ICHARM Activity Report

FY2018-2019

For the 4th ICHARM Governing Board

On 2 June 2020

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

Contents

Abbreviation

ACECC	Asian Civil Engineering Coordinating Council
ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
ADCP	Acoustic Doppler Current Profiler
ADRC	Asian Disaster Reduction Center
AGRHYMET	AGRrometeorology, HYdrology, METeorology
AMSR2	Advanced Microwave Scanning Radiometer 2
AOGEO	Asia-Oceania Group on Earth Observations
AOP	Annual Operating Plan
APFM	Associated Programme on Flood Management
APWF	Asia-Pacific Water Forum
APWS	Asia-Pacific Water Summit
Area-BCM	Area- Business Continuity Management
ARIS	Agatown Risk Information System
ASEAN	Association of South-East Asian Nations
AWCI	Asian Water Cycle Initiative
BOSS	Bosai-Business Operation Support System
CECAR	Civil Engineering Conference in the Asian Region
CHy	Commission of Hydrology
CLVDAS	Couple Land and Vegetation Data Assimilation System
COIIS	Commission for Observation, Infrastructures and Information Systems
CSA	Commission for Weather, Climate, Water and Related Environmental Service Applications
DIAS	Data Integration and Analysis System
DSM	Digital Surface Model
DWIR	Directorate of Water Resources and Improvement of River Systems
EDITORIA	Earth Observation Data Integration and Fusion Research Initiative
ET	Evapotranspiration

FUNCEME	Fundação Cearense de Meteorologia e Recursos Hídricos
GCM	General Circulation Models
GCOM-W	Global Change Observation Mission – Water
GEOSS	Global Earth Observation System of Systems
GFDL	Geophysical Fluid Dynamics Laboratory Climate Model
GLDAS	Global Land Data Assimilation System
GRIPS	National Graduate Institute for Policy Studies
GSMaP	Global Satellite Mapping of Precipitation
GUI	Graphical User Interface
GWP	Global Water Partnership
HELP	High-level Experts and Leaders Panel on Water and Disasters
HMD	Head Mounted Display
HLPF	High Level Political Forum
HLPW	High Level Panel on Water
IAEA	International Atomic Energy Agency
IAHS	International Association of Hydrological Sciences
ICFM	International Conference on Flood Management
ICHARM	International Centre for Water Hazard and Risk Management
IDRIS	ICHARM Disaster Risk Information System
IFAS	Integrated Flood Analysis System
IFI	International Flood Initiative
iRIC	International River Interface Cooperative
IWS	Integrated Workshop
JAXA	Japan Aerospace Exploration Agency
JICA	Japan International Cooperation Agency
JMA	Japan Meteorological Agency
JST	Japan Science and Technology Agency
LAI	Leaf Area Index
LDAS-UT	Land Data Assimilation System of The University of Tokyo
MJIIT	Malaysia-Japan International Institute of Technology

MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MoC	Memorandum of Cooperation
MOFA	Ministry of Foreign Affairs
MoU	Memorandum of Understanding
MRI-AGCM	Meteorological Research Institute - Atmospheric General Circulation Model
NBA	Niger River Basin Authority
NBRO	National Building Research Organization
NILIM	National Institute for Land and Infrastructure Management
NCEP	National Centers for Environmental Prediction
NEDM	Northeast Drought Monitor
NGO	Non-Governmental Organization
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PF	Particle Filter
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
RCA	Regional Cooperative Agreement
RRI	Rainfall-Runoff-Inundation
RSC-AP	Regional Steering Committee for Asia and the Pacific
RTC	Regional Training Course
SAR	Synthetic Aperture Radar
SATREPS	Science and Technology Research Partnership for Sustainable Development
SBP	Support Base Partner
SDGs	Sustainable Development Goals
SIMRIW	Simulation Model for Rice-Weather Relationships
SIP	Cross-ministerial Strategic Innovation Promotion Program
SNS	Social Networking Service
SPADE	Spatial Data Analysis Explorer

TC	UNESCAP/WMO Typhoon Committee
TOUGOU	Integrated Research Program for Advancing Climate Models
UCCR	Urban Climate Change Resilience
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
UNISDR	United Nations International Strategy for Disaster Reduction
UTM	Universiti Teknologi Malaysia
VBA	Volta Basin Authority
VR	Virtual Reality
WADiRe-Africa	Water Disaster Platform to Enhance Climate Resilience in Africa
WBF	World BOSAI Forum
WEB-DHM	Water and Energy Budget-based Distributed Hydrological Model
WEB-DHM-S	Water and Energy Budget-based Distributed Hydrological Model-Snow
WEB-RRI	Water and Energy Balance-based Rainfall Runoff Inundation
WGDRR	Working Group on Disaster Risk Reduction
WGH	Working Group on Hydrology
WGM	Working Group on Meteorology
WMO	World Meteorological Organization
WRF model	Weather Research and Forecasting model
WWAP	World Water Assessment Programme
WWDR	World Water Development Report
WWF	World Water Forum
Web-GIS	Web Geographic Information System
X Band MP Radar	X-band polarimetric Multi Parameter Radar
YTU	Yangon Technological University

1. Introduction

1.1 Research

1.1.1 Water-related disaster data archiving, sharing, and statistics

ICHARM developed a real-time flood forecasting system for the Pampanga River basin on the Data Integration and Analysis System (DIAS) in collaboration with the Earth Observation Data Integration and Fusion Research Initiative (EDITORIA), managed by the University of Tokyo, and started to provide flood forecasting information to related organizations in the Philippines. ICHARM also developed the prototype system to upload the socio-economic, damage, and hazard datasets of Davao City onto DIAS in collaboration with EDITORIA. This system has a function to archive data with related meta-information such as their element, domain, period, spatial resolution, unit, and data-producing organization.

1.1.2 Water risk assessment

ICHARM developed the Water and Energy Budget-based Rainfall-Runoff-Inundation (WEB-RRI) model to analyze water-related hazard phenomena with high accuracy by integrating the Hydro-SiB2 model capable of calculating the dynamics of the water and energy balance with the Rainfall-Runoff-Inundation (RRI) model capable of 2D runoff/inundation calculation. By using the new model in combination with atmospheric models, it has become possible to evaluate not only flood hazard impacts but also drought hazard impacts due to future climate changes. We developed another model that calculates driftwood behavior as the density of sediment using a water/sediment momentum equation. This model is suitable to reproduce typical flood and sediment hazard phenomena in mountain rivers. We have also been making efforts to disseminate these models by improving their user interfaces and offering training activities for users.

In addition, we built a model for predicting the dam reservoir inflow by utilizing a runoff model called the Water and Energy Budget-based Distributed Hydrological Model-snow (WEB-DHM-S), which estimates snowfall, snow cover and snowmelt quantitatively in combination with rainfall forecasting information from ensemble weather forecasting. We are studying the optimization of the current operation methodology for hydroelectric dams to reduce ineffective dam discharges, improve power generating efficiency during a flood, and secure the storage capacity of a dam reservoir after a flood.

1.1.3 Monitoring and forecasting water-related disaster risk changes

ICHARM proposed and applied a series of forecasting methods that can take the uncertainty of forecasting into account to three cities of Vietnam (Hue, Ha Giang, and Vinh Yen) in an ADB project on climate-change impact evaluation. In this study, four GCMs were

selected for their high expressiveness for meteorological factors; the uncertainty originating in GCMs concerning future prediction were evaluated by applying statistical downscaling (DS); future climate scenarios were created using dynamic DS; and flood risk evaluation was conducted using the RRI model.

1.1.4 Support through proposal, evaluation and application of policies for water disaster risk reduction

In the World Bank Brazil project, ICHARM developed a real-time agriculture drought monitoring and seasonal prediction system for Ceará State in the Brazilian Northeast. By using a Leaf Area Index (LAI), which is output from this system, a method was also devised to estimate crop yield and the required volume of irrigation water. Furthermore, ICHARM developed a high spatial-resolution system (1km grid) to estimate LAI growth for the Banabuiú River basin, the most important basin in Ceará State. In addition, considering that researchers familiar with local conditions should improve the system after learning its basic theory, two researchers of the Northeast States Meteorology and Water Resources Foundation (FUNCEME), which is responsible for the meteorological drought monitoring and prediction, were invited and received training at ICHARM.

Japan has many small and medium river basins. Since the water level during a flood rises sharply in those rivers, riverside areas are exposed to a high flood risk with many residents at a high risk of failing to evacuate safely. To address this problem, ICHARM developed an inexpensive, simple technology for water-level prediction in the Public/Private R&D Investment Strategic Expansion Program (PRISM), established by the Cabinet Office in FY2018, in cooperation with local offices of MLIT. The system is designed to use real-time water-level data collected from water gauges which have recently been installed in many rivers specifically for emergency use during a flood.

In West Africa, flood disasters often occur in the Niger and Volta River basins, causing deaths and hindering the development of the countries in the region. Hence, UNESCO decided to develop flood monitoring and prediction systems over those basins and their surrounding areas in an effort to reduce human damage using flood information provided by the systems. After concluding a partnership agreement with UNESCO in the framework of the Water Disaster Platform to Enhance Climate Resilience in Africa, ICHARM developed a flood early warning system for the Niger and Volta River basins to help reduce water disaster risks. Simultaneously, ICHARM invited engineers of AGRHYMET and VBA to Japan and provided training about the flood early warning system and flood risk management.

As the representative organization for disaster risk analysis and evaluation in the ongoing SATREPS project in Thailand, “Enhance regional resilience through visualization of disaster risks with industry, government and academia collaboration,” ICHARM has been developing

a flood inundation prediction model for the entire Chao Phraya River basin and the industrial centers in order to prepare detailed information on water disaster risks.

1.1.5 Technological support for strengthening the capabilities of local governments in water-related disaster management

ICHARM has been conducting research to assist local governments in strengthening their water-related disaster management capabilities. Our current research focuses on creating new flood risk indicators using inundation simulation results by the RRI model and finding ways to improve flood risk information sharing to assist local governments in mountainous areas facing the lack of disaster information for the safe evacuation of residents. We also developed a new portal site for disaster information sharing that allows one-stop viewing of water-related disaster information, and opened it for the public as test operation not only for emergency use but also for improving the abilities of local governments and residents in disaster prevention and mitigation in normal times.

In addition, we conducted questionnaire surveys from a perspective of behavioral economics for residents living in areas affected by disasters in recent years. Based on the findings that a flood experience leads residents to take appropriate actions such as early evacuation, we developed simple simulation software using virtual reality (VR) technology for people to experience simulated inundation in a private house.

We have also been studying new indicators to evaluate the aspects of disaster cases that have not been evaluated adequately by existing methods. For example, we have conducted on-site interviews and questionnaire surveys to identify indicators that can be used to evaluate the resilience of residents and businesses in particular and the resilience of communities affected by water-related disasters in general.

Furthermore, to assist local governments in improving its capacity to use a disaster response timeline effectively, we studied disaster reports reviewing disaster response efforts in past water-related disasters and analyzed issues to be overcome for strengthening the capacity of administrative staff to take timely actions in time of a disaster.

1.2 Education and training

ICHARM has provided educational and training programs that are designed to strengthen the capabilities of both individuals and organizations in disaster management.

The main programs include: 1. One-year master's degree program, "Water-related Risk Management Course of Disaster Management Policy Program," conducted in collaboration with GRIPS and JICA; 2. Three-year doctoral degree program, “Disaster Management Program” jointly conducted with GRIPS; 3. Short-term training programs held in Japan and overseas; 4. Follow-up Seminar held annually overseas for graduates and trainees; and 5. Short- and

long-term internship programs.

From 2018 to 2019, while continuing to provide these training programs, ICHARM stepped up the efforts to recruit quality candidates who are expected to be responsible for policy development and implementation in the future in respective countries.

In 2018, JICA started a new scholarship program, “Disaster Risk Reduction Leaders Capacity Development for the Sendai Framework Implementation,” for international doctoral students. Since FY2018, two students have been enrolled, using the JICA scholarship. The program will continue to accept new students.

1.3 Information networking

ICHARM continues promoting information networking on a global scale. As a UNESCO category 2 center, it keeps close ties with each UNESCO-IHP and its National Committee, other UNESCO category 2 centers, and UNESCO Chairs. It also maintains cooperative relations with UN organizations such as WMO and UNDRR, and other international and regional organizations such as HELP and the Typhoon Committee (TC).

As the secretariat of IFI, ICHARM is promoting the global effort to establish Platforms on Water Resilience and Disasters based on the Jakarta Statement, which was adopted by the member organizations as the basic action plan of IFI after the elaborations at the October 2016 workshop in Jakarta, Indonesia, and the January 2017 workshop in Tokyo, Japan. ICHARM has been supporting the establishment of Platforms on Water Resilience and Disasters in the Philippines, Myanmar, Pakistan and Sri Lanka. ICHARM has also started providing support for Indonesia.

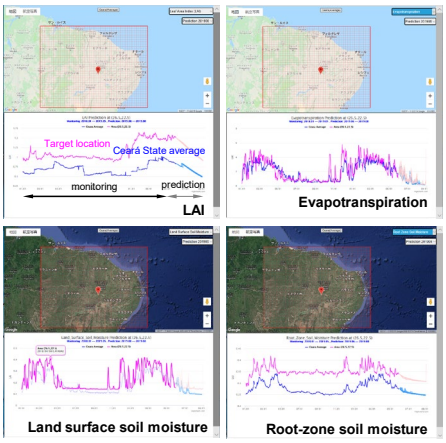
At the Global Earth Observation System of Systems (GEOSS) Asia-Pacific Symposium and other similar conferences, ICHARM has held the Asian Water Cycle Initiative (AWCI) sessions and invited representatives from the Platform implementing organizations of those countries every year since 2017. In the past meetings, they reported the progress of their Platform projects and discussed how to establish a regional cooperative framework among the participating countries.

During the 2018-2019 period, important international conferences were convened around the world, such as the 8th World Water Forum, the intergovernmental council meeting of UNESCO-IHP, and the 4th UN Special Thematic Session on Water and Disasters. ICHARM participated in those conferences and hosted sessions and side events, which strengthened the relationships with other participants and organizations and expanded the professional and organizational network. Currently, a chief researcher of ICHARM assumes the chair of the Working Group of Hydrology (WGH) in TC, which is an intergovernmental community jointly organized by UNESCAP and WMO. ICHARM is playing the leading role in the implementation of the Annual Operating Plans (AOPs) in collaboration with the TC members.

2． Special topics

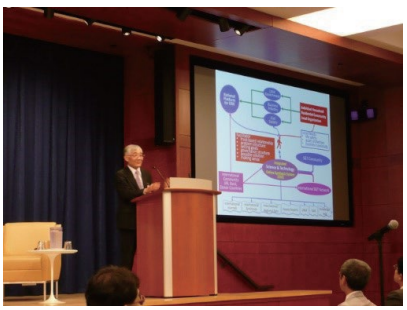
2.1 Development of a real-time agriculture drought monitoring and seasonal prediction system

In the World Bank Brazil project (Technical Assistance in Implementing a Pilot of Agriculture Drought Monitoring and Prediction), DIAS collects and integrates three types of data in real time: the NASA Global Land Data Assimilation System (GLDAS) meteorological global forcing data, the GCOM-W/AMSR2 microwave brightness temperature global data, and the Geophysical Fluid Dynamics Laboratory Climate Model version 2.5 (GFDL) seasonal predictive global precipitation data. By inputting these data into a land surface model, the Coupled Land and Vegetation Data Assimilation System (CLVDAS) can calculate the land water cycle and the dynamic vegetation growth. Then, applying CLVDAS to the Brazilian Northeast, ICHARM developed a DIAS 25km-gridded real-time agriculture drought monitoring and seasonal prediction system for Ceará State in the Brazilian Northeast. The Banabuiú River basin was selected as the target area because the basin is a highly important area in meteorology, hydrology, and agriculture. We also developed the high-spatial-resolution (1km grid) WEB-DHM for this river basin and were provided a crop database of Ceará State by FUNCEME (the Northeast Drought Monitor: NEDM, monitordesecas.ana.gov.br). Using this database and the LAI output from the real-time agriculture drought monitoring and seasonal prediction system developed for Ceará State, we devised a method to estimate crop yield and the required volume of irrigation water and applied the method in order to estimate the 1km-gridded LAI growth for the Banabuiú River basin.



DIAS 25km-gridded real-time agriculture drought monitoring and seasonal prediction system in the Brazilian Northeast
(UL：LAI, UR：Evapotranspiration,
LL：Land surface soil moisture content,
LR：Root-zone soil moisture content)

ICHARM attended two meetings related to this project in Washington, D.C; the Japan-World Bank Seminar on Water and Disasters on June 26, 2019 and the Japan-World Bank Deep Dive into Agricultural



Japan-World Bank Seminar on water and disasters

Drought meeting on June 27, 2019. ICHARM presented not only the achievements of this project but also the past achievements and the latest information regarding similar projects in Africa. The meetings were excellent opportunities for ICHARM to share its activities and achievements with the World Bank.

2.2 Study on Flood Awareness by Flood Simulated Experience using Virtual Reality

In recent years, floods have recurred frequently, causing significant damage. In particular, many human casualties have resulted due to delays in evacuation. One of the causes that people fail to evacuate timely is their low awareness towards floods; people tend to think that a disaster will not occur to themselves.

To solve this problem, we developed a "Flood Simulation Experience Application," which enables the user to have a realistic flood experience by using VR technology, whose progress has been remarkable in recent years. This application is expected to help people increase awareness towards floods and thus to promote effective and efficient disaster prevention and mitigation activities by residents and other stakeholders involved in disaster prevention,

To verify whether the application raise flood awareness of the residents who have never seen or experienced a flood disaster before and motivate them to take action in time of flooding, we conducted a questionnaire survey for 111 general visitors who tried out the application at an open house event jointly held by NILIM and PWRI on April 19, 2019.

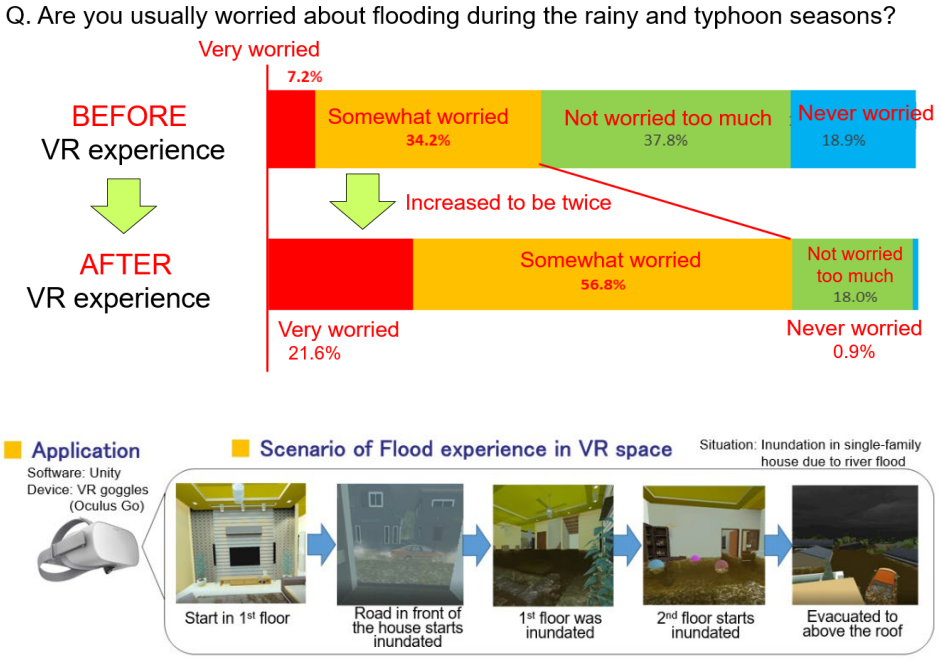
The survey found that the virtual flood experience gave a strong sense of fear to some people who had never experienced a flood before. In addition, for more than half of the participants, even though it was a virtual flood, the experience increased the level of concern about flood disasters. Those who felt fear more intensely during a simulation were more motivated to look at hazard maps.

Overall, the results confirmed that the application helped increase public awareness towards floods and suggested that VR-driven flood experience can contribute to raising public awareness of disaster prevention and increase their motivation to take action for safer evacuation.

We are planning to modify the VR application to realize area-specific flood simulation for different communities.

In addition, we conducted a poster presentation at the World BOSAI Forum in Sendai, Japan, in November 2019 and provided an opportunity for visitors to have a VR flood experience.

Flood simulation experience by VR



2.3 Research Group on River Basin Design with Sediment Transport Processes

Flood hazards take place often in mountainous areas, and they are characterized by flooding with a huge amount of sediment and driftwood, which are produced in numerous landslides and debris flows owing to severe rainfalls. Sediment and driftwood carried by flood flows worsen damage by causing river channel variation and closure. Predictions indicate that the intensity of rainfall is likely to increase temporally and spatially due to climatic change and thus that such flood hazards may occur more frequently. To address this type of flood hazards with runoffs of sediment and driftwood, tools for river channel design should be developed. Focusing on such circumstances, ICHARM formed a research group with domestic researchers in this area and held the first research meeting on January 25 and 30 and the second research meeting on May 25 and 28 in 2018. The participants discussed the results obtained by each researcher and clarified the applicability and issues of existing tools and methods that may be useful to simulate and evaluate floods with sediment and driftwood.

Concurrently, the committee on hydro-science and hydraulic engineering held a workshop on September 11, 2018, to discuss and summarize research findings and their applicability and set a direction for future research regarding debris flows, river bed variation due to sediment runoff, and rainfall events caused by climatic change. The workshop consisted of researchers' reports and panel discussions. The following topics were chosen for the report session:

- Actual conditions and technological issues derived from flood and sediment-related disasters resulting from the Northern Kyusyu Severe Rainfall in July 2018 (Dr. AKIYAMA Juichiro, professor emeritus, Kyushu Institute of Technology)
- River planning and management in view of sediment runoff from mountains (Dr.

FUJITA Masaharu, professor, Kyoto University)

- Evaluation of debris-flow behavior and sediment-driftwood runoff (Dr. TAKEBATASHI Hiroshi, associate professor, Kyoto University)
- Scaling of target phenomena and associated modelling, and a simple numerical method for evaluating three-dimensional open channel flows (Dr. UCHIDA Tatsuhiko, associate professor, Hiroshima University)
- Prediction of sediment transportation and channel changes (Dr. SHIMIZU Yasuyuki, professor, Hokkaido University)
- Change of the severe rainfall pattern resulting from climatic change (Dr. YAMADA Tomohito, associate professor, Hokkaido University)
- Unified method for evaluating flood flows with sediment transportation and channel changes (Dr. EGASHIRA Shinji, research and training advisor, ICHARM)

In the panel discussion, moderated by Prof. KOIKE Toshio, the director of ICHARM, the participants discussed the conditions of severe rainfall and corresponding flood and sediment-related hazards, qualitative resolutions of hazard prediction and evaluation methods, and a suitable research system. The discussion confirmed that analyses and predictions of rainfall occurrences and characteristics suggest that severe rainfall tends to increase its frequency and areal locality. In fact, the occurrence of sediment-related flood hazards has been increasing in local areas as experienced in the Hokkaido-Tohoku severe rainfall event in 2017 and the Northern Kyushu severe rainfall event in 2018. In these events, the river channels clogged and changed drastically owing to supplies of sediment and driftwood, which worsened damage severely. The panel proposed developing methods for river channel design as well as for the delineation of hazardous areas in order to prepare for such hazards. In response to this proposal, the panel discussed, together with the attendees, the current state of the existing models for evaluating landslides and debris flows and their runoff processes involving driftwood, as well as the relation of resolutions and objectives in their predictions, and finally proposed methods to treat these sediment processes occurring at different scales of basin, slope, stream, and reach. A numerical model to evaluate local flows in steep open channels was also proposed, which is useful for designing hydraulic structures.

In addition, the participants discussed issues arising in applying the methods to actual cases, as well as how the research system should be organized and how research findings should be implemented in society. Although a flood flow, for instance, can be evaluated at the reach scale using the depth-averaged Reynolds equation and corresponding sediment-transport and driftwood models, the computed results depend largely on the upstream conditions employed for sediment and driftwood supplies. To specify their boundary conditions reasonably, evaluations need to be done on the spatiotemporal transport processes of sediment and driftwood resulting from landslides and debris flows. Thus, to understand such compound

phenomena, collaboration with associated research fields is essential. The panel proposed coordinating a collaborative research system in which hydraulic engineering and erosion control engineering will play the leading role while cooperating with meteorology, forestry, geology, geography, and geotechnical engineering. It also proposed facilitating educational interactions among individuals in different areas of research and stressed that close cooperation between the river and Sabo research groups is indispensable to implement ideas in society.

2.4 New Ph.D. Training for "Water and Disaster" Policy Leaders in Collaboration with GRIPS

In 2015, the international community agreed on the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals, and the Paris Agreement. In December 2016, the UN General Assembly adopted the Decade of Water for Sustainable Development. These processes have led to the development of a framework for creating a society that can reduce the risk of water disasters and achieve sustainable development under climate change.

In 2010, ICHARM opened a doctoral program, "Disaster Management Program," in collaboration with GRIPS, aiming to produce experts who can plan and practice disaster prevention and mitigation at a national level and can play a leading role in producing more experts in the field. As of September 2019, the program has graduated nine students with a doctoral degree.

In addition to these achievements, ICHARM and GRIPS jointly planned and created a new doctoral program, aiming to foster specialists with expertise in disaster prevention and mitigation and policy development and implementation, capabilities to create social value, and the leadership in planning and executing policies.

At the same time, JICA launched a new scholarship program, "Disaster Risk Reduction Leaders Capacity Development for the Sendai Framework Implementation," to support international students in this new doctoral program.

The new doctoral program is targeted at executive candidates of government agencies responsible for disaster management in 11 Asian countries (the Philippines, Vietnam, Indonesia, Myanmar, Fiji, Sri Lanka, Mongolia, Nepal, Bangladesh, Pakistan, Iran), which are characterized by high natural disaster risks and for which JICA has been providing continuous assistance in disaster prevention.

Since the program shares the fundamental concept with the Disaster Management Program, i.e., the original doctoral course ICHARM jointly offers with GRIPS, the new program has been carried out using the framework of the original course. Since FY2018, two students have been enrolled, using the JICA scholarship. The program will continue to accept new students.

2.5 Key activities of IFI

IFI is a worldwide framework to promote collaboration in flood management among

international organizations such as UNESCO, WMO and UNDRR. ICHARM has been serving as the secretariat since its establishment. In October 2016, the Jakarta Statement was adopted by the member organizations to establish an interdisciplinary and transdisciplinary partnership for consolidating flood risk reduction and sustainable development. Based on the statement, ICHARM is promoting activities to contribute to integrated flood management in collaboration with the relevant organizations of the participating countries.

As part of this effort, the Philippines, Sri Lanka, Pakistan, and Myanmar have already decided to establish a Platform on Water Resilience and Disasters involving various government agencies, and ICHARM has been supporting their decision as a facilitator. Further, ICHARM has started assisting Indonesia in the establishment of a Platform.

At the GEOSS Asia-Pacific Symposium and other conferences, ICHARM has held AWCI sessions, inviting representatives from the organizations of the Platform implementing countries every year since 2017. In these sessions, they reported the progress of their Platform projects and discussed how to promote a regional cooperative framework among the participating countries.

In April 2016, the United Nations and the World Bank Group created the High-Level Panel on Water (HLPW), which consisted of 11 sitting heads of states and governments and one special adviser. The panel was set to provide the leadership required to champion a comprehensive, inclusive and collaborative way of developing and managing water resources and improving water and sanitation-related services. On March 14, 2018, the HLPW mandate ended with the release of an outcome document, in which HLPW endorsed IFI's initiative on Platforms, saying: "Platforms on Water Resilience and Disasters among all stakeholders should be formulated in countries to facilitate dialogue and scale up community-based practices."

Participants in the AWCI session during the 11th GEOSS Asia-Pacific Symposium

2.6 Special lecture by Mr. Koïchiro Matsuura, the 8th Director-General of UNESCO

ICHARM organized a special lecture by inviting Mr. Koïchiro Matsuura, the eighth Director-General of UNESCO, as a Research and Development (R&D) Seminar on January 16, 2019. After becoming the first Asian who assumed the top position of UNESCO, Mr. Matsuura led the organization for 11 years from November 1999 to November 2009. During his tenure, he

carried out so many projects, including the establishment of ICHARM as a UNESCO category 2 centre in March 2006.

In the lecture, he spoke about the current global situation under the title of “Global trend and Japan.” Dividing the post-WWII era into three phases – the Cold War, America as No.1 superpower, and China’s rise and global disorder, he explained how the recent surge of populism around the world became possible and how the power shift in Eastern Asia had evolved over time. Referring to the fierce competition between China and the U.S., he insisted that Japan should waste no time in meeting global expectations and playing a vital role in restoring global order.

The special lecture was very fruitful and successful. The ICHARM auditorium was packed to its full capacity of about 70 people. Many people, including master’s and doctoral students studying at ICHARM, listened to him intently and asked many questions after his lecture.

Mr. Matsuura answers a question from the audience.

Mr. Matsuura (front row, center) and the audience

３．Research

3.1 Water-related disaster data archiving, sharing and statistics

3.1.1 Data integration and real-time flood forecasting system in the Philippines

The Pampanga River in the Republic of the Philippines has the second largest drainage area in Luzon Island and flows into the northern part of Manila Bay. The Pampanga River basin often suffers serious damage from flood disasters due to typhoons, such as Ondoy in 2009 and Pedring in 2011, and monsoonal rainfall. Flood risk reduction and sustainable development are critical issues in the basin. In February 2019, ICHARM developed a real-time flood forecasting system for the Pampanga River basin on the DIAS in collaboration with the EDITORIA, managed by the University of Tokyo, and started to provide flood forecasting information to related organizations in the Philippines. Using 17 ground rain gauges of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), hourly rainfall data are collected and accumulated on DIAS in real time and automatically input into the RRI model developed by ICHARM.

ICHARM also developed the prototype system to upload the socio-economic, damage and hazard datasets of Davao City onto DIAS in collaboration with EDITORIA. This system has a function to archive data with meta-information such as their element, domain, period, spatial resolution, unit, and data-producing organization.

3.1.2 Prototype system development

ICHARM developed a prototype system for flood monitoring, forecasting, and early warning incorporating real-time data integration techniques for various platforms (ground rainfall, GSMaP and clouds (Himawari, and re-analysis data from global models), advance models (e.g. WEB-RRI, ensemble rainfall forecasting), and information technologies such as DIAS. The system is placed under test-operation from 2018 to now in Sri Lanka and information is shared with relevant organizations.

3.2 Risk assessment on water-related disasters

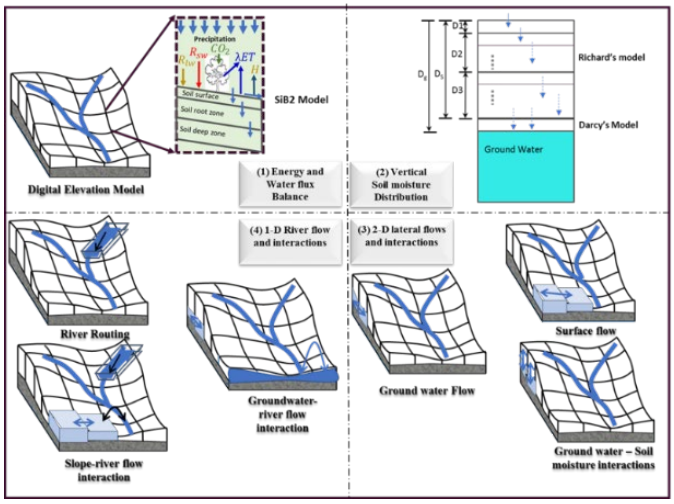
3.2.1 Development and dissemination of the Water and Energy Budget-based Rainfall Runoff Inundation

The proper risk evaluation of flood disasters requires an analytical model that can reproduce a flood event from runoff to flooding accurately. The RRI model developed some years ago has been used in various regions as a simple model for calculating runoff and inundation during a heavy rainfall event. On the other hand, because it is not designed to handle important hydrological factors, such as soil moisture, canopy interception, evapotranspiration, and soil-vegetation-atmosphere interaction, the model has been found not

applicable to the detailed analysis of flood and other water-related events in arid and semi-arid areas and not suitable for the accurate evaluation of the impact of global warming on hydrological phenomena.

ICHARM developed the WEB-RRI model to analyze water-related hazard phenomena with high accuracy by integrating the Hydro-SiB2 model capable of calculating dynamics of the water and energy balance with the RRI model capable of 2D runoff / inundation calculation. By using the new model in combination with atmospheric models, it has become possible to evaluate not only flood hazard impacts but also drought hazard impacts due to future climate changes. We developed another model that calculates driftwood behavior as the density of sediment using a water/sediment momentum equation. This model is suitable to reproduce typical flood and sediment hazard phenomena in mountain rivers. We have also been making efforts to disseminate these models by improving user interfaces and offering training activities for users.

In addition, we built a model for predicting the dam reservoir inflow utilizing a runoff model called the Water and Energy Budget-based Distributed Hydrological Model-snow (WEB-DHM-S), which estimates snowfall, snow cover and snowmelt quantitatively in

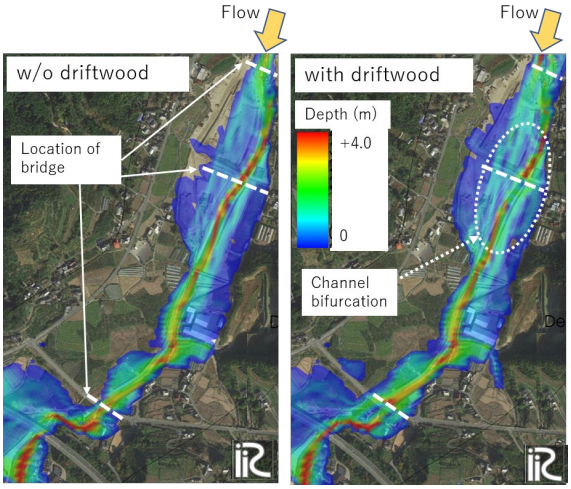


Schematic diagram of the WEB-RRI model based on the water and energy budget and four main modules: 1. Calculation of the water and energy budget between the atmosphere and the land surface in each model grid; 2. Vertical soil moisture distribution calculation; 3. Calculation of surface flow, flood flow and groundwater by 2D diffusion wave; and 4.Calculation of river flow by 1D diffusion wave.

combination with rainfall forecasting information from ensemble weather forecasting. We are studying the optimization of the current operation methodology for hydroelectric dams to reduce ineffective dam discharges, improve power generating efficiency during a flood, and secure the storage capacity of a dam reservoir after a flood.

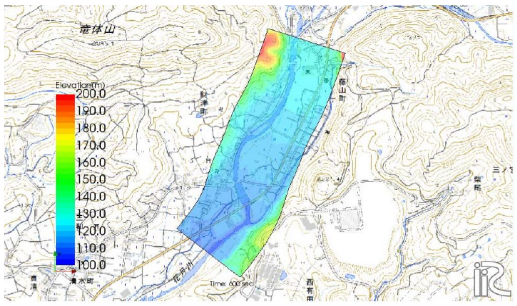
3.2.2 Development and implementation of a method to simulate the flood flow with sediment and driftwood

As part of technical assistance for the "Policy Vision on Rebuilding Flood-Conscious Societies," ICHARM developed a model to simulate the flood flow with sediment, which frequently takes place in both mountainous areas and boundary areas between mountains and floodplains. In this model, a method was proposed to analyze the behavior of driftwood in the flood flow using a convection-diffusion equation, which is useful to analyze driftwood transportation, erosion and deposition processes. Observations found that, in the flood disaster of the Akatani River in July 2017, a huge amount of fine sediment and driftwood from upstream affected the flood flow in downstream areas. Numerical simulations of the Akatani River event using the proposed method verified the method's high reproducibility regarding the event. The simulation results are expected to contribute to developing hazard maps in similar areas.



Simulation result of the flood flow with sediment and driftwood in the Akatani River

In addition, the proposed model has been added to the International River Interface Cooperative (iRIC) and improved its function so as to set calculation conditions and visualize calculation results more easily on the Graphical User Interface (GUI). iRIC is a system available on the web for researchers and municipalities to facilitate discussions on disaster prevention.

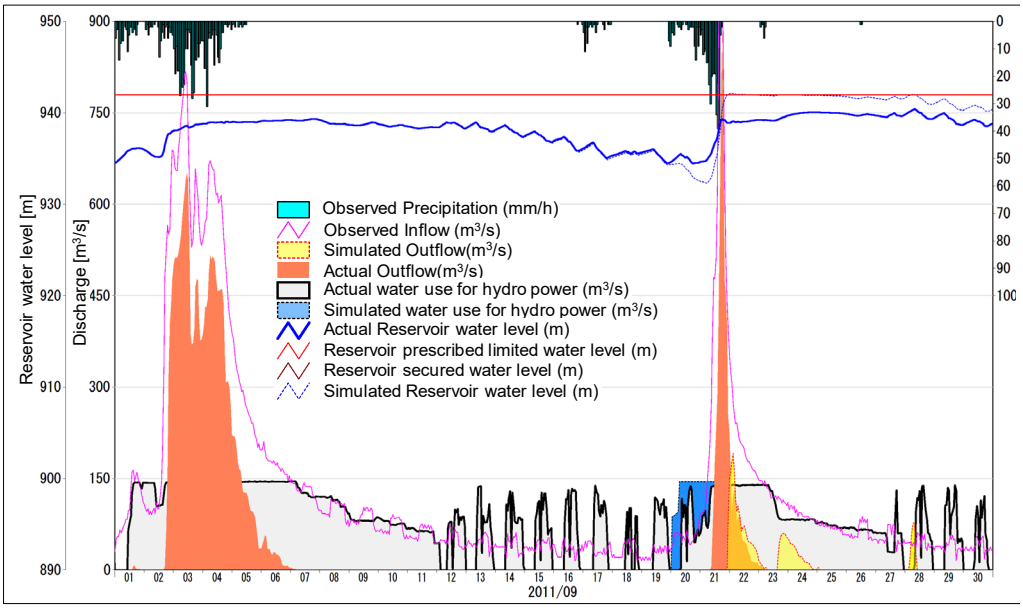


Application of the simulation model to the target river on iRIC GUI.

3.2.3 Research on an optimized dam operation method using precipitation forecasting data

Due to climate change, events of extreme and no rainfall are predicted to become even more severe in the future. It is thus necessary to increase the efficiency of water use and the effectiveness of flood control. For this reason, ICHARM developed a dam inflow prediction

system by integrating precipitation forecasting data estimated by an ensemble numerical weather forecasting model and the Water and Energy Budget-based Distributed Hydrological Model with Snow (WEB-DHM-S), which can estimate snowfall, snow cover and snowmelt. This system was applied to the electric power generation dams in the Oi and Sai river basins in Japan in a case study jointly conducted with electric power and consulting companies in which the dam inflow was estimated for several flood events in those basins and used to optimize the dam operations in order to reduce ineffective dam discharges, increase the efficiency of power generation, and secure the reservoir volume after a flood. This study showed the possibility that the system can contribute to maximizing the water use for electric power generation and flood control in the downstream areas of the study basins.



An example of using heavy rainfall predictions to increase the efficiency of power generation and decrease the flood peak by discharging the dam water before the heavy rainfall events.

3.3 Monitoring and forecasting water-related disaster risk changes

3.3.1 Evaluation of climate change impact

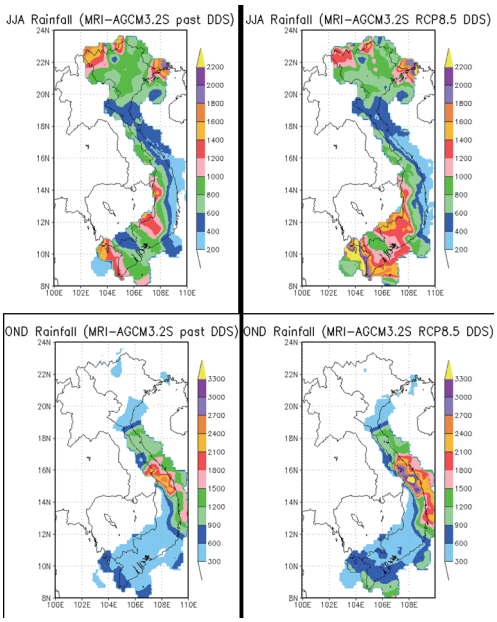
In June 2018, ICHARM submitted the final report of the ADB Study Project "Climate Change and Flood Hazard Simulations Tools for ADB Spatial Application Facility (SC 109094REG)." The main objective of the project was to evaluate future flood inundation risk due to climate change in the three cities of Vietnam: Hue, Ha Giang and Vinh Yen.

In this study project, four GCMs (CESM1 - CAM5, CNRM-CM5, GFDL-CM3, MPI-ESM-LR) were selected from CMIP5 for their high expressiveness for the following six meteorological factors in the target area: rainfall, upward longwave radiation, sea surface

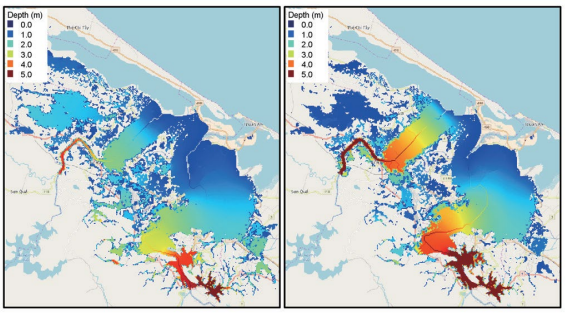
pressure, temperature at the 850hPa surface, east-west wind, and north-south wind.

Each selected GCM was bias-corrected using the Nyunt et al. method and daily rainfall observations at 53 ground gauges in Vietnam. Statistical downscaling (DS) was also applied to the selected GCMs, and then the uncertainty caused by those GCMs in making future predictions was evaluated. Dynamic DS was conducted using the WRF model ver. 3.7.1 for the past climate and the end-of-21st-century climate of the RCP 8.5 scenario calculated by the MRI-AGCM 3.2S model. All data and analytical tools used for the study were available on DIAS.

In order to evaluate future flood risk, future rainfall from the dynamic DS results was inputted to the RRI model, and rainfall-runoff-inundation analysis was conducted. The model development was carried out using not only data provided by local governments, such as ground observed rainfall, river discharge, land coverage, and river cross-section, but also field survey results collected to understand geographical characteristics and flood history. The results of the future flood risk evaluation found that both future precipitation and inundation depth would increase in Vinh Yen and Hue, whereas both future precipitation and inundation depth would decrease in Ha Giang. ICHARM took only a year to complete the project and delivered practical output with solid scientific explanations to the Vietnam government.



Dynamic DS results of MRI-AGCM3.2S (Left: Average precipitation in past climate, June to August (top) and October to December (bottom); Right: Average precipitation in the future climate, June to August (top) and October to December (bottom))



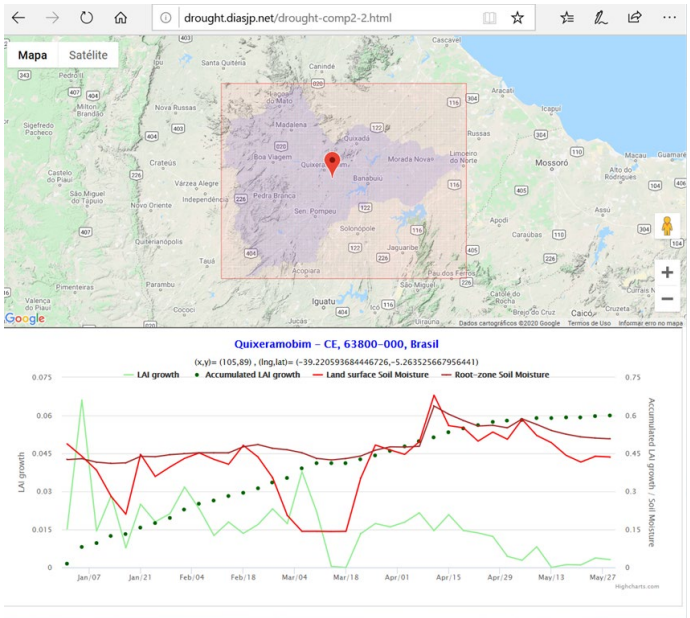
Inundation depth of 100-year return period rainfall in Hue (Left: past, Right: future)

Based on the products and data provided by ICHARM, ADB has developed the Spatial Data Analysis Explorer (SPADE), a web-based platform system, and is promoting the Urban Climate Change Resilience (UCCR) program in Asian 25 cities.

3.4 Support through proposal, evaluation and application of policies for water disaster risk reduction

3.4.1 Development of a real-time agriculture drought monitoring and seasonal prediction system

In the World Bank Brazil project (Technical Assistance in Implementing a Pilot of Agriculture Drought Monitoring and Prediction), ICHARM developed a real-time agriculture drought monitoring and seasonal prediction system for Ceará State in the Brazilian Northeast. The DIAS collects and integrates three types of data: the NASA GLDAS meteorological global forcing data, the GCOM-W/AMSR2 microwave brightness temperature global data, and the GFDL seasonal predictive global precipitation data. Using these data, ICHARM applied the CLVDAS, which can calculate the land water cycle and the dynamic vegetation growth, to the Brazilian Northeast and developed a DIAS 25km-gridded agriculture drought monitoring and seasonal prediction system (Drought system). Using a crop database of the Ceará State (the Northeast Drought Monitor: NEDM, monitordesecas.ana.gov.br) provided by FUNCEME, ICHARM also developed a method to estimate crop yield and the required volume of irrigation water for Ceará State using LAI output from the drought system. The Banabuiú River basin was selected as the target area because it is a highly important area in meteorology, hydrology, and agriculture. The high-spatial-resolution (1km grid) WEB-DHM was also developed for this river basin. By applying WEB-DHM to the Banabuiú River basin, ICHARM devised a method to estimate 1km-gridded LAI growth using 25km-gridded LAI as output from CLVDAS via the evapotranspiration output



Estimation system for 1km-gridded LAI and soil moisture content in the Banabuiú River basin of Ceará State, Brazil: Accumulated LAI growth (●), Land surface soil moisture content (—), Root-zone soil moisture content (—).

from WEB-DHM and CLVDAS. However, to achieve a high level of reliability for drought information, more data were needed, such as land-cover data with a high spatial resolution and in-situ precipitation data collected at multiple stations. In addition, researchers familiar with local conditions should be able to work on the system. Hence, in October 2019, ICHARM offered one-month training to study the basic theory and operation of the system for two researchers of FUNCEME, which is a Brazilian organization that collects land-cover, precipitation and other data through meteorological drought monitoring and prediction.

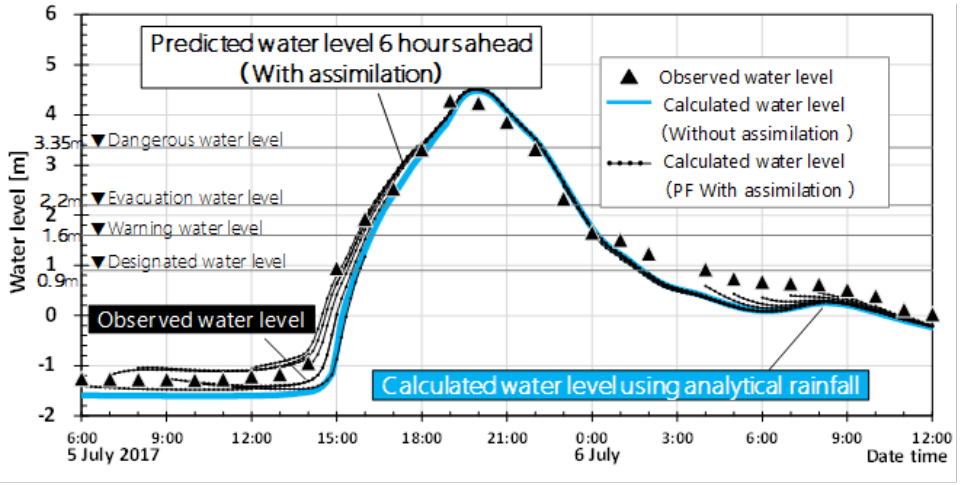
3.4.2 Development of a flood forecasting system for small and medium rivers

In recent years, disasters due to torrential rainfall have become more frequent and severe in Japan, consequently causing more human damage. At present, flood forecasting has not been implemented for many small and medium rivers, though the water level tends to rise rapidly in those rivers during a flood; thus, many residents living in nearby areas are more likely not to be able to evacuate in time and exposed to a high risk of suffering damage from flooding.

In collaboration with related organizations such as MLIT, ICHARM has been conducting a research project "Development of a system for providing the water level information of small and medium rivers by conducting trend analysis using observed water levels" in the PRISM, led by the Cabinet Office.

In this project, ICHARM carried out the

Crisis-management type water gauge (low-cost water gauge specializing in water level monitoring during floods)



Example of the assimilation of water-level data using the Particle Kalman Filter method

following tasks:

① Development of a simple, inexpensive run-off model and a water-level conversion method

② Research on a method for improving prediction accuracy using observed water levels collected from “Crisis-management type water gauges” which have been installed specifically for emergency use during a flood.

③ Development of an automatic calculation and display system for flood forecasting.

3.5 Support for improving the capacity to practice disaster prevention and mitigation

3.5.1 Implementation of the UNESCO project “Water Disaster Platform to Enhance Climate Resilience in Africa” (WADiRe-Africa)

In West Africa, floods in the Niger and Volta rivers cause devastating damage, including casualties, and hinder the development of the countries in the region. For this reason, UNESCO decided to implement measures to promptly initiate flood monitoring and forecasting systems in areas around the Niger and Volta rivers and reduce human damage by facilitating safe evacuation based on flood information. After signing a partnership agreement with UNESCO in the framework of the Water Disaster Platform to Enhance Climate Resilience in Africa, ICHARM installed a flood early warning system (FEWS) for water disaster mitigation in the Niger and Volta River basins and invited experts from AGRHYMET and VBA to Japan and provided training on the flood early warning system and flood risk management.

On June 17 and 18, 2019, the representatives of related organizations attended a kick-off meeting held in Lome City, Togo. ICHARM played a central role in sorting out key issues at the local and national levels regarding flood management, data utilization, capacity development, hydrological model development, and platform construction and finalizing the "Key Points of Lome Declaration." Training on flood forecasting systems and flood risk management was conducted at ICHARM for two African experts in November 2019 for about one and a half months and one more expert in March 2020.

Participants in the kick-off meeting

3.5.2 Strength of Area-Business Continuity Management (Area-BCM) in Thailand (JICA-SATREPS Program)

ICHARM is participating in the ongoing program of SATREPS “Regional Resilience Enhancement through Establishment of Area-BCM at Industry Complexes in Thailand.” This

research project aims to contribute to the sustainable development of society and economy in Thailand by enhancing local resilience through the establishment of Area-BCM. The expansion of its achievements to ASEAN countries is also expected. The program consists of four research items: Item 0. Survey on the current conditions of local communities; Item 1. Disaster risk analysis and assessment; Item 2. Business impact analysis; and Item 3. Establishment and expansion of the Area-BCM management system. Assigned as the representative organization of Item 1, ICHARM is in charge of the analysis and assessment of water-related disaster risk. The findings will be provided to design Area-BCM to improve the disaster resilience of local communities. Specifically, ICHARM develops a basin-scale and an industrial park-scale flood inundation model to create advance risks and detailed information on the occurrence of water disasters.

Hearing survey at the management office of Rojana Industrial Park

3.5.3 Research on flood risk assessment for river basins in mountains and information sharing

To assist local governments in mountainous areas facing the lack of disaster information for the safe evacuation of residents, ICHARM has been conducting research on creating new flood risk indicators using inundation simulation results by the RRI model and improving flood risk information sharing. For Iwaizumi Town, located along the Omoto River in Iwate Prefecture, Japan, we proposed the introduction of "flood diagnostic charts," which we developed to evaluate flood risks of communities using eight indicators: ①Lead time before inundation exceeds the first-floor level, ②Duration when evacuation is required during a flood, ③Maximum inundation depth in the community, ④Maximum inundation depth at evacuation shelters, ⑤Traffic disruption between the community and the municipal office, ⑥Maximum number of isolated people during a flood, ⑦Number of vulnerable people likely to be affected by a flood, ⑧Amount of debris and waste after a flood. Using these indicators, we conducted a study on the development and application of flood diagnostic charts, which categorize an area into several sections and indicate possible flood risks in each section. We drafted a manual on how to create flood diagnostic charts.

We also developed a new disaster information portal site called "ICHARM Disaster Risk Information System (IDRIS)," which allows one-stop viewing of water-related disaster information in the area. The system is designed not only for emergency use but also for improving disaster prevention and mitigation in normal times. A preliminary operation of the

system has started in Aga Town, Niigata Prefecture, which is located in the middle reach of the Agano River. The customized system of IDRIS for Aga Town was named “Aga Town Risk Information System (ARIS).”

IDRIS was awarded a prize as innovative technology by the Institute of Social Safety Science of Japan in May 2019.

In August 2019, the test version of ARIS was opened to the public (moving to a site that can be viewed by general users). Through the test operation, we investigated the applicability of the developed system to the actual local area. We conducted another test operation of the system in Iwaizumi Town, Iwate Prefecture, starting from the second half of fiscal 2019. From these test operations, we confirmed that IDRIS can be used effectively by any local governments.

Top screen of ARIS

3.5.4 Development of a risk communication system for enhancing public awareness of water-related disasters

In Hita City, Oita Prefecture, which suffered severe flood damage in 2012 and 2017, and Iwaizumi Town, Iwate Prefecture, which also suffered severe flood damage in 2016, we conducted questionnaire surveys for residents from a perspective of behavioral economics.

From the viewpoint that a flood experience leads residents to take appropriate actions such as early evacuation, we have developed simple simulation software for people to experience a virtual inundation in a private house using a head-mounted display driven by VR technology. After about 200 residents tried out this device, we confirmed that it can help raise people’s awareness of the danger of floods. In addition, we are developing VR flood experience software specifically designed for Hita City and Aga Town, combining actual cityscapes and the results of flood and inundation simulations in the areas.

3.5.5 Study on globally-applicable multiple-risk assessment of water-related disasters and on a method of building a resilient society based on assessment results

Based on the results of a questionnaire survey in Joso City, Ibaraki Prefecture, which was damaged severely when the Kinu River flooded in 2015, we have been studying new

indicators to evaluate the aspects of disaster cases that have not been evaluated adequately by existing methods and proposed indicators to evaluate "resilience in daily life and business activities." The new indicators were used for the estimation of the resilience of affected business activities in "Technical Study Report on Countermeasures against Giant Disasters that Cause National Crisis" by the Japan Society of Civil Engineers. They were also used to estimate resilience in the "Simulation tool for flood damage estimation at business activities" published by the Economic Consortium for Disaster Management, hosted by the Cabinet Office. In addition, we are conducting similar surveys in Iwaizumi, Iwate prefecture, which was damaged by Typhoon No. 10 in 2016, and in Okayama and Hiroshima Prefectures, which were damaged by the heavy rain disaster in July 2018.

We have begun studying another set of new indicators to evaluate the effectiveness of disaster prevention measures and investment in an easy-to-understand manner, focusing on the level of damage at which a pre-disaster level of population and gross regional product can still be sustained after a disaster. We are trying out the new indicators to Iwaizumi, Iwate Prefecture, and developing an evaluation method.

3.5.6 Research on disaster response timeline and the ability of local governments to respond to water-related disasters

We developed a timeline showing a series of actions that should be taken in case of underground mall inundation caused by a river or urban flood in cooperation with businesses around the West Exit of Yokohama Station in Japan through participation in the Cross-Ministerial Strategic Innovation Promotion Program (SIP).

We analyzed disaster reports reviewing disaster response efforts in past water-related disasters and identified problems regarding the ability of administrative staff to respond to disasters in order to improve their capacity to use a disaster response timeline effectively. Through this analysis, we collected cases in which disaster management personnel experienced difficulties, troubles, confusions, frustrations, and so on, in response efforts, and compiled a “Collection of Tense Moments during Flood Disaster Response” to make it easier for local disaster response staff to learn from past disasters.

４． Training

4.1 Master’s program: Water-related Risk Management Course of Disaster Management Policy Program

Since 2007, ICHARM has provided a one-year Master’s program, “Water-related Risk Management Course of Disaster Management Policy Program (JICA Training Program: Training for Expert on Flood-Related Disaster Mitigation),” as a joint effort with JICA and 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 2019, the master’s program of ICHARM graduated 139 students from 33 countries.

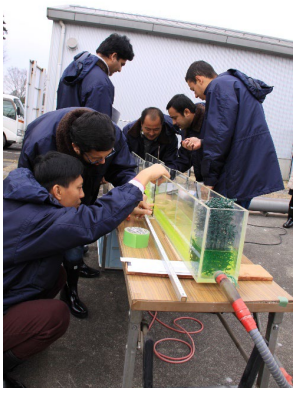
In September 2018, the 11th batch of 14 students from 10 countries (Bangladesh, Brazil, Fiji, India, Nepal, Pakistan, the Philippines, Sri Lanka, Tanzania, Vietnam), who entered the program in October 2017, graduated with a master’s degree. In the following month, the 12th batch of 8 students from 8 countries (Bangladesh, India, Liberia, Myanmar, Nepal, Pakistan, the Philippines, Sri Lanka) entered the program.

In September 2019, the 12th batch of 7 students from 7 countries graduated, and in the following month, the 13th batch of 11 students entered the program from 6 countries (Bangladesh, Bhutan, Brazil, Myanmar, Nepal, Pakistan).

In 2019, a paper submitted by the 11th batch student was published in the American Meteorological Society's Journal of Hydrometeorology.

This was the first case that a master's thesis research at ICHARM was published in an international journal with an impact factor. The following is the information of the paper:

Malik Rizwan Asghar, USHIYAMA Tomoki, Muhammad Riaz, MIYAMOTO Mamoru: Flood and Inundation Forecasting in the Sparsely Gauged Transboundary Chenab River Basin Using Satellite Rain and Coupling Meteorological and Hydrological Models, Journal of Hydrometeorology, Vol.20, No.12,



Hydraulic Model Experiment

pp.2315-2330, 2019.

Recognizing that training should be more strategically conducted by recruiting quality individuals and train them to become experts who can contribute to their countries in disaster management, ICHARM has strengthened recruitment activities since 2018.

ICHARM sent a recruiting team to the Philippines in August and Thailand in December in 2018 and Nepal and Indonesia in January, Myanmar in February, and Bhutan in March in 2019 to explain the training programs to relevant ministries and agencies and exchange opinions on the selection of possible candidates.

Recruitment activities were also conducted using other opportunities, for example, when ICHARM researchers participated in international conferences in Sri Lanka in August 2019 and February 2020 and Indonesia in September 2019.

Lecture by Director KOIKE

Activities of Master Course (Site Visiting)

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 the end of 2019, 11 students from 7 countries completed the doctoral program.

In September 2018, the 6th batch of 2 students graduated with a doctoral degree in disaster management. In October, the 9th batch of 3 students entered the program.

In September 2019, the 7th batch of 2 students graduated with a doctoral degree in disaster management.

Currently, 4 doctoral students (1 third-year, 3 second-year students) are studying in the program.

Among the four students, two were enrolled in September 2018 using JICA’s new scholarship program for international doctoral students, “Disaster Risk Reduction Leaders Capacity Development for the Sendai Framework Implementation.” This program was realized in response to international discussion on water hazards about promoting cooperation between policy and science. It aims to provide high-level training for individuals who are expected to

assume an executive position of their governments in the future. It has been implemented through coupling the ICHARM training program with the GRIPS policy program.

ICHARM graduates (September 2018)

Diploma Awarded by GRIPS President (September 2019)

4.3 Short-term training

4.3.1 JICA Knowledge Co-Creation Program: Water Related Disaster Management (Preparedness, Mitigation and Reconstruction)

From May 28 to June 1, 2018, and from June 5 to June 7, 2019, ICHARM collaborated with JICA to implement the Knowledge Co-Creation Program, “Water Related Disaster Management (Preparedness, Mitigation and Reconstruction)," in which lectures and exercises were conducted. With the overall goal of this program set for the participants to eventually become able to “formulate policies and plans that will contribute to the mitigation of water disasters using the results of the training in their countries,” they were expected to "enhance the capacity of participants to plan and implement policies aimed at reducing the damage caused by water disasters by learning Japanese flood control and disaster prevention measures” during the training.

Flood simulation experience using VR (ICHARM) (June 2019)

Visit to a flood evacuation shelter (Sakai Town, Ibaraki Prefecture) (June 2019)

This training had been conducted for

three years from FY2016 to FY2018, and JICA is planning to hold the training for another three years from FY2019 to FY2021. The training gathered 12 participants from Bhutan, Brazil, Chile, Macedonia, Iran, Liberia, Morocco, Myanmar, Peru, Sri Lanka, Thailand and Vietnam in 2018, and 12 participants from Afghanistan, Brazil, Fiji, Kenya, Liberia, Malaysia, Mexico, Somalia and Sri Lanka in 2019.

Presentation of disaster prevention maps prepared by the participants
(Sakai Town, Ibaraki Prefecture) (June 2019)

The lectures given by ICHARM researchers covered issues such as IFAS, RRI model, flood risk communication, and flood risk assessment. The on-site exercise was carried out in Sakai Town, Ibaraki Prefecture. The participants took a close look at measures implemented for water disaster mitigation and conducted “Town Watching”, in which they studied the town in groups while walking around and created disaster prevention maps so that they could improve the ability to plan water disaster mitigation measures.

4.3.2 Support for Malaysia’s disaster management course

The Malaysia-Japan International Institute of Technology (MJIIT), an academic entity to provide Japanese-style engineering education in Malaysia, was officially launched in September 2011 as part of Universiti Teknologi Malaysia (UTM). The institute opened its fifth course on disaster risk management in September 2016, which is targeted at middle-ranking government officials in charge of disaster management. Japanese universities and research institutes formed a consortium to provide the institute with assistance in education, research, management and other areas, and ICHARM has been part of it, involved in planning the course and sending teaching staff. ICHARM staff has so far lectured about the flood forecasting and hazard mapping. On July 25, 2018, and July 22, 2019, ten and seventeen faculty members and students, respectively, visited ICHARM and participated in lectures on research on integrated disaster prevention and human resource development.

4.3.3 Trainings on climate change

Trainings were conducted in Myanmar, the Philippines, and Sri Lanka on climate change prediction model analysis using DIAS climate model analysis tool. These trainings provided an opportunity for the participants to increase the understanding of climate change impact, and the analysis method of a climate change model using DIAS efficiently.

4.4 Follow-up Seminar for ICHARM Alumni

ICHARM has held a 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 enhance its research activities.

From January 23 to 24, 2019, the FY2018 Follow-up Seminar was held in Kathmandu, Nepal, with 25 participants, including officials from the Nepalese government, and the Embassy of Japan in Nepal, JICA Nepal Office, and ICHARM. The seminar consisted of presentations and discussions and a field trip to flood-prone areas in the Jhiku River.

The FY2019 Follow-up Seminar was held on February 12 and 14, 2020, in Colombo, Sri Lanka. A total of 32 people participated from the Irrigation Department, the Department of Irrigation-Eastern Province, the Sri Lanka Land Reclamation and Development Corporation, the Embassy of Japan in Sri Lanka, JICA Sri Lanka Office, and ICHARM. The first day was spent for presentations and discussions, and the second day for a field trip to the Maha River near Negombo and the Deduru River near Chirawa, where the participants observed the situation of riverbank erosion.

4.5 Internship

ICHARM has accepted interns from both Japan and overseas. In 2018, ICHARM accepted six international interns: two students of Nagoya University from the Philippines, one student each of Yokohama National University from Bangladesh, Pukyong National University, Korea, Kobe University from Myanmar, and Osaka Institute of Technology from China. In 2019, four international interns studied at ICHARM: one student each of Seoul National University from Korea, Kyoto University from Cambodia, Sichuan University from China, and the University of Tokyo from Indonesia. Each intern spent a week to several months at ICHARM studying hydraulic and hydrologic analysis, disaster risk analysis, or other subjects depending on their interests while getting technical advice from ICHARM researchers.

５． Information networking

5.1 International Flood Initiative

5.1.1 Global activities

A new strategy and an action plan of IFI were approved at the UNESCO-IHP Intergovernmental Council held at the UNESCO headquarters in June 2016. At the side event of the 8th HELP meeting in Jakarta, Indonesia, in October 2016, the Jakarta Statement was adopted by the member organizations of IFI to establish an interdisciplinary and transdisciplinary partnership for consolidating flood risk reduction and sustainable development. The Jakarta Statement explains the current status of water-related disaster risk reduction and sustainable development and presents the direction and actions to take for the promotion of those two ultimate goals. Based on the statement, ICHARM is promoting the global effort to establish Platforms on Water Resilience and Disasters.

ICHARM participates in various international conferences. By utilizing these opportunities, ICHARM organizes sessions and side events to promote IFI activities in general and Platform activities in the IFI implementing countries.

In June 2018, ICHARM organized a side event at the UNESCO-IHP Intergovernmental Council meeting in collaboration with UNESCO, WMO and IAHS. ICHARM also held sessions at the 8th Civil Engineering Conference in the Asian Region (CECAR8) in Tokyo, Japan, in April 2019 and at the panel on water and disasters during the UNESCO International Water Conference in Paris, France, in May 2019. The sessions were great opportunities to disseminate IFI's Platform activities with invited experts from the IFI implementing countries and the relevant international organizations.

ICHARM also actively participated in and provided presentations at the major international conferences including the side event co-organized by WMO and UNESCO at the High-Level Political Forum (HLPF) held at the UN headquarters in New York, USA, in July 2018 and the Stockholm World Water Week of August 2018 and 2019.

Further, on June 24, 2019, when the fourth UN Special Thematic Session on Water and Disasters was held at the UN Headquarters in New York, USA, ICHARM gave a presentation on the IFI Platform activities at the Science

Side event at the 23rd UNESCO-IHP Intergovernmental Council meeting (June 2018)

and Technology Session.

In April 2016, the United Nations and the World Bank Group convened the HLPW, which consisted of 11 sitting heads of states and governments and one special adviser. HLPW was set to provide the leadership required to champion a comprehensive, inclusive and collaborative way of developing and managing water resources and improving water and sanitation-related services. On March 14, 2018, the HLPW mandate ended with the release of an outcome document, in which HLPW endorsed IFI's initiative on Platforms, saying that "Platforms on Water Resilience and Disasters among all stakeholders should be formulated in countries to facilitate dialogue and scale up community-based practices."

5.1.2 Regional activities in Asia

As a regional activity, ICHARM held the AWCI sessions at the 11th GEOSS Asia-Pacific Symposiums in Kyoto, Japan, in October 2018 and at the 12th Asia-Oceania Group on Earth Observations (AOGEO) Symposium in Canberra, Australia, in November 2019, inviting representatives from the organizations of the Platform implementing countries. In these sessions, they reported the progress of their Platform projects and discussed how to promote a regional cooperative framework among the participating countries.

Since 2019, the "Platform on Water Resilience and Disasters under IFI" has been implemented as one of the AOPs of TC-WGH, whose chair is currently a chief researcher of ICHARM. WGH has publicized Platform activities, mainly focusing on those of the Philippines, a member of TC.

Participants in the AWCI session held during the 12th AOGEO Symposium

5.1.3 Activities in each country

Based on the basic action plan of IFI after the elaborations at the January 2017 workshop in Tokyo, ICHARM has been supporting the establishment of Platforms on Water Resilience and Disasters in the Philippines, Sri Lanka, Myanmar and Pakistan. ICHARM has started providing support for Indonesia.

In the Philippines, after the meetings with concerned organizations in Manila in March 2018 and Davao in May 2018, the third plenary meeting of the Platform was held in Manila in February 2019. The plenary meeting adopted a proposal to include the Cagayan River basin in the activities of the Platform in terms of flood forecasting and conduct capacity development training on climate change in Davao. The decision led to an orientation on climate change in Davao in October 2019. The members of TC-WGH also participated in the plenary meeting.

3rd Plenary Meeting of the IFI Platform in the Philippines (February 2019)

For Sri Lanka, after the flood and landslide disaster in May 2017, the 1st plenary session on the Platform was held in Colombo in August 2017. Since then, the plenary sessions were held in March 2018, February 2019, and February 2020. Progress has already been made: flood forecasting and warning systems have been introduced for the Kalu River, where a flood disaster occurred in 2017, hydro-meteorological data have been accumulated and integrated, and integrated water resources management has started being practiced for the Mahaweli River basin. ICHARM has signed Memorandums of Understanding (MOUs) with the National Building Research Institute (NBRO) and the Irrigation Department, both of which are the Platform participating organizations, aiming to promote joint research for flood forecasting, capacity building, and other areas of research.

For Myanmar, after two meetings with the director generals of related organizations in 2017, the director-level meeting was held in September 2018. The meeting agreed on the concrete plans proposed for future activities, such as identification of data to be used for activities and training to operate the DIAS. Based on this agreement, DIAS training was held on February 4 and 5, 2019, at Yangon Technological University (YTU) in cooperation with YTU, the SATREPS project led by the University of Tokyo and other organizations, and the DIAS project led also by the University of Tokyo.

For Pakistan, ICHARM explained the necessity of a platform and discussed how to reduce water disaster damage in two workshops related to the UNESCO Pakistan project, which were held, respectively, in Jakarta, Indonesia, on December 20-21, 2018, and in Islamabad,

Pakistan, on April 23-24, 2019.

For Indonesia, preparatory meetings for the establishment of a Platform on Water Resilience and Disasters were held with water-related government organizations in 2018. In August 2019, a meeting for the Platform on Water Resilience and Disasters was held, gathering director generals from relevant organizations. In the discussion, the participants recognized the necessity of a data sharing policy. In February 2020, an orientation on climate change was held for the Solo river basin.

5.2 Contribution to the international community

ICHARM has been committed to disseminating research findings and increasing its international presence on various occasions by hosting international conferences, organizing sessions at international conferences hosted by overseas institutions, and making presentations as invited speakers. As major activities related to IFI have been described in section 5.1, the following outlines other important activities.

5.2.1 Contribution to UNESCO-IHP

As a UNESCO category 2 centre, ICHARM has been contributing to UNESCO-IHP at national, regional and international levels. For example, on June 11-15, 2018, ICHARM sent a party of researchers led by the director of ICHARM to the 23rd UNESCO-IHP Intergovernmental Council and the first Water Science-Policy Interface Colloquium (SPIC Water), which was held at the same time. On the 11th, ICHARM co-organized a side event, "Platform on Water Resilience and Disasters," with the UNESCO-IHP Secretariat. In the event, the participants discussed how to achieve the worldwide implementation of the recommendations presented by the HLPW in March 2018, which was convened by the United Nations and the World Bank Group, while sharing experiences of Asian countries.

ICHARM also sent researchers to other IHP-related conferences to speak about its activities and exchange views and ideas with other participants.

During the United Nations High-level Political Forum on Sustainable Development (HLPF), held in July 2018, WMO and UNESCO-IHP organized a side event, “Hydrology Towards Sustainable Resilient Societies,” on July 10, which ICHARM joined as a partner organization of UNESCO and WMO. HLPF is the main United Nations platform on sustainable development and plays a central role in the follow-up and review of “the 2030 Agenda for Sustainable Development: Sustainable Development Goals (SDGs)” at the global level. At this side event, ICHARM made a presentation on “Progress of the Platforms on Water Resilience and Disasters in the IFI active countries.” ICHARM also explained how Japan had revised its policies and laws to cope with the changing patterns of climate and water-related hazards in recent years and stressed the important role of science and

technology in water-related disaster risk reduction.

ICHARM convened the “Panel on Water and Disasters” on May 13, 2019, with HELP at the International Water Conference, which UNESCO organized for the first time. Two ministers, the minister of Land Management, Water and Sanitation Services from Botswana and the minister of Water and Sanitation from Burkina Faso, joined this panel and introduced issues on water and disasters in their countries. ICHARM explained the end-to-end approach to achieving sustainable socio-economic development against water-related disasters and climate change, and the need for facilitators in implementing science and technology in society.

“Panel on Water and Disasters” at the UNESCO International Water Conference (May 2019)

ICHARM also participates in the UNESCO-IHP Regional Steering Committee for Asia and the Pacific (UNESCO-IHP RSC-AP) as a core member. ICHARM sent researchers to the 26th Committee in Shanghai, China, in November 2018 and the 27th Committee in Naypyidaw, Myanmar, in October 2019. They reported the activities of ICHARM and exchanged the information with other participants by actively attending relevant workshops.

In addition, as a member of the IHP session of the Natural Science Subcommittee of the Japanese National Commission for UNESCO, ICHARM reports on its activities on a regular basis and supports the operation of the session.

5.2.2 Contribution to hydrology on a global basis

As its establishment is closely related to issues of hydrology, the field is one of the important research areas for ICHARM. For this reason, it continues participating in research projects and international workshops on hydrology to exchange views and ideas with other organizations.

5.2.2.1 Participation in the HydroConference and related committees organized by WMO

The “WMO Global Conference: Prosperity through Hydrological Services (HydroConference)” took place at the WMO headquarters in Geneva on May 7-9, 2018. An ICHARM researcher attended the conference as part of the secretariat’s work for IFI. As one of the international water-related initiatives, IFI participated in this conference from the planning stage and contributed to creating a matrix of the scheme to support international organizations and national stakeholders through three segments, i.e., hydrological data

management, hydrological products, and hydrological services. Since one of the most important purposes of the conference was to bridge between international initiatives and national stakeholders, ICHARM explained the outline and cooperative framework of IFI to conference participants at an exhibition booth.

The director and a researcher of ICHARM participated in the Technical Conference on Future Hydrological Priorities and Arrangement and the Extraordinary Session of the Commission for Hydrology (CHy) held at the WMO headquarters from February 11 to 14, 2019, and joined discussions about the reorganization and future policy of CHy. The Technical Conference met from the 11th to the morning of the 13th and discussed the functional requirements needed for a future WMO and possible activities in hydrology in association with the ongoing WMO reorganization. The Extraordinary Session discussed the pros and cons of integrating the existing eight commissions into two commissions, i.e., the Commission for Observation, Infrastructures and Information Systems (COIIS) and the Commission for Weather, Climate, Water and Related Environmental Service Applications (CSA), in line with the proposal from the Executive Council in June 2018, and achieved a consensus among the CHy members.

A Hydrological Assembly took place from June 6 to 8, 2019, as a parallel event of the Eighteenth World Meteorological Congress at the International Conference Centre of Geneva from June 3 to 14, 2019. The assembly discussed WMO's vision and strategy in hydrology, eight long-term ambitions, the definition of "Operational Hydrology," action plans for each ambition, and the Hydro Declaration. With innovative changes underway in association with the WMO reform plan, ICHARM was involved in setting the vision and ambitions and developing the action plans for major initiatives and facilitated cooperation with WMO through the activities of IFI, CHy, the Associated Programme on Flood Management (APFM), and RA II.

5.2.2.2 Participation in APFM by WMO/GWP

Organized by WMO and GWP, APFM held its annual meeting on August 24, 2018, and August 23, 2019, at the GWP secretariat in Stockholm, Sweden. A Virtual Forum, a teleconference among Support Base Partners (SBP), was also held on January 18, 2019. An ICHARM researcher participated in discussions on the activity reports of each component and the review of a future action plan in those meetings. By developing a mechanism of the Technical Support Unit (TSU), APFM has strengthened itself to ensure constant cooperation with partners throughout the year. In this framework, ICHARM will continue to contribute to APFM as an SBP to further promote Integrated Flood Management through activities worldwide, such as a project in the Volta River basin of Africa and those related to the IFI Platform in the Philippines, Sri Lanka, Myanmar, and Pakistan.

5.2.2.3 Participation in the Working Group of Hydrological Services in RA II of WMO

Since one of the researchers of ICHARM serves as a theme leader of mass movement for the Working Group of Hydrological Services in Regional Association II of WMO, he participated in the Third Session of WMO's Regional Association II Working Group in Hydrological Services in Moscow, Russian Federation, from October 7 to 9, 2019. The session at the Federal Service for Hydrometeorology and Environmental Monitoring (RosHydromet) discussed the future activities of the working group in accordance with the discussions in closely related meetings and conferences such as the Extraordinary Session of the Commission for Hydrology in February 2019 and the Hydrological Assembly and World Meteorological Congress in June 2019. His presentation on recent topics on science and technology regarding mass movement in the session was included in the session report with new work plans.

Third Session of Working Group of Hydrological Services in RA II of WMO, Moscow

5.2.3 Contribution to disaster prevention in the world

ICHARM also contributes to disaster prevention worldwide through international conferences.

5.2.3.1 Participation in Global Platform for Disaster Risk Reduction

Researchers of ICHARM, including the director, participated in the Global Platform for Disaster Risk Reduction, held in Geneva, Switzerland, on May 13-17, 2019. The Global Platform, held biennially since 2007, is a forum that is officially recognized by the United Nations General Assembly to provide advice for global efforts in disaster risk reduction and monitor the progress in the efforts. In this meeting, the participants included those from the IFI Platform implementing countries: the Philippines, Myanmar and Sri Lanka.

5.2.3.2 Technical session and poster presentation at the World BOSAI Forum 2019

ICHARM held a technical session, "Contribution from meteorology, hydrology and DRR for the Platform on Water Resilience and Disasters," on November 11 at the World BOSAI Forum 2019 on November 9-12, 2019, in Sendai, Japan. ICHARM led the session

as a moderator. Speakers, from organizations such as JMA, MLIT, and the Asian Disaster Reduction Center (ADRC) and countries such as Thailand, Korea and Turkey, delivered a presentation on the current situation of water-related disasters in Japan and other Asian countries. They also discussed how to promote a more effective collaborative scheme across different fields of meteorology, hydrology and DRR. ICHARM also exhibited a poster presentation on a VR flood simulation tool with the results of a verification test of its effects, while giving visitors a chance to try out the tool and have a VR flood experience.

Technical session at the World BOSAI Forum 2019 (November 2019)

5.2.3.3 Participation in the 3rd Indo-Japan Workshop on Disaster Risk Reduction

On March 18, 2019, the 3rd Indo-Japan Workshop on Disaster Risk Reduction was held in New Delhi, India, focusing on three themes: collaboration between research institutes, collaboration between cities, and collaboration in the private sector. The bilateral workshop was planned under a memorandum of cooperation (MoC) on disaster risk reduction (DRR), signed between the Ministry of Home Affairs of India and the Cabinet Office of Japan in September 2017, when Prime Minister of Japan Shinzo Abe visited India. This workshop had already been organized twice since March 2018. ICHARM gave a presentation during the parallel session on “collaboration between research institutes.” After the presentations from both sides, the participants joined discussions in which the importance of establishing an information platform for data sharing and utilizing was emphasized. The importance of capacity development was also highlighted for prediction, analysis and operation in terms of DRR. In the closing session, the assistant secretary general and special representative of the Secretary General for Disaster Risk Reduction, UNISDR, provided a special comment emphasizing the significance of mutual cooperation between Japan and India and the importance of integrating risk information into decision-making processes.

5.2.4 Contribution to the World Water Development Report of the UN World Water Assessment Programme

The World Water Development Report (WWDR) is a global report on the comprehensive assessment of freshwater at a global scale and published annually by the UN World Water Assessment Programme (WWAP). The WWDR 2020 entitled “Water and Climate Change”

addresses critical linkages between water and climate change in the context of the broader sustainable development agenda in terms of adaptation, mitigation and improved resilience. ICHARM was committed to the development of the report from the initial stage of planning and contributed to drafting several chapters, including International policy frameworks (Chapter 2), Water-related extremes and risk management (Chapter 4), Water governance for resilience to climate change (Chapter 11), and Technological innovation and citizen knowledge (Chapter 13). The report also contains descriptions of ICHARM's activities such as IFI and contingency planning.

5.2.5 Contribution to other major international conferences

5.2.5.1 4th UN Special Thematic Session on Water and Disasters

Among all types of disasters, water-related disasters account for 90%, and climate change is likely to intensify their impact on human activity. Therefore, political commitments must be matched by appropriate finance and policies to achieve water-related disaster risk reduction and climate change adaptation. In March 2013, the United Nations Special Thematic Session on Water and Disasters was held for the first time, stressing that the theme of water and disasters should be recognized as a top political agenda. On June 24, 2019, the fourth UN Special Thematic Session on Water and Disasters was held at the UN Headquarters in New York, USA, co-sponsored by several UN Member States (Indonesia, Japan, the Republic of Korea, Mexico, the Netherlands, and Tajikistan) and HELP.

ICHARM made a presentation at the science and technology (S&T) session, highlighting that the S&T community needs to play the role of facilitator to clarify the mechanisms of problems and provide possible solutions. The session published two reports, "Global Report on Water and Disasters" and "Principles on Investment and Financing for Water-related Disaster Risk Reduction."

4th UN Special Thematic Session on Water and Disasters (June 2019)

5.2.5.2 8th World Water Forum

The World Water Forum (WWF) is one of the largest international events, in which experts in water-related fields gather from all over the world and discuss and exhibit global water issues to find solutions. The 8th World Water Forum (WWF8) took place in Brasilia, Brazil, on March 17-23, 2018, with the presence of 14 heads of states, including Brazilian

President and His Imperial Highness the Crown Prince of Japan. The forum offered more than 300 sessions in total, attracting over 120,000 attendees from 172 countries. H.I.H. the Crown Prince of Japan gave a keynote lecture titled “Water to bring about prosperity, peace and happiness” at the special session, “High-Level panel: Water and Disasters,” on March 19. ICHARM highlighted the importance of global actions on water and disasters, including “Alliance of Alliances on Disaster Risk Reduction Researches.” ICHARM also made presentations at the session of the Asia Pacific Regional Process, “Climate change, disasters and water related adaptation in the Asia Pacific” and “Upscale innovation for a water-secure Asia and the Pacific.” On March 21, a special session, “From 7th to the 8th World Water Forum: Three Years of Implementation Roadmap,” was held. ICHARM played an important role as “Champion” (the principal coordinator) for the theme session entitled “Adapting to Change: Monitoring risk and uncertainty for resilience and disaster preparedness,” which was one of the main thematic processes at the 7th World Water Forum (WWF7). ICHARM reported the overall progress by the participating organization of WWF7. WWF, a triennial global event, is an extremely significant opportunity for countries to confirm the three-year progress in implementing globally-agreed actions and promote further actions by reflecting opinions and ideas from participants.

5.2.5.3 ICHARM technical session on “Water and Disasters - Toward Building Resilient Society under Climate Change -” at the 8th Civil Engineering Conference in the Asian Region

Since 1998, CECAR has been held by the Asian Civil Engineering Coordinating Council (ACECC) every three years, covering all technical fields of civil engineering relevant to the Asia Pacific Region, such as structural, geotechnical, environmental, water resources, transportation, and disaster management issues. The CECAR8 was held on April 16-19, 2019, in Tokyo, Japan, and ICHARM organized a technical session (TS2-6) titled “Water and Disasters – Toward Building Resilient Society under Climate Change –” on April 17, which gathered about 50 participants. A series of technical presentations were then delivered by experts in different areas, including those from MLIT of Japan, the National Cheng Kung University of Taiwan, and the Research Centre for Water Resources of Indonesia. An ICHARM researcher also spoke about the Philippines’ progress in disaster management efforts on behalf of the Department of Public Works and Highways of the Philippines. The technical presentations were followed by the panel discussion, chaired by ICHARM, where they discussed how to take necessary actions to cope with changes in the scale of hazards as well as social changes such as aging and depopulation.

5.2.5.4 ADBI-ICHARM Policy Dialogue “Water-related Disaster Resilience under Climate

Change”

Funded by the Asian Development Bank Institute (ADBI), ICHARM co-organized “ADBI-ICHARM Policy Dialogue Water-related Disaster Resilience under Climate Change” on January 27-28, 2020, at ADBI in Tokyo, Japan. Placing a high priority on the policy-relevant aspects of water-related disaster resilience, this policy dialogue focused on efforts for strengthening governance and investment for water-related disaster resilience under climate change in Asia through transdisciplinary dialogue and collaborative work between the science and technology community and other stakeholders, including senior government officials and experts from international development organizations. In the opening plenary, the keynote presentation was given by the vice-minister for engineering affairs, MLIT of Japan. The policy dialogue was composed of four sessions: “Sharing Experiences,” “Strengthening Governance,” “Encouraging Investment” and “Implementation Design,” in each of which the session keynotes and presentations were made by representatives from the Platform participating organizations of the IFI project implementing countries (the Philippines, Sri Lanka, Myanmar and Indonesia) and experts from the government or academic organizations of Japan. The conference emphasized that policy makers and experts need to share knowledge for reducing water-related disaster risks under climate change via improved policy coordination, financing and investment, and the application of science and technology.

ADBI-ICHARM Policy Dialogue Water-related Disaster Resilience under Climate Change (January 2020)

5.2.6 Invited lectures by overseas organizations and universities

ICHARM researchers, including the director, the research and training advisor, chief and senior researchers, and research specialists, were invited by overseas organizations and universities to give lectures and presentations or join discussions as a panelist on flood forecasting technology, flood forecasting and warning, and hydrological models.

5.3 Contribution to the Typhoon Committee

TC is an intergovernmental community jointly organized in 1968 by UNESCAP 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. The members are composed of governmental organizations of 14 nations and territories in East and Southeast Asia. The committee consists of four Working Groups of Meteorology, Hydrology, Disaster Risk Reduction, and Training and Research, each of which works on its projects independently. Integrated Workshops and Annual Sessions are also held periodically. A chief researcher of ICHARM has been the chair of WGH. As an AOP1 of the WGH, ICHARM implemented the "Flash Flood Risk Information for Local Resilience" project during the 2017-2019 period in collaboration with the WGH members. In 2019, ICHARM started another project, "Platform of Water Resilience and Disasters under the International Flood Initiative," as an AOP7. The following lists the TC-related meetings held in the 2018-2019 period:

- The 13th Annual Meeting of Working Group of Disaster Risk Reduction and the Advisory Working Group (Ulsan, Korea; May 29-June 1, 2018)
- The 7th Annual Meeting of WGH (Tokyo, Japan; October 9-12, 2018)
- The 13th Annual Integrated Workshop (Chang Mai, Thailand; November 5-9, 2018)
- The 51st Annual Session (Guangzhou, China; February 25-March 2, 2019)
- The 14th Annual Meeting of Working Group of Disaster Risk Reduction and the Advisory Working Group (Ulsan, Korea; June 18-21, 2019)
- The 8th Annual Meeting of WGH (Seoul, Korea; October 15-18, 2019)
- The 14th Annual Integrated Workshop (Guam, USA; November 4-7, 2019)

51st TC Annual Session (Guangzhou, China in February 2019)

The 7th Annual Meeting of WGH held in October 2018 was co-organized by MLIT and ICHARM. It was the first time for Japan to host a WGH meeting after 2012, when WGH started to meet annually. The director general of MLIT gave an opening address, and the ICHARM director delivered technical presentations.

In the 13th Integrated Workshop held in November 2018, ICHARM proposed a new AOP on "Platform on Water Resilience and Disasters under the International Flood Initiative". In

response, the WGH members joined an IFI meeting held in February 2019 in the Philippines, a member of TC, to observe discussions on the progress of IFI Platform activities. The 51st Annual Session in February 2019 approved the action and budget plans for the new project of WGH, i.e., Platform on Water Resilience and Disasters under International Flood Initiative, as an AOP7. The session also appointed a chief researcher of ICHARM as the new chair of WGH after the predecessor, who was also a chief researcher of ICHARM.

Playing an important role in TC, for example, by continuously assuming the chair of WGH in collaboration with its members such as MLIT and JMA, ICHARM actively participated in the Annual Meeting of WGH in October 2019 and the Annual Integrated Workshop in November 2019.

The Panel on Tropical Cyclones (PTC) for the Bay of Bengal and the Arabian Sea targets the region prone to tropical cyclones as an intergovernmental body of WMO and UNESCAP just like TC targeting the typhoon-affected region. Since ICHARM has recently been working on "Platform on Water Resilience and Disasters under the International Flood Initiative" as an AOP7 of TC-WGH, it also supports the establishment of an IFI Platform in Myanmar, Sri Lanka and Pakistan, which are members of PTC. On September 9-13, 2019, the 46th session of PTC was held in Nay Pyi Taw, Myanmar, where ICHARM provided a presentation on its activities, including those related to IFI. During the session, the participants discussed how to develop regional collaborative activities and expressed their expectations for ICHARM to build a bridge between the PTC and TC through IFI activities.

5.4 Leading the International Atomic Energy Agency (IAEA)/Regional Cooperative Agreement (RCA) RAS/7/030 Project on "Assessing Deep Groundwater Resources for Sustainable Management through Utilization of Isotopic Techniques" in Japan

Based upon a request from the Japanese Ministry of Foreign Affairs (MOFA), ICHARM leads the IAEA/RCA RAS/7/030 Project in Japan and contributes to the implementation of the RAS/7/030 Project in other 19 Asia-Pacific region countries by assigning a research specialist of ICHARM as one of the national project coordinators and representatives of Japan for the following purposes:

- Conduct training for participants from the RCA member countries for the sustainable management of groundwater resources on the basis of comprehensive assessment using an integration of isotopic, hydrogeological and chemical techniques
- Provide expert advice for specific study areas of the RCA member countries by answering questions on groundwater sources, recharge mechanisms, age and volumes
- Promote the application of isotope techniques in Japan to characterize water cycles in subsurface and surface water components
- Contribute to the research development of new numerical modeling technology and

preparation of the next 3-year IAEA/RCA projects for reducing water-related disasters of floods and droughts.

In 2018, the same research specialist was again given a role of co-lecturer and expert in the 3rd Regional Training Course (RTC) on the use of isotope techniques for assessing the groundwater quality of the IAEA/RCA RAS/7/030 project in Jakarta, Indonesia, on August 6-10 with 21 participants and in a national training course in Ulaanbaatar, Mongolia, on September 3-7 with 11 participants.

In addition, he represented Japan in the IAEA/RCA technical meeting and workshop of the RAS/7/030 project held in Beijing, China, on September 17-23, 2018, with other representatives of the governments of 14 Asia-Pacific countries.

In 2019, the research specialist was again given a role of co-lecturer and expert in the 4th RTC on isotopic data processing and interpretation, including hands-on exercises, regarding the IAEA/RCA RAS/7/030 project, in Tsukuba, Japan, on March 18-22 with 14 participants and in a national training course in Vientiane, Lao PDR, on December 16-21 with 12 participants.

He also represented Japan in the final progress assessment meeting on the IAEA/RCA RAS/7/030 project, held in Ulaanbaatar, Mongolia, on September 23-27, 2019, with other representatives of the governments of 15 Asia-Pacific countries.

In January 2020, the IAEA Governing Board approved the launch of a new project, IAEA/RCA RAS/7/035 “Enhancing Regional Capability for the Effective Management of Ground Water Resources Using Isotopic Techniques,” which will continue until December 2023.

To represent Japan as an alternate project coordinator, the IAEA/RCA RAS/7/035 project requires participation in 2020 the project coordination meetings for the RAS/7/035 project implementation across the Asia region.

5.5 Visitors

Date	Visitors & Affiliations	No. of Visitors	Purpose
January 25, 2018	Delegates from Department of Hydraulic Engineering, Tsinghua University, China	18	To attend a symposium organized by ICHARM for introduction and academic communication
February 21-22, 2018	Dr. Ng Yu Jin, Senior Lecturer, etc., Universiti Tenaga Nasional (UNITEN), Malaysia	4	To study disaster risk reduction research in the Pampanga River and discuss future collaboration

March 9, 2018	Ramona Pelich, Luxembourg Institute of Science and Technology (LIST)	1	To have a meeting and a discussion on research and training
April 2, 2018	S. L. Mohamed Aliyar, Additional Director General, etc., Irrigation Department, Sri Lanka	9	To discuss the activities of IFI Platform in Sri Lanka
May 8, 2018	Dr. Siswo Hadi Sumantri, ST, MT, etc., Indonesia Defense University	38	To attend a seminar on water related hazard and risk management measures organized by ICHARM
May 21, 2018	Prof. Akihiko Nakayama, Tunku Abdul Rahman University, Malaysia	1	To give a lecture on “Application of Large Eddy Simulation to Hydraulic Flows” to ICHARM researchers
July 25, 2018	Mr. Ali bin Selamat, Dean, etc., MJIIT	14	To attend lectures given by, Prof. EGASHIRA Shinji (ICHARM Training and Research Advisor) and Prof. TAKEUCHI Kuniyoshi (University of Yamanashi, Former ICHARM director) as part of the JICA training program, "MJIIT Master of Disaster Risk Management Japan Attachment"
August 3, 2018	Mr. Habibur Rahman, Joint Secretary, etc., from Local Government Division, Planning Commission, and Local Government Engineering Department (LGED), Bangladesh	11	As part of the study tour on "Infrastructure Development and Livelihood"
August 30, 2018	Lee Rae Chul, CEO, etc., Korean Society of Disaster Information (KOSDI)	12	To attend a meeting with PWRI/ICHARM researches
September 6, 2018	Professor Tadashi Yamada, Assistant professor Daiwei Cheng, etc., Chuo	14	To visit PWRI experiment facilities and participate in a

	University		short lecture by ICHARM
November 7, 2018	Delegates from companies in Yokohama City	16	To learn ICHARM activities
December 12, 2018	Dr. Gordon Wells, etc., the University of Texas at Austin	4	To attend a meeting on estimating the run-off and flood discharge by using a hydrological model
February 28, 2019	LDP (Liberal Democratic Party) upper house members, Japan	5	To deepen the understanding of research activities of ICHARM
May 8, 2019	Mr. Raj Kumar Srivastava, etc., Embassy of India	2	To discuss collaboration on disaster risk reduction between India and Japan
May 10, 2019	Zhong Zhiyu, etc., Changjiang Water Resources Commission (CWRC)	6	To discuss technical issues and exchange ideas between CWRC and ICHARM
May 30, 2019	Mr. Nuguid Jeric John Umlas, etc., Department of Public Works and Highways (DPWH), Davao City, JICA Philippines, JICA Tokyo and Oriental Consultants Global	11	To attend training on projects for the master plan and feasibility study on flood control and drainage in Davao City
June 25, 2019	Dr. M. Adnan Madjid, S.H., M.Hum., etc., Indonesia Defense University,	34	To attend a seminar on water related hazard and risk management measures organized by ICHARM
July 11, 2019	Students from Miyagi Prefecture Sendai-daiichi High School	4	To learn how to evacuate from tsunamis and how to create a city that protects people from flood hazards
July 22, 2019	Ms. Faizah Che Ros, Senior Lecturer, etc., MJIIT	20	To attend lectures given by, Prof. EGASHIRA Shinji (ICHARM Training and Research Advisor) and Prof. TAKEUCHI Kuniyoshi (University of Yamanashi, Former ICHARM director) as part of the JICA training

			program, "MJIIT Master of Disaster Risk Management Japan Attachment"
August 6, 2019	Nam So, etc., Mekong River Commission	7	To attend Dr. HARADA's lecture on "Characteristics of flood hazard in Japan -Development of tools for analysis and warning system"'
August 8, 2019	Mr. Iuma Bani, the Vanuatu Meteorology & Geo-Hazards Department (VMGD), and Hisaki Eito, the Japan Meteorological Agency (JMA)	2	To conduct the internship on water hazard and risk management
November 1, 2019	Chen, Jiann-Fong, etc., Water Resources Agency, MOEA, and Department of Hydraulic and Ocean Engineering, NCKU	7	To learn how ICHRM carries out international support
November 7, 2019	JICA students and staff	9	To attend lectures and training as part of JICA course work, "Disaster Management on infrastructure (river, road and port)": lectures and RRI model training " Overview of Flood Forecasting" by Dr. KAKINUMA (Research Specialist), Mr. MOCHIZUKI (Senior Researcher), and Dr. MOROOKA (Researcher)
November 18, 2019	Heejun Chang, Portland State University, USA	1	To conduct expert interviews on the perception and governance of urban floods among flood experts and practitioners
December 10,	Tsang-Jung Chang, Hydrotech	1	To discuss technical issues

2019	Research Institute, National Taiwan University (NTU)		and exchange ideas between NTU and ICHARM
December 11, 2019	Zhang Jing, etc., China Meteorological Administration	20	To study Japan's prevention and mitigation measures against weather related disasters and capacity development on risk management
December 13, 2019	Professor Vladimir Smakhtin, United Nations University - Institute for Water, Environment and Health (UNU-INWEH)	1	To give a presentation on "UNU-INWEH current work and new strategy 2020-2024 and have a discussion
December 17, 2019	Professor Zhang Jianyun, Nanjing Hydraulic Research Institute (NHRI), China	6	To have an academic exchange on urban flood management and visit Tokyo underground flood regulation reservoir

The former president of the Nanjing Hydraulic Research Institute (NHRI), China, paid a courtesy visit to the director general of the Water and Disaster Management Bureau of MLIT (December 2019)

6． Academic Field Surveys in Japan and Overseas Countries

6.1 Field Surveys of the July 2018 Torrential Rain Disaster in Western Japan

From July 5 to 7, 2018, continuous rainfall in western Japan induced numerous landslides, debris flows and floods with a massive transport of sediment in several prefectures of the Chugoku and Shikoku regions, including Hiroshima, Okayama, and Ehime. Those events caused severe damage with about 230 people dead or missing throughout Japan. ICHARM has been studying public responses to disasters resulting from levee breaches. In addition, focusing on floods with massive sediment supplies, which often take place with landslides and debris flows, ICHARM has conducted field investigations to identify the geomorphological characteristics of this type of floods and evaluated them from an engineering viewpoint.

Flood damage in Mabi Town due to a levee breach along the Oda River

An area along the Souzu River severely affected by a flood with a massive amount of sediment (Saka Town, Hiroshima Prefecture)

6.2 Field Surveys of Disaster Damage by the Torrential Rainfall Due to Typhoon No.19 (Hagibis)

On October 12, 2019, Typhoon No.19 (Hagibis) hit the Izu Peninsula and brought record-breaking heavy rainfall over a wide area of Japan. At one location, the accumulated precipitation exceeded 1,000 mm. At many locations, mainly in eastern Japan, the 3-, 6-, 12-,

and 24-hour precipitations reached a record high, causing floods with a massive transport of sediment, as well as landslides and debris flows. Considerable damage resulted, including 102 people dead or missing throughout Japan. Since this event, ICHARM has been conducting research on floods with a massive transport of sediment, which have been frequent in recent years, to clarify their mechanisms and phenomena and study effective methods for sharing information in the event of such a disaster.

(The damage statistics cited in this section is quoted from the Disaster Report issued by Cabinet Office on December 12, 2019.:
http://www.bousai.go.jp/updates/r1typhoon19/pdf/r1typhoon19_42.pdf

A house half-buried after a flood with a massive amount of sediment hit the area
(Marumori Town, Miyagi Prefecture)

6.3 Field Survey on Geomorphological Changes of the Sittaung River Estuary

The Sittaung River drains the area of 36,000 km^2 and plays an important role in the water resources of Myanmar. The funnel-shaped estuary had a bed and banks composed of silt-clay particles and a shallow flow field; thus, active sediment transportation takes place corresponding to the river flow and tidal currents, resulting in sand bar deformation and channel changes with bank erosion. In particular, bank retreat occurs at the rate of 1,000 m/year in some sections where the retreat is most active. Such bank erosion has caused losses of agricultural land and settlements. ICHARM has studied the bank erosion and associated issues with the Directorate of Water Resources and Improvement of River Systems (DWIR) since 2017 through data analyses, field surveys, flume experiments and numerical simulations.

Survey preparation and measurement on a boat

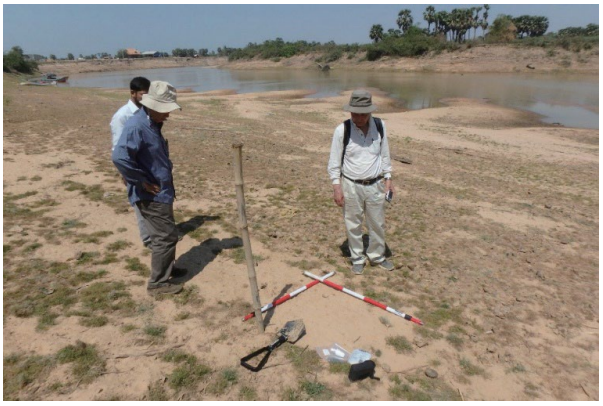
The research activities have led to important achievements such as a tidal-current model, a method for evaluating sediment transportation and channel changes, the relationship between the periodicity of bank line changes and associated village formation and disappearance.

Seminar attendants after a meeting at DWIR

Tidal bore observed at the Sittaung River estuary

6.4 Field Survey on Sediment Transport Processes and Associated Changes in Coastal Geomorphology in the Tonlé Sap Lake

This study has been conducted to investigate the role of riparian sediment transportation in the geomorphic development of the Tonlé Sap Lake coast, focusing on the Stung Sen River and the corresponding coastal area of the lake. The study is supported by the Department of Geology of Ministry of Mines and Energy of Cambodia with partial financial assistance from the Japan Society for the Promotion of Science. ICHARM has investigated the physical characteristics of riverbed material and sediment transport processes along the river reach in relation to seasonal changes in the lake water level and obtained interesting results. Morphologically, the river channel can be divided into three sections: the natural channel section, the channel section influenced by the backwater effect of the lake, and the submerged channel section by the lake water. The natural channel section is characterized by a meandering channel in which suspended sediment transportation dominates; the backwater-affected section by sediment sorting; and the submerged channel section by an abrupt channel-width decrease with silt and clay being dominant particles in the reach due to further sediment sorting.



Survey of bed material in the Stung Sen River

７． Public relations and other important activities

7.1 Awards

The following lists the awards received by researchers of ICHARM for their quality research, presentations and academic papers in the 2018-2019 period.

ICHARM has its own prize, “ICHARM BEST PAPER AWARD,” mainly to encourage young researchers at ICHARM. Every year, the selection committee selects and examines papers of ICHARM researchers published in international journals for creativity and relevancy in terms of water-related disaster risk reduction, and finally decides the best paper for the prize.

7.1.1 2017 Award by Association of Japanese Geographers

NAGUMO Naoko, OHARA Miho, SHRESTHA Badri Bhakta and SAWANO Hisaya: Flood Simulation and GIS Mapping in Flood-prone Region of the Philippines: Efforts and Issues in Contingency Planning. E-journal GEO, Vol. 11, pp.361-374, 2016

7.1.2 Outstanding Student Presentation Award (OSPA) during Japan Geoscience Union Meeting (JpGU)

Md. Khairul Islam: Inter-comparison of gauge-adjusted global satellite rainfall estimates for water resources management in the Maghna river basin

7.1.3 Award for outstanding research activities by the President of PWRI

Senior Researcher Mohamed Rasmy Abdul Wahid

Contribution to the efficient implementation of high-quality infrastructure through significant effort in research and technical advice against water-related disaster risk, the development of a WEB-RRI model, and its application to flood control in Sri Lanka

7.1.4 Excellent Presentation Award at Japan Society of Civil Engineering (JSCE)

Gul Ahmad Ali, Atsuhiro Yorozuya, Hiroshi Koseki, Shinji Egashira, Shoji Okada: STUDY OF BEDFORM AND BOIL BASED ON OBSERVATIONS IN BRAHMAPUTRA RIVER, JSCE 2018 Annual Meeting

7.1.5 International Science Cooperation Award 2018 from the Chinese Academy of Science

KOIKE Toshio

7.1.6 2019 Chinese Government Friendship Award

KOIKE Toshio

7.1.7 Asia-Oceania Group on Earth Observations (AOGEO) Fellow

KOIKE Toshio

7.1.8 2018 Excellent Technology Award by the Institute of Social Safety Science (ISSS)

Senior Researcher KURIBAYASHI Daisuke and OHARA Miho

Development of the ICHARM Disaster Risk Information System (IDRIS) for municipalities.

Director KOIKE received the 2019 Chinese Government Friendship Award

7.1.9 2019 SCAT (Support Center for Advanced Telecommunications Technology Research Foundation) Chairman's Award

KOIKE Toshio

7.2 ICHARM Open day

ICHARM held the annual “ICHARM Open Day” on April 16, 2018, and April 23, 2019, as part of the open house event of PWRI during the Tsukuba Science & Technology Week every April.

International researchers and master’s and doctoral students of ICHARM invited students and teachers from the Ibaraki Prefectural Takezono High School and the Ibaraki Prefectural Namiki Secondary School.

All communication during the lectures, presentations and Q&A sessions took place in English between the local school students and the master’s and doctoral students and staff of ICHARM. The event consisted of lectures by ICHARM researchers and students and poster presentations about countries of overseas students, including topics on culture and water-related disasters.

ICHARM Open Day (April 23, 2019)

Date	Participants	Content
April 16, 2018	・91 students Takezono High School: 73	・Greetings by Director KOIKE Toshio ・Short lecture by Ahmed Tanjir, a PhD student, on

	Namiki Secondary School: 18 ・5 teachers	Water Related Disasters around the World ・Poster presentations by ICHARM students from 10 countries
April 23, 2019	・112 students Takezono High School: 81 Namiki Secondary School: 31 ・6 teachers	・Greetings by Director KOIKE Toshio ・Short lecture by Ahmed Tanjir, a PhD student, on Water Related Disasters around the World in 2018 ・Poster presentations by ICHARM students from 9 countries

7.3 Virtual flood experience for the public

To achieve effective water-related disaster management, it is critical that each citizen keeps in mind that a flood disaster can occur to anybody and trains themselves to take appropriate evacuation actions when noticing signs of a disaster or receiving warnings. ICHARM has been studying practical disaster management measures to support citizens in attaining those goals and, as part of such effort, developed a virtual flood experience system using VR technology.

VR provides an opportunity for people to virtually experience water-related disasters before they actually occur. Since not many people experience a flood in reality, VR is very useful for them to see and feel what a flood would be like before they experience a real one.

In 2019, we conducted a questionnaire survey on VR at two outreach events held by ICHARM and PWRI. In those events, the participants used VR and experienced a virtual flood situation, in which they tried to evacuate to the second floor. After collecting 226 answers (adults: 111, children: 115), we statistically analyzed them to see whether the VR experience had any effect on how people view a flood. We also compared adults and children in the effect of the VR experience.

Virtual flood experience

The results found no difference in the perception of a flood between adults and children. All age groups answered that being in a flood situation was very scary, even knowing that it was only virtual. Merely 40% were worried about a future flood before the virtual flood experience, but the figure went up to 80% after the VR experience. These results indicate that VR can be an effective tool to help people realize the destructive nature of floods and the importance of

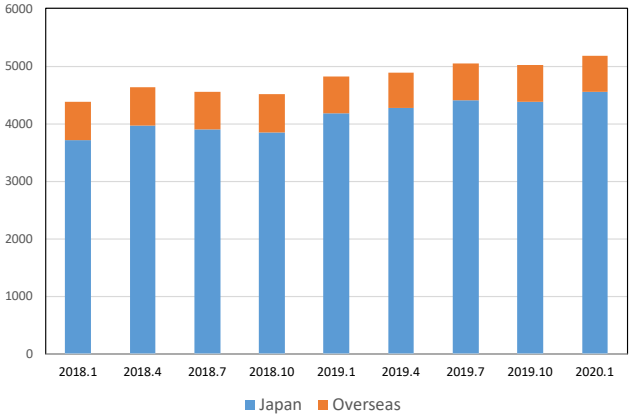
preparing for future events.

7.4 Newsletters and website

The ICHARM Newsletter has been published four times a year since March 2006 to publicize its activities of research, education and training, and local practice projects, as well as a list of published papers. During the 2018-2019 period, the newsletter was published eight times from No. 48 of April 2018 to No. 55 of January 2020. The number of subscribers has reached over 5,000. Since No. 47 of January 2018, the online survey on the newsletter has started. The results have been published in the newsletter and used to further improve the contents. In addition, the table of contents has been added to improve the accessibility to each article, and more efforts have been made to diversify news topics by collecting contributions from people outside the institute. In 2019, for example, the newsletter started to include contributions from graduates of ICHARM educational programs to enrich the contents, diversify the topics, and establish and maintain a continuous relationship with them.

ICHARM Newsletter No. 54

ICHARM's website has gone through a great renewal. A new section, "What's New," has been added to show progress in research and projects in addition to the latest information and notifications of upcoming events. A new site has been created to receive opinions from viewers around the world, and efforts have been made to respond to inquiries quickly and adequately.



Trend of the number of subscribers of ICHARM

7.5 ICHARM R&D Seminars

ICHARM R&D Seminars are held on an irregular basis as an opportunity to keep up with the latest knowledge and information from domestic and international experts in the field of hydrology and water-related disasters. In the 2018-2019 period, four seminars were held as shown in the table below, inviting experts from Japan and overseas, and attracted many

participants, including PWRI and NILIM (National Institute for Land and Infrastructure Management).

No.	Date	Speaker	Affiliation	Title
61	April 10, 2018	Couch Wouter		Leading Change in Projects: What It Takes
62	August 10, 2018	Prof. A. W. Jayawardena	Department of Civil Engineering, the University of Hong Kong	Data driven approaches of hydrological modelling
63	November 15, 2018	Distinguished Prof. Soroosh Sorooshian	Director of the Center for Hydrometeorology and Remote Sensing, University of California, Irvine	Climate Variability and The Global Hydrologic Cycle: Efforts in Monitoring, Modeling and Challenges in Forecast Changes
64	January 16, 2019	Mr. Koïchiro Matsuura	8th Director-General of UNESCO	Global trend and Japan

Group photo with audience after the lecture by Distinguished Prof. Soroosh Sorooshian at the 63rd R&D seminar

7.6 Research Meeting

Research Meetings have been held roughly once a month since March 2008 for researchers to upgrade their research skills and perspectives and practice interaction with other researchers.

During the 2018-2019 period, the meeting was held 24 times.

ANNEX 1

Number of Alumni of ICHARM training program (as of March 2020, with possibility)

Ph.D. Program "Disaster Management"

Country / Year	Afghanistan	Bangladesh	Bhutan	Bosnia-Herzegovina	Brazil	Burkina Faso	Cambodia	China	Colombia	Cote d'Ivoire	El Salvador	Ethiopia	Djibouti	Fiji	Guatemala	India	Indonesia	Japan	Kenya	Laos	Malaysia	Malawi	Maldives	Mozambique	Myanmar	Nepal	Netherland	Niger	Nigeria	Pakistan	Papua New Guinea	Philippines	Republic of Albania	Serbia	Sri Lanka	Tajikistan	Tanzania	Thailand	Timor-Leste	Tunisia	Venezuela	Vietnam	Zimbabwe	Liberia	Total	(Number of students conferred degree)
2010-2013																		1																											1	1
2011-2014												1														1	1																			3	1
2012-2015		1													1																													2	2
2013-2016		2													1																													3	3
2014-2017																										1																1			2	-
2015-2018		1																												1														2	2
2016-2019		1																												1														2	2
2017-2020		1																																										1	-
2018-2021																		1																	1									3	-
2019-2022																																												0	-
Total	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**19**	11

Master's. Program "Water-related Disaster Management Course of Disaster Management Policy Program"

2007-2008		2						3								1		3								1					1													11	10
2008-2009		2						2				1					1									1												2							9	7
2009-2010		2						1				1					3	1							1							1			2			1							13	12
2010-2011		2						2	1						1		1								1	3			1															12	12
2011-2012		2						2					1				2									2			6		1			1					1		1			19	19
2012-2013		2							1											2					1	1		1				1	1	1										12	12
2013-2014		2						1			1								1						1				1	2		2								1			12	12
2014-2015		1							1				1		2				3						1				2			2											13	13
2015-2016		2			1																		1		1	1			2		1			2			1			1			13	13
2016-2017					1																1		1		1				2	1	1						1			2			11	8
2017-2018		2			1								1		1											2			2		1			2		1				1			14	14
2018-2019		1														1										1	1			1		1			1							1	8	7
2019-2020		2	2		2																					2	2			1													11	-
Total	**0**	**22**	**2**	**0**	**5**	**0**	**0**	**11**	**3**	**0**	**1**	**2**	**0**	**3**	**1**	**5**	**7**	**4**	**4**	**0**	**2**	**1**	**1**	**1**	**10**	**14**	**0**	**0**	**1**	**18**	**1**	**9**	**1**	**1**	**13**	**0**	**1**	**3**	**2**	**1**	**2**	**4**	**1**	**1**	**158**	**139**

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		1						10
2010		1	2														2			1					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**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**17**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**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**

UNESCO West Africa Project

2019						**2**																							**1**														**3**

Country / Year	Afghanistan	Bangladesh	Bhutan	Bosnia-Herzegovina	Brazil	Burkina Faso	Cambodia	China	Colombia	Cote d'Ivoire	El Salvador	Ethiopia	Djibouti	Fiji	Guatemala	India	Indonesia	Japan	Kenya	Laos	Malaysia	Malawi	Maldives	Mozambique	Myanmar	Nepal	Netherland	Niger	Nigeria	Pakistan	Papua New Guinea	Philippines	Republic of Albania	Serbia	Sri Lanka	Tajikistan	Tanzania	Thailand	Timor-Leste	Tunisia	Venezuela	Vietnam	Zimbabwe	Liberia	Total
Total	**4**	**41**	**13**	**4**	**5**	**2**	**9**	**21**	**3**	**0**	**1**	**3**	**1**	**3**	**3**	**9**	**29**	**6**	**21**	**15**	**13**	**1**	**3**	**1**	**21**	**17**	**1**	**1**	**12**	**38**	**1**	**38**	**1**	**1**	**27**	**3**	**1**	**25**	**2**	**1**	**3**	**26**	**1**	**1**	**432**

ANNEX 2

List of the Master Theses in 2017-18 & 2018-19

Year	Country	Title
2017–2018	Nepal	Prediction of Sediment Run-Off Processes in West Rapti River Basin, Nepal
	Pakistan	Real Time Flood and Inundation Forecast in Trans-Boundary River Basin using Multi-Model High Resolution Precipitation Forecast
	Viet Nam	Risk Assessment of Urbanization Plan in Ma River Basin, Thanh Hoa Province
	Brazil	An Integrated Flood Damage Assessment in Brazil
	Philippines	Assessment of Flood Impact on Local Socio-Economic Development in the Davao River Floodplain, Philippines
	Bangladesh	Bed Form and Side Bank Erosion of Padma River Reach
	Bangladesh	Investigating the Impact of Climate Change on Flooding in the Teesta River Basin, Bangladesh
	Sri Lanka	Development of an Integrated Research Method for Effective Water Resource Management in a Complex Watershed System: The Case of Mahaweli River Basin
	Tanzania	Effects of Infrastructure Construction in Flood Disaster Prone Areas Case Study: Construction of Dumila-Rudewa-Kilosa-Mikumi Road
	Sri Lanka	Development of Effective Water Usage Plan for Dry Zone of Sri Lanka: Case Study in Malwathu Oya Basin
	Fiji	Regional Disaster Profiles in the South Pacific Revealed by the South Pacific Convergence Zone Position
	Pakistan	Integrated Water Resources Management through Efficient Reservoir Operation in Swat River Basin, Pakistan
	Nepal	Impact of Sediment Supply Condition on Morphological Change along Lower West Rapti River, Nepal
	India	Development of Satellite Rainfall Based Approach for Effective Flood Disaster and Water Resource Management in Transboundary Rivers -A Case of Gandak River Basin
2018–2019	Bangladesh	Study On Channel Changes And Bed Deformation In Confluence Region Of Ganges And Jamuna Rivers Under Different Inflow Conditions
	India	Development Of Integrated Hydrological Modelling Framework For Flood Inundation Mapping In Branhamanibaitarani River Basin, India
	Liberia	Analysis Of Climate Change Impact Using Bias-Corrected Precipitation In St. Paul River Basin, Liberia
	Nepal	Influence Of Sand Bar Behaviour On Channel Changes Along Kaligandaki River, Nepal
	Pakistan	Assessment Of The Climate Change Impact On The Flood Risk Change In Chenab River Basin
	Philippines	Rri Model-Based Flood Evacuation Timeline Of City And Municipality Lgus In Pampanga River Basin, Philippines
	Sri Lanka	Development Of Integrated Water Resources Management Plan For Eastern Dry Zone In Sri Lanka: The Case Of Gal Oya River Basin

ANNEX 3

List of Ph.D Theses accepted in FY2018 & 2019

Year	Country	Title
2015–2018	Pakistan	DEVELOPMENT OF AN INTEGRATED HYDROLOGICAL MODELING FRAMEWORK IN MOUNTAINOUS AREAS INCLUDING RAINFALL AND SNOWFALL QUANTIFICATION DERIVED FROM DATA INTEGRATION
2015–2018	Bangladesh	ASSESSMENT OF SELECTED STRATEGIES TO INCREASE ECONOMIC BENEFITS IN HAOR AREAS IN BANGLADESH
2016–2019	Pakistan	Fundamental Study for 2-D Numerical Simulation of Channel Changes in Large Rivers Dominated by Fine Sediment
2016–2019	Bangladesh	Developing a Methodology for Integrated Flood Risk Assessment in a Transboundary River Basin Using Multi-Platform Data Under Global Change- the Case of the Meghna River Basin

ANNEX 4

List of internships in FY2018 & 2019 at ICHARM

Year	Country	Affiliation	Title
FY 2018	Philippines	Nagoya University	Flood simulation for estimating flood flow impact on river channels
	Philippines	Nagoya University	Flood risk management and disaster resilience in river basin focusing on agriculture sector
	Bangladesh	Yokohama National University	Study on flood and drought risk assessment based on climate change
	Korea	Pukyong National University	Flood forecasting of Davao River basin caused by typhoon rainfall
	Myanmar	Kobe University	Study on urban flood simulation using Rainfall-Runoff-Inundation Model
	China	Osaka Institute of Technology	Exercise on Flood Analysis System
FY 2019	Korea	Seoul National University	Study on flood forecasting using Rainfall-Runoff-Inundation Model
	Cambodia	Kyoto University	Depth-averaged two-dimensional numerical simulation of the backwater effects on sediment transportation
	China	Sichuan University	Development of a Global System for Flood Risk Early Warning
	Indonesia	University of Tokyo	Analysis of River Channel Planform Change in the Meandering Plain

ANNEX 5

ICHARM　Publication List　(January 2018 ~ March 2020)

A. Peer Reviewed Papers

- Basara, B.N., Perera, E.D.P., (2018) Analysis of land use change impacts on flash flood occurrences in the Sosiani River basin Kenya, International Journal of River Basin Management, https://doi.org/10.1080/15715124.2017.1411922, pp. 1-10
- 南雲直子、江頭進治、2016年度台風10号による小本川の洪水・土砂氾濫に関する地形学的考察、地形、日本地形学連合、Vol.39、pp.47-66、2018年1月
- 牛山朋來、小池俊雄、大井川・犀川流域の効率的ダム操作支援を目的とした領域アンサンブル降雨予測の開発、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp.I_103-I_108、2018年2月
- 中村要介、池内幸司、阿部紫織、小池俊雄、江頭進治、中山間地河川における洪水予測と予測水位誤差 －平成29 年7 月九州北部豪雨を例としてー、水工学論文集第62巻（土木学会論文集B1（水工学）、Vol.74、No.4、pp.I_1177-I_1182、2018年2月
- 原田大輔、江頭進治、流砂・流木を伴う洪水流の解析　―2017年7月九州北部豪雨による赤谷川洪水を対象としてー、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp.I_937-I_942、2018年2月
- 宮本守、松本和宏、流出モデルの水文パラメータ最適化に基づく空間解像度が異なる降雨データの有用性評価、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp. I_1345-I_1350、2018年2月
- 松本和宏、宮本守、複数のハイドログラフを説明する少数組みの分布型流出モデルのパラメータ推定、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp. I_1015-I_1020、2018年2月
- Danang Dwi Admojo、Taichi Tebakari、Mamoru Miyamoto、Evaluation of a Satellite-based Rainfall Product for a Runoff Simulation of a Flood Event; a Case Study、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp. I_1015-I_1020、2018年2月
- 江頭進治、原田大輔、南雲直子、山崎祐介、萬矢敦啓、崩壊・土石流による堆積土砂に着目した微細砂の流出予測法　―2017年7月九州北部豪雨災害時の赤谷川を対象として―、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp. I_925-I_930、2018年2月
- 山崎祐介、江頭進治、南雲直子、豪雨時における土砂流出量の推定法、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp.I_925-I_930、2018年2月
- 海野仁、Msksym GUSYEV、長谷川聡、千田容嗣、気候変動がインドネシア国ソロ

川流域の利水に及ぼす影響評価、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp. Ⅰ_121- Ⅰ_126、2018年2月
- 玉川勝徳、Mohamed RASMY、小池俊雄、水域と灌漑域を考慮したカンボジアにおけるAMSR2輝度温度補正と土壌水分推定改善手法の検討、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp.I_271-I_276、2018年2月
- 大原美保、南雲直子、澤野久弥、平成27年9月関東・東北豪雨による常総市内の事業所の被災特性に関する調査研究、水工学論文集第62巻（土木学会論文集B1（水工学））、Vol.74、No.4、pp.I_1159-I_1164、2018年2月
- 佐貫宏、渋尾欣弘、李星愛、吉村耕平、田島芳満、古米弘明、佐藤愼司、都市沿岸部を対象とした浸水ナウキャストシミュレーション、土木学会論文集B2（海岸工学）、73 巻（2017）2 号、pp. I_499-I_504、土木学会
- 大原美保、徳永良雄、澤野久弥、馬場美智子、中村仁、滋賀県における宅地建物取引時の水害リスク情報提供の努力義務に関する実態調査、地域安全学会論文集、No.32、2018年3月
- Young-Joo Kwak, Flash Flood Mapping for Mountain Streams Using High-resolution ALOS-2 Data, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., Vol.XLII-3/W4, pp.307-312, 2018
- Zhang H., Ao T., Gusyev M., Ishidaira H., Magome J. and K. Takeuchi (2018). Distributed source pollutant transport module based on BTOPMC: a case study of the Laixi River basin in the Sichuan province of southwest China. Proceedings of IAHS 2018, 379, pp.323–333, https://doi.org/10.5194/ piahs-379-323-2018, June 2018
- Thu M., Gusyev M., Hasegawa A., and A. Husiev (2018). Analysis of floods and droughts for past and future climates in the Bago River basin, Myanmar. Proceedings of International Conference at the International Academy of Life Protection, Kyiv, pp.138-146, ISBN 978-966-699-935-4, June 2018
- Islam M. Khairul, Nikolaos Mastrantonas, Mohamed Rasmy, Toshio Koike and Kuniyoshi Takeuchi, Inter-Comparison of Gauge-Corrected Global Satellite Rainfall Estimates and Their Applicability for Effective Water Resource Management in a Transboundary River Basin: The Case of the Meghna River Basin, Remote sensing, Vol.10 Issue 6, https://doi.org/10.3390/rs10060828, June 2018
- Odhiambo C., Gusyev M., Hasegawa A., and A. Husiev (2018). Evaluation of Proposed Multi-Purpose Dams For Flood and Drought Hazard Reduction in the Upper Ewaso Ngiro North River Basin, Kenya. Proceedings of International Conference at the International Academy of Life Protection, Kyiv, 119-127, ISBN 978-966-699-935-4
- 原田大輔、江頭進治、移流拡散方程式に基づく流木の解析、河川技術論文集、Vol.24、pp.197～202、土木学会、2018年6月
- 山崎祐介、江頭進治、豪雨に伴う土砂・流木の生産と流下過程に関する研究、河川

技術論文集、Vol.24、pp.71～76、土木学会、2018年6月

- Mahtab Mohammad Hossain, Miho Ohara, Mohamed Rasmy, Effective of the Submersible Embankment in Hoar Area in Bangladesh, Journal of Disaster Research, Vol.13 (4), pp.780-792, August 2018
- Andrea M. Juarez-Lucas, Kelly M. Kibler, Takahiro Sayama, Miho Ohara, Flood risk-benefit assessment to support management of floodprone lands, Journal of Flood Risk Management, https://doi.org/10.1111/jfr3.12476, September 2018
- 栗林大輔、大原美保、岩崎貴志、徳永良雄、平常時から緊急時までのシームレスな利用を考慮した自治体向け災害情報共有システムの提案、地域安全学会論文集、Vol.33、pp. 247-257、2018年11月
- 筒井浩行、澤田洋平、小池俊雄、ブラジル北東域における2005年歴史的渇水の植生動態－陸面結合データ同化によるモニタリング、水工学論文集、Vol.63、pp. I_1417-I_1422、2018年11月
- 玉川勝徳、長谷川聡、Maksym GUSYEV、Bhuwneshwar SAH、牛山朋来、伊藤弘之、小池俊雄、ベトナムにおける気候変動による降雨変化予測の不確定性とその気候学的理解、水工学論文集、Vol.63、pp. I_97-I_102、2018年11月
- 菊森佳幹、池内幸司、江頭進治、伊藤弘之、中山間地河川における合理式モデルを用いた洪水予警報手法の開発、水工学論文集、Vol.63、pp.I_1345-I_1350、2018年11月
- 中村要介、小池俊雄、阿部紫織、中村和幸、佐山敬洋、粒子フィルタを適用したRRIモデルによる河川水位予測技術の開発、水工学論文集、Vol.63、pp.I_1381-I_1386、2018年11月
- Gul Ahmad Ali, Atsuhiro YOROZUYA, Hiroshi KOSEKI, Shinji EGASHIRA, Shoji OKADA, ANALYSIS OF BEDFORM AND BOIL BASED ON OBSERVATIONS INBRAHMAPUTRA RIVER, 水工学論文集, Vol.63, pp.I_925-I_930, November, 2018
- Vystavna Y., Diadin D., Rossi P.M., Gusyev M., Hejzlar J., Mehdizadeh R., and F. Huneau (2018). Quantification of water and sewage leakages from urban infrastructure into a shallow aquifer in East Ukraine, Environ Earth Sci 77: 748. https://doi.org/10.1007/s12665-018-7936-y
- Badri Bhakta Shrestha, Hisya Sawano, Miho Ohara, Yusuyuke Yamazaki, Yoshio Tokunaga, Methodology for agricultural flood damage assessment, Flood Risk Management, December 2018
- Miho OHARA, Naoko NAGUMO, Badri Bhakta SHRESTHA, Hisaya SAWANO, Evidence-based contingency planning to enhance local resilience to flood disasters, flood risk management, December 2018
- 原田大輔、江頭進治、流砂機構に着目した流砂の縦断分級現象の評価法、水工学論文集、Vol.63、pp.I_907-I_912、2018年11月

- 南雲直子、雨季・乾季の環境変動を伴う東南アジアの河川研究、第四紀研究、Vol.58、No.1、pp.13-27、2019年1月
- 瀬口貴文、岩崎杉紀、鴨川仁、牛山朋來、岡本創、Observation of Jumping Cirrus with Ground-Based Cameras, Radiosonde, and Himawari-8、Journal of the Meteorological Society of Japan、早期公開、2019年1月
- Badri Bhakta Shrestha, EDP Perera, Shun Kudo, Mamoru Miyamoto, Yusuke Yamazaki, Daisuke Kuribayashi, Hisaya Sawano, Takahiro Sayama, Jun Magome, Akira Hasegawa, Tomoki Ushiyama, Yoichi Iwami and Yoshio Tokunaga, Assessing Flood Disaster Impacts in Agriculture under Climate Change in the River Basins of Southeast Asia, Springer, Natural Hazards, June, 2019
- Asif Naseer, Toshio Koike, Mohamad Rasmy, Tomoki Ushiyama, Maheswor Shrestha, Distributed Hydrological Modeling Framework for Quantitative and Spatial Bias Correction for Rainfall, Snowfall, and Mixed‐Phase Precipitation Using Vertical Profile of Temperature, JGR Atmospheres, Vol.124, Issue9, pp.4985-5009, May, 2019, https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2018JD029811
- Stewart, M.K., Morgenstern, U., Tsujimura, M., Gusyev, M.A., Sakakibara, K., Imaizumi, Y., Rutter, H., van der Raaij, R., Etheridge, Z., Scott, L., and S.C. Cox (2019). Mean residence times and sources of Christchurch springs, Journal of Hydrology (New Zealand) 57(2): 81-94.
- Gusyev M.A., Morgenstern U., Nishihara T., Hayashi T., Akata N., Ichiyanagi K., Sugimoto A., Hasegawa A., and M.K. Stewart (2019). Evaluating anthropogenic and environmental tritium effects using precipitation and Hokkaido snowpack at selected coastal locations in Asia. Science of the Total Environment 659: 1307-1321, doi: 10.1016/j.scitotenv.2018.12.342
- Chatterjee S., Gusyev M.A., Sinha U.K., Mohokar H.V., and A. Dash (2019). Understanding water circulation with tritium tracer in the Tural-Rajwadi geothermal area, India. Applied Geochemistry 109: 104373, https://doi.org/10.1016/j.apgeochem.2019.104373
- Thapa B.R., Ishidaira H., Gusyev M.A., Pandey V.P., Udmale P., Hayashi M., and N.M. Shakya (2019). Implications of the Melamchi water supply project for the Kathmandu valley groundwater system. Water Policy: 1-18.
- Hisaya Sawano, Katsunori Tamakawa, Badri Bhakta Shrestha, Tomoki Ushiyama, Maksym Gusyev and Toshio Koike, Formulation of adaptation measures for flood management under the uncertainty of future projection, Proceedings of THA2019 International Conference on Water Management and Climate Change towards Asia's Water-Energy-Food Nexus and SDGs (Bangkok, Thailand, 2019), pp.475-480, http://aseanacademicnetwork.com/sites/default/files/conference/Proceedings_THA2019-01

0519.pdf

- Daisuke Harada, Naoko Nagumo, Yousuke Nakamura and Shinji Egashira, Characteristics of Flood Flow with Active Sediment Transport in the Sozu River Flood Hazards at the Severe Rainfall Event in July 2018, Journal of Disaster Research (JDR), Vol.14, Issue6, pp.886-893, September 2019
- OHARA Miho and NAGUMO Naoko, Mortality by Age Group and Municipality in the July 2018 Torrential Rainfall, Journal of Disaster Research, Vol.14, No.6, pp. 912-921, 2019.
- 中村要介、池内幸司、小池俊雄、伊藤弘之、江頭進治、粒子フィルタによる水位と河床変動の逐次推定、水工学論文集、Vol.64、pp.I_205-I_210、水文・水資源学会
- 原田大輔、江頭進治、Tanjir Saif Ahmed、片山直哉、連行の概念を用いた河床の侵食率に関する研究、水工学論文集、水工学講演会、土木学会水工学委員会、pp.I_967-I_972、大宮ソニックシティ、2019年11月4日～6日
- Robin K. Biswas, EGASHIRA Shinji, HARADA Daisuke, NAKAMURA Yousuke, Lateral and Longitudinal Sediment Sorting in Seri River, Japan, 水工学論文集, 水工学講演会, 土木学会水工学委員会, pp. I_895-I-900, 大宮ソニックシティ, 2019年11月4日～6日
- Malik Rizwan Asghar, USHIYAMA Tomoki, Muhammad Riaz, MIYAMOTO Mamoru, Flood and Inundation Forecasting in the Sparsely Gauged Transboundary Chenab River Basin Using Satellite Rain and Coupling Meteorological and Hydrological Models, Journal of Hydrometeorology, Vol.20, No.12, pp.2315-2330
- 南雲直子、江頭進治、2017年九州北部豪雨による赤谷川流域の氾濫の実態と地形分類に基づく被災家屋の立地分析、地学雑誌、Vol.128、No.6、pp.835-854、2019年12月
- Mohamed Rasmy, SAYAMA Takahiro, KOIKE Toshio, Development of Water and Energy Budget-based Rainfall-Runoff-Inundation Model (WEB-RRI) and Its Verification in the Kalu and Mundeni River Basins, Sri Lanka, Journal of Hydrology, Vol.579, pp.1-20, December 2019

B: Non-peer Reviewed Paper

C: Oral Presentation

- 小池俊雄、頻発する水災害の背景と地域防災力の向上、「第3回防災・減災シンポジウム」～社会・地域・住民で水防災意識を未来に繋いでいくために～、国土交通省九州地方整備局、福岡県、久留米シティプラザ、2018年2月28日
- Young-Joo Kwak, Jonggeol Park, Wataru Takeuchi, Long-term flood detection mapping

using multi-satellite data for international river basin, 26th IIS forum proceeding, 26th IIS forum, Institute of Industrial Science (IIS) U-Tokyo, Tokyo, March 5-6, 2018

- 海野仁、徳永良雄、インドネシア国チタルム川上流における洪水被害の推計に向けた提案、第45回土木学会関東支部技術研究発表会、土木学会、山梨大学、2018年3月7～8日
- 玉川勝徳、WEB-DHM作成GISシステム、DIASコミュニティフォーラム2018、DIAS事務局、御茶ノ水ソラシティカンファレンスセンター、2018年3月9日
- 原田大輔、土砂・洪水一体型モデルの開発、DIASコミュニティフォーラム2018、DIAS事務局、御茶ノ水ソラシティカンファレンスセンター、2018年3月9日
- Tsujimura M, Sakakibara K, Imaizumi Y, Gusyev M., Morgenstern U, Spatial and temporal variation of residence time of spring and groundwater in multiple watersheds, Japan and New Zealand, The 14th Australasian Environmental Isotope Conference, Wellington, March 26-28, 2018
- 李星愛、渋尾欣弘、佐貫宏、古米弘明、下水道施設内観測水位データとXRAINを用いた鶴見川流域における内水氾濫解析、第54回下水道研究発表会、日本下水道協会、東京ビックサイト、2017年8月1～3日
- Sungae LEE, Yoshihiro SHIBUO, Hiroshi SANUKI, Yoshimitsu Tajima, Shinji SATO, Long term monitoring of water level in sewer networks for validation of urban flood model, 14th IWA/IAHR International Conference on Urban Drainage, ICUD, Prague, September 10-15, 2017
- Stewart M.K., Morgenstern U., Toews M., van der Raaij R., and M.A. Gusyev (2018). Uncertainties of tritium streamflow transit times: Experiments with single and double lumped parameter models. The EGU 2018 General Assembly, Geophysical Research Abstracts EGU2018-11167, Vienna, April 8-13, 2018, Austria
- 小池俊雄、水災害発生過程と予測の必要性、2018年春季気象学会　公開シンポジウム「防災・減災のための観測・短時間予測技術の未来」、2018年春季気象学会実行委員会、つくば国際会議場大ホール、2018年5月18日
- Badri Bhakta Shrestha, Yusuke Yamazaki, Daisuke Kuribayashi, Akira Hasegawa, Hisaya Sawano, Yoshio Tokunaga, Assessment of future flood damage on agricultural areas under climate change in the Chao Phraya River basin of Thailand, Japanese Geoscience Union, Japanese Geoscience Union Meeting 2018, Tokyo, May 20-24, 2018
- Gusyev M.A., Kikumori Y., Denda M., Toda H., Tsujimura M., Sakakibara K., Morgenstern U., and M.K. Stewart (2018). Application of tritium-tracer and stable isotopes in the Chikuma River basin, Japan. Presentation at the JpGU 2018 Meeting, Chiba, May 20-24th, 2018, Japan
- Stewart M.K., Morgenstern U., Gusyev M.A., and J. Thomas (2018). Residence times of water and chemical flows in a karst spring. Presentation at the JpGU 2018 Meeting, Chiba,

May 20-24th, 2018, Japan

- Tsujimura M., Sakakibara K., Katsuyama M., Mizugaki S., Gusyev M.A., Yamamoto C., Sugiyama A., Ogawa M., Kato K., Yamada T., Yano S., Sasakura N., Morgenstern U., and M.K. Stewart (2018). Integrated study on spatiotemporal variation of residence time in spring and groundwater at headwater catchments. Presentation at the JpGU 2018 Meeting, Chiba, May 20-24th, 2018, Japan
- Young-Joo Kwak, Utilization of Advanced Remote Sensing and GIS Technologies for Disaster Risk Management and Emergency Response (Discussion), 日本地球惑星科学連合、千葉幕張メッセ、2018年5月20～24日
- 松永晋平、小室隆、赤松能久、乾隆帝、今村能之、日本全国におけるヤナギ類の空間分布予測及び高津川における樹林化要因分析、土木学会中国支部研究発表会、土木学会中国支部、2018年5月26日
- 栗栖直之、森啓年、今村能之、中田幸男、佐々木翔太、ワイヤレス傾斜計による河川堤防の変形モニタリング手法の開発、土木学会中国支部研究発表会、土木学会中国支部、2018年5月26日
- 牛山朋來、Mohamed Rasmy、小池俊雄、2017年5月スリランカ豪雨の数値実験、日本気象学会2018年度春季大会、日本気象学会、エポカルつくば、2018年5月16～19日
- Tetsuya Ikeda (2018). ICHARM's Activities on Water-Related Disaster and Flood Management in Japan for Climate Change Adaptation. The Third CICHEJSCE Joint Workshop in 2018, Taichung, June 1, 2018
- Tomoki Ushiyama, Mohamed Rasmy, Toshio Koike, Regional ensemble prediction of heavy rainfall in Sri Lanka flood in 2017 May, AOGS2018, AOGS, Honolulu, Hawaii, June 3-8, 2018
- Young-Joo Kwak, Ramona Pelich, J.Park, Integrated Multiple Satellite Application for Flood Mapping using ALOS-2 and Sentinel-1 Data, AOGS2018, AOGS, Honolulu, Hawaii, June 3-8, 2018
- Hasegawa A. and Gusyev M. (2018). Comparative standardized precipitation evapotranspiration index analysis of d4PDF_GCM dataset, AOGS2018, AOGS, Honolulu, Hawaii, June 3-8, 2018
- Hasegawa A. and Gusyev M. (2018). Concept Study on Seasonal Prediction of Meteorological Droughts Using the Comparative Standardized Precipitation Index, AOGS2018, AOGS, Honolulu, Hawaii, June 3-8, 2018
- Tomoki Ushiyama, Ensemble flood forecasting based on two ways of regional ensemble prediction systems: simple downscaling of global EPS and regional data assimilation, AOGS2018, AOGS, Honolulu, Hawaii, June 4-8, 2018
- 小池俊雄、水災害レジリエンスの強化－持続可能な開発と気候変動適応に向けて－、

第154回 GRIPSフォーラム、政策研究大学院大学（GRIPS）、政策研究大学院大学想海樓ホール、2018年6月25日

- Yosuke Nakamura, Koji Ikeuchi, Shiori Abe, Toshio Koike, Shinji Egashira, Evaluation of the uncertainty of flash flood prediction using the RRI model in mountainous rivers, 13th International Conference on Hydroinformatics, Hydroinformatics, University of Palermo, July 2-6, 2018
- Naoko Nagumo, Shinji Egashira, Characteristics of the 2016 flood disaster in the Omoto River Basin: an example of floods in mountainous river basins, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Young-Joo Kwak, Rapid Flash Flood Mapping Using High-resolution ALOS-2 Data: A pilot case study of Omoto River, Japan, Global Conference on the International Network of Disaster Study in Iwate, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Yusuke Yamazaki, Shinji Egashira, Method to estimate the supply rate of sediment and driftwood into stream channels, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Daisuke Harada, Shinji Egashira, Numerical simulation model of driftwood in flood flows with sediment erosion and deposition, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Yosuke Nakamura, Koji Ikeuchi, Shiori Abe, REAL TIME FLASH FLOOD PREDICTION USING THE RRI MODEL IN MOUNTAINOUS RIVERS, Global Conference on the International Network of Disaster Studies, INDS, Aiina in Iwate Prefecture, July 17-19, 2018
- Yoshito Kikumori, Shinji Egashira, Hiroyuki Ito, Yosuke Nakamura, Research on a Flood Forecasting System in Mountainous Rivers, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Daisuke Kuribayashi, Miho Ohara, Takashi Iwasaki, Yoshio Tokunaga, A Disaster Information System for Local Governments Promoting Seamless Usage from Normal Times to Emergency, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Miho OHARA, Daisuke KURIBAYASHI, Manabu TERAWAKI and Yoshio TOKUNAGA, Analysis of Tense Moments during Emergency Flood Disaster Response of Local Governments, Global Conference on the International Network of Disaster Study in Iwate, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina", July 17-19, 2018
- Badri Bhakta Shrestha, Practices on flood prediction, prevention and mitigation, Tenth NEAJ Symposium on Current and Future Technologies, NEAJ, Tokyo, Japan, July 21,

2018

- Mahtab Mohammad Hossain, Miho Ohara, Mohamed Rasmy, The Impact of Rainfall Variation on Flash Flooding in Haor Areas in Bangladesh, World Congress on Water Conservation & Environmental Management (WC2EM), Indonesia, August 10-12, 2018
- Gul Ahmad Ali, Atsuhiro YOROZUYA, Hiroshi KOSEKI, Shinji EGASHIRA, Shoji OKADA, STUDY OF BEDFORM AND BOIL BASED ON OBSERVATIONS IN BRAHMAPUTRA RIVER, 土木学会全国大会 International Program, 土木学会, 北海道大学, August 29-31, 2018
- Yusuke Yamazaki, Shinji Egashira, A method to specify critical rainfall conditions for sediment disasters and their regionality, 21st Congress of Asia and Pacific Division of International Association for Hydro-Environment Engineering and Research (IAHR-APD), IAHR-APD, Yogyakarta, INDONESIA, September 2-5, 2018
- Daisuke Harada, Shinji Egashira, Behavior of driftwood in terms of convection-diffusion equation, 21st Congress of Asia and Pacific Division of International Association for Hydro-Environment Engineering and Research (IAHR-APD), IAHR-APD, Yogyakarta, INDONESIA, September 2-5, 2018
- Young-Joo Kwak, Emergency flash flood mapping for disaster risk reduction: 2018 flood in Bangladesh, International Workshop 2018 on Bangladesh Water Development Board (BWDB), Bangladesh Water Development Board (BWDB), Dhaka, Bangladesh, September 5, 2018
- Young-Joo Kwak, W. Takeuchi, Future cooperation with stakeholders in International River Management between India & Bangladesh, International Workshop 2018 on Bangladesh Water Development Board (BWDB), Bangladesh Water Development Board (BWDB), Dhaka, Bangladesh, September 5, 2018
- Young-Joo Kwak, Advanced flood mapping using Earth Observation data, Intensive training in BWDB, Bangladesh Water Development Board (BWDB), Dhaka, Bangladesh, September 4-6, 2018
- 小池俊雄、リスクの同定、削減、管理の各分野における最近の動向、第11回国際水協会（IWA）世界会議・展示会、国際水協会（IWA）、東京ビッグサイト、2018年9月17日
- Yoshito KIKUMORI, Shinji EGASHIRA, Hiroyuki ITO, Yosuke NAKAMURA, Daisuke HARADA, RESEARCH ON A FLOOD FORECASTING SYSTEM IN OUNTAINOUS RIVERS, Global Conference on the International Network of Disaster Study in Iwate, Iwate University, Iwate Prefecture Citizens' Cultural Exchange Center "Aiina" July 17-19, 2018
- 中村要介、牛山朋來、阿部紫織、平成29年7月九州北部豪雨を対象とした72時間先洪水予測、2018年度研究発表会要旨集、pp.34～35、水文・水資源学会、2018年8月

- 菊森佳幹、市川温、Common MPラッピングマニュアルの刊行、土木学会全国大会、土木学会、北海道大学、2018年8月29～31日
- Tetsuya Ikeda, ICHARM's contribution on water-related disaster risk reduction in Asia and the world, Asia Water Forum 2018, Asia Development Bank, Manila, Philippine, October 2-5, 2018
- 大原美保、澤野久弥、馬場美智子、中村仁、建築規制を伴う浸水警戒区域指定の前後における住民意識の変化、第37回日本自然災害学会学術講演会、日本自然災害学会、pp.193-194、仙台市中小企業活性化センター、2018年10月6～7日
- Badri Bhakta Shrestha, Experiences and Practices on Flood Prediction, Prevention and Mitigation in Various Asian Countries, Fourth International Workshop on Effective Engineering Education, Kisarazu Kosen, Chiba, October 10-11, 2018
- Mohamed Rasmy, Tomoki Ushiyama, Toshio Koike, Masaki Yasukawa, Masaru Kitsuregawa, A Platform on Water Resilience and Disaster: Towards Integrating Multi-Platform Data for Enhancing Water Related Disaster Early Warning and Management in Sri Lanka, International Association of Applied Science and Engineering (IAASE), Jeju Island, South Korea, October 12-14, 2018
- Islam M. Khairul, Nikolaos Mastrantonas, Mohamed Rasmy, Kuniyoshi Takeuchi, Combined use of satellite estimates and rain gauge observations for water resource management in an inaccessible transboundary river basin– the case of the Meghna river basin, International Association of Applied Science and Engineering (IAASE), Jeju Island, South Korea, October 12-14, 2018
- Yoshiyuki Imamura, Study on country-based flood risk index using earth observation data, 39th Asian Conference on Remote Sensing (ACRS), Asian Association on Remote Sensing (AARS), Kuala Lumpur, Malaysia, October 15-19, 2018
- Katsunori Tamakawa, Activities for "Platform on Water Resilience and Disaster" under the frame work of International Flood Initiative (IFI) using Data Integration and Analysis System (DIAS), Improvement of Delivery of Weather, Climate and Hydrological Services in Myanmar: Annual Development Partner Workshop 2018, Department of Meteorology and Hydrology (DMH) of Myanmar, Nay Pyi Taw, Myanmar, October 17-19, 2018
- Gusyev M.A. (2018). Understanding water circulation with tritium and stable isotopes: a case study of water transit times and storage in Hokkaido watersheds. Tokyo Institute of Technology, Tokyo, October 22, Japan
- Katsunori Tamakawa, Climate Change Impact Assessment: Online demonstration of DIAS tool for the analysis of Coupled Model Intercomparison Project Phase 5 (CMIP5), The 11th GEOSS Asia-Pacific Symposium, Group on Earth Observations, Kyoto, Japan, October 24-26, 2018
- Mohamed Rasmy, Real-Time Flood Forecasting: Online demonstration of DIAS System

for Sri Lanka for the analysis of Coupled Model Intercomparison Project Phase 5 (CMIP5), The 11th GEOSS Asia-Pacific Symposium, Group on Earth Observations, Kyoto, Japan, October 24-26, 2018

- Mohamed Rasmy, ICHARM ACTIVITIES FOR A PLATFORM ON WATER RESILIENCE AND DISASTERS IN SRI LANKA for the analysis of Coupled Model Intercomparison Project Phase 5 (CMIP5), The 11th GEOSS Asia-Pacific Symposium, Group on Earth Observations, Kyoto, Japan, October 24-26, 2018
- Mohamed Rasmy, ICHARM TECHNICAL AND SCIENTIFIC ACTIVITIES FOR THE PLATFORM ON WATER RESILIENCE AND DISASTERS IN SRI LANKA for the analysis of Coupled Model Intercomparison Project Phase 5 (CMIP5), The 11th GEOSS Asia-Pacific Symposium, Group on Earth Observations, Kyoto, Japan, October 24-26, 2018
- 牛山朋來、Maksym Gusyev、玉川勝徳、長谷川聡、小池俊雄、ベトナム3都市圏における豪雨の温暖化影響、日本気象学会2018年度秋季大会、日本気象学会、仙台国際センター、2018年10月29日～11月1日
- S. Egashira, Sediment-and driftwood-runoffs resulting from landslides and debris flows, and their impacts on flood flows, 5th International Debris Flow Workshop, Beijing, November 5-6, 2018
- Y. Yamazaki, S. Egashira, Formation process of natural dam resulting from landslides and debris flow, 5th International Debris Flow Workshop, Beijing, November 5-6, 2018
- T.S. Ahmed, S. Egashira, D. Harada, A. Yorozuya, Y. Kwak, On bank erosion in estuary of Sittaung river in Myanmar, The 9th International Conference on Scour and Erosion, The 9th International Conference on Scour and Erosion, Taipei, Taiwan, November 5-8, 2018
- D. Harada, S. Egashira, A. Yorozuya, Method to evaluate longitudinal sediment sorting processes, The 9th International Conference on Scour and Erosion, The 9th International Conference on Scour and Erosion, Taipei, Taiwan, November 5-8, 2018
- Y. Yamazaki, S. Egashira, N. Nagumo, Method to predict sediment runoff resulting from landslides and debris flows, The 9th International Conference on Scour and Erosion, The 9th International Conference on Scour and Erosion, Taipei, Taiwan, November 5-8, 2018
- M. Stewart, U. Morgenstern, M. Tsujimura, M. Gusyev, K. Sakakibara, Y. Imaizumi, H. Rutter, R. van der Raaij, Z. Etheridge, and L. Scott (2018). Subsurface Flowpaths of Christchurch Springs. Poster Presentation at the Joint Conference of New Zealand Hydrological Society and Meteorological Society, Christchurch, December 4-7, New Zealand
- 原田大輔、移流拡散方程式を用いた洪水流に伴う流木の解析、基礎水理シンポジウム2018「流木の現象と力学」、土木学会 水工学委員会 基礎水理部会、土木学会講堂、2018年12月14日

- 南雲直子、江頭進治、シッタン川河口域の流路変化に関する地理学的検討、日本地理学会発表要旨集、Vol.95、pp.118、2019年日本地理学会春季学術大会、日本地理学会、専修大学、2019年3月
- 船引彩子、久保純子、南雲直子、山形眞理子、Kien Nguyen、メコンデルタ、オケオ遺跡における古代運河の形成、日本地理学会発表要旨集、Vol.95、pp.117、2019年日本地理学会春季学術大会、日本地理学会、専修大学、2019年3月
- 南雲直子、ハザードマップをどう扱うか、日本地理学会発表要旨集、Vol.95、pp.10、2019年日本地理学会春季学術大会、日本地理学会、専修大学、2019年3月
- Gusyev M.A. (2019). Modelling of groundwater and surface water residence times using tritium as a tracer. The International Atomic Energy Agency (IAEA)/Regional Cooperative Agreement (RCA) Regional Training Course (RTC) RAS7030 Project “Isotopic Data Processing and Interpretation – Hands on Exercises”, Tsukuba University, Tsukuba, March 18th, Japan.
- 牛山朋來、中村要介、平成30年7月豪雨に伴う岡山県高梁川のアンサンブル洪水予測実験、日本気象学会2019年度春季大会予稿集、p.297、日本気象学会、2019年5月15日～18日
- Mamoru Miyamoto, Yosuke Nakamura, Anurak Sriariyawat, Supattra Visessri, Operational inundation forecasting contributing to business continuity management in the industrial complex scale – A case of the Chao Phraya River basin, Thailand - , EGU General Assembly 2019, vol.21, 12486, April 4-12, 2019
- Gusyev M.A., Kikumori Y., Nishihara T., Hayashi T., Ichiyanagi K., Akata N., Oda T., Morgenstern U., and M.K. Stewart (2019). Using tritium in apanese precipitation for tritium-tracer transit time studies across Asia. Presentation at the JpGU 2019 Meeting, Chiba, May 20-24th, Japan.
- 栗林大輔、崔 国慶、大原美保、藤兼雅和、浸水過程を考慮した地区単位での簡便な洪水リスク評価システムの開発、地域安全学会梗概集、No.44、pp.35-38、地域安全学会春季大会、地域安全学会、長野県木曽町、2019年5月
- Gusyev M.A. (2019). Water circulation in the Chikuma River basin. National Research Institute of Fisheries Sciences, Ueda, August 22, Japan.
- Tomoki Ushiyama and Yosuke Nakamura, Ensemble flood forecasting of a disastrous flood event in 2018 Japan, AOGS 2019 annual meeting, AOGS, Singapore, July 29-August 2, 2019
- 中村要介、池内幸司、山崎 大、近者敦彦、日本域表面流向マップを活用したRRIモデルの洪水再現性に関する研究、2019年度研究発表会要旨集、pp.30-31、2019年度研究発表会、水文・水資源学会、千葉工業大学、2019年9月11日～13日
- 深見和彦、水災害分野の気候変動影響評価を支える技術開発と適応策実装への戦略－発展途上国における取組－、令和元年度土木研究所講演会講演集、第4391号、

pp.25-32、2019年10月16日

- 牛山朋來、瀬古 弘、藤田実季子、小司禎教、船舶搭載GPS PWVの同化インパクト実験その２、日本気象学会2019年度秋季大会予稿集、p.268、日本気象学会2019年度秋季大会、日本気象学会、福岡国際会議場、2019年10月
- Tanjir Saif Ahmed, EGASHIRA Shinji, HARADA Daisuke, YOROZUYA Atsuhiro, B. B. Shrestha, Numerical simulation of sand bar deformation in Sittaung river estuary, Myanmar, 11th River, Coastal & Morphodynamics Symposium, November 2019
- Tanjir Saif Ahmed, EGASHIRA Shinji, HARADA Daisuke, YOROZUYA Atsuhiro, Sediment Transportation and Sand Bar Deformation owing to Tidal Currents in Sittaung River Estuary, Myanmar, 水工学論文集, November 2019
- 筒井浩行、澤田洋平、生駒栄司、喜連川 優、小池俊雄、ブラジル北東域における植生動態－陸面結合データ同化手法による長期渇水解析に基づく穀物生産量・必要灌漑水量の推定に関する研究、水工学論文集、水工学講演会、土木学会水工学委員会、pp.I_283-I_288、大宮ソニックシティ、2019年11月4日～6日
- HARADA Daisuke, EGASHIRA Shinji, Evaluation of driftwood behaviour in terms of convection-diffusion equation -In the Akatani reach at the flood disaster in July, 2017-, 11th River, Coastal & Morphodynamics Symposium, 11th River, Coastal & Morphodynamics Symposium, IAHR, Auckland University of Technology, November 16-21, 2019
- EGASHIRA Shinji, HARADA Daisuke, Tanjir Saif Ahmed, Entrainment of Very Fine Sediment in Treating the Estuary Bed Evolution, 11th River, Coastal & Morphodynamics Symposium, IAHR, Auckland University of Technology, November 16-21, 2019
- Robin K. Biswas, HARADA Daisuke, NAKAMURA Yousuke, EGASHIRA Shinji, Riverbed evolution and sediment sorting during flood, 11th River, Coastal & Morphodynamics Symposium, IAHR, Auckland University of Technology, November 16-21, 2019
- TOMIZAWA Yosuke, Climate Resilience for Sustainable Development, 6th HATHI International Seminar, p.34, HATHI : Indonesian Association of Hydraulic Engineers, Kupang, Indonesia, November 22-24, 2019
- TAMAKAWA Katsunori, Introduction of WEB-DHM and application to Saigawa basin in Japan, The 4th UTokyo-NTU Joint Conference, The University of Tokyo, December 9, 2019
- 牛山朋來、数値天気予報を用いた洪水予測と発電ダムの効率的運用について、第19回PCクラスターシンポジウム、PCクラスタコンソーシアム、秋葉原コンベンションホール、2019年12月12日～13日

D: Poster Presentation

- 南雲直子、江頭進治、赤谷川流域の地形特性からみた2017年九州北部豪雨災害による被災家屋の立地、日本地理学会発表要旨集、日本地理学会、Vol.93、2018年3月
- Yoshihiro SHIBUO, Hiroshi Sanuki, Sungae LEE, Kouhei YOSHIMURA, Yoshimitsu Tajima, Development of Data Base Integrated Hydrological- and Hydraulic Modeling for River Flood- and Urban Inundation Forecast, useR!2017 Conference, useR!, Brussels, August 1-3, 2017
- 渋尾欣弘、佐貫宏、吉村耕平、李星愛、田島芳満、XRAIN，高解像度降水ナウキャスト，降水短時間予報を活用した都市流域浸水解析、水文・水資源学会2017年度研究発表会要旨集、pp. 214-215、水文・水資源学会、北見工業大学、2017年9月19～21日
- Young-Joo Kwak、Asia flood mapping using multiple satellite data、日本地球惑星科学連合、千葉幕張メッセ、2018年5月20～24日
- Young-Joo Kwak、Daisuke KURIBAYASHI、Hisaya SAWANO、Shinji EGASHIRA、Coastal erosion and land loss detection using multi-temporal ALOS/ALOS2 data in Sittaung Estuaries, Myanmar、日本地球惑星科学連合、千葉幕張メッセ、2018年5月20～24日
- Imaizumi Y., Tsujimura M., Yamamoto C., Sugiyama, A., Ogawa M., Sakakibara K., Kato K., Mizugaki S., Katsuyama M., Yamada T., Yano S., Sasakura N., Gusyev M.A., Morgenstern U. and M.K. Stewart (2018). Spatial distribution of residence time and total number of prokaryotes in spring water in headwater catchments underlain by different lithology. Poster at the Presentation at the JpGU 2018 Meeting, Chiba, May 20-24th, 2018, Japan
- Islam M. Khairul, Nikolaos Mastrantonas, Mohamed Rasmy, Toshio Koike and Kuniyoshi Takeuchi, Inter-comparison of gauge-adjusted global satellite rainfall estimates for water resources management in the Maghna river basin, JpGU-AGU Joint Meeting, Chiba, May 20-24th, 2018, Japan
- Young-Joo Kwak, S. Yun, A Comparative Pilot Study of Flood Mapping using ALOS-2 Data in Japan, AOGS2018, AOGS, Honolulu, Hawaii, June 3-8, 2018
- 郭　栄珠、朴　鍾杰、近藤昭彦、気候変動及び社会経済シナリオを考慮した広域河川氾濫リスク予測モデル開発、2018（平成30）年度 海外学術調査フェスタ、東京外国語大学、アジア・アフリカ言語文化研究所、2018年6月16日
- Young-Joo Kwak, S. Yun, Effect of Building Orientation on Urban Flood Mapping Using ALOS-2 Amplitude Images, International Geoscience and Remote Sensing Symposium (IGARSS)2018, Geoscience and Remote Sensing Symposium, Spain, July 22-27, 2018
- Young-Joo Kwak, R. Pelich, J. Park, W. Takeuchi, Improved Flood Mapping Based on the Fusion of Multiple Satellite Data Sources and In-Situ Data, International Geoscience and Remote Sensing Symposium (IGARSS)2018, Geoscience and Remote Sensing Symposium,

Spain, July 22-27, 2018

- 南雲直子、原田大輔、萬矢敦啓、小関博司 、山崎祐介、江頭進治、ネパール国ウエストラプティ川の流路変動、2018年日本地理学会秋季学術大会、日本地理学会、和歌山大学、2018年9月22～23日
- 大原美保、南雲直子、平成30年７月豪雨での地域別・年齢階級別死者発生状況に関する一考察、地域安全学会秋季大会、地域安全学会、静岡県地震防災センター、No.43、pp.103-106、2018年11月2～3日
- Imaizumi, Y., Tsujimura, M., Yamamoto, C., Sugiyama, A., Ogawa, M., Sakakibara, K., Kato, K., Mizugaki, S., Katsuyama, M., Yamada, T., Yano, S., Sasakura, N., Gusyev, M., Morgentern, U., Stewart, M. (2018). Relationship between residence time and microbe information in spring water in headwater catchments underlain by different lithology. Poster Presentation H13N-1961, the AGU 2018 Fall Meeting, Washington D.C., December 10-14, USA
- Yosuke Nakamura, Toshio Koike, Kazuyuki Nakamura, Shiori Abe and Takahiro Sayama, Real-time flood prediction utilizing a particle filter combined with RRI model, EGU General Assembly 2019, the European Geosciences Union, Austria Center Vienna, April 7-12, 2019
- Gusyev M.A., Kikumori Y., Denda M., Mizugaki S., Machida I., Akata N., Sakakibara K., Tsujimura M., Imaizumi Y., Morgenstern U., and M. Stewart (2019). Understanding water circulation with tritium-tracer measurements in selected catchments across Japan. Poster Presentation at the International Symposium on Isotope Hydrology: Advancing the Understanding of Water Cycle Processes CN-271, International Atomic Energy Agency (IAEA), Vienna, May 20-24, Austria.
- Gusyev M.A., Kikumori Y., Nishihara T., Hayashi T., Ichiyanagi K., Akata N., Oda T., Morgenstern U., and M.K. Stewart (2019). Using tritium in Japanese precipitation for tritium-tracer transit time studies across Asia. Presentation at the JpGU 2019 Meeting, Chiba, May 20-24th, Japan.
- 原田大輔、江頭進治、ダム流域における流砂・河床変動の評価法に関する研究、河川技術論文集、25巻、pp.711-716、河川技術に関するシンポジウム、土木学会水工学委員会河川部会、東京大学農学部弥生講堂、2019年6月12日～13日
- 山崎祐介、江頭進治、土石流の支配方程式を用いた天然ダムの形成過程、河川技術論文集、25巻、pp.705-710、河川技術に関するシンポジウム、土木学会水工学委員会河川部会、東京大学農学部弥生講堂、2019年6月12日～13日
- Mohamed Rasmy, Ye Seul Cho, HASEGAWA Akira, KOIKE Toshio, Climate Change Impacts on Water Resources of the Andong Watershed in South Korea under CMIP-5 Scenarios, AOGS 2019 annual meeting, AOGS, Singapore, July 29-August 2, 2019
- Gusyev M.A., DENDA M., KIKUMORI Y., HIRABAYASHI K., TOYOTA M.,

TSUJIMURA M., SAKAKIBARA K., YAMANAKA T., AKATA N., MACHIDA I., Morgenstern U., and M. Stewart (2019). Water circulation dynamics in the Chikuma River basin. 22nd River Ecosystem Symposium, Tokyo, November 7, Japan.

- 南雲直子、江頭進治、久保純子、Ben Bunnarin、湖水位の影響を受ける河川の地形および材料特性-トンレサップ湖に流入するセン川を対象として-、日本地形学連合2019年40周年記念大会、日本地形学連合、京都大学防災研究所、2019年11月8日～10日
- OHARA Miho, KURIBAYASHI Daisuke, DENDA Masatoshi, MOROOKA Yoshimasa, KOYABU Tsuyoshi, Disaster Awareness Improvement by Flood Simulated Experience in Virtual Reality, World Bosai Forum 2019 Poster Session, Sendai, Japan, Nov 10-12, 2019.
- NAGUMO Naoko, EGASHIRA Shinji, Dynamic Channel Shifting and Corresponding Formation and Destruction of Villages in the Sittaung River Estuary, 11th River, Coastal & Morphodynamics Symposium, IAHR, Auckland University of Technology, November 16-21, 2019
- Gusyev M.A., DENDA M., KIKUMORI Y., Morgenstern U., AKATA N., HIRABAYASHI K., TOYOTA M., TSUJIMURA M., YAMANAKA T., SAKAKIBARA K., and M. Stewart (2019). Combining environmental tritium and modelling of hydrologic systems on large scale for decision making and climate change and landuse assessment. Poster Presentation, New Zealand Hydrological Society Conference, Rotorua, December 3-6, NZ.
- NAKAMURA Yosuke, MIYAMOTO Mamoru, Anurak Sriariyawat, Supattra Visessri, Study on a nested hydrological model for the Chao Phraya River, AGU Fall Meeting 2019, American Geophysical Union, Moscone Center in San Francisco, December 9-13, 2019
- Abdul Wahid Mohamed Rasmy, KOIKE Toshio, Incorporating Evapotranspiration Processes in the Rainfall-Runoff-Inundation (RRI) Model and validating the model outputs with the MODIS and GLEAM Evapotranspiration Products, AMS Annual meeting, AMS, Boston, USA, January 12-16, 2020

E: PWRI Publication

- Maksym Gusyev, Jun Magome, Anthony Kiem, Kuniyoshi Takeuchi, The BTOP Model with Supplementary Tools User Manual, Technical Note of PWRI No.4357, ISSN 0386-5878, Public Works Research Institute (PWRI), March 2017
- 徳永良雄、江頭進治、新屋孝文、白井隆、2016-2017 修士課程「防災政策プログラム水災害リスクマネジメントコース」実施報告書、土木研究所資料 第4371号、国立研究開発法人土木研究所（PWRI）、2018年4月
- ICHARM, Meeting material of the 3rd ICHARM Governing Board Meeting, Technical Note of PWRI, Public Works Research Institute (PWRI), No. 4377, ISSN0386‐5878, July

2018

F: Magazine, Article

- 池田鉄哉、安川雅紀、アブドゥル　ワヒド　モハメッド　ラスミ、牛山朋來、スリランカへの洪水対策支援について、土木技術資料、土木研究センター、Vol.60-5、pp.32-35、2018年5月
- 澤野久弥、世界での防災・減災への取組みと日本の役割、土木技術資料、土木研究センター、Vol.60-5、pp.6-7、2018年5月
- 澤野久弥、水防災に関する科学・技術分野間の学際研究と社会との協働、土木技術資料、一般財団法人　土木研究センター、第61巻、pp.10-13、平成31年1月号、2019年1月
- 大原美保、徳永良雄、小林亘、地下街等関係事業所の避難確保・浸水防止体制の強化に向けた情報配信アプリの活用、土木技術資料、一般財団法人　土木研究センター、pp.8-11、平成31年3月号、2019年3月
- 南雲直子、沖積平野を対象とした地形分類と洪水氾濫解析、地理、pp.66-73、Vol.64、2019年4月号
- 澤野久弥、国内外で激甚化する水災害への対応について、土木コスト情報、pp.6-11、2019年10月号
- 栗林大輔、深見和彦、ICHARMのリスクコミュニケーション研究－世界の水災害被害軽減のためにー、土木技術、Vol.74、No,11、pp.79-82、2019年11月号
- 深見和彦、水災害リスクの低減に何が必要か？、土木技術資料、一般財団法人　土木研究センター、pp.6-7、令和2年2月号、2020年2月
- 牛山朋來、伊藤弘之、地球温暖化による将来の降雨量変化を詳細に評価するためのダウンスケーリング技術、土木技術資料、一般財団法人　土木研究センター、pp.8-11、令和2年2月号、2020年2月
- Abdul Wahid Mohamed RASMY、牛山朋來、安川雅紀、深見和彦、観測情報の乏しい発展途上国で運用可能な洪水予測システムの開発～全球規模の衛星降雨観測・降雨予測情報の活用～、土木技術資料、一般財団法人　土木研究センター、pp.12-17、令和2年2月号、2020年2月
- Badri Bhakta SHRESTHA、宮本守、澤野久弥、深見和彦、気候変動影響による洪水氾濫・農業リスクの変化予測～フィリピン・パンパンガ川流域での検討事例～、土木技術資料、一般財団法人　土木研究センター、pp.18-21、令和2年2月号、2020年2月
- 大原美保、栗林大輔、藤兼雅和、水害対応ヒヤリ・ハット事例集（地方自治体編）の作成、土木技術資料、一般財団法人　土木研究センター、pp.22--25、令和2年2月号、2020年2月
- 宮本守、小池俊雄、多様な水防災・減災関係者が参画するプラットフォームを通じ

た、気候変動適応策 実装への取組み、土木技術資料、一般財団法人　土木研究センター、pp.26-29、令和2年2月号、2020年2月

- 鷲尾洋一、人材育成による発展途上国における水災害リスク低減への貢献、土木技術資料、一般財団法人　土木研究センター、pp.30-33、令和2年2月号、2020年2月
- 南雲直子、江頭進治、Aung Myo Khaing、ミャンマー・シッタン川河口域における潮汐流と河岸侵食に関する調査研究、土木技術資料、一般財団法人　土木研究センター、pp.38-41、令和2年2月号、2020年2月
- 萬矢敦啓、小関博司、山本晶、実河川における流砂の水理とその計測技術の開発、一般財団法人　土木研究センター、pp.42-45、令和2年2月号、2020年2月
- 南雲直子、カンボジア低地部の水と暮らし、科学、Vol.90、No.4、pp.290-292、2020年3月

G: Others

- 今村能之、洪水による被害軽減に資する指標の開発、技術開発支援事業成果報告書、一般社団法人　中国建設弘済会、pp. 149-188, 2018年9月
- 小池俊雄、豪雨対策 見直し議論　-わがこと感育てる-（インタビュー記事）、中国新聞 朝刊、2018年12月2日
- Gusyev M.A. (2019). Progress Report of the PWRI tritium research in the Chikuma River basin. Chikuma River Office, Nagano, April 12, Japan.
- 小池俊雄、令和の天皇と皇后　ー模索始まる　新しい公務ー（コメント）、日本経済新聞朝刊社会面、2019年5月4日
- 小池俊雄、JAPAN特集「BOSAI: An Educational Journey ～Flood Edition」、NHK-World、2019年7月6日放送、https://www3.nhk.or.jp/nhkworld/en/special/episode/201907060810/
- 小池俊雄、BOSAI学びの旅 水害編～日本とインドを歩く～、NHK BS1、7月8日放送、https://www3.nhk.or.jp/nhkworld/en/ondemand/program/video/bosai/
- 小池俊雄、気候変動を見据えた対策、NHK総合ニュースウォッチ9（インタビュー）、2019年12月2日放送