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ICHARM
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Message from Executive Director

End-to-End Science

Lecture on "The Life of a Japanese Christian Civil Engineer, Dr. Isami HIROI" at ICHARM on July 5, 2021
講義「キリスト教徒であった日本の土木技術者、廣井勇博士の生涯」
（2021 年 7 月 5 日 , ICHARM にて）

Under climate change and gradual progress in social vulnerability, how can science and technology contribute to enhancing water-related disaster resilience and sustainability? Issues that stand at the border between the field of science and that of political or social decision-making have been discussed in the context of "Science for Human and Society."

M. Gibbons argued about conceptual differences in scientific knowledge and categorized it into "Mode 1" and "Mode 2." The former is produced as academic, investigator-initiated and discipline-based knowledge production while the latter is a scientific activity for application apart from any traditional discipline by aggregating knowledge in context-driven and problem-focused ways. Similarly, defining theoretical and experiential knowledge activities aiming to recognize phenomena as "cognizing science" and those aiming to produce and improve phenomena as "designing science," the Science Council of Japan proposes a new scientific field dedicated to the discovery of "social wishes," which aims to reveal critical issues for social problem resolution using scientific methods. In Future Earth towards promoting cooperative work between society and the science community, researchers from wide-ranging fields and various stakeholders share practical issues, co-design and co-produce research and co-deliver the results to understand and resolve global environmental problems.

As symbolized by "The Two Cultures and the Scientific Revolution (C. P. Snow)," it is considered inevitable for disciplines based on different scientific principles to be isolated from one another since human information processing ability is limited. To break through the situation, I would like to propose "End-to-End Science." By making full use of information technology, it would be possible to integrate data and models, exchange scientific knowledge, and promote dialogue among different disciplines, thus realizing consilience. At the same time, advanced two-way communication between science and society should be materialized so that science can act beyond its realm and interact with society, which leads to the establishment of End-to-End Science. This is a paradigm shift needed to enhance disaster resilience and sustainability and for science and society to achieve.

July 30, 2021
KOIKE Toshio
Executive Director of ICHARM

一気通貫の科学

気候が変化し、社会の脆弱化が進む中で、水災害に対する社会のレジリエンスを高め、持続可能性を確保するために、科学技術はどのように貢献できるでしょうか。このように科学の領域と政治や社会の選択責任の領域の境界に位置する問題に関しては、これまで「人間と社会のための学術の在り方」として、国内外で議論が展開されてきました。

M. ギボンズは科学の知の概念的な違いを議論し、学術的な探求の文脈で専門分野に基礎をおいて行われる知識生産であるモード１に対して、既存のどの専門領域にも属さない知識生産が応用の文脈で行なわれるモード２の科学があり、ここでは解決すべき問題に対して必要な知識が集約されるとしています。日本学術会議では、現象の認識を目的とする理論的・経験的な知識活動である認識科学と、現象の創出や改善を目的とする理論的・経験的な知識活動である設計科学を定義し、さらに社会的問題を解決するための課題を科学的手法により発見するという社会的期待発見研究という分野の創設を提案しています。研究コミュニティと社会との連携を目指すフューチャーアースでは、様々な専門分野の研究者と社会の様々な関係当事者が、問題を共有し、研究を協働して企画、推進し、成果を共に社会実装することによって地球規模の環境問題の理解と解決に取り組んでいます。

一方、C.P. スノーの「二つの文化と科学革命」に象徴されるように、異なる秩序原理に基づく文理の乖離は、人間の情報処理能力に限界があるがゆえに避けられないとされていなす。そこで一気通貫の科学の推進を提案します。IT 分野との協力によって、データやモデルを統合し、分野間の対話を深め、情報を融合することによって知の統合を実現するとともに、社会との双方向のコミュニケーションを確立して、科学の区分を越え、社会と相互に影響し合う、一気通貫の科学の確立を目指すものです。これは、災害レジリエンスと持続可能性を高めるためのパラダイムの転換と言えましょう。

Contents

Request to participate in online survey on ICHARM Newsletter

ICHARMニュースレター購読者アンケートのお願い

ICHARM では、2006 年 3 月の設立以降、最新の動向をお知らせする「ICHARM ニュースレター」を、年 4 回発行しています。

このたび、一層の内容の充実を図るべく、読者の皆様にアンケートをさせて頂きたく存じます。

つきましては、以下のサイトにアクセス頂き、アンケートにお答え下さい。

https://forms.gle/1rHq13UFiYK8kb9d7

回答期限：2021 年 10 月 28 日まで
回答時間（目安）：5 分程度

Thank you for subscribing ICHARM Newsletter. ICHARM has been publishing the quarterly newsletter since its establishment in March 2006 to deliver the latest news about research, projects and other activities to readers around the world. As we are currently working on the improvement of the newsletter, we would be grateful if you could spare time to answer the following questions and let us hear your voices about our publication.

Survey posted at: https://forms.gle/1rHq13UFiYK8kb9d7
Survey to be done by: October 28, 2021
Time required: about 5 minutes

Special Topics

5th ICHARM Governing Board Meeting was held
第 5 回 ICHARM 運営理事会を開催しました


Participants in the 5th ICHARM Governing Board meeting
第 5 回 ICHARM 運営理事会の参加者

On May 12, 2021, the fifth ICHARM Governing Board (GB) meeting was held using a web system via the Internet as a precaution against COVID-19. The GB meeting is to be held every year from this year on, in compliance with the agreement between the government of Japan and UNESCO, signed on February 13, 2020. In the meeting, the GB examines the ICHARM activity report and also examines and adopts its work plan for the next year. The GB had met four times in the past from the first one on February 25, 2014, until the fourth on June 2, 2020.

As defined in the agreement, the GB is chaired by the president of PWRI, currently NISHIKAWA Kazuhiro, and composed of eight members, including YAMADA Kunihiro, the vice-minister for Engineering Affairs of MLIT, representing the government of Japan, and Shamila NAIR-BEDOUELLE, the assistant director-general for Natural Sciences, representing UNESCO on behalf of the director-general.

At the meeting, ICHARM Executive Director KOIKE Toshio reported and then the GB members examined the activities of ICHARM in the last year from 2019 to 2020. He also explained the work plan for the next year, which was unanimously adopted by the GB after thorough discussions.


A scene of the Governing Board meeting
運営理事会の様子

Overall, all the GB members highly appreciated the efforts of ICHARM. They also gave valuable advice for further improvement of the activities and the organization. Mr. YAMADA expressed MLIT's continuous support to ICHARM, in addition to praising ICHARM's research and local practice, human resource development, and information network. Some members suggested that ICHARM should be more active in spreading its outputs worldwide and linking the activities more closely with the global agenda such as SDGs and the Sendai Framework for Disaster Risk Reduction. Others expected ICHARM to expand its activity further in the Africa and Latin-America regions.

Following the work plan adopted at the meeting with the suggestions provided by the GB members, ICHARM will continue striving for disaster risk reduction on a global basis.

The meeting materials are available at the ICHARM website below.
https://www.pwri.go.jp/icharm/special_topic/20210512_GoverningBoard.html

2021 年 5 月 12 日 に 第 5 回 ICHARM 運営理事会を開催しました。この運営理事会は、2020 年 2 月 13 日に署名・締結された日本国政府とユネスコとの協定に基づき、ICHARM の活動に関する報告書の審査、及び事業計画を審査・採択するために、年に一度開催することとされています。

これまで、2014 年 2 月の第 1 回会合から 2020 年 6 月の第 4 回会合までは 2 年に 1 回の開催でしたが、2020 年 2 月の協定によって年に一度開催することとされ、今回が第 5 回目の会合となりました。会議は新型コロナウィルスの感染拡大防止のため、前回に引き続き WEB での開催となりました。

運営理事会の委員は、本協定の規定により、土木研究所・西川和廣理事長が議長を務め、日本国政府の代表として国土交通省・山田邦博技監、ユネスコ事務局長の代理としてシャミラ・ナイア・ベドウェル自然科学局　事務局長補等、計 8 名の委員が出席しました。

会合では、ICHARM 小池俊雄センター長から 2019 年から 2020 年の 1 年間の活動報告がなされて、その審査が行われるとともに、今年度の事業計画について説明し、その審査が行われ、満場一致で採択されました。

国土交通省の山田委員からは、ICHARM の行っている研究開発とその現地実践の取り組み、人材育成、そして情報ネットワーク活動を高く評価いただくとともに、今後の活動に対し国土交通省として継続的な支援を行うことが述べられました。また、他の委員からも、ICHARM のこれまでの活動成果を高く評価していただき、今後とも ICHARM の活動を国際社会で更に普及させていくこと、SDGs や仙台防災枠組み等の国際的なアジェンダとより強く関連付けていくこと、そしてアフリカやラテンアメリカ地域での活動展開を期待する意見などをいただきました。

ICHARM では、本会合で採択いただいた事業計画に基づき、また委員の皆様よりいただいたご助言などを踏まえ、今後とも精力的な活動に取り組んで参ります。

なお、本会合での配布資料および発表スライドは、ICHARM ホームページでご覧いただけます。
https://www.pwri.go.jp/icharm/special_topic/20210512_GoverningBoard_j.html

Summary of the 5th ICHARM Governing Board meeting

Date: 16:00-17:30, Wednesday, 12th May 2021

Web meeting system: BlueJeans

Agenda:

- Confirmation of the rules and procedures for the ICHARM Governing Board meeting
- Examination of ICHARM Activity Report
- Examination and adoption of ICHARM Work Plan

Participants (listed in an alphabetical order of their organizations):

TANAKA Akihiko, President, National Graduate Institute for Policy Studies (GRIPS)

IWASAKI Eiji, Director General of Global Environment Department, on behalf of Mr. KITAOKA Shinichi, President, Japan International Cooperation Agency (JICA)

YAMADA Kunihiro, Vice Minister for Engineering Affairs, Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

NISHIKAWA Kazuhiro (Chairperson), President, Public Works Research Institute (PWRI)

MATSUOKA Yuki, Head of the United Nations Office for Disaster Risk Reduction (UNDRR) Office in Japan, on behalf of Ms. Paola ALBRITO, Chief of Branch, Intergovernmental Processes, Interagency Cooperation and Partnerships, UNDRR

Shamila NAIR-BEDOUELLE, Assistant Director-General for Natural Sciences, on behalf of Ms. Audrey AZOULAY, Director-General, United Nations Educational, Scientific and Cultural Organization (UNESCO)

TAKARA Kaoru, Chair Holder, Research and Educational Unit of UNESCO Chair on Water, Energy and Disaster Management (WENDI), Professor, GSAIS in Human Survivability, Kyoto University

Elena MANAENKOVA, Deputy Secretary-General, World Meteorological Organization (WMO)


TANAKA Akihiko (GRIPS)


IWASAKI Eiji (JICA)


YAMADA Kunihiro (MLIT)


NISHIKAWA Kazuhiro (PWRI)


MATSUOKA Yuki (UNDRR)


Shamila NAIR-BEDOUELLE (UNESCO)


TAKARA Kaoru (WENDI)


Elena MANAENKOVA (WMO)

(Written by TOMIZAWA Yosuke)

Research

ICHARM session was held in the conference ICWFM2021, organized by BUET (March 30th, 2021)
BUET 主催の国際会議（ICWFM2021）にて ICHARM セッションを開催しました（3/30）

ICHARM hosted a session during the 8th International Conference on Water and Flood Management (ICWFM2021), held online from March 29 to 31. The session took place as proposed by Dr. Robin Kumar Biswas, a former research specialist of ICHARM, since the conference was organized by the Bangladesh University of Engineering and Technology (BUET), many graduates of which studied in ICHARM's educational programs. The session was entitled "Fine sediment transport and river morphology" and moderated by Training and Research Advisor EGASHIRA Shinji. Research Specialist HARADA Daisuke delivered a research presentation, and Dr. Robin, Dr. Afmad Tanjir Saif, Mr. Masbahul Islam, and Mr. Shahinur Rahman of BUET also spoke about their research related to the topics they pursued when studying at ICHARM (Dr. Saif graduated from the Ph.D. course in 2020, and Messrs. Islam and Rahman from the master's in the same year). After the presentations, Prof. M. M. Hossain of BUET and Prof. TAJIMA Yoshimitsu of the University of Tokyo made comments and asked questions. The participants actively discussed the method to treat fine sediment transportation in Bangladesh rivers and the difference between the bedload transport equations with two different powers, i.e., 3/2 and 5/2, of non-dimensional tractive force.

Oral presentation at an ICHARM meeting room (left) and a photo session with remote participants (right)
左：ICHARM 会議室での口頭発表の様子、右：遠隔参加者を含めた記念撮影

(Written by HARADA Daisuke)

2021 年 3 月 29 日から 31 日にかけてオンライン開催された国際会議 ICWFM2021 (8th International conference on Water and Flood Management) において ICHARM セッションを開催しました。本国際会議は BUET（バングラデシュ工科大学）が主催するもので、ICHARM はこれまで多くの BUET の卒業生を修士・博士課程の学生として受け入れてきたことから、Robin Kumar Biswas 元専門研究員の提案により実現したものです。本セッションは「細粒土砂の輸送と地形変化」と題し、江頭進治研究・研修指導監が司会進行を務めました。ICHARM からは原田大輔専門研究員が発表を行い、BWDB (Bangladesh Water Development Board) からは Robin Kumar Biswas 氏、Afmad Tanjir Saif 氏 (2020 年博士課程卒業)、Masbahul Islam 氏 (2020 年修士課程卒業)、Shahinur Rahman 氏（2020 年修士課程卒業）がそれぞれ ICHARM で行った研究を発表しました。各自の研究発表の後に、BUET の M. M. Hossain 教授及び東京大学大学院の田島芳満教授から各発表に対するコメント及び質問がありました。特に、バングラデシュの河川を対象とした微細土砂の解析手法に関して、また掃流砂モデルの 3/2 乗の式と 5/2 乗の式の違いなどについて、活発な議論が行われました。

Development of Water and Energy Budget Based Rainfall-Runoff-Inundation (WEB-RRI) Model for Integrated Water Resources Management Practices under Climate Change

In recent years, fatalities and economic damage caused by storms, floods and droughts have significantly increased in the world due to global warming and accelerated population growth, as pointed out by the United Nations International Strategy for Disaster Reduction (UNISDR, 2018). Global warming has been claimed as the primary cause for inducing climate and hydrological extremes and threatening the security of water resources and sustainable development (IPCC, 2014). At the same time, ever-increasing population growth places additional pressures on the availability of water resources as well as disaster risk mitigation and adaptation measures. Therefore, decision-makers crucially require reliable information on water resources as well as water-related disasters to quantify hydrological risk (i.e., the combination of hazard, vulnerability, and exposure) for efficient management of resources and effective strategies for adaptation and mitigation. To this end, distributed hydrological models (DHMs), which are used for understanding various watershed hydrological processes and predicting watershed behaviors, play a crucial role in generating information on water resources and water-related disasters to support decision-making strategies. ICHARM has been conducting innovative research by accumulating a broad range of knowledge to support the implementation of very important global agreements, i.e., the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework), the Sustainable Development Goals (SDGs), and the Paris Agreement on Climate Change, and by producing high-quality research outcomes to make practical policy recommendations and to solve problems in the fields of Integrated Water Resources Management (IWRM) and Water-related disaster Risk Reduction (WDRR).

In this context, DHMs with the capability of simulating catchment-scale water and energy budgets as well as rainfall-runoff-inundation processes are essential tools for IWRM as well as WDRR under a changing climate. Previously, ICHARM developed the Rainfall-Runoff-Inundation (RRI) model (Sayama et al., 2012). The RRI model is a runoff-inundation type model, which estimates flood depth and inundation mainly based on the conservation of water balance. Model-related uncertainty arises primarily due to negligence of several fundamental and critical water-energy-related parameters and physical processes (e.g., soil moisture, canopy interception, evapotranspiration (ET), and soil-vegetation-atmosphere interactions), which cannot be overlooked for IWRM practices as well as for flood-related applications. For example, moisture within the soil layers controls the surface runoff and infiltration ratio, whereas the accurate estimation of the soil-vegetation ET component of the water budget is crucial for simulating accurate soil-vegetation water storages, river discharges, and flood depths. The negligence of essential physical formulations for water and energy budget components and land-vegetation-atmosphere interactions within rainfall-runoff-inundation modelling will result in several critical issues in applying these types of models for flood- and drought-related applications under a changing climate, such as uncertainties in the initial soil and vegetation water-storages, insensitivity to temperature changes and its impacts on ET. These issues have been recognized as major drawbacks for the applicability of water-budget models to water resources management as well as to water-related disaster management under a changing climate.

As a result, ICHARM has further developed a new model called the Water and Energy Budget Based Rainfall-Runoff-Inundation (WEB-RRI) model by integrating the RRI model with a land surface model (hydros-SiB2). Particularly, the hydro-SiB2 model is coupled with the RRI-model's 2D flow equations to incorporate water and energy budget processes, land-vegetation-atmosphere interactions, multi-layer soil moisture dynamics, and 2D lateral water flows to improve interception, ET, infiltration processes, runoff, and inundation processes. As the WEB-RRI model takes into account the entire natural hydrological processes of a catchment, the model overcomes the limitations identified in the RRI model and thus can be used for solving issues in IWRM as well as WDRR under the variability of the water cycle as well as a changing climate (Rasmy et al., 2019).

The overall WEB-RRI model structure consists of four major modules (Figure 1):

1) The Simple Biosphere Model 2 (SiB2) module for the vertical energy and water flux transfer between land and atmosphere for each model grid;
2) The vertical soil moisture distribution module for soil moisture dynamics and groundwater recharge;
3) The 2D diffusive wave lateral flow module for surface flow and groundwater flow; and
4) The 1D diffusive wave river flow module.
   In addition, the interactions between the surface flow and the river flow, between the groundwater flow and the soil moisture content, and between the groundwater flow and the river discharge were also implemented in the WEB-RRI model.

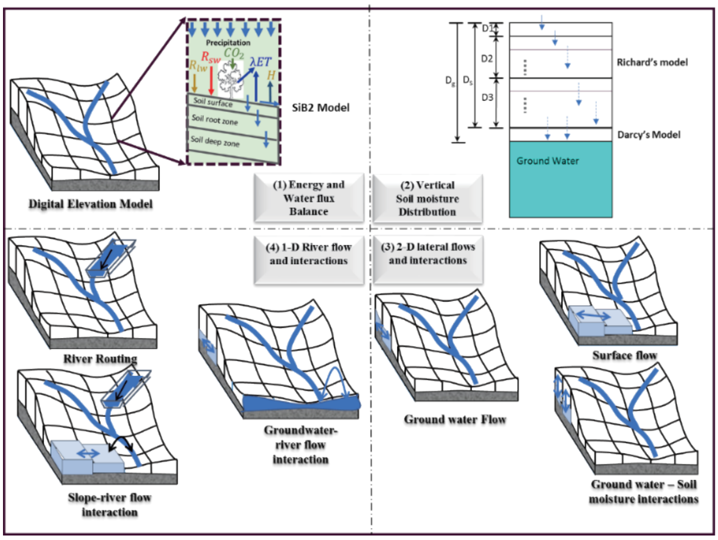

Figure 1 Schematic diagram of the Water and Energy Balanced based Rainfall–Runoff–Inundation (WEB-RRI) model and its four major modules

The merits of the WEB-RRI model are:

• Physical formulations of hydrological processes (e.g., evapotranspiration, interception, and soil moisture dynamics) to improve the accuracy of low flow estimations (droughts), the timing of the flood onset, flood peak discharges, and inundation depths and extent for improving the reliability of flood- and drought-related risk assessment (RA).

• The capability of reconstructing the actual conditions of hydrological parameters at each time step and thus reducing the computational burden of pre-running of the model in practical applications such as flood forecasting, drought monitoring, and seasonal predictions.

• The capability of producing reliable responses to the water cycle variability as well as climate change scenarios and thus being applicable to execute IWRM practices under a changing climate for sustainable development.

The detailed model formulations, experimental set-up for different climatic regions, model calibration and validations with respective to discharges, ET, and inundation can be found in Rasmy et al. (2019).

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Rasmy, M.; Sayama, T.; Koike, T. 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. J. Hydrol. 2019, 579, 124163

(Written by Mohamed Rasmy Abdul Wahid)

The kick-off meeting of HyDEPP-SATREPS in the Philippines was held online
フィリピン共和国 HyDEPP - SATREPS キックオフ会議を開催しました

ICHARM is currently leading “The Project for Development of a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change in the Republic of the Philippines (HyDEPP)” under the Science and Technology Research Partnership for Sustainable Development (SATREPS) with the University of Tokyo, Tohoku University, the University of Shiga Prefecture, Nagoya University and Kyoto University. The project is funded by the Japan International Cooperation Agency (JICA) and the Japan Science and Technology Agency (JST).

SATREPS is a Japanese government program that promotes international joint research. The program is a collaboration between JST, which provides competitive research funds to research organizations in Japan, and JICA, which provides development assistance (ODA) in the counterpart country. The principal organization on the Japan side is ICHARM, while the counterpart on the Philippine side is the University of the Philippines Los Baños (UPLB). JST’s 5-year project started in April 2020 after one-year preparation. However, JICA’s project for the same duration was postponed due to the COVID-19 pandemic. About one year later, the JICA’s project officially started on June 3, 2021.

The kick-off meeting of the HyDEPP-SATREPS Project was held online on the morning of June 30, 2021, attended by about 100 participants from research organizations of both countries, cooperating organizations in the Philippines, JICA, and JST. The meeting consists of three parts: Session1: Opening Session, Session2: Science and Technology Session, Session3: Business Meeting, which was closed for project members only.

Session1 began with the opening remarks by Dr. Jose V. Camacho, Jr., the chancellor of UPLB, which was followed by the remarks from Dr. Fernando C. Sanchez, Jr. of UPLB, the project director on the Philippine side, Ms. OSHIMA Ayumu, the senior representative of the JICA Philippines office, OHARA Miho, a senior researcher of ICHARM and the project director on the Japanese side. After the opening remarks, Project Leader OHARA and Project Manager Dr. Patricia Ann J. Sanchez (UPLB) explained the objectives and research plan of the HyDEPP-SATREPS project.

They explained that the project aims to create hybrid water-related disaster risk assessment models by combining climate-change, hydrological, agricultural, and economic models and conduct objective assessments of the effectiveness of investment in disaster prevention measures in the Pampanga River basin and the Pasig-Marikina River and Laguna Lake basins in the environs of Metro Manila. They added that policy recommendations for sustainable economic development in urban and rural areas under climate change will also be formulated through a transdisciplinary approach using the hybrid water-related disaster risk assessment models.

In Session2, the leaders of four groups presented their research plans in detail. The four groups are as follows: Group1 for data collection and integration; Group2 for flood and drought risk assessment; Group3 for water-related disaster resilience assessment; and Group4 for predection of sustainable economic development scenario. OHARA also explained a future project plan, including e-learning programs starting from mid-July. The session was concluded with expectation for future research activities by Dr. ASAEDA Takashi, a JST research supervisor, Mr. NAKAMURA Satoshi of the JICA headquarters, Prof. KOIKE Toshio, the executive director of ICHARM, and the representatives of other research and cooperating organizations. At the end of the session, Dr. ASAEDA gave closing remarks, emphasizing the importance of smooth communication among the members in both countries for the success of joint research.

The third session was a business meeting closed for the project members only. The members discussed and confirmed the detailed activity plan for this year, the roles of

土木研究所水災害・リスクマネジメント国際センター（ICHARM）は、東京大学、東北大学、滋賀県立大学、名古屋大学、京都大学とともに、国際協力機構（JICA）、科学技術振興機構（JST）による「地球規模課題対応国際科学技術協力プログラム（SATREPS）」の防災部門の研究課題「気候変動下での持続的な地域経済発展への政策立案のためのハイブリッド型水災害リスク評価の活用/Development of a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change（課題名の略称：HyDEPP）」を実施しています。

SATREPS は、開発途上国の研究者と共同で行う研究プログラムであり、日本国内では JST 事業として、相手国内では JICA による ODA 事業として実施されます。本研究課題はフィリピン共和国を対象としており、日本国側研究代表機関は土木研究所 ICHARM、相手国側研究代表機関はフィリピン大学ロスバニョス校（UPLB）です。日本国内での JST 事業としては、2019 年度における 1 年間の準備期間の後、2020 年度からの 5 か年間の研究活動を開始していました。全世界的な新型コロナウイルス感染症の拡大に伴い、フィリピン共和国国内での JICA 事業の開始を延期していましたが、2021 年 6 月 3 日から現地での 5 か年間の JICA 事業を開始しました。

2021 年 6 月 30 日午前に、日本・フィリピン両国の研究参画機関、連携機関、JICA・JST の参加のもと、本研究プロジェクトのオンライン・キックオフ会議を開催しました。会議には約 100 名が参加し、第 1 セッション：Opening Session, 第 2 セッション：Science and Technology Session、第 3 セッション：プロジェクト関係者のみによる Business Meeting という 3 部構成で開催されました。

第 1 セッションでは、UPLB の Dr. Jose V. Camacho, Jr. 学長、本研究課題の Project Director の Fernando C. Sanchez, Jr. 教授（UPLB）、JICA フィリピン事務所の大島歩次長、日本側の Project Leader の ICHARM 大原美保主任研究員が開会の挨拶を行いました。続いて、大原主任研究員及び Project Manager の Patricia Ann J. Sanchez 教授（UPLB）が研究プロジェクトの目的や計画の概要を説明しました。本研究課題は、マニラ首都圏近郊のパンパンガ川流域およびパッシグ・マリキナ川・ラグナ湖を対象として、従来の気候変動・水理水文・農業・経済活動モデルを結合させたハイブリッド型モデルを用いた水災害リスク評価とこれを用いた事前の防災投資の客観的評価に基づき、分野横断型のアプローチにより、気候変動下での都市と農村における持続可能な経済発展のための政策提言を行うことを目指しています。

第２セッションでは、グループ１（データの収集・統合化）、グループ２（洪水・渇水リスク評価）、グループ３（水災害レジリエンス評価）、グループ４（持続可能な経済発展シナリオの検討）という４つのグループのリーダーが、詳細な研究計画の発表を行いました。続いて、大原主任研究員より、2021年７月中旬からのｅラーニング研修や今後の予定について説明がありました。その後、JSTの浅枝隆Research Supervisor、JICA地球環境部防災グループの中村覚課長、ICHARMの小池俊雄センター長、共同研究機関および連携機関の代表者から、本研究プロジェクトへの期待が表されるとともに、今後の活動などへのコメントをいただきました。閉会の挨拶では、浅枝Research Supervisorから、共同研究を推進する上での両国の更なる連携への期待が寄せられ、第２セッションを終了しました。

第３セッションは、プロジェクト関係者のみのBusiness Meetingとして開催し、今年度の詳細な研究活動計画、各研究機関の役割分担、各グループ内でのユニットチームの構成などについての協議と確認が行われました。

新型コロナウイルス感染症の拡大により、引き続き、フィリピン共和国への渡航や現地調査などが実施できない環境ではありますが、両国メンバーで連携しながら、共同研究を進めていく予定です。

研究プロジェクトのURL：
https://www.pwri.go.jp/icharm/research/articles/project-HyDEPP-SATREPS_j.html

each research organization, and the plans for the unit teams, which will be launched under each group.

The project members in both countries will continue communicating closely for the joint research, although the local activities in the Philippines are still facing difficulties due to COVID-19 pandemic.

For more information on this research project, please visit:
https://www.pwri.go.jp/icharm/research/articles/project-HyDEPP-SATREPS.html

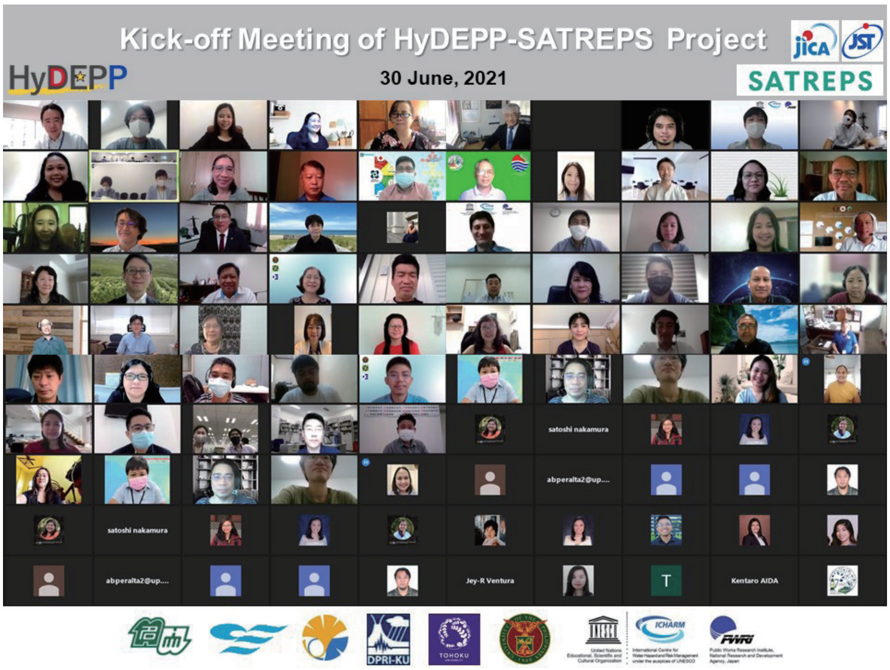

Photo1 Group photo of the participants of the Kick-off Meeting
写真１　キックオフ会議参加者による集合写真

(Written by OHARA Miho)

Introduction of ICHARM research projects / 研究紹介

ICHARMは、その使命を果たすため、世界及び地域での災害の傾向及び経験と災害対応に関する地域のニーズ、重要課題、開発段階等を踏まえつつ、自然、社会及び文化といった地域の多様性を考慮する原則というローカリズムを念頭に、研究、能力育成及び情報ネットワーク構築の３本柱を有機的に連携させて、現地実践活動を実施しています。

そのうち、研究としては

(1) 水災害データの収集、保存、共有、統計化
(2) 水災害リスクのアセスメント
(3) 水災害リスクの変化のモニタリングと予測
(4) 水災害リスク軽減の政策事例の提示、評価と適用支援
(5) 防災・減災の実践力の向上支援

の５つの柱のもと、革新的な研究活動を行っています。

本号では、秦 梦露専門研究員の「土砂の量的・質的供給条件の違いが土砂・洪水氾濫現象に及ぼす影響」と南雲直子専門研究員の「中山間地河川における豪雨時の土砂輸送に関する地形解析」を紹介します。

ICHARM sets three principal areas of activity: research, capacity building, and information network. It plans and implements projects in these areas in order to fulfill its mission, always keeping in mind “localism”, a principle with which we respect local diversity of natural, social and cultural conditions, being sensitive to local needs, priorities, development stage, etc., within the context of global and regional experiences and trends of disasters.

At present, ICHARM conducts innovative research in the following five major areas:

(1) Water-related disaster data archiving, sharing and statistics
(2) Risk assessment on water-related disasters
(3) Monitoring and forecasting water-related disaster risk changes
(4) Support through proposal, evaluation and application of policies for water disaster risk reduction
(5) Support for improving the capacity to practice disaster prevention and mitigation

This issue introduces two researchers as listed below:

QIN Menglu, Research Specialist

The effect of the transported sediment conditions from upstream area on the behavior of sediment and flood inundation in fluvial plain rivers

NAGUMO Naoko, Research Specialist

Geomorphic analysis on sediment transport during torrential rainfall in mountainous rivers

The effect of the transported sediment conditions from upstream area on the behavior of sediment and flood inundation in fluvial plain rivers
土砂の量的・質的供給条件の違いが土砂・洪水氾濫現象に及ぼす影響

QIN Menglu, Research Specialist
秦　梦露　専門研究員

Recently, so-called sediment and flood inundation disasters have been frequently reported across Japan. Typical cases include the Northern Kyusyu Heavy Rain in 2017, the Western Japan Heavy Rain in 2018, and the Eastern Japan Typhoon in 2019. These disasters are characterized by a large amount of sediment that is carried by an intense flood flow from the mountainous area and suddenly deposit in the fluvial plain where the river slope significantly decreases (inland basins, alluvial fans) or at a location where the river width temporarily expands (valley bottom). Consequently, the river bed rapidly rises, inducing the sediment and muddy flow to inundate the inland area. Nevertheless, although inundation hazard mapping has also been in progress for medium- and small-size rivers, the impact of such sediment dynamics has not been considered in this effort yet. Therefore, to reflect this newly emerging risk in hazard maps, it is essential to estimate the effect of the extensive sediment propagation due to extreme rainfall events on the behavior of sediment and flood inundation in the plain area.

Hence, I am currently developing a basin-scale sediment transportation model called RRIS-link (Rainfall-Runoff-Inundation-Sediment-link) to accurately calculate the conditions of the flow and sediment (amount and texture) from moment to moment as they propagate to the plain area. Figure 1 shows the model structure. A one-dimensional sediment transportation model that defines the section between confluences as a link (unit river channel) is introduced to the RRI model. In a simulation, the hydraulic condition is first calculated by the RRI model. Then the flow discharge at the downstream-end river cell of each link is used by the link model to conduct sediment transportation calculation. After that, changes in bed elevation due to sediment deposition and erosion are outputted into the RRI model to move on to the next calculation time step. I compared the calculated accumulative sedimentation volume in the dam reservoir with the observed data after excluding unreliable data showing significant decreases in 2016 and found that the model's calculation results show a good agreement with the observed data, as in Figure 2.

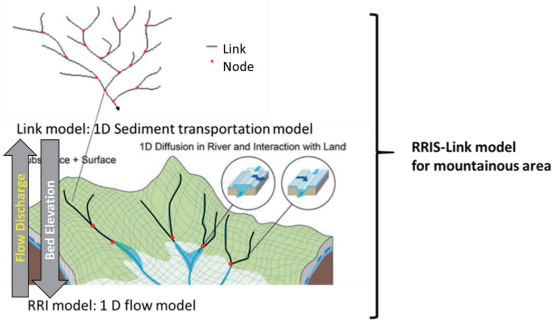

Figure 1 The structure of the RRIS-link Model
(Basin scale flow/sediment transportation model)
図 1　RRIS-link モデルの構成（流域スケールの流れ・土砂輸送モデル）

In the next step, I am planning to analyze the effect of transported sediment conditions predicted by the RRIS-link regarding sediment and flood inundation disasters in fluvial plain rivers.

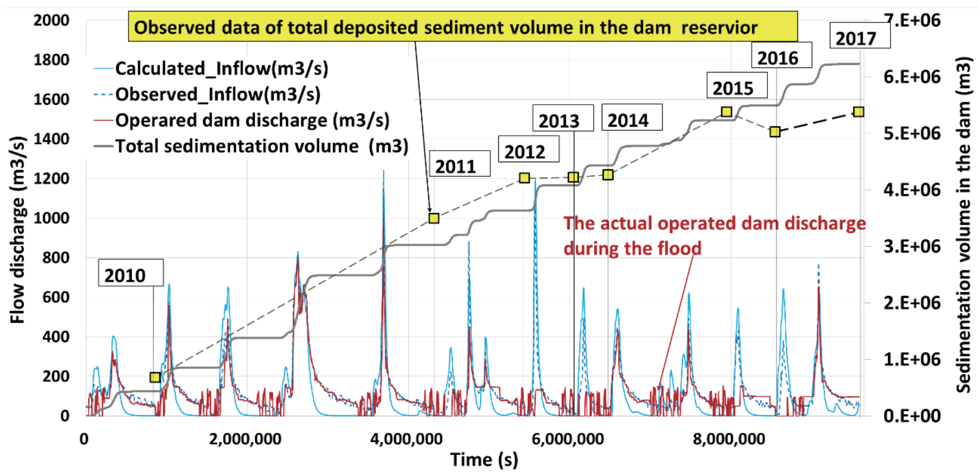

Figure 2 The simulation results of dam sedimentation during a flood using the RRIS -link model (2010/7/11-2017/10/28)
図 2　RRIS-link モデルを用いた出水時のダム堆砂量の計算結果 (2010/7/11-2017/10/28)

近年、洪水流とともに山地から運ばれてきた大量な土砂が、勾配の緩くなる（山間盆地、扇状地）あるいは山間部で谷幅が一時的に広がる（谷底平野）平野部で堆積するため、河床が上昇し、土砂と泥水の氾濫が発生する、いわゆる土砂・洪水氾濫が頻発しています。最近の例としては、2017 年の九州北部豪雨、2018 年の西日本豪雨、2019 年の東日本台風でこのような現象が起こりました。中小河川においても近年浸水想定区域図の作成が進展していますが、その想定にあたってはこのような土砂の動態による影響は考慮されていないのが現状であり、豪雨や台風による大規模な土砂の移動が河床変動や氾濫等に及ぼす影響に関する研究の進展が望まれています。

そのため、私は、降雨条件の変化に対して、平野部の河川がどのように変動するかを正確に予測するために，まず降雨ごとに山地から平野に到達する水理量と土砂の条件（量・質）の経時変化も含めて適切に表現できるよう、既存の氾濫解析 RRI モデルに、合流点間を link（単位河道）と定義した一次元土砂輸送モデルを導入し、RRIS-link（Rainfall-Runoff-Inundation-Sediment-link）という流域土砂輸送計算モデルを開発しています。このモデルは、Figure 1 のように、まず RRI モデルによって、降雨から各河道セルの水理量を計算し、次に各 link の下流端にある河道セルの流量を用いて、各 link における河床変動計算を行い、その後、計算された河床変動量を用いて河道セルの河床高を更新し、RRI モデルに出力して、次のタイムステップに進んでいくような仕組みになっています。そして、Figure 2 は、RRIS-link モデルを用いて、あるダム流域における流域土砂輸送計算の結果を示しています。図中、灰色線は計算された各年分の累積ダム堆砂量で、黄色プロットはその実測値です。両者を比較しますと、測量精度の問題による実測値が大きく減った年を除くと、計算結果は実測値とかなり一致していることがわかります。

今後このモデルによって推定される境界条件を用いて、平野部におけるその土砂・洪水氾濫解析を行う予定です。

Geomorphic analysis on sediment transport during torrential rainfall in mountainous rivers

中山間地河川における豪雨時の土砂輸送に関する地形解析

NAGUMO Naoko, Research Specialist
南雲直子　専門研究員

日本の中山間地河川は一般に流域面積が小さく流路の勾配が急であるため、流域に強い降雨があると急激な水位上昇が起こりやすいという特性があります。また、崩壊・土石流が多発するような強度の豪雨になると、洪水が短時間のうちに土砂や流木を下流へと輸送します。輸送された大量の土砂や流木は、谷出口、あるいはそれより下流で堆積し、激しい流路・河床変動を引き起こします（写真1）。このような流木を含む土砂・洪水氾濫は、近年では2017年の九州北部豪雨や、2018年の西日本豪雨、2019年の台風第19号通過の際に起こり、被害を助長しました。

土砂流出を伴う洪水イベントは、降雨を誘因として生じる地形発達の一過程であり、流域の地形は過去の洪水による土砂流出の規模や地域性を反映したものであると考えられます。そのため、地形を丁寧に観察することで、将来起こりうる氾濫の規模や特性を帰納法的に推定することが可能です。しかし、地形観察のみでは洪水による土砂輸送の物理過程を読み解くことはできません。また、中山間地河川における土砂・洪水氾濫は、山地部での崩壊や土石流の発生、低地部での流路・河床変動に至るまで、広域にわたる多様な土砂輸送過程の中の一コマであり、これを評価するにあたっては調査・検討すべき技術的課題が多いのが現状です。課題解決の一環として、私たちは洪水時の流路の侵食・堆積現象や土砂輸送能力を簡便に表す流域面積 A と河床勾配 i からなる指標を提案し、中山間地河川における土砂輸送過程を踏まえた氾濫特性の理解や氾濫に対する弱点部の特定に取り組んできました。

図1は、2017年九州北部豪雨で氾濫した赤谷川および支川の乙石川と、2019年台風19号により氾濫した内川および支川の五福谷川における Ai の縦断分布を示したものです。Ai は、流路の任意の断面における流水の侵食力を河床せん断力によって評価したもので、これを土砂輸送能力 P として次のようにおいています。

$$P \sim Ai \qquad (1)$$

ここに、A：流路の任意の地点における流域面積、i：河床勾配、あるいはエネルギー勾配となります。この式の誘導においては、降雨に伴う流量は流域面積に変換され、水深はマニング則を使って流量に変換され、さらに、川幅はレジーム則を使って流域面積に変換されています。Ai が縦断的に増加する場合には流路が侵食される傾向、減少する場合には土砂が堆積する傾向にあることを示しており、その縦断的な増減から、崩壊・土石流に伴う一次堆積土砂や河道堆積物の侵食・堆積過程を説明できま

Mountainous rivers in Japan generally have a small drainage area and a steep bed slope; thus, their water levels rapidly increase with strong rainfall in the basins. In addition, torrential rainfall induces slope failures and debris flows, causing a large amount of sediment and driftwood to be transported by floodwaters and accumulate in valley mouths or further downstream resulting in significant channel changes and bed deformation (Photo 1). Such floods with sediment and driftwood happened on several recent occasions, including the Northern Kyushu Torrential Rainfall in 2017, the West Japan Torrential Rainfall in 2018, and Typhoon Hagibis in 2019, each aggravating the damage already done to the areas by heavy rain.

Photo 1 An example of channel changes and bed deformation caused by sediment deposition with driftwood
(Photo taken on 23rd of July, 2018, in the Sozu River basin)
写真1　土砂と流木の堆積による流路・河床変動の例
（2018年7月23日、総頭川にて撮影）

Flood events with sediment runoff are considered as one of the topographic development processes triggered by rainfall, and the topography of each basin reflects the scale and regional characteristics of sediment runoff in past flood events. It is, therefore, possible to predict those in future flood events by observing the basin's topography. However, mere observations of the topography are not enough to understand physical sediment transport processes. Moreover, floods with sediment in mountainous rivers are only a small part of the various, extensive sediment-transport processes involving different phenomena ranging from slope failures and debris flows in the mountains to channel changes and bed deformation in lowlands. For these reasons, there are still many technical issues needed to be investigated and discussed for proper evaluation of floods with sediment. To address all these challenges by considering the sediment transport processes in mountainous rivers, we proposed an indicator using drainage basin area A and bed slope i to simply express the processes of erosion and deposition and the sediment transport capacities along river channels and then conducted research to understand flood characteristics and detect areas susceptible to floods.

Figure 1 shows the longitudinal profiles of Ai in the Akatani River and its tributary, the Otoishi River, which both flooded during the 2017 Northern Kyushu Torrential rainfall. It also shows those of the Uchikawa River and its tributary, the Gofukuya River, which also both flooded during the 2019 heavy rain due to Typhoon Hagibis. Ai evaluates the erosional force of the flow in terms of the bed shear stress in a cross-section and describes sediment transport capacity P as follows:

$$P \sim Ai \qquad (1)$$

where A is the area of the drainage basin in a cross-section, and i is the energy slope or bed slope. To derive this equation, the flow discharge due to rainfall is converted to the drainage area, and the flow depth is changed into the flow discharge using Manning's formula, and the flow width is converted to the drainage area according to the regime theory. Longitudinal increases and decreases in Ai can explain the erosional and depositional processes of primary deposits due to slope failures and debris flows as well as channel deposits, respectively; longitudinal increases in Ai

Ai is a parameter for sediment transport capacity. Increase of *Ai* shows tendency of erosion while decrease of *Ai* indicates sediment deposition. *A*: Drainage area, *i*: energy slope or bed slope

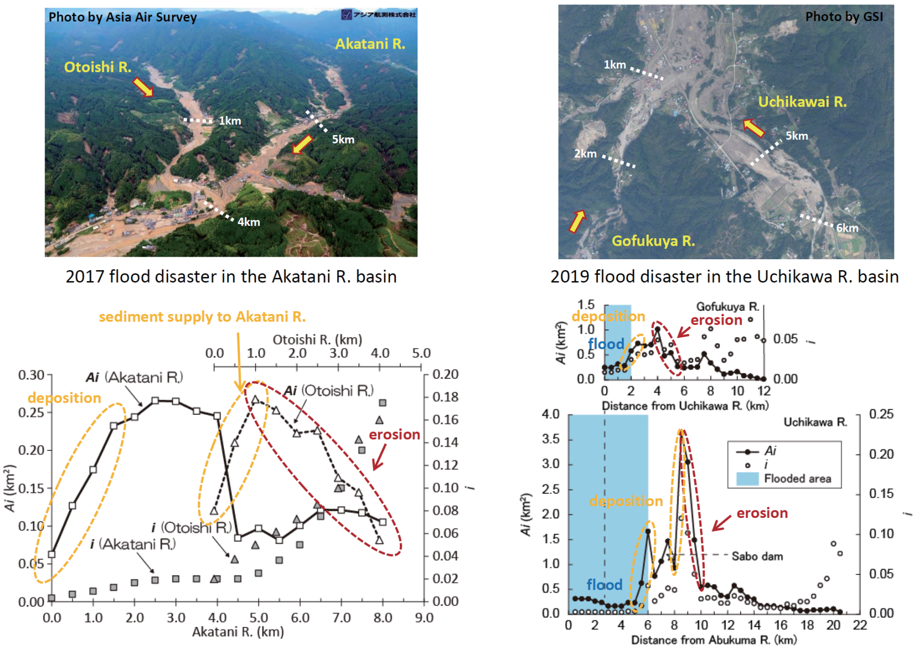

Figure 1 Longitudinal profiles of the sediment transport capacities (*Ai*) in the Akatani and Otoishi Rivers (left) and the Uchikawa and Gofukuya Rivers (right)
図 1 赤谷川および乙石川（左）と内川および五福谷川（右）の土砂輸送能力（*Ai*）の縦断分布

show a tendency of channel erosion, while longitudinal decreases indicate sediment deposition.

In the Otoishi River, *Ai* increases in the section from the mountains to the point 1.0 km upstream from the confluence with the Akatani River, suggesting dominant erosion and active sediment transport downstream. However, observations confirmed abundant sediment supplies from the river bank due to slope failures and debris flows, causing massive sediment deposition in the river bed. On the other hand, *Ai* significantly decreases as the Otoishi River comes closer to the confluence with the Akatani River, suggesting abundant sediment supplies into the Akatani River. In the case of the Akatani River, *Ai* suddenly starts to decrease at the 1.5 km point, where a large volume of sediment deposited and channel changes and bed deformation occurred. As *Ai* in the upper Akatani River is smaller than that in the Otoishi River, most of the sediment that flooded and deposited in this area is assumed to have been transported from the Otoishi River basin.

Similarly, *Ai* starts to decrease in the Uchikawa River around the 10.0 km point from the Abukuma River, suggesting dominant erosional processes and active sediment transport downstream. *Ai* sharply drops between the 6.0 km point and the 5.0 km point, around which the Uchikawa River flooded. This indicates that the flood resulted as the river's sediment transport capacity reduced.

As shown above, sediment erosion, transport and deposition induced by floods in mountainous rivers can be explained using longitudinal changes in *Ai* in addition to analyzing aerial photographs, topographic maps, and field survey results. The proposed indicator might also be useful for detecting areas where floods involving large amounts of sediment may occur. We will continue research to mitigate flood damage in mountainous rivers.

Reference: Nagumo and Egashira (2019) Journal of Geography 128, 835-854; Nagumo and Egashira (2021) Geographical Review of Japan 94, 64-81

す。

乙石川について上流側からみると、*Ai* は赤谷川との合流点から 1.0 km 地点に向かって増しており、侵食が支配的で土砂が下流へと活発に輸送されていることが示唆されます。しかし、実際には、崩壊・土石流によって河岸から大量の土砂供給があるため、乙石川の河床では大規模な堆積が生じています。一方、赤谷川との合流点に近づくと乙石川の *Ai* は著しく減少するため、赤谷川に顕著な土砂供給をもたらすものと考えられます。赤谷川の 1.5 km 地点より下流では *Ai* が急減しますが、実際に大規模な土砂の堆積と流路・河床変動が生じました。赤谷川上流の *Ai* は乙石川と比べて小さいことから、この場所で氾濫・堆積した土砂は多くが乙石川流域を起源とするものであると推察できます。

同様に、内川では阿武隈川から 10.0 km 地点付近で *Ai* が増加するようになり、侵食作用が支配的で土砂が下流へと活発に輸送されていることが示唆されます。6.0 km から 5.0 km 地点で *Ai* は急減しますが、この場所は実際に内川の氾濫の起点となっていて、土砂輸送能力の低下によって氾濫がもたらされたことを意味しています。

このように、空中写真や地形図の分析、現地調査に加えて *Ai* の縦断的な変化を用いることで、中山間地河川の洪水に伴う土砂の侵食、輸送、堆積の過程を説明することができ、土砂・洪水氾濫の発生領域をある程度特定できることが分かってきました。中山間地河川の洪水に伴う被害軽減に向け、今後もさらに研究を推進していきたいと考えています。

参考文献：南雲・江頭（2019）地学雑誌 128，835-854；南雲・江頭（2021）地理学評論 94，64-81

Introduction of research projects by ICHARM Ph.D. students /
ICHARM 博士課程研修員の研究紹介

A study on climate change adaptation and resilience strategies for optimizing benefits of the Mahaweli River Basin in Sri Lanka

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Climate change, disasters and multiple non-climatic drivers globally and collectively reinforce hazardous impacts on the social system, the quality of life, the natural and built environment, and the food-water-energy nexus in which they are closely related to one another. Impacts due to climate change and subsequent disasters have to be strategically handled by connecting natural science and technology for policy making to implement adaptation and resilience strategies. Therefore, this research focused on developing a standardized method to understand water-related disaster risks and proposing strategies based on dam operations to improve disaster risk reduction and water resources management.

To understand water-related disaster risks, this research developed an integrated approach to assessing climate change impacts by utilizing recent advancements in science and technology to integrate globally available data sources and a reliable hydrologic model. As a result, this research utilized the Data Integration and Analysis System of Japan (DIAS) for collecting, manipulating, and downscaling big-data of General Circulation Models (GCM) and the Water Energy Budget-based Rainfall-Runoff-Inundation model (WEB-RRI) for reproducing various long-term hydrological variables more accurately. The approach was applied to the Mahaweli River Basin (MRB) in Sri Lanka (Figure 1) to understand climate change impacts on rainfall, inundation, floods and droughts.

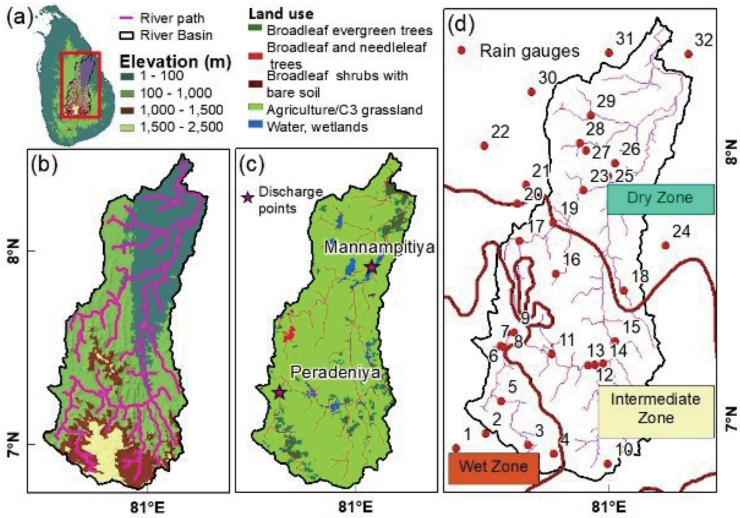

Figure 1 (a) Topography of Sri Lanka (b) topography of MRB, (c) land use with distribution of discharge measurement points, and (d) climatic zones with rain gauge network

The results from four selected GCMs for the Representative Concentration Pathway (RCP8.5) scenario showed that with an average temperature increase of 1.1 °C over the 20 years in the future (2026 to 2045), as shown in Figure 2, the basin will experience more rainfall (increases ranging from 204 to 476 mm/year, as shown in Figure 3 and intense flood disasters (Figure 4-a1 to -d1) and receive sufficient water in the future climate (inflow increases will range between 11 m^3/s and 57 m^3/s). The socio-economic damage due to flood inundation will also increase in the future climate, as shown in Figure 5. However, qualitatively, the overall trend of model responses showed an increasing pattern in future meteorological droughts, whereas there is uncertainty in hydrological droughts

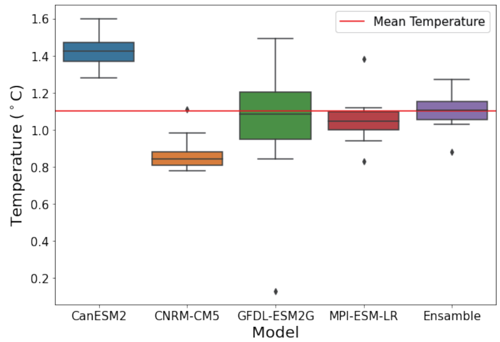

Figure 2 Basin average temperature difference (future-past)

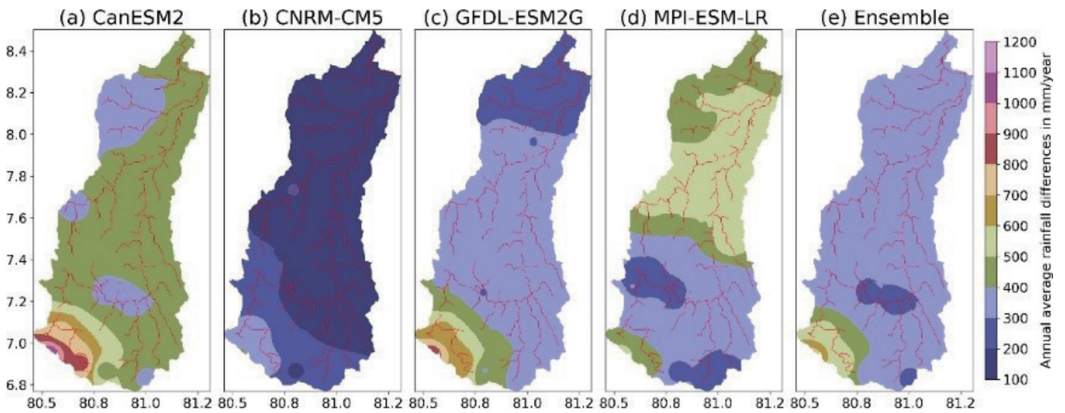

Figure 3 The comparison of annual average rainfall differences (future-past) in mm/year for the selected models and the ensemble mean

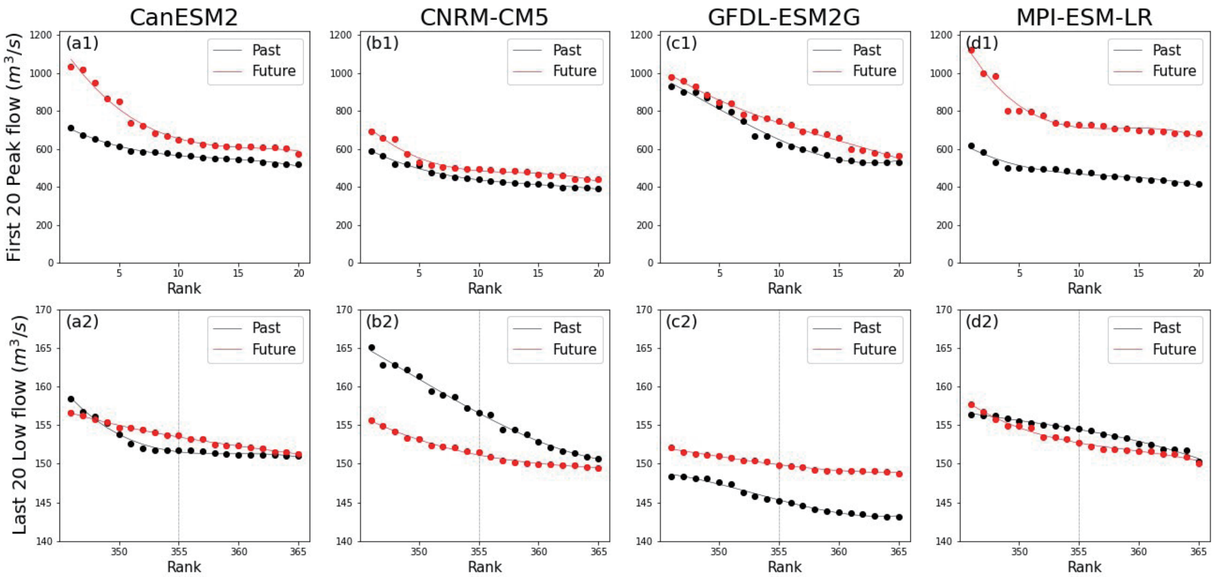

Figure 4 First 20 peak flow and the last 20 low flow of daily average discharge values of the past and future 20 years of the selected GCMs

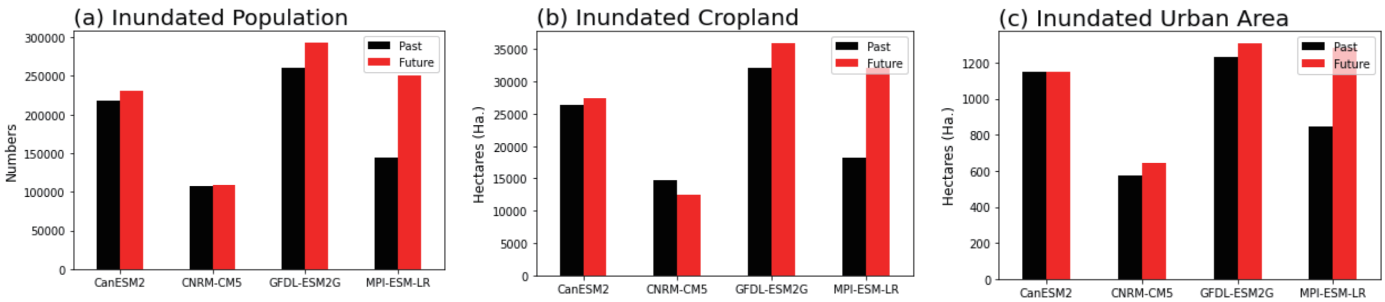

Figure 5 Socio economic damage

(Figure 4-a2 to -d2). The study also found that MRB, especially its downstream region, will be vulnerable to future droughts during the North East (NE) monsoon period and the Intermediate Monsoon-2 (IM-2) period.

The climate change impact assessment indicated that water availability, excess and shortage, which can influence the MRB system operation, will vary seasonally and spatially in the future. But these future changes depict the information regarding the average over a 20-year period only. Still, the onset and withdrawal of these events are uncertain based on the available information. Therefore, it is necessary to use seasonal forecasting and short-term weather prediction for flood and drought management. Hence, to utilize future water resources and manage flood and drought disasters to ensure food, water, and energy security, adaptation strategies were developed by utilizing seasonal forecasts and reservoir operation based on short-term weather prediction.

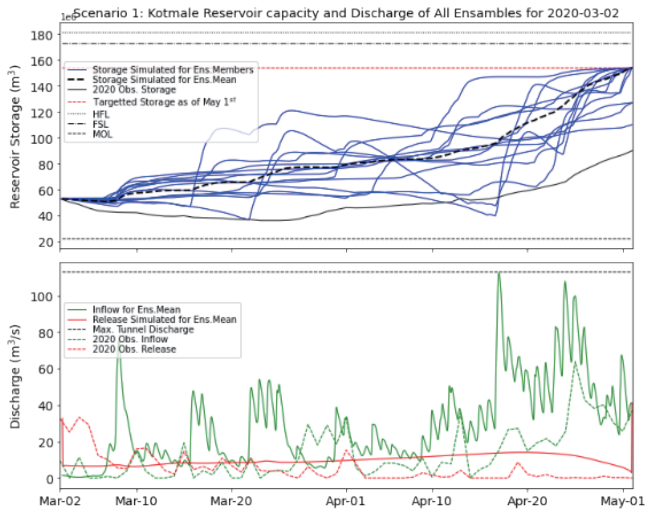

Figure 6 Seasonal forecast informed reservoir operation for a selected scenario by allowing flood storage at the end of the time period

This strategy development was conducted by coupling Japan Meteorological Agency's (JMA) seasonal forecasting data and the downscaled versions of National Centers for Environmental Predictions – Global Forecast Systems (NCEP-GFS) deterministic forecasting data by Weather Research and Forecasting model (WRF) with the WEB-RRI model to simulate forecasted discharges at a selected location (the Kotmale reservoir). Then, the simulated discharges were used to perform reservoir operations by introducing a dam module (a real-time reservoir optimization tool by Deltares) to the WEB-RRI model. The experimental results show that by utilizing seasonal-forecast-informed reservoir operation and the reservoir operation rules for allowing flood storage, it is possible to achieve flood and drought risk reduction by saving enough water for an upcoming agriculture season and enhance energy generation by pre-releasing a future flood through a power turbine (Figure 6).

Moreover, the results of the short-term operation showed that the expected flood inflow can be utilized for power generation by pre-releasing the forecasted inflow and keeping the reservoir elevation at a low level to receive a future flood, thus preventing the reservoir from spilling.

Integrated operation of reservoirs for maximizing hydropower and reducing flood risk

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Water resources provide a potential energy value for electricity generation. As an important renewable energy resource, hydropower contributes to massively cutting down carbon emissions and mitigating global warming. Therefore, if properly planned and implemented, hydropower generation could be an affordable, reliable, sustainable, modern technology and will help mitigate the impact of climate change (the Sustainable Development Goals, SDGs, include a dedicated, stand-alone goal on energy as SDG 7). The significant public interest has been drawn in the use of hydro-power generation in a concerted approach, which aims to improve the operational efficiency of existing reservoir systems as a preferred solution not only for mitigating flood damage but also for the effective use of water resources.

In order to introduce the concerted approach successfully, the study presented an integrated method for demonstrating the effectiveness of dam operations by combining a rainfall forecasting model and a distributed hydrological model capable of analyzing reservoir operations and simulating downstream flooding. The research framework is shown in Figure 1. Two additional research novelties were considered while investigating strategies for flood damage reduction. Firstly, the study proposed an integrated method to quantitatively evaluate the contribution of current hydropower generation dams to flood risk reduction (Figure 2). Second, the study also proposed an integrated approach developed for investigating the effectiveness of reservoir operation strategies by conducting the analysis, evaluation, and proposal of reservoir operation scenarios corresponding to the uncertainty scenarios of the forecasts (Figure 3).

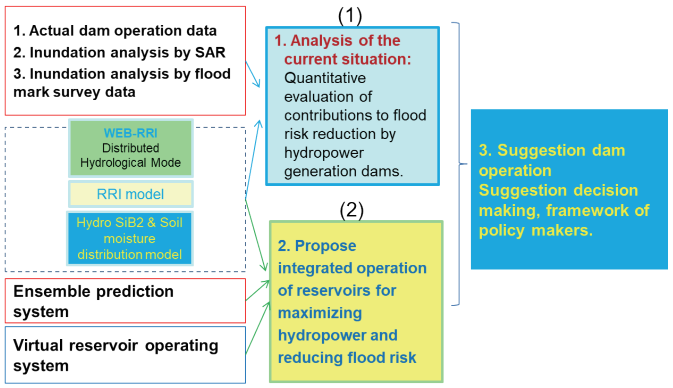

Figure 1 Research framework

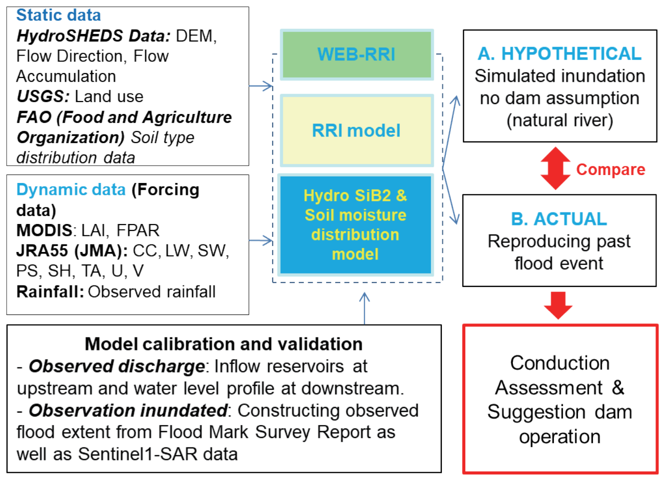

Figure 2 Quantitative evaluation of contributions to flood risk reduction by hydropower generation dams (1)

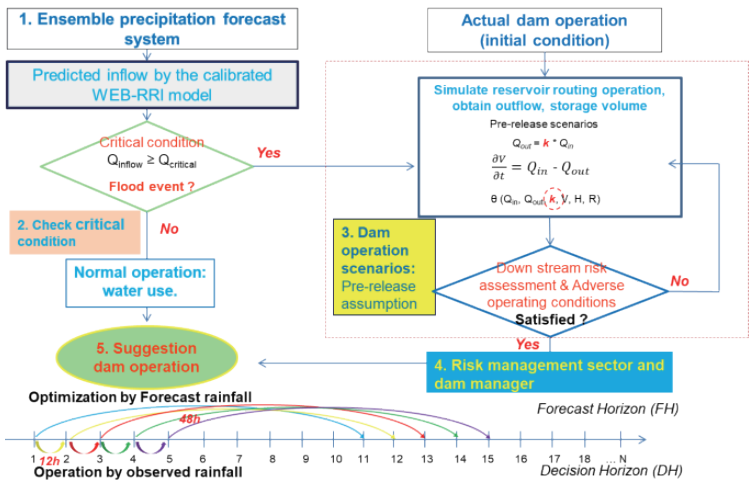

Figure 3 Integrated operation of reservoirs for maximizing hydropower and reducing flood risk (2)

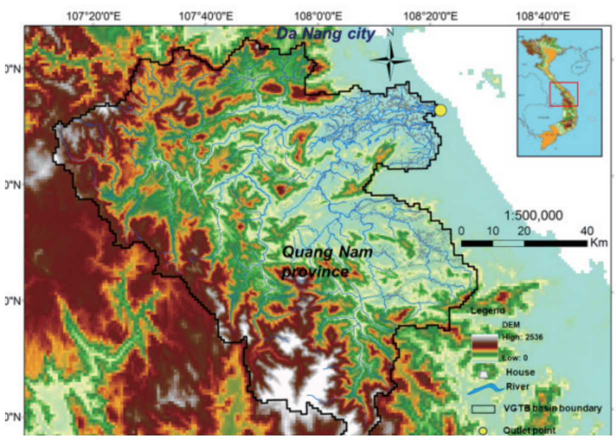

Figure 4 Vu Gia Thu Bon river basin

The system was applied to the Vu Gia Thu Bon (VGTB) river basin (Figure 4), one of the major river basins in central Vietnam, and evaluated based on data availability, government policy, and the urgency to develop integrated solutions that will improve the basin's resilience against flood hazards by effectively utilizing available infrastructure.

The integrated method was further applied to quantitatively evaluate the effect of hydropower dam operations on flood mitigation in the VGTB basin. The results indicated that the lowering of the reservoir water level of an upstream dam may have contributed to reducing flood extent and inundation depth in the area downstream of the dam during the flood event, suggesting the potential of effective dam operations to improve flood risk management in this river basin. The study quantitatively confirmed an effective way of using existing infrastructure for flood risk reduction. In addition, downstream flood simulations were conducted using a distributed hydrological model (WEB-RRI), and the simulation results were verified based on information from ground surveys (Flood Mark Survey data-FMS, Figure 5) and aerial observations (SAR data, Figure 6). The flooding process was completely reconstructed and compared during each period of inundation: before (SAR), during (maximum inundation depth by FMS), and after (SAR) the inundation (Figure 7).

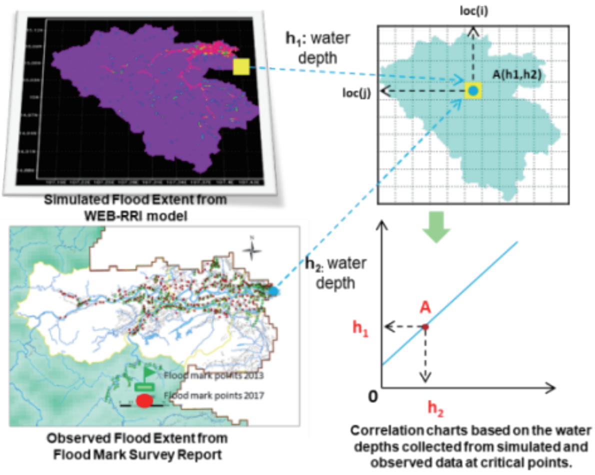

Figure 5 Correlation charts based on the water depths collected from simulated and observed data (FMS) at critical points

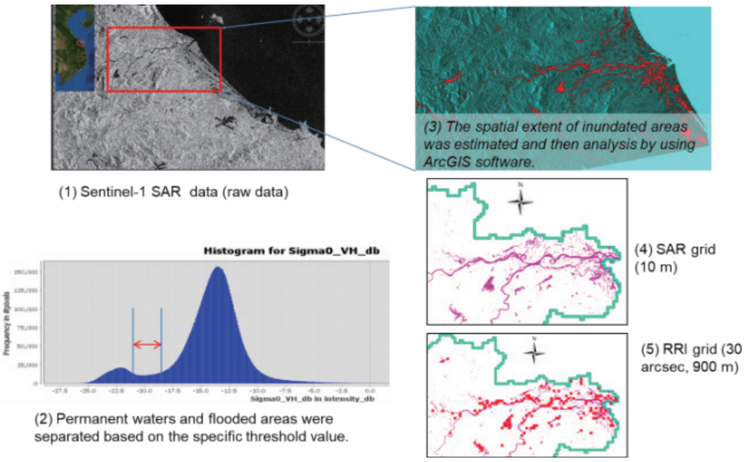

Figure 6 Estimated inundation areas derived for the 2017 flood event in the VGTB river basin from Sentinel-1 SAR data

The uncertainty in predicted streamflow causes difficulty for dam managers to decide a suitable operation strategy, for they are caught in a dilemma between securing economic benefits when prioritizing water storage for electricity generation and prioritizing downstream flood risk reduction when releasing dam water in advance. This study attempted to address uncertainties in forecasts by employing an ensemble forecasting system and reviewing dam operation and pre-release strategies. Then, an integrated system was developed to propose and evaluate reservoir operation strategies based on ensemble hydrological prediction information. The system was evaluated on the VGTB river basin by applying the methodology to the hypothetical pre-release of dam water (Figure 8). The results showed that the magnitude of inundation could be reduced while maintaining the water level of the dam after flooding (Figure 9 and Figure 10). By adopting ensemble rainfall forecast information while considering the current state of the reservoir, the system can provide a timely recommendation for the operator to take the initiative in pre-release, including determining the starting time and flow rates of water release, as well as no water release in advance in some cases.

Therefore, effective dam operations have the potential to improve flood risk management in this river basin. Considering flood risk management issues that have emerged after the rapid socioeconomic expansion in central Vietnam, the region is urgently in need of improved capability of flood risk management. The study suggests how the basin without flood control dams could improve resilience against flood hazards by effectively utilizing currently available infrastructure. The reference information presented in this study can provide a harmonious solution to promote the integrated management of a river basin among relevant parties.

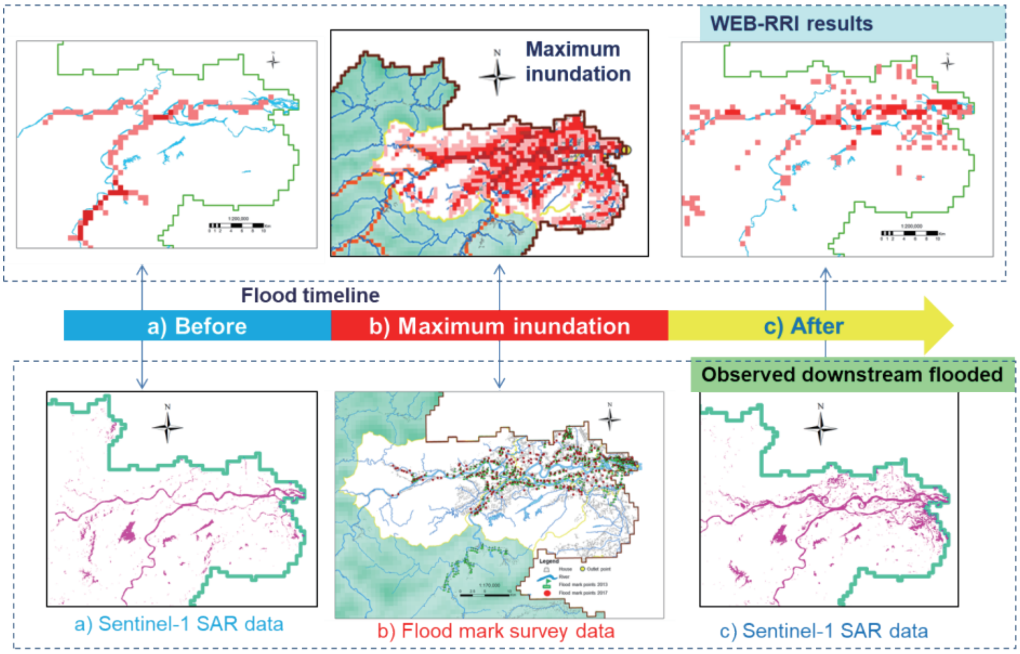

Figure 7 Compare observed downstream flooded and WEB-RRI output

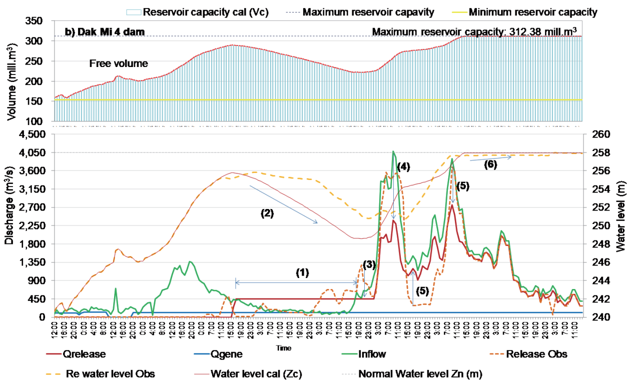

Figure 8 Compare the Dak Mi 4 dam hydrograph of actual and assumption operation during flood event 2017

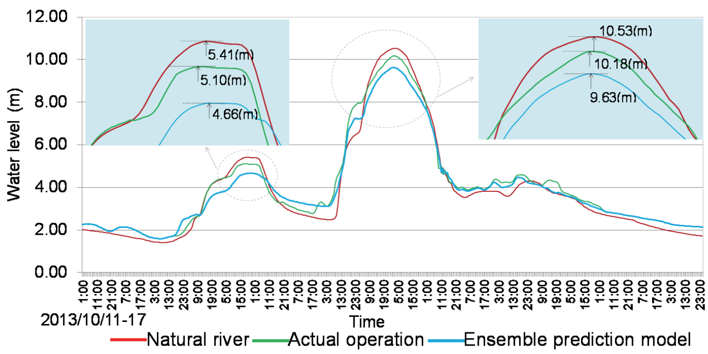

Figure 9 Comparison flood water level at Ai Nghia hydrology station during flood event 2017 between a) No dam assumption case (natural river), b) Actual dam operation case (Actual operation) and c) Ensemble prediction model

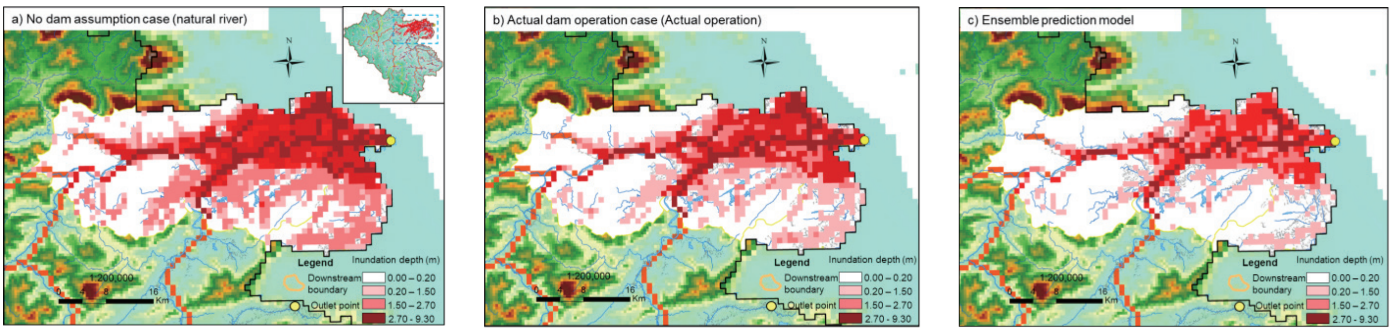

Figure 10 Maximum downstream inundated during flood event 2017
a) No dam assumption case (natural river), b) Actual dam operation case (Actual operation) and c) Ensemble prediction model

Research on a method to assess the effectiveness of flood damage mitigation measures on flood risk reduction for promoting consensus building necessary to achieve River Basin Disaster Resilience and Sustainability by All
流域治水の推進に必要な合意形成のための減災対策による被害軽減効果の評価手法の研究

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In recent years, heavy rains and flood disasters that have never been experienced before are frequently occurring across Japan. Furthermore, based on predictions regarding the impact of climate change due to global warming, such events are likely to be even more intense and frequent. Thus, it is a matter of urgency to implement various measures to prevent and mitigate the damage to be caused by heavy rains and resulting flood hazards.

A strategical shift from conventional flood management to new flood management to cope with climate change impacts has been discussed. In April 2021, a technical task force of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) for planning flood management to adapt to climate change proposed an approach to setting rainfall increase rates. According to the proposed approach, simulations suggest assuming significantly larger scales of rainfall and flood events than the current ones to plan future flood management.

In these circumstances, the Panel on Social Infrastructure Development of MLIT submitted a policy report to the government in July 2020, highlighting the concept of "River Basin Disaster Resilience and Sustainability by All." The panel stresses that, in addition to promoting the development of flood control structures such as levees and dams, the new concept should be introduced to flood management, in which various actors in the basin, including the potential flooded areas, should engage in concerted efforts to promote sustainable flood management over the entire basin.

While flood control infrastructure should continue to be built and improved (level-1 flood management), additional damage mitigation measures should also be implemented in preparation for heavy rains and floods whose scales exceed the design scales for flood management planning. Such mitigation measures include ones to reduce damage to property and assets such as houses and farmland, in addition to protecting human lives, in the event of flooding whose scale exceeds the design scale. In past years, mitigation measures are primarily designed to protect human lives by encouraging safe evacuation in case of flooding of the assumed maximum scale (level-2 flood management). However, in order to realize the speedy restoration and reconstruction of local communities after a disaster and ensure their sustainability, it is indispensable to implement measures for mitigating damage to property and assets. In other words, new flood management should include the enhancement of community resilience in its scope (Figure 1).

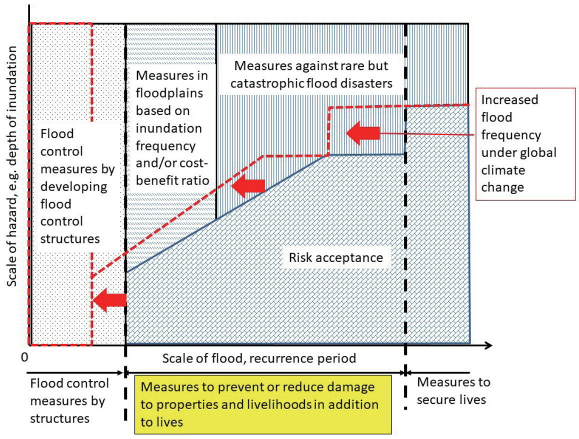


Figure 1　Classification of flood control measures and the scope of the research
図１　洪水対策の分類と本研究の対象範囲

Nonetheless, although the implementation of measures to improve community resilience to disasters has been increasingly important under ongoing climate changes, there has not been much progress in developing approaches to testing and evaluating such measures for their effectiveness in damage reduction.

Ian. L. McHarg (1969) rightly pointed out: "The more intrinsically an environment is

近年、これまでに経験したことのないような豪雨・洪水災害が全国で頻発しています。地球温暖化による影響を踏まえると、豪雨・洪水の強大化・頻発化が引き続き見込まれ、豪雨・洪水被害の防止・軽減対策の推進が喫緊の課題です。

気候変動の影響を考慮した治水計画への移行については、国土交通省の「気候変動を踏まえた治水計画に係る技術検討会」から 2021 年 4 月に具体的な降雨増加率の設定手法が提案されていますが、現行の治水計画に比べかなり大きな降雨・洪水を想定せざるを得ない状況です。

このようななか、堤防・ダム等の治水施設の整備を推進するとともに、氾濫域を含む流域の様々な主体が協働して流域全体で行う持続可能な治水対策である「流域治水」が国土交通省 社会資本整備審議会の 2020 年 7 月の答申等において強調されています。

治水施設の着実な整備（レベル 1 対策）の推進を前提として、治水計画規模を超える豪雨・洪水への備えとして、減災対策（治水計画の規模を超える洪水時に、人命の確保に加え、住家・農地等の資産被害等を軽減するための対策）が重要です。これまで、想定最大規模の洪水 (レベル 2) を対象とした避難による人命確保を中心とした減災対策が進められてきていますが、被災後の地域の迅速な復旧・復興と地域社会の持続性を確保するためには、人命の確保に加え、住家・農地等の資産被害等の軽減対策を併せて実施していくことにより、地域のレジリエンス強化を図っていくことが重要です（図 1）。

このように、治水計画規模を超える洪水時の住家・農地等の資産被害などを軽減するための減災対策の重要性が気候変動下に一層増大しているのにもかかわらず、減災対策の具体的な検討手法及び被害軽減効果の評価手法は確立されていません。

なお、イアン・L・マクハーグ（1969）が、本質的に環境が生態系・生物・土地利用のいずれかに適していればいるほど、それだけ適応の作業が少なくてすむと主張しているように、場所ごとの浸水しやすさ等に応じた土地利用を進めることが、自然環境の保全とともに水害リスクを低減することにつながると考えられますが、自然環境の保全便益の評価手法が未確立である現状を踏まえ、水害被害の防止・軽減効果を直接の指標とした手法の検討を本研究では行うこととしました。

本研究では、下記 2 つの減災対

策の検討手法（①のみ）及び効果の評価手法（①、②ともに）の試案を提示するとともに、その適用性を検証しました。手法の検討に当たっては、流域の様々な主体による活用を念頭に、既存公表データに基づき、誰でも適用可能な手法とすることを重視し、開発途上国の洪水対策の検討の場等でも活用できるように留意しました。

①治水計画規模を超過する洪水時に堤防越水地点を制御することによる減災対策

江戸時代に用いられた野越（のこし）、米国陸軍工兵隊の管理された越水を踏まえ、これまでの治水施設整備のストックを活かしつつ、流下能力を超過する洪水時に越水地点を制御することにより河道の貯留・流下能力を保全し、氾濫水量を低減する減災対策について、越水地点の選定手法及び効果の評価手法を提案し、近年激甚な破堤氾濫が発生した河川に試験適用し、越水地点の候補を選定するとともに効果を試算しました（図 2）。

②河川改修と氾濫原における暴露・脆弱性対策を統合した洪水被害防止・軽減対策

国土技術政策総合研究所 気候変動適応研究本部の研究成果を活用し、複数種類の対策を統合した水害リスク低減効果の評価手法を提案するとともに、フィリピンのアグサン川下流において河川改修と住家移転・宅地嵩上げを行った洪水対策プロジェクトに試験適用し、統合的な水害リスク低減効果を示しました（図 3）。

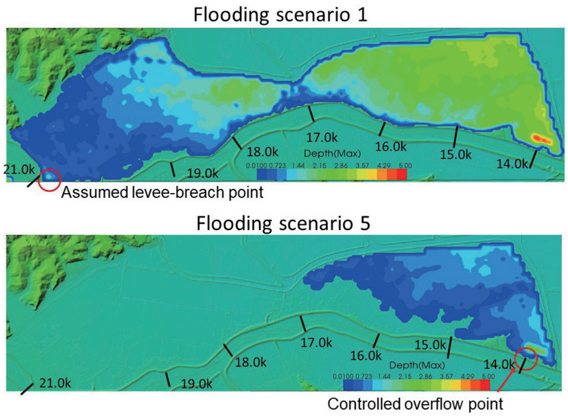
本研究成果が、流域治水の推進に必要な様々な種類の対策の具体的検討手法、効果の評価手法の確立に向けて活用されることを期待します。

fit for any of these, the less work of adaptation is necessary", here, 'these' refers to ecosystems, organisms and land uses in the previous sentence. In other words, if land use planning is carried out, for example, based on the probability of flooding of each location, it is probably better in terms of the conservation of the natural environment and the reduction of flood risk. However, since a method has not yet been established for evaluating possible benefits to be gained from preserving the natural environment, in this research I decided to study an evaluation method using the effect of flood damage prevention and mitigation as an indicator.

In this research, I proposed and tested the following two methods for applicability. In the process of developing the methods, I designed them to be easily applicable by any user using existing data available for public use so that they can be employed by different actors in the basin, as well as by those in developing countries, for planning flood management.

(1) Flood damage mitigation by controlling overflow points in case of a flood exceeding the design flood scale.

This mitigation measure employs the ideas of "nokoshi," a flood control approach used in the Edo period (1603-1867) in Japan, and "managed overtopping of levee systems," presented by the US Army Corps of Engineers. In addition to maximizing the existing flood control infrastructure, the measure aims to secure the river channel's retarding and discharge capacities and reduce the volume of overflow by controlling overflow points in case of a flood exceeding the channel's discharge capacity. In this research, I proposed a method for selecting overflow points and a method for evaluating the effect of controlled overflow on damage reduction. The methods were experimentally applied to a river where large-scale levee breaches resulted in massive flooding in the recent past. Overflow points were selected, and the effect of the proposed flood damage mitigation method was evaluated (Figure 2).



*The images were created using iRIC and superimposed onto a color elevation map providedby Geospatial Information Authority of Japan.
※ iRIC により作成　背景に国土地理院色別標高図を使用

Figure 2 Reproduced image of a past flood event (top) and simulated image of the same flood with controlled overflow (bottom)
図 2　実洪水の再現計算結果（上）と越水地点制御時の浸水範囲（下）

(2) Flood damage prevention and mitigation by conducting river improvement and exposure and vulnerability reduction in floodplains.

This integrated method is built on the research done by the Climate Change Adaptation Research Group of the National Institute for Land and Infrastructure Management. I proposed a method to evaluate the effectiveness of the integrated measure on flood risk reduction. It was experimentally applied to a flood management project in the lower Agusan River of the Philippines, in which river improvement, the relocation of houses, and the heightening of residential land were conducted. The results found that the integrated measure can effectively reduce the flood damage risk (Figure 3).

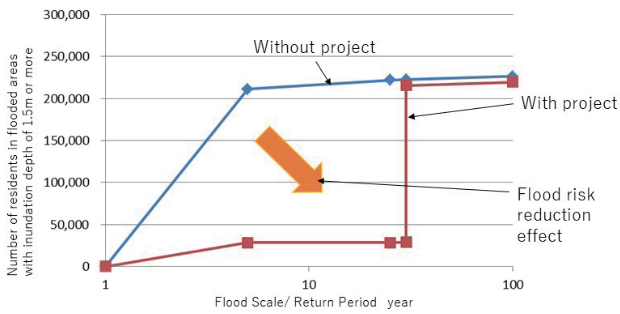


Figure 3 Flood damage risk reduction effect by river improvement, relocation of houses, and heightening of residential land
図 3　河川改修と住家移転・宅地嵩上げによる水害リスク低減効果

I hope that this research's findings will contribute to establishing approaches to testing and evaluating various measures needed to promote River Basin Disaster Resilience and Sustainability by All.

Training & Education

Educational program updates
研修活動報告

Since 2007, ICHARM has provided a one-year master's program in collaboration with Japan International Cooperation Agency (JICA) and Graduate Institute for Policy Studies (GRIPS), which is designed mainly for officers of overseas government organizations. Students mainly attend lectures and practices in the first six months from October to March and work on their individual theses in the second six months from April to August.

<Lectures>
On March 10, Professor FUKUOKA Shoji of Chuo University delivered his first lecture on "Flood Hydraulics and River Channel Design" course online. His class usually takes place earlier in the master's course around October, but due to the global pandemic of COVID-19, it had to be delayed. He delivered the first half series of his lectures online, but because of his earnest requests to give the students face-to-face lectures, the second half of his lectures were given at ICHARM.

Final Lecture by Prof. FUKUOKA Shoji of Chuo University
福岡捷二中央大学教授による最終講義

Wrapping up his final lecture on March 31, Prof. Fukuoka gave heartfelt words of encouragement to the students, who were very impressed and inspired with his words while feeling his endless energy.

<Practices>
"Practice on Open Channel Hydraulics" by Dr. YOROZUYA Atsuhiro of ICHARM started in April. On April 5, the students practiced hydraulics at an outdoor experimental facility of a construction consulting company in Tsukuba.

The students were divided into two groups and worked on tasks using two different experimental flumes alternately.

At the final lecture of this course in May, they presented and discussed the experimental results.

A group of students practicing hydraulics with experimental flumes
実験水路にて作業を行う 1 グループ

<Interim Presentation>
On April 20, the Second Interim Presentation was held in the morning, and the seven master's students spoke about their research projects.

As they had gained a lot of knowledge and experiences through the lectures and practices in the last six months, every student delivered their presentation more confidently this time compared to the first presentation.

Research and Training Advisor EGASHIRA (top, right) making comments on the presentations
総括コメントを述べる江頭 ICHARM 研究・研修指導監

After making some general comments on the presentations, Research and Training Advisor EGASHIRA Shinji told the students that all of them would proceed to the "Degree Course," which means that they are now offi-

ICHARM では 2007 年以降、国際協力機構（JICA）、政策研究大学院大学（GRIPS）と連携し、主に外国人行政職員を対象として、約 1 年間で学位を取得できる修士課程研修コースを設けています。例年、10 月から翌年 3 月までの 6 カ月は主に講義や演習が行われ、4 月から 8 月にかけては論文執筆に取り組みます。

＜講義＞
3 月 10 日、中央大学の福岡捷二教授による Flood Hydraulics and River Channel Design のコースがオンラインで開講しました。このコースは通常、研修開始当初の 10 月から開講しますが、今年度は COVID-19 の感染拡大により、開講が遅くなりました。

コース前半の講義はオンラインでしたが、できるだけ多くの修士学生と対面で講義をしたいという福岡教授の要望もあり、コース後半は、ICHARM において対面で行われました。

3 月 31 日の最終講義では、福岡教授から全学生に激励の言葉が贈られました。学生たちは、福岡教授のエネルギッシュな姿勢に感銘を受けていました。

＜実習＞
4 月から萬矢敦啓 ICHARM 主任研究員による Practice on Open Channel Hydraulics の実習が始まりました。4 月 5 日、学生は、つくば市内の建設コンサルタント会社の屋外実験施設で、水理学の実習を行いました。学生は 2 つ のグループに分かれ、異なる実験水路を交互に利用し実習を行いました。5 月の最終実習では、実験結果について発表し、討論を行いました。

＜中間発表＞
4 月 20 日の午前中に第 2 回中間発表会が行われ、修士課程の学生 7 名が研究内容について発表しました。この半年間の講義と演習で多くの知識と経験を積んだことで、学生は第 1 回目に比べて自信を持って発表を行うことができました。

江頭進治研究・研修指導監は、発表内容について総括コメントを述べた後、学生全員が Degree Course に進めることを伝えました。これにより学生全員が、修士取得に向けて論文の作成に取りかかることが正式に認められたことになります。

＜現地視察＞
第 2 回中間発表会を終えたのち、学生はチャーターバスで新潟県の信濃川流域と群馬県の利根川流域へ3泊4日の視察に出発しました。

ICHARM の研究員が同行し、実際の河川での観測手法の実習や現場視

察を行ったほか、国土交通省北陸地方整備局と関東地方整備局の職員から、さまざまな治水対策を学びました。

1日目の4月21日、学生は新潟県新潟市にある国土交通省信濃川下流河川事務所を訪問しました。事務所では、職員から信濃川の地形・水理特性と主要治水構造物を中心とした講義を受けました。各講義テーマの合間には、学生は毎回積極的に職員に質問しました。

その後、日本海沿岸の海岸侵食を見ながら南下し、大河津分水路の河口をはじめ日本海沿岸の地形が見渡せる弥彦山に到着しました。そこでは信濃川河川事務所の職員から、越後平野の特徴や日本海側の地形などの説明を受けました。それから信濃川大河津資料館を訪れ、資料館の職員から、大河津分水路の歴史と役割について説明を受けました。また､「にとこ・みえ〜る館」で山地部を掘削して川幅を広げる現在の大河津分水路改修事業について説明を受けるとともに、信濃川に架かるＪＲ越後線の橋梁により、堤防が低い箇所や堤防漏水箇所を視察しました。

2日目の4月22日は、小千谷市に移動し、信濃川河川公園にて流量観測の実習を行いました。天候に恵まれ、また実際の河川での初めての実習ということもあり、学生は真摯に実習に取り組んでいました。

その後、三国川ダムを訪問し、ダム管理所の職員からロックフィルダムの歴史や構造の説明を受けた後、ダム堤体内を視察しました。

最終日の4月23日には、浅間山北麓ビジターセンターを訪れ、浅間山噴火の歴史の説明を受けました。浅間山の溶岩が造った人の背の高さほどある奇岩に学生は驚いていました。また、1783年の浅間山噴火で、土石流に気づいて階段を上がり、観音堂まで避難できた人のみが助かった鎌原観音堂を訪れました。その後、吾妻川の河岸に移動し、地形図や地質図を見ながら降雨や土砂流出の過程について議論を行いました。

午後には八ッ場ダム管理支所を訪問し､「利根川ダム統合管理事務所と八ッ場ダムの役割」について、利根川ダム統合管理事務所副所長から講義を受けました。その後、八ッ場ダム堤頂部と堤体の下部を見学し、ダムの構造を間近で見る機会を得ました。

これまで学生はコロナ禍のなかで、非常に制限されたストレスの多い生活を強いられていたため、この視察は学生にとって特別なものであったに違いありません。

最後に、本視察のために対応いただきました関係者の皆様に深い感謝の意を表します。

cially allowed to start working on their theses for a master's degree.

<Field Trip>

April 20-23, 2021

On the afternoon of April 20, right after they finished the Second Interim Presentation, the students set out for field trip of three nights and four days on a chartered bus to the Shinano River basin in Niigata Prefecture and the Tone River basin in Gunma Prefecture.

They practiced using river observation methods on an actual river and visited various sites with researchers of ICHARM. They also learned various flood control efforts led by the Hokuriku and Kanto Regional Bureaus of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

On April 21, the students visited the Shinanogawa Karyu River office, MLIT, located in Niigata city. They heard mainly about the topography and hydraulic features of the Shinano River and the main flood control structures in the river from an officer there. On each topic, the students asked many questions.

Then, they headed for the south, watching coastal erosion on the coast of the Japan Sea, and arrived at Mt. Yahiko, where they can overlook the topography of the coast of the Japan Sea, including the estuary of the Ohkouzu Diversion Channel. They heard the features of the Echigo (the old name of the Niigata region) plain and the topography along the Japan Sea side from an officer of the Shinano River Office. Their next destination was the Shinanogawa Ohkouzu Museum, where they learned about the Ohkouzu Diversion Channel. They heard outline of the history and the roles of the Channel from a museum staff.

Students listening to a staff member of the Shinanogawa River Office at the Shinanogawa Ohkouzu Museum
信濃川大河津資料館にて信濃川河川事務所職員による説明

After that, they moved to the "Nitoko Mie-ru Museum," where the students listened to an explanation about the Ohkouzu Diversion Channel Improvement Project to widen the river channel by excavating mountainous area. They were also taken to observe the low levee due to the Japan Railway Echigo line bridge crossing the Shinano River and the point where levee leaks occurred.

On April 22, the students visited the Shinano River Park in Ojiya City, where they practiced discharge measurements on the Shinano River. Blessed with good weather, they worked on the practice diligently, which was their first outdoor training in an actual river.

Students practicing discharge measurements on the Shinano River
信濃川にて流量観測実習を行う学生

Then they visited Sagurigawa Dam. An officer of the Sagrigawa Management Office explained the history and structure of the rockfill dam and took them to the inside of the dam body.

On April 23, they visited the Asama Volcano Museum, where they studied the history of the eruption of the mountain. They were surprised at the many strange rocks that were made by the lava of Mt. Asama and were as tall as a person.

An officer of the Sagurigawa Dam Management Office (far right) explaining the history and structure of the rock fill dam
三国川ダム管理所職員によるロックフィルダムの歴史と構造の説明

After that, they visited the Kambara Kannon Temple. During the 1783 Mt. Asama eruption, only people who noticed the debris flow and evacuated up the stairs to the temple survived the disaster.

They then moved to the banks of the Agatsuma River and discussed the process of rainfall and soil runoff in the area while looking at topographic and geological maps.

Students and ICHARM staff observing the Agatsuma River and discussing the rainfall and soil runoff processes there while looking at topographic and geological maps
吾妻川河岸にて、地形図や地質図を見ながら、降雨や土砂流出の過程について ICHARM 職員と議論

On the afternoon, they visited the Yamba Dam Management Branch Office and attended a lecture on "the Role of the Tone River Dams Integrated Control Office and the Yamba Dam" by the engineering deputy director of the control office. They also had an opportunity to visit the top and bottom of the dam body and take a close look at the structure of the dam.

The trip must have been particularly special to the students because they had been forced to live a highly restricted, stressful life due to COVID-19.

Finally, we would like to express our deepest appreciation to all the people involved with their excellent support for this visit.

Students listening to an explanation about Yamba Dam by the engineering deputy director of the Tone River Dams Integrated Control Office
利根川ダム統合管理所副所長による八ッ場ダムの説明を聴講

In front of Yamba Dam
八ッ場ダム前にて

(Written by MIYAZAKI Ryosuke)

Action Reports from ICHARM Graduates

ICHARMでは、政策研究大学院大学（GRIPS）、国際協力機構（JICA）と連携して、世界各国から洪水対策の行政官を対象として、1年間の修士課程「防災政策プログラム　水災害リスクマネジメントコース」を実施するとともに、3年間の博士課程「防災学プログラム」を実施しています。これまで100名を超える実務者・研究者の方々が各課程を修了し、帰国後、本研修で習得された知識や経験を生かして、様々な分野において活躍されています。

ICHARMニュースレターでは、こうした卒業生の方々から、ご活躍の様子について寄稿していただくこととしております。本号では2020年度（13期）修士課程卒業のHerman Ameno氏（ブラジル）から寄稿いただきましたので、ご紹介します。

ICHARM provides graduate-level educational programs for foreign government officers in charge of flood risk management in collaboration with GRIPS and JICA: a one-year master's program, "Water-related Risk Management Course of Disaster Management Policy Program," and a three-year doctoral program, "Disaster Management Program."

Since their launches, over 100 practitioners and researchers have completed either of the programs. They have been practicing knowledge and experience acquired through the training in various fields of work after returning to their home countries. This section is devoted to such graduates sharing information about their current assignments and projects with the readers around the globe. Lieutenant Firefighter Herman Ameno (Brazil), who graduated from the master's program in 2020, has kindly contributed the following article to this issue.

Herman Ameno

Lieutenant Firefighter, Military Fire Brigade of Minas Gerais, Brazil

In Brazil, usually all firefighter lieutenants who graduate from a fire academy, are trained for 3 years in topics such as urban fires, wildfires, pre-hospital care, search and rescue, vehicle extrication, lifeguarding, diving, hazardous material, disaster risk management, and disaster management. This was the case for me from 2012 to 2014.

After finishing my master's course in Japan, I came back to Brazil at the end of September 2020. At the Military Fire Academy of Minas Gerais (MFAMG), one of the units of the Military Fire Brigade of Minas Gerais (MFBMG), I was appointed as the head of a class of 35 firefighter cadets who intend to be lieutenants by the end of 2021. They have already completed 2 out of the 3 years of their course, and through their last year in the Fire Academy, I will be responsible for guiding and teaching them about disaster risk management, disaster management, and, specifically, the analysis and evaluation of dams. The knowledge I am sharing with them during the past months is what I had learned while I was at PWRI/ICHARM for a year.

Besides, I am also attending online seminars and helping to organize some events to spread knowledge concerning tailings dams. Of course, in my presentation, I address topics about which I increased my knowledge while studying in Japan. One of the initiatives I helped organize in Brazil was the VIII International Seminar on Disaster Risk Management, which was held on February 25 and 26, 2021. Due to the spread of COVID-19, the event was held online for the first time. It focused on practical actions carried out by the firefighters of my institution and the Municipal Civil Defense Coordinators, aiming to promote more cooperation between the Brazilian society and the officials on disaster risk management.

Photo 1: VIII International Seminar on Disaster Risk Management

This event was a joint initiative of the MFBMG, the Japan International Cooperation Agency (JICA), and the Honorary Consulate of Japan in Belo Horizonte with the participation of international speakers in addition to representatives from several regions of Brazil.

In 2021, the seminar adopted a topic entitled "Technologies promoting Resilience" to stimulate the use of technologies to enhance civil defense actions: namely prevention, mitigation, preparation, response, recovery, and reconstruction.

In this edition, Dr. OHARA Miho, from ICHARM under the auspices of UNESCO, Japan, shared her knowledge with the participants. She presented a lecture about "Evidence-based Flood Contingency Planning and Recommended Flood Response under the Risk of COVID-19." Moreover, former master's students at ICHARM, like

Photo2: Presentation by Dr. OHARA translated into Portuguese

myself, and Mr. Rafael Silva Araujo, a geologist, also discussed their master's theses in this seminar. The first presentation was about "Hazard Area resulting from tailings dam failure," and the second on "Flood Impact Assessment in the Itapocu River Basin."

All activities I am developing with my students and other firefighters are challenging since we are all struggling under restrictions imposed upon us by the pandemic created by COVID-19. Even society has undergone several temporal lockdowns, we firefighters cannot stop our work; we have lives depending on our efforts. In this way, I believe the knowledge I brought home from Japan is essential to help us deal with this world crisis using adequate actions and strategies.

The degree is important as it allows me to be in the MFAMG to share knowledge with the cadets and other people through seminars. I expect Japan and Brazil to continue to cooperate as we still need to enhance the coordination among our institutions in order to improve our actions against disasters.

I am grateful for the opportunity I had at ICHARM to get the knowledge that helps develop my community and country.

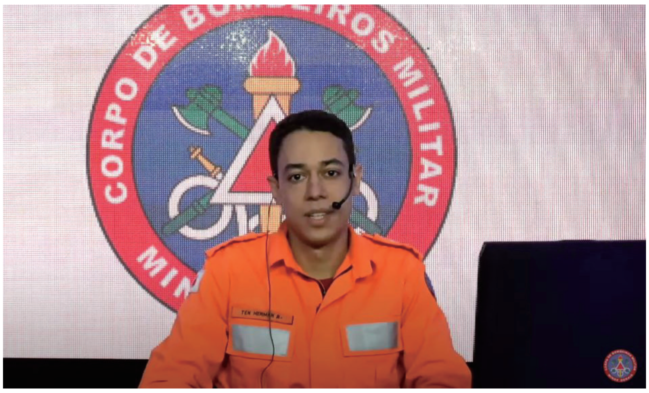


Photo3: Lieutenant Firefighter Herman presenting his master's thesis

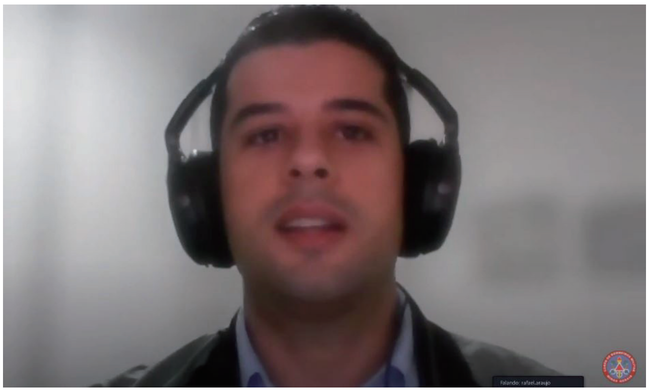


Photo4: Mr. Rafael Silva Araujo presenting his master thesis

Photo 5: Studio assembled to stream the seminar (1)

Photo 6: Studio assembled to stream the seminar (2)

Information Networking

E-learning & Workshop for Fostering "Facilitators" in Davao City, Philippines
フィリピン・ダバオ市におけるファシリテータ育成のための e ラーニング・ワークショップを開催

ICHARM held an e-learning & workshop for candidates of "Facilitators" in Davao City, Philippines, for about a month from April 19 to May 17, 2021, in cooperation with the Department of Science and Technology Region 11 (DOST XI). The workshop took place as one of the activities organized by the platform on water resilience and disasters with the aim of fostering local Facilitators by utilizing the Online Synthesis System (OSS) developed on DIAS. The OSS for Davao City is designed to integrate knowledge and information on real-time flood forecasting and climate change impact assessment and allow local stakeholders to learn about them through e-learning (Figure 1).

2021 年 4 月 19 日から 5 月 17 日までの約 1 か月をかけて、フィリピンのダバオ市におけるファシリテータ育成のための e ラーニング・ワークショップを科学技術省第 11 地域局（ダバオ地域）と共同で開催しました。e ラーニング・ワークショップは、水のレジリエンスと災害に関するプラットフォームの活動の一環として、DIAS 上に開発したオンライン知の統合システム（OSS）を活用しファシリテー

タを育成することを目的としました。ダバオ市における OSS は、リアルタイム洪水監視・予測と気候変動影響評価に関する知見・情報を集約し、それらを現地ステークホルダーが e ラーニングで学習することができるシステムとして開発されました（図 1）。

e ラーニングでは、10コマの講義受講、オンライン試験、2つの課題提出が課され、それらの詳細については、開会セッション、概要説明セッション、質疑セッション、閉会セッションにおいて解説や議論がなされました（図 2）。参加者は OSS を通して、気候変動に関連する3コマ、洪水マネジメントに関する3コマ、災害リスク軽減に関する4コマの計 10 コマの講義を各自で受講した上で、オンライン試験を受け、サイエンス・コミュニケーションとワークショップの企画に関する2つの課題を提出し、それらが一定の基準を満たすことで合格が判断されました。今回の e ラーニングでは 29 名の参加者のうち全ての基準を満たした21名が合格となり、閉会セッションで証明書が発出されました（図 3）。

一連のセッションでは、OSS の使用性や今後の現地による運用方法と持続性、関連プロジェクトとの連携、現地の知識や経験、洞察などの反映、現地の政策立案者や災害関係機関・企業、メディア、市民コミュニティなど対象となる聴衆への効果的な伝達など多くのフィードバックを基に有意義な議論が交わされました。これらを踏まえて、今後とも現地との協働により OSS のさらなる改良や実践的研修を実施することを予定しています。

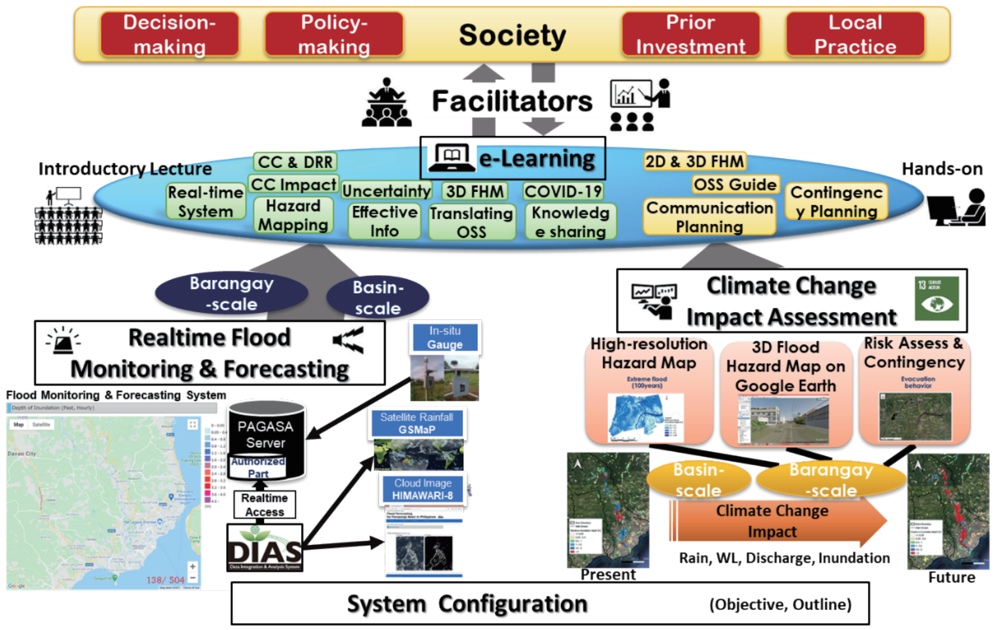


Figure 1 Concept of the Online Synthesis System
図 1　オンライン知の統合システムの概念図

During the e-learning, the participants were required to view 10 lectures (three on climate change, three on flood management, and four on disaster risk reduction), take an online exam, and submit two assignments. These requirements were explained and discussed in detail at the opening session, introduction sessions, Q & A sessions, and closing session (Figure 2). The participants were evaluated based on the results of the online exam and the submitted assignments on science communication and workshop planning. In the end, 21 of 29 participants met all criteria and completed the course with a certificate issued at the closing session (Figure 3).

2021				
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
April 19	April 20	April 21	April 22	April 23
9:00–12:00 **Opening Session** **Introduction: CC-1-3**	13:00–15:00 **Q & A Session: CC-1-3** **Introduction: FM-1-3**	Self-learning	13:00–15:00 **Q & A Session: FM-1-3** **Introduction: Exam**	Self-learning & Exam
April 26	April 27	April 28	April 29	April 30
13:00–14:00 **Review: CC, FM** **Introduction: DDR-1-4**	Self-learning & Exam	13:00–15:00 **Q & A Session: DDR-1-4** **Introduction: Assignment**	Self-learning, Exam, & Assignment	9:00–10:00 **Q & A Session: Assignment**
May 3	May 4	May 5	May 6	May 7
Self-learning, Exam, & Assignment	Self-learning, Exam, & Assignment	Due: **Exam and Assignment**	Evaluation by lecturers	Evaluation by lecturers
May 10	May 11	May 12	May 13	May 14
Evaluation by lecturers	Evaluation by lecturers	Evaluation by lecturers	Evaluation by lecturers	Evaluation by lecturers
May 17	May 18	May 19	May 20	May 21
10:00–12:00 **Closing Session**				

Figure 2 Schedule of e-learning & workshop
図 2　e ラーニング・ワークショップのスケジュール

We had significant discussions on various issues based on a lot of feedback from the participants through a series of sessions, including the usability and sustainability of OSS operation by local stakeholders, cooperation with related projects, inclusion of local knowledge, experience, and insights, effective communication to the target audience such as policy-makers, governmental agencies, private sectors, media, and civil communities. Following the discussions, the OSS for Davao City will be improved, and another e-learning & workshop with hands-on training will be planned through collaboration with all relevant stakeholders in Davao City.

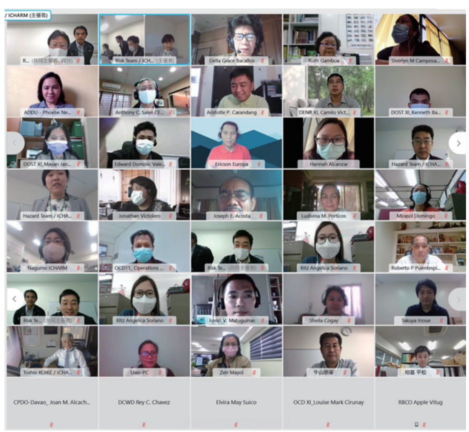


Figure 3 Participants in the e-learning & workshop
図 3　e ラーニング・ワークショップ参加者

(Written by MIYAMOTO Mamoru)

ICHARM organized the Science and Technology Panel at the 5th UN Special Thematic Sessions on Water and Disasters
第 5 回国連水と災害に関する特別テーマ会合で科学技術パネルを主催しました

The Fifth UN Special Thematic Session on Water and Disasters (STSWD5) was held online on June 25, 2021, to raise awareness and promote actions globally regarding building back better towards a more resilient and sustainable society in the post-COVID-19 era by addressing issues on water and disasters. The UN Special Thematic Sessions on Water and Disasters have been held biennially since 2013.

Prior to the plenary session of STSWD5, ICHARM organized the Science and Technology Panel (S&T Panel), which was jointly facilitated by ICHARM Executive Director KOIKE Toshio and Prof. Gretchen Kalonji, the dean of Sichuan University. The opening remark was given by Prof. TANAKA Akihiko, the president of GRIPS, and the keynote speech was delivered by Prof. Xu Weilin, the executive vice-president of Sichuan University. Presentations followed by panelists representing global and regional key organizations such as UNESCO, WMO, UNDRR, the National Water Commission (CONAGUA) of Mexico, and the Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) of Malaysia. In the panel discussion, each panelist presented ideas on the concrete actions and their implementation. Attracting more than 160 viewers worldwide, the S&T Panel summarized the concrete actions: open science policy, systemic solutions, integrated and science-based actions, and tripartite cooperation among science, policy and operation. The summary was reported to STSWD5, convened soon after the S&T Panel.

The Plenary Session of STSWD5 started with the opening remarks by Dr. Han Seung-Soo, the chair of High-Level Experts and Leaders Panel on Water and Disasters (HELP), H.E. Mr. Antonio Guterres, the UN secretary-general, and H.E. Mr. Volkan Bozkir, the president of the 75th Session of the UN General Assembly. His Majesty the Emperor of Japan gave a keynote speech titled "Passing on the Memory of Disasters – Toward Building Resilient and Sustainable Post-Corona Society." In the high-level panel discussion, Mr. AKABA Kazuyoshi, the minister of Land, Infrastructure, Transport and Tourism of Japan, spoke about the country's updated policies on water-related disaster risk reduction.

The outcomes are expected to be used as input to future global milestone events, including the mid-term review processes on the Sustainable Development Goals (SDGs) and the Sendai Framework on Disaster Risk Reduction 2015-2030, the UN High-Level Political Forums, and the 4th Asia Pacific Water Summit in 2022.

(*) HELP website:
https://www.waterandddisaster.org/fifth-un-special-thematic-session-on-water-and-disasters/

Participants of the Science and Technology Panel
科学技術パネル参加者

(Written by IKEDA Tetsuya)

2021 年 6 月 25 日、第 5 回国連水と災害に関する特別テーマ会合（STSWD5）がオンラインで開催されました。本会合は、水と災害の問題を取り上げることで、ポスト・コロナ（COVID-19）時代における、より強靭で持続可能な社会へのより良い復興に向けて地球規模で意識を高めて活動を促進することを目的としています。この国連水と災害に関する特別テーマ会合は 2013 年より 2 年ごとに開催されてきました。

STSWD5 の本会議に先立ち、科学技術パネル（S&T Panel）が ICHARM によって主催され、小池俊雄センター長と四川大学の Gretchen Kalonji 学部長とが共同で進行役を務めました。冒頭、政策研究大学院大学（GRIPS）の田中明彦学長が開会挨拶を行い、四川大学の Xu Weilin 常務副学長が基調講演を行いました。その後、UNESCO、WMO、UNDRR、メキシコ国家水委員会（CONAGUA）及びマレーシア東南アジア防災研究イニシアティブ（SEADPRI-UKM）の代表者 5 名によって発表及びパネルディスカッションが行われました。そこで今後講じるべき具体的な活動とその実施方法について、それぞれアイデアが述べられ、開かれた科学政策、システム的な解決策、科学に基づく統合的な行動、そして科学･政策･実行面での協力が提言されました。科学技術パネルには世界から 160 名以上が視聴し、提言内容はその後引き続いて開催された STSWD5 へ報告されました。

STSWD5 本会議では、水と災害に関するハイレベルパネル（HELP）の Han Seung-Soo 議長、国連 Antonio Guterres 事務総長、第 75 回国連総会 Volkan Bozkir 議長がそれぞれ開会挨拶を行い、日本からは天皇陛下が "Passing on the Memory of Disasters – Toward Building Resilient and Sustainable Post-Corona Society" と題して基調講演を行いました。またハイレベルパネルディスカッションでは赤羽一嘉国土交通大臣から日本の水災害対策に関する最新の政策について報告がなされました。STSWD5 の成果は持続可能開発目標（SDGs）や仙台防災枠組みの中間レビュー、国連ハイレベル政治フォーラム、2022 年の第 4 回アジア太平洋水サミット等、今後の地球規模での主要な行事に反映される予定です。

(*) HELP ウェブサイト：
https://www.waterandddisaster.org/fifth-un-special-thematic-session-on-water-and-disasters/

Public Relations

The 12th ICHARM Open Day held online, first in its history
第 12 回「ICHARM Open Day」 ～初めての Web 開催～

4 月 14 日に第 12 回目となる「ICHARM Open Day」を初めて Web 方式で開催しました。竹園高等学校の生徒 81 人、並木中等教育学校の生徒 28 人がオンラインで参加しました。

「ICHARM Open Day」は、毎年 4 月の科学技術週間の行事として、一昨年までは両校の生徒が ICHARM を訪問し、ICHARM で研修中の博士・修士課程の学生との国際交流の機会として対面方式で開催してきました。昨年はコロナ禍で中止し、今年も土木研究所の科学技術週間一般公開は中止となりましたが、「ICHARM Open Day」は Web 方式で開催しました。

一昨年までの対面方式では、各国紹介のポスターを前に博士・修士課程の学生 1 人が 10 人程度の生徒から質問を受けていましたが、Web 方式では学生 1 人が 100 人を超える生徒から質問を受けることで質問が出にくいことが予想されたことから、一昨年までよりも学生の発表時間を減らし、双方向となる質疑応答の時間を可能な限り確保しました。また、質問が出やすいように、両校の先生に事前に学生の発表資料を送付し，生徒が予習し、質問を事前に考えて参加してもらうように依頼しました。

当日は、小池センター長の基調講演「Climate Change and Floods」に続き、7 カ国（トンガ、マレーシア、ミャンマー、バングラデシュ、ブータン、モーリシャス、エチオピア）の博士・修士過程の学生 10 人が東から西の順に、各国の地理、歴史、文化、水災害の特徴などを発表しました。 7 カ国のうち、トンガ、モーリシャスからの 2 名は、コロナ禍で来日できていないため、本国からのオンライン参加となりました。学生は、両校の生徒から「水道水は直接飲めるか?」「災害復旧にかかる時間は?」「災害時の非常食は?」などの質問を英語で受けました。

一昨年までの対面方式では、生徒は 3 か国程度のポスターを回るのが限界でしたが、今回は、7 カ国の学生全員の発表を聴講することができました。また、対面方式では引率の先生のみの参加でしたが、今回は在校のまま参加できたため、両校で 9 人と多くの先生が参加できました。

一方、Web 方式のため、生徒の質問の意図が学生に通じにくい場面がありました。また、特定の生徒が何回も質問する場面も見られ、質問ができた生徒の割合は、対面方式に比べて少なくなりました。

Web 方式では、対面方式におけるポスター準備・掲示の必要がなくなりましたが、来年は、Web 方式を継続するか、対面方式を復活させるか、開催方式への両校の要望や社会状況も考慮して開催したいと考えています。

The 12th ICHARM Open Day was held on April 14, 2021. The event took place online for the first time in its 12th history, gathering 81 students from Takezono High School and 28 from Namiki Secondary School.

The ICHARM Open Day is an annual event held every April during the Science and Technology Week. Up to 2019, local school students visited ICHARM and enjoyed face-to-face interaction with international students studying in the master's or doctoral program at ICHARM. In 2020, when the COVID-19 pandemic broke out, the event was canceled. This year, although other open-house events hosted by the Public Works Research Institute during the Science and Technology Week were canceled, ICHARM decided to hold the yearly event online.

When the ICHARM Open Day is held in person, local students are usually divided into small groups of around ten and have an opportunity to ask questions to a graduate student of ICHARM in front of a poster about their country. However, this year's Open Day was decided to be held in a webinar-style format, in which over 100 junior high and high school students would be watching each speaker delivering a presentation from ICHARM. Worrying that not many students would raise a hand for questions in such a situation, the staff in charge of the event decided to allocate less time for the presentations and more time for the question-and-answer session. They also sent presentation materials to teachers of both schools prior to the Open Day and asked them to have their students look at the materials and think of questions in advance.

The Open Day began with a keynote lecture entitled "Climate Change and Floods" by Executive Director KOIKE Toshio. Then, ten graduate students of ICHARM from seven different countries (Tonga, Malaysia, Myanmar, Bangladesh, Bhutan, Mauritius, and Ethiopia) spoke in an east-to-west order about their countries from various aspects, including geography, history, culture, and water-related disasters. Among them, two master's students attended the event online from their home countries, Tonga and Mauritius, because they had not been able to come to Japan due to the pandemic. Junior high and high school students asked the speakers many questions all in English, such as "Is it safe to drink tap water in your country?" "How long does it take to recover from a disaster?" and "What kind of emergency food would you have in the event of a disaster?"

Presentation by Ph.D. student from Ethiopia
ICHARM Open Day 2021 参加者
エチオピア博士課程学生の発表

When the Open Day was held in person, each group of local students could stop at only a few poster presentations to talk with a graduate student of ICHARM. In a webinar-style format, however, all students were able to watch all presentations. Moreover, though only a few teachers came to ICHARM to attend their students when the event took place in a regular way, nine from the two schools together participated because they could do so while at school.

On the other hand, there were a few times when the speakers had a hard time figuring out what junior high or high school students wanted to know. Also, because the same students asked questions repeatedly, other students did not have as many chances to do so in the online event as in the regular face-to-face events.

Compared with the regular-style Open Day, the online event required less preparation; graduate students and the staff did not have to make and put up posters for presentation, for example. Considering such advantages and disadvantages, the requests from local schools about how the event should be held, and other social conditions, ICHARM will plan the next year's event, including whether it should be held online or in person.

(Written by KOBAYASHI Hajime)

Miscellaneous

ICHARM Executive Director KOIKE Toshio received FY2020 JSCE International Lifetime Contribution Award
小池俊雄センター長が令和２年度土木学会国際貢献賞を受賞しました

Evaluated on the contribution to solving scientific and social problems on global water issues, ICHARM Executive Director KOIKE Toshio received the International Lifetime Contribution Award at the FY2020 Japan Society of Civil Engineering (JSCE) awarding ceremony held on June 11. He was among the five award winners.

This award is given to those who have made long-term contributions to achieving the advancement of civil engineering and infrastructure development through international activities.

For more than 30 years, he has been contributing to the development of technologies to observe and predict global water circulation from fundamental research to implementation of the technologies.

The award recognizes, to name a few among many, his contributions to the development of "Momo 1," launched in 1987 as Japan's first marine observation satellite, and the development and dissemination of Data Integration and Analysis System (DIAS), as well as his leadership in large-scale international joint observation and research projects, such as the establishment of the Group on Earth Observations (GEO) in 2005.

Executive Director KOIKE and the honorable certificate
小池センター長と国際貢献賞状

The Fiscal Year 2020 JSCE Award Ceremony
令和２年度土木学会授与式の様子

(Written by NAITO Kensuke)

世界の水に関する科学的・社会的問題解決への貢献が評価され、小池俊雄センター長に国際貢献賞が授与されました。同賞は、長年の活動の積み重ねによって、国際社会における土木工学の進歩発展あるいは社会資本整備に貢献し、その活動が高く評価された日本人に授与されます。

小池センター長は、30 年以上にわたり、グローバルな水循環変動の観測・予測技術の開発に関して、基礎研究から社会実装に至るまで国際的に貢献してきました。その例として、1987 年に日本初の海洋観測衛星として打ち上げられた「もも１号」開発への貢献、データ統合・解析システム（DIAS）の開発・普及への貢献、そして 2005 年の地球観測に関する政府間会合（GEO）の立ち上げをはじめ、大型国際共同観測・研究プロジェクトでの主導的役割が挙げられます。

表彰は６月 11 日の令和２年度土木学会授与式にて行われ、小池センター長を含む５名が同賞を受賞しました。

Personnel change announcements
人事異動のお知らせ

New ICHARM Members

Two new members joined ICHARM.
They would like to say brief hello to the readers around the world.

KAWAMOTO Takatoshi / 河元隆利
Senior Researcher / 主任研究員 — *Japan*

I'm so glad to be a member of ICHARM. This is the first time for me to work in the Tsukuba area. Before coming to ICHARM, I worked at MLIT and CAS, government organizations promoting infrastructure system development in developing countries using Japan's technologies and know-how. I would like to contribute to ICHARM by making use of my experiences.

Shrestha Badri Bhakta / シェレスサ　バドリ　バクタ
Research Specialist / 専門研究員 — *Nepal*

I joined ICHARM again in May, and I am very excited to be a team member of ICHARM. My research interests are developing methods and approaches for risk assessment of water-related disasters and formulating sustainable mitigation strategies to reduce the risk of such disasters. At ICHARM, I would like to address issues and future challenges in the field of water-related disasters to build a more resilient society. I look forward to collaborating with people around the world.

Leaving ICHARM

- **TOMIZAWA Yosuke:** Senior Researcher
  Overseas Projects Division, Policy Bureau,
  Ministry of Land, Infrastructure, Transport and Tourism

○**冨澤洋介**　主任研究員
国土交通省
総合政策局　海外プロジェクト推進課

Awards / 受賞リスト

* April - June 2021

- *Executive Director KOIKE Toshio received FY2020 JSCE International Lifetime Contribution Award.*
  See **Miscellaneous on page 27.*
- *HARADA Daisuke was awarded the 'Young Best Presentation Award' by the Japan Society of Erosion Control Engineering for the presentation at the Annual Conference 2021. Presentation Title; 多量の土砂を含む洪水氾濫流の特徴 -2019年五福谷川洪水を例に-*

Publications / 発表論文リスト

* April - June 2021

1. Journals, etc. / 学術雑誌（論文誌、ジャーナル）

- *Hemakanth Selvarajah, Toshio Koike, Mohamed Rasmy, Katsunori Tamakawa, Akio Yamamoto, Development of an Integrated Approach for the Assessment of Climate Change Impacts on the Hydro-Meteorological Characteristics of the Mahaweli River Basin, Sri Lanka, Water MDPI Open Access Journals, Vol.13, Issue9, 1218*

2. Oral Presentations (Including invited lectures) / 口頭発表（招待講演含む）

- *原田大輔、江頭進治、多量の土砂を含む洪水氾濫流の特徴 -2019年五福谷川洪水を例に、令和3年度（公社）砂防学会研究発表会概要集、令和3年度(公社)砂防学会研究発表会（Online）、（公社）砂防学会、2021年5月、pp.27-28、2021年5月19日～21日*
- *柿沼太貴、沼田慎吾、望月貴文、大沼克弘、伊藤弘之、安川雅紀、根本利弘、小池俊雄、池内幸司、中小河川を対象とした洪水時におけるリアルタイム水位予測システムの開発に向けた研究、河川技術論文集、2021年度河川技術に関するシンポジウム（Online）、土木学会、pp.105-110、第27号、2021年6月10日～11日*
- *大原 美保、藤兼 雅和、地方自治体の建設関連部局での水害対応ヒヤリ・ハット事例の分析、地域安全学会春季研究発表大会梗概集、No.48、pp.189-192、地域安全学会（Online）、2021年5月21日*

3. Poster Presentations / ポスター発表

- *南雲直子、会田健太郎、大原美保、2020年台風Ulyssesによるフィリピンの洪水被害マッピング、日本地球惑星科学連合大会（Online）、日本地球惑星科学連合、2021年5月30日～6月6日*
- *南雲直子、江頭進治、久保純子、センン川下流域の川幅と河床材料の粒度分布特性について、日本地球惑星科学連合大会（Online）、日本地球惑星科学連合、2021年5月30日～6月6日*
- *会田健太郎、南雲直子、大原美保、国際共同研究プロジェクトでの広域台風災害に関する情報提供・共有における Google Earth Engine 活用事例、日本地球惑星科学連合大会（Online）、日本地球惑星科学連合、2021年5月30日～6月6日*

4. Magazines, Articles / 雑誌、記事（土技資含む）

- *池田鉄哉、水と災害に関する世界的な目標とその達成に向けたICHARMの貢献、土木技術資料、pp.6-7、2021年5月号*

5. PWRI Publications / 土研刊行物（土研資料等）

None / 該当者無し

6. Other/ その他

None / 該当者無し

Editor's Note
編集後記

日頃より ICHARM ニュースレターをご愛読いただき、厚く御礼申し上げます。新型コロナウィルス感染症が世界的に拡大し始めてから、ほぼ 1 年半が経過しました。その間も ICHARM では鋭意、水災害対策に関する活動を進め、そのいくつかは本号のニュースレターで紹介しました。これからも予防措置を講じつつ活動の推進に努め、ニュースレターで紹介していきたいと思っております。引き続き、皆様にご愛読いただき、その中から有用な情報を得ていただければ大変嬉しく思います。

Firstly, I would like to express my sincere appreciation to all for reading ICHARM newsletters. Almost one and a half years have passed since COVID-19 started spreading worldwide. Meanwhile, ICHARM is promoting activities on water-related disaster risk reduction eagerly, as some of them are reported in this newsletter. We will continue to develop the activities while taking precautions and report their progress in the coming editions of newsletters. It will be of our great pleasure if you can enjoy our newsletters and get some useful information from them.

ICHARM Newsletter Editorial Committee
IKEDA Tetsuya

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