



Water
Resource
Research

Marine
Science

Disaster
Mitigation

Urban and
Regional
Design

Center for Water Cycle, Marine Environment and Disaster Management



くまもと水循環・減災研究教育センター



We Contribute to Development of Kumamoto by Presenting Results of our Research on Water Circulation



Overview of CWMD

Kumamoto Prefecture, dubbed 'the Land of Water', is blessed with groundwater which supplies quality tap water to almost all households in the city. A groundwater cycle system in Kumamoto extends some dozen kilometers from Mt. Aso to the Ariake Sea, supporting agricultural areas which produce an abundance of crops, and creating Japan's widest tidal flats in the Ariake Sea and the Yatsushiro Sea and supporting its wide variety of marine products.

This water cycle system is supported by the volcanic geology, and the average annual rainfall of 3000 mm a year, which constantly drench the mountainous areas. On the other hand, however, such natural environment causes frequent disasters such as floods and landslides in the area. Mt. Aso is an active volcano which erupts repeatedly, and the tidal flats of the Ariake Sea and the Yatsushiro Sea are exposed to the frequent risk of storm surges due to the tidal variation that is the biggest in Japan. We are also confronted by some other problems, including a drawdown of groundwater, pollution of water by nitrate nitrogen, deterioration of the environment in coastal areas which include tidal flats, and declining aquatic resources.

The Center for Water Cycle, Marine Environment and Disaster Management (CWMD) consists of the Water Resource Research Laboratory, Marine Science Laboratory, Disaster Mitigation Laboratory, and Urban and Regional Design Laboratory. The center cultivates human resources, using our academic knowledge, and distributes the result of our research in and out of the country, especially to the monsoon regions in Asia. The center is to contribute to the revitalization of Kumamoto through such activities, and to support the reconstruction of areas affected by the Kumamoto earthquakes in 2016.

The center has a marine facility, the Aitsu Marine Station in Amakusa, where field studies are provided, and provides environmental education to primary, junior, and senior high-school students as well as adults.

Water Resource Research Laboratory

Aims to perpetuate the water cycle on the groundwater resource through various research and academic efforts.

Marine Science Laboratory

Carries out the research on biodiversity and ecosystems, sustainable development and conservation of marine resources.

Disaster Mitigation Laboratory

Promotes a wide range of research and education in disaster prevention and reduction activities.

Urban and Regional Design Laboratory

Works on the development of design and implementation towards a livable, resilient and sustainable region.

Water Resource Research Laboratory



About the Laboratory

The water circulation system in Kumamoto is standing on the collaboration with surface water and groundwater flows from Mt. Aso to the Ariake Sea maintaining a fine balance with agricultural activities. The research on the groundwater circulation is promoted under the cooperation of researchers from various fields, expertise, and findings.

In our laboratory, we have researchers in the hydrogeologic field who analyze physical aspects of water such as flow rate, specialists who assess water environment, agricultural engineers who study the relationship between water and agriculture, sanitary engineers who study biological processes of water, and researchers who study the relationship between water and material circulations which leads to biological production.



Outline of the Research

● Research on water quality control of groundwater for water resource conservation

In Kumamoto, groundwater is supplied to over one million people for their drinking-water demand, making a unique city in the world. There is no doubt that groundwater is dependent on the water circulation system composed of not only natural phenomena like a precipitation and surface-water flow but also human activities such as agriculture and infrastructure development. We are constantly monitoring water volume and quality for understanding of water circulation system based on the groundwater of Kumamoto and developing the water cycle model for conservation of water resource into the future.

● Research on agricultural hydrotechnics in paddy fields

We gauge the variously scaled hydrological phenomenon, including water balance in paddy fields and water circulation of river basins, by monitoring and analyzing numerical values. We also analyze local tradition for agricultural irrigation systems and transition of land usage along basin areas, using methods related to the humanities and social sciences. In doing so, we forecast the local water circulation and assess its sustainability and clarify specific policies to maintain basin areas.

● Research on wide-ranging transportation and morphological changes of elements and organic matters which are related to the maintenance of life forms

We promote research on elements that foster growth and internal adjustment of organisms. We also study their wide-ranging transportation to the land, rivers, groundwater, and the coastal areas, as well as their morphological changes in the water systems.

These elements are the essential fabric to maintain life of organisms. They change and take many forms, such as suspended solids, dissolved matter, and organic and non-organic sediment. Therefore, we observe them carefully, and try to clarify the mechanism of their material dynamics so that the result of our research will help estimate the state of the future aquatic environment.

● Research on nitrogen removal technology using Anammox: anaerobic ammonium oxidation

Anammox is a unique nitrogen metabolic pathway which firstly discovered in the late 1990s. In the anammox reaction, ammonium ion is oxidized by nitrite ion and both ions are converted to nitrogen gas under anaerobic condition. Anammox is catalyzed by autotrophic anammox bacteria which require no organic-carbon source or oxygen for their growth. Therefore anammox is expected as a promising-basic reaction in the future to apply to cost-effective nitrogen removal technology. We established two types of anammox-bacterial culture derived from freshwater and marine environments, and are promoting the basic study and applied research of them for water-quality conservation.



Staff

Name	Specialty
Leader Yasunori Kawagoshi Professor, D.Eng.	Water Environment
Tsugihito Watanabe Project Professor, D.Agr.	Irrigation and Drainage Engineering
Kei Ishida Associate Professor, D.Agr.	Hydrology
Hiroaki Ito Assistant Professor, D.Eng.	Water Environment
Luong Van Duc Research Assistant, Ph.D.	Environmental Engineering

Marine Science Laboratory



About the Laboratory

In the closed water areas including the Ariake Sea and the Yatsushiro Sea, many problems including loss of biodiversity and decline of bioresources, occur due to the deterioration of natural environment. Moreover, in the coastal areas, floods and high tides also occur frequently. Additionally, many other urgent issues have surfaced such as depopulation, a declining birth rate, and an aging population. Our laboratory promotes cutting edge and wide-ranging research and education to help solve these issues and makes efforts to create a rich natural environment. Especially, we now highlight the research and education for the restoration and creation of riverine and coastal areas, e.g. habitat utilization, life history, community structure, molecular mechanism of marine life, and interactions among different environments in the atmosphere, water and sediment. We are sure that these research and education efforts will contribute to regions in Asia and Africa which have similar issues, and which now experience rapid development of infrastructure.



Outline of the Research

Many of our research efforts on the conservation of coastal areas of the Ariake Sea and the Yatsushiro Sea are still in process of collecting basic data, and specific research regarding environmental restoration and creation has just started. However, environmental restoration of the Ariake Sea and the Yatsushiro Sea is an impending issue for the national government, and municipalities are seeking specific plans to improve the environment. In Japan, bridges, dikes, and dams constructed in the period of high economic growth are now in process of reconstruction, and newly-designed structures are required to be resistant to natural disasters and harmonized with the natural and social environment of the areas. In this context, we promote research to elucidate mutual relationships between various elements comprised of natural and social environments and human life, coordinating nature, industry, history, culture, climate, and landscape to maintain healthy management of rivers and coastal environments.

As a matter of course, the research for the environmental conservation of the Ariake Sea and the Yatsushiro Sea is delegated to Kumamoto University because it is located in the home region of both seas, and moreover, research on coastal environments is a subject on which Kumamoto University can take the lead as a global hub. And, in order to conserve coastal environments, understanding and maintaining watershed ecosystems of terrestrial and river areas is paramount. From this point of view, we need to undertake more advanced research, grasping accurately the situation of river catchments and coastal environments, analyzing collected data and making efforts to restore and create each specific area in the environment. Furthermore, we are aiming to establish a global hub.



Staff

Name	Specialty
Leader Yasuhisa Henmi Professor, D.Sc.	Marine Ecology
Motohiro Shimanaga Professor, D.Sc.	Community Ecology
Kazumi Akimoto Associate Professor, D.Sc.	Geoscience
Katsumasa Yamada Associate Professor, D.Sc.	Coastal Ecology
Ryuya Matsuda Researcher, D.Sc.	Marine Biology
Hideyuki Shimasaki Technical Staff	

Concurrent Staff

Haruhiko Nakata Associate Professor	Takeshi Kitano Associate Professor
Tomoko Minagawa Associate Professor	Shigeru Morimura Associate Professor



Disaster Mitigation Laboratory



About the Laboratory

Our laboratory consists of three sections, **Research and promotion of disaster management for natural and social infrastructure systems**, **Social skill implementation**, and **Education for disaster management**. In these three sections, research, education, and actual practices are provided to establish a disaster management society, and they have close contact with each other. We also promote our activities, cooperating with the national government, local municipalities, educational institutions, industries, NPOs and local citizens.

These activities are not only provided on our campus but also in local society, where actual practices are specifically available (the field campus), and where development of research methods and their outcomes can be linked seamlessly to social technology. And by doing so, people who are able to support disaster mitigation society can be nurtured.

Outline of the Research

Our laboratory is providing research and educational activities for wide-ranging disaster mitigation and risk reduction and making efforts to enable an early establishment of a disaster-mitigating society where flexible and rapid measures are available against disasters.

●Research and promotion of disaster management for natural and social infrastructure systems

Covering research and development of technology in a wide range of fields, including natural sciences which elucidate changes in the natural environment and mechanisms of disaster, disaster management includes engineering of earthquake-resistant structures and construction against avalanches, and social sciences which improve disaster risk communication.

●Social skill implementation

In order to introduce research outcome and develop cutting-edge technology designed to mitigate disasters in society at large, a prototype of disaster mitigation social system was developed and demonstrated.

●Education for disaster management

Cooperating with other universities in the Kumamoto area, we will nurture leaders who, supported by basic knowledge, master professional education in a wide range of academic fields and can lead discussions joined by those having different opinions. As we provide diversified disaster management education by individual topography, geology, and society, we make educational programs and teaching materials with the cooperation of educational institutes including primary, junior, and senior high schools, municipalities, and voluntary organizations for disaster risk mitigation.

Staff

Name	Specialty
Leader Masahide Matsumura Professor, D.Eng	Bridge Engineering, Seismic Design of Bridge, Bridge Maintenance
Yasuo Miyabuchi Professor, Ph.D.	Volcanology, Quaternary Research
Toshio Fujimi Associate Professor, D.Agr.	Disaster Economics Disaster Risk Management
Sooyoul Kim Associate Professor, Ph.D.	Ocean and Coastal Engineering
Masayuki Torii Project Associate Professor, D.Sc.	Geology Tephrochronology
Yoshito Inamoto Special Researcher	System Development Information System for Risk Management
Toshiaki Hasenaka Professor Emeritus, Ph.D.	Volcanology Mechanism of Volcanic Eruption Disaster Mitigation

■ Concurrent Staff

Hiroki Matsuda Professor, D.Sc.	Hiroshi Isobe Professor
Gozo Tsujimoto Professor	Toshifumi Mukunoki Professor
Yukiko Takeuchi Associate Professor	Hitoshi Moriyama Assistant Professor



Urban and Regional Design Laboratory



About the Laboratory

Based on the achievements of cross-sectional research in our university, we promote social contribution and provide activities for social implementation, aiming to establish a resilient society which can provide quality of life. Through hands-on learning experiences at studios in the area, we provide a resilient regional design research with the collaboration of residents, considering their history, their culture, and their landscape. To be specific, we support reconstruction of the area, being a liaison between municipalities and residents, having Mashiki Labo as one of our bases, which is the satellite institute established in Mashiki-machi, the disaster area most affected by the Kumamoto Earthquake.



Outline of the Research

As practical research to support reconstruction after the Kumamoto Earthquake, we provide the following activities while stationing in Mashiki-machi. We support planning and designing of the Earthquake Memorial Park with the collaboration of residents, support designing a highway which will be highly standardized, provide practical support for city planning along the streets, support planning and designing disaster-recovery public houses, support city planning intended to preserve the memory of the earthquake from generation to generation. We also visit sufferers at temporary houses for interviews, and ask for their opinions about their residences, analyze the reasons they changed their intention, and discuss to find methods to enhance efficiency and a better method for our interviews. Furthermore, we discovered some problems in the current system about the resettlement of sufferers through fact-finding investigations, so we suggest changing the current system.

In a comprehensive survey about disaster prevention and disaster risk management concerning the Kumamoto Earthquake, we check the resilience of the city by using a model of a five-story pagoda. To be specific, it categorizes the impact of Kumamoto Earthquake into five stages from a spacio-temporal point of view: Status of fault and earthquake (foundation) and damage to cultural assets (the first layer), responses of municipalities (the second layer) to damage, damage to social infrastructure (the third layer), damage to buildings (the fourth stage), impact to lives and economic activities (the fifth stage).

As for the activities based on the affected area mentioned above, we are planning to collaborate with other local universities which also have witnessed mega-earthquakes, including the Great Hanshin-Awaji Earthquake, the Chuetsu Earthquake, and the Great East Japan Earthquake. By comparing damage by earthquakes in other areas with that in Kumamoto, we shall integrate our knowledge, which will prove useful in times of disaster.



Staff

Name	Specialty
Director of the center/Leader Ryuji Kakimoto Professor, Ph.D.	Urban planning Disaster Mitigation
Yuji Hoshino Associate Professor, Ph.D.	Landscape and Urban Design
Takuya Maruyama Associate Professor, Ph.D.	Urban Planning Transportation Planning
Yoshihiro Sato Research Assistant	Urban planning Transportation Planning
Concurrent Staff	
Tomoyuki Tanaka Professor	Naoto Tanaka Associate Professor

Digital Archives Laboratory

熊本大学アーカイブ「ひのくに災史録」

平成28年熊本県を襲った地震で多くの犠牲者を出した熊本大学として、被災した校舎の復旧と、被災した校舎の歴史を伝えるために、このサイトを開設しました。



(山) 山崎 昭彦 (池) 池田 武門 (森) 森田 孝一 (松) 松本 浩一 (田) 田中 浩一 (山) 山崎 昭彦 (池) 池田 武門 (森) 森田 孝一 (松) 松本 浩一 (田) 田中 浩一

このサイトについて

About the Laboratory

The 2016 Kumamoto Earthquake caused great damages to the Memorial Museum of Fifth High School which is one of the nationally important cultural property, Faculty of Engineering (Building No.1) and others. Figures showed damages visually. However, there are fears fading away the memories and lessons of this earthquake due to restoration works and reducing number of students after the graduation who experienced this earthquake.

Digital Archives Laboratory builds the archive system “*Hinokuni Saishiroku*” to record and store memories and lessons of this earthquake for the future. This digital laboratory would help to carry out research and education activities on the importance of preparations for not only earthquake but also for various disasters.

Tell, Learn and to Make Preparedness for Next Disaster “Hinokuni Saishiroku”

<https://cwmd.kumamoto-u.ac.jp/terada/>

Outline of the Research

“*Hinokuni Saishiroku*” are being built to record, organize and accumulate the damages, know-how obtained from the process of recovery and revival and lessons from 2016 Kumamoto Earthquake and to make efficient use of the digital archives for future revival supports and disaster education.

A physicist, Torahiko TERADA, who studied at Fifth High School, the predecessor of Kumamoto University, left the words “natural disasters will occur when we forget”. We respect him and establish the Team TERADA (Team of Education and Research According Digital Archive). TERADA promotes each activities based on the following three policies.

1. Connect data and people

The succession place of memory of Kumamoto Earthquake in Kumamoto University were extracted from questionnaire survey of students and considered setting of succession signboard linked to digital archive and practical use method. Also, the short film production is promoted for the succession of experiencing earthquake disaster behaviors to new students.

2. Connect what you were able to do and what you were not able to do

Digital archives make possible to watch/look/listen photos, videos and sounds about disaster wherever they are and to maintain massive amount of data without consideration of deterioration. The way of data building are considered to gather and show the data not only immediately after the earthquake but also recovery and revival and the past disasters in Kumamoto, heavy rainfall disaster, storm surge disaster, volcanic disaster and so on.

3. Connect field and education

Our laboratory shares the instances of practical use and data building of “*Hinokuni Saishiroku*” with Tohoku University and Harvard University that archive The Great East Japan Earthquake in 2011, works on collaboration and exchange of research and education based on using archive data and carries out development and verification of education programs.



Staff

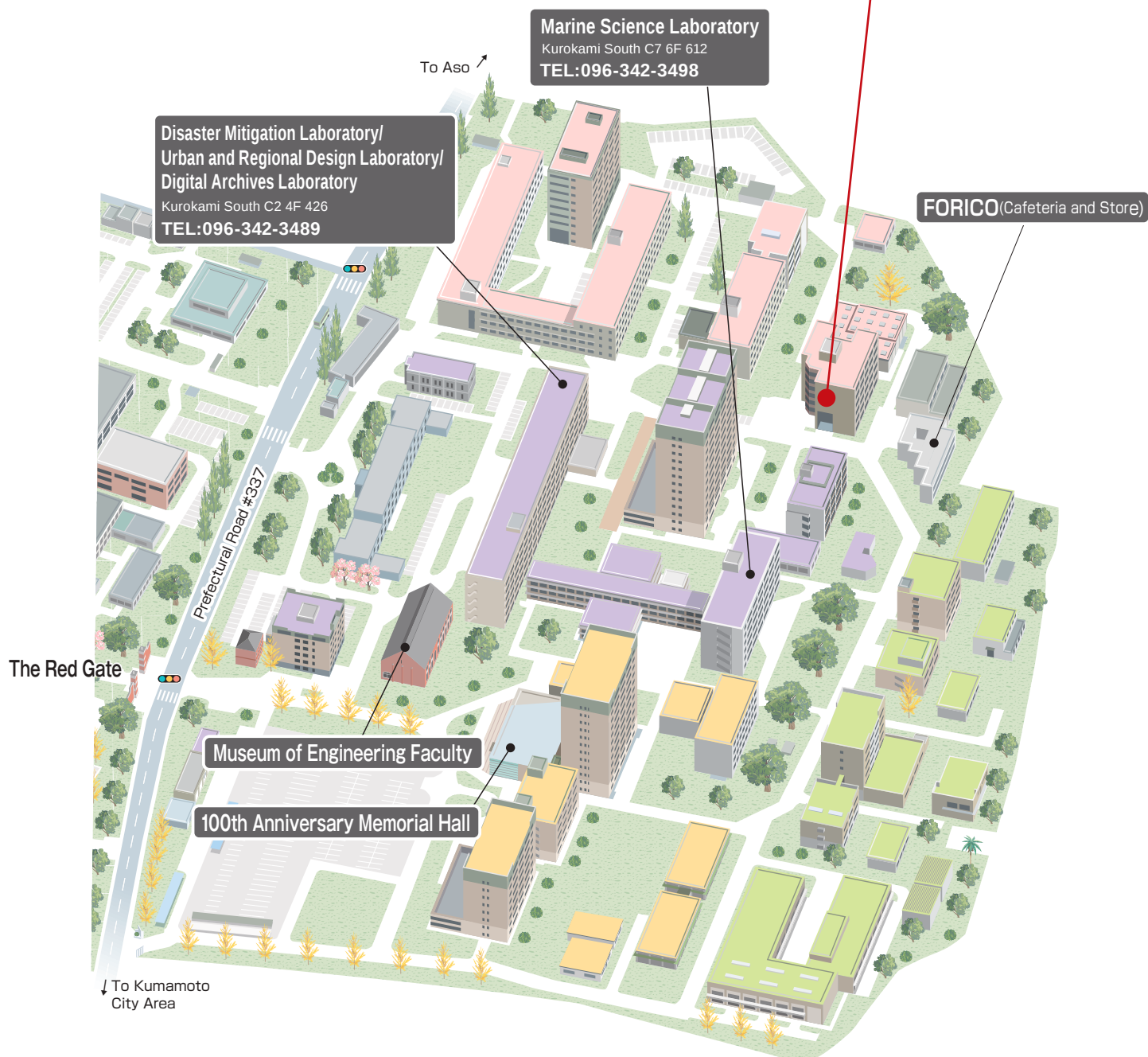
Name	Specialty
Director of the laboratory/ Leader Yukiko Takeuchi Associate Professor, Ph.D.	Community Based Disaster Risk Reduction Disaster Education
Toshitaka Yamao Professor Emeritus, Dr.Eng.	Structural Mechanics Seismic Engineering
Naoto Tanaka Associate Professor, Ph.D.	Urban and Regional Planning Landscape Management
Yoshito Inamoto Special Researcher	System Development Information System for Risk Management
Mariko FUKUNAGA Researcher	Regional planning

Campus Map

Kurokami South Campus

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