Training and research for promoting disaster preparedness
--- Mission and roles of ICHARM ---

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1. Introduction

Since its establishment in March 2006, the International Centre for Water Hazard and Risk Management (ICHARM) has been active in addressing water issues around the world. This report will provide the basic information of ICHARM since its establishment, about its purposes and activities of training, research and localbased practices.

2. Establishment, mission and guiding principles

As a response to increasing water-related disasters worldwide, both in number and in intensity, the United Nations and UNESCO have set up initiatives such as the International Decade for Natural Disaster Reduction and the World Water Assessment Programme. Moreover, in 2002, UNESCO and the World Meteorological Organization (WMO) started the preparation process for the establishment of the International Flood Initiative (IFI), and in 2005, the launch of the IFI was officially announced and the United Nations University (UNU) and UNISDR joined. The UN and UNESCO have continued playing a leading role in addressing water-related disasters. Under such circumstances, the proposal by the Japanese government to establish an international centre for water-related hazards under the auspices of UNESCO hosted by the Public Works Research Institute (PWRI) was approved by 191 Member States at the 33rd General Conference of UNESCO in October 2005, and ICHARM was officially established in March 2006.

Box 1 Objectives and functions of ICHARM

The following is excerpted from the agreement between the government of Japan and the United Nations Educational, Scientific and Cultural Organization (UNESCO) regarding the International Centre for Water Hazard and Risk Management (category 2) under the auspices of UNESCO:

Objectives and Functions

1. The objectives of the Centre shall be of conduct research, capacity-building and information networking activities in the field of the water-related hazards and their risk management at the local, national, regional and global level in order to prevent and mitigate their impacts with a view of sustainable and integrated river basin management.

2. In order to achieve the above objectives, the functions of the Centre shall be:
(a) to promote scientific research and undertake effective capacity-building activities at institutional and professional levels;
(b) to create and reinforce networks for the exchange of scientific, technical and policy information among institutions and individuals;
(c) to develop and coordinate cooperative research activities, taking advantage particularly of the installed scientific and professional capacity of the relevant IHP networks, World Water Assessment Programme, International Flood Initiative/Programme and the relevant programmes of non-governmental organizations and involving international institutions and network under those auspices;
(d) to conduct international training courses especially for the practitioners and researchers of the world;
(e) to organize knowledge and information transfer activities including international symposia or workshops, and to engage in appropriate awareness-raising activities targeted at various audiences including the general public;
(f) to develop a strong programme of information and communication technology;
(g) to provide technical consulting services; and
(h) to produce technical publications and other media items related to the activities of the Centre.

3. The Centre shall pursue the above objectives and functions in close coordination with IHP.

The mission of ICHARM is to be the world centre of excellence to provide and assist implementation of best practicable strategies to localities, nations, regions and the globe to manage the risk of water-related disasters, including floods, droughts, landslides, debris flows, storm surges, tsunamis and water contamination. As of July 2013, there are 48 members at ICHARM working according to the following guiding principles of the institute:

-To be needs-driven, rather than supply-driven, and responsive to respective local realities.
-To prescribe tailored strategies to realize integrated risk management (avoidance, reduction, transference and acceptance) under the multifaceted, social, economic, institutional and cultural conditions as well as technological availability.
-To produce policy-effective information and raise public awareness to promote societal action.
-To promote research development and capacity building jointly to bring science where most needed.
-To work in alliance with all the related organizations of the world to mutually complement resources and expertise and to create synergy in implementation.
-To serve as a global think-tank in water hazard and risk management and play a central role in its strategic promotion.

Box 2　Logo of ICHARM

The logo of ICHARM shows a calm water surface consisting of three individual crescents. The upper crescent is from the PWRI logo; the lower one stands for the letter "U" from UNESCO; and the third one refers to ICHARM. The three crescents together are expected to hold the image of gently embracing and supporting people and water all over the world in mutual cooperation with one another.

3. Main activities

Based on the mission and guiding principles, ICHARM has been promoting capacity development and developing advanced technology. The centre also emphasises local practice by taking advantage of an information network crafted between the centre and participants through ICHARM training programs. The following lists individual activities with brief explanations.

3-1　Capacity Development for Organizational Empowerment

To cope with major water-related disasters like floods, it is important to empower

not only individuals but also organizations involved in disaster management. For that reason, ICHARM provides training programs that help improve both individual problem-solving capacity and organizational coping capacity in disaster management (Table 1).

(1) Short-term training program: Participants learn knowledge and technologies related to water-related disaster risk management for a period of several days or weeks. Participants come from the government organizations related weather /disaster management from various countries. "Capacity Development for Flood Risk Management with IFAS" has been provided since FY2012, and the total number of participants reached 160 from 19 countries in July 2013.

(2) M.Sc. program: This one-year M.Sc. program, named "Water-related Disaster Management Course of Disaster Management Policy Program," has been organized since 2007 in cooperation with JICA and GRIPS. The program is mainly designed for administrators in flood management in developing countries. Students attend lectures, practices and field trips in the first half of the program and work on a Master's thesis in the latter half. As of September 2013, a total of 72 students had graduated with a master's degree in disaster management.

(3) Ph.D. program: The three-year Ph.D. program, "Disaster Management Program," has been organized since 2010 in collaboration with GRIPS. As of July 2013, five students from Japan, the Netherlands, Nepal, Bangladesh and Guatemala are working towards their Ph.D. through this program. On September 2013, we had first Ph. D graduate.

(4) Follow-up activities: Post-training seminars and other workshops and meetings are organized to support ex-trainees' activities in their respective countries. During these meetings information is collected on local needs for training and research. Such meetings have been held in Kuala Lumpur (Malaysia), Guangzhou (China), Manila (the Philippines), Bangkok (Thailand), Hanoi (Vietnam), and Dhaka (Bangladesh). Ex-trainees receive ICHARM newsletters to maintain an information network between the centre and trainees.

Table 1. Number of past and current participants by country in ICHARM's domestic training programs (as of August 2013)

Country	Bangladesh	Bhutan	Cambodia	China	Colombia	El Salvador	Ethiopia	Fiji	Guatemala	India	Indonesia	Japan	Kenya	Laos	Malaysia	Maldives	Myanmar	Nepal	Netherland	Nigeria	Pakistan	Philippines	Republic of Albania	Serbia	Sri Lanka	Tajikistan	Thailand	Tunisia	Venezuela	Vietnam	Total
Total	25	5	9	21	2	1	3	1	2	3	29	5	7	15	13	2	7	10	1	5	22	20	1	1	13	3	20	1	2	20	269

Photo 1. M.Sc. of 2012-2013 and Ph.D of 2010-2013 before the graduation ceremony (September 2013)

3-2 Development and Dissemination of IFAS

The Integrated Flood Analysis System (IFAS) is designed to facilitate runoff analysis using topographic and land-use data which cover almost the entire globe and are available free of charge via the Internet. With IFAS, users can conduct a series of tasks necessary for runoff analysis, including data acquisition, model creation, rainfall-runoff analysis and result display. With an additional module named Auto-IFAS, the system is capable of executing automatic functions such as downloading satellite rainfall information, loading ground rainfall information, performing runoff calculation, issuing warnings, etc. With these automatic functions, users can build a real-time flood forecasting and warning system with minimal functions. IFAS in combination with the additional module is especially

useful in areas with limited Internet access. It can perform calculations while collecting data regularly according to a predetermined time schedule. In this way, the network and computer can avoid being overloaded with information processing, which enables fast runoff calculation and quick flood forecasting and warnings. IFAS training workshops have been held both at ICHARM and abroad since 2007, with participants totaling 732 from 43 countries as of March 2013.

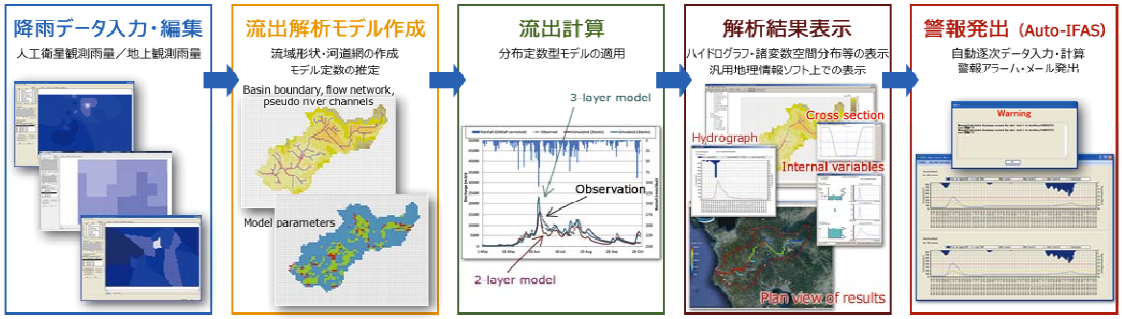

Figure 1　Procedure of IFAS

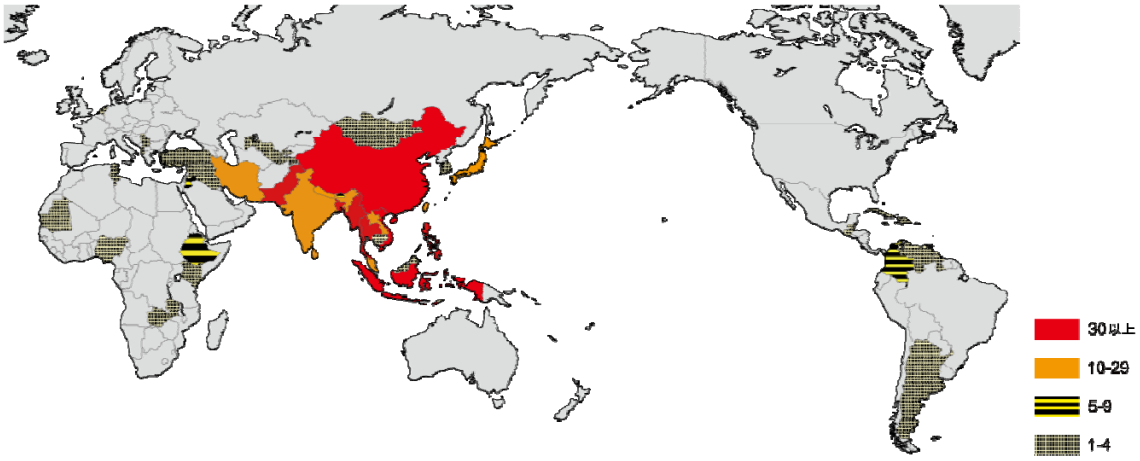

Figure 2　Total number of participants by country involved in IFAS and other capacity development programs

3-3　Rainfall-Runoff-Inundation (RRI) Model

Conventional flood prediction models, which mainly focus on rainfall-runoff

processes in mountainous areas, have difficulties in simulating floods on low-lying areas with large-scale inundations, such as the 2010 Pakistan and 2011 Thailand floods. In addition, although it is important to quickly simulate a large-scale behaviour of floodwaters in global-scale flood risk assessment and large-scale flood prediction, conventional models are only capable of predicting river discharge, and not capable of quickly estimating inundation depth and extent from rainfall information. To overcome this weakness, ICHARM has been developing a new numerical model called the Rainfall-Runoff-Inundation (RRI) model. The model simulates various hydrologic processes including rainfall-runoff, stream-flow propagation, and inundation over floodplains in an integrated manner. Using the RRI model, we can assess future flood risks for different regions under different climatic conditions, including predicted climate-change conditions.

In mid-October 2011, when the Thailand flood was approaching peak levels in its lower basin, ICHARM conducted an emergency response-type flood prediction using the RRI model. Predictions based on satellite topographic and rainfall information suggested the possibility of prolonged flooding in the country. This information was disseminated through various media to alert the public. The model was evaluated and validated through post-flood analysis and field investigation. ICHARM has continued improving the model for use in flood risk assessment by testing model performance over long-term continuous simulation considering evapotranspiration.

3-4 Water-related Disaster Mitigation Project with ADB

In June 2008, ICHARM was officially acknowledged as a Knowledge Hub with particular focus on disaster risk reduction and flood management. As a Knowledge Hub, ICHARM is expected to promote local application of high value-added know-how and research results in order to realize water security in the Asian-Pacific region under the framework of the Asia-Pacific Water Forum (APWF).

As a Knowledge Hub, ICHARM conducted a technical assistance project, “Capacity Development Technical Assistance for Supporting Investments in Water-Related Disaster Management (TA7276-REG),” with the Asian Development Bank (ADB) for three years and four months from November 2009 to March 2013. The project, implemented in Bangladesh, Indonesia, the lower Mekong area (in Cambodia), and the Philippines, comprises country-specific activities and regional standard

activities. In Indonesia, an IFAS-based flood forecasting and warning system was put in operation over the Solo River basin. Workshops were also organized for future model development and system maintenance and management. Moreover, training for better disaster management was provided by demonstrating community disaster mitigation efforts by effective use of forecasting and warning information. In Bangladesh, a proposal for an improved flood forecasting and early warning system was made through discussions with local associations. In the lower Mekong area, flood vulnerability indices were developed, and training was held about the indices and their use. IFAS was also introduced in the Pampanga and Cagayan Rivers in the Philippines, and flood control training with IFAS was organized to practice identifying causes of past flood cases. Additionally, a prototype of flood risk indices was developed to mitigate flood damage.

On March 12, 2013, Taketo Uomoto, the chief executive of the Public Works Research Institute, and Kuniyoshi Takeuchi, the director of ICHARM, visited the ADB headquarters to hand in the final report to Seethapathy Chander, the director general of the ADB Regional and Sustainable Development Department (RSDD) (Photo 2). At the meeting, ADB officials thanked and highly praised ICHARM for the project outcomes and expressed their hope for ICHARM's involvement in future projects.

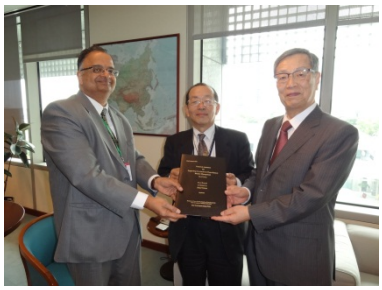

Photo 2　PWRI Chief Executive Taketo Uomoto (center) and ICHARM Director Kuniyoshi Takeuchi (right) hand over the final project report to ADB-RSDD Director General Seethapathy Chander (March 12, 2013).

3-5　UNESCO Pakistan Project

In late July 2010, the monsoon brought a record rainfall over northern Pakistan and caused the worst flood in the past 80 years. As a part of the restoration effort from this flood disaster, UNESCO launched a project called "Strategic Strengthening of Flood Warning and Management Capacity of Pakistan" in July 2011. This comprehensive project consists of three components, and ICHARM has

since been assigned to two of these components: technical assistance and capacity development. In the first component, ICHARM has assisted Pakistan in the development and implementation of "Indus-IFAS" and the production of flood hazard maps. Indus-IFAS is specifically designed to fit the conditions and needs of the Indus River basin by combining IFAS and the RRI model (Figure 3). In the second component, ICHARM has provided the opportunity to participate in its M.Sc. program and short-term training programs for government administrators.

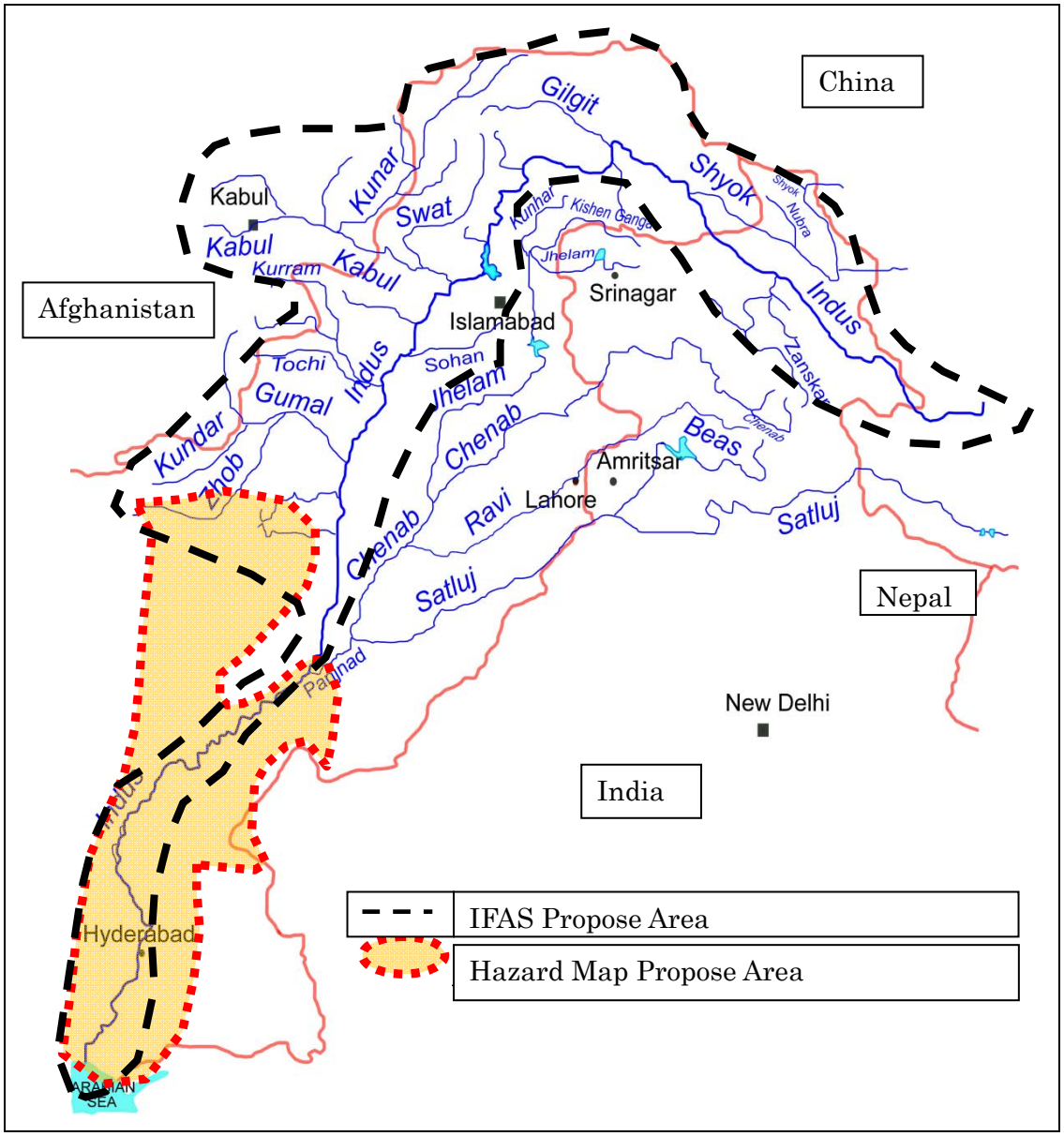

Figure 3 Hazard mapping area and Indus-IFAS coverage
The Indus-IFAS coverage is enclosed in the black dotted line.
The hazard mapping area is enclosed in the red dotted line.

Photo 3　Pakistani officials (front row) at the opening ceremony (May 2013)

In May 2013, the short-term workshop was held for the second time, inviting high-ranking government officials of Pakistan as participants (Photo 3). Participants were particularly impressed with river management in Japan, for instance, how steadily plans are put into action. They also commented that retarding basins like the one they saw at Watarase should be effective for flood control in the Indus River basin. Furthermore, they seemed inspired by the fact that the Arakawa diversion channel has been playing a very important part in Tokyo's development. Some of them also showed a strong interest in sabo structures at Nikko and the CCTV system implemented in the Kanto Bureau's service area. Back in Pakistan, they are expected to develop visions and plan concrete measures for future river management, and they found the workshop very useful for such planning.

In June 2013, Indus-IFAS, a prototype version of the flood forecasting and warning system for the Indus River, was introduced to the Flood Forecasting and Warning Section of the Pakistan Meteorological Department. Test runs of the system during the 2013 monsoon season have started by the section staff, especially by key members who had graduated from the master's degree program at ICHARM. Indus-IFAS comprises two types of forecasting models: IFAS and the Rainfall-Runoff-Inundation (RRI) model. The first model is applied to mountainous areas with steep slopes for fast calculation, and the second model mainly to the lower and middle river basin including low-lying areas for considering the impact of inundation. This innovative system has been realized by coupling these two models to utilize their unique strengths for flood warning and forecasting.

3-6 *Sosei* Project (Contribution to two major projects led by Japan's Education Ministry)

ICHARM has been part of a new research project, "Program for Generation of Climate Change Risk Information (*Sosei* Project)." Using climate forecasting data of the fifth-generation CMIP, ICHARM has been working on the development of a method to quantitatively project changes in flood and drought risks due to global warming on a global basis as well as for five river basins in Asia in consideration of projection uncertainties. Socio-economic impacts likely to be caused by such risk changes will also be examined as part of the project.

In the Innovative Program of Climate Change Projection for the 21st Century (*Kakushin* Project), conducted during FY2007-2011 prior to the *Sosei* Project, ICHARM focused on flood disaster risk simulated under climate change by using high-resolution GCMs (MRI-AGCM3.1S and 3.2S, 20km×20km) and assessed flood discharge, inundation area and changes in flood risk by coupling a simple bias correction method and the BTOP model, which is a distributed hydrological simulation model. In this previous project, ICHARM also proposed a method for estimating changes in household and agricultural damage in the lower Mekong River basin and West Rapti River basin of Nepal.

3-7 From Flood Analysis to Risk Assessment

Risk assessment is generally conducted through a series of analyses on possible hazards, vulnerability to and countermeasures for the hazards*. ICHARM carries out risk assessment, based on one of the most important institute principles: localism. We start the process with thorough local investigation in each target basin to understand its physical, social and economic conditions, while also using advanced hydrological and hydraulic modelling technology. We then assess the impact of socioeconomic risk on a basin and propose effective coping measures for such risk.

*Source: 2009 UNISDR Terminology on Disaster Risk Reduction

3-8　Other Research Projects

(1) Basin-scale water/material cycle model (WEP model)

The Water and Energy Transfer Processes (WEP) model was originally developed as a basin-scale water cycle model. Responding to the recent need for the management of nutrient load and runoff in closed water bodies, ICHARM has been further improving the WEP model into a basin-scale water/material cycle model by adding the function for simulating the behaviour of nitrogen and phosphorus in both dissolved and particulate forms.

(2) Automated measurement system for river discharge during flooding

ICHARM is developing and disseminating a next-generation discharge measurement system that ensures highly reliable measurements while requiring less labor and cost. The system under development is unique in that automated measurement using fixed current meters such as non-contact current meters (radio current meters) is combined with an acoustic Doppler current profiler (ADCP) for accuracy control. Through observational experiments, the system has been proven applicable even to severe flow regimes, typically seen in Japanese steep rivers. We are further exploring methods to observe river bed fluctuations by use of this advanced automated system.

3-9　The 5th International Conference on Flood Management (ICFM5)

ICHARM organized ICFM5 in Tokyo on 27-29 September 2011. More than 450 people from 41 countries participated. Under its main theme, “Floods: From Risk To Opportunity,” the participants had productive discussions on five topic areas including flood risk management. The conference finally adopted the ICFM5 declaration crafted based on the discussion results of each topic-area. ICFM6 is planned to be held in Brazil in 2014. Selected papers presented at the conference were published in the Red Book No.357 in May 2013. This publication collected 49 peer-reviewed papers and sorted them out in five chapters under the main theme of ICFM5.

3-10. International Flood Initiative (IFI)

IFI is a framework to promote collaboration in flood management among international organizations such as UNESCO, WMO, UNU and UNISDR. IFI focuses on research, information networking, education and training, community

empowerment, and technical assistance in various areas including integrated flood management. ICHARM is currently serving as its secretariat.

4. ICHARM as the most active category II center

ICHARM is highly recognized for its activities listed above by UNESCO, of which the center is under the auspices. For example, ICHARM was listed as the most active among category II centers in water issues in the external audit report published by UNESCO in August 2010 (paragraph 64, Part II, EX32, p.185). Moreover, in the 20th Inter-governmental Executive Board of the UNESCO International Hydrological Program (IHP) held in June 2012, ICHARM was also recognized as the most active category II center and also referred to as "Star Centre."

5. Conclusion

This report has outlined the activities of ICHARM. We incorporate technological innovation into research. We improve the new technologies through capacity development programs and other projects. We apply them to practical cases and get feedback for further research. In this upward spiral process, ICHARM will increase expertise in disaster risk reduction and flood control as a knowledge hub center, and devote itself to mitigation of water-related disasters worldwide. ICHARM is also seeking highly-motivated people to carry out the mission with us (those who are interested in joining us, contact at http://www.icharm.pwri.go.jp).

On July 23, 2013, the Ambassador of Japan to UNESCO, H.E. Mr. Isao Kiso, and the Director-General of UNESCO, Irina Bokova, signed an agreement for the renewal of ICHARM at the UNESCO Headquarters in Paris. The agreement, which entered into force upon their signatures, grants ICHARM the status of an international centre under the auspices of UNESCO (Category 2) for a second six-year term.

For the soft-copy and other information, Please refer under page.
http://whrm-kamoto.com/top.html