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Report on 2018-2019 M.Sc. Program, "Water-related Disaster Management Course of Disaster Management Policy Program"

July 2022

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

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Report on 2018-2019 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)

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ICHARM conducted a one-year Master's program entitled the "Water-related Disaster Management Course of Disaster Management Policy Program" from 1st October 2018 to 10th September 2019 in collaboration with the Japan International Cooperation Agency (JICA) and the National Graduate Institute for Policy Studies (GRIPS). The eight 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 2019

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at Auditorium, ICHARM, PWRI.

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

Congratulatory Address
by Mr. NISHIKAWA,
President of PWRI

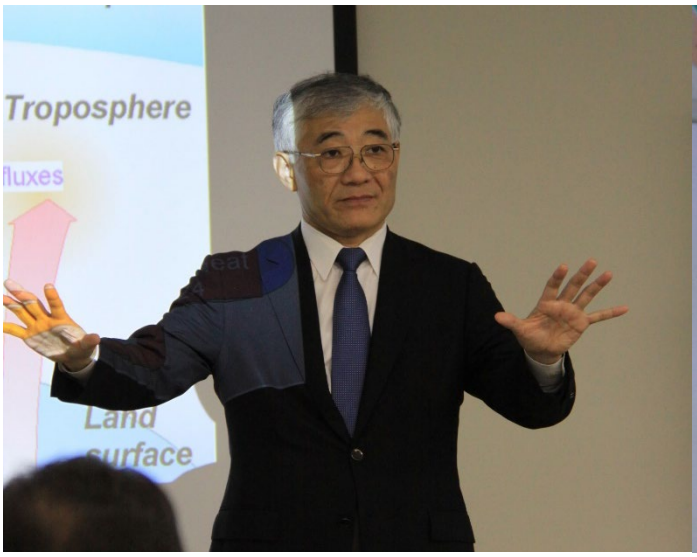
Congratulatory Address by Prof. KOIKE,
Executive Director of ICHARM

Address by participant representative,
Mr. Mohamed Zuhail

Welcome Lunch (October 10, 2018)

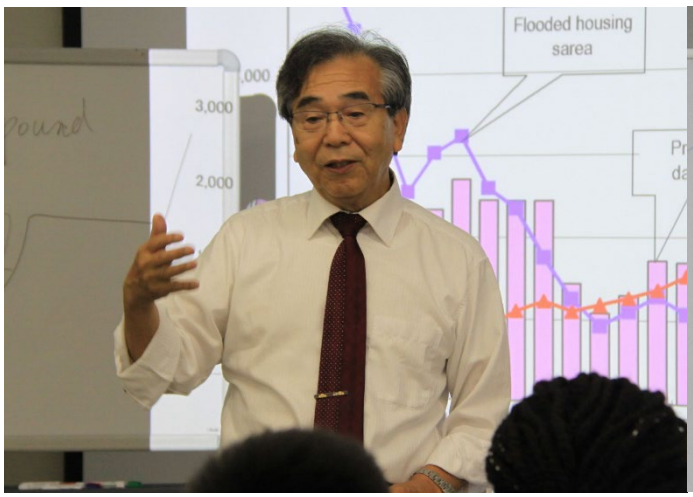
at 2nd floor of ICHARM, PWRI.

Lecturers (1)



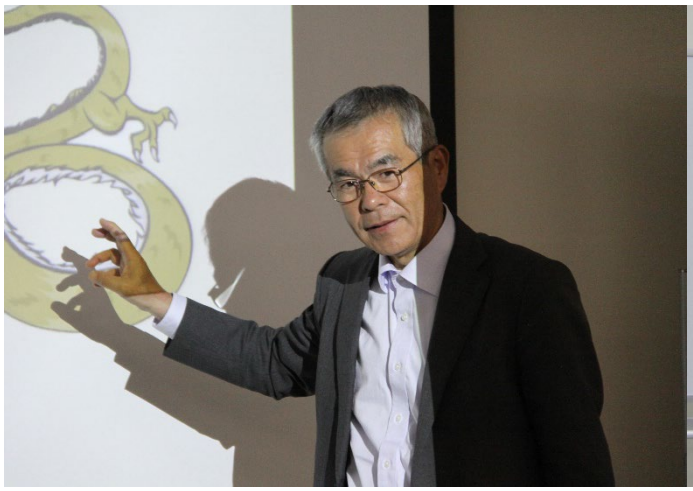
Prof. KOIKE, ICHARM

Prof. TAKEUCHI, ICHARM



Prof. FUKUOKA, Chuo University

Prof. EGASHIRA, ICHARM



Prof. TANAKA, Kyoto University

Prof. OHNO,
Sabo and Landslide Technical Center

Lecturers (2)

Assoc. Prof. OHARA, ICHARM

Assoc. Prof. YOROZUYA, ICHARM

Assoc. Prof. USHIYAMA, ICHARM

Assoc. Prof. SAYAMA, Kyoto University

Assoc. Prof. RASMY, ICHARM

Assoc. Prof. SHIBUO, ICHARM

Lecturers (3)

Prof. HAYASHI, President of National Institute for Earth Science and Disaster Resilience

Prof. SASAHARA, Kochi University

Specially Appointed Prof. OSANAI, Hokkaido University

Dr. TSUNAKI, Sabo and Landslide Technical Center

Dr. SAKAMOTO, Advisor, Nippon Koei Co., Ltd.

Dr. YASUDA, Director, Japan Dam Engineering Center

Lecturers (4)

Prof. SUMI, Kyoto University

Assoc. Prof. MIKAMI, Tokyo City University

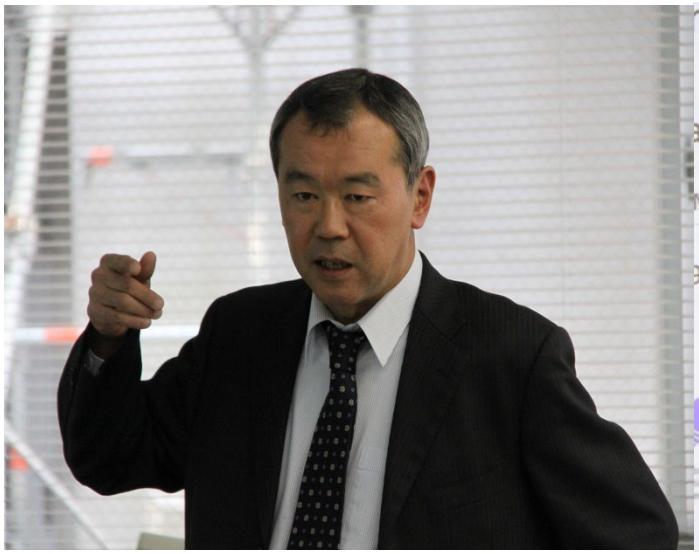
Specially Appointed Assistant Prof. KODAKA, Keio University

Prof. SUGAI, University of Tokyo

Mr. WATANABE, Representative, Institute for international, social development & cooperation

Dr. TAKANASHI, Advisor, Asia Air Survey Co., Ltd.

Lecturers (5)

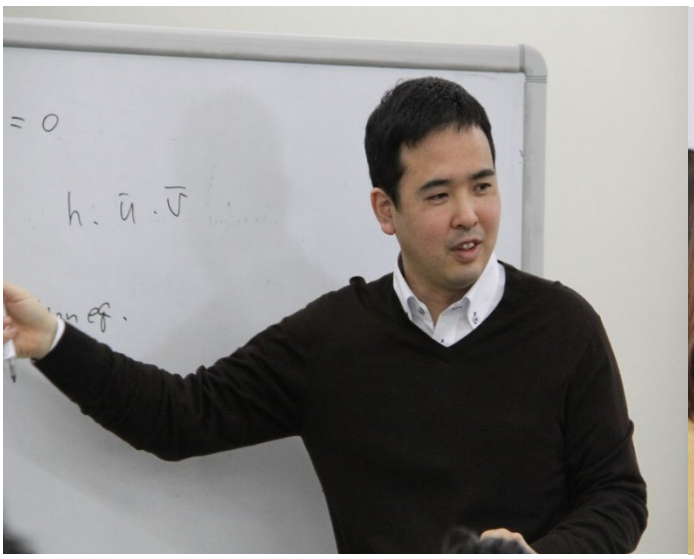


Dr. IKEDA, Chief Researcher of ICHARM

Mr. TOKUNAGA, Chief Researcher of ICHARM

Dr. Gusyev, Research Specialist of ICHARM

Dr. KWAK, Research Specialist of ICHARM



Dr. HARADA, Research Specialist of ICHARM

Mr. MOCHIZUKI, Senior Researcher of ICHARM

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Ikari Dam (October 25)

Site Visit
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Kawaji Dam (October 25)

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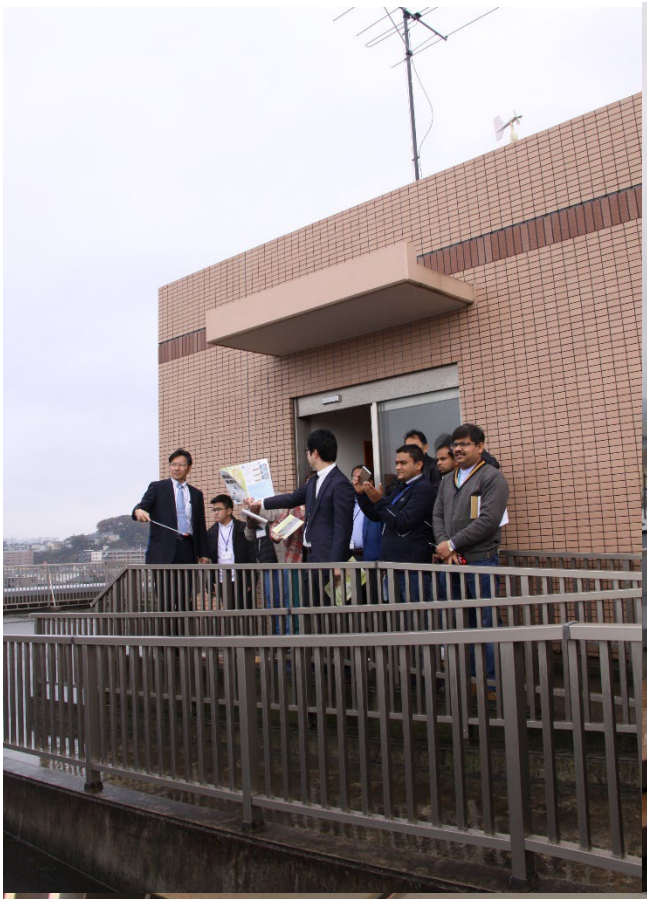

Tsurumi River Basin Center (December 5)

Site Visit
Urban River in Japan (2) (December 5, 6 and 7, 2018)

Site Visit
Urban River in Japan (3) (December 5, 6 and 7, 2018)

Hydraulic exercise held at an experiment station in Tsukuba City (December 26, 2018)

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from Mt. Godai observation platform
(February 27)

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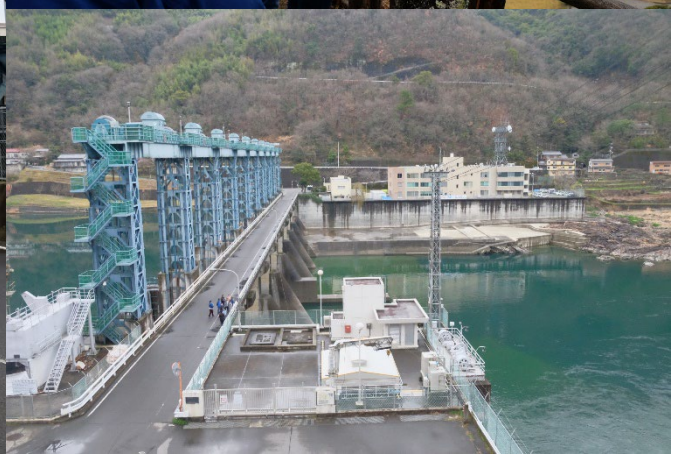


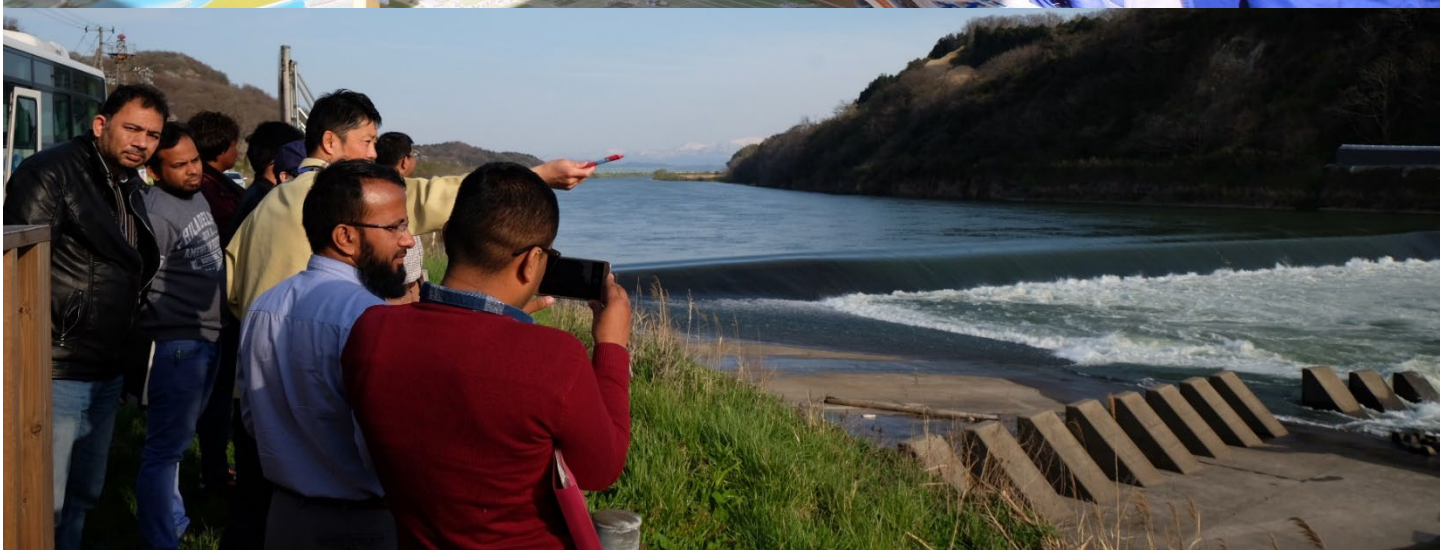
Site Visit
Shikoku Region (4) (February 26, 27, 28 and March 1, 2019)

Site Visit
Fukuoka Weir (April 3, 2019)

Site Visit
Shinano River Basin (1) (April 18 and 19, 2019)

Shinanogawa Karyu River Office (April 18)

Shinanogawa River Office (April 18)



Site Visit
Shinano River Basin (2) (April 18 and 19, 2019)

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Kinki Regional Development Bureau,
MLIT (June 25)

Misu Lock Gate,
Fushimi, Kyoto City (June 26)

Site Visit
Yodo River Basin (2) (June 25, 26, 27 and 28, 2019)

Site Visit
Yodo River Basin (3) (June 25, 26, 27 and 28, 2019)

Nanzenji Temple (June 28)

Lake Biwa Canal Museum of Kyoto (June 28)

Final Presentation (1) (August 8, 2019)

at Auditorium, ICHARM, PWRI.

A F M Tauhid JAMAN

Kale Ravindra Vitthal

Davis Cynthia Wantee

Shwe Pyi Tan

Dhaka Ram Acharya

Ali Imran

Final Presentation (2) (August 8, 2019)

at Auditorium, ICHARM, PWRI.

Christian Darwin Jacob Valencia

Mohamed Thajudeen Mohamed Zuhail

Closing Ceremony（September 10, 2019）

at JICA Tsukuba

Closing Ceremony（September 10, 2019）

at JICA Tsukuba

Graduation Ceremony at GRIPS (September 11, 2019)

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.

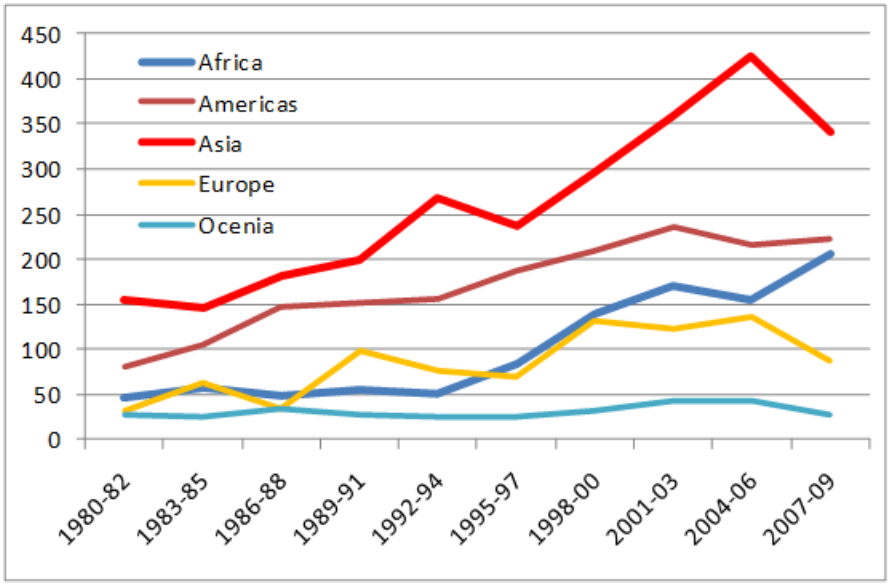


Figure 1-1 Annual variation in the number of water-related disasters by region

(Prepared by ICHARM based on CRED EM-DAT)

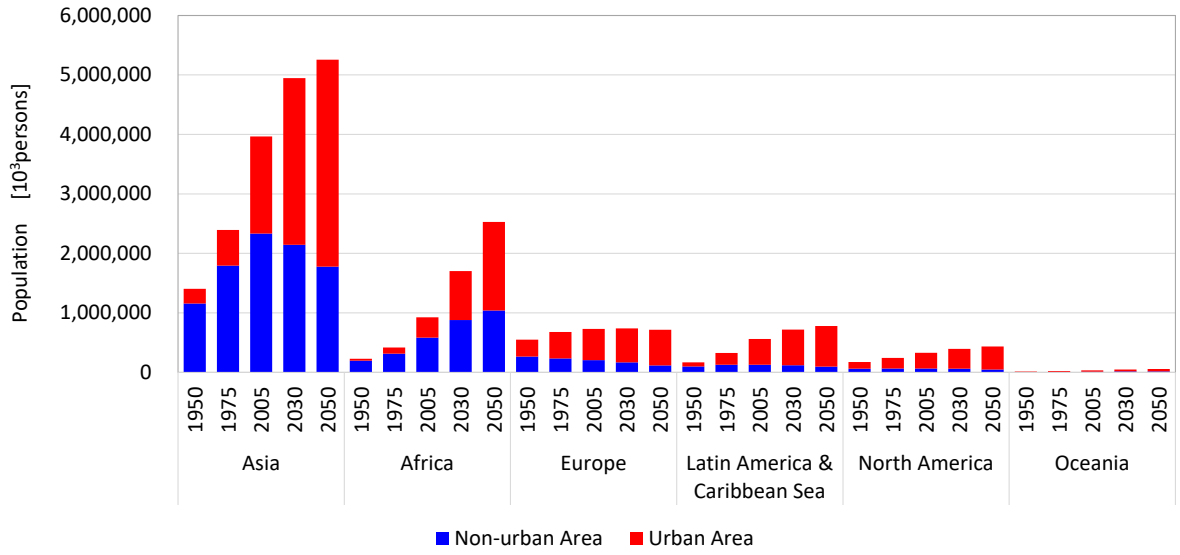


Figure 1-2 Demographic change in urban and non-urban areas by region

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

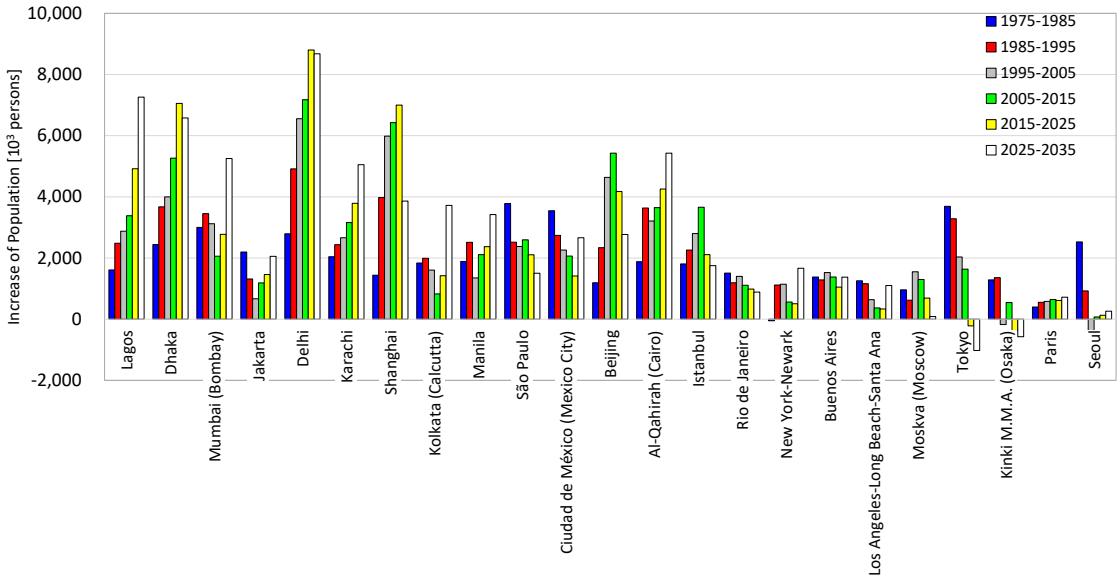


Figure 1-3 Demographic changes in major cities worldwide between 1975 and 2035

(Prepared by ICHARM based on World Urbanization Prospects:

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

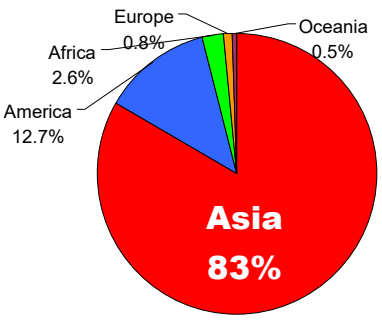


Figure 1-4
Distribution of fatalities due to water-related disasters (1980–2006)

(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 12th 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: 19 countries

Bangladesh, Bhutan, Brazil, Colombia, India, Indonesia, Liberia, Myanmar, Nepal, Pakistan, Peru, Philippines, Saint Christopher and Nevis, Serbia, Sri Lanka, Trinidad and Tobago, Tunisia, Vietnam, Zimbabwe

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:

Applicants must:

1) 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) have a working knowledge of civil engineering, especially of hydraulics and hydrology.

3) be familiar with mathematics such as differentiation and integration techniques.

4) satisfy the English language requirements with a minimum test score of TOEFL iBT 79, TOEFL PBT 500, IELTS Academic 6.0 or its equivalent.

5) 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 SUNOHARA Hiroki, a professor of the National Graduate

Institute for Policy Studies (GRIPS), was held on May 28, 2018, and made the final decision on the enrollees to the program.

After the discussion among the program committee members, a total of 8 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)	SHIBUO Yoshihiro*

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

*As of September 2019

Chapter 2: Course Content

2.1 Course Schedule

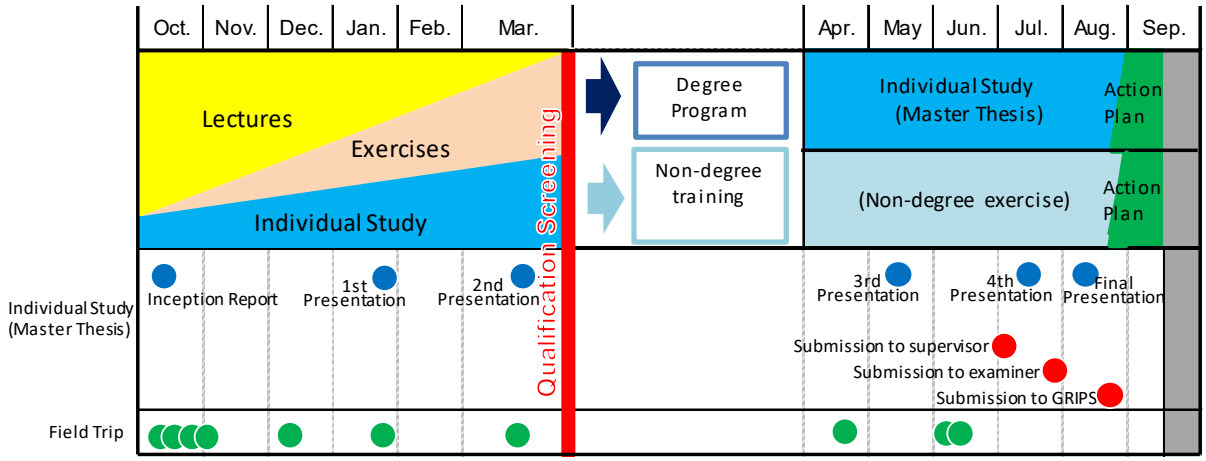


Figure 2-1 Conceptual figure of course schedule

The course was conducted over a period of around one year, from September 30, 2018 (arrival date) to September 12, 2019 (departure date). The opening guidance at GRIPS was held on October 3, 2018, and the graduation ceremony on September 11, 2019.

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
2018 October	1st	Opening Ceremony at ICHARM
	3rd	Entrance Guidance & Orientation at GRIPS
	5th	Visit to Sontoku Museum
	23rd	Visit to a high school in a JICA program
	24th-26th	Visit to the Kinu River basin
November	7th	Inception report presentation
	9th	Visit to the Geospatial Information Authority in Tsukuba
	16th-30th	Lectures at GRIPS
December	5th-7th	Visit to the Japan Meteorological Agency, the Tsurumi River basin, the Kawawa Retarding Basin
	20th	Assigning of Supervisors to M.Sc. students
2019 January	8th-10th	Training of Project Cycle Management
February	1st	First Interim Presentation
	26th - Mar. 1st	Visit to the Shikoku region

Date		Event
April	2nd	Second Interim Presentation
	18th-19th	Visit to the Shinano River (Training of river discharge measurement in the Shinano River)
	23rd	ICHARM Open Day
June	4th	Third Interim Presentation
	25th -28th	Visit to the Yodo River basin (an MLIT Office, Amagase Dam, the Katsura River)
July	1st	Fourth Interim Presentation
	7th	Participation in a flood fighting drill in Joso City
August	5th	Submission of draft theses to ICHARM supervisors
	8th	Final Presentation
	20th	Submission of final theses to GRIPS
	21st	Faculty meeting at GRIPS
September	10th	Closing Ceremony at JICA
	11th	Graduation Ceremony at GRIPS
	12th	Return to home countries

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 34 lecturers joined the faculty this year from outside and inside ICHARM: 12 from universities, 9 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. To ensure that the field trips will not end up with a mere leisure activity, students are required to submit reports after each field trip so as to increase their understanding of effective practice in disaster management.

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	16
	DMP2010E	Disaster Management Policies B: from Urban and Community Aspect	SUNOHARA Hiroki	Fall	2	
	DMP2800E	Hydrology	KOIKE Toshio	Fall through Winter	2	
	DMP2810E	Hydraulics	EGASHIRA Shinji	Fall through Winter	2	
	DMP2820E	Basic Concepts of Integrated Flood Risk Management (IFRM)	TAKEUCHI Kuniyoshi	Fall through Winter	2	
	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	30
	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	Fall through Winter	1	
	DMP2890E	Practice on Flood Forecasting and Inundation Analysis	SAYAMA Takahiro, RASMY Mohamed	Fall through Winter	1	
	DMP3802E	Practice on GIS and Remote Sensing Technique	YOROZUYA Atsuhiro	Fall through Winter	1	
	DMP3900E	Site Visit of Water-related Disaster Management Practice in Japan	SHIBUO Yoshihiro	Fall through Summer	1	
	DMP3910E	Practice on Open Channel Hydraulics	YOROZUYA Atsuhiro	Fall through Spring	1	
		* Selected Topics in Policy Studies I -IV				

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

Lecturer	Affiliation	Lecture
University		
Prof. SUNOHARA Hiroki 春原　浩樹	GRIPS	Disaster Management Policies B: from Urban and Building Aspect
Prof. IEDA Hitoshi 家田　仁	GRIPS	Disaster Management Policies A: from Regional and Infrastructure Aspect
Assoc. Prof. SAYAMA Takahiro 佐山　敬洋	Kyoto University	Practice on Flood Forecasting and Inundation Analysis
Prof. TANAKA Shigenobu 田中　茂信	Kyoto University	Urban Flood Management and Flood Hazard Mapping
Prof. SUGAI Toshihiko 須貝　俊彦	University of Tokyo	Urban Flood Management and Flood Hazard Mapping
Prof. FUKUOKA Shoji 福岡　捷二	Chuo University	Flood Hydraulics and Sediment Transport
Prof. SASAHARA Katsuo 笹原　克夫	Kochi University	Control Measures for Landslide & Debris Flow
Prof. SUMI Tetsuya 角　哲也	Kyoto University	Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management
Dr. OSANAI Nobutomo 小山内　信智	Hokkaido University	Control Measures for Landslide & Debris Flow
Mr. KODAKA Akira 小高　暁	Keio University	Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management
Dr. MIKAMI Takahiro 三上　貴仁	Tokyo City University	Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management
Prof. TAKEUCHI Kuniyoshi 竹内　邦良	Yamanashi University	Basic Concepts of IFRM
National Research and Development Agency		
Prof. HAYASHI Haruo 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 渡辺　正幸	Institute for international, social development & cooperation	Basic Concepts of IFRM
Mr. IMBE Masahiro 忌部　正博	Association for Rainwater Storage and Infiltration Technology	Urban Flood Management and Flood Hazard Mapping
Prof. OHNO Hiroyuki 大野　宏之	Sabo & Landslide Technical Center	Control Measures for Landslide & Debris Flow
Dr. HARA Yoshihumi 原　義文	CTI Engineering Co., Ltd.	Control Measures for Landslide & Debris Flow
Dr. TAKANASHI Kazuyuki 高梨　和行	Asia Air Survey Co., Ltd.	Control Measures for Landslide & Debris Flow

Dr. TSUNAKI Ryosuke 綱木　亮介	Sabo & Landslide Technical Center	Control Measures for Landslide & Debris Flow
Dr. SAKAMOTO Tadahiko 坂本　忠彦	NIPPON KOEI CO., LTD.	Dam Special Lecture
Dr. YASUDA Nario 安田　成夫	Japan Dam Engineering Center	Dam Special Lecture
ICHARM		
Prof. KOIKE Toshio 小池　俊雄	Hydrology, Master's Thesis	
Prof. EGASHIRA Shinji 江頭　進治	Mechanics of Sediment Transportation and River Change, Hydraulics, Master's Thesis	
Assoc. Prof. OHARA Miho 大原　美保	Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management, Master's Thesis	
Assoc. Prof. YOROZUYA Atsuhiro 萬矢　敦啓	Practice on GIS and Remote Sensing Technique, Practice on Open Channel Hydraulics, Master's Thesis	
Assoc. Prof. Abdul Wahid Mohamed RASMY	Computer Programming, Practice on Flood Forecasting and Inundation Analysis, Practice on GIS and Remote Sensing Technique, Master's Thesis	
Assoc. Prof. SHIBUO Yoshihiro 渋尾　欣弘	Site Visit of Water-related Disaster Management Practice in Japan, Master's Thesis	
Dr. USHIYAMA Tomoki 牛山　朋來	Computer Programming, Master's Thesis	
Mr. TOKUNAGA Yoshio 徳永　良雄	Urban Flood Management and Flood Hazard Mapping, Master's Thesis	
Dr. UMINO Hitoshi 海野　仁	Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management	
Dr. Kwak Young Joo 郭　栄珠	Practice on GIS and Remote Sensing Technique, Master's Thesis	
Dr. HARADA Daisuke 原田　大輔	Computer Programming, Hydraulics, Master's Thesis	
Dr. Gusyev Maksym	Practice on Flood Forecasting and Inundation Analysis, Master's Thesis	
Mr. MOCHIZUKI Takahumi 望月　貴文	Practice on Flood Forecasting and Inundation Analysis	

Table 2-4 List of field trip sites

Date	Destination	Content	Cooperating office
October 24th (Wed)	Shimodate River Office	Kinugawa River Emergency Project	Shimodate River Office, Kanto Regional Development Bureau, MLIT
October 25th (Thu)	Kinugawa Integrated Dam Control Office	Lecture on the collaboration of dams along the Kinu River	Kinugawa Integrated Dam Control Office, Kanto Regional Development Bureau, MLIT
	Ikari Dam	Gravity Concrete Dam	Ikari Dam Branch Office, MLIT
	Kawaji Dam	Arch Dam	Kawaji Dam Branch Office, MLIT
October 26th (Fri)	Sabo project in Nikko	Sabo project in Nikko	Nikko Sabo Office, Kanto Regional Development Bureau, MLIT
	Sabo project in Ashio	Sabo project in Ashio	Watarase River Office, Kanto Regional Development Bureau, MLIT
November 9th (Fri)	Geospatial Information Authority of Japan	Disaster prevention activities, Utilization of GEONET, etc.	Geospatial Information Authority of Japan, MLIT
December 5th (Wed)	Japan Meteorological Agency (JMA)	Meteorological services of Japan, etc.	Japan Meteorological Agency (JMA)
December 6th (Thu)	Tsurumi River Basin Information Center	Characteristics of Tsurumi River, Roles of Tsurumi River Multipurpose Retarding Basin	Keihin River Office, Kanto Regional Development Bureau, MLIT
	Kawawa Retarding Basin	Flood control measures in Kanagawa Prefecture (Comprehensive flood disaster prevention measures)	Yokohama Kawasaki Flood Control Office, Kanagawa Prefectural Government
February 27th (Wed)	Kusaka River New Floodway Construction Site	Kusaka River New Floodway Construction Site	Kochi River and Road Office, Shikoku Regional Development Bureau, MLIT
	New Kochi Port, Mt.Godai observation platform	Triple protection	Port and Coast Division, Kochi Prefectural Government Port Management Section, Kochi Public Works Office, Kochi Prefectural Government
February 28th (Thu)	Manno Lake	Manno Lake	Land Improvement District of Manno Lake Land Improvement Division, Department of

			Agriculture, Forestry and Fisheries, Kagawa Prefectural Government
March 1st (Fri)	ISHII Disaster Prevention Station	Basic flood fighting methods, Exercises on rope works, etc.	Tokushima River and Road Office, Shikoku Regional Development Bureau, MLIT
April 18th (Thu)	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	Shinano River Office, Hokuriku Regional Development Bureau, MLIT
April 19th (Fri)	Sagurigawa Dam	Structure of rockfill dams, Roles of Sagurigawa Dam in flood control	Sagurigawa Dam Control Office, Hokuriku Regional Development Bureau, MLIT
June 25th (Tue)	Kinki Regional Development Bureau	Damage from and response to Typhoon No. 18, Flood forecasting	River Planning Division, River Department, Kinki Regional Development Bureau, MLIT
June 26th (Wed)	Yodogawa River Big Weir, Yodogawa River Drainage Pump Station	Outline of the Yodo River Basin	Yodo River Office, Kinki Regional Development Bureau, MLIT
	Ikaga-nishi Super Levee	Super levee	
	Misu Lock Gate	Outline of Misu Lock Gate	
June 27th (Thu)	Yodogawa Integrated Dams Control Office	Outline of dams under the jurisdiction	Yodogawa Integrated Dams Control Office, Kinki Regional Development Bureau, MLIT
	Amagase Dam	Amagase Dam	

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

As was the case last year, in the first half of the course from October to March, 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 2019, 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: 2018–2019 Activity Report

Group photo taken at the GRIPS (September 11, 2019)

(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, 2018, to September 10, 2019, 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 eight students this year: one each from eight countries of Bangladesh, India, Liberia, Myanmar, Nepal, Pakistan, Philippines, and Sri Lanka. These eight students passed the examination, obtained a master's degree in disaster prevention policy, and returned to their home countries.

The course started on October 1, 2018, with a course orientation meeting held at JICA.

On the same day, the opening ceremony was held at PWRI with the attendance of officials from ICHARM (Executive Director KOIKE Toshio, Training & Research Advisor EGASHIRA Shinji, Chief Researcher TOKUNAGA Yoshio) and JICA Tsukuba (Director General TAKAHASHI Masayuki, Officer NISHIOKA Miki, Training Coordinator YAMADA Yumi). Following welcome speeches by the directors, Mr. Mohamed Thajudeen Mohamed Zuhail of Sri Lanka spoke in return on behalf of the students.

On October 3, the entrance guidance was held by GRIPS at the GRIPS building in Roppongi, Tokyo.

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. The students also went on field trips in order to learn from actual cases where Japan's flood countermeasures had been implemented.

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.

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

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. Professor Emeritus 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.

Hydraulics was another essential subject to teach the students the basics of hydraulics. Prof. EGASHIRA Shinji of ICHARM lectured about the basic hydraulic concepts.

Prof. FUKUOKA Shoji of Chuo University gave lectures on the basic principles of flood flow and sediment transport in his class entitled "Flood Hydraulics and River Channel Design," and Prof. EGASHIRA of ICHARM lectured on "Mechanics of Sediment Transportation and River Changes."

Prof. KOIKE Toshio of ICHARM also conducted a class, "Hydrology," from October to November, teaching basin-wide water circulation/hydrological processes, field observations/remote sensing, and water resources management. Assoc. Prof. SHIBUO Yoshihiro of ICHARM gave lectures on soil moisture and groundwater.

As lectures shifted to more practical ones, "Urban Flood Management and Flood Hazard Mapping" was provided. Prof. TANAKA Shigenobu of Kyoto University and Chief Researcher TOKUNAGA Yoshio of ICHARM 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 ICARHM. The Integrated Flood Analysis System (IFAS) by Senior Researcher MOCHIZUKI Takafumi of ICHARM, and the BTOP model by Research Specialist Maksym Gusyev of ICHARM.

In the "Practice on GIS and Remote Sensing Technique" exercise, the students engaged in exercises on GIS by Research Specialist Young Joo Kwak of ICHARM. Assoc. Prof. Mohamed Rasmy and Assoc. Prof. YOROZUYA Atsuhiro, both from ICHARM, gave lectures and training on remote sensing.

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

Special lectures on dams were provided by Dr. SAKAMOTO Tadahiko of NIPPON KOEI CO., LTD., who was once the president of PWRI, and Dr. YASUDA Nario of the Japan Dam Engineering Center in order for the students to learn the basics of dams before visiting the Kinu River basin in late October.

In the two weeks from November 16 to 30, 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. SUNOHARA Hiroki of GRIPS.

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.

<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, Prof. SASAHARA Katsuo of Kochi University, Dr. HARA Yoshifumi, an adviser of the Technology Control Headquarters of CTI Engineering Co., Ltd., Dr. TSUNAKI Ryosuke, a manager of the Sabo and Landslide Technical Center, Dr. TAKANASHI Kazuyuki, a consultant of Asia Air Survey Co., Ltd., and Prof. OSANAI Nobutomo of Hokkaido University.

On December 26, 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.

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

On April 19 during the visit to the middle reach of the Shinano River, 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 Researcher SHIMIZU Takeshi of 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.

On October 5, they visited the Ninomiya Sontoku Museum in Moka city, Tochigi Prefecture. This visit was very beneficial for them because understanding Sontoku’s philosophy of “*Hotoku Shiso*” helped them realize the importance of developing an affluent society through the cooperation of many people and the importance of self-help, mutual support, and public assistance. Every year, ICHARM offers the “ICHARM *Sontoku* Award” to honor a student selected through mutual voting among the students for his/her outstanding contribution to fellow students and this course.

From October 24 to 26, the students visited a few destinations in the Kinu River basin to observe examples of flood control measures in non-urban areas, especially dams, which are considered a flood control technology taking advantage of the topographical features of a rapid river.

On October 24, they visited restoration project sites along the Kinu River to see progress in recovery from the damage caused by the Kanto Tohoku heavy rain in September 2015, and they listened to a lecture by the Shimodate River Office of MLIT.

On the following day, October 25, they visited some places to learn about the effective operation of the Kanto Region Dam Group with the cooperation of the Kinu River Integrated Dam Control Office of MLIT. After they listened to a lecture on the collaboration of four upstream dams in the office, they visited Ikari Dam and Kawaji Dam located in the upper Kinu River.

On the following day, October 26, they visited erosion control sites in the Nikko and Ashio area with the cooperation of the Nikko Sabo Office and the Watarase River Office. In the Ashio area, they listened to a lecture on sediment control works with mock-up display models at the Akagane Shinsui Park and then visited an actual site where hillside works were being carried out. The trip was a great opportunity for the students to realize the importance of erosion control projects.

On November 9, they visited the Geospatial Information Authority of Japan (GSI) and learned about disaster prevention activities and GEONET.

From December 5 to 7, another study tour was conducted with a primary emphasis on flood control in urban rivers. On December 5, they visited the Japan Meteorological Agency (JMA) and were given an overview of the meteorological services and methods of forecasting, and then they moved on to the forecasting room. They were informed that JMA, MLIT, and prefectural governments work closely together to forecast river floods.

On the following day, December 6, they went to observe comprehensive flood control measures in an urban river basin with the help and guidance from Executive Director IMBE Masahiro of the Association for Rainwater Storage and Infiltration Technology and the Kanagawa prefectural government. They visited the Kawawa Retarding Basin and the houses of local residents who had installed rainwater infiltration systems on their properties. Since the area along the Tsurumi River was rapidly urbanized after the Second World War, learning about the flood measures implemented there was thought to be useful in planning flood control measures in major Asian cities as their populations are still increasing. In particular, in the Kawawa Retarding Basin, the students learned that there is a storage facility underneath a subway line depot. This facility strongly reminded them of the importance of intersectional collaboration, for example between rivers and railroads, when implementing flood control measures in urban areas where there is a scarcity of land for structural measures. There are growing concerns about the recent frequent occurrence of localized short-term heavy rainfall caused by global warming, and the students understood the importance of providing storage facilities in urban areas to cope with such sudden rainfall events.

On the following day, December 7, they visited an overwhelmingly huge underground structure called the Metropolitan Area Outer Underground Discharge Channel, which is also nicknamed “a temple in the underground.”

The students visited Kochi, Tokushima, and Kagawa prefectures from February 26 to March 1, 2019. On the first day, they visited the Kochi University of Technology and attended a lecture on the “Development of Decision Making System for Water Resource Policy under Climate Change in Shikoku Area” by Prof. NASU Seigo. On the second day, they visited the Nagoya *chinka-bashi* (“submerged bridge”) and the Kusaka River New Floodway Construction Site. After that, they moved to the Anti-Earthquake and Tsunami Triple Safety Measures Sites in Wakamatsucho with the guidance and cooperation of the Kochi prefectural government. On the third day, they visited Manno Lake in

Kagawa Prefecture with the guidance and cooperation of the Kagawa prefectural government and the Land Improvement District of Manno Lake. On the last day, March 1, they visited the Ishii Disaster Prevention Station located downstream of the Yoshino River and learned several measures and rope techniques that are used in flood fighting efforts with the cooperation of the Tokushima River and Road Office of the Shikoku Regional Development Bureau, MLIT.

On April 3, they visited the Fukuoka Weir. It was built to secure irrigation water, so this visit provided an opportunity to learn about irrigation technologies in addition to those for flood control. During the visit, the students also enjoyed the beautiful nature of Japan as the *sakura* season was in full swing.

From April 18 to 19, the students visited the midstream area of the Shinano River and conducted discharge observation exercises. On the 18th, they were given an overview of flood control measures at the Shinanogawa-Karyu River Office of MLIT and then moved to the Ohkouzu Diversion Channel, where they learned the history of floods and countermeasures implemented in the Shinano River and observed the new and old movable weirs to understand the roles of the Ohkouzu Diversion Channel, a key flood measure in the Shinano River. On the 19th, they visited the Sagurigawa Dam. After a lecture on the structure of a rockfill dam, they observed the dam body. Finally, they participated in discharge observation in the Shinano River near the Shinanogawa Riverside Park in Ojiya City.

From June 25 to 28, they took a study tour to the Kinki region to see flood control measures in the Yodo River basin, whose basin area had been developed over the years owing to abundant water resources from Lake Biwa. The tour was also to learn about the impact of Typhoon No.18 and administrative responses to the event, which brought record rainfall in September 2013. First, they visited the Kinki Regional Development Bureau of MLIT to get an overview of the typhoon and damage caused within its jurisdiction. The students learned that though Typhoon No.18 brought record precipitation and wreaked enormous damage on many parts of Japan, quite a few areas in the bureau's jurisdiction were able to avert damage thanks to measures implemented after the typhoon damage in 2004. Expansion of damage was also avoided through collaborative operations of dams in the Yodo River system and the timely operation of the Setagawa Weir. On the following two days, they visited the bureau's field offices and areas damaged by the typhoon and were provided with detailed descriptions. On the final day, they visited the Lake Biwa Canal Museum to learn about the rich culture of the Yodo River basin. Throughout this study tour, the students attended the observations enthusiastically and asked the personnel on site many questions, some of which were related to their master's theses.

On July 7, the students observed the flood fighting drill organized by the city government of Joso. The students observed a variety of flood fighting methods and were amazed at the fact that such a drill is performed every year.

<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 November 7 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 8 to 10, a lecturer from the GLM Institute was 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 February 1, followed by the three ensuing on April 2, June 4, and July 1. 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 8, the assistant supervisors of GRIPS, such as Prof. SUGAHARA Masaru, Prof. IEDA Hitoshi, Prof. OSANAI Nobutomo, also joined and commented on each student's achievement.

<Graduation and other events>

The students were also encouraged to participate in ICHARM R&D Seminars occasionally conducted by inviting experts on issues in the field of water-related disasters. The master's program offered them many opportunities to learn about the latest trends and knowledge related to water disasters in both Japan and the world.

On March 28, a cherry blossom viewing party was held in the premises of PWRI for the students to experience Japanese culture. They were enchanted by the view of cherry blossoms beautifully in bloom.

The closing ceremony was held at JICA Tsukuba on September 10. During the ceremony, JICA Tsukuba Director General WATANABE, ICHARM Executive Director KOIKE and GRIPS Prof. SUGAHARA 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 Mohamed Thajudeen Mohamed Zuhail of Sri Lanka and Christian Darwin Jacob Valencia of Philippines. 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 Shwe Pyi Tan of Myanmar by Executive Director KOIKE. Representing the students, A F M Tauhid JAMAN of Bangladesh shared a few words of thanks to conclude the ceremony.

On September 11, the graduation ceremony was held at GRIPS. Prof. SUGAHARA, the program director, read out the name of each student, and Prof. TANAKA, the dean of GRIPS, presented a diploma to each of them on the stage. The students then firmly shook hands with Prof. KOIKE, holding their diplomas in the other hand—the fruit of their year's study—showing great satisfaction on their faces.

Over the following days, the students left Japan for their respective homes.

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

2018	7th , November	Presentation on Inception Report
2019	8th -10th , January	Project Cycle Management exercise
	1st, February	1st Interim Presentation
	2nd, April	2nd Interim Presentation
	4th , June	3rd Interim Presentation
	1st , July	4th Interim Presentation
	8th , August	Final Presentation
	20th ,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 during the two weeks in the middle of August and finally submitted their master's theses to their supervisors and assistant supervisors on August 20. After their papers had been evaluated, seven students out of eight 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 and their main supervisor and assistant supervisors. 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	Thesis Title	Teaching Staff
1	Mr. JAMAN A F M Tauhid ジャマン アフマド タウヒード	STUDY ON CHANNEL CHANGES AND BED DEFORMATION IN CONFLUENCE REGION OF GANGES AND JAMUNA RIVERS UNDER DIFFERENT INFLOW CONDITIONS	**EGASHIRA** HARADA YOROZUYA
2	Mr. Kale Ravindra Vitthal カレ ラビンドラ ビットホール	DEVELOPMENT OF INTEGRATED HYDROLOGICAL MODELLING FRAMEWORK FOR FLOOD INUNDATION MAPPING IN BRAHMANI-BAITARANI RIVER BASIN, INDIA	**KOIKE** IMAMURA SHIBUO
3	Ms. DAVIS Cynthia Wantee デイビス シンシア ワンティ	ANALYSIS OF CLIMATE CHANGE IMPACT USING BIAS-CORRECTED PRECIPITATION IN ST. PAUL BASIN, LIBERIA	**OHARA** TAKEUCHI TAMAKAWA
4	Ms. Shwe Pyi Tan シュエ ピー タン	DEVELOPMENT OF INTEGRATED WATER RESOURCES MANAGEMENT PLANS OF SITTAUNG RIVER BASIN UNDER CHANGING CLIMATE	**KOIKE** RASMY SAWANO SHRESTHA
5	Mr. ACHARYA Dhaka Ram アチャリ ダッカ ラム	INFLUENCE OF SAND BEHAVIOUR ON CHANNEL CHANGES ALONG KALIGANDAKI RIVER, NEPAL	**YOROZUYA** HARADA EGASHIRA
6	Mr. IMRAN Ali イムラン アリ	ASSESSMENT OF THE CLIMATE CHANGE IMPACT ON THE FLOOD RISK CHANGE IN CHENAB RIVER BASIN	**USHIYAMA** TAMAKAWA MIYAMOTO
7	Mr. VALENCIA Christian Darwin バレンシア クリスチャン ダーウィン	RRI MODEL-BASED FLOOD EVACUATION TIMELINE OF CITY AND MUNICIPALITY LGUs IN PAMPANGA RIVER BASIN, PHILIPPINES	**OHARA** SHRESTHA MAKSYM
8	Mr. MOHAMED THAJUDEEN Mohamed Zuhail モハメッド タジャディーン モハメッド ズハイル	DEVELOPMENT OF INTEGRATED WATER RESOURCES MANAGEMENT PLAN FOR EASTERN DRY ZONE IN SLI LANKA: THE CASE OF GAL OYA RIVER BASIN	**RASMY** KOIKE

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 12th 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 eleven years, from the second year to the 11th. 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 eleven years.

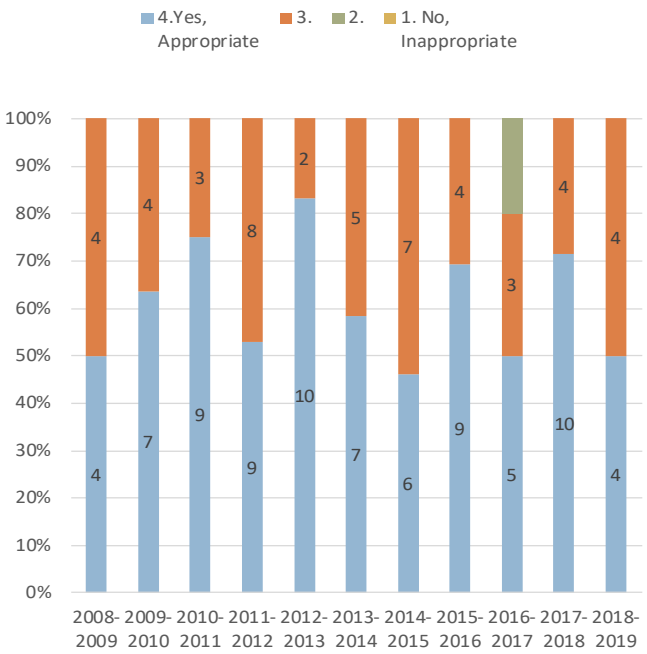
1. あなたもしくは所属組織が案件目標を達成する上で、プログラムのデザインは適切であると思いますか。

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**

図5-1Figure 5-1



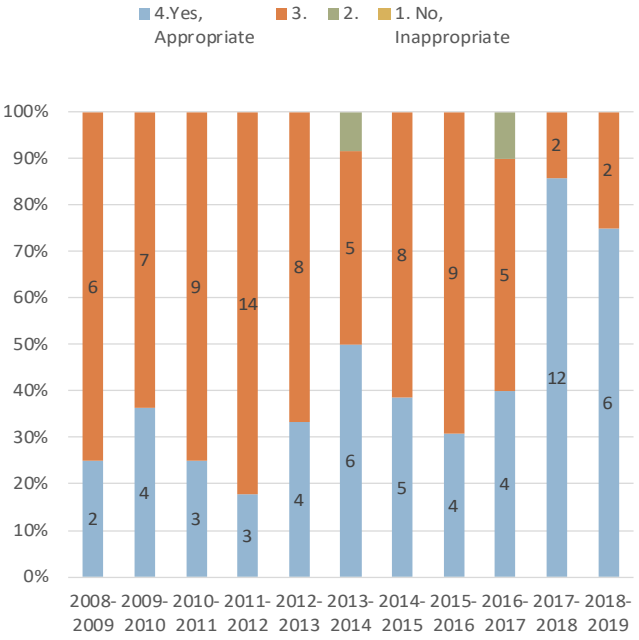
2. 講義の質は高く、理解しやすかったですか。

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**

図5-2Figure 5-2



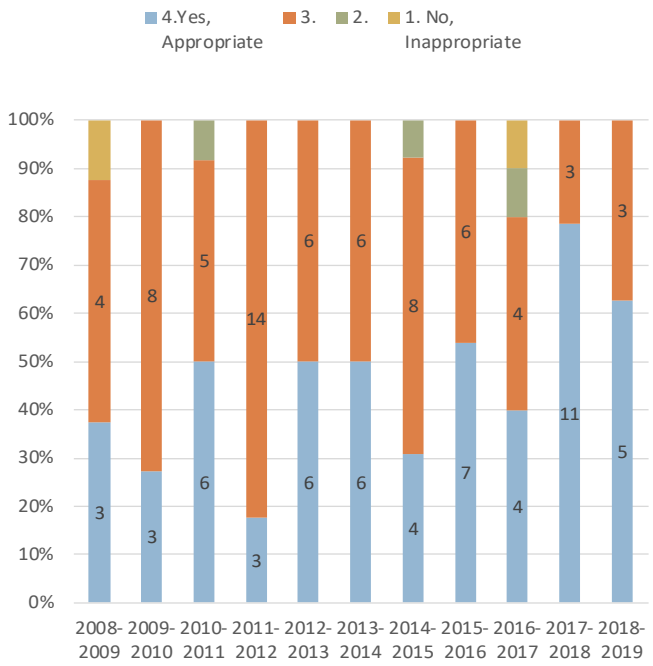
3. テキストや研修教材は満足するものでしたか。

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**

図5-3Figure 5-3



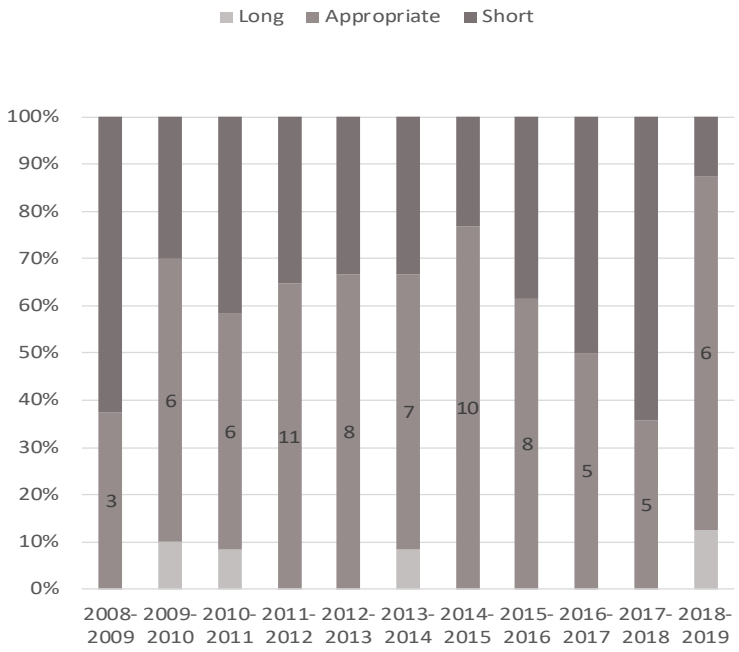
4. 研修期間は適切でしたか。

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**

図5-4Figure 5-4



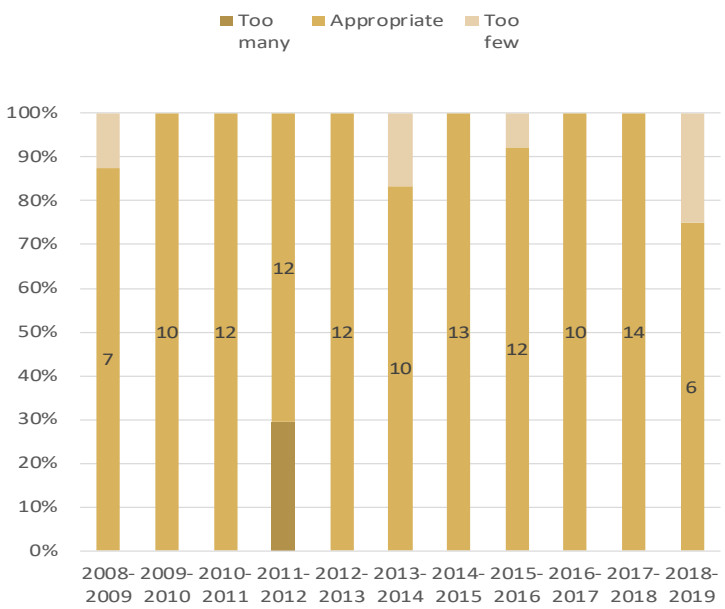
5. 本研修の参加者人数は適切と思いますか。

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**

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 throught 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**

図5−6Figure 5−6

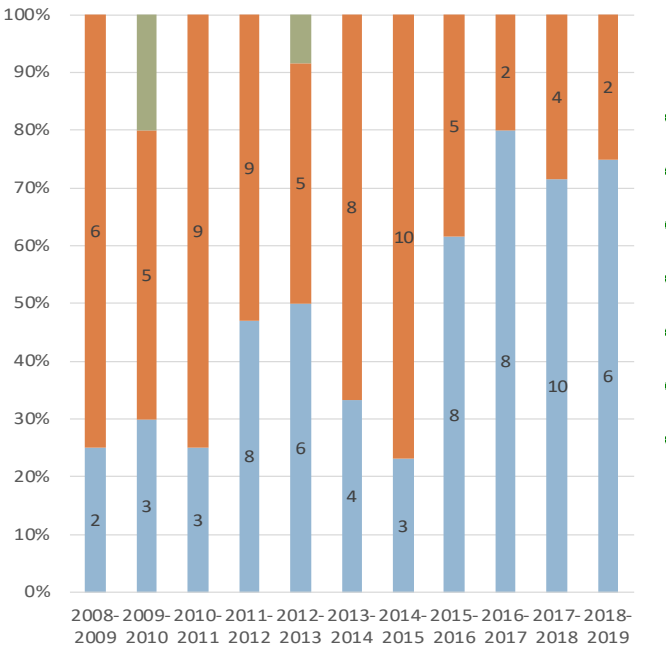


Table 5-1 and Figure 5-1 show the students' response to Question No. 1. All of the students give a positive answer to the question. We have been improving the program year by year by scheduling lectures, study tours, and other events in a more efficient way and providing more effective supervision for 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, more students answered that the length of the course was "Appropriate," compared to last year, though some answered "Short". 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. Many of the students rated the number of participants as "Appropriate," but some answered "Too few." Judging from past results, about 10 to 14 are rated as the right number of participants for students. We also think that that number is appropriate for proper management including taking them on a study tour and other events.

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 rated highest on this aspect throughout the history of this program. 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 eleven-year history. We are pleased with these results that are derived from improvements we have made over the years.

5.1.2 Course Contents

A questionnaire survey was conducted by ICHARM in March 2019, 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. It happens every year that many students request more time for the practical exercises. Moreover, students made constructive requests regarding the composition and balance of lecture schedules.

Table 5-7 Feedback from students

Q1. The structure of the course curriculum (schedule, lectures to add, etc.)

- My kindly suggestion is to add Disaster Law because this will deal with the legal and political point of view.
- Structure of the Course is fantastic no doubt on that but if the programme language like R and Python are included, it is much better. Hence, please include some design part of Hydraulic design and structural design of water-related structures.
- It will be better if add more technical subject rather than theory because most of the theory subject, syllabus is different but description is on a same way.
- Exercise part of course like computer programming, hydrological models and GIS and remote sensing should have more time for practice.

Q2. Lecture (Write down requests or comments, if any.)

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

- This course should be given end of other courses.
- Course content should include more regional case study other than Japan too in order to make better understanding of the regional aspect.

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

- This course should be given end of other courses.
- We learnt a quite a lot about Japan's disasters, but same lectures were repeated several times by visiting lecturers. For the evaluation of subject for grading was totally unacceptable, only considered with group presentation. Whole group members get same results. The assessment shall made individually in the base of some criteria.

3. Hydrology (Prof. Koike)

- This lecture documents are very useful for future but lectures are power point. This one should be text book.
- If we have lecture ending date and exam is near, it is much better.

4. Hydraulics (Prof. Egashira)

- If the hands-on practical to learn the software package like iRIC is added to course content it will be fruitful to understand the meaning and use of various hydrodynamic equations.
- Course content was good and help a lot the governing equations behind the phenomenon. Physical description of mathematical equation is very useful in understanding the concept.

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

- Broadens the scope of understanding on the efforts and best practices in flood risk management in different countries and in different time.
- This one is useful but the lecture notes and we need more time and then some lecture notes lapping with other.

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

- This course helps us equipped with a very useful tool in flood risk reduction. Provides in depth knowledge on flood hazard mapping, evacuation and most of all flood management.
- It was fantastic to study frequency analysis basics but if it is modernized using program like R or Python, it is better.

7. Flood Hydraulics and River Channel Design (Prof. Fukuoka)

- This course is very important because it taught us in depth knowledge on flood wave propagation, effect of channel geometry and vegetation in open channel flow, etc.
- The course content was very informative and interesting. The additional field trips e.g. levee construction sites for practical demonstration of the system may be added.

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

- This lecture time is short. We need more practices for calculation.
- Very good. But introduced some numerical modelling practice, it is better.
- The overall course content was very interesting. But, if some hands-on practical's to solve sediment related problem by using the software package like iRIC is added to course content, then it will be fruitful to understand the meaning and use of various hydrodynamic equations taught in the lectures.

9. Control Measures for Landslide & Debris Flow (Prof. Ohno)

- Not well structured as it involved many outside lecturers.
- The overall course content was very interesting. If some onsite demonstration added to it will be fruitful.

10. Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management (Assoc. Prof. Ohara)

- Documents are lapping with other lecture but all the professors of this course are very clever and they give good instruction.

- The course content was interesting. It is kind request to add the social-economic experience from the other developing countries in more details.
- More theoretical than realistic

11. Computer Programming (Assoc. Prof. Ushiyama)

- Programming course is needed more time.
- The basics of language shall be much addressed.

12. Practice on Flood Forecasting and Inundation Analysis (Assoc. Prof. Sayama/ Assoc. Prof. Rasmy)

- If IFAS system application to country specific problem will be given to each student it will be beneficial to learn the basic of this program. The RRI, and BTOP course content was very interesting.
- We find it hard difficult to the exercise because what was given to us is different from what we learned from the class. I suggest giving example doing the entire process of inundation analysis first before giving the assignment doing it in our own basin.

13. Practice on GIS and Remote Sensing Technique (Assoc. Prof. Yorozuya)

- GIS and remote sensing is very important part of research work but it should be taught in more understandable way and more exercise base classes should be conducted.
- It is also better to have classes using free software such as QGIS. Because most probably we will use that more often when we go back to our own country.

14. Site Visit of Water-related Disaster Management Practice in Japan (Assoc. Prof. Shibuo)

- It was quite good and important part of this master course which allow to learn from the actual site seeing. More useful field sites may be added.
- Study trips were fun and productive at the same time. Deadlines for the submission of after study trip reports are also reasonable.

15. Practice on Open Channel Hydraulics (Asso. Prof. Yorozuya)

- The advanced content like UAV use for addressing the open channel hydraulic problems may be added.
- If possible it's good to add more class on these subject.
- Practice at some experimental facility is useful but practice at some real site is more useful experience for professionals.

Q3. Daily Life in ICHARM/ PWRI

- Lecture time should be adjustable because some days have class four times but some days have no class.
- For the schedule maybe we can let students go to ICHARM late if they do not have their first class or leave ICHARM early if they not have their last class. This will give them time to do their assignment and have enough rest.

Q4. Individual Study

- Actually, Individual study time is not enough for research. It was too short for master level thesis.
- Gathering data is very difficult considering the time and we are not in our own country to collect data. Maybe we can allow students to go back to their country to collect data at their own expense.

Q5. Other requests to ICHARM or JICA

- JICA should be flexible for the rules related with JICA bus.
- Some periodical technical/brainstorming sessions may be arranged so that all faculty members of the ICHARM and student will share the knowledge with each other's and also some fruitful discussion may take place on current issues and possible solution through which new ideas will emerge.
- Studying a large number of subjects and thesis is really difficult in one year. If possible JICA may increase the duration of master course.
- It is very hard to do simulation using the laptop that ICHARM provided since the laptop runs very slow and most of the time connecting to internet is difficult.

5.1.3 Considerations in This Year

(1) Improvements made this year

<Master's thesis proofreading editor>

Some of the students were not familiar with writing papers in English. English proofreading was provided intensively by a proofreader at ICHARM for about three weeks from the beginning of August to the submission of the theses. The students had opportunities to consult the proofreader in person when necessary. Efficient advice tuned to the characteristics of each student's English was given successfully.

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

< Improving schedule balance >

The class schedule should be arranged carefully to avoid a busy schedule in a certain period so that students will be able to focus on and understand each class better.

< Introducing site-visit pre-lectures >

Lectures before site visits should be included in the curriculum. They will help students realize what to see and learn when they visit the sites, which facilitates their learning from the site visits.

< 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.

＜Utilizing student's thesis theme＞

In the process of writing a master's thesis, students conduct various analyses using different types of data regarding their countries. Although such data are very valuable, ICHARM has thought very little about utilizing them for its research and other purposes. Considering the value of the data, ICHARM should seek for practical ways to use them with the students' approval.

＜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. Although distributing the ICHARM Newsletter four times a year, more should be done to keep in touch with graduates and provide them with more opportunities for improving individual capabilities in the field.

Chapter 6: Conclusion

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

Now that the 12th 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 contribute 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 12 year. Over the last 12 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.

Subject: Computer Programming

Course number：DMP1800E
Instructor：Assoc. Prof. USHIYAMA Tomoki, Assoc. Prof. Mohamed RASMY, Dr. HARADA Daisuke
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. DMP3810E “Flood Hydraulics and River Channel Design” and No. DMP2890E “Practice on Flood Forecasting and 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: Fortran95/2003 for Scientists and Engineers (Third Ed.), by Stephen J. Chapman, McGraw-Hill, 2007.

Subject: Practice on Flood Forecasting and Inundation Analysis

Course number：DMP2890E
Instructor：Assoc. Prof. SAYAMA Takahiro, Assoc. Prof. Abdul Wahid Mohamed
RASMY 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：Associate Prof. YOROZUYA Atsuhiro
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) Working with ArcGIS and Q-GIS
3 ：Geographic Information System (GIS) (3) ArcGIS Data management
4 ：Geographic Information System (GIS) (4) ArcGIS Data processing
5 ：Geographic Information System (GIS) (5) ArcGIS Spatial analysis
6 ：Geographic Information System (GIS) (6) ArcGIS Hydrology analysis
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

Participation (100%)

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：SHIBUO Yoshihiro
Term / Time：Fall through Winter

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 ：Discontinuous levee
13 ：Pumping station

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：DMP3910
Instructor：Associate Prof. YOROZUYA Atsuhiro
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

Subject: Hydrology

Class Name: Hydrology

Course Number: DMP2800E

Course instructor(Full Name): KOIKE Toshio, SHIBUO Yoshihiro

Academic Year: April 2018 - March 2019

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) Roles of Water Cycle in Climate System
   2) Water Cycle under Changing Climate

   (2) Water Cycle Observation
   1) In-situ Observation -case studies-
   2) Satellite Remote Sensing -in general-
   3) Satellite Remote Sensing -microwave-

   (3) Hydrological Processes and Modeling
   1) Moist Air and Precipitation
   2) River Basin Hydrological Processes
   3) Atmosphere-Land Interaction
   4) Soil Moisture
   5) Ground Water
   6) Runoff Modeling
   7) Snow Hydrology

   (4) Water Resources Planning and Management
   1) Drought Management
   2) Flood Planning
   3) Climate Change Impact Assessment and Adaptation

3. Grading：

   Active participation(25%), Short Reports(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: An Introduction to Dynamic Meteorology, Academic Press, 1992.

5. Note：

Subject: Hydraulics

Course number： DMP2810E
Instructor：Prof. EGASHIRA Shinji
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
8. Experimental study of open channel flow
9. Field experiences for flow and discharge measurement

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: TEKEUCHI Kuniyoshi
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 IFRM and "Integrated Water Resources Management (IWRM)" 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 IFRM 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.
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 WATANABE Masayuki).
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, Part 2-1 Coordination, 2-2 Flood Management, 2-3 Irrigation. (UNESCO, 2009)

Subject: Urban Flood Management and Flood Hazard Mapping

Course number：DMP2870E
Instructor：Prof. TANAKA Shigenobu
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 in Japan	Prof. TANAKA
2 ：Local disaster management plan	Prof. TANAKA
3 ：Flood control planning	Prof. TANAKA
4 ：Flood control structure	Mr. TOKUNAGA
5 ：Case study of comprehensive flood control measures -Tsurumi river-	Mr. IMBE
6 ：Flood frequency analysis(1)	Prof. TANAKA
7 ：Flood frequency analysis(2)	Prof. TANAKA
8 ：Flood frequency analysis(3)	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" (2009), ICHARM

"Hydrological Frequency Analysis" (2015), Tanaka

4-2 Others

Subject: Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management

Class Name: Socio-economic and Environmental Aspects of Sustainability-oriented Flood Management
Course Number: DMP2900E
Course Instructor (Full Name): Assoc. Prof. OHARA Miho
Academic Year: (April 2018 - March 2019)
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. Outline of socio-economic and environmental aspects
2. Socio-economic impacts of disasters (1)
3. Socio-economic impacts of disasters (2)
4. Methodology for assessing socio-economic impacts (1)
5. Methodology for assessing socio-economic impacts (2)
6. Disaster information dissemination in Japan
7. Disaster information dissemination in Asia, Guest lecturer, Dr. Mikami
8. Disaster information dissemination in Asia, Guest lecturer, Mr. Kodaka
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, Professor Sumi, Kyoto University
13. Sediment management in reservoirs (1), Professor Sumi, Kyoto University
14. Sediment management in reservoirs (2), 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: Flood Hydraulics and River Channel Design

Class Name:	Flood Hydraulics and River Channel Design
Course Number:	DMP3810E
Course instructor:	FUKUOKA Shoji
Year:	2018
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. Characteristics of flood flows (1)
4. Characteristics of flood flows (2)
5. Hydrograph propagation of water level and discharge in flood (1)
6. Hydrograph propagation of water level and discharge in flood (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 and discharge in rivers
12. Channel design harmonizing the flood control and river environment (1)
13. Channel design harmonizing the flood control and river environment (2)
14. Hi-i river diversion channel design from viewpoints of flow and bed variation
15. Summary of “Flood Hydraulics and River Channel Design”

３．Grading：

Reports (20%) Final examination (80%)

４．Textbooks： (4-1:Required 4-2:Others)

５．Note：

Subject: Mechanics of Sediment Transportation and Channel Changes

Course number：DMP 3820E
Instructor：Prof. EGASHIRA Shinji
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, Wiley.
- Julien, Pierre Y.(2002): River Mechanics, Cambridge University Press

(Website: http://www.cambridge.org/us/catalogue/catalogue.asp?isbn=9780521529709)
(http://www.amazon.co.jp/River-Mechanics-Pierre-Y-julien/dp/0521529700)

- Albert Gyr and Klaus Hoyer, (2006): Sediment Transport, A Geophysical Phenomenon, Springer Netherlands

(https://www.springer.com/gp/book/9781402050152)

- 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. OHNO Hiroyuki
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	Prof. Sasahara
３． Sabo planning and control of sediment transport	Prof.Sasahara
４． Planning and design of Sabo facilities	Prof. Sasahara
５． Restoration of vegetation on wasteland and its effects	Prof .Osanai
６． Countermeasures for natural dams	Prof . Osanai
７． Introduction of landslides	Dr. Tsunaki
８． Survey and emergency response for landslides	Dr.Tsunaki
９． Permanent measures for landslide damage reduction	Dr. Tsunaki
１０． Warning and evacuation system for sediment-related disaster	Dr. Hara
１１． Hazard mapping for sediment-related disasters	Dr. Takanashi
１２． Training of hazard mapping for sediment-related disasters (1)	Dr. Takanashi
１３． Training of hazard mapping for sediment-related disasters (2)	Dr. Takanashi
１４． Application of Sabo/landslide projects to other countries (1)	Prof. Ohno Prof . Osanai
１５． Application of Sabo/landslide projects to other countries (2)	Prof. Ohno Prof . Osanai

3 Grading

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

4 Textbooks

4-1Required

4-2 Others

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