



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



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

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ICHARM

Photos:

1. ICHARM Open Day 2019 (June 14, 2019)
2. Master's program students at the Metropolitan Outer Area Underground Discharge Channel in a study trip (December 20, 2019)
3. Lecture by Executive Director KOIKE Toshio (far right) at ICHARM
4. Cherry blossom appreciation at PWRI (March 2019)
5. Asia-Pacific Symposium of the Global Earth Observation System of Systems (Kyoto, October 24, 2018)

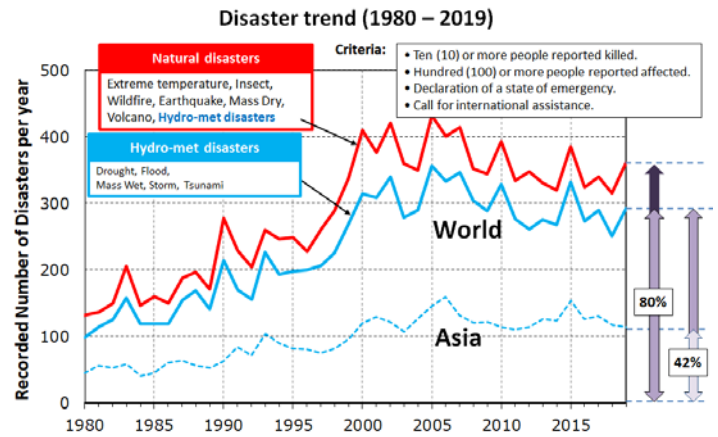
Background

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has been promoting water sciences and technologies and, as part of its effort, encouraging the activities of the International Hydrological Programme (IHP) and the establishment of UNESCO water centers.

In fact, the world has been struggling with water-related disasters, such as floods, droughts and windstorms. They have been a primary source of disaster damage worldwide in recent decades and have been reported to become increasingly frequent and intense in recent years. Today, water-related disasters account for about 80% of all natural disasters in the world, and about 40% of all water-related disasters occur in Asia alone.

In the meantime, Japan has a long history of fighting and overcoming water-related disasters and consequently has a wealth of knowledge and experience, as well as sophisticated technology, in the field. Leveraging this expertise, Japan has been taking the initiative in addressing water-related disasters by participating in the activities of IHP and the World Water Assessment Programme (WWAP) and demonstrating global leadership by hosting the 3rd World Water Forum in 2003 in Kyoto, Japan.

With its growing presence in the water arena, Japan has further realized international expectations that it should share its long-accumulated expertise with other countries in consideration of their needs and conditions in order to help reduce disaster damage.



produced by ICHARM based on the EM-DAT database

Launch of ICHARM under the auspices of UNESCO

To respond to global expectations to fight against water-related disasters, a proposal was made to establish a UNESCO water center in Japan. The proposal received widespread support from member countries and UN organizations at the IHP intergovernmental board meeting in September 2004 and was adopted at the UNESCO general meeting in October 2005. Finally, on March 6, 2006, the International Centre for Water Hazard and Risk Management (ICHARM) was officially established as a UNESCO category II center and part of the Public Works Research Institute of Japan.



Signing ceremony for the official launch of ICHARM: the representative of the Japanese government (left), UNESCO Secretary-General (center) and PWRI Chief Executive. (March 3, 2006)

ICHARM's institute sign written by the then MLIT Minister

水災害・リスクマネジメント
国際センター

Executive Directors

March 2006-September 2014: TAKEUCHI kuniyoshi , emeritus professor, Yamanashi University
October 2014-present: KOIKE Toshio, emeritus professor, Tokyo University



ICHARM opening ceremony (March 6, 2006)

Revision of the agreement and ICHARM Governing Board

Based on the agreement between UNESCO and the Government of Japan, the ICHARM Governing Board had biennial meetings three times until 2018, chaired by the President of PWRI. The governing board reviews the ICHARM Activity Report and reviews and adopts the ICHARM Work Plan. The agreement was revised and renewed on February 13, 2020. On June 2, 2020, the 4th ICHARM Governing Board meeting was held for the first time after the renewal.



ICHARM Special Lecture by Mr. MATSUURA Koichiro, the 8th Director-General of UNESCO (January 16, 2019)



The fourth ICHARM Governing Board meeting (February 14, 2018)



The Government of Japan and UNESCO signed the revised agreement regarding ICHARM (February 13, 2020).

Mission

(Adopted on March 3, 2016)

The mission of ICHARM is to serve as **the Global Centre of Excellence** for Water Hazard and Risk Management by, inter alia, observing and analyzing natural and social phenomena, developing methodologies and tools, building capacities, creating knowledge networks, and disseminating lessons and information in order to help governments and all stakeholders manage risks of water-related hazards at global, national, and community levels. The hazards to be addressed include floods, droughts, landslides, debris flows, tsunamis, storm surges, water contamination, and snow and ice disasters.

We envision a Center of Excellence housing a group of leading people, superior facilities, and a knowledge base, which enables conducting: i) innovative research, ii) effective capacity building, and iii) efficient information networking. Based on these three pillars, ICHARM will globally serve as a knowledge hub for best national/local practice and an advisor in policymaking.



Scheme of ICHARM Programme

ICARM Long-Term Programme

(Adopted on March 3, 2016)

In order to fulfill the Mission, ICHARM will engage in the following activities by effectively arranging its three pillars of research, capacity building and information networking, while keeping in mind “localism,” a principle that requires us to accommodate local diversity of natural, social and cultural conditions by paying close attention to local needs, priorities, and development stages in disaster management, as well as global and local disaster-related experiences and trends:

(i) Innovative research

1. Promote data collection, storage, sharing, and statistics on water-related disasters
2. Conduct risk assessment of water-related disasters
3. Monitor and predict changes in water-related disaster risks
4. Propose, evaluate, and support the implementation of policies for water-related disaster risk reduction
5. Provide support in improving the capability of water-related disaster management

(ii) Effective capacity building

1. Provide training programs to produce solution-oriented practitioners and Training-of-Trainers (TOT) instructors with a good understanding of both theoretical and engineering aspects of disaster management, who can contribute effectively to planning and practicing disaster management at all levels, from local to international.
2. Build and strengthen a network of local experts and organizations that engage in disaster management by providing them with expertise that ICHARM has accumulated in research and local projects through workshops at international meetings and educational programs at ICHARM.

(iii) Efficient information networking

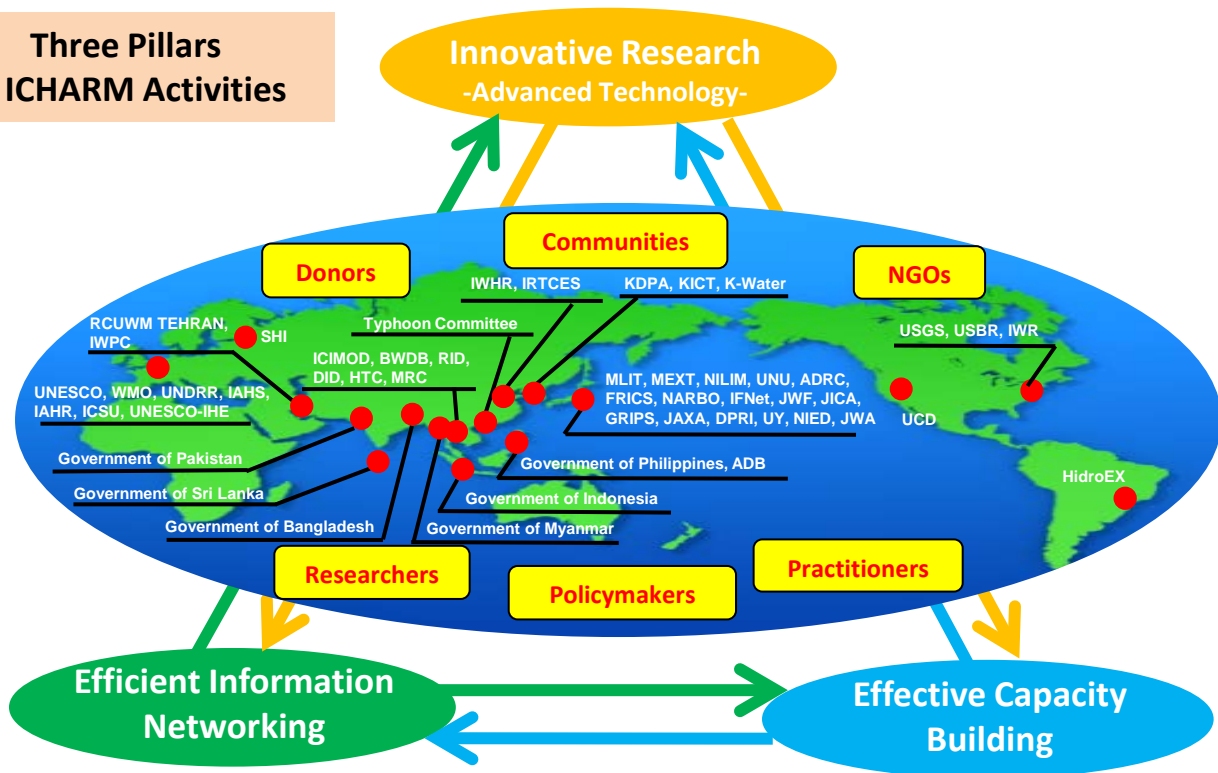
1. Promote the collection, analysis, and sharing of data and information on large-scale water-related disasters around the world by strengthening a global network of researchers.
2. Mainstream disaster risk reduction in the national and international agenda by disseminating expertise on water-related disaster risk management and building and maintaining an international network of influential organizations, such as the International Flood Initiative.

The ICHARM Mid-Term Programme and the ICHARM Work Plan are also available at:

<http://www.icharm.pwri.go.jp/program/index.html>

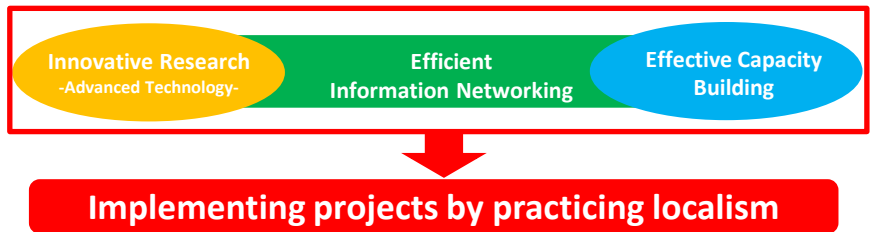
http://www.icharm.pwri.go.jp/special_topic/20200609_GoverningBoard/5_Work%20Plan.pdf

Three Pillars of ICHARM Activities



Practicing Localism

ICHARM act on "localism." We interpret the term to refer to the implementation of projects tailored to local needs and conditions and practice this principle by taking full advantage of the three pillars of ICHARM: innovative research, effective capacity building, and efficient information networking.



Efficient Information Networking



<http://www.ifi-home.info/>

International Flood Initiative (IFI)

The International Flood Initiative (IFI) is a worldwide framework to promote collaboration in flood management among international organizations such as UNESCO, WMO, UNU and UNISDR. ICHARM has been serving as its secretariat.

On October 31, 2016, IFI hosted a side event in advance of the 8th High-Level Expert Panel on Water and Disaster (HELP), and the participants discussed the implementation strategy and the framework for action proposed to achieve better flood management throughout the world.

The meeting adopted the Jakarta Declaration to facilitate interdisciplinary collaboration to further advance sustainable development and flood risk reduction. Based on the declaration, ICHARM is conducting activities to support countries in the establishment of the "platform" to discuss and formulate strategies for the reduction of disasters in collaboration with other IFI partners. This effort has already started in Asia-Pacific countries such as the Philippines, Sri Lanka, Myanmar and Pakistan, and is expected to expand to other countries.



Meeting on the Platform in Philippines (February 7, 2019)



Session on the platform in Australia (November 4, 2019)

Contribution to Typhoon Committee



The Typhoon Committee is an inter-governmental body under the joint auspices of the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization, established in 1968 to promote and coordinate the planning and implementation of damage reduction measures for the protection of people and property in the Asia-Pacific region from typhoons. Researchers of ICHARM have been serving as the chairperson of the Hydrology Working Group of the committee.

Flood Analysis Systems developed by ICHARM

Development of Water and Energy Budget Based Rainfall-Runoff-Inundation (WEB-RRI) Model

ICHARM has developed a new hydrological model, "Water and Energy Budget Based Rainfall-Runoff-Inundation (WEB-RRI) Model," to address floods, droughts, and other issues related to Integrated Water Resources Management (IWRM) under changing climate. The WEB-RRI model consists of four major modules (Fig. 1).

The merits of the WEB-RRI model are as follows:

- Physical formulations of hydrological processes, which is necessary to improve the accuracy of reproduction and risk assessment of flood and drought events.
- Reconstruction of hydrological parameters, which enables a decrease in computational burden from pre-running of the model in practical applications such as flood forecasting, drought monitoring, and seasonal predictions.
- Reliable responses to the water cycle variability as well as climate change scenarios, which are necessary to practice IWRM under changing climate for sustainable developments.

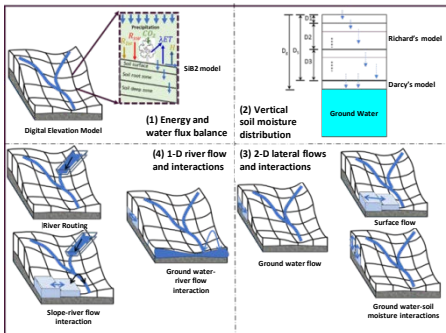


Image of WEB-RRI model

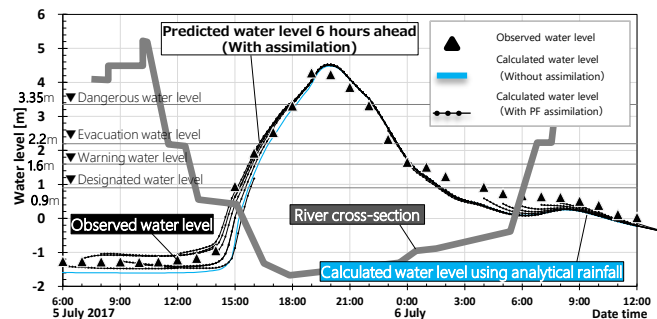
Figure 1. Schematic diagram of the Water and Energy Balanced based Rainfall-Runoff-Inundation (WEB-RRI) model and its four major modules:

- 1) the vertical energy and water flux transfer between land and atmosphere;
- 2) soil moisture dynamics and groundwater recharge;
- 3) surface flow and groundwater flow estimation using 2-D diffusive wave equations and their interactions;
- 4) river flow estimation using 1-D diffusive wave equations and its interactions.

Development of a system for providing the water level information of small and medium rivers

In collaboration with related organizations such as MLIT, ICHARM has been conducting a research project aimed to develop a system for providing the water level information of small and medium rivers by conducting trend analysis using observed water levels. This program is part of the PRISM program, led by the Cabinet Office, and ICHARM is in charge of the following tasks:

- ① Development of a simple, low-cost run-off model and a water-level conversion method (the RRI model and a particle filter method)
- ② Research on a method for improving prediction accuracy using observed water levels collected using water gauges designed specifically for emergency use during a flood.
- ③ Development of an automatic calculation and display system for flood forecasting.



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

Field Investigations

In addition to data and numerical analysis, ICHARM conducts field investigations and uses data and information from them to study flooding and associated sediment and driftwood transport and topographic changes over a wide area from the upper basin to the estuary. We apply the findings on those phenomena to study disaster risk assessment methods.



A house half-buried in a massive amount of sediment after a flood event that hit Marumori Town, Miyagi Pref., Japan, during the passing of Typhoon Hagibis in September 2019.



An area along the Souzu River in Saka Town, Hiroshima Pref., Japan, severely affected by a flood with a massive amount of sediment in July 2018

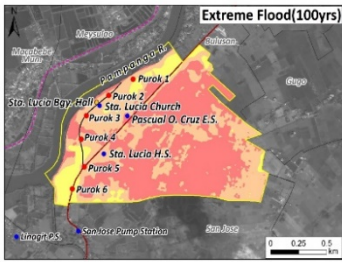


Field investigation in February 2019 in the Sittaung River, Myanmar: preparation of equipment (right), sampling of river water and bank and riverbed material (middle), and a tidal bore in the river estuary. Bank retreat occurs at the rate of 1,000 m/year in some sections where the retreat is most active. The bank erosion is causing life-threatening issues, such as losses of agricultural land and settlements.

Research Activities on Risk Assessment and Risk Reduction

Creation of Community-Level Flood Contingency Plans

ICHARM has been studying methods for supporting municipalities and communities in developing flood contingency plans by creating a chronological scenario of a possible flood disaster based on scientific findings acquired using advanced technologies such as the RRI model. We have so far provided this assistance for communities in the Pampanga River basin of the Philippines and the Volta River basin of the Republic of Niger.



Flood hazard map of an extreme flood event



Open discussion with residents

Publication of Collection of Critical Situations during Flood Emergency Response

ICHARM developed a collection of critical situations during flood emergency response based on post-disaster reports (after-action review reports) produced by local governments.



Pages explaining a case of the critical situations

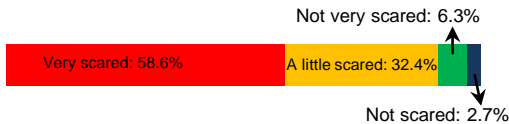
Research on flood risk assessment and information sharing in poorly-gauged river basins

Scenario of flood experience in VR space

Situation: A house is being inundated due to a river flood.



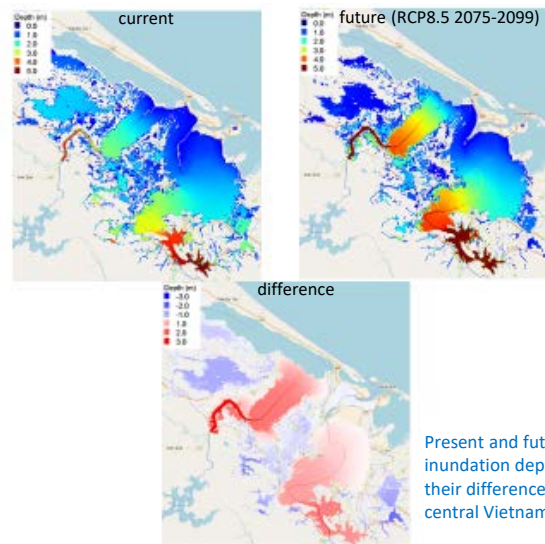
Q. Did you feel scared when you experienced flooding virtually?



Floods are not an everyday event. Because of that, people tend to think that floods certainly occur, but somewhere not where they are. This mentality poses a serious problem in preparing well for floods. To address this issue, ICHARM has developed an application to experience a virtual flood using VR technology (Fig.1). At two outreach events held by ICHARM and the Public Works Research Institute, people had opportunities to try out this new application and were asked afterward to answer some questions, such as if they felt scared when experiencing a flood virtually. From their responses, we found that over 90% of them felt scared, though to different degrees, which indicates that this type of application can be an effective tool to help people realize the destructive nature of floods and the importance of preparing well for future events.

Water Disaster Risk Assessment under Climate Change

ICHARM has been a member institute of a MEXT 5-year research project, "Integrated Research Program for Advancing Climate Models (TOUGOU program)," since 2017. In this project, we have worked on the development of a quantitative method to project possible changes in flood and drought risks in the Davao River basin, the Philippines, and the Solo River basin, Indonesia, due to global warming and to evaluate resulting socio-economic impacts. Based on these results, we are working with their government agencies to develop and implement adaptation plans. In 2018, we calculated changes in flood risk due to future climate variations in three cities of Vietnam as part of an ADB project.



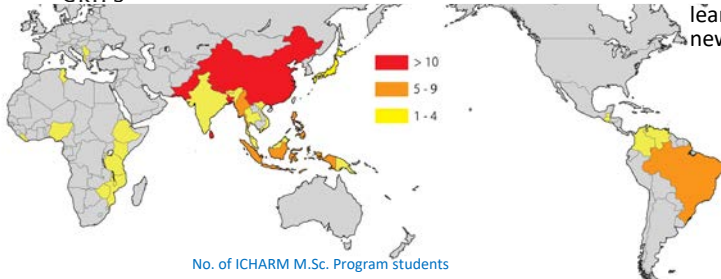
Present and future maximum inundation depths (top) and their difference (bottom) in central Vietnam

Effective Capacity Building



Educational and training programs

ICHARM offers educational and training programs that strengthen the capacity of both individuals and organizations in disaster management. We also conduct post-training follow-up activities, such as seminars for ex-trainees in their countries, to learn issues they are facing in their work so that we can design new training courses to help solve them.



No. of ICHARM M.Sc. Program students



The 13th ICHARM Follow-up Seminar (2020.2)

- 1. M.Sc. program:** This one-year M.Sc. program, "Water-related Disaster Management Course of Disaster Management Policy Program," has been provided since 2007 jointly with JICA and GRIPS. The program is mainly designed for government officers in flood management in developing countries. Students attend lectures, practices and field trips in the first half of the year and work on a master's thesis in the second half. As of September 2020, a total of 150 students graduated with a master's degree in disaster management.
- 2. Ph.D. program:** Ph.D. program, "Disaster Management Program," has been provided since 2010 in collaboration with GRIPS. As of October 2020, a total of 12 students received a doctoral degree, and five students (Bangladesh, Sri Lanka, Vietnam, Ethiopia and Japan) are studying in the program.
- 3. Short-term training program:** Participants learn knowledge and technologies relevant to water-related disaster risk management for a period of several days or weeks. Since 2019, we have been supporting JICA in implementing a training course on flood risk reduction by conducting capacity building activities as part of the course curriculum.
- 4. Follow-up activity:** Post-training seminars and other workshops and meetings are occasionally organized mainly to support ex-trainees' activities in their countries.

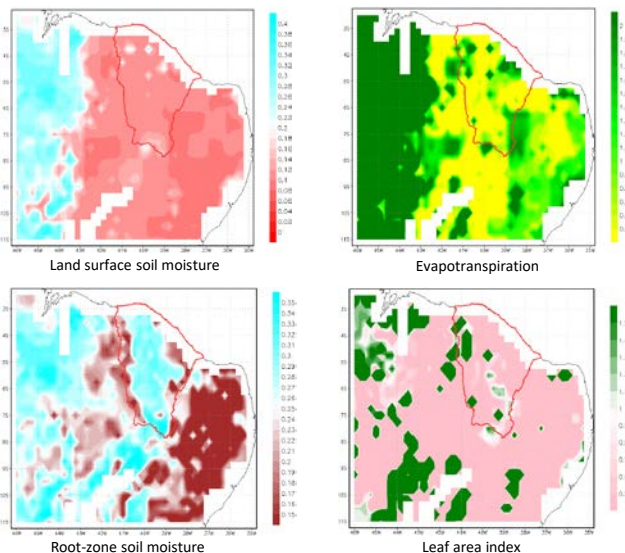


Graduation ceremony at GRIPS (2018.9)

Implementing projects by practicing localism

World Bank Brazil project

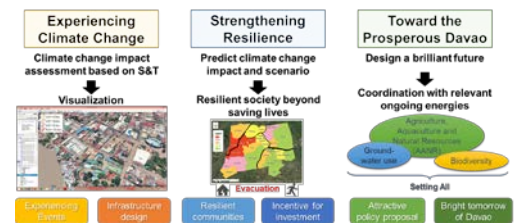
In the World Bank Brazil project (Technical Assistance in Implementing a Pilot of Agriculture Drought Monitoring and Prediction), ICHARM developed a drought monitoring and seasonal prediction system for the Brazilian Northeast. This system can monitor surface and deep soil moisture and crop growth (in terms of leaf area index and evapotranspiration) and predict them for up to approximately three months ahead. It can also estimate the water use needed to maximize crop yields. Locally, the drought status is determined through monitoring and seasonal prediction using this system, and the results are used to formulate farming plans. ICHARM will continue to improve the system, hoping to create an advanced system for providing information useful for farming.



Sample results of drought monitoring and seasonal prediction

Platform on Water Resilience and Disasters in Davao City, Philippines

ICHARM has been assisting communities in the Philippines in promoting the Platform on Water Resilience and Disasters in cooperation with local water-related organizations and other stakeholders to improve their risk management of and resilience to water-related disasters. In Davao City, one of the most active areas regarding the Platform project, an activity design has been developed to plan climate-change adaptation measures, which include preparation of recommendations to policymakers, capacity building for stakeholders, and implementation of policies in society.



Davao City's activity design for climate change adaptation



Orientation on climate change in Davao City (2019.10)

