ISSN 0386－5878
土木研究所資料 第4452号

ICHARM Publication No.46E

# Report on 2020-2021 M.Sc. Program, "Water-related Disaster Management Course of Disaster Management Policy Program"

United Nations Educational, Scientific and Cultural Organization

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

Public Works Research Institute, National Research and Development Agency, Japan

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

ISSN 0386-5878

Technical Note of PWRI
No. 4452

# Technical Note of PWRI

## Report on 2020-2021
## M.Sc. Program,
## "Water-related Disaster Management Course of Disaster Management Policy Program"

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

ISSN 0386-5878
Technical Note of PWRI
No.4452

# Report on 2020-2021 M.Sc. Program, "Water-related Disaster Management Course of Disaster Management Policy Program"

By
International Centre for Water Hazard and Risk Management under the auspices of UNESCO (ICHARM)
ITOU Hiroyuki, Deputy Director*
EGASHIRA Shinji, Training and Research Advisor
KOBAYASHI Hajime, Chief Researcher*
Miyazaki Ryosuke, Chief Staff
OHKUBO Masahiko (Proofreading)

ICHARM conducted a one-year Master's program entitled the "Water-related Disaster Management Course of Disaster Management Policy Program" from 1st October 2020 to 15th September 2021 in collaboration with the Japan International Cooperation Agency (JICA) and the National Graduate Institute for Policy Studies (GRIPS). The seven students were mainly technical officials, engineers or researchers in the field of river management or water-related disasters in developing countries.

This course aims to foster solution-oriented practitioners with solid theoretical and engineering bases who can serve for planning and practices of flood management within the framework of integrated river basin management at all levels from nations to localities.

In the first half of the course, the students mainly attended lectures and exercises; in the second half, they worked on their individual studies, this enabling them to prepare and complete their master's theses and to visit numerous locations across Japan over the course of several field trips in order to learn about up-to-date flood control countermeasures in action.

This report details the course activities and the achievements thereof and aims to contribute improvements in the next year.

**Key Words:** Training, Master's program, Disaster prevention, Flood disaster

*As of September 2021

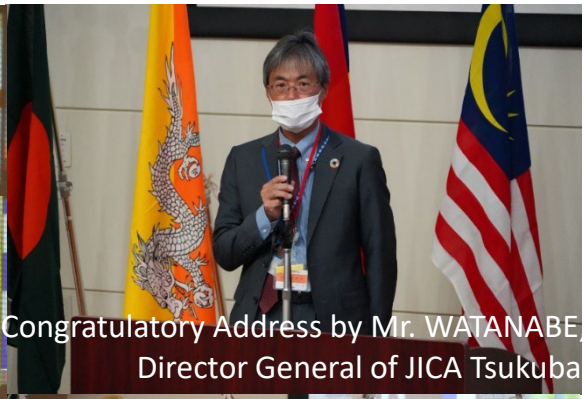
# Contents of Report on 2020-2021 M.Sc. program, "Water-related Disaster Management Course of Disaster Management Policy Program"

- Table of Contents -

# - Annexes -

# JICA Opening Ceremony (October 1, 2020)

at Auditorium, ICHARM, PWRI.



Congratulatory Address by Mr. WATANABE, Director General of JICA Tsukuba


Congratulatory Address by Prof. Koike, Executive director of ICHARM (recorded video)

Congratulatory Address by Mr. NISHIKAWA, President of PWRI

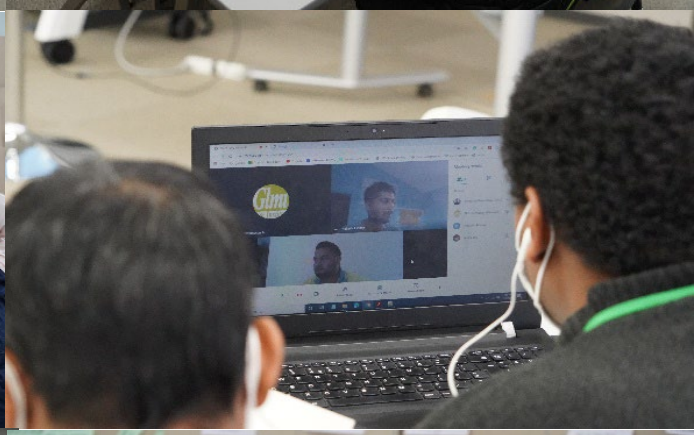
Congratulatory Address by Prof. Sugahara, GRIPS

# Welcome Gathering (December 11, 2020)

at 2nd floor of ICHARM, PWRI.

# Training Workshop on Project Cycle Management (January 5, 6 and 7, 2021) at ICHARM, PWRI



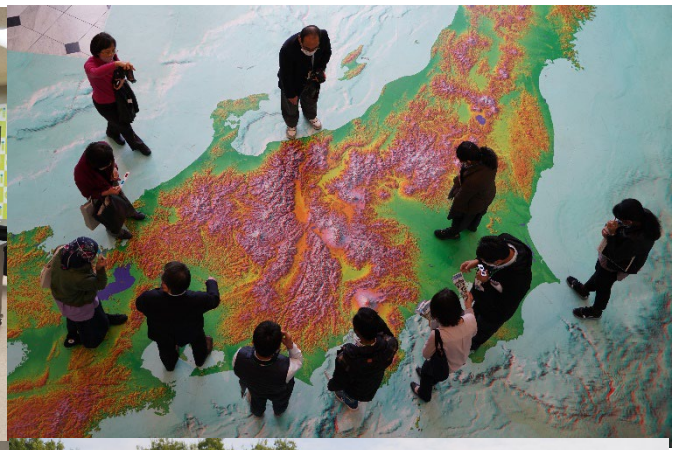





# Online lecture by Japan Meteorological Agency (March 18, 2021) at lecture room, ICHARM, PWRI.

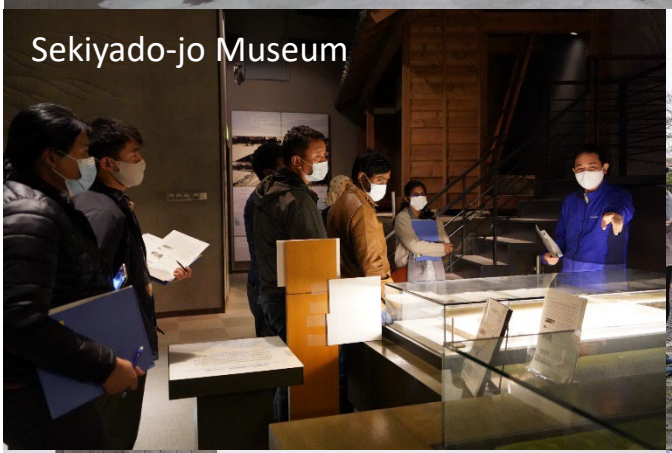
Site Visit

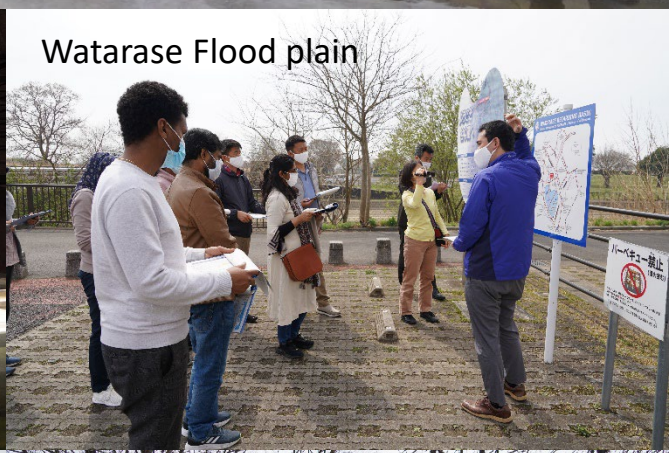
Geospatial Information Authority of JAPAN (March 19, 2021)



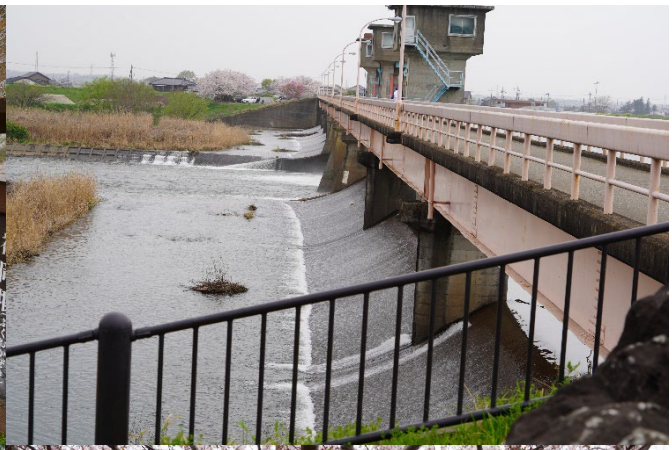

# Site Visit
# Tone River Basin (1) (March 24, 25 and 26, 2021)


# Site Visit
# Tone River Basin (2) (March 24, 25 and 26, 2021)

# Site Visit
# Fukuoka Weir （March 30, 2021）




Hydraulic exercise held at an experiment station in Tsukuba City (April 5, 2021)

# Site Visit
## Shinano and Tone River Basin (1) (April 21, 22 and 23, 2021)


Shinanogawa Downstream River Office


Panorama Tower of Mt. Yahiko

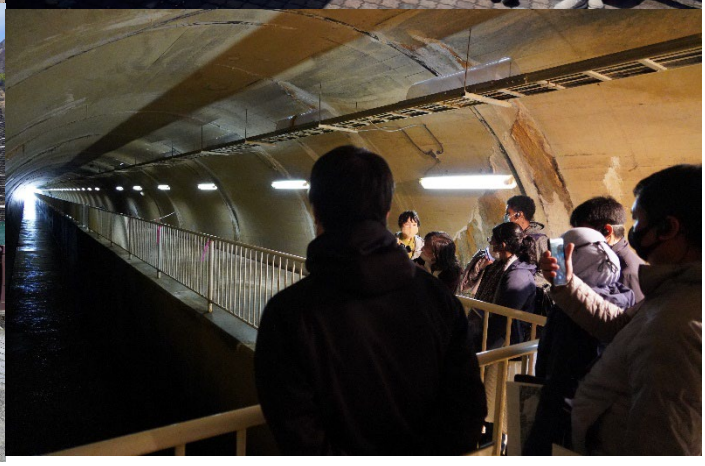
Ohkouzu Museum
Tsubame city, Niigatan pref.


Nitoko-mieru Reference Center

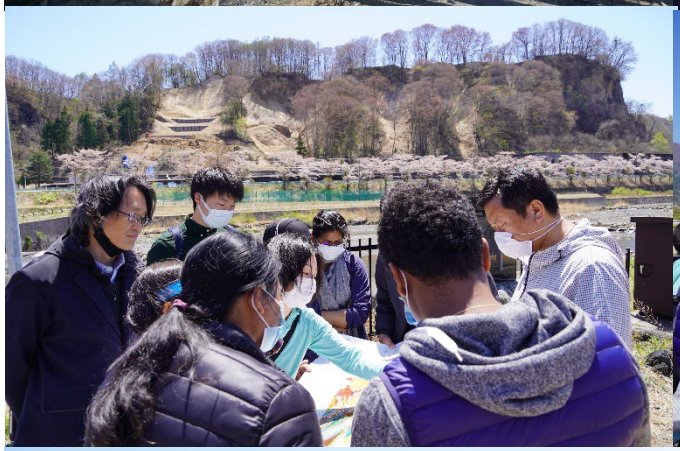
# Site Visit
# Shinano and Tone River Basin (2) (April 21, 22 and 23, 2021)


Exercise on River Discharge Measurement, Shinano River


Sagurigawa Dam



# Site Visit
## Shinano and Tone River Basin (3) (April 21, 22 and 23, 2021)

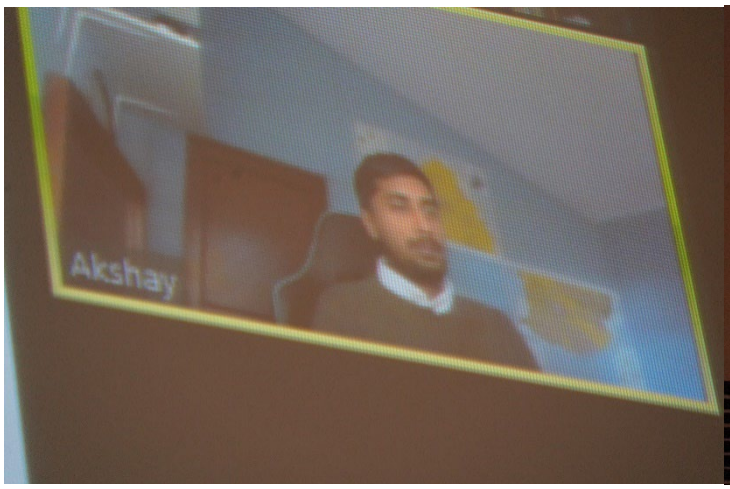




# Final Presentation (1) (August 5, 2021)

at Auditorium, ICHARM, PWRI.


Mr. Tevita Aho

Ms. Aye Mon Khaing




Mr. KOWLESSER Akshay Prakash

Ms. Norain Binti Osman

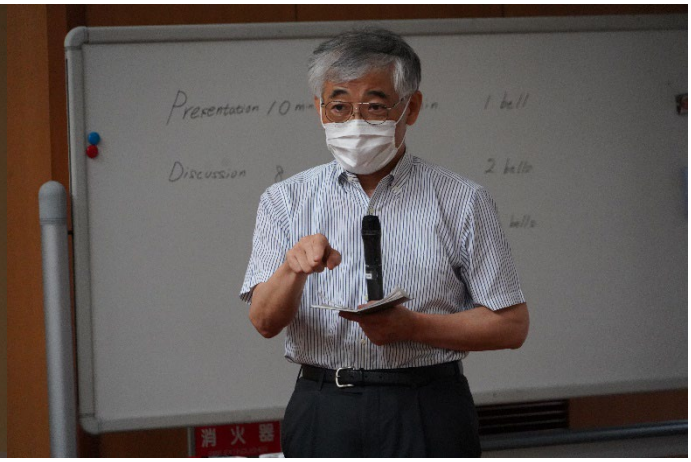
Mr. Jamyang ZANGPO

Mr. Nedrup Tshewang

# Final Presentation (2) (August 5, 2021)

at Auditorium, ICHARM, PWRI.

Ms. AHMED Farzana

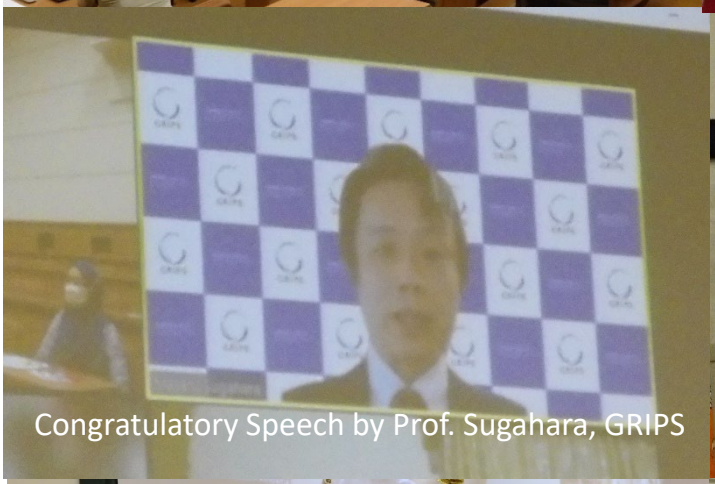

# Tree Planting Ceremony （September 14, 2021）

At PWRI.

# JICA Closing Ceremony (1) (September 14, 2021)

at Auditorium, ICHARM, PWRI.

Congratulatory Speech By Mr. Watanabe, Deputy Director of JICA Tsukuba

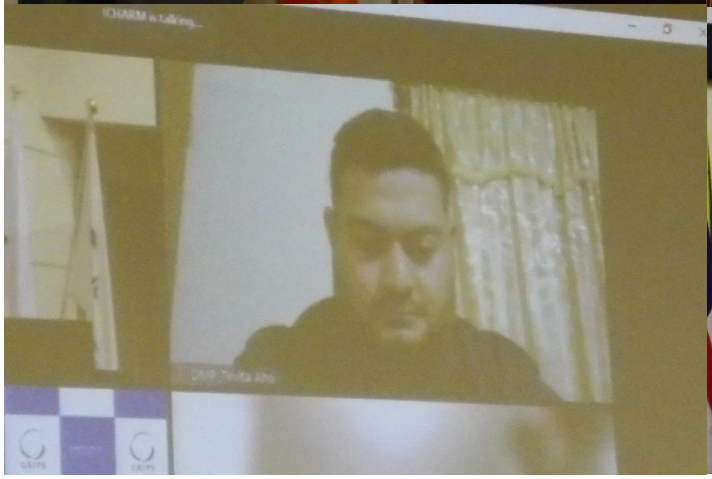


Congratulatory Speech by Prof. Sugahara, GRIPS

Congratulatory Speech By Prof. KOIKE, Executive Director of ICHARM

Presentation of Best Research Award

Presentation of ICHARM Sontoku Award

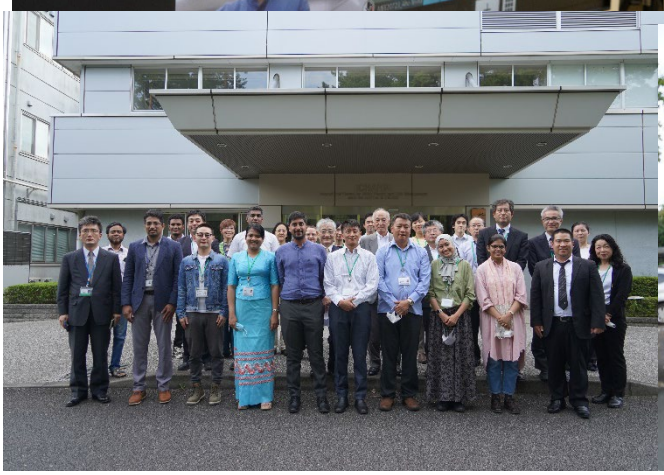


# JICA Closing Ceremony (2) (September 14, 2021)

at Auditorium, ICHARM, PWRI.

# GRIPS Graduation Ceremony （September 15, 2021）

at Auditorium, ICHARM, PWRI.



# Chapter 1: Background and Objectives of this Course

## 1.1 Background of this Course

Natural disasters cause human tragedies and economic losses and hamper the development of the countries where they occur. In particular, due to recent urbanization in developing countries, there is a tendency for the poor to be forced to settle in buildings and areas that are vulnerable to natural disasters. This significantly increases vulnerability to natural disasters in developing countries.

The mitigation of damage caused by natural disasters, particularly by water-related disasters such as floods and droughts, is a major challenge that needs to be overcome through international cooperation in order to ensure the sustainable development of societies and the alleviation of poverty. The number of such devastating disasters has been increasing around the world, and particularly so in Asia and Africa (Figure 1-1). According to a UN population projection (UN World Urbanization Prospects 2018), the urban population will continue growing in size and proportion across the world, and most of the growth will be seen in developing countries. For example, between 2005 and 2050, the urban population in Asia and Africa is projected to increase rapidly, growing from 1.631 to 3.479 billion and 0.341 to 1.489 billion, respectively (Figure 1-2). Projections show that rapid population growth will occur in major waterfront cities in Asia, e.g., Dhaka (Bangladesh), Mumbai (India), and Jakarta (Indonesia). If appropriate measures are not taken to protect these cities, their vulnerability to large-scale water-related disasters, such as floods, storms, and tsunamis, is likely to become increasingly high (Figure 1-3).

Asia alone accounts for over 80% of worldwide fatalities due to water-related disasters (Figure 1-4). Precipitation and its patterns of distribution are predicted to change due to climate change, and this may exacerbate the intensity and frequency of water-related disasters. Sea level is expected to rise worldwide due to global warming, which in turn will worsen the water-related disaster risks in coastal areas, delta areas in the lower reaches of rivers, and small islands.

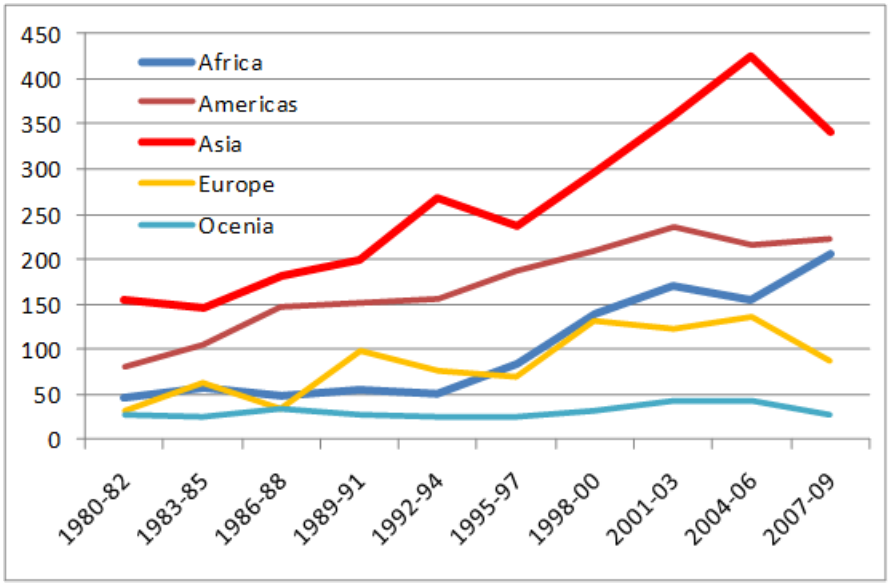



Figure 1-1 Annual variation in the number of water-related disasters by region

(Prepared by ICHARM based on CRED EM-DAT)

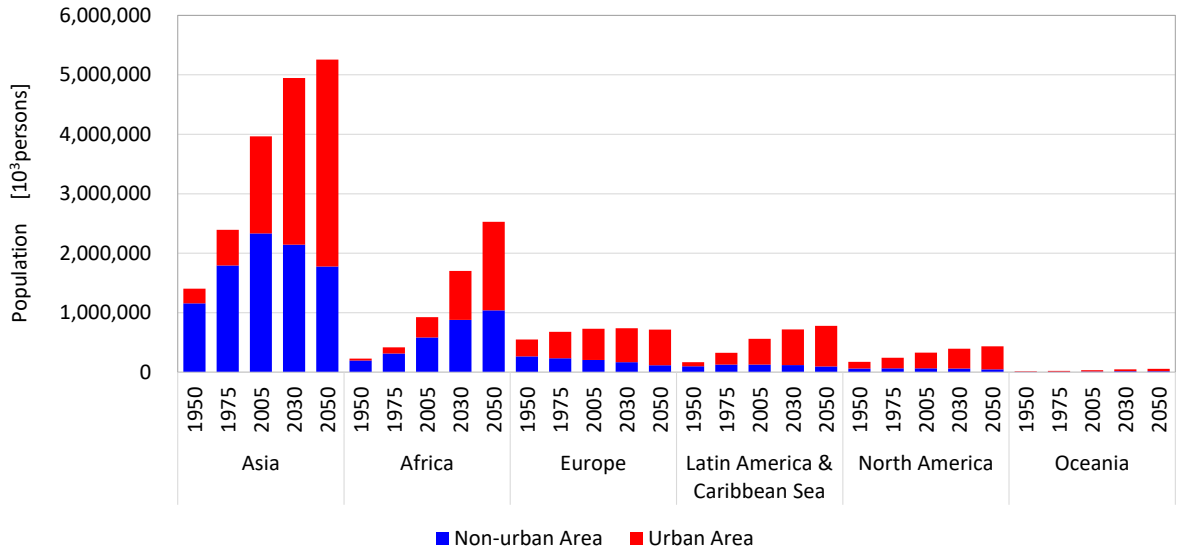



Figure 1-2 Demographic change in urban and non-urban areas by region

(Prepared by ICHARM based on World Urbanization Prospects:
2018 Revision by the Population Division, Department of Economic and Social Affairs, UN)

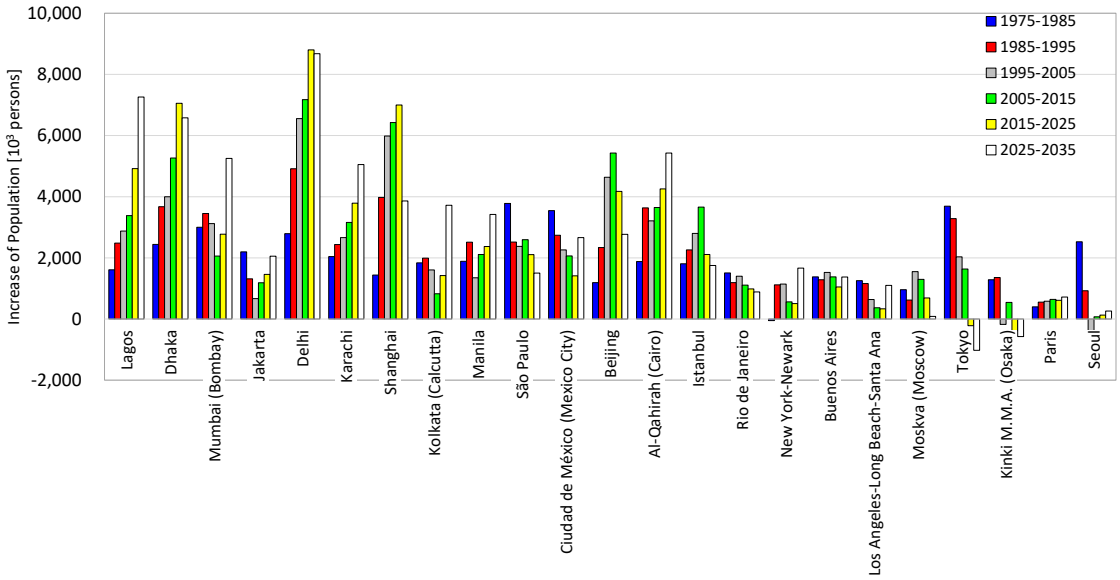



Figure 1-3 Demographic changes in major cities worldwide between 1975 and 2035

(Prepared by ICHARM based on World Urbanization Prospects:

2018 Revision by the Population Division, Department of Economic and Social Affairs, UN)

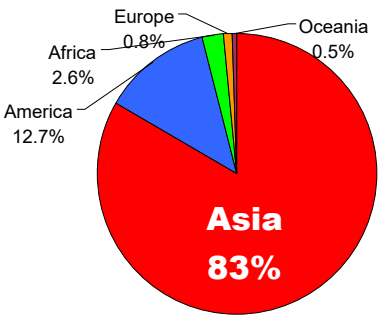



Figure 1-4
Distribution of fatalities due to water-related disasters (1980–2006)

(Prepared by ICHARM based on CRED EM-DAT)

In order to reduce the impact of natural disasters, well-coordinated risk management to be executed before, during, and after disasters must be established in a multi-disciplinary manner. Such management needs to use both structural measures such as dams and levees and non-structural measures such as flood warning systems, risk maps, and hazard maps, and both types of measures should be planned and implemented by employing the expertise in psychology, engineering, and other areas. To achieve this management, disaster management experts must be created through professional education and training. They should be able to develop practical disaster management policies and technologies based on local conditions and needs and exchange various types of information with local residents to raise awareness of disaster prevention in local communities.

Given these circumstances, in order to enhance the capabilities of experts in developing countries to cope with water-related disasters, ICHARM, the National Graduate Institute for Policy Studies (GRIPS), and the Japan International Cooperation Agency (JICA) jointly launched a master's degree program called the "Water-related Disaster Management Course of Disaster Management Policy Program" (hereafter referred to as "the course") in 2007. JICA also internally calls it "Group and Region-Focused Training: FLOOD DISASTER RISK REDUCTION." The course marked its 14th year.

In March 2015, Japan hosted the third United Nations World Conference on Disaster Reduction in Sendai, Japan, and the government of Japan announced the Sendai Cooperation Initiative for Disaster Risk Reduction. In this initiative, as a country advanced in disaster risk reduction, Japan declared to provide non-structural assistance such as support for establishing social systems and enhancing human resources. It also listed concrete measures including human resource development, training, and technical transfer to assist other countries in planning disaster risk reduction policies and emergency disaster relief efforts (both domestic and international). The intent of this part of the initiative precisely matches the goal of this course, which is capacity development for disaster management policy planning. In step with the spirit of the Sendai Cooperation Initiative, the significance of the course is higher than ever before.

## 1.2 Objectives of this Course

Against this background described in the previous section, the final goals and objectives of the course are set as follows:

**<Overall Goal>**

The damage of water-related disasters is reduced by planning and implementing the countermeasures of water-related disasters in their countries.

**<Program Objective>**

The participant's capacity to practically manage problems and issues concerning water-related disasters is developed for contributing to the mitigation of water-related disasters in their countries.

## 1.3 Outputs of this Course

Participants are expected to achieve the following outputs:

(1) To be able to explain basic concepts and theories on the generation process of water-related disasters, water-related hazard risk evaluation, disaster risk management policy and technologies.

(2) To be able to explain basic concepts and theories on flood countermeasures including landslide and debris flow.
(3) To formulate the countermeasures to solve the problems and issues concerning water-related disasters in their countries by applying techniques and knowledge acquired through the program.

## 1.4 Features of this Course

The course is characterized by the following three points:

*I. "Problem Solving-Oriented" course*

In order to manage large-scale disasters, it is essential to develop disaster management capabilities at the organizational level as well as at the individual level, since there is always a limit on what each individual can achieve.

JICA training programs in recent years have shifted their focus to "problem solving-oriented training," which aims to improve the ability of organizations to deal with problems and situations. This shift of the course emphasis is based on the idea that such training delivers a dual benefit. First, the training will be more effective and efficient for each student if they first identify water issues specific to their countries and study proactively in order to solve them. Moreover, the training will produce results that are practical to solve the issues faced by organizations to which each student belongs.

Based on this philosophy, the course is designed to motivate students to find, analyze, and solve problems independently, rather than to instruct them to do so. One of the requirements for graduation from this course is to write a master's thesis on an issue that students find critical to their country. Such assignments help students develop the ability to formulate integrated flood mitigation plans and help them learn how to address other issues at home.

*II. "Practical" rather than "Theoretical"*

To make the course problem solving-oriented, lectures and exercises put an emphasis on practicality rather than theory to train students to be able to work effectively in actual situations. For this reason, field trips are also planned as an essential part of the course for students to see disaster management at work.

*III. One-year master's course*

This master's course is intended for personnel working in administrative organizations. For this reason, it is designed for them to be able to earn a master's degree within a single year rather than the usual two years so that they do not have to be absent from work for an excessively long period.

## 1.5 Qualifications for this Course

There are two ways to participate in this course. In one way, students are recruited and selected by overseas JICA offices as participants in the JICA training program called "GROUP AND REGION-FOCUSED TRAINING ON FLOOD DISASTER RISK REDUCTION" and accepted as GRIPS students. On the other way, students apply directly to GRIPS and are accepted by GRIPS. In the former way, a local JICA office first consults relevant organizations of the country where the office is located regarding whether they would like to send their personnel to this program. If the organizations show no interest, no students will participate from them.

### 1.5.1 Application as JICA Participants

A preliminary participation-needs survey identified the candidate countries listed below along with eligible organizations and requirements for applicants.

Target Regions or Countries: 14 countries

Indonesia, Malaysia, Philippines, Vietnam, Myanmar, Bhutan, Bangladesh, India, Pakistan, Sri Lanka, Fiji, Tonga, Zimbabwe, Mauritius

Eligible/Target Organizations:

Governmental organizations concerning river management or water-related disasters

Nominee Qualifications:

Applicants should:

(1) be nominated by their governments.

(2) be technical officials, engineers, or researchers who have three (3) or more years of experience in the field of flood management in governmental organizations.
(*Basically, researchers in universities (e.g., professors) are excluded.)

(3) be university graduates, preferably in civil engineering, water resources management, disaster mitigation, or related departments.

(4) be proficient in basic computer skills.

(5) be proficient in English with a minimum test score of TOEFL iBT 79, PBT 500, IELTS Academic 6.0 or its equivalent.

(6) be in good health, both physically and mentally, to participate in the program in Japan.

(7) be over twenty-five (25) and under forty (40) years of age.

### 1.5.2 Direct Application to GRIPS

Requirements for direct application to GRIPS were as follows:

To be eligible for admission to this master's program, an applicant

1) must hold a bachelor's degree or its equivalent from a recognized/accredited university of the highest standard in the field of civil engineering, water resource management, or disaster mitigation.
2) must have working knowledge of civil engineering, especially of hydraulics and hydrology.
3) must be familiar with mathematics such as differentiation and integration techniques.
4) must satisfy the English language requirements with a minimum test score of TOEFL iBT 79, TOEFL PBT500, IELTS Academic 6.0 or its equivalent.

must be in good health.

### 1.5.3 Final Decision on Acceptance of Students

After recruiting students through 1.5.1 and 1.5.2, the committee of the Disaster Management Policy Program led by Director SUGAHARA Masaru, a professor of the National Graduate Institute for Policy Studies (GRIPS), was held on July 2nd, 2020, and made the final decision on the enrollees to the program.

After the discussion among the program committee members, a total of 7 students were selected.

## 1.6 Organization of Faculty

The following list shows the faculty members with their positions for the master's program. All of them were appointed as faculty members by GRIPS.

International Centre for Water Hazard and Risk Management (ICHARM), PWRI

| | |
|---|---|
| Collaborating Professor (Executive Director) | KOIKE Toshio |
| Collaborating Professor (Research and Training Advisor) | EGASHIRA Shinji |
| Collaborating Associate Professor (Senior Researcher) | OHARA Miho |
| Collaborating Associate Professor (Senior Researcher) | Abdul Wahid Mohamed RASMY |
| Collaborating Associate Professor (Senior Researcher) | YOROZUYA Atsuhiro |
| Collaborating Associate Professor (Research Specialist) | USHIYAMA Tomoki |
| Collaborating Associate Professor (Research Specialist) | HARADA Daisuke |
| Collaborating Associate Professor (Researcher) | MIYAMOTO Mamoru |

ICHARM researchers also provided advice for students, when necessary, to accommodate the needs of the students studying issues of different areas.

## Chapter 2: Course Content

### 2.1 Course Schedule

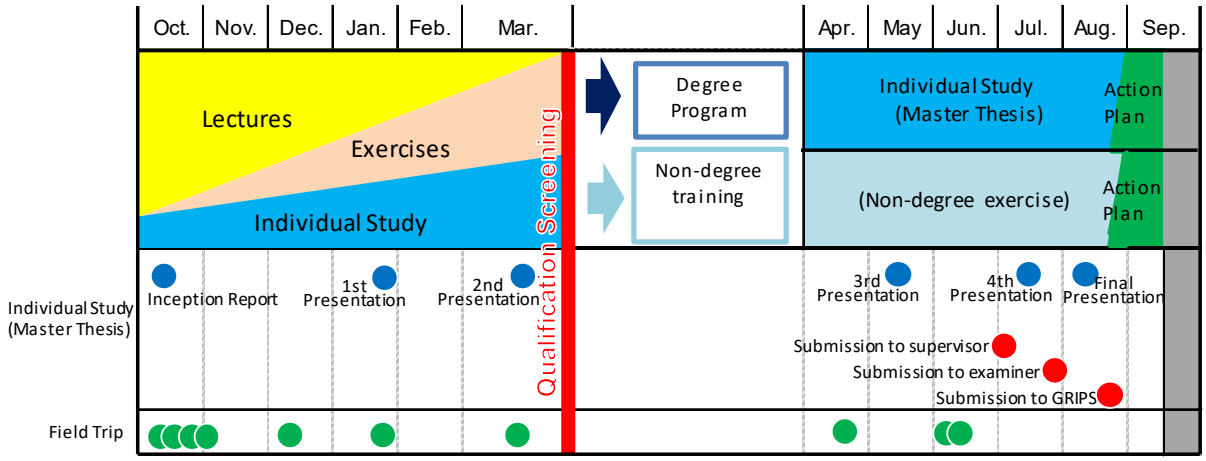



Figure 2-1 Conceptual figure of course schedule

The course was conducted over a period of around one year, from September 30, 2020 (arrival date) to September 17, 2021 (departure date). The opening guidance at GRIPS was held on October 5, 2020, and the graduation ceremony on September 15, 2021.

Figure 2-1 shows the course schedule.

The first half of the course (October to March) consisted mainly of "Lectures" (10 subjects) and "Exercises" (5 subjects). "Site Visit" (1 subject) was also conducted several times throughout the year to enhance the students' understanding of the content of the lectures. In addition, in order to provide opportunities for students to learn about the latest knowledge and trends regarding water-related disasters, they were required to attend ICHARM R&D Seminars held with invited experts.

In late March, the Qualification Screening was held, in which the ICHARM faculty determined whether the students had reached the level of knowledge required to write a master's thesis.

In the second half of the course (April to September), the students started working exclusively on their master's theses as "Individual Study (1 subject)", while consulting with their supervisors (ICHARM researchers, etc.). To report progress in master's theses, the students had to make a ten-minute presentation in the "Interim Presentations" session about once every one to two months. In this session, they received advice from other students and supervisors as necessary. The final presentation was held at the beginning of August, and they submitted their master's theses at the end of August.

Table 2-1 shows a summary of the year's course schedule.

Table 2-1 Main schedule for the year

| Date | | Event |
|---|---|---|
| 2020<br>October | 1st<br>5th<br>19th | Opening Ceremony at ICHARM (Online)<br>Entrance Guidance & Orientation at GRIPS (Online)<br>Presentation on Inception Report |
| November | Early | Allocation of Supervisors to M. Sc. Students<br>Lectures at GRIPS（Nov.20th – Dec.4th）(Online) |
| December | | Lectures at GRIPS（Nov.20th – Dec.4th）(Online) |
| 2021<br>January | 5th-7th | Exercise on Project Cycle Management (PCM) |
| March | 2nd<br>19th<br>24th – 26th<br><br><br>30th | 1st Interim Presentation<br>Visit to Geospatial Information Authority of Japan (GSI) in Tsukuba City<br>Site Visit to Urban river basin and Tone River basin<br>(The Metropolitan Area Outer Underground Discharge Channel, Watarase Retarding Ground)<br>Visit to Fukuoka Weir |
| April | 20th<br>20th -23rd | 2nd Interim Presentation<br>Site Visit to Shinano River basin and Tone River basin<br>(Exercise on river discharge measurement at Shinano River, Yamba Dam ) |
| May | 31st | 3rd Interim Presentation |
| July | 2nd | 4th Interim Presentation |
| August | 2nd<br>5th<br>13th<br>18th | Deadline of the draft thesis to ICHARM Supervisor<br>Final Presentation<br>Deadline of final thesis to GRIPS<br>Faculty meeting at GRIPS (Online) |
| September | 6th -9th<br>14th<br>15th<br>16th - | Online Program by JICA “ Understanding the Japanese Development Experience”<br>Closing Ceremony at ICHARM<br>Graduation Ceremony at GRIPS (Online)<br>Return to home country |

## 2.2 Course Curriculum

### 2.2.1 Lectures and Exercises

This master's program is oriented towards problem solving and focuses on practicality. Therefore, in addition to basic subjects on water-related hazard risk management, the program offers classes for students to learn how to apply knowledge and technology to actual problems.

Table 2-2 shows the list of classes in this master's program. Overall, the program consists of 16 subjects in three categories: I. Required Course, II. Recommended Course, and III. Elective Course. Lecture-based classes are in the second category, and exercise-based classes are in the third category.

Each subject consists of 15 periods. All subjects in the Recommended Course are compulsory (lectures: two credits), all subjects in the Elective Course are optional (exercises: one credit), and the Individual Study counts as ten credits. To be awarded a master's degree, students must earn at least 30 credits, 16 credits of which must be from the subjects in the Recommended Course. Students are awarded a master's degree in "disaster management" after having earned the necessary credits and passing the thesis review. Students in this program do not have to take all subjects to earn the credits required for graduation, but they usually do.

As a reference, the syllabus of each subject, also available on the GRIPS webpage, is shown in the Annex chapter.

### 2.2.2 Lecturers

The faculty for this master's program consists of not only ICHARM researchers but also many professionals invited from universities and other institutes so that students can learn the latest knowledge and technologies. As shown in Table 2-3, a total of 33 lecturers joined the faculty this year from outside and inside ICHARM: 13 from universities, 7 from government agencies, foundations, research institutes of private corporations, and 13 from ICHARM.

With respect to the implementation of lectures, exercises, and individual studies, the ICHARM educational staff and thesis supervisors are also contracted as GRIPS coordinating instructors to provide supervision for students.

### 2.2.3 Field Trips and Lectures Conducted by Officials Related to Disaster Prevention Administration

Field trips are also conducted for students to study disaster management structures in place, such as retarding basins, diversion channels, dams, and sediment control and landslide prevention works, in addition to lectures and exercises at ICHARM. Students also visit the regional bureaus of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and local government offices to listen to lectures given by disaster prevention officials whose work involves direct interaction with local residents. These officials lecture about flood information transmission systems and flood hazard maps used in Japan, which helps students enhance their understanding of the problems actually encountered by Japanese disaster prevention authorities. Table 2-4 shows the list of the field trip destinations this year. Such destinations are carefully selected for students to see representative flood prevention facilities and structures in Japan, including those they learned in lectures.

Also, more than one facilitator was assigned for each site visit so that they can coordinate with site lecturers about the lecture theme and prerequisite information for the students, which aimed to enhance the quality of overall site visits.

In addition, students are required to deepen the knowledge by pre-lecture by the course instructors as well as submit reports after each field trip so as to increase their understanding of effective practice in disaster management.

Furthermore, although we could not carry out all the planned site visits due to the COVID-19, we have implemented some alternative opportunities such as online lectures or guidance by field office personell or site visits to neighbouring river basin with ICHARM staffs guidance.

Table 2-2 List of courses

| Category | Course No. | Course Title | Instructor | Term | Credit | |
|---|---|---|---|---|---|---|
| I Required Courses | DMP4800E | Individual Study | | Winter through Summer | 10 | 10 |
| II Recommended Courses | DMP2000E | Disaster Management Policies A: from Regional and Infrastructure Aspect | IEDA Hitoshi | Fall | 2 | |
| | DMP2010E | Disaster Management Policies B: from Urban and Community Aspect | SUGAHARA Masaru | Fall | 2 | |
| | DMP2800E | Hydrology | MIYAMOTO Mamoru, KOIKE Toshio | Fall through Winter | 2 | |
| | DMP2810E | Hydraulics | HARADA Daisuke, EGASHIRA Shinji | Fall through Winter | 2 | |
| | DMP2820E | Basic Concepts of Integrated Flood Risk Management (IFRM) | TAKEUCHI Kuniyoshi | Fall through Winter | 2 | 16 |
| | DMP2870E | Urban Flood Management and Flood Hazard Mapping | TANAKA Shigenobu | Fall through Winter | 2 | |
| | DMP3810E | Flood Hydraulics and River Channel Design | FUKUOKA Shoji | Fall through Winter | 2 | |
| | DMP3820E | Mechanics of Sediment Transportation and Channel Changes | EGASHIRA Shinji | Fall through Winter | 2 | |
| | DMP3840E | Control Measures for Landslide & Debris Flow | OHNO Hiroyuki | Fall through Winter | 2 | |
| | DMP2900E | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management | OHARA Miho | Fall through Winter | 2 | |
| III Elective Courses | DMP1800E | Computer Programming | USHIYAMA Tomoki, HARADA Daisuke | Fall through Winter | 1 | |
| | DMP2890E | Practice on Flood Forecasting and Inundation Analysis | SAYAMA Takahiro, GUSYEV Maksym | Fall through Winter | 1 | |
| | DMP3802E | Practice on GIS and Remote Sensing Technique | RASMY Mohamed, KWAK Youngjoo | Fall through Winter | 1 | |
| | DMP3900E | Site Visit of Water-related Disaster Management Practice in Japan | KOIKE Toshio | Fall through Summer | 1 | |
| | DMP3910E | Practice on Open Channel Hydraulics | YOROZUYA Atsuhiro | Fall through Spring | 1 | |
| | | * Selected Topics in Policy Studies I -IV | | | | 30 |

Table 2-3 List of Lecturers (positions as of that time)

| Lecturer | Affiliation | Lecture |
|---|---|---|
| **University** | | |
| Prof. SUGAHARA Masaru<br>菅原　賢 | GRIPS | Disaster Management Policies B: from Urban and Building Aspect |
| Prof. IEDA Hitoshi<br>家田　仁 | GRIPS | Disaster Management Policies A: from Regional and Infrastructure Aspect |
| Assoc.Prof.SAYAMA Takahiro<br>佐山　敬洋 | Kyoto University | Practice on Flood Forecasting and Inundation Analysis |
| Prof. TANAKA Shigenobu<br>田中　茂信 | Kyoto University | Urban Flood Management and Flood Hazard Mapping |
| Prof. SUGAI Toshihiko<br>須貝　俊彦 | University of Tokyo | Urban Flood Management and Flood Hazard Mapping |
| Prof. FUKUOKA Shoji<br>福岡　捷二 | Chuo University | Flood Hydraulics and Sediment Transport |
| Prof. SUMI Tetsuya<br>角　哲也 | Kyoto University | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management |
| Prof. OSANAI Nobutomo<br>小山内　信智 | GRIPS | Control Measures for Landslide & Debris Flow |
| Assoc. Prof. UCHIDA Taro<br>内田　太郎 | Tsukuba University | Control Measures for Landslide & Debris Flow |
| Assoc. Prof. KODAKA Akira<br>小高　暁 | Keio University | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management |
| Assoc. Prof. MIKAMI Takahiro<br>三上　貴仁 | Tokyo City University | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management |
| Project. Prof. KAWASAKI Akiyuki<br>川崎　昭如 | University of Tokyo | Practice on GIS and Remote Sensing Technique |
| Prof. TAKEUCHI Kuniyoshi<br>竹内　邦良 | Yamanashi University | Basic Concepts of IFRM |
| **National Research and Development Agency** | | |
| Prof. HAYASHI Haruo<br>林　春男 | National Research Institute for Earth Science and Disaster Resilience | Urban Flood Management and Flood Hazard Mapping |
| **Private sectors, and others** | | |
| Mr. WATANABE Masayuki<br>渡辺　正幸 | International Institute for Social Development and Cooperation | Basic Concepts of IFRM |
| Mr. IMBE Masahiro<br>忌部　正博 | Association for Rainwater Storage and Infiltration Technology | Urban Flood Management and Flood Hazard Mapping |
| Prof. OHNO Hiroyuki<br>大野　宏之 | Japan Sabo Association | Control Measures for Landslide & Debris Flow |
| Mr. TAKESHI Toshiya | Sabo & &Landslide | Control Measures for Landslide & |

| | | |
|---|---|---|
| 武士　俊也 | Technical Center | Debris Flow |
| Dr. SAKAMOTO Tadahiko<br>坂本　忠彦 | NIPPON KOEI CO., LTD. | Dam Special Lecture |
| Dr. YASUDA Nario<br>安田　成夫 | Japan Dam Engineering Center | Dam Special Lecture |
| **ICHARM** | | |
| Prof. KOIKE Toshio<br>小池　俊雄 | Hydrology,<br>Site Visit of Water-related Disaster Management Practice in Japan,<br>Master's Thesis | |
| Prof. EGASHIRA Shinji<br>江頭　進治 | Mechanics of Sediment Transportation and Channel Change, Hydraulics,<br>Master's Thesis | |
| Mr. FUKAMI Kazuhiko<br>深見　和彦 | Urban Flood Management and Flood Hazard Mapping | |
| Assoc. Prof. OHARA Miho<br>大原　美保 | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management<br>Master's Thesis | |
| Assoc. Prof. YOROZUYA Atsuhiro<br>萬矢　敦啓 | Practice on GIS and Remote Sensing Technique<br>Practice on Open Channel Hydraulics<br>Master's Thesis | |
| Assoc. Prof. Abdul Wahid Mohamed RASMY | Computer Programming,<br>Practice on Flood Forecasting and Inundation Analysis,<br>Practice on GIS and Remote Sensing Technique<br>Master's Thesis | |
| Assoc. Prof USHIYAMA Tomoki<br>牛山　朋來 | Computer Programming,<br>Master's Thesis | |
| Dr. UMINO Hitoshi<br>海野　仁 | Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management | |
| Dr. Kwak Young Joo<br>郭　栄珠 | Practice on GIS and Remote Sensing Technique | |
| Assoc. Prof. HARADA Daisuke<br>原田　大輔 | Computer Programming,<br>Hydraulics,<br>Master's Thesis | |
| Assoc. Prof. MIYAMOTO Mamoru<br>宮本　守 | Hydrology,<br>Master's Thesis | |
| Dr. Maksym Gusyev | Practice on Flood Forecasting and Inundation Analysis | |
| Mr. MOCHIZUKI Takafumi<br>望月　貴文 | Practice on Flood Forecasting and Inundation Analysis | |
| Dr. KAKINUMA Daiki<br>柿沼　太貴 | Practice on Flood Forecasting and Inundation Analysis | |

Table 2-4 List of field trip sites

| Date | Destination | Content | Cooperating office |
|---|---|---|---|
| March 19th (Fri) | Geospatial Information Authority of Japan | Disaster prevention activities, Utilization of GEONET, etc. | Geospatial Information Authority of Japan, MLIT |
| March 24th (Wed) | The Metropolitan Outer Area Underground Discharge Channel | Urban flood control measures | Guided by ICHARM staffs |
| | Sekiyado-jo Museum | History and Culture formed by Tone-river and Edo-river | Guided by ICHARM staffs |
| March 25th (Thu) | Watarase Flood plain | The largest flood plain located in the lower Watarase river basin | Guided by ICHARM staffs |
| | Kathleen park, Minuma Motoiri (Intake gate) park | A park developed on the site of the Tone River embankment break mouth and a park with a water intake for agricultural use | Guided by ICHARM staffs |
| March 26th (Fri) | The roadside/riverside station "Sawara" | Local disaster management station | Guided by ICHARM staffs |
| | Inoh Tadataka Museum | About the first person to create an actual map of Japan | Guided by ICHARM staffs |
| April 21st (Wed) | Shinanogawa-Karyu (Shinano River Downstream) River Office | Outline of flood disasters and past disasters in the Shinano River Basin (torrential rain in July 2011, torrential rain in July 2004, etc.) | Shinanogawa-Karyu (Shinano River Downstream) River Office, Hokuriku Regional Development Bureau, MLIT |
| | Ohkouzu Diversion Channel | Ohkouzu Museum, Ohkouzu Movable Weir, Mouth of the diversion channel (Nitoko-Mieru reference center) | Shinano River Office, Hokuriku Regional Development Bureau, MLIT |
| April 22nd (Thu) | Sagurigawa Dam | Structure of rockfill dams, Roles of Sagurigawa Dam in flood control | Sagurigawa Dam Control Office, Hokuriku Regional Development Bureau, MLIT |
| April 23rd (Fri) | Yamba Dam | Tone River Dam Integrated Management Office and role of Yamba Dam | Tone River Dam Integrated Management Office, Kanto Regional Development Bureau, MLIT |

### 2.2.4 Studying and Living Environment

As is usual in universities, classes were 90 minutes each. Table 2-5 shows the daily timetable. The students stayed at JICA Tsukuba (Kouyadai, Tsukuba, Ibaraki) and commuted to ICHARM for classes on a JICA bus.

Table 2-5 Daily timetable

| | |
|---|---|
| 1st period | 9:00–10:30 |
| 2nd period | 10:45–12:15 |
| 3rd period | 13:15–14:45 |
| 4th period | 15:00–16:30 |

This year, during the period when students were unable to come to Japan due to the spread of COVID-19, all the students were required to submit a Daily Report, in which they were asked to write down their communication status and key words and comments on each lecture, etc., in order to maintain motivation. For those students who came to Japan, as was the case last year, class chores were managed by the "*Nicchoku*" system, in which students took turns being a *nicchoku*, or a person in charge of class chores for the day. The *nicchoku* person performed chores such as taking attendance, cleaning whiteboards after classes, making sure doors and windows are locked and lights are turned off, and writing a simple report on the day's activities on a "Nicchoku Sheet" (one page of A4 sized paper). In the second half of the course from April to September, which mainly consisted of individual study, students took turns on a weekly basis, checking attendance and producing a weekly summary report.

## 2.3 Master's Thesis

As mentioned above, this master's program is designed to develop the students' problem-solving capabilities and encourage their independent learning instead of the faculty always leading the way for them. In accordance with this objective, the students are required, for their master's thesis, to study themes related to problems they have identified in their countries. They are expected to become trained professionals with the ability to create comprehensive plans for the reduction of damage from water-related disasters and contribute to solving problems in their home countries when they return there.

Therefore, immediately after the course started, the "Inception Report" presentation was held, in which the students explained water-related problems in their countries, presented information concerning possible study areas for their master's theses, and described tasks required for the implementation of disaster management projects. ICHARM researchers also introduced their research to the students so that it would be easier for both sides to find a right match for supervision. Once each student found a supervisor from ICHARM researchers, they started discussing themes for master's theses and then began working on the theme even before they had completed lectures and exercises in the first half of the program. The deadline for submitting master's theses was late August, and the submission was followed by a thesis review meeting by the faculty at GRIPS to determine whether the students should be awarded a master's degree.

## Chapter 3: 2020-2021 Activity Report

JICA Closing Ceremony Group photo (September 14, 2021, at ICHARM auditorium)

(See the attachment for more photos. The position titles are effective as of the date when each photo was taken.)

ICHARM implemented the Water-related Disaster Management Course of Disaster Management Policy Program (named as a JICA training “FLOOD DISASTER RISK REDUCTION”) over a period of around one year from October 1, 2020, to September 15, 2021, as a joint program with the Japan International Cooperation Agency (JICA) and the National Graduate Institute for Policy Studies (GRIPS).

The goal of this course is to improve participants’ capability to practically manage problems related to water-related disasters at a local level and to eventually contribute to socioeconomic or environmental improvement at a national level.

The course has several specific features. Students can earn a master’s degree in one year. The training is oriented toward problem solving in order to improve the students’ ability to propose solutions to actual problems in their home countries. The course focuses on practice rather than theory.

There were seven students this year from six countries: two from Bhutan and one each from Bangladesh, Malaysia, Mauritus, Myanmar, and Tonga. This year, under the pandemic, although the arrival of students was delayed and one student from Tonga was not able to come to Japan, all the seven students passed the examination and obtained a master's degree in disaster prevention policy.

On October 1, 2020, the opening ceremony was held at ICHARM auditorium and online. While students participated online from respective countries, it was held with the attendance of officials from ICHARM (Training & Research Advisor EGASHIRA Shinji, Deputy Director MATSUKI Hirotada, Chief Researcher FUJIKANE Masakazu, Chief Researcher KOBAYASHI Hajime), GRIPS (Professor SUGAHARA Masaru) and JICA Tsukuba (Director General WATANABE Takeshi, Officer NEMOTO

Otome, Training Coordinator SAKUMA Naoko). Following welcome speeches by respective attendee, Ms. AHMED Farzana of Bangladesh spoke in return on behalf of the students.

On October 5, the entrance guidance was held online by GRIPS.

The first half of this one-year course consisted mainly of lectures and exercises related to water-related disasters, and in the second half, students spent most of the time working on their individual studies. Although the pandemic limited the number of sites to visit, field trips were conducted as appropriate in order for the students to learn from actual cases of Japan's flood countermeasures on site while ensuring that infection control measures were in place.

The instructors for this course included not only researchers of ICHARM but also those of universities in Japan involved in leading-edge research in various fields of study related to water-related disasters. As the lectures were held in the COVID-19 pandemic this year, lectures were given online by external lecturers who do not live in the suburbs of Tsukuba City.

<Lectures/Exercises (October to December)> (Positions as of that time)

The students started to take the lecture courses online from their own countries. During the first two weeks, they studied independently using e-learning materials, including introductory materials used in ICHARM's West Africa project and video clips of the final thesis presentations of the students who graduated in September.

After that, Prof. KOIKE Toshio of ICHARM conducted a class, "Hydrology," from October to November, teaching basin-wide water circulation/hydrological processes, field observations/remote sensing, and water resources management. Lectures on soil moisture and groundwater was given by Assoc. Prof. MIYAMOTO Mamoru of ICHARM.

At the same time, Prof. EGASHIRA Shinji of ICHARM lectured about the basic hydraulic concepts on his "Hydraulics" class, where the students learned the basis of hydraulics, which is another essential subject for this course. Prof. EGASHIRA also lectured on the basic principles of flood flow and sediment transport in his class entitled "Mechanics of Sediment Transportation and River Changes."

In the two weeks from November 20 to December 4, intensive lectures, "Disaster Management Policies A: from Regional and Infrastructure Aspect" and "Disaster Management Policies B: from Urban and Community Aspect," were delivered mainly by Prof. IEDA Hitoshi of GRIPS and Prof. SUGAHARA Masaru of GRIPS.

Lectures included the "Basic Concepts of Integrated Flood Risk Management (IFRM)" to provide indispensable knowledge on flood disaster management and global warming for master's course students. Prof. TAKEUCHI Kuniyoshi of the University of Yamanashi, and Mr. WATANABE Masayuki, the president of the Institute for International Social Development & Cooperation, were lecturers for this subject.

As lectures shifted to more practical ones, "Urban Flood Management and Flood Hazard Mapping" was provided. Prof. TANAKA Shigenobu of Kyoto University and Director of Research Planning FUKAMI Kazuhiko of PWRI lectured on disaster management in Japan, including Japanese disaster prevention systems, river information systems, and evacuation.

In addition to the lectures, the students started several types of hands-on training instructed by ICHARM researchers.

In the "Practice on Flood Forecasting and Inundation Analysis" exercise, the students were provided with lectures and exercises on the following topics: the Rainfall-Runoff-Inundation model (RRI

model) by Assoc. Prof. SAYAMA Takahiro of Kyoto University and Assoc. Prof. Mohamed Rasmy of ICHARM, the Integrated Flood Analysis System (IFAS) by Senior Researcher MOCHIZUKI Takafumi and Research Specialist KAKINUMA Daiki of ICHARM, and the BTOP model by Research Specialist Maksym Gusyev of ICHARM.

In the “Computer Programming” exercises, Assoc. Prof. USHIYAMA Tomoki, Assoc. Prof. Mohamed RASMY and Assoc. Prof. HARADA Daisuke, all from ICHARM, provided instructions on numerical solutions using FORTRAN.

<Lectures/Exercises (January to May)> (positions as of that time)

A series of lectures on the latest trends and technologies in erosion control were delivered in “Control Measures for Landslide & Debris Flow” by the following lecturers: Prof. OHNO Hiroyuki, the director of the Sabo and Landslide Technical Center, Assoc. Prof. UCHIDA Taro of Tsukuba University, Prof. OSANAI Nobutomo of GRIPS, and Dr. TAKESHI Toshiya, a manager of the Sabo and Landslide Technical Center.

In the “Practice on GIS and Remote Sensing Technique” exercise, lectures and training were delivered by the following lectures respectively; on GIS, by Project Prof. KAWASAKI Akiyuki of University of Tokyo and on remote sensing, Assoc. Prof. Mohamed RASMY and Assoc. Prof. YOROZUYA Atsuhiro, both from ICHARM.

Furthermore, Prof. HAYASHI Haruo of the National Research Institute for Earth Science and Disaster Resilience provided a lecture on disaster psychology, and Prof. SUGAI Toshihiko of the University of Tokyo gave a lecture on geomorphology, an important topic for understanding flood-prone areas.

In “Socio-economic and Environmental Aspects of Flood Management” Assoc. Prof. OHARA Miho of ICHARM, Assoc. Prof. KODAKA Akira of Keio University, Assoc. Prof. MIKAMI Takahito of Tokyo City University, and Prof. SUMI Tetsuya of Kyoto University delivered lectures on the impacts of dams and river ecosystems on the river environment.

In March, Prof. FUKUOKA Shoji of Chuo University gave lectures on “Flood Hydraulics and River Channel Design.”

On April 5, the students visited a hydraulic experiment facility of the Tsukuba Research Center of Pacific Consultants Co., Ltd. in Sakutani, Tsukuba City, to learn the basics of hydraulics under the guidance of Assoc. Prof. YOROZUYA Atsuhiro. The students conducted hydraulic experiments in groups.

On April 19, special lectures on dams were provided by Dr. SAKAMOTO Tadahiko, who was once the president of PWRI, and Dr. YASUDA Nario of the Japan Dam Engineering Center in order for the students to deepen the knowledge of dams prior to visit the Shinano River basin.

The visit to the middle reach of the Shinano River was conducted on April 20 to 23. On April 22, acoustic Doppler current profilers (aDcp), a type of flow observation equipment, were introduced to the students. They performed exercises on discharge observation in groups using the float observation method and a radio current meter in the Shinano River near the Shinanogawa Riverside Park, located in Ojiya City, Niigata Prefecture, under the guidance of Assoc. Prof. YOROZUYA Atsuhiro, and Research Specialist KAKINUMA Daiki, both from ICHARM. Although it was the first discharge observation for many of the students, each group showed a keen interest in the exercise.

<Field trips and exercises>

With the support of local offices of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and local governments, field trips were planned to visit various flood control facilities in Japan in the hope that the students would find clues to solve problems caused by water-related disasters in their countries.

This year, due to the outbreak of COVID-19, although not all the planned field visits were able to be conducted, students were able to receive online lectures and explanations from some river office personnel.

On March 12, a lecture on comprehensive flood control measures in an urban river basin (Tsurumi River basin) was delivered online by Executive Director IMBE Masahiro of the Association for Rainwater Storage and Infiltration Technology. Since the area along the Tsurumi River was rapidly urbanized after the Second World War, it would be useful for the students to learn about the flood measures implemented there in planning flood control measures in major Asian cities as their populations are still increasing.

On March 16, with the cooperation of tthe Tokushima River and Road Office of the Shikoku Regional Development Bureau, MLIT, a lecture on flood prevention methods was given online byTAKASAKI Shinzo, Shikoku disaster prevention expert.

On March 18, the students learned about an overview of the meteorological services and methods of forecasting through the lecture given by a personel of the Japan Meteorological Agency (JMA). They were informed that JMA, MLIT, and prefectural governments work closely together to forecast river floods.

On March 19, they visited the Geospatial Information Authority of Japan (GSI) and learned about disaster prevention activities and GEONET.

From March 24 to 26, day-trip study tour was conducted with a chartered bus. The students visited various sites alongside the Tone River basin under the guidance of Assoc. Prof. HARADA Daisuke.

On March 24, they visited an overwhelmingly huge underground structure called the Metropolitan Area Outer Underground Discharge Channel, which is also nicknamed “a temple in the underground.” They then visited the Sekijuku Castle Museum in Noda City, Chiba Prefecture. They learnt about the history and culture uniquely formed at the site on a super embankment by the Tone and Edo Rivers.

On March 25, the students visited the Watarase Flood Plain, which spans Tochigi, Gunma, Saitama and Ibaraki prefectures, to learn about the largest flood plain in Japan, which was created to precipitate and render harmless the mineral poison caused by the Ashio Mine Poisoning Incident. After that, they visited Kathleen Park, which was built on the site of a break in the Tone River embankment after the Typhoon Kathleen in 1947, and Minuma Motoiri Park, where an inlet for agricultural water was built.

On March 26, the group visited Sawara City, Chiba and toured the Roadside Station "Mizu-no-sato Sawara", which is also a river disaster prevention station approved by the MLIT and a center for disseminating a variety of information on disasters and tourism. In the afternoon, they visited the Ino Tadataka Memorial Museum in the same city to learn about Ino Tadataka, who surveyed and walked all over Japan after the age of 50 and created the first map of Japan.

From April 21 to 23, the students visited the midstream area of the Shinano River in Niigata prefecture and the Tone River in Gunma prefecture. They not only conducted discharge observation exercises but also learned various water management measures through the lectures given by the officers of Hokuriku Regional Development Bureau and Kanto Regional Development Bereau of MLIT.

On April 21, they visited the Shinanogawa-Karyu River Office of MLIT in Niigata City, Niigata, where they were given an overview of flood control measures by officials from the Shinanogawa-Karyu River Office of MLIT. The team then travelled southwards, observing coastal erosion along the coast facing Sea of Japan and visited Mt. Yahiko, where the topography of the Japan Sea coast including the mouth of the Ohkouzu Diversion Channel can be seen. They received a lecture on the characteristics of Echigo Plain and the topography of the land facing the Japan sea by officials from the Shinanogawa-Karyu River Office of MLIT. After that, they visited the Shinano River Ohkouzu Museum, where they learnt about the history and the role of Ohkouzu Diversion Channel. Then they moved to the Museum of Ohkouzu Diversion Channel (Nietoko Mieru Kan) and were lectured about the current rehabilitation project of the Ohkouzu Diversion Channel to excavate the mountainous areas to widen the river. They also inspected the embankments' low and leaking areas from the JR Echigo Line bridge over the Shinano River.

On April 22, they participated in discharge observation in the Shinano River near the Shinanogawa Riverside Park in Ojiya City with a guidance provided by ICHARM Sinior Reseracher MOCHIZUKI Takafumi. After that, they moved to the Sagurigawa Dam, where they observed the dam body after receiving a lecture on the history and structure of a rockfill dam.

On April 23, the students first visited the Mt. Asama North Foothills Visitor Centre in Naganohara-machi, Gunma, where they were briefed on the history of the Mt. Asama eruption. They then visited the Kamahara Kannon Hall, which has an anecdote that, during the 1783 Mt. Asama eruption, only those who noticed the mudslide and climbed the stairs to the Kannon Hall were able to evacuate and survive. The group then moved to the banks of the Agatsuma River, where they looked at topographical and geological maps and discussed the processes of rainfall and sediment run-off. In the afternoon, they visited the Yamba Dam Management Branch Office and received a lecture from its deputy director on the role of the Tone River Dam Integrated Management Office and the Yamba Dam. After that, they visited the top and the lower parts of the Yamba Dam embankment and observed the structure of the dam up close.

Due to the spread of the COVID-19, the site visits scheduled for September 1 to 4 were cancelled, but the students received online explanations from the Yamanashi Prefectural Erosion Control Division on September 2 regarding the Ashiasu weir, and from the Numazu Office of River and National Highways, MLIT, on September 3 regarding the Fuji Coastal Conservation Project. Each of them utilized videos, some of which filmed by a drone, to show the site and project so that it can be as informative as actual site visit.

<Master's thesis>

In principle, each student selected a theme for their master's thesis while considering what research can contribute to solving issues regarding water-related disasters in their country. ICHARM researchers also provided individual consultation for them in this decision-making process, respecting their decisions. The process started on October 19 with the presentation of inception reports by each student. After the presentation, the students and the researchers tried to match the research interest of each student and the expertise of each ICHARM researcher in order for the students to conduct research under appropriate supervision. Through several discussions with the researchers, the students narrowed down their research themes.

For three days from January 5 to 7, lecturers from the GLM Institute were invited to conduct a session on "Project Cycle Management." This subject aimed to teach students to illustrate a problem in a tree structure, analyze it, identify measures to be taken, and develop a roadmap for their implementation. This is a very useful exercise as it helps students objectively analyze problems faced by each student's home country and to determine the direction of their thesis research.

A total of four interim thesis presentations were scheduled throughout the course: the first on March 2, followed by the three ensuing on April 20, May 31, and July 2. These interim presentations not only provided the students with opportunities to receive advice from ICHARM researchers but also allowed them to see their fellow students' progress, which motivated them to work harder on their own. At the final presentation on August 5, the sub-supervisors of GRIPS, such as Prof. SUGAHARA Masaru, Prof. HIBINO Naohiko, Prof. OSANAI Nobutomo, also joined and commented on each student's achievement.

<Graduation and other events>

The closing ceremony was held at JICA Tsukuba on September 14. During the ceremony, JICA Tsukuba Deputy Director WATANABE, GRIPS Prof. SUGAHARA (participated oline) and ICHARM Executive Director KOIKE made congratulatory remarks, after which JICA awarded the students with their program completion certificates. The Best Research Award, an award established jointly by GRIPS and PWRI for students who wrote a quality master's thesis, was given to KOWLESSER Akshay Prakash of Mauritius. Then, the ICHARM Sontoku Award, an award for students selected through mutual voting among the students for their outstanding contribution to fellow students and this course, was presented to Jamyang Zangpo of Bhutan by Executive Director KOIKE. Representing the students, Norain binti Osman of Malaysia shared a few words of thanks to conclude the ceremony.

Due to the COVID-19 outbreak, the graduation ceremony was held online on September 15, while the group photo in graduation gowns was taken at GRIPS prior to the event. Each of all the seven students received a diploma (M.S. in disaster management). Holding their diplomas in the other hand—the fruit of their year's study—each student was showing great satisfaction on their faces.

## Chapter 4: Master's Thesis

As noted above, Table 4-1 shows the main schedule relating to the master's theses this year.

Table 4-1 Schedule relating to master's thesis

| | | |
|---|---|---|
| 2020 | 19th , October | Presentation on Inception Report |
| 2021 | 5th -7th, January | Project Cycle Management exercise |
| | 2nd, March | 1st Interim Presentation |
| | 20th, April | 2nd Interim Presentation |
| | 31st, May | 3rd Interim Presentation |
| | 2nd, July | 4th Interim Presentation |
| | 5th, August | Final Presentation |
| | 17th, August | Submission to GRIPS |

As this is a one-year master's course, students selected their thesis themes from October to November, immediately after arriving in Japan and while attending lectures and exercises. In principle, each student was assigned to an appropriate ICHARM teaching faculty member after ample time was taken to consider the various research areas of each ICHARM researcher. A student and a supervisor were matched carefully. First, ICHARM researchers were divided into groups by area of research, and then the students were assigned to one of the groups according to their research interests. Then, a supervisor was selected for each student after thorough discussions.

There were four interim presentations in which students presented their own research in order to receive advice from ICHARM faculty and other students. Each presentation meeting was also a good opportunity for them to see the progress of other students and then keep a good level of motivation for their work. Another aim was to improve the presentation skills of the students by giving them several opportunities to speak in front of other people. This method was very effective and well-received by students.

The students worked on their master's theses with the assistance of an English proofreader who intensively checked English in the master's theses and finally submitted their master's theses to their supervisors and assistant supervisors on August 17. After their papers were evaluated, all the seven students were successfully awarded a master's degree in disaster management.

Table 4-2 lists the names of the students with the titles of their master's theses. Note that the synopsis of each thesis was collected in a separate report by GRIPS.

Working on their master's theses allows students not only to increase their knowledge but to build a closer relationship with ICHARM staff, which is an important first step to ensure smooth communication channels between the agencies to which students belong and ICHARM. Such channels will be reciprocally beneficial in conducting research and projects, such as sharing research data with each other. Establishing this sort of international network through students will be a great asset for future ICHARM initiatives.

Table 4-2 List of master's theses

| .No. | Name (Call Name) | Thesis Title |
|---|---|---|
| 1 | Ms.AHMED Farzana<br>アハメッド ファルザナ | A STUDY ON THE MORPHOLOGICAL CHARACTERISTICS OF DAWKI-PIYAN RIVER SYSTEM IN BANGLADESH |
| 2 | Mr.Nedrup Tshewang<br>ニードロップ テュワン | ASSESSMENT OF INTEGRATED WATER RESOURCES MANAGEMENT UNDER CLIMATE CHANGE IN WANGCHU BASIN, BHUTAN |
| 3 | Mr.Jamyang Zangpo<br>ジャムヤン ザンポ | IMPACT ASSESSMENT ON EXTREME FLOODS DUE TO CLIMATE AND SOCIAL CHANGES IN THE AMOCHU BASIN, BHUTAN |
| 4 | Ms.Norain binti Osman<br>ノーレイン ビンティ オスマン | FLOOD DAMAGE INSPECTION METHOD FOR PUBLIC BUILDING IN MALAYSIA |
| 5 | Mr.KOWLESSER Akshay Prakash<br>カウレッサ アクシェイ プラカッシュ | A STUDY ON AN INTEGRATED WATER RESOURCES MANAGEMENT PLAN UNDER CLIMATE CHANGE FOR GRAND RIVER NORTH WEST RIVER BASIN, MAURITIUS |
| 6 | Ms.Aye Mon Khaing<br>イー モン カン | METHOD FOR PREDICTING THE SEDIMENT RUNOFF PROCESS DUE TO HEAVY RAINFALL IN THE YAZAGYO RESERVOIR BASIN, MYANMAR |
| 7 | Mr.Tevita Aho<br>テヴィタ アホ | IMPACT OF CLIMATE CHANGE, SEA-LEVEL RISE IN TONGATAPU, HA'APAI AND ITS EFFECT ON LIVELIHOOD |

## Chapter 5: Course Evaluation and Issues for Future Improvement

### 5.1 Course Evaluation

In order to identify points for improvement, this section analyzes the results of questionnaires on "Course Design," which deals with the course period and design, and "Course Contents," which asks about lectures and exercises.

For "Course Design," we analyzed the results from the questionnaire survey given to the students during the JICA Evaluation Session on the final day of the course. For the "Course Contents," we analyzed the results from the questionnaire survey conducted from time to time by ICHARM.

#### 5.1.1 Course Design

This year was the 14th year for the course, which began in 2007. Since the second year, a questionnaire with the same questions has been given to students every year; therefore, it is possible to see the changes in students' evaluation on this course over the past thirteen years, from the second year to the 14th. Although various questions were asked in the questionnaire, the analysis focused on the following six questions:

1. Do you find the design of the program appropriate for you (your organization) to achieve the Program Objective?
2. Was the quality of lectures good enough for you to understand clearly?
3. Were you satisfied with the textbooks and materials used in the program?
4. Do you find the period of the program appropriate?
5. Do you find the number of participants in the program appropriate?
6. Do you think the knowledge and experience you have acquired through the program in Japan are useful?

Tables 5-1 to 6 and Figure 5-1 to 6 in the following pages show the evaluation results with breakdowns on the above six items in the past thirteen years.

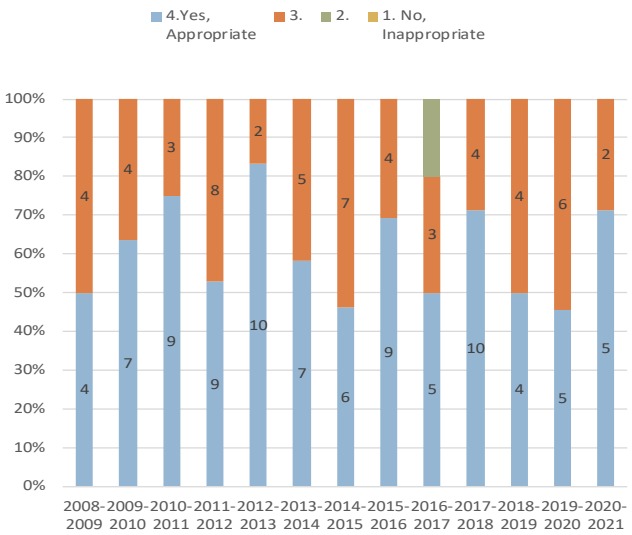
**1. あなたもしくは所属組織が案件目標を達成する上で、プログラムのデザインは適切であると思いますか。**

**Do you find the design of the program appropriate for you (your organization) to achieve the Program Objective?**

表5−1 Table 5−1

| | 4.Yes, Appropriate | 3. | 2. | 1. No, Inappropriate |
|---|---|---|---|---|
| 2008−2009 | 4 | 4 | 0 | 0 |
| 2009−2010 | 7 | 4 | 0 | 0 |
| 2010−2011 | 9 | 3 | 0 | 0 |
| 2011−2012 | 9 | 8 | 0 | 0 |
| 2012−2013 | 10 | 2 | 0 | 0 |
| 2013−2014 | 7 | 5 | 0 | 0 |
| 2014−2015 | 6 | 7 | 0 | 0 |
| 2015−2016 | 9 | 4 | 0 | 0 |
| 2016−2017 | 5 | 3 | 2 | 0 |
| 2017−2018 | 10 | 4 | 0 | 0 |
| 2018−2019 | 4 | 4 | 0 | 0 |
| 2019−2020 | 5 | 6 | 0 | 0 |
| **2020−2021** | **5** | **2** | **0** | **0** |

図5−1Figure 5−1



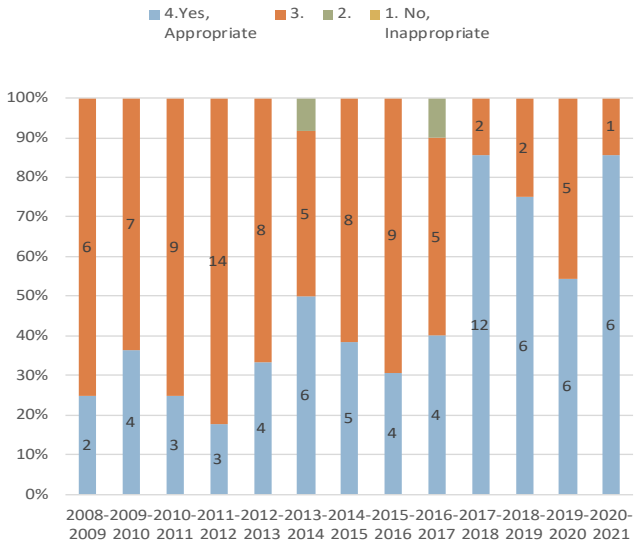

**2. 講義の質は高く、理解しやすかったですか。**

**Was the quality of lectures good enough for you to understand clearly?**

表5−2 Table 5−2

| | 4.Yes, Appropriate | 3. | 2. | 1. No, Inappropriate |
|---|---|---|---|---|
| 2008−2009 | 2 | 6 | 0 | 0 |
| 2009−2010 | 4 | 7 | 0 | 0 |
| 2010−2011 | 3 | 9 | 0 | 0 |
| 2011−2012 | 3 | 14 | 0 | 0 |
| 2012−2013 | 4 | 8 | 0 | 0 |
| 2013−2014 | 6 | 5 | 1 | 0 |
| 2014−2015 | 5 | 8 | 0 | 0 |
| 2015−2016 | 4 | 9 | 0 | 0 |
| 2016−2017 | 4 | 5 | 1 | 0 |
| 2017−2018 | 12 | 2 | 0 | 0 |
| 2018−2019 | 6 | 2 | 0 | 0 |
| 2019−2020 | 6 | 5 | 0 | 0 |
| **2020−2021** | **6** | **1** | **0** | **0** |

図5−2Figure 5−2



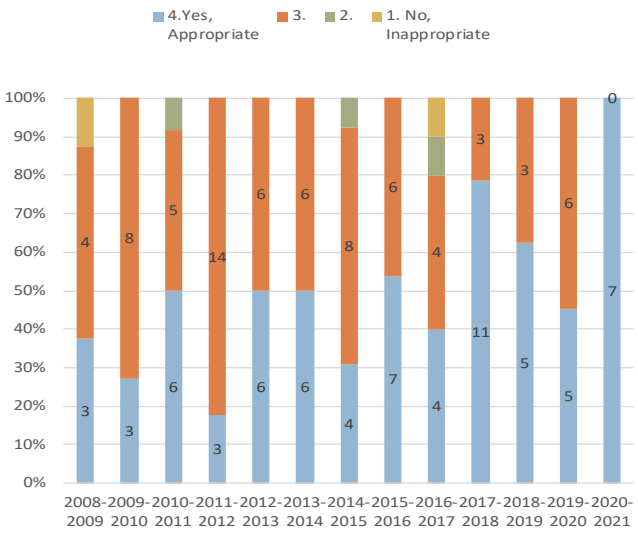
**3. テキストや研修教材は満足するものでしたか。**

**Were you satisfied with the textbooks and materials used in the program?**

表5−3 Table 5−3

| | 4.Yes, Appropriate | 3. | 2. | 1. No, Inappropriate |
|---|---|---|---|---|
| 2008−2009 | 3 | 4 | 0 | 1 |
| 2009−2010 | 3 | 8 | 0 | 0 |
| 2010−2011 | 6 | 5 | 1 | 0 |
| 2011−2012 | 3 | 14 | 0 | 0 |
| 2012−2013 | 6 | 6 | 0 | 0 |
| 2013−2014 | 6 | 6 | 0 | 0 |
| 2014−2015 | 4 | 8 | 1 | 0 |
| 2015−2016 | 7 | 6 | 0 | 0 |
| 2016−2017 | 4 | 4 | 1 | 1 |
| 2017−2018 | 11 | 3 | 0 | 0 |
| 2018−2019 | 5 | 3 | 0 | 0 |
| 2019−2020 | 5 | 6 | 0 | 0 |
| **2020−2021** | **7** | **0** | **0** | **0** |

図5−3Figure 5−3



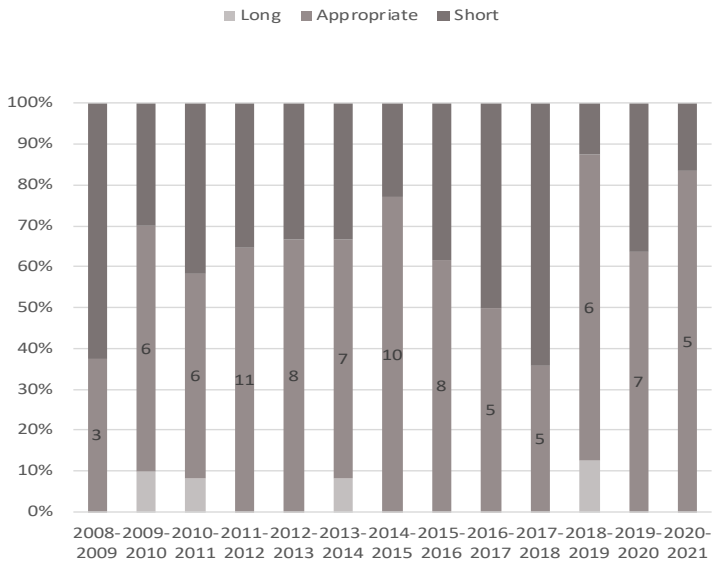

**4. 研修期間は適切でしたか。**

**Do you find the period of the program appropriate?**

表5−4 Table 5−4

| | Long | Appropriate | Short |
|---|---|---|---|
| 2008−2009 | 0 | 3 | 5 |
| 2009−2010 | 1 | 6 | 3 |
| 2010−2011 | 1 | 6 | 5 |
| 2011−2012 | 0 | 11 | 6 |
| 2012−2013 | 0 | 8 | 4 |
| 2013−2014 | 1 | 7 | 4 |
| 2014−2015 | 0 | 10 | 3 |
| 2015−2016 | 0 | 8 | 5 |
| 2016−2017 | 0 | 5 | 5 |
| 2017−2018 | 0 | 5 | 9 |
| 2018−2019 | 1 | 6 | 1 |
| 2019−2020 | **0** | **7** | **4** |
| **2020−2021** | **0** | **5** | **1** |

図5−4Figure 5−4




＊2020−2021 one perticipant: No answer

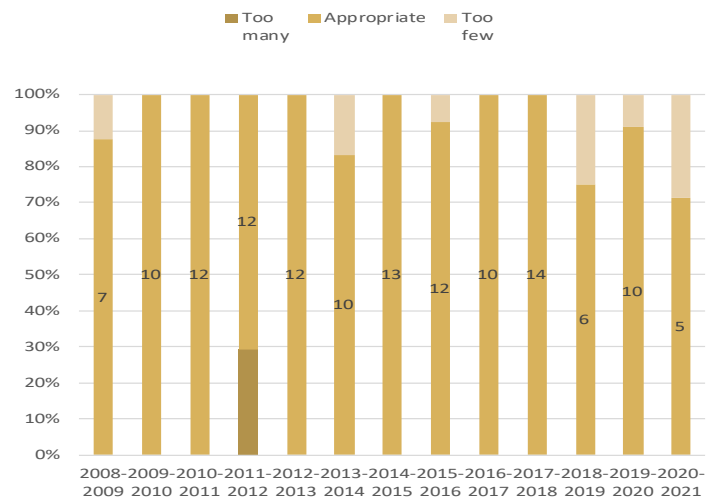
**5. 本研修の参加者人数は適切と思いますか。**

**Do you find the number of participants in the program appropriate?**

表5−5 Table 5−5

| | Too many | Appropriate | Too few |
|---|---|---|---|
| 2008−2009 | 0 | 7 | 1 |
| 2009−2010 | 0 | 10 | 0 |
| 2010−2011 | 0 | 12 | 0 |
| 2011−2012 | 5 | 12 | 0 |
| 2012−2013 | 0 | 12 | 0 |
| 2013−2014 | 0 | 10 | 2 |
| 2014−2015 | 0 | 13 | 0 |
| 2015−2016 | 0 | 12 | 1 |
| 2016−2017 | 0 | 10 | 0 |
| 2017−2018 | 0 | 14 | 0 |
| 2018−2019 | 0 | 6 | 2 |
| 2019−2020 | 0 | 10 | 1 |
| 2020−2021 | 0 | 5 | 2 |

図5−5Figure 5−5




**6. 本邦研修で得た日本の知識・経験は役立つと思いますか？**

**Do you think the knowledge and experience you acquired through the program in Japan?**

表5−6 Table 5−6

| | A. Yes, it can be directly applied to work | B. It cannnot be directly applied, but it can be adaptable to work | C. It cannnot be directly applied or adapted, but it can be of reference to me. | D. No, it was not useful at all |
|---|---|---|---|---|
| 2008−2009 | 2 | 6 | 0 | 0 |
| 2009−2010 | 3 | 5 | 2 | 0 |
| 2010−2011 | 3 | 9 | 0 | 0 |
| 2011−2012 | 8 | 9 | 0 | 0 |
| 2012−2013 | 6 | 5 | 1 | 0 |
| 2013−2014 | 4 | 8 | 0 | 0 |
| 2014−2015 | 3 | 10 | 0 | 0 |
| 2015−2016 | 8 | 5 | 0 | 0 |
| 2016−2017 | 8 | 2 | 0 | 0 |
| 2017−2018 | 10 | 4 | 0 | 0 |
| 2018−2019 | 6 | 2 | 0 | 0 |
| 2019−2020 | 5 | 6 | 0 | 0 |
| 2020−2021 | 6 | 1 | 0 | 0 |

図5−6Figure 5−6

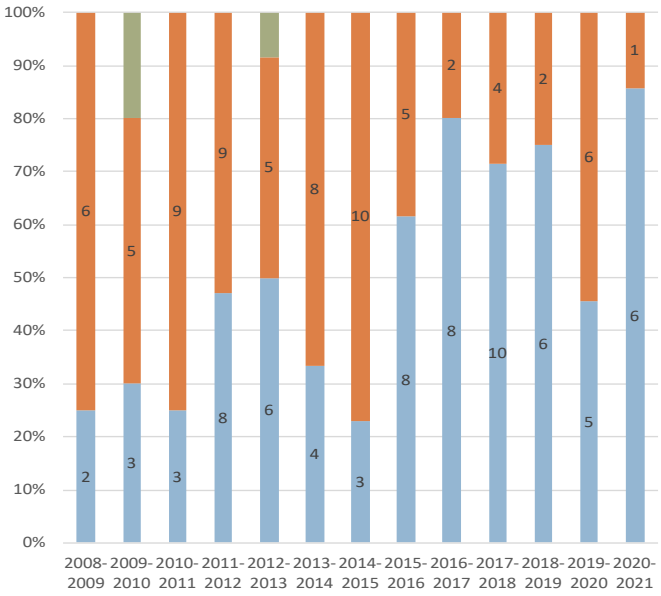


Table 5-1 and Figure 5-1 show the students' response to Question No. 1. All the students gave a positive answer to the question. We have been improving the program year by year, including this year with the different circumstances, by scheduling lectures, study tours, and other events in a more efficient way and providing more effective supervision for students in writing a graduation thesis.

Table 5-2 and Figure 5-2 show the students' responses to Question No. 2. The students are mostly satisfied with the quality of lectures they attended in this program.

Table 5-3 and Figure 5-3 show the students' responses to Question No. 3. Their satisfaction level on the textbooks and other materials is very high. In this course, we ask each lecturer every year to create a textbook that is easy for students to understand, and we believe that the high evaluation in recent years is the result of the efforts of each lecturer.

Table 5-4 and Figure 5-4 show the students' responses to Question No. 4. This year, as in the precvious years, more students answered that the length of the course was "Appropriate," while one answered "Short" (and one did not answer). Since this master's course declares that students can complete the program in one year, we do not think that extending the period of the program should be a solution to this response of the students. Instead, we continue focusing our effort on sorting out the content so that students can learn efficiently and effectively within a single year.

Table 5-5 and Figure 5-5 show the students' responses to Question No. 5. Most students rated the number of participants as "Appropriate," even though we had the least number of students this year. We assume that this is the result of the studnets cooperating with each other in a homely atmosphere, even in a restricted environment.

Table 5-6 and Figure 5-6 show the students' responses to Question No. 6. This question is particularly important for this master's course whose design concept emphasizes the practicality of the training. All the students in this academic year answered that what they learned through this course will be applied to their work directly or indirectly. In writing a graduation thesis, students select their own theme related to problems in disaster management of their home countries. They will continue working on such issues after return to their countries, and the program assisted them in developing the essential capacity to do so from a professional viewpoint.

Overall, the master's course received a better-than-average evaluation in its thirteen-year history. We are pleased with these results that are derived from improvements we have made over the years, despite this year's course delivered during the pandemic.

### 5.1.2 Course Contents

A questionnaire survey was conducted by ICHARM in March, when most of the lectures scheduled were completed, and the students answered a series of questions anonymously.

The questionnaire asked open-ended questions to obtain feedback from them, and the comments considered especially important were categorized and summarized in Table 5-7.

Table 5-7 Feedback from students

Ql. Structure of the course curriculum (Schedule, Lecture to add, etc.)

・This course curriculum is well structured covering good number of relevant courses. (3)

・The structure of the course curriculum was quite intensive in the months of December, January and February with full day lectures and assignment deadlines. The schedule itself due to the time difference was quite tedious to deal with in the beginning but overall the recorded lectures were a true blessing to refer back to the main points at any time especially for the GIS and modelling courses.

(Improvement point)

・The exams should be at the first period (9:00) so that the students can be with a fresh mind.

・More disaster management rather than current 6:4 (water theory: disaster management)

Q2. Lecture (If you have any request or comment, fill out for each lecture.)

1. Disaster Management Policies A: from Regional and Infrastructure Aspect (Ieda)

・IEDA Sensei's lectures were very much interesting and I enjoyed a lot. I highly appreciate His teaching technique. (and 5 more positive comments)

・We taught sensei's lecture from online, it is better for us if we had a chance to teach sensei's lecture in class room.

2. Disaster Management Policies B: from Urban and Community Aspect (Sugahara)

・As Prof. IEDA, Prof SUGAHARA also had shared his great experienced in how Japan handling disaster management. The best that we should learn. I appreciated so much. (and 5 more positive comments)

・It is better for us if we had a chance to teach sensei's lecture in class room.

・The course contents were too many.

3. Hydrology (Miyamoto, Koike)

・Koike sensei's lectures were very much enjoyable. Miyamoto Sensei is also a very good.

・This subject we have considered one of the basic components of our master's program. Infact, the subject was comprehensive and to the point where we understood the concept of

the Hydrology. The overall concept given by the senior most prof. was really amazing and applicable to our field works also beside the individual thesis. Have no more comments. (and 4 more positive comments)

4. Hydraulics (Harada, Egashira)

- Hydraulics was my favorite subject. Egashira Sensei's lectures were very much conceptual but a bit difficult. I found Harada Sensei's lectures easily understandable. Both of them are very caring to the students.
- The Syllabus is a must as this is the basic theory that we should know and understand when we facing with water related disaster. (and 4 more positive comments)

5. Basic Concepts of Integrated Flood Risk Management (IFRM) (Takeuchi, Watanabe)

- This course was very helpful to understand the model of the DMP, how it originated and at the moment the place where we reached. From UN to SFM, IFRM, at RISK model and Japanese experiences. Infact, the senior most Prof. was kind enough to guide us in others fields also beside his time constraints.
- Takeuchi sensei is such a gentleman and a very knowledgeable professor and the courses were extremely engaging and waking up at 4 am for his courses was not hard at all. (and 4 more positive comments)

6. Urban Flood Management and Flood Hazard Mapping (Tanaka)

- I appreciate for sensei's support and kindness. I studied urban flood management and flood hazard mapping integrated various legend. These lectures are very effective and can be used in my country.
- As a component to integrated and comprehensive flood management, urban flood management and flood hazard maps are indispensable. We were thoroughly introduced to various techniques of flood frequency analysis, policies and acts of flood hazard mapping. I found the lectures adequate. (and more positive comments)
- This was for me the hardest course to follow especially the part on Mathematica.

7. Flood Hydraulics and River Channel Design (Fukuoka)

- This course was very interesting to me. Fukuoka Sensei was very friendly to students.
- The best ever experienced is learning from the most experienced and old timer lecture. I will not forget the moment in class as he was giving his full effort and energy to teach us. His fatherly way gave me a comfort and at the same time make me easy to understand the topics that I have left behind for quite some time. Despite of his old age, his energy gave me power to love everything that I learned. A very good exposure. (and 4 more positive comments)

8. Mechanics of Sediment Transportation and Channel Changes (Egashira)

- This course was very unique to me as it was simultaneously interesting and difficult. Egashira Sensei's lectures were highly conceptual and he was able to make students concentrate in the class.
- In fact, the subject was bit tough for me with regards to sediments. It was hard for me to understand given very poor in math. However, over all concept given by the senior most prof. was really amazing and applicable to our field works also beside the individual thesis. (and 3 more positive comments)

### 9. Control Measures for Landslide & Debris Flow (Ohno, Uchida, Takeshi, Osanai)

- The subject was very practical. In fact we learned many practical things with regard to the control measures for landslide and debris flow which can be applicable in our country.
- I appreciate for sensei's support and kindness. Thank you so much for opportunities of learning of landslide and debris flow. These lectures are very effective and can be used in my country and for my thesis. Thank you so much sensei for teaching us so many explanations. (and 2 more positive comments)

### 10. Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management (Ohara, Sumi, Mikami, Umino, Kodaka)

- Subject was important for End to End Approaches for the project works. It will be helpful to me especially for the impact assessment.
- Comprehensive lectures on ways to consider the socio-economic and environmental aspects of different flood management components were delivered. The class lectures and assignments were also adequately arranged.
- One of the best syllabus and a great experienced from them as it is very related to my work. They had done their very best to teach and shared their experienced and I am so much delighted to leaned from them. Everything that they shared is based on their own experienced and that is the treasured as for me, experienced teach us the best way to perform although it may not be going to settle every problem, at least it could help to easy some of it. (and more positive comments)

### 11. Computer Programming (Ushiyama, Harada, Rasmy)

- Computer programming (FORTRAN) is a very useful tool but it demands continued practice and analyzing power to effectively and efficiently make things easy. Even though I find it difficult to apply at present for different possible analyses, I look forward to progressing deeper to understand better.
- I am blessed with this subject as it was being left untouched since graduated, but with the sensei helps, I can recall on how to use the programming. Teaching method with plenty of interesting example is a much help also.

・Hard in the beginning but quite bulky syllabus for a 1 credit course.

12. Practice on Flood Forecasting and Inundation Analysis(Sayama, Rasmy, Gusyev, Kakinuma)

・It gave us the basic knowledge about the model which is used for Flood Forecasting and inundation analysis and also hydrological modeling calibration concept.

・While dealing with the models and software is important, I think that including a lecture or two on ingestion of real-time meteorological data into the models to produce a real-time flood forecasting system would be additional knowledge.

・Very interesting course. (and more positive comments)

13. Practice on GIS and Remote Sensing Technique (Rasmy, Kawasaki, Yorozuya)

・GIS and remote sensing techniques have a wide range of use. Therefore, the course was well designed and helpful. I don't find a need to include additional lectures.

・All professors were very competent to give us the clear knowledge about GIS. In fact it is important tool useful for our thesis as well as our daily job.

・Tools that were taught very applicable for Work. (and more positive comments)

14. Site Visit of Water-related Disaster Management Practice in Japan (Koike)

・This component we found it very important as the whatever we learned in theory can be verified during the site visit and get more important aspect with regards to the Japanese experience, knowledge, attitude and the skill.

・Practical experience always compliments theoretical knowledge, I learned a lot already by visiting the different flood control measures in the Tone river basin and Shinano river basin. The field visits taught a great lesson that humanity should always strive without giving up easily, only then we can come up with various solutions and issues can be solved.

・This site visit is a must. Without it, theory alone could not have showed us how it going to be about. Despite of the pandemic, I am so much appreciated the effort that the management has given in choosing the location of Site Visit. It is the place where we could see the reality that is going on and how we can use the theory and technical to blend with it. The people at site who has dedicated their time and experienced is also priceless. This site visit can be an eye opener to the student (especially the government officer) who never had the experience in their working life handling things like the one who experienced. And this might be a good learning session where they can bring back to their own country and implement the same/partially method of solving problem.

・Unfortunately missed due to COVID-19 restrictions. (and more positive comments)

15. Practice on Open Channel Hydraulics (Yorozuya)

・Very interesting and useful for better understanding of hydraulics. The experiments helps us to clarify the theoretical aspects.

・The practical sessions were conducted successfully in both lab and in the field (Shinano River). It was very interesting and gained the practical knowledge for measurement of Discharge in the field.

・Unfortunately missed due to COVID-19 restrictions. (and more positive comments)

<Overall>

・I would like to comment to all of the lecture from 1-15. All of that lecture is brilliant, impressive and outstanding. I have learned a lot from every each of paper but I would like to say thank to ICHAM and JICA for this opportunity that giving to me for one of the participants.

・I would like to say, more than 90% of 1-15 lecture if new to myself compared to what I am doing on my current work and my past academic. Therefore, I would like to say thank you to all my Sensei for your warm, accessible, enthusiastic and caring and the help that done for me. Not only benefit and enhance for me what I learnt from this lecture but also to my home country.

Q3. Daily Life in ICHAR/PWRI **or Network Condition from your country**

・I highly appreciate the facilities at ICHARM. ICHARM ensures an excellent research environment. All the Senseis and researchers are very helpful.

・The atmosphere in ICHARM is really good. We really enjoy learning with the professors who are frank enough and very supportive.

・Life at ICHARM/PWRI is great so far. The study environment is so apt with very open-minded professors, staff and senpais. Except for the COVID-19 situation in Japan as a whole, the rest is all so good that I cannot demand anything more than this.

・The courses ran for the most part very smoothly even with the distance learning. The whole staff including Miyazaki san, Mikiko san and now Sato san do everything to make sure that we do not miss a thing.

・Network is good but poor sometime.

Q4. Individual Study

・We are having very limited period for individual study due to COVID situation. We are worried

about the final outcomes of the individual study.

- My individual study is on right track with the guidance of Senseis. However, feeling worried it may not complete in time.
- This is the toughest part of the whole course here at ICHARM since I have to produce something worthy and useful for my country back at home. But things are made a lot easier by the constant guidance of the supervisors. The progress of the study is slow but it is progressing.
- The individual study can be however an isolating process when you are not at ICHARM. But the support from the students and Senseis have helped a lot to make it easier.

Q5. Other request to ICHARM or JICA
(Including the COVID-19 Situation)

- Is it possible to prepare a separate corner in the multipurpose room of ICHARM for female participants.
- I had some personal problem may be due to my ill luck. I was in Depression/Anxiety where I lost appetite, loss concentration in studies and loss of weight. However, with the support from the JICA Health personal I am under medications and gaining my strength and I am trying my best. I would like to thank JICA and ICHARM for considering my weakness and taking care.
- The management of course by ICHARM and JICA has been so far exceptional and we have successfully broken the chain of COVID-19 spread in TBIC. I don't have any additional request but I would rather thank both parties and the government of Japan for continued care and support.
- Personally, I would like JICA to really select students who are deserve to be part of the program in ICHARM. To any other country, they should really be selecting people base on his/her criteria especially in how he/she be able to speak or to understand English (Slowly speaking is ok, but understand is for me the most important), what is his/her Working Experienced, is he/she really related to Water Disaster (because this is ICHARM Specialty) and could he/she carry him/herself without family in any circumstances (this should play with psychology). I am worried with some of students in JICA that doesn't have the capability to study and dependable everything to others for help in doing assignment and others. If he/she is behaving like that throughout the program, I think that behavior is not appropriate and giving others problem (as everyone is also having their own personal problem too). I know it is humanity work and we should be helping and protecting each other but in terms of study, it should be a personal effort and there should be a limit.

・I don’t have request to ICHARM or JICA. Everything is ok for me. There are strict rules regarding COVID-19.

5.1.3 Considerations in This Year

(1) Management of the training course during the COVID-19 outbreak

Due to the delay in the arrival of the students, the initial events of the training course including the opening ceremony and the inception report presentation were held online. In order for the students to take the classes online smoothly, electric blackboard was introduced, which enabled them to see the blackboard notes on screen timely. Also, e-learning materials was utilized for self-study. Lecturers from outside ICHARM were asked to deliver their classes online remotely. Furthermore, various infection control measures were taken including sanitizing the podium after every lecturer’s classes and setting up partations in the lecture room and in ICHARM auditorium. Some site visits were cancelled or conducted online. As a result, there was no cases of COVID-19 among the students and ICHARM staffs. Not only that, two out of seven students completed almost all the coursework including writing the thisis with online supervision.

(2) Improvements made this year

<Utilizing students’ data from each country which are produced in the process of thesis writing>

In the process of writing master’s thesis, students conduct various analyses using different types of data from their countries. Until last year, such data had not been accumurated in ICHARM after the thesis work was done. However, we have gained approval of all the students to utilize their data in the future research works in ICHARM.

(3) Items to consider for the next year and beyond

< Cooperation with students’ institutions >

To this end, students need close cooperation from the institutions to which they belong back in their countries. To gain this kind of cooperation requires the institutions’ understanding of this program and their commitment to the education of their staff. More efforts should be made to strengthen the commitment of the institutions to this program by improving the understanding of their managers and directors about the program’s uniqueness characterized by problem solving-oriented course and the enhancement of organizational capability of emergency response.

＜Follow-up program after returning to home countries＞

The aim of this training course is to train students to be experts capable of mobilizing the latest technology for social demands. ICHARM hopes that students, after the training, will become able to convince other people of the importance of disaster management in developing plans for their country. However, since it takes time for them to become able to do so, follow-up efforts

are essential even after they return to their countries. So far, ICHARM is trying to maintin the network through distributing the ICHARM Newsletters several times a year and disseminating timely information of the ongoing training program through utilizing the facebook account managed by the training team. Not only that, ICHARM tries to gather information of the graduates' activities after returning to their home country by asking them to write an article for the Newsletter. We believe that further activities should be considered to keep in touch with graduates.

## Chapter 6: Conclusion

At ICHARM, training is regarded as one of the three pillar activities along with research and information networking.

Now that the 14th year of the course has been successfully completed, ICHARM has accumulated more know-how on the planning and management of training programs. By assisting students in working on their master's theses, we have also contributed to solving water-related problems in the corresponding countries. These efforts have given momentum to "localism," one of the keywords for ICHARM activities.

This course also makes a considerable contribution to effective information networking. That is to say, connections with the students' home organizations have been becoming stronger each year, and this has improved our understanding of local situations in many respects. This worldwide information networking through students will definitely be helpful for ICHARM to conduct other activities, and we need a system allowing us to keep close contact with the students even after they have graduated.

When some of what the students have learned during this yearlong master's course is of use in their work, that means that through them, ICHARM contributes to reducing water-related disaster damage in their home countries. Through the implementation of this course, we expect to make a steady contribution to the mitigation of damage due to water-related disasters in the world.

- Acknowledgment -

This course has now completed its 14th year. Over the last 14 years, we have revised the overall schedule and curriculum based on experiences and worked to enhance both the educational content and environment for students. There is, however, still room left for more improvement, and we would appreciate any opinions and suggestions from a diverse range of individuals.

Finally, we would also like to express our gratitude to instructors and administration officials who devoted themselves to providing lectures and exercises for this course, and to the MLIT offices, local government officials, and local residents that kindly accepted our requests on the field trips.

Class Name: Hydrology
Course Number: DMP2800E
Course instructor(Full Name): Toshio Koike, Mamoru Miyamoto
Academic Year: April 2020 - March 2021
Term: Fall through Winter

1. Course Description:
   Water is a key which makes a bridge between the socio benefit areas including agriculture and forestry, health, energy and human settlement and the geophysical and bio-geochemical water cycle processes in atmosphere, land and oceans. To establish a physical basis on water cycle, this course aims to introduce important roles of water in climatological and meteorological processes and the basic concepts of hydrology including understanding, observing and modeling of hydrologic processes. Remote sensing and statistic and stochastic approaches are introduced as advanced facets of hydrology.

2. Course Outline :

   (1) Water Cycle and Climate System
   1) Hydrology, creating environmental diversity in the world
   2) Water Cycle as a part of the climate system

   (2) Hydrological Processes; Observation and Modeling
   1) Atmosphere-Land Interaction
   2) Soil Moisture
   3) Snow Hydrology
   4) Remote sensing of hydrology
   5) Data assimilation of water cycle among atmosphere, land, and biosphere
   6) Surface Flow
   7) Stream Flow
   8) Ground Water
   9) Runoff Modeling
   10)River Basin Hydrological Processes

   (3) Water Resources Planning and Management
   1) Statistical Hydrology
   2) River Planning
   3) Climate Change Adaptation

3. Grading :
   Active participation(25%), Short Test(25%), Final Examination(50%)

4. Textbooks : (4-1:Required 4-2:Others)
   4-2 Roland B.Stull: An Introduction to Boundary Layer Meteorology, KLUWER ACADEMIC PUBLISHERS, 1988
   4-2 J.R.Holton and G.J.Hakim: An Introduction to Dynamic Meteorology, Academic Press, 2012
   4-2 Wilfried Brutsaert: Hydrology: An Introduction, Cambridge University Press, 2005

5. Note :

## Subject: Hydraulics

Course number：DMP2810E
Instructor：Prof. Shinji EGASHIRA, Assoc. Prof. Harada
Term / Time：Fall through Winter

1 Course Description

All flows formed in water environments such as river channels, irrigation channels, lakes and seas are subjected to conservation laws of mass, momentum and energy, and are described by means of partial differential equations. This course aims to obtain knowledge on water flows formed in river channels and flood plains, and discusses methods to evaluate such flows. Special attention are paid on open channel flow.

2 Course Outline (Course Topics)

1. Basic mathematical tools
   - Partial differential equation
   - Integral of the Partial differential equation
2. Governing equations for water flow -Conservation principles
   - Mass conservation law
   - Momentum conservation law
   - Energy conservation law
3. Open channel flows
   - Velocity profile and friction law
   - Governing equations for open channel flow
   - Water surface profile
4. Flood waves
   - Flow and wave
   - Dynamic wave, diffusive wave, kinematic wave
5. Flows over flood plains
   - Modeling of depth-integrated flows with various obstacles
6. Transportation of substances (Mass conservation equations)
   - Convective diffusion equation
   - Dispersion equation
7. Similarity principle

3 Grading

50 points for reports and short quizzes
50 points for the examination at the end of semester

4 Textbooks

4-1 Required

- Egashira, S. (2016): Hydraulics, Lecture Note

4-2 Others

**Subject: Basic Concepts of Integrated Flood Risk Management (IFRM)**

Course number：DMP2820E
Instructor: Kuniyoshi TAKEUCHI
Term / Time：Fall through Winter

1. Course Description

This course provides the basic concepts of "Integrated Flood Risk Management (IFRM)" as part of Integrated Disaster Risk Management. The formation of disaster risk will be explained in relation to natural hazard, exposure, basic vulnerability and coping capacity. The concepts of IWRM and IFRM will be introduced with the recent global challenges of sustainable development policy. As concrete examples, IWRM at basin scale, Japanese flood management experiences and some example of overseas application of the concept of IWRM will be introduced. Anticipated future direction of risk management to cope with societal and other global changes will also be touched upon.

2. Course Outline (Course Topics)

1. Introduction: There is no such thing as a natural disaster. Disaster risk, hazard, exposure, vulnerability and coping capacity.
2. PAR Model: Root causes, progression of dynamic pressure and unsafe conditions.
3. ACCESS Model: Disaster impacts on family levels.
4. UN policies (1) UN initiatives on environment and development: From Stockholm to Rio+20.
5. UN policies (2) UN initiatives on disaster reduction: From Yokohama to Sendai.
6. IWRM and IFRM (1) Concept of IWRM.
7. IWRM and IFRM (2) Guideline for IWRM at basin scale.
8. Japanese experiences (1) Overview of hydrology and water resources.
9. Japanese experiences (2) Dark post-war period.
10. Japanese experiences (3) Comprehensive flood control measures and concepts from river to basin.
11. Japanese experiences (4) Current challenges and GEJET (L1 and L2 approach).
12. Japanese experiences (5) Ground subsidence, water pollution and waste water recycling; transdisciplinary approach.
13. Application examples of IFRM overseas (by Masayuki Watanabe).
14. Future Issues of IFRM: Climate change adaptation; Aging society; Depopulation; Social capital.
15. Final Examination.

3. Grading　Active participation (30%), Reports (20%), Final Examination (50%)

4. Textbooks

4-1 Required

1. Ben Wisner, Piers Blaikie, Terry Cannon and Ian Davis, At Risk -natural hazards, people's vulnerability and disasters-(Routledge, London & NY, 2004)
2. UNESCO IWRM guidelines steering committee, IWRM Guidelines at River Basin Level: Part 1 Principles, 2-1 Part 2-1 Coordination, 2-2 Flood Management, 2-3 Irrigation Practitioners. (UNESCO, 2009)

## Subject: Urban Flood Management and Flood Hazard Mapping

Course number：DMP2870E
Instructor：Prof. Shigenobu TANAKA
Term / Time：Fall through Winter

1 Course Description

This course is specifically designed to study urban flood management. In the first stage of the course, students will learn about Japanese systems for flood risk management, such as relevant laws, river planning, flood control structures and comprehensive flood control measures for urban areas. The second stage aims to acquire knowledge required to promote early public evacuation with a flood hazard map. Students will also study flood frequency analysis, topography and psychological aspects underlying public behavior during disaster.

2 Course Outline (Course Topics)

Week

| | | |
|---|---|---|
| 1 | : Laws for flood risk management and local disaster management plan in Japan | Prof. TANAKA |
| 2 | : Flood control planning | Prof. TANAKA |
| 3 | : Flood control structure | Mr. FUKAMI |
| 4 | : Case study of comprehensive flood control measures -Tsurumi river- | Mr. IMBE |
| 5 | : Flood frequency analysis(1) | Prof. TANAKA |
| 6 | : Flood frequency analysis(2) | Prof. TANAKA |
| 7 | : Flood frequency analysis(3) | Prof. TANAKA |
| 8 | : Flood frequency analysis(4) | Prof. TANAKA |
| 9 | : Flood hazard map | Prof. TANAKA |
| 10 | : Evacuation Plan with Flood Forecast | Prof. TANAKA |
| 11 | : Emergency operation | |
| 12 | : Geomorphology around rivers and alluvial plain (1) | |
| 13 | : Geomorphology around rivers and alluvial plain (2) | |
| 14 | : Developments in social sciences on people’s reactions and responses to disasters | |
| 15 | : Examination | |

3 Grading

Final Exam (70%) , Attitude in the class(30%)

4 Textbooks

4-1 Required

"Local Disaster Management and Hazard Mapping" (2008), ICHARM

"Hydrological Frequency Analysis" (2019), Tanaka

4-2 Others

| | |
|---|---|
| Class Name: | Flood Hydraulics and River Channel Design |
| Course Number: | DMP3810E |
| Course instructor: | FUKUOKA Shoji |
| Year: | 2020 |
| Term: | Fall through Winter |

１． Course Description:

This course provides the basic knowledge necessary for planning and designing the structural measures for Integrated Flood Risk Management (IFRM). The course first describes the river administration and planning for application of IFRM. Especially the methodology of comprehensive river management will be emphasized that includes planning of flood hydraulics, flood controls, river structures and sediment movement to river channels. This will be followed by specific technologies of channel control and channel improvement.

２． Course Outline：

1. Characteristics and management of Japanese rivers (1).
2. Characteristics and management of Japanese rivers (2).
3. Hydraulic characteristics of flood flows (1)
4. Hydraulic characteristics of flood flows (2)
5. Time and apace propagation characteristics of water level and discharge in flood flows (1) .
6. Time and apace propagation characteristics of water level and discharge in flood flows (2 ) .
7. Flow resistance in rivers with compound channels.
8. Prediction method of flow resistance in compound channels.
9. Effects of channel vegetations on flood propagation.
10. Quasi-two -dimensional analysis of flood flows in rivers with vegetations.
11. Learning from natural rivers－Relationship between dimensionless width, depth versus dimensionless channel forming discharge in stable rivers
12. Channel design harmonizing the flood control and river environment (1)
13. Channel design harmonizing the flood control and river environment (2)
14. Bed form and bed variation in sandy river
15. Diversion channel ensuring less inflow of sediment discharge during floods

３． Grading：

Reports (20%), Final examination (80%)

４． Textbooks： Textbook will be distributed to students in the class.

## Subject: Mechanics of Sediment Transportation and Channel Changes

Course number：DMP 3820E
Instructor：Prof. Shinji EGASHIRA
Term / Time：Fall through Winter

1 Course Description

Sediment transportation takes place in various forms such as bed-load, suspended load, debris flow, etc. and its spatial imbalance causes river bed degradation and aggradation, side bank erosion, sand bar formation and channel shifting. Such channel changes will be suitable for ecological systems, if they are within an allowable level. However, if these are over some critical level, flood and sediment disasters will happen. This course provides methods for evaluating sediment transportation and associated channel changes with attention focused on basic principles of sediment mechanics. In addition, methods of sediment management are discussed for disaster mitigation as well as for developing a suitable channel condition.

2 Course Outline (Course Topics)

Week

1 : Introduction (1)
- Characteristics of sediment

2 : Introduction (2)
- Sediment transportation and corresponding channel changes
- Methods to evaluate channel changes

3 : Mechanics of sediment transportation (1)
- Parameters associated with sediment transportation

4 : Mechanics of sediment transportation (2)
- Critical condition for initiating bed load

5 : Mechanics of sediment transportation (3)
- Bed load formulas

6 : Mechanics of sediment transportation (4)
- Bed load formulas

7 : Mechanics of sediment transportation (5)
- Extension of bed load formula to non-uniform sediment

8 : Mechanics of sediment transportation (6)
- Suspended load

9 : Mechanics of debris flow (1)
- Constitutive equations
- Debris flow characteristics over erodible beds

10 : Mechanics of debris flow (2)
- A bed load formula derived from constitutive equations

11 : Bed forms and flow resistance (1)
- Geometric characteristics of bed forms
- Formative domain of bed forms

12 : Bed forms and flow resistance (2)
- Flow resistance

13 : Prediction of channel changes (1)
- Governing equations employed in steep areas

- Topographic change in steep areas

１４：Prediction of channel changes (2)

- Governing equations employed in alluvial reaches
- Topographic change in alluvial reaches

１５：Method to predict sediment transport process in drainage basins

-Sediment management in drainage basin

3　Grading

50 points for reports and short quizzes

50 points for the examination at the end of semester

Notice: Either a report or a short quiz is assigned every two weeks, regarding questions illustrated at the end of each chapter in Lecture Note.

4　Textbooks

4-1 Required

- Egashira, S. (2009): Mechanics of Sediment Transportation and River Changes, Lecture Note

4-2 Others

- Sturm, T. W. (2001): Open Channel hydraulics, McGraw-Hill.
- Graf, W. H. (1998): Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry, Wiley.
- Julien, P.Y. (2002): River Mechanics, Cambridge University Press
  (Website: http://www.cambridge.org/us/catalogue/catalogue.asp?isbn=9780521529709)
  (https://www.amazon.co.jp/River-Mechanics-Pierre-Y-julien/dp/0521529700)
- Gyr, A. and Hoyer, K. (2006): Sediment Transport, A Geophysical Phenomenon, Springer Netherlands
  (https://link.springer.com/book/10.1007/978-1-4020-5016-9)
- Ashida, K., Egashira, S. and Nakagawa, H. (2008), River Morphodynamics for the 21st Century, Kyoto University Press (in Japanese)

## Subject: Control Measures for Landslide & Debris Flow

Course number：DMP 3840E
Instructor：Prof. Hiroyuki OHNO
Term / Time：Fall through Winter

1 Course Description

This course provides the necessary knowledge and understanding of landslide and debris flow phenomena and their control measures necessary to exercise the IFRM. The lecture will illustrate the devastating phenomena and the causes of landslides and debris flows and provide the basic concepts of the measures for sediment-related disasters, so-called Sabo Works which is executed in the hill slopes and the channels. It will cover the important role of hazard mapping for sediment-related disasters in both structural and non-structural measures.

2 Course Outline (Course Topics)

Week

| | | |
|---|---|---|
| 1. | Outline of sediment-related disasters and Sabo projects | Prof. Ohno |
| 2. | Sediment yield, transport and deposition in a river basin (1) | Dr. Uchida |
| 3. | Sediment yield, transport and deposition in a river basin (2) | Dr. Uchida |
| 4. | Sabo planning and control of sediment transport | Dr.Uchida |
| 5. | Planning and design of Sabo facilities | Dr. Uchida |
| 6. | Restoration of vegetation on wasteland and its effects | Prof .Osanai |
| 7. | Countermeasures for natural Dams | Prof . Osanai |
| 8. | Introduction of landslides | Mr. Takeshi |
| 9. | Survey and emergency response for landslides | Mr. Takeshi |
| 10. | Permanent measures for landslide damage reduction | Mr. Takeshi |
| 11. | Warning and evacuation system for sediment-related disasters | Prof. Osanai |
| 12. | Training of hazard mapping for sediment-related disasters (1) | Dr. Uchida |
| 13. | Training of hazard mapping for sediment-related disasters (2) | Mr. Takeshi |
| 14. | Application of Sabo/landslide projects to other countries (1) | Prof.Ohno<br>Prof . Osanai |
| 15. | Application of Sabo/landslide projects to other countries (2) | Prof. Ohno<br>Prof . Osanai |

3 Grading

Class participation (30%) Report and final examination (70%)

4 Textbooks

4-1Required

4-2 Others

Class Name: Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management
Course Number: DMP2900E
Course Instructor (Full Name): Assoc. Prof. Miho OHARA
Academic Year: (2020 - 2021)
Term: Fall through Winter

1. Course Description:
   This course provides the basic understanding of socio-economic and environmental aspects of flood management. The first stage of the course aims to study how to assess socio-economic impacts of disasters and manage the identified risk. The second stage of the course introduces environmental aspects of flood management.

2. Course Outline :
   1. Introduction: Socio-economic aspects of disasters
   2. Framework of Disaster Risk Reduction
   3. Methodology for assessing socio-economic impacts (1)
   4. Methodology for assessing socio-economic impacts (2)
   5. Example of assessing socio-economic impacts
   6. Disaster information dissemination in Japan
   7. Disaster information dissemination in Asia, Guest lecturer, Dr. Mikami, Tokyo City University
   8. Disaster information dissemination in Asia, Guest lecturer, Mr. Kodaka, Keio University
   9. Effective use of information for disaster risk reduction (1)
   10. Effective use of information for disaster risk reduction (2)
   11. Environmental impacts of dams, Guest lecturer, Dr.Umino, ICHARM
   12. Environmental impacts of dams, Guest lecturer, Professor Sumi, Kyoto University
   13. Sediment management in reservoirs, Guest lecturer, Professor Sumi, Kyoto University
   14. Sediment management in reservoirs, Guest lecturer, Professor Sumi, Kyoto University
   15. Exam

3. Grading:
   50% Assignments and participation
   50% Exams and short quizzes

4. Textbooks: (4-1:Required 4-2:Others)
   Provided by the instructor

5. Note:

## Subject: Computer Programming

Course number：DMP1800E
Instructor：Assoc. Prof. Tomoki USHIYAMA
Term / Time：Fall through Winter

1 Course Description

This course provides general knowledge on Fortran90 computer programming and its skills for solving water-related problems covered in Course No. DMP2800E “Hydrology”, No. DMP2810E “Hydraulics”, No. DMP3800E, No. DMP3810E “Flood Hydraulics and Sediment Transport” and No. DMP2860E “Basic Practice on Flood Forecasting & Inundation Analysis”.

2 Course Outline (Course Topics)

Week

1 ：Introduction of Computer Programming with Fortran90
2 ：Variables, Arithmetic Calculation
3 ：Program Structure (if)
4 ：Program Structure (if)
5 ：I/O Statement
6 ：Program Structure (do loop)
7 ：Program Structure (do loop)
8 ：Arrays (vectors)
9 ：Arrays (matrix)
10 ：Procedures and Structured Programming (subroutine, function)
11 ：Exercise on arrays, procedures
12 ：Hydrologic Application Exercise (1)　Tank model
13 ：Numerical approximations in hydrological application Exercise (2)
14 ：Advanced Hydrologic modeling (RRI algorithm and structures)
15 ：Quiz

3 Grading

Quiz (50%), Reports (50%)
If a report is late for the deadline, it will be not evaluated.

4 Textbooks

Reference: Stephen J. Chapman (2007): Fortran95/2003 for Scientists and Engineers (Third Ed.), McGraw-Hill

## Subject: Practice on Flood Forecasting and Inundation Analysis

Course number：DMP2890E
Instructor：Assoc. Prof. Takahiro SAYAMA, Dr. Maksym GUSYEV
Term / Time：Fall through Winter

1 Course Description

The objective of this course is to introduce the basic technique for undertaking flood forecasting and inundation analysis in poorly-gauged basins using state-of-the-art global information and technologies. The course consists of three components: introduction of Rainfall-Runoff-Inundation (RRI) modeling, practice on Integrated Flood Analysis System (IFAS) and Block-wise use of TOPMODEL (BTOP) for runoff analysis at different scales.

2 Course Outline (Course Topics)

Week

1 ：Basics of Flood Hazard Models
2 ：Rainfall-Runoff-Inundation modeling (1) Data preparation
3 ：Rainfall-Runoff-Inundation modeling (2) Running model
4 ：Rainfall-Runoff-Inundation modeling (3) Command User Interface
5 ：Rainfall-Runoff-Inundation modeling (4) Parameter setting
6 ：Rainfall-Runoff-Inundation modeling (5) Analysis of simulation results
7 ：Rainfall-Runoff-Inundation modeling (6) Advanced model settings
8 ：Runoff analysis with IFAS (1) Basic concept
9 ：Runoff analysis with IFAS (2) Data preparation
10 ：Runoff analysis with IFAS (3) Running model
11 ：Runoff analysis with IFAS (4) Parameter setting and analysis of simulation results
12 ：Large-scale Runoff analysis with BTOP (1) Basic concept
13 ：Large-scale Runoff analysis with BTOP (2) Data preparation
14 ：Large-scale Runoff analysis with BTOP (3) Running model
15 ：Large-scale Runoff analysis with BTOP (4) Parameter setting and analysis of simulation results

3 Grading

Reports (100%)
If a report is late for the deadline, it will be not evaluated.

4 Textbooks

4-1 Required

4-2 Others

Material made by the instructors

## Subject: Practice on GIS and Remote Sensing Technique

Course number：DMP3802E
Instructor：Assoc. Prof. Abdul Wahid Mohamed RASMY, Project Prof. Akiyuki KAWASAKI
Term / Time：Fall through Winter

1 Course Description

The objective of this course is to build capacities for undertaking basic tools, which are expecting to be applied in the individual study. This course introduces the basic techniques on Geographic Information System (GIS) and Remote Sensing (RS) applications . The course consists of three components: a) hand-on practice on the GIS, b) introduction of Satellite microwave remote sensing and Satellite rainfall estimation for hydrological simulation, and c) introduction of Remote Sensing (RS) for inundation mapping.

2 Course Outline (Course Topics)

Week

1：Geographic Information System (GIS) (1) Understanding GIS data structures
2：Geographic Information System (GIS) (2) ArcGIS Data management
3：Geographic Information System (GIS) (3) ArcGIS Data processing
4：Geographic Information System (GIS) (4) ArcGIS Spatial analysis
5：Geographic Information System (GIS) (5) ArcGIS Hydrology analysis
6：Geographic Information System (GIS) (6) Working with ArcGIS and Q-GIS
7：Remote Sensing (1) Basic principles of satellite image
8：Remote Sensing (2) Preparation of satellite images from MODIS
9：Remote Sensing (3) Image analysis with ArcGIS
10：Basis of Satellite microwave remote sensing & Satellite rainfall estimation
11：Real-time Satellite rainfall observations (Global Satellite Mapping of Precipitation (GSMaP) and application of bias correction algorithm (1) case study (1)
12：Real-time Satellite rainfall observations (Global Satellite Mapping of Precipitation (GSMaP) and application of bias correction algorithm (1) case study (2)
13：Remote Sensing for Inundation Mapping (1) Application to water index
14：Remote Sensing for Inundation Mapping (2) Case study
15：Remote Sensing for Inundation Mapping (3) Group project

3 Grading

Assignments (50%( and Participation (50%)

4 Textbooks

4-1 Required

Material made by the instructors

4-2 Others

## Subject: Site Visit of Water-related Disaster Management Practice in Japan

Course number：DMP3900E
Instructor：Toshio Koike
Term / Time：Fall through Summer

1 Course Description

This course provides opportunities for students to visit actual fields to study structural countermeasure and flood control practice in Japan so that they would experience and understand the concept and ideas that can possibly be introduced to their countries. The course shall provide insight of structural countermeasures, which include but not limited to, river levees, flood retarding basins, dams, and Sabo structures. After each study-visit, students will be requested to submit a report describing the lessons they have learnt and discussion of any possibility to introduce the concept to their countries.

2 Course Outline (Course Topics)

1 ：Diversion channel
2 ：Super levee
3 ：Weir, Water gate
4 ：Disaster management station
5 ：River administration in normal time
6 ：Awareness enlightening activities for flood (Flood mark, Water level indication tower, etc.)
7 ：Retarding basin
8 ：Metropolitan area outer underground discharge channel
9 ：Integrated flood management in urbanized river
10 ：Dam
11 ：Sabo work
12 ：Traditional river works
13 ：Pumping station
14 ：Lake canal

3 Grading

Attendance (60%), Report (40%)
If a report is late for the deadline, it will be not evaluated.

4 Textbooks

4-1 Required - handouts are planned to be provided by corresponding organizations
4-2 Others

## Subject: Practice on open channel hydraulics

Course number：DMP3910E
Instructor：Associate Prof. Atsuhiro YOROZUYA
Term / Time：Fall through Winter

1 Course Description

The objective of this course is to understand the basic hydraulics with not only mathematical explanation, but also an experimental study, an field study, as well as other lecture. In this course, students will learn, through the experimental study, 1) hydraulic phenomena, such as hydraulic jump, water surface profile, and 2) usage of the experimental instrumentation. In the field study, student will learn 3) the methodology of flow discharge measurement, such as acoustic Doppler current profiler (ADCP), and non-contact current meter in actual river. In addition to that, some other lecture relating to above two topics will be provided for deep understanding.

2 Course Outline (Course Topics)

Week

1 ：Experimental study (1) about experimental study
2 ：Experimental study (2) Work at experimental facility (1)
3 ：Experimental study (3) Work at experimental facility (2)
4 ：Experimental study (4) Work at experimental facility (3)
5 ：Experimental study (5) Discussion about results
6 ：Open channel flow (1) Review of governing equations
7 ：Open channel flow (2) Simplification of momentum equation
8 ：Open channel flow (3) water surface profile (1)
9 ：Open channel flow (4) water surface profile (2)
10 ：Open channel flow (5) flow registance
11 ：Field study (1) principal of ADCP
12 ：Field study (2) principal of non-contact current meter
13 ：Field study (3) work on actual river (1)
14 ：Field study (4) work on actual river (2)
15 ：Field study (5) Discussion about results

3 Grading

Participation (100%)

4 Textbooks

Material made by the instructors

土木研究所資料
TECHNICAL NOTE of PWRI
No.4452



本資料の転載・複写の問い合わせは

国立研究開発法人土木研究所 企画部 業務課
〒305－8516 茨城県つくば市南原1－6 電話029－879－6754