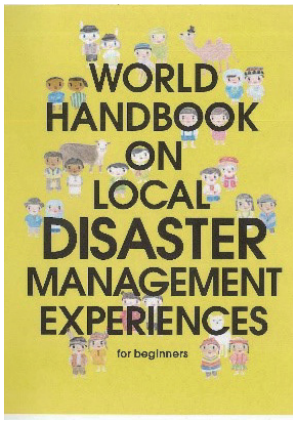

Figure 3 ICHARM World Handbook on Local Disaster Management Experiences

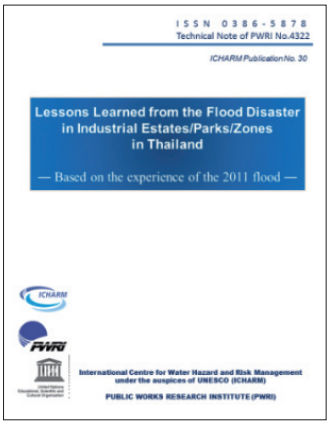

Figure 4 Lessons Learned from the Flood Disaster in Industrial Estates/ Parks/Zones in Thailand

(3) Assess water-related disaster risk using simulation models

While learning about the situation of water-related disasters in the world, ICHARM has launched research to develop a technique to assess various risks of water-related disasters. In 2008, ICHARM formulated the World Flood Risk Map based on the data sets published by international organizations such as the United Nations and the World Bank.

Flood hazard maps are important tools to show and share the results of flood risk assessment. ICHARM has conducted interviews with government officials of Asian countries (those who returned to their countries after participation in ICHARM training programs in Japan) to investigate the current efforts of map preparation in Asia. The contents that should be included in hazard maps were also investigated through interviews and reported in the PWRI Technical Note No. 4164, "Progress Report on Flood Hazard Mapping in Asian Countries", in 2010.

ICHARM conducted flood risk assessments of Asian countries as a partner organization of the Asian Development Bank (ADB) in charge of the chapter of Key Dimension 5 "Resilience to Water-related Disasters" in the 2013 edition of AWDO (Asia Water Development Outlook), which is issued by ADB every three years. ICHARM also proposed a methodology to analyze effects of water-related disaster countermeasures by using flood simulation models in a report issued by the World Bank.

In 2012, ICHARM participated in the Research Program for Risk Information on Climate Change (Sousei), a research and development program sponsored by the Ministry of Education, Culture, Sports, Science and Technology, targeting five river basins in Asia (Pampanga River in the Philippines, Solo River in Indonesia, Lower Mekong River, Chao Phraya River in Thailand, and Indus River in Pakistan).

In this program, ICHARM conducted flood hazard analysis using flood simulation models such as the RRI model and daily discharge analysis using the BTOP model to assess flood and drought risk and create information on risk change under climate change in the future. Especially for flood disaster risk assessment, ICHARM developed a flood damage curve for rice crops by combining the statistics collected from Bureau of Agricultural Statistics of the Philippines (2013) with the plant height data from IRRI (2009) (Figure 5). This method is used to assess risk change under climate change. This research was implemented in cooperation with the governments of Asian countries by sharing information.

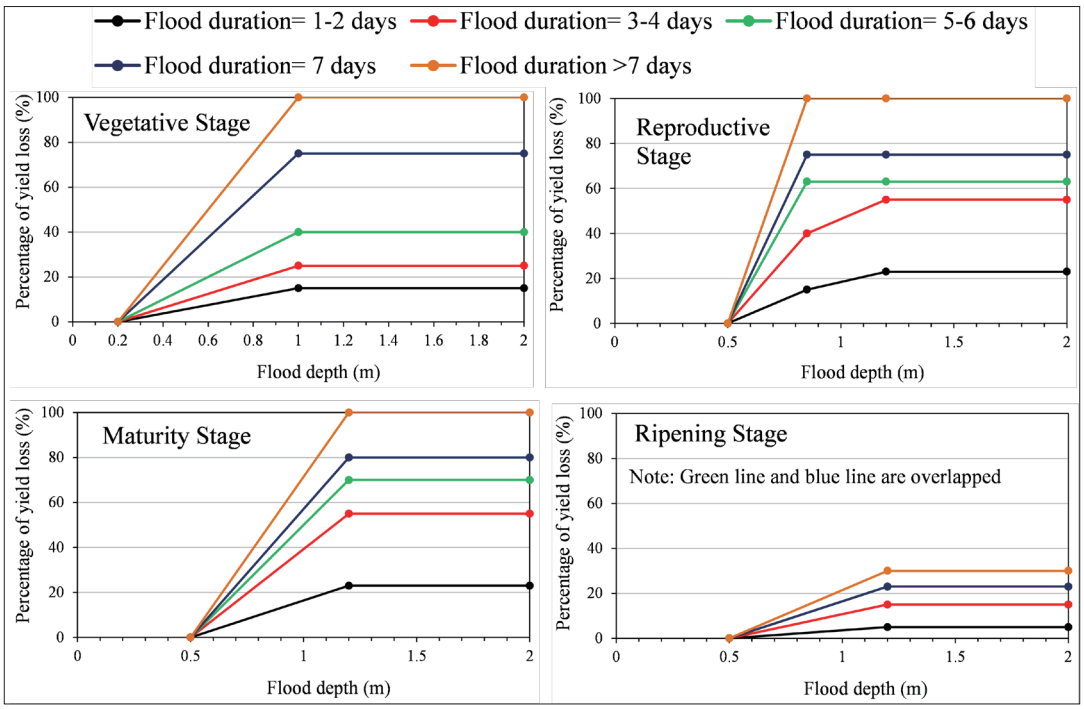

Figure 5 Flood damage curve for rice crops by ICHARM

(4) Propose water-related disaster risk reduction countermeasures based on risk assessment

In 2009, to help municipal officials understand the municipality's weakness in disaster management and assist them in the improvement of local disaster management capacity, ICHARM conducted research on risk assessment methods on local disaster management capacity and developed the Flood Disaster Preparedness Indices (FDPI), which was released in 16 languages on ICHARM's website (Figure 6). A part of this research was conducted as an annual action plan of the Working Group of Hydrology of the ESCAP/WMO Typhoon Committee, and the final report on the research was published in English (Figure 7).

In 2014, ICHARM conducted another research project on the development of a flood risk assessment method using the RRI model, targeting rivers in mountainous areas where, unlike large rivers, information for disaster management is limited and flood forecasting is not available, in order to create information for local municipal officials and residents to practice disaster management activities. This project also targeted developing countries where meteorological and hydrological information is also limited.

In Japan, the Agano River was selected as the study river for this research, and a survey was conducted at Aga Town in Niigata Prefecture, where serious flood damage occurred recently (Photo 1), by interviewing officials of Aga Town, the Regional Development Bureau of the Ministry of Land, Infrastructure, Transport and Tourism, local river office, Niigata Prefecture, and local residents in order to understand the actual situation and

Figure 6 Website of FDPI

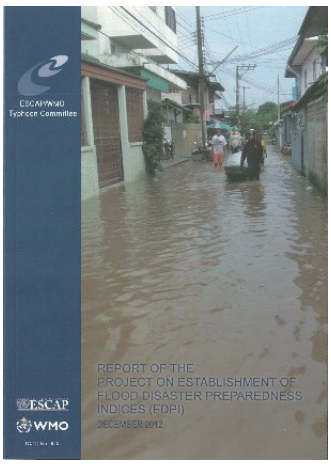

Figure 7 Project on Establishment of Flood Disaster Preparedness Indices (FDPI) Report

the needs of the local government and residents. Based on this survey and application of the RRI model (Figure 8), ICHARM developed flood risk assessment methods, “Flood Diagnostic Chart” for understanding the flood vulnerability of each district of Aga Town and “Flood Hot Spots” for identifying districts of high risk that may require particular precautions. These methods are expected to help municipal officials without adequate experience of disasters to perform disaster management activities effectively. The research activities are still in progress and now in the process of developing techniques for real-time disaster risk assessment and information sharing systems.

Photo 1 Flood damage in Aga Town (July 30, 2011)

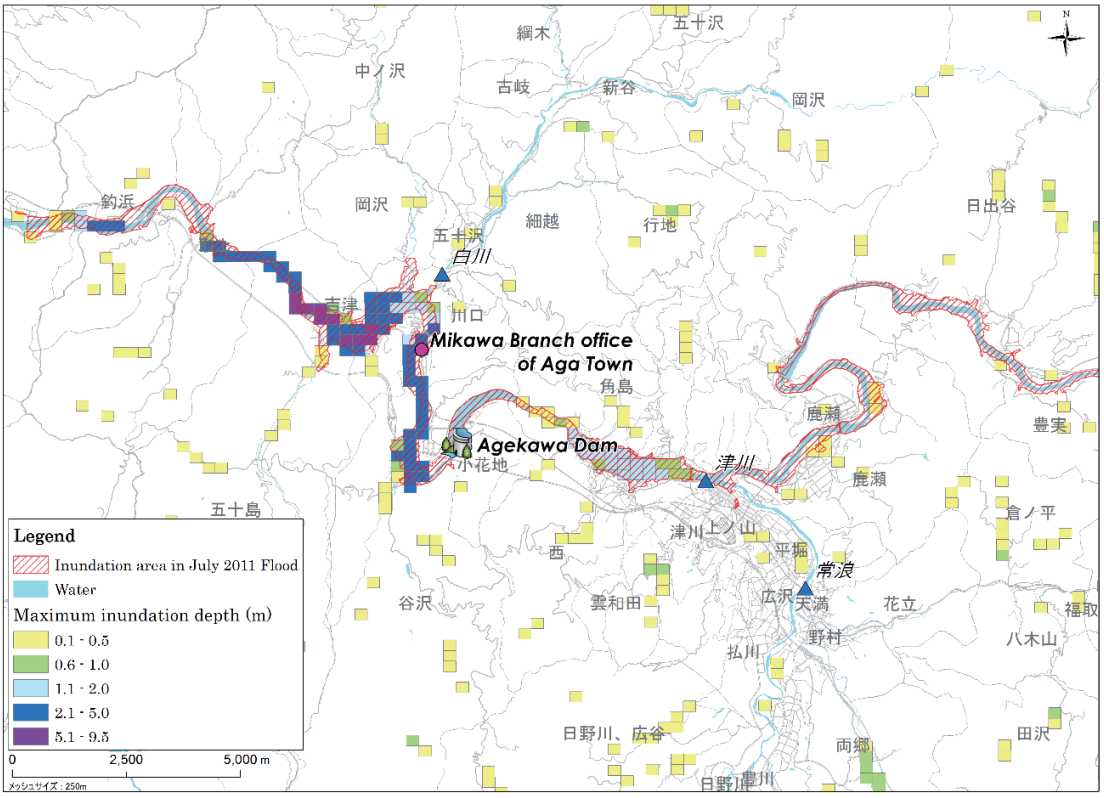

Figure 8 Calculated inundation area along Agano River by RRI model

In the Philippines, ICHARM conducted a research project to support the formulation of community level flood risk management plans (flood response plans) at Calumpit Municipality in the Pampanga River Basin, based on the result of scientific analysis (hazard maps, a time line of inundation) using the RRI model and discussions with local government officials and residents.

ICHARM’s research activities are not limited to floods. After the 2004 Indian Ocean tsunami, ICHARM conducted research on tsunami disaster mitigation methods and tsunami risk assessment. ICHARM also conducted research on the assessment of sediment disasters risk using satellite precipitation data.

As mentioned above, risk management research of ICHARM generally starts with collecting information from disaster-affected areas in Japan and abroad. Based on such information as field evidence, ICHARM develops research activities in order to assist the world’s efforts in the formulation of risk reduction strategies suitable for the local situation. ICHARM will continue practicing this localism approach in cooperation with governments and institutions in Japan and abroad, and actively publicizing the achievements.