United Nations
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International
Hydrological
Programme

# Celebrating 50 years of Water Leadership in Asia and the Pacific

## Success Stories from the Field

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# Content Disclaimer

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# Contents

# Foreword

This year 2015 is a special year for the UNESCO Water Family as it marks the 50th anniversary of the water programmes in UNESCO, as well as the 70th anniversary of UNESCO's establishment as a UN Organisation. It also marks the launch of the new 2030 Agenda and it's Sustainable Development Goals (SDGs) for which water is a key component.

Since 1965, UNESCO's Water Programmes have evolved from the establishment of demonstration basins around the world into the development of comparative studies on hydrological processes at a basin scale in different hydro-climatological environments.

The Asia-Pacific region, with its numerous water security challenges, has played a significant role in implementing programmes initiated by UNESCO through the International Hydrology Decade (IHD) (1965 – 1974) and, most of all, through the International Hydrology Programmes (IHP) (since 1975). The annual meetings and international conferences of the Regional Steering Committee for Southeast Asia and the Pacific (RSC-SEAP) have also greatly contributed to shape UNESCO's Water Programmes to solve water problems such as water scarcity, water-related disasters and water education.

This booklet deals with the following areas:

- History of UNESCO Water Programmes from IHD to IHP;
- Introduction of RSC-SEAP;
- Regional presence of UNESCO water programmes in the region;
- Cross-cutting UNESCO water programmes;
- Future challenges and key focus areas, and
- Success stories from the field.

This document provides an overview of the previous and present achievements, discusses future challenges, and highlights efficient and effective ways to address these matters within the scope of UNESCO's Water Programmes.

During the past five decades, the UNESCO Water Programme in Asia and the Pacific, including AP-FRIEND (Asia Pacific Flow Regimes from International and Experimental Network Data), AP-HELP (Asia Pacific Hydrology, Environment, Life and Policy), AP-Ecohydrology and a number of capacity building programmes such as annual IHP Nagoya training courses, have been successfully implemented, producing a wide range of positive results and impacts on sustainable water resources management in the region. I look forward to the 23rd of RSC-SEAP and sincerely hope that this publication will contribute to the goals of the meeting in Indonesia and beyond.

**Flavia Schlegel**

*Assistant Director-General for Natural Sciences, UNESCO*

# Renewing wishes for a better future

Fifty years of cooperation, fifty years with a common goal: linking science, the expert community and decision-makers for the sustainable and integrated development of water resources. Water management is a major challenge for all countries. Its importance for the international development agenda and, more generally, the fate of humanity, has been widely recognized and is now enshrined in the United Nations 2030 Agenda for Sustainable Development, with a dedicated goal.

Scientists stressed the necessity for concerted action on water issues already half a century, which led to the International Hydrological Decade, an outstanding example of international scientific and technical cooperation. The International Hydrological Programme, is building on the Decade's achievements to face increasingly complex challenges.

In South Asia for example, one billion people still do not have access to improved sanitation services and much remains to be done to improve the situation. In the region, IHP is promoting, inter alia, integrated water resource management and related capacity development at national and regional level, notably through its network of UNESCO field offices, the Regional Steering Committee for Southeast Asia and the Pacific (RSC-ASPAC), National Committees, water-related Category 2 centres and Chairs. This network is part of the global UNESCO Water Family, key component of the IHP in its Eighth Phase, conceived as the tool for Member States to make Water Security a reality at global, regional and local level.

This booklet is an opportunity to review past achievements in the Asia-Pacific region. It is part of the celebration of the 50th anniversary of UNESCO's water programmes, which also includes the global commemorative volume "Water, People and Cooperation".

In the same spirit of international cooperation that led to the successful creation of UNESCO seventy years ago and of its water programmes twenty years later, we renew our wishes for a better future together.

**Blanca Jiménez-Cisneros**

*Secretary of the International Hydrological Programme*

*Director of the Division of Water Sciences*

# Message from IHP RSC-SEAP Chairperson

Sponsored by UNESCO, the International Hydrological Decade (IHD) was initiated in January 1965 as man's first concerted attempt to take stock of his diminishing available resources of fresh water and to co-ordinate world-wide research on ways of making better use of them. The general purpose of the IHD was to accelerate scientific study of water resources and water regimes in order to improve water conservation, management and use, which is necessary in all countries developed and developing alike. An important objective of the IHD was to bring the bystanders (non-experts) into action, recognizing that no country can go far on borrowed skill and doled assistance. Each country must develop its own skill to manage its own resources.

The IHD was successful and was developed as a new phase since 1975, divided into two parts: International Hydrological Programme (IHP) and OHP (Operational Hydrological Programme). The IHP is mainly in charge of scientific aspects of hydrological issues sponsored by UNESCO, while the OHP in charge of practical aspects by WMO. So, some countries set up IHP-OHP National Committees. Currently, many countries have IHP National Committee under the National Commission for UNESCO. And the International Hydrological Programme (IHP) is the only intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building.

The remarkable change in the Asian and Pacific region in terms of the IHP was the establishment of the Regional Steering Committee (RSC) for Southeast Asia and the Pacific in 1993, which was brought by two Japanese hydrologists: Prof. Yutaka Takahasi and Prof. Kuniyoshi Takeuchi. They proposed an idea of the RSC and realized it by persuading

a number of countries in the region. Since then, many countries in the region encouraged hydrological sciences and capacity building, conducting various activities under the umbrella of the UNESCO-IHP and the RSC.

With such a history of IHD and IHP, now I am very pleased to have such a publication contributed by the IHP National Committees in the region to commemorate the 50th anniversary of IHD and IHP, as well as the 70th anniversary of UNESCO. I really hope that hydrology and water resources issues will be more advanced by active participation of scientists, engineers, practitioners, and decision makers, as well as many other stakeholders, in IHP, supported strongly by each country.

Finally, I very much appreciate UNESCO Office Jakarta, especially Dr. Shahbaz Khan and his team, to realize this publication.

October 2015

**Kaoru Takara**

*Chairperson,*

*UNESCO-IHP Regional Steering Committee for Southeast Asia and the Pacific*

# Getting Ready with Asia and the Pacific Regional Responses to Water Issues in Agenda 2030

This publication comes at a critical moment in time with the adoption of the Agenda 2030 on Sustainable Development Goals. The success stories highlighted in this publication clearly shows that IHP has been playing a major role in the sustainable management of water resources and is well positioned to deliver to Agenda 2030 especially "Sustainable Development Goal 6 – Ensure Availability and Sustainable Management of Water and Sanitation for All". The regional science support strategy (2014-21) of Jakarta office also recognises the new global water realities in water and sanitation. In Asia and the Pacific region the humanity is facing numerous unprecedented and inter-connected socio-economic and environmental sustainability challenges further complicated by an intensifying hydrological cycle under global change. The persistent pressing regional water challenges of the 21st century include:

- Intensifying water inefficiencies in food production
- Failing access to water and sanitation
- Stressed aquatic ecosystems and biodiversity loss
- Increasing conflicts on water rights
- Degrading water quality
- Ever increasing human water, energy, and climate foot prints
- Unsustainable groundwater abstractions
- Frequent hydrologic extreme events causing floods and droughts
- Lack of investments to provide adequate services
- Closing rivers and over exploited aquifer systems leading to water stress for all uses
- Unplanned urban growth threatening water balances
- Sectorial water management leading to confused, conflicted and unintended policy outcomes
- Inadequate human and institutional capacities to deal with the above challenges

UNESCO Regional Science Bureau for Asia and the Pacific in Jakarta is implementing the International Hydrological Programme (IHP) in the region, which is the only Intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building. The programme is working in partnership with UNESCO category-2 water centres and university chairs to help meet Agenda 2030 needs on environmental sustainability, water supply, sanitation, food security and poverty alleviation. The science contributions by water professionals and coordination by UNESCO field offices in the region are crucial for extending IHP activities to policy makers and water managers.

The Regional Science Bureau is grateful for the continuous support from Member States in the region especially through the existing Funds-in-Trust cooperation programmes of the Governments of Indonesia (IFIT), Japan (JFIT) and Malaysia (MFIT).

**Shahbaz Khan**

*Director and Representative*
*Regional Science Bureau for Asia and the Pacific*


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# 1 UNESCO Water Programme: The beginning

Issues related to freshwater resources figured prominently in UNESCO's work in arid zones in the 1950s. Hydrology was the first problem area addressed (in 1951–52) in the Arid Zone Research Programme, with arid zone hydrology featuring in the first two volumes in the Arid Zone Research Series. Several subsequent volumes in the series were concerned with more finely focused aspects, such as the use of saline waters (1954), recent progress in arid zone hydrology (1959), salinity problems in the arid zone (1961), plant–water relationships in arid and semi-arid conditions (1960), evaporation reduction (1965) and physical principles of water percolation and seepage (1968).

Capacity building included a five-year research and training project on the use of saline water for irrigation in Tunisia, launched in 1962 with the support of the United Nations Special Fund (subsequently, the UNDP). At about the same time, during 1961–64, the international community of hydrologists set in train a process that was to lead to the launching by UNESCO in 1965 of the International Hydrological Decade. In the late 1960s, support was provided to work on the biological dimensions of freshwater resources, through ICSU's Committee for Research on Water (COWAR) and the Productivity of Freshwater Communities' section of the International Biological Programme. One of the aims was to highlight the role of biological phenomena in issues related to water quality – including the control of water weeds and the role of detritus in aquatic ecosystems (Source: UNESCO, 2006)[1].

1 UNESCO 2006: Sixty Years of Science at UNESCO 1945–2005 http://unesdoc.unesco.org/images/0014/001481/148187e.pdf

# From International Hydrological Decade (IHD) to International Hydrological Programme (IHP)

The first worldwide UNESCO water programme was launched when it began the International Hydrological Decade (IHD) focusing on hydrological studies after the 13th session of the General Conference of UNESCO in November 1964. National Decade Committees and Coordinating Council were set up at this time in order to coordinate national programmes, maintain liaison at the international level, and provide overall direction. IHD programme was introduced in 1965 in a response to the development of hydrology as an independent subject as well as the emergence of hydrologists as a professional group that is distinctive from other professions. The scientific programme of the IHD (1965 – 1974) included all aspects of hydrology and took into account the great diversity in the quality and quantity of hydrologic available information across the world. In the very first year of the IHD, a number of important results were obtained. National committees were established in 96 countries involving, in most cases for the first time, representatives of different national organizations dealing with water-related issues. The Decade Council also established ten working groups and four panels to coordinate the implementation of specific parts of the scientific programme of the IHD at an international level.

In 1975, ten years after the launching of the IHD, this initiative evolved into the International Hydrological Programme (IHP) as a water programme successor. IHP has evolved from an internationally coordinated hydrological research programme into an encompassing, holistic and multi-disciplinary programme to facilitate education and capacity building and enhance water resources management and governance. IHP is continuously progressing and emphasising the role of water resources management for achieving sustainable development and adapting the hydrological sciences to cope with climate change and the environmental conditions within the framework of the Sustainable Development Goals (SDGs) and the 2030 development agenda. As the only existing intergovernmental programme of the UN system devoted to water research, water resources management, and education and capacity building in the field of hydrology and water resources management, IHP has been implemented in phases through comprehensive processes.

### The Phases of IHP: from IHP-I to IHP-VIII

The UNESCO IHP has been implemented in programmatic time intervals or phases. Since 1975, eight phases (in a series of consecutive six-year phases) have been adopted with seven successfully implemented. The current IHP phase (2014-2021) has been adopted for eight years and is now ongoing

**The first phase (IHP-I, 1975-1980)**

As IHD was focusing on research activities at this time, this phase was also mainly research-oriented.

**The second phase (IHP-II, 1981-1983):**

***Hydrology and the Scientific Bases for Rational Water Resources Management***

Due to the concerns raised by Member States, the orientation area of IHP changed in the second phase, to include practical aspects of hydrology and water resources with the introduction of key themes to guide the actions of the programme.

**The third phase (IHP-III, 1984-1989):**

***Hydrology and the Scientific Bases for Rational Water Resources Management***

Due to the importance of the theme and the challenges remaining at the end of the second phase, the theme of IHP-II was postponed until IHP-III

**The fourth phase (IHP-IV, 1990-1995):**

***Hydrology and Water Resources Sustainable Development in a Changing Environment***

**The fifth phase (IHP-V, 1996-2001):**

***Hydrology and Water Resources Development in a Vulnerable Environment***

With the increased presence of the social science component, there was a transition between IHP-V and IHP-VI. IHP became a truly inter-disciplinary programme from a single discipline programme, capitalising on the recognition that the solution of the water problem is not just a technical issue.

**The sixth phase (IHP-VI, 2002-2007):**

***Water Interactions: Systems at Risk and Social Challenges***

**The seventh phase (IHP-VII, 2008-2013):**

***Water Dependencies: Systems under Stress and Societal Response***

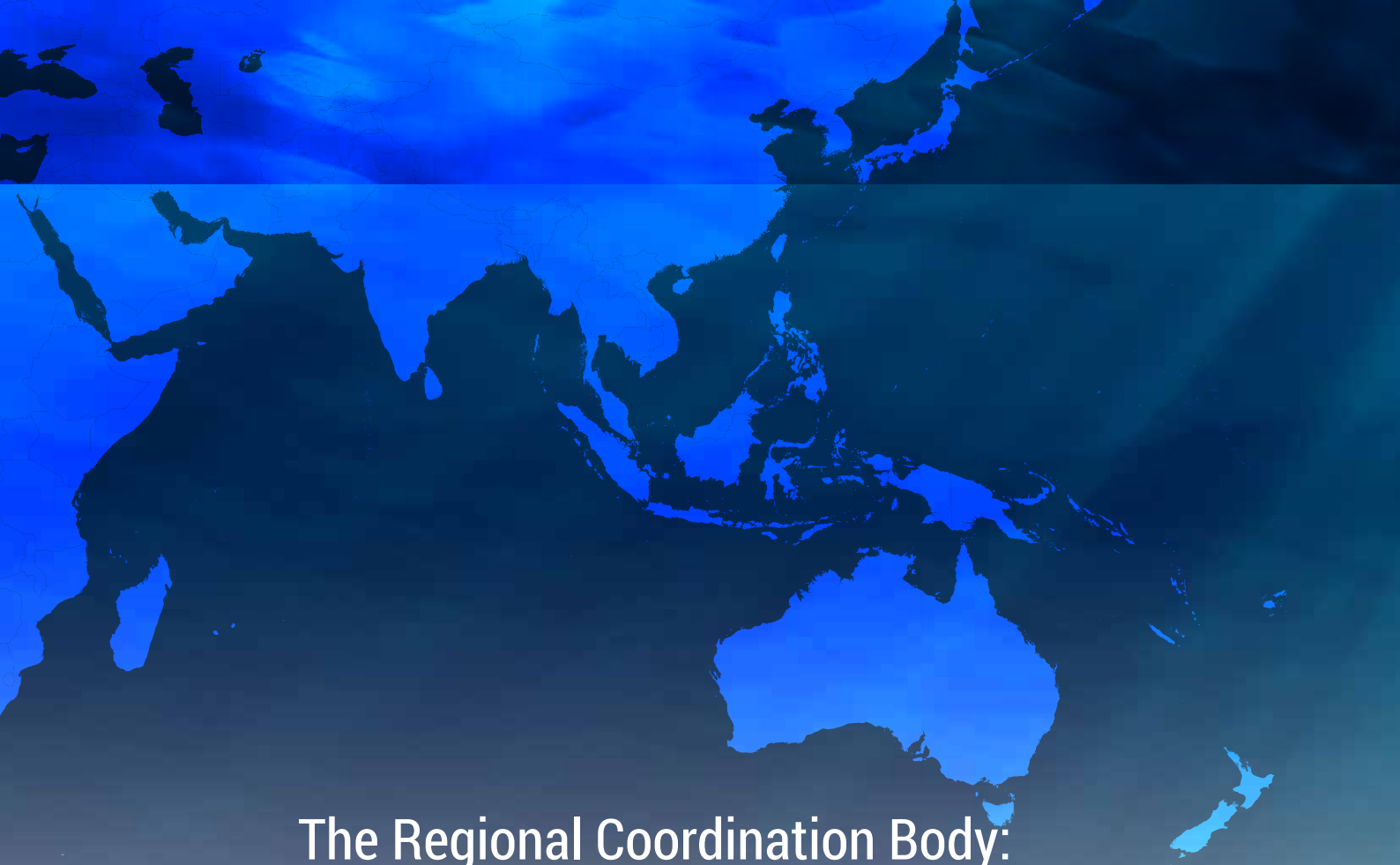
**The eight phase (IHP-VIII, 2014-2021):**

***Water Security: Responses to Local, Regional, and Global Challenges***

This phase, aligned with UNESCO's new eight-year Medium Term Strategy (2014-2021), provides a framework of action for a variety of activities reflecting a deeper understanding of the interconnections between the water – energy – food nexus, to further improve integrated water resources management.

This phase will be marked by the celebration of two main events, namely the 70th anniversary of the creation of UNESCO and the 50th anniversary of UNESCO's Water Programme. In Asia and the Pacific, there are many reasons for taking an active part in these celebrations as the achievements of UNESCO-IHP in the region are highly visible and easily identifiable. For instance, the regional coordination and cooperation mechanisms have been developed and have supported the Member States in adopting IHP in key programmes and activities in a response to the regional water challenges.

In the Asia and the Pacific region, IHP is supported by National Committees from each Member State, UNESCO Category II water centres and UNESCO Chairs spread across the region under the coordination of UNESCO national offices and the UNESCO Jakarta Office as the UNESCO Regional Sciences Bureau for the Asia-Pacific region.



# 2 The Regional Coordination Body: Regional Steering Committee for Southeast Asia and the Pacific (RSC-SEAP)

In order to address and implement the water programme as well as to establish cooperation among Member States, the IHP Regional Steering Committee for Southeast Asia and the Pacific (RSC-SEAP) was set up in 1993. Since its establishment, the RSC-SEAP has moved to be efficient and successful as a long-lasting coordination body even with minimal funds. The RSC-SEAP, composed of representative scientists nominated by each IHP National Committee, is responsible for planning, managing and coordinating the IHP activities in the region.

The RSC-SEAP annual meetings have been convened in different countries of the region to report, evaluate and review a wide range of activities carried out within the framework of IHP, and to design the new plan for further implementation of the activities.

During the first seven years, the agenda of the RSC-SEAP meeting was closely linked to the international event on a specific IHP topic. The annual international conferences and symposium together with the RSC-SEAP meetings today are rather held to meet the needs of intensive training and capacity building from RSC-SEAP and Member States. The theme raised in each international conference is in line with the running IHP phase at that moment. The first and second meetings in 1993-1994 were not officially organised alongside international conferences, yet multi-national stakeholders participated in these meetings aligned with the following themes:

| No | Year | Location | Theme of International Symposium/Conference |
|---|---|---|---|
| 1st | 1993 | Philippines | RSC Establishment |
| 2nd | 1994 | Cambodia | Humid Tropics Hydrology |
| 3rd | 1995 | Japan | Rivers and People in Southeast Asia and the Pacific |
| 4th | 1996 | Indonesia | Comparative Research on Hydrology and Water Resources |
| 5th | 1997 | Thailand | International Symposium on Hydrology and Water Resources for Research and Development in South East Asia and the Pacific |
| 6th | 1998 | Republic of Korea | International Symposium on Hydrology and Environment Development and Management in Southeast Asia and the Pacific |
| 7th | 1999 | China | International Symposium on Floods & Droughts |
| 8th | 2000 | New Zealand | Fresh Perspectives on Hydrology and Water Resources in Southeast Asia and the Pacific |
| 9th | 2001 | Viet Nam | International Symposium on Achievements of IHP-V in Hydrological Research |
| 10th | 2002 | Malaysia | International Symposium on Comparative Regional Hydrology and Mission for IHP Phase VI of UNESCO |
| 11th | 2003 | Fiji | International Conference on Managing Water Resources under Climatic Extremes and Natural Disasters |
| 12th | 2004 | Australia | International Conference on Water sensitive Urban Design 'Cities and Catchments |
| 13th | 2005 | Indonesia | International Symposium on Ecohydrology |
| 14th | 2006 | Thailand | International Symposium on Managing Water Supply for Growing Demand |
| 15th | 2007 | Philippines | Hydrology & Water Resources Management for Hazard Reduction and Sustainable Development |
| 16th | 2008 | Mongolia | Uncertainties in Water Resource Management: causes, technologies and consequences |
| 17th | 2009 | China | Hydrology and Disaster Management |
| 18th | 2010 | Viet Nam | Methodologies applied to hydrological and hydrogeological field investigations in the context of climate change |
| 19th | 2011 | Japan | Meteorological, Hydrological and Tsunami Disasters: Social Adaptation and Future |
| 20th | 2012 | Malaysia | International Conference on Water Resources-Sharing Knowledge of Issues in Water Resources Management to Face the Future |
| 21st | 2013 | Republic of Korea | Nakdong River International Water Week; World Water Forum – Gyeongju International Water Forum |
| 22nd | 2014 | Indonesia | International Conference on Ecohydrology: Ecohydrology Approaches Facing the Global Water Environment Challenges |
| 23rd | 2015 | Indonesia | Integrated Actions for Global Water and Environmental Sustainability |

*Table 2.1 IHP RSC-AP Meeting and Theme of International Conference or Symposia (1993-present) ©UNESCO Jakarta.*
*Table ©UNESCO Jakarta*


## UNESCO Field Offices

The Water Programme is implemented in Asia and the Pacific region through 14 UNESCO field offices in Almaty, Apia, Bangkok, Beijing, Dhaka, Hanoi, Islamabad, Jakarta, Kabul, Kathmandu, New Delhi, Phnom Penh, Tashkent and Tehran. Through these field offices, UNESCO strategies, programmes and activities on water developed in consultation with national authorities and other partners are implemented by specialists across the whole region of Asia and the Pacific.

**UNESCO Category 2 Water Centre and Chair**

- UNESCO Category 2 Water Centre
- UNESCO Water Chair

*Map ©UNESCO Jakarta*

## IHP National Committees

Under the authority of national governments, IHP National Committees play a fundamental role in involving Member States in the international UNESCO Water Programme. The national committees support IHP activities to implement practices by ensuring the strong links with multi-stakeholders in the field of hydrological studies and water resources management.

There are presently 168 IHP National Committees in the world with 22 in the Asia-Pacific region. They are established in Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Iran, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Papua New Guinea, Philippines, Republic of Korea, Thailand, Timor Leste, Uzbekistan and Vietnam.

## Category II Water Centres and UNESCO Water Chairs

The UNESCO Category II Centres and Chairs devoted to UNESCO's Water Programme are growing and expanding in numbers and areas of expertise in the region.

Currently, there are six UNESCO Category II Water Centres and six UNESCO Water Chairs in the region (and some are under establishment), contributing in the implementation of the UNESCO Water Programme through capacity building, information and results of research exchange, advanced training and cooperation between Centres, Chairs or even countries.

# Regional Presence of UNESCO Water Programme in Asia and the Pacific

## UNESCO Water Family in Asia and the Pacific

| AP-UNESCO Category II Water Centre | Location |
|---|---|
| Asia Pacific Centre for Ecohydrology (APCE) | Indonesia |
| Humid Tropics Centre Kuala Lumpur (HTC KL) | Malaysia |
| International Research and Training Centre on Erosion and Sedimentation (IRTCES) | China |
| International Centre for Water Hazard and Risk Management (ICHARM) | Japan |
| International Centre on Qanats & Historic Hydraulic Structures, Yazd (ICQHS) | Iran |
| Regional Centre on Urban Water Management (RCUWM) | Iran |

*Table 3.1 List of UNESCO Category II Water Centre in Asia and the Pacific. Table ©UNESCO Jakarta*

| AP-UNESCO Water Chairs | Location |
|---|---|
| UNESCO Chair in Sustainable Water Management | China |
| UNESCO Chair in Sustainable Groundwater Management | Japan and Mongolia |
| UNESCO Chair in Water Economics and Transboundary Water Governance | Australia |
| UNESCO Chair in Community Education for Mountain Conservation and Watershed Management | Pakistan |
| UNESCO Chair in Hydroinformatics for Ecohydrology | China |
| UNESCO Chair in Water and Environment Management for Sustainable Cities | Iran |

*Table 3.2 List of UNESCO Water Chairs in Asia and the Pacific. Table ©UNESCO Jakarta*

Adding to the Water Centres and Chairs, a network of universities from different countries are also contributing to improved water research across the region. They are collaborating to develop and strengthen the academic and research networks between hydrologist students and professionals from Member States. The collaboration also includes the support of teamwork research, regular training courses, workshops and seminars.

In order to maximise the level of cooperation and synergy among key partners, the UNESCO Water Family in Asia and the Pacific are working on addressing their thematic and geographic priorities within their capabilities, and implementing UNESCO's Water Programme through finding viable solutions to tackle regional water challenges.

# 3 Cross-Cutting UNESCO Water Programme in Asia and the Pacific

In cooperation with the key regional stake-holders of UNESCO Jakarta, the Member States, IHP National Committees and UNESCO Water Family, the RSC-SEAP has coordinated a wide range of initiatives, including research studies, technical projects, workshops, training courses and annual symposia, bringing together a number of professionals involved in water-related activities. In progressing and adopting the IHP in the Asia Pacific region from the earlier phase to the latest IHP-VIII, some of the major achievements and cross-cutting programmes that have been carried out under the initiative of RSC-SEAP are:

- Introduction of the Asian Pacific FRIEND (AP-FRIEND) programme and publication of the Catalogue of Rivers for Southeast Asia and the Pacific;
- Proposal for establishing Asia and the Pacific regional programmes on Hydrology for Environment, Life and Policy (AP-HELP) and Ecohydrology (AP-Ecohydrology);
- Capacity building programme including annual IHP Nagoya Training Courses, workshops and seminars.

## AP-FRIEND Programme

AP-FRIEND, which stands for Asia and the Pacific Flow Regimes from International Experimental and Network Data, launched in 1997, is a regional component of FRIEND (Flow Regimes from International and Experimental Network Data), a global cross-cutting IHP project aimed at advancing technical knowledge and research in the field of hydrology.

The first Phase of AP-FRIEND (1997 – 2001) was carried out to improve the understanding of hydrological science and water resources management in the region through comparative studies of the similarity and variability of the regional hydrological occurrences and water resources systems. With great efforts from nearly 200 scientists in five working groups, significant achievements have been obtained for phase I of the AP-FRIEND during the past several years. The results were summarised in the AP-FRIEND Report for Phase 1 (1997-2001) and published in 2002[2].

In the initial stage of AP-FRIEND Phase 2, two surveys were conducted by the IHP National Committees in 2002-2003 to investigate the critical issues of IHP-VI as part of the AP-FRIEND programme. It was found that issues involving extreme rainfall events and the resulting flooding in both rural and urban areas were the primary concern for most countries. The second most highly addressed concern was the investigation of low flows including droughts. In order to progress with the plan for Phase 2, each country provided available data at national and international levels, and designed guidelines, standards and analysis techniques.

2 IHP V – Technical document in Hydrology No. 9, Regional Steering Committee for Southeast Asia and the Pacific, UNESCO Jakarta Office 2002

The results obtained in the initial stage of the Asia Pacific FRIEND Phase 2 through these activities were presented at the "Intensity Frequency Duration and Flood Frequencies Determination Meeting" held in the Regional Humid Tropic Hydrology and Water Resources Centre for Southeast Asia and the Pacific (HTC) in Kuala Lumpur in 2005.

In addition, Catalogues of Rivers for Southeast Asia and the Pacific were published in the framework of AP-FREIND to promote a common understanding of hydrology and water resources, information exchange within different institutions, and establishment of an international data exchange and collaborative research network in the region since 1995. Volume VI, the last volume of this catalogue, was published in March 2012.


*Figure 3.2 Catalogues of Rivers for Southeast Asia and the Pacific Photo ©UNESCO Jakarta*

## AP-HELP Programme[3]

Achieving water sustainability remains a major challenge in the world as many factors combine together to cause severe water problems. To a large extent, factors such as environmental, social and economic aspects all have considerable impacts on water sustainability in a river basin, but they are often managed and researched separately. This traditional separation among different basin stakeholders, called Paradigm Lock, hinders dynamic and integrated approaches to water resources management in the basin.

With a cross-cutting and transdisciplinary initiative named Hydrology for Environment, Life and Policy (HELP), UNESCO has adapted a framework addressing hydrology, environment, life and policy issues. Through a dynamic global network of HELP river basins, UNESCO has supported stakeholders in the water-related communities to achieve water security by connecting the links between hydrology and the needs of society. To date, the program has been successful in terms of stakeholder involvement, engaging a network of 67 river basins worldwide, over 600 organizations and more than 1000 individuals of water scientists, water law and policy experts, policy makers and water resources managers. The Asia-Pacific region has 18 target basins, including two Demonstration basins, six Operational basins, seven Evolving basins and three Proposed basins.

3 Lee, S (2013) inputs into "Strategic Meeting of Asia-Pacific IHP HELP and Ecohydrology" Jakarta, Indonesia in December 2013

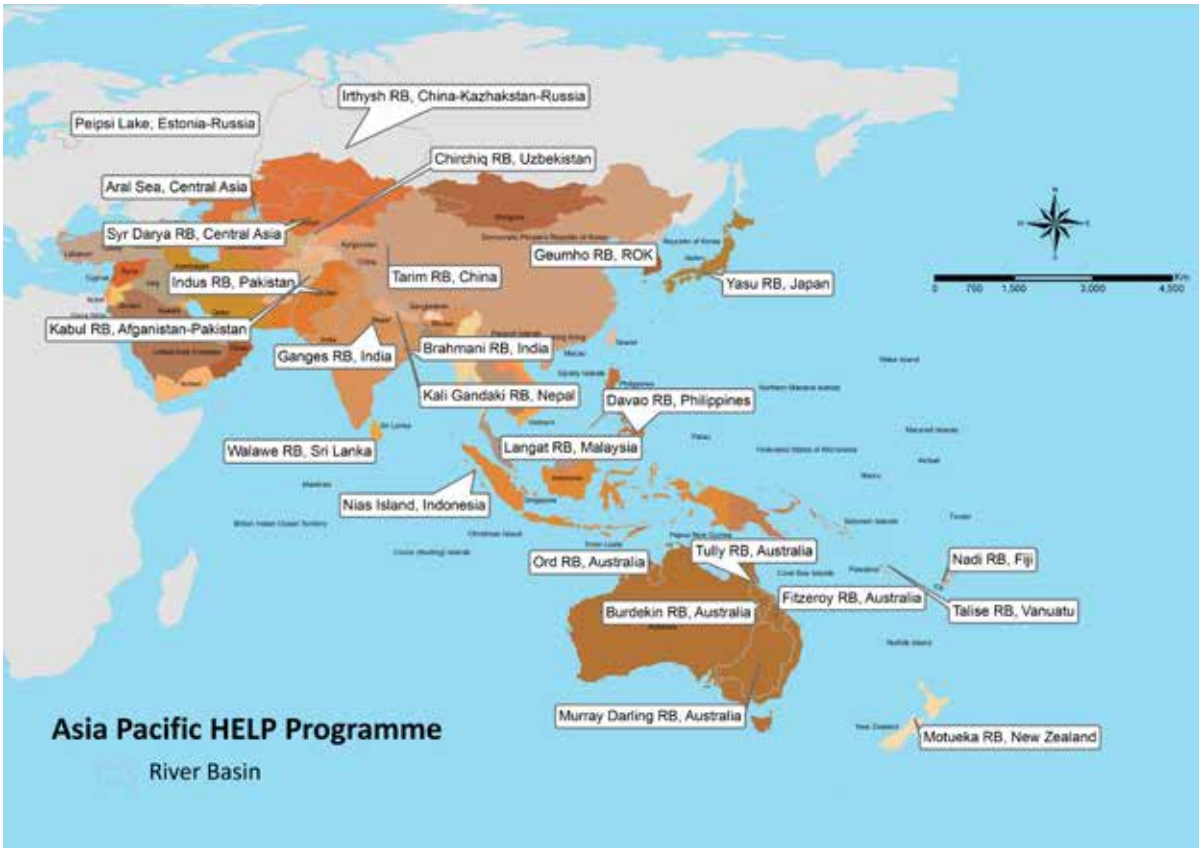



*Figure 3.3. AP-HELP Network Map ©UNESCO Jakarta*

UNESCO Jakarta is currently customising IWRM guidelines in implementing AP-HELP Programme in Asia-Pacific region and, also developing the Watershed Sustainability Index (WSI) guideline as an assessment tool in HELP River Basin in the region. AP-HELP River Basins have been assessed by using the WSI guideline.

Geumho River Basin and Langat River Basin, for example, are significant HELP networks in the Asia-Pacific region. The results from the WSI analysis for those river basins, using HELP indicator, implied that implementing IWRM policies in the Geumho River Basin is considered relatively successful. The WSI of Langat River Basin as an evolving HELP river basin is overall below the Geumho River Basin. Despite the significant progress of governance approaches, the Langat River Basin still needs to focus on the real effects of the policy on the health of the basin. Nevertheless, the application of IWRM as a tool to assist AP-HELP programme facilitates the evolution of river basin management and improves the quality of environment and life in river basins in Asia Pacific in general.

## AP-Ecohydrology Programme

Ecohydrology can be defined as an "integrative science for understanding the interrelationship between hydrological and ecological process in a terrestrial or aquatic water system"[4]. The Ecohydrology approach considers how the hydrological factor together with ecological aspects influence water dynamics and water quality for enhancing environmental sustainability. It proposes a dual regulation of ecology and hydrology interactions to regulate, remediate and conserve the ecosystem.

The Ecohydrology concept, advanced as the UNESCO Ecohydrology Programme, started in 1996 through a key theme of the fifth phase of International Hydrological Programme's (IHP) Hydrology and Water Resources Development in Vulnerable Environment. This furthered in the establishment of European Regional Centre for Ecohydrology (ERCE) in 2006, International Centre for Coastal Ecohydrology (ICCE) in 2009, and the Asia Pacific Centre for Ecohydrology (APCE) in 2010.

The Ecohydrology approach has been widely applied at both implementation and research levels. Much research has been carried out in several countries in Asia and the Pacific. Through various partnership programmes, integrated water management systems were implemented to tackle the issues related to water in the region. In the Asia-Pacific region, there are presently 16 demonstration sites of ecohydrology studies located in China, Malaysia, Philippines, Indonesia, Australia and Micronesia.

The AP-Ecohydrology demonstration sites comprise various themes in the field of hydrology applying the Ecohydrology approach. The ecosystems vary from tropical river basin to sub-tropical wetland.


*Figure 3.4. AP-Ecohydrology Demonstration Sites[5] Map ©UNESCO Jakarta*

4 Zalewski M. 2002. Ecohydrology-the use of ecological and hydrological processes for sustainable management of water resources. Hydrological Sciences Journal 47(5):825-834

5 The demonstration sites will be further explained in in Table 3.3

| Location | Country | Theme |
|---|---|---|
| | | **Operational Projects** |
| **Beijing** | China | Management of regional water resources linking with managing of wetland biodiversity in the suburban area of metropolitan |
| **Northeast China** | China | Watershed management: hydrological processes, vegetation optimisation and sustainability. |
| **Putrajaya** | Malaysia | Integrated catchment management (Lake and wetland). |
| | | **Evolving Projects** |
| **Ord River** | Western Australia | Ecohydrology in action: Addressing changing hydrology, ecological condition and community attitudes to water. |
| **Australia** | Australia | Developing fit for purpose tools to address complex social, ecological and economic issues in water planning. |
| **Western Sydney** | Australia | Developing solutions for environmental friendly water management in peri-urban landscapes. |
| **Heihe River Basin** | Northwest of China | Integration of eco-hydrological processes demonstration research. |
| **Sanjiang Plain** | Northeast China | Linkage of wetland ecology and hydrology with support of information techniques for assessing the degraded inland fresh water wetland habitat. |
| **Manas River Basin** | Northwest of China | Study of irrigation management practices and impacts of soil salinisation. |
| **Saguling Reservoir** | Indonesia | Improved ecosystem management to control euthrophication at the Saguling reservoir and relevant hydro-meteorological disasters by wetland construction and river flow regulation. |
| **Micronesia** | Oceania in Pacific Ocean | Integrating watershed management activities with the protection of coastal coral reef ecosystems. |
| **Philippines** | Philippines | Understanding ecohydrological connectivity in multiple catchments to conserve groundwater, protect surface water and contain risks in a globalising city. |
| | | **Emerging Project** |
| **Bangladesh** | Bangladesh | Assessing performance of ETP (Effluent Treatment Plant) using Duck weeds and activated sludge management system and sustainably managing limnology to develop hydro ecological regime. |
| **Bandung City, West Java** | Indonesia | Caring for Cikapundung River by Reforestation, fetiver plantation, biopores, relocation of squatter, settlements along the River banks, long storage, communal septic tank and ecotechnology to treatment grey water and effluent of communal septic tank for sustainable water supply for Bandung City. |
| **Saguling Reservoir** | West Java, Indonesia | Improved ecosystem management to control eutrophication and relevant hydrometeorological disasters by wetland construction and river flow regulation. |
| **Zhalong Nature Reserve** | China | Study of avian community during wetland restoration. |
| **Davao River Basin** | Philippines | Rehabilitation of Balagunan Watershed to restore biodiversity and flood control in Carmen, Davao del Norte. |

*Table 3.3. Ecohydrology demonstration studies in Asia and the Pacific.Table ©UNESCO Jakarta*

## Capacity Building through Annual Training Course, Workshop and Seminar

In the recent decades, the Capacity Building Programme has been implemented on many hydrology segments and related topics. The workshop is annually conducted as part of RSC Meeting on a wide range themes and topics with the financial support from Indonesia (IFIT), Japan (JFIT) and Malaysia (MFIT).

*Figure 3.5a, International Ecohydrology Conference as inception of 22nd RSC Meeting ©UNESCO Jakarta*

*3.5b. IWRM Workshop in Davao City Philippines Photo ©Philippine Information Agency*

| No | Location |
|---|---|
| 1999 | 8th "Remote Sensing" |
| 1999 | 9th "Limnology" |
| 2000 | 10th "Hydrology related to Head Water Management" |
| 2001 | 11th "Hydrogen and Oxygen Isotopes in Hydrology" |
| 2003 | 12th "Precipitation and Water Resources" |
| 2004 | 13th "Effects of Pollutants on Atmospheric Environment" |
| 2004 | 14th "Hydrology in Asia" |
| 2006 | 15th "Water and Carbon Cycles in Terrestrial Ecosystems" |
| 2006 | 16th "Oceanography Basics" |
| 2007 | 17th "Numerical Prediction of High-Impact Water Systems" |
| 2008 | 18th "Satellite Remote Sensing of Atmospheric Constituents" |
| 2009 | 19th "Water Resources and Water-Related Disasters under Climate Change- Prediction, Impact Assessment and Adaptation" |
| 2010 | 20th "Groundwater as a Key for Adaptation to Changing Climate and Society" |
| 2011 | 21st "Introduction to River Basin Environment Assessment under Climate Change" |
| 2012 | 22nd "Precipitation Measurement from Space and its Applications" |
| 2013 | 23rd "Ecohydrology for River Basin Management under Climate Change" |
| 2014 | 24th "Forest Hydrology–Conservation of Forest, Soil, and Water Resources" |

*Table 3.4. Annual IHP Nagoya Training Courses (1999-2014). Table ©Nagoya University*

*Figure 3.6 a and b 24th IHP Nagoya Training on Forest Hydrology. Photo ©Nagoya University*

The IHP Nagoya Training Courses have been conducted since 1991 and have been attended by over 200 participants from government and research institutions in Asia and the Pacific. They are organised by the Water and Environmental Science Unit of UNESCO Jakarta and the Institute of Hydrospheric-Atmospheric Sciences of Nagoya University, Japan. The Japanese Fund In-Trust from the Ministry of Education, Culture, Sports, Science and Technology of the Japanese Government (MEXT) has financially supported the activity, and the courses are held in Japan on an annual basis for hydrologists from the Southeast Asia and Pacific region. The training courses at the initial stages are mainly focused on general hydrology issues but lately these have been concentrated more on specified themes.

The course can be enrolled online trough Connect-Asia supported by JFIT in partnership with School on Internet Asia Project (SOI). SOI Asia Project utilises the web-based network to provide lectures and classes, including IHP Nagoya training courses in an inexpensive, easier and more feasible way for the universities located in the regions with limited internet accesses. Through this network, information and news with regard to IHP activities can be shared and disseminated to wider audiences with more water scientist connected across Asia and the Pacific.

# 4 Future Challenges and Key Focus Areas of the IHP in the AP region

The Asia-Pacific region is extremely dynamic, undergoing rapid urbanisation, industrialisation and economic development. These desirable development trends also represent drivers that are affecting the freshwater resources, thus jeopardising future water availability of the region. While some countries are making significant progress, many have failed to reach a water secure stage and millions of people are still living without clean and secure water supplies and sanitary facilities. Hence, water availability in the region is very diverse; from highly arid temperate zones and small island states facing water pressure to water-abundant areas in the Himalayan snowfields and the tropics, which often alternate between drought and floods. Today, relatively water-rich countries of the region, such as Malaysia, Indonesia, Bhutan and Papua New Guinea, now face water supply and quality constraints in their major cities because of population growth, growing water consumption, environmental degradation, damaging agricultural activities, poor management of river basins and groundwater overuse.

Water security is the capacity of a population to safeguard access to adequate quantities of water of acceptable quality for sustaining human and ecosystem health on a watershed basis, and to ensure efficient protection of life and property against water related hazards-floods, landslides, land subsidence and droughts. It appears that the region of Asia and the Pacific still has many challenges to overcome.

During the past years and decades, IHP in Asia and the Pacific has been very active in collecting, compiling and providing regional data on water related resources for the international scientific and management community as well as providing advice to the government on policy and management issues. It is fundamental to ensure the continuity of IHP programs and projects, while also responding to new challenges from Member States. To this aim, the thematic areas identified under IHP-VIII helps to develop innovative methods; models, technologies and approaches in order to optimise resources and capitalise on the advances of water sciences and social and/or economic opportunities. Using a multi-disciplinary approach and involving the UNESCO water family in Asia and the Pacific, IHP will remain responsive to the needs of countries and be able to provide answers to various sectors of society.

At this is a critical moment in time, when the international community is adopting the Post-2015 development agenda on the Sustainable Development Goals (SDGs), IHP actions will take stock from the results of the cross-cutting programmes such as AP-FRIEND, AP-HELP, AP-Ecohydrology to build actions, together with regional initiatives such as the RSC-ASPAC, the IHP Nagoya training course and the Asia Pacific Water Forum (APWF), to work with Member States for maintaining the leadership role of UNESCO on providing solutions for securing the region's water future.

## Key focus areas for IHP in Asia and the Pacific

In responding to these future challenges and addressing the sustainable management of water resources in the region, the following six areas should be incorporated for the further implementation of the IHP VIII in the Asia and the Pacific region.

- **Integrated Water Resources Management (IWRM):**
  Support a holistic approach that promotes coordination in the development and management of water, land and related resources and helps to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
- **Trans-disciplinary water management:**
  Programmes (AP-HELP, AP-FRIEND and AP-Ecohydrology) that are designed to incorporate relevant policy and scientific issues through cross-cutting approaches on water management will be promoted.
- **Science, technology and innovation:**
  Facilitate the dialogue between science and technology community and water policy makers for the integration of tools and techniques such as eco-technologies and eco-biotechnologies for a cost-effective, eco-friendly and people-oriented water management.
- **Improving community knowledge on local water resources:**
  It is important to develop capacities and skills to give to stakeholders necessary tools for a better understanding of water issues and for finding possible solutions for positive change.
- **Strengthening regional water cooperation:**
  The IHP network in Asia and the Pacific, as well as other such as the APWF Regional Network of Water Knowledge Hubs could play a significant role in addressing the challenges related to water security in the region.
- **Hydrological hazards and water disaster management:**
  Asia and the Pacific region suffer from a significant number of water related disasters. Hence the IHP is expected to deal with flood, drought, land subsidence, and debris flows.

# 5 Key Partners for Water Programme in the Asia and the Pacific region

## UNESCO Category 2 Centres in Water Programme in Asia and the Pacific

**International Centre on Qanats and Historic Hydraulic Structures (ICQHHS)**

Yazd, Islamic Republic of Iran
Hoessein Ghafori, Director a.i.
Tel: +98 35 3825 05 53
Fax: +98 35 3824 16 90
Email: info@icqhs.org
Website: http://www.icqhs.org

- **Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific, HTC Kuala Lumpur**

  Kuala Lumpur, Malaysia
  Mohamed Roseli bin Zainal Abidin, Director
  Fax: +60 3 4256 1894
  Email: dirhtc@water.gov.my; drroseli@water.gov.my

- **Asia-Pacific Centre for Ecohydrology (APCE)**

  Cibinong, Indonesia
  Hery Harjono, Executive Director
  Tel: +62 21 5281850
  Fax: +62 21 5260804
  Mobile: +62 81 1 21 4304
  Email: hery.harjono@gmail.com

- **Regional Centre on Urban Water Management (RCUWM)**

  Tehran, Islamic Republic of Iran
  Ali Chavoshian, Director
  Tel: +98 21 22911027 - 8
  Fax: +98 21 22911027
  Email: chavoshian@gmail.com; info@rcuwm.org.ir
  Website: http://www.rcuwm.org.ir/

- **International Centre for Water Hazard and Risk Management (ICHARM)**

  Tsukuba, Japan
  Kuniyoshi Takeuchi, Advisor
  Tel: +81-(0) 29-879-6809
  Fax: +81-(0) 29-879-6709
  Email: icharm@pwri.go.jp; kuni.t@pwri.go.jp; cck03520@nyc.odn.ne.jp
  Website: http://www.icharm.pwri.go.jp/

- **International Research and Training Centre on Erosion and Sedimentation (IRTCES)**

  Liu Cheng
  Tel : +86-10-6841-3372
  Fax : +86-10-6841-1174
  E-mail: irtces@public.bta.net.cn; chliu@iwhr.com; cliu.beijing@gmail.com
  Website: http://www.irtces.org/

## UNESCO Chairs in Water Programme in Asia and the Pacific

- **UNESCO Chair in Sustainable Groundwater Management**

  Institute of Geoecology, Mongolian Academy of Sciences, Mongolia
  Erdenechimeg Badamgarav, Corresponding Person
  Tel: 976-11-325-993
  Fax: 976-11-321-862
  Email: geoeco@magicnet.mn; janchivdorj_mn@yahoo.com

- **UNESCO Chair in Hydroinformatics for Ecohydrology**

  Capital Normal University, China
  Zhou Demin, Co-Chairholder
  Email: zhoudemin@neigae.ac.cn
  deminzhou@yahoo.com

- **UNESCO Chair in Water and Environment Management for Sustainable Cities**

  Sharif University of Technology, Iran
  Ahmad Abrishamchi, Chairholder
  Tel: +98(21)66164238
  Fax: +98(21)66014828
  Email: abrisham@sharif.edu
  Website:http://www.sharif.ir/web/en/

- **UNESCO Chair in Water Economics and Transboundary Water Governance**

  Australian National University, Australia
  Quentin Grafton, Chairholder
  Tel: +61-2-6125-6558
  Fax: +61-2-6257-5570
  Email: quentin.grafton@anu.edu.au
  Website:http://www.crawford.anu.edu.au/staff/qgrafton.php

- **UNESCO Chair on Knowledge Systems for Integrated Water Resources Management**

  COMSATS Institute of Information Technology, Pakistan
  Hassan Abbas, Chairholder
  Email: hassan.abbas@ciitwah.edu.pk

- **UNESCO Chair in Sustainable Water Management**

  University of Bangui, China
  Joseph Mabingui, Chairholder
  Email: joseph.mabingui@yahoo.fr

# 6 IHD and IHP activities in Southeast Asia and the Pacific by Member States

## Australia

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### Early contributions

The Programme started as the International Hydrological Decade (IHD) for the period 1965-1974, and was followed by the International Hydrological Programme (IHP) in 1975 (Australian Permanent Delegation, 2005). Since its inception, much progress has been achieved regarding the methodologies for hydrological studies and training and education in the water sciences, as outlined in the early reports of Neil Body (1974, 1987). Although the general objectives remain valid, greater emphasis is now being put on the role of water resources management for sustainable development and the adaptation of the hydrological sciences to cope with the expected changing climate, increasing populations, urbanisation and environmental conditions.

Reflecting Australia's national priority in water management, Australia was one of the founders of the IHP serving in the Intergovernmental Council of IHP from 1975-1978, 1984-1987, 1994-2001, 2006-2009, 2011-2014. A founding member of the Council, Dr Neil Body, Deputy Director CSIRO Division of Water Sciences, was Vice-Chair from 1977-1978 and Professor Ian White from ANU is presently Vice Chair from 2014-2016. Professor White was also IHP Asia-Pacific representative on the Governing Board of UNESCO IHE, Institute for Water Education, Delft, the Netherlands, from 2006 to 2011, and from 1999 to 2003 he was a member of the Water Sub-Commission, UNESCO World Commission on Ethics of Scientific Knowledge (COMEST). Tony Falkland was Chair of the Resolutions Committee in 1995 and a member of this committee in 1996 as was Trevor Daniell in 2000. Trevor Daniell was Chair of the Finance Committee in 2008 and a member of this committee in 2010 and the Publication and Communication Committee in 2012.

## Australia's National Committee/Network

IHP activities in Australia are carried out under the guidance of the national UNESCO Science and Technology Network. The Australian UNESCO Committee for the IHP (AUCIHP) was formed following the IHD in 1975 and worked in conjunction with AWRC committees through the 1980s to undertake IHP activities. This committee was revamped into the Australian IHP National Committee/Network in mid-1995 and was then chaired by Bruce Stewart of the Bureau of Meteorology, from 1995 until 2010. From 2010 to 2015, Mr. Stewart was Director of the World Meteorological Organization's Climate and Water Department, and maintained a close liaison with IHP. The 1995 committee was composed of Bruce Stewart, Tony Falkland, Russell Mein, Ian Cordery, Ray Volker, Peter Dillon, Peter Martin and Trevor Daniell. From among this membership, Tony Falkland, Peter Dillon and Trevor Daniell are still committee members in 2015, with Mr Dasarath Jayasuriya from the Bureau of Meteorology as the current Chairperson. This committee brings together many of the key hydrological research groups within Australia and in the Pacific small island country region. As such, Australia is able to contribute towards IHP activities through the research programmes currently existing in the country.

## Contributions to IHP Secretariat

Two members of Australia's IHP Committee, the late Professor Mike Bonell and Professor Shahbaz Khan, have served in the wider UNESCO IHP community through appointments to the IHP Secretariat. Professor Mike Bonell, who had been a Reader in Geography and Director of the Institute of Tropical Rainforest Studies at James Cook University, joined the UNESCO Division of Water Sciences in 1992, taking responsibility for the IHP component on the 'Impacts of Climate Variability and Change in Hydrology and Water Resources', and the Humid Tropics Programme. He catalysed the establishment of the IHP's category 2 Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific (HTC Kuala Lumpur) Centre, and he later became the Division's inaugural Chief of Section: Hydrological Processes and Climate (1998-2006). His tenure at the IHP included the global coordination of two major cross-cutting IHP initiatives; Flow Regimes from International Experimental and Network Data (FRIEND); and Hydrology for the Environment, Life and Policy (HELP). After he retired from UNESCO, Professor Bonell joined the University of Dundee in Scotland as a Professor of Catchment Science at the IHP Category 2 Centre for Water Law, Water Policy and Science.

Professor Khan was Professor of Hydrology, Director of International Centre of Water at the Charles Sturt University and Research Leader/ Director of Irrigated Systems and Rural Water Use areas of CSIRO, Australia. At the UNESCO Division of Water Sciences, Professor Khan was the Chief of Section on Sustainable Water Resources Development and Management, where he was responsible for Water Education for Sustainable Development; Hydrology for Environment, Life and Policy (HELP); Ecohydrology, Water and Ethics; and Energy and Food Nexus within the IHP. Professor Khan is currently Director of Asia and the Pacific Regional Science Bureau of UNESCO based in Jakarta, Indonesia, and a key player in initiating projects within the region and coordinating the regional steering committee for IHP South East Asia and the Pacific.

Dr Andrew Ross from ANU joined the IHP Secretariat as a consultant to work on groundwater governance (Ross, 2012).

Professor Quentin Grafton holds the UNESCO Chair in Water Economics and Transboundary Water Governance, which was established in 2010 at the Australian National University. He is a member of the Australian IHP Committee and has established the Global Water Forum (GWF), which is an online resource publishing concise, open-access articles from leading researchers on water governance, policy, and science. The GWF also provides open access resources, courses, and tools to help to understand water challenges.

### Participation in the Regional Steering Committee

The Regional Steering Committee of IHP for South East Asia and the Pacific was established in 1993 and the following list shows the participation of Australians in this Committee.

1. The Philippines (1993)
2. Cambodia (1994): Tony Falkland.
3. Japan (1995): Bruce Stewart.
4. Indonesia (1996): Trevor Daniell.
5. Thailand (1997): Trevor Daniell (Rapporteur) and Ross James.
6. Republic of Korea (1998): Trevor Daniell (Rapporteur) and Ross James.
7. China (1999): Trevor Daniell (Rapporteur) and Ross James.
8. New Zealand (2000): Trevor Daniell, Ross James and Ian White.
9. Viet Nam (2001): Trevor Daniell (Rapporteur) and Ross James.
10. Malaysia (2002): Trevor Daniell (Rapporteur) and Ross James.
11. Fiji (2003): Ross James and Trevor Daniell (TSC).
12. Australia (2004): Bruce Stewart, Trevor Daniell (Rapporteur), Ross James (Rapporteur) and Ian White.
13. Indonesia (2005): Ross James (Rapporteur).
14. Thailand (2006): Trevor Daniell (Rapporteur) and Ross James.
15. The Philippines (2007): Trevor Daniell and Ross James (Rapporteur).
16. Mongolia (2008): Trevor Daniell (Rapporteur).
17. China (2009): Trevor Daniell (Rapporteur).
18. Vietnam (2010): Trevor Daniell (Rapporteur).
19. Japan (2011): Trevor Daniell (Rapporteur).
20. Malaysia (2012): Trevor Daniell (Chairman).
21. Republic of Korea (2013): Trevor Daniell (Chairman).
22. Indonesia (2014): Trevor Daniell.

### FRIEND and HELP

Two main cross-cutting programmes of the IHP are Flow Regimes From International Experimental And Network Data (FRIEND) - An International Collaborative Study in Regional Hydrology, with Trevor Daniell as the Asia-Pacific Coordinator (2002-2014); and Hydrology for the Environment, Life and Policy (HELP) – A Joint programmes of UNESCO's IHP and WMO, with Jeff Camkin as Australia's Coordinator.

Trevor Daniell was a Member of the FRIEND International Coordinating Committee (2002-2015), Chairman (2006-2010) and editor of a number of Proceedings of Global FRIEND between 2010 and 2014.

### Recent Activities

Mr Bruce Stewart who was President of the WMO Commission for the Hydrology Network, provided a link between the UNESCO IHP and WMO's Operational Hydrology Programme. Mr Tony Falkland and Professor Ian White are members of the Water Working Group of the Science, Technology and Resources Network of the South Pacific Applied Geoscience

Commission. Professor Ian White is a member of the Asian Pacific Association of Hydrology and Water Resources. Dr Peter Dillon chairs the IAH Commission on Managed Aquifer Recharge. Peter Dillon, Rick Evans, Craig Simmons and Neil Power participated in the Groundwater Governance, A Global Framework for Action, Fourth Regional Consultation, Asia and Pacific Region, between 3-5 December 2012 in China, to give Australia's contribution to this important IHP initiative (Ross, 2012).

The University of Western Australia signed a Memorandum of Understanding with the International Centre for Coastal Ecohydrology (under the auspices of UNESCO) and through this, Professor Jeff Camkin, who coordinates HELP in Australia, has designed and delivered new components of the Erasmus Mundus MSc in Ecohydrology course in 2010, 2011 and 2012, and further work is being developed under the MoU.

### Australian IHP Activities and Visions for the future for Pacific Island Countries

An analysis was carried out by Tony Falkland (2011) for the Australian Government of the threats to water security in 14 diverse Pacific Island Nations, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu as well as Timor Leste, up to the year 2030. The analysis included projections of changes in future climates and sea-level up to the year 2030.

The study concluded that the highest risks to water security up to the year 2030 were:

- Increased water demands due to population growth and urbanisation
- Pollution of water resources
- Saline intrusion into fresh groundwater due to over extraction
- Leakage from urban pipe systems
- Impact of natural hazards
- Poor water governance, management and monitoring
- Inadequately resourced agencies with restricted capacity
- Financially unsustainable water supply systems
- Vandalism and conflicts arising from property rights disputes between land owners and governments

Crowded urban and peri-urban locations, remote communities and low-lying areas were considered most at risk.

Strategies for reducing the above risks included:

- improving water governance
- increasing assessment and monitoring of water resources
- designing appropriate water supply systems
- improving demand management
- improving drought and flood planning
- capacity-building and training
- improving community education, awareness and participation

Both Ian White and Tony Falkland have attempted to develop practical responses to climate change in developing national water policy and implementation plans for Pacific small island countries (White and Falkland, 2010, 2011 and 2012a,b). It is anticipated that the Australian IHP committee will be involved in the Pacific Island water dilemma for many years to come.

# People's Republic of China

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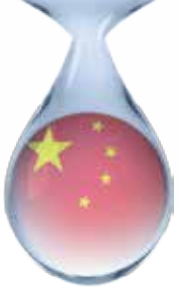
## Background

China joined IHP in 1974, and established the national committee in December 1979, which have been taking part in IHP activities involving education, technical communication and researches etc., representing the Chinese government. The national committee of China is under administrative management of the Ministry of Water Resources, coordinating between UNESCO IHP with hydrology and water resources firms of different provinces, autonomous regions and municipalities, as well as different departments and ministries in China.

The present committee is composed of 32 members from water field of China involving various institutions including different government offices such as from different levels of the ministry of water ministry (national level and provincial level), ministry of education etc., universities, research institutions etc.

During the past 30 years, IHP China national committee has been taking part in inter-governmental exchange and cooperation under UNESO IHP framework. Topics involve basic hydrology, flood management and disaster reduction, water resources management, sustainable water utilization, eco-environment protection etc. Cooperation and communication has been made through cross-cutting program with international organizations such as WMO, IAHS, as well as water institutions and organizations of foreign countries.



## Activities and case studies

IHP China has contributed hydrological development and sustainable social-economic development nationally and internationally through introducing and exchanging advanced and innovative hydrological technologies, promotes hydrological development and provide capacity building assistance to those in needs. Special efforts have been given on capacity building (e.g. IRTCE) for international trainees. In addition, through the platform of IHP national committee, technical assistance has been provided for various countries on water resources management, flood management etc. at real time operation and practices such as during the big flood in 2011 in Thailand, the big flood occurred in Myanmar this year (2015) when experts from China has been sent to the flooding area to provide technical support for flood management.

### A. Participation in international programmes and activities

Since joined UNESCO IHP in 1974, China has been the council member throughout the history of IHP except for the 2nd and the 21st when China act as observer. Chinese delegation have taken part in all inter-governmental council meetings, several members of IHP China national committee has been elected as vice chairman of the council (on the sessions of 3rd, 4th, 5th, 10th and 16th by Mr. Yan Kai, Mr. Liang Ruiju and Mr. Liu Heng (2008), in 2014, Ms. Huang Yan was elected as the chairman of the communication and outreach committee during the 23rd session of council meeting. During the council meetings, representatives from China has actively taken part in drafting committee, financial committee, and technical working groups for temporal work programmes. Activities continues after the council meeting when China established more and more technical exchange relationships with countries or organizations with joint and mutual interests and communications and exchanges happened through IHP platform which has promoted technical development for China hydrological field.

IHP China national committee has also participated in the Regional Steering Committee (RSC) of South-East Asia and Pacific Area since it was established in 1993, organized 2 times RSC meeting and international conferences in 1999 (7th) and 2009 (17th). During the RSC meeting and the associated international conferences/ symposia, China representatives joined the discussion and organizing of activities on its planning, implementation and reviewing. Under the RSC framework, China participated in various cooperation or projects, particularly contributing the "River Catalog" with detailed information and data of Chinese rivers for Vol. 1 ~ Vol. 6. Information of more than 10 rivers are selected and included in the river catalog. Meanwhile, more than 100 experts and water professionals from China have actively participated in the international conferences and symposiums with contribution of presentations and keynote speeches.

Moreover, IHP China encouraged and assisted establishing the International Sediment Initiative (ISI) to assess erosion and sediment transport to marine as well as their social, economic and environmental impacts, lake or reservoir environments. During IHP 15th session council meeting (Paris, June 2002), to deal with these sediment issues Resolution XV-8 was adopted, which has resulted the establishment of an international Steering Committee to develop the ISI

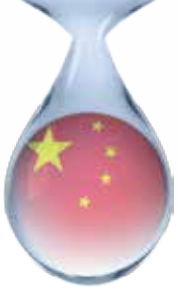
strategy along with the participation of UNESCO officials. This Steering Committee, formerly known as ISI Task Force Group, was approved and endorsed at the IHP's 16th Session of the Intergovernmental Council. The ISI's governing structure was reorganized in 2014 in order to ensure the continued efficient coordination of the initiative. Associated with which, the International Research and Training Centre on Erosion and Sedimentation (IRTCES) established in July 1984 has provided large numbers of training programs for professionals from all over the world.

**B. Participate in international projects and promote technical development**

IHP national committee of China contributed IHP development phases with various contributions: e.g. provided information and data for 2 working groups during the II phase, participated 3 working groups during the III phase/ session, and participated 7 working groups during the IV phase in which 10 Chinese experts acted as coordinators. In the V phase, among 8 themes and 31 projects, China participated 5 working groups and 2 regional working groups in Asia pacific area (RSC) involving 6 themes and 12 topics. For such work 24 Chinese water professionals took part in the work, and carried our researches and international exchanges during this phase. During the VI and VII phase, China contributed the strategic development work in the area of hydrology, water resources, sediment and eco-environmental protection. At the present it is within the VIII phase strategic development period, which is also the time for water conservancy development in China. How to balance integrated water utilization and protection of water and eco-environment needs shall be the present focus and China is willing to discuss and share experiences and knowledge regarding sustainable development through integrated planning and development of river basins and water resources.

Meanwhile, Chinese representatives also participated programmes under IHP framework such as the Flow Regimes from International Experimental and Network Data (FRIEND) programme, a regional cooperation aiming to sharing experiences and technology on water management, which was launched in 1985. Since its start with four European countries, the FRIEND programme has grown into a worldwide network of 8 regional groups, located in Europe (EURO FRIEND), the Mediterranean region (MED FRIEND), Latin American and the Caribbean (AMIGO FRIEND), Southern Africa (SA FRIEND), West and Central Africa (AOC FRIEND), Asian Pacific (AP FRIEND), the Hindu-Kush Himalayas including Central Asia (HKH FRIEND), and the Nile (NF). In 2010 162 countries from around the world are participating in the programme. China participated in the AP FRIEND and the HKH FRIEND. Professionals form operational agencies, universities and research institutes participated in the FRIEND work. IHP China participated in the cooperation and projects lunched/identified in AP and HKH FRIEND, particularly on sharing with Chinese technology and experiences, such as conducting joint researches on "flood forecasting technology", "methodology on design floods" etc. Representative of China has been acting as the coordinator of HKH-FRIEND since 2007.

Moreover, IHP China cooperated with various cross-cutting programmes such as HELP, JIIHP etc.



**C. Share water knowledge and experiences and promote international innovations**

At the beginning of the IHP phases, in order to introduce implementation of IHP in China as well as to spread research outcomes, HP national committee of China published "IHP actions", translated IHP newsletters, IHP science and technology issues and distributed to organizations and institutions in China and other Asian countries. The publications include:

- "IHP information" (IHP-Waterway), 4 issues each year, 200 copies each issue;
- "IHP publications documents" (vol. 1, Vol. 2), which collected papers, documents, books and abstracts of IHP publications since 1970s;
- Translate and edited "guideline of water and sustainable development, policy and principles" providing technical references for water resources professionals in China;
- Organized translation and editing of "international hydrological terminology", "water resources assessment – bullet of assessment of state capacity";
- In 2010, translated "Hydrometry" (by Wubbo Boiten).

The secretary of IHP China national committee act as coordinators, communicate withal relevant parties including organizations, individuals, interesting groups etc., for information and technical cooperation and exchange. With its assistance, each 2 years regular talks have been made between IHP China national committee and national committee of different countries world-widely. For instance, through the help and assistance of IHP national committee of China and USA, USACE, USGS and China river basin authorizes (e.g. Changjiang River Commission) has established regular communication and exchange channel, which has in fact trained quite a few Chinese engineers on hydrological work, in 2009 and 2010. Such training program has introduced different and innovative concepts in hydrological monitoring technology and methodology which has largely helped the monitoring optimization work in Changjiang River during the past few years.

Furthermore, in order to promote IHP and distribute information and outcomes from IHP work, a website of IHP national committee (www.chinaihp.org) was developed. The website published IHP information and newsletters, and provide discussion platform for water professionals for communication and exchange world-widely. The website is linked with major water webs of China, from which access to water achievements and activates of China is available.

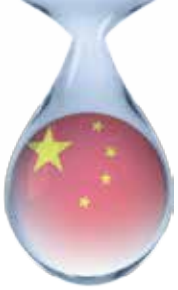
**D. Organize international / national conferences and workshops**

To promote and encourage international, supported by UNESCO IHP and water organizations in China, IHP national committee or members of the committee have organized various international conferences, workshops and symposia on hydrology and water resources. The most important conferences and workshops from 1990s are:

- June 2014, International Conference on Desalination and Water Reuse was held in Qingdao, Shandong province, China.

- June 2014, the 2nd Hydrology, Ocean and Atmosphere Conference (HOAC 2014) was held in Beijing, China.
- September 2012, the 5th International Yellow River Forum was hold in Zhengzhou city, China.
- November, 2011, Ministerial Seminar on Water Resources and Small Hydropower for Developing Countries was held in Hangzhou, Zhejiang Province.
- April 2011, the 4th Yangtze Forum was held in Nanjing, in which, IHP national committee jointly organized the sub-forum of climate change and water resources management in Nanjing, China.
- November 2009, the international conference of "hydrology and disaster management" and the 17th Regional Steering Committee (RSC) of Asia-Pacific area was held in Wuhan, China.
- April 2009, in the 3rd Yangtze Forum, IHP national committee jointly organized the sub-forum of "climate change and urban water security" in Shanghai, China.
- March 2008, jointly organized with Hong Kong University the international conference of water resources management innovative in Hong Kong,
- November 2007, Organized international Symposium on Ecological Effects of Water Resources and Hydropower Engineering.
- October 1999, organized "international symposium of floods and droughts" and the 7th meeting of Regional Steering Committee (RSC) of south-east Asia-pacific area. 160 professionals (45 non-Chinese) participated the symposium. 130 papers were collected and a proceedings was published by Hehai university, Nanjing.
- June 1998, organized "symposium on water quality and quantity for Sustainable Development of China" in Wuhan. 112 professional (31 non-Chinese) participated the symposium.
- July 1996, Organized Symposium on Urban Hydrology of South-east Asia in Shanghai. 55 Chinese and 11 international participants took part in the symposium. The proceedings were collected and published by Hehai University publishing house.
- September 1994, organized international colloquium on Arid and semiarid areas of flood in Xian China. 71 Chinese professionals and 9 international experts participated the colloquium, 55 papers were published in the proceedings.
- Nov 1993, organized International Symposium on tropical storms and floods in East and South Asia, in Guangzhou city. 59 Chinese professionals and 13 international experts participated in the symposium. 58 papers were collected and a proceedings was published.

In general, through organizing or jointly organizing international conference/ symposiums/workshops, IHP China has contributed technical development and application in water field, covering



the water issues of floods, droughts, water management, water quality and environment/eco-system safety, for sustainable social-economic development world-widely.

**E. Provide training course at national and international level**

To contribute for the hydrology and water resources field internationally particularly to support technical development of the developing countries and regions, sponsored by UNESOC IHP, IHP china national committee and Hehai University (one of the top water education university in China) jointly held 6 times high level training courses, in total 127 young water professionals received training program from this classes. In additional, in 1998, during the 12th inter-governmental council meeting of IHP, a resolution was adopted on establishing "Water resources and environment training center of UNESCO IHP" in Nanjing. In 1998 and 2000, there were 8 and 6, respectively, participants from developing countries jointed the training center and took master programs. In recent years, under the cooperation framework with UNESCO-IHE, young students studied in Hehai university took "sandwich" master training program in Hehai university and UNESCO-IHE. Meanwhile, with the application of innovative become broader and consultant services has been widely provided by Chinese companies, technology on flood forecasting, water resources planning etc., has become hot topic for developing countries and regions to take. In 2011, Changjiang River Commission provided particular training program on "flood forecasting technology and its application in reservoir operation and water resources management" has been provided for participants from Mekong river countries; in 2014, organized by Changjiang institute of survey planning design and research, a one-year training program was given by Wuhan University for 21 participants from Ecuador, the topics were on water resources and master planning of river basins, as well as river management. Members of IHP national committee of China usually were the main lecturers for those training courses, who also provide short courses organized by IHP related programmes in other countries. For instance, July 2010, Dr. Yan Huang, supported by IHP China national committee, provided short training course on flood forecasting and flood management technology for UNESCO IHE Alumina in Katmandu, Nepal. The short course was organized by UNESCO IHE, nearly 20 IHE alumina from the Asian Pacific region participated in the course.

It should be particularly noted that the International Research and Training Centre on Erosion and Sedimentation (IRTCES) established in July 1984, which is dedicated for providing training courses, has trained hundreds of professionals from all over the world on sediment and water issues.

Meanwhile, not only providing training courses for international trainees, IHP China national committee also selected excellent Chinese young water professionals to participate in international training courses. In the past decades, most of the Chinese participants were sponsored by organizers. At the present, as the international programmes do not consider China as developing country, funds are in general no longer

available for Chinese participants or applicants. But this has not prevent Chinese young scientists or engineers or water professionals from going for high or better education or practices. Most training programs are sponsored by offices or government of China. Thus, during recent years, about 3~5 young scientists can go abroad for high education on water sponsored by Chinese government.

At present, with the widely accepted distant learning technology and methodology, more training courser are provided online. IHP China national committee distribute and encourage young Chinese scientists, researchers and engineers to receive online-courses and to express their views and to discuss via internet platforms.

IHP China national committee paid continuous attention on providing regular training courses for Chinese participants on particular water subjects, the following shows some examples during the past few years.

- April, 2013, training course on satellite communication for hydrology, Suzhou city, Jiangsu province, China.
- 1 March ~ 8 June, 2013, special training course to support the hydrological development on Western China, Yangzhou University, China.
- September 2013, training course on implementation of national regulation of groundwater monitoring and application of instruments, Chengdu, China.
- 23-27 September, 2012, training course on Urban Flood Risk Management, Guangzhou.
- 29 Feb ~ 2 March, 2012, training course on "Integrated water resources and river basin management" between China and France, Tianjing.

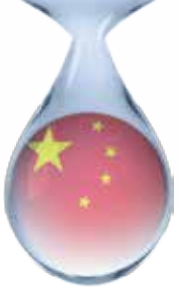
## Future Challenges

### A. Summary

Through more than 30 years, IHP China national committee has made great efforts in sustain the international communication and cooperation on water field. In summary, China national committee of IHP has contributed greatly hydrological development and application hence sustaining the social-economic development nationally and internationally, with its dedication and diligent efforts and continuous work through generations. With the committee, although it is a loose origination, it has gathered the most excellent water professionals in China, and has the communication channel with international professionals and keep up with the innovations world-widely, thus has brought in and introduced out practical water knowledge and technology for China and for the rest of the world. It is of significant importance for IHP China national committee to continue such momentum with appropriate capacity including people and resources, subject to a dedicated policy which is however on its way of improving and development.

The IHP national committee of China is planning to:

- Continue participating in IHP work with in-depth participation at management level and technical cooperation areas, through training excellent professionals, creating them with opportunities of international



cooperation and exchange. With the national committee as the platform, it can coordinate and bring young professionals together to continue contributing to IHP work.

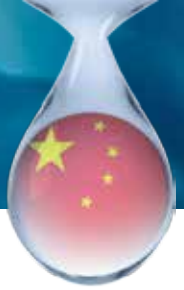
- Provide technical support for government work and inter-department water projects. Most committee members are from different ministries including water ministry, national resources ministry, education ministry, Chinese Academy of Science etc., there are multiple departments involving multiple disciplines. Integrate multiple-disciplines is becoming more and more important in research programmes, educational programmes and technical development projects. As many members are from those departments who are generally well recognized by its field, it is rather effective for the committee to coordinate and cooperate through IHP platform or framework.

- Promote communication and outreach for IHP work. It is become a concern that although IHP has made great efforts in assisting sustainable development through all types of cooperation and coordination in the field of water which is essential to human life, the importance of IHP receives inadequate attention and recognition from public. China national committee, as one member is the chairperson of the IHP committee of Communication and Outreach, shall promote largely the outcomes and IHP, including improving the website with better and attractive interface, printing out publications and increasing exchange of visits to other countries etc., to increase awareness of publics to the IHP and its activities and achievements.

- Calls for more support to IHP work. Participation of IHP work is government actions. However, support from governmental offices and non-government institutes are considered insufficient. Advices and suggestions shall be given to the competent authorities requiring more support so that IHP China national committee can better represent the country to complete the related tasks. The first task is to adjust the members of committee by including more young fresh bloods to provide more energy and activities to the IHP work at national level and international level.

- Develop work plan regarding the implementation of the VIII phase strategic development plan for the coming 8 years.

  - In general, no funds are allocated for IHP work or the implementation of IHP-VIII phase strategic plan. Without funds it is impossible to carry out effective or efficient steps. It is proposed to identify important work area / field / topics by the secretary and the committee members shall joint together to form task forces and carry out relevant researches and work associated with their interested topics. The secretary shall receive progress report from the task forces regularly so that suggestions, newsletters and publications can be distributed for all members and water firms in China.



- In addition, cooperation and coordination with other international programmes shall be as well considered, for instance, cooperation with IAHS. In the new decade of plan, IAHS has launched "PantaRhei" program and set up different working groups for the implementation of such plan. Mr. Xia Jun, member of IHP national committee, is the chairman of the working group in China. Various concepts and components of IHP VIII phase and PatanRhei are in common. Thus, working group of IAHS PantaRhei and IHP-VIII phase shall joint together and make use of each other's data, information and results.

**B. Challenges**

In the past, IHP national committee has been encourage and support members to carry out activities individually, at the same time keep the committee noted. The secretary is mainly responsible for communication, coordination and promotion, keep connection with international organizations and platforms. Such working mechanism can maintain the "normal run" of the IHP national committee, however, it is far from being adequate to play the role of China in IHP work, giving the new challenges arisen in the new situation. Therefore, it is necessary to explore the mechanisms and seeking for action to cope with the new situation.

The first challenge is funds. Financial support is always essential to sustain IHP work or any other work in general. In the past, when individuals carried out their work they were self-supported or with a little seeds money from the ministry. At the present, such financial situation is no longer sustainable due to the economic crisis as well as the cost for traveling and participation has largely increased during the past decade. Without funds it is rather difficult to maintain work momentum, not mention to involve more young people or to make IHP work attractive. Thus, to obtain continuous and regular sufficient funds to support IHP work is the challenge that IHP national committee shall overcome at the present. Such issues have been discussed and has been gradually receiving attention from the management level, i.e. the ministry level. However, challenge is also comes from how to make IHP work attractive towards government officers not only researchers or scientists.

The second challenge is manpower. At the present, IHP china national committee is in short of professionals with sufficient qualification, i.e. strong professional background and communication skills (including language capability), especially young people. The short of funds also reduces its attractiveness to young Chinese who are in such development speed more seeking for quick results. This is becoming the greatest constraints for the development of IHP in China. Without serving for Chinese water development at national level, it is rather difficult to bring contributions world-widely. Thus, again, it is urgent needs to increase funds from the government budget and to encourage and send young people out for better communication and cooperation opportunities.

The third but not the last challenge is that, IHP itself has been attractive during the past decades when exchanges and communication activities are limited, however, with the development and use of Internet, there are more channels for communication and cooperation outside of IHP and more at bilateral levels, IHP seems is losing its advantage on communication and cooperation. It might be the time for IHP to reconsider its role and its work manner from top, and national committee in China and other countries shall change its way of work accordingly.

# Indonesia

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## Introduction

Water is the source of all lives on Earth and is a resource that is indispensable for our social and economic activities. Water is our most valuable natural resource. The availability and quality of fresh water not only affect human health and wellbeing, but also the functioning of essential ecosystems, including rivers, wetlands, lakes and coastal ecosystems. Without sound water resources management, human activities can upset the delicate balance between water resources and environmental sustainability. Climate change and anthropogenic activities are believed to have a multitude of immediate and long-term impacts on water resources in Asia-Pacific countries. These include flooding, drought, sea-level rise in estuaries, drying up of rivers, poor water quality in surface and groundwater systems, precipitation and evapotranspiration pattern distortions. These effects, when combined, have devastating impacts on ecosystems and communities, ranging from economic and social impacts to health and food insecurity, all of which threaten the continued existence of many regions in Asia and the Pacific.

Water-related disaster/problem vulnerability varies according to individual countries, geographical positioning and the capacity to mitigate or adapt to the changes. Coping, adapting and building the resilience capacities of Asia-Pacific countries towards the impacts of climate change and human activities on water resources requires a holistic approach, involving systems thinking and risk management strategies. In addition, the solutions for the policy basis of water resources management should be able to take urgent action to utilize science, technology and innovation, local wisdom (culture), and policies relevant to water audit and management for a major crisis in the water security sector to be averted.

Indonesia's National Committee for the IHP was established in the period of 1975 – 1980. Indonesia IHP supports activities related to: synthesizing information and accounting for knowledge gaps to address issues related to critical water environment systems; promoting the understanding of concepts and systems; and enhancing knowledge regarding tools and technologies for past experiences and on-going research projects related to terrestrial ecosystems processes, water issues in landscapes, rivers, floodplains, wetlands, reservoirs, and coastal and urban areas.

The purpose of the establishment of the IHP National Committee is reflected in the tasks as follows:

1. To foster, encourage and coordinate research activities concerning water issues conducted by various agencies.
2. To establish a national programme in hydrology research to support national development in line with the UNESCO IHP.
3. To act as an advisory body to the Indonesian Institute of Sciences in matters related to research topics on water issues.
4. To act as the National Committee in facilitating relationships and cooperation with international agencies in the field of water issues, in particular with the UNESCO IHP.
5. To act as an information centre for activities and research outcomes related to water issues in Indonesia.

In order to support the IHP Phase VIII programmes, the Indonesian National Committee for IHP has revitalised its management structure. The IHP Chairman will be assisted by five deputy chairmen who oversee the five main themes listed in the programmes of the IHP Phase VIII. The new Indonesian National Committee structure for IHP is shown in figure 1.

The five themes and working groups are:

- **THEME 1/WORKING GROUP I :**
  WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE : Ministry of Public Works and Housing
- **THEME 2/WORKING GROUP II :**
  GROUNDWATER IN A CHANGING ENVIRONMENT : Ministry of Energy and Mineral Resources
- **THEME 3/WORKING GROUP III :**
  ADDRESSING WATER SCARCITY AND QUALITY : Ministry of Environment and Forestry
- **THEME 4/WORKING GROUP II:**
  WATER AND HUMAN SETTLEMENTS OF THE FUTURE : Ministry of Public Works and Housing
- **THEME 5/WORKING GROUP IV:**
  ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD : APCE-UNESCO LIPI
- **THEME 6/WORKING GROUP V:**
  WATER EDUCATION, KEY FOR WATER SECURITY : Ministry of Education and Culture (KNIU)

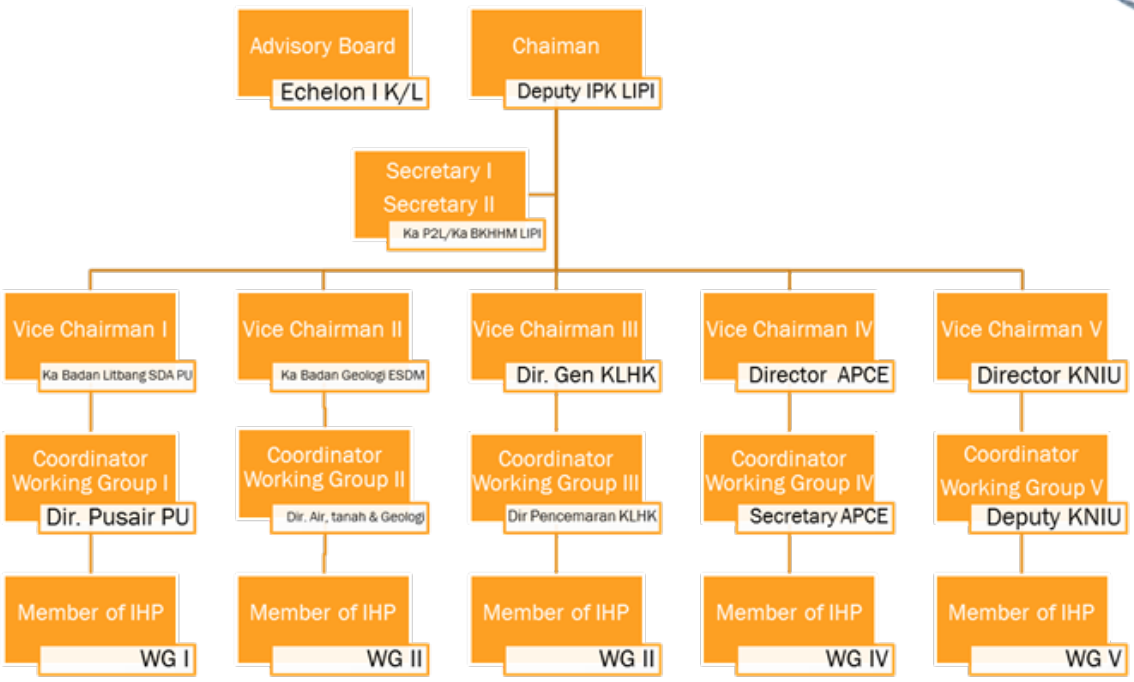


*Figure 6.3.1 Currently the Chairman of Indonesia National Committee of IHP is Dr. Ir. Zainal Arifin. Figure ©IHP Indonesia*

## Recent Activities

Many activities have already taken place in the last five years:

- **2011:** In this year, Indonesia IHP participated in the project of SWITCH in ASIA (collaboration with UNESCO Jakarta Office and RC Limnology LIPI); World Water Day celebration (collaboration with UNESCO Jakarta Office and RC Limnology LIPI); National Seminar on Ecohydrology (collaboration with RC Limnology).
- **2012:** Indonesia IHP supported the Designing of APCE Building and attended to several meetings for: Public Communication related to Demosite in the Saguling Reservoir area, West Java; preparing the WLC in Indonesia with ILEC in Kyoto; Public Awareness of water resources management in Islamic Boarding School in Ciamis, West Java; 20th RSC IHP AP in Langkawi, Malaysia.
- **2013:** Indonesia IHP as co-host with APCE-UNESCO for IFAS Training Course in collaboration with ICHARM and UNESCO Jakarta Office; public awareness of water resources management in Islamic Boarding School in Ciamis, West Java; attended 21st RSC IHP AP in Daegu, Korea; assisted APCE Building construction; supported APCE-UNESCO in contributing article in UNESCO's Free Flow Publication.
- **2014:** Indonesia IHP supported the Training Workshop on Lake Management hosted by APCE-UNESCO in collaboration with ILEC Japan, Public Communication for DemoSite in Saguling Reservoir, West Java); attended IHP Council Meeting in UNESCO, Paris: invited as Keynote Speaker for International Symposium on Landscape in Canberra; attended WLC 15 in Perugia; served as host for 22nd RSC IHP AP and Ecohydrology Training Course, and International Conference on Ecohydrology (ICE 2014), in Yogyakarta, Indonesia; attended the Meeting for Water Diplomacy in Koblenz, Germany.

- **2015:** Indonesia IHP actively supported the preparation of the 16th World Lakes Conference to be hosted by Indonesia in 2016. And also contributing to the National Celebration of World Water Days. Indonesia IHP contributed to the 7th World Water Forum 2015, held in Daegu/Gyeongbuk, Rep. of Korea in, April 2015; Indonesia IHP committee has also supported research activities for APCE-UNESCO in collaboration with the UNESCO Jakarta Office

## Next Activities

In the new phase of IHP, Indonesia IHP National Committee will actively engage by planning, coordinating and collaborating with regard to the International Hydrologycal Programmeby:

- Getting more support from the Government (Relationship, Institutionally, Financially)
- Strengthening the networking with the centre under UNESCO, universities, and other institutions
- Developing demosites in selected area with specific purpose: Small Island Demosites, Karstic, Ecohydrolody Demosite, Peatland Ecohydrology Demosite
- Promoting research and activities related to:
  - sustainable water management for developing resilient cities
  - Ecohydrology for water security in urban and rural areas
  - development of appropriate technologies for water security in marginal areas
  - strengthening water management capacity for local communities

## Recorded Activities

*Figure 6.3.2 Opening Ceremony of ICE 2014. Photo ©IHP Indonesia*

*Figure 6.3.3 Best practice encouragement by capacity-building of community leaders. Photo ©IHP Indonesia*


*Figure 6.3.4 IHP Training Course Lectures and Participants in Yogyakarta – Indonesia. Photo ©IHP Indonesia*

*Figure 6.3.5 22th RSC Meeting of IHP Asia and the Pacific, Yogyakarta – Indonesia. Photo ©IHP Indonesia*

# Japan

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Japan's contribution to hydrological sciences in the UNESCO framework dates back 50 years to the International Hydrological Decade (1965-1974). Since that time urbanised areas have rapidly expanded as a result of which Japan's contribution has help to reduce flood damage and solve water resource problems which have become important national and regional issues. IHD was the catalyst for providing various observational studies in experimental basins. The result of improved understanding of hydrological processes and the progress made in terms of hydrological observation, modelling and prediction have both contributed greatly to a reduction in water-related disasters and led to well-managed water resources and environment.

Japan has been very active as a member of the Intergovernmental Council of the IHP, and significantly involved in regional and international water science issues. One of the important Japanese contributions has been the foundation of the Regional Steering Committee (RSC) for IHP in Southeast Asia and the Pacific (SEAP). The RSC was originally established in July 1993 in Manila. Since then it has held annual meetings to exchange experiences, discuss problems and solutions and promote scientific cooperation, exemplified by the publication of the Catalogue of Rivers for Southeast Asia and the Pacific Volumes 1 to 6, as well as Asian Pacific FRIEND programme.

In addition to active participation in the RSC for SEAP, the Japanese National Committee supports various national scientific and educational projects on hydrology and water resources in line with IHP-VIII. Since 1991, it has also organised the annual IHP Training Course (TC) in association with Nagoya University, Kyoto University and other related universities and institutes.

Climate change influences the hydrological cycle, causing serious impacts on ecosystems and water resources, as well as water-related disasters. To address these issues, advanced hydrological knowledge and the ability to make accurate predictions become more important. The Japanese National Committee, in cooperation with IHP RSC in SEAP, seeks to promote scientific and technological activities with the aim of sustainable water resource development, preservation of ecosystems, and building disaster resilient societies in the context of a changing climate.

- **IHP-Japan home page:**
  http://hywr.kuciv.kyoto-u.ac.jp/ihp/japan/
- **IHP RSC for Southeast Asia and the Pacific:**
  http://hywr.kuciv.kyoto-u.ac.jp/ihp/rsc/
- **IHP Nagoya/Kyoto Training Course:**
  http://www.hyarc.nagoya-u.ac.jp/japanese/02activity/ihp/

## IHP Training Course in Nagoya University and Kyoto University

Joji ISHIZAKA

Hydrospheric Atmospheric Research Center (HyARC), Nagoya University

The IHP training course was started by Hydrospheric Atmospheric Research Centre (HyARC; the former Institute for Hydrospheric-Atmospheric Sciences, IHAS) and the Nagoya University since 1991 and from 2009 onwards, it has been held by Disaster Prevention Research Institute (DPRI), Kyoto University, and HyARC every other year. This training course is supported by the Japanese trust fund to UNESCO Jakarta office. Every year, 5-10 trainees are invited to Japan from mostly Asian-Pacific countries and trained in hydrology related subjects over the course of two weeks via lectures, hands-on training sessions and a field trip. We select various topics for each year, such as forest hydrology, river basin management, remote sensing, ground water, and so on. More than 170 people have been trained in the last 24 years, and many of them are now working as experts of related fields in their countries. The contents are published as text books, and recently the lectures have also been provided through TV conference systems and/or the internet. Recent information is available in the following web site.

http://www.hyarc.nagoya-u.ac.jp/japanese/02activity/ihp/index.html

This is a great opportunity for sharing information, including scientific knowledge and skills and hydrological problems and solutions, among the scientists and managers in the Asian-Pacific region. It is also valuable to build a human network among the communities. Both Nagoya University and Kyoto University are willing to continue this activity with the support of the UNESCO Jakarta office and of the Ministry of Education, Culture, Sport, Science and Technology (MEXT), Japan.

### History of IHP Training Courses (1991-2015)

1. General Hydrology, 1991
2. General Hydrology, 1992
3. General Hydrology, 1993
4. General Hydrology, 1994
5. River Control and Management, etc. 1994 and 1995
6. General Hydrology, August 1996
7. Snow Hydrology, March 1998
8. Remote Sensing, March 1999
9. Limnology, July-August 1999
10. Hydrology related to Head Water Management, 2000
11. Hydrogen and Oxygen Isotopes in Hydrology, 2001
12. Precipitation and Water Resources, 2002
13. Effects of Pollutants on Atmospheric Environment, 2004
14. Hydrology in Asia, 2004
15. Water and Carbon Cycles in Terrestrial Ecosystems, 2006
16. Oceanography Basics, 2006
17. Numerical Prediction of High-Impact Water Systems, 2007.
18. Satellite Remote Sensing of Atmospheric Constituents, 2008
19. Water Resources and Water-Related Disasters under Climate Change, 2009
20. Groundwater as a key for adaptation to changing climate and society, 2010
21. Introduction to River Basin Environment Assessment under Climate Change, 2011
22. Precipitation Measurement from Space and its Applications, 2012
23. Ecohydrology for River Basin Management under Climate Change, 2013
24. Forest Hydrology-Conservation of Forest, Soil, and Water Resources, 2014
25. Risk Management of Water-related Disasters under Changing Climate, 2015

## Short Memory of IHD-IHP in Japan

Takeo KINOSITA

1. In 1965, when the IHD started, it was not well known and rather misunderstood.
2. Professor Koichi Aki clearly stressed that IHD was important, because lack of water would induce poverty in 21st century, and that reliable hydrological data should be collected for the IHD project for future evaluation of water resources.
3. When IHD was informed to Japan, the execution of the project was discussed. It was established that it consisted of two aspects: administrative and academic, under the National Committee of UNESCO. The former was carried out by the STA Bureau of Natural Resources and the latter by the Science Council of Japan. The author was working as a staff of the Bureau and was later appointed as a member of Hydrological Committee of the Council.
4. IHD advised the study of experimental basins to make clear the elementary processes. Since the 1930s, the experimental basins were managed by forest scientists in Japan. According to IHP the author and others proposed to make a summary of the experimental basins in Japan. In 1985, a booklet was compiled, in which 115 experimental basins were listed with purpose, location, organization, observation, period and other information. Basins for river hydrology were mostly $1km^2$-$10km^2$, while forest hydrology 10ha-$1km^2$.
5. The Government of Japan organised the IHD Roving Mission to Indonesia, Malaysia, Thailand, Taiwan and Korea to help IHD activities. The experimental basins, hydrometry, groundwater prospecting and others were discussed. The author was a member of the mission.
6. Since around 1965, every city faced a population explosion. Flood damage increased. In order to make clear the mechanism, the author made an experimental basin in Syakuzii River in the northern part of Tokyo and analysed the data obtained. Both impervious area increasing in the urban area and marsh area decreasing were main reasons for the flood intensification. The report is printed "Change of Runoff due to Urbanization, Takeo Kinosita et al. UNESCO International Symposium held in Leningrad 1967."
7. In the past 50 years, HIP-IHD contributed to human development through upgrading knowledge of water. In the coming 50 years IHP will contribute to world peace through the fair distribution of water resources.

# Congratulations for the 50th Anniversary of IHD/IHP

My life-long engagement in hydrology has always been with the IHD/IHP. I congratulate it for its 50th anniversary and appreciate that my great fortune has been a part of it for such a long time.

My first visit to UNESCO was in 1974 together with Professor Hideo Kikkawa on the occasion of his service to the IHD as a co-editor of World Catalogue of Very Large Floods. I have been involved in IHP in one way or another ever since.

In 1992, when Professor Yutaka Takahasi was elected as vice-president of the IHP Inter-Governmental Council, I took part in establishing the Regional Steering Committee for Southeast Asia and the Pacific (RSC) and served as its Secretary in 1993-99. In this region, there was virtually no communication lobby of hydrologists before then. Since its first meeting in Manila, 1993, the RSC has been meeting every year with a research symposium rotating among different nations. Now the region is one of the most active regions in the world of IHP.

In 1998, I was elected as the Chairperson of the IHP Inter-Governmental Council, serving until 2000. It was a splendid memory to discuss the establishment of various UNESCO Water Centres under the strong leadership of Andras Szollosi-Nagy, Director of Water Sciences Division supported by IHP member countries. There are now over 25 water centres.

From 2006 to 2014, I served as the founding director of International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of UNESCO. It was truly a rewarding experience to work closely with many IHP and other water and disaster management partners through research, capacity development and information networking.

I had the privilege of serving both for the IHP and IAHS as the Chair and the President and promoted mutual collaboration which had been a tradition since the birth of IHD. Water is now central in global sustainability issues. The role of IHP is increasing as a driver and an integrator of all water sciences. I trust there will be another successful half a century for the IHP.

**Kuniyoshi TAKEUCHI**
*International Centre for Water Hazard and Risk Management (ICHARM)*

# Republic of Korea

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Life on this planet has evolved around the availability, movement, and quality of water. Like every other living being on this planet, water is essential for human survival. However, this fatal element has now been challenged and found to be untenable. In recent years the availability of and access to freshwater have been highlighted as the most critical natural resource issues facing the world. It is generally believed that global water shortage represents a full-scale emergency, where the global water cycle seems unlikely to be able to adapt to the demands that will be made of it in the coming decades. Therefore, over the next 25 years, one-third of the world's population will experience severe water scarcity as well as water-related disasters by extreme hydrologic events, and then water resources will become a limiting factor and its management increasingly complex task.

To cope with these global water challenges, the IHP Water Programmes in 1975, after the termination of its preceding water programme in 1974 -initiated in 1965 as the UNESCO intergovernmental programme of the UN system- devoted to the scientific study of the hydrological cycle and to formulating strategies and policies for the sustainable management of water resources. The programme is implemented in phases of six years, in order to remain prompt in identifying new, emerging problems, alerting decision makers, raising public awareness and providing the necessary resources to respond with action. This IHP is a multidisciplinary programme at the forefront of assuming all global water challenges and governed by its Intergovernmental Council with strong support and participation of IHP National Committees, UNESCO water-related centres and chairs.

The Republic of Korea in an active participant in the programme, whereby appointing within its Ministry of Construction (presently, Ministry of Land, Infrastructure and Transport) an IHD National Committee (later known as the IHP National Committee). The IHD National Committee undertook pioneer hydrologic surveys of selected representative basins in three major river systems during the programme period, and embarked in 1975 on a six-year International Hydrological Programme (IHP) project as the first step towards an extension of surveys of domestic river basins in order to fulfil its responsibilities in the world's consolidated efforts to cope with the water problem.

After the completion of the first phase of IHP in 1980, followed by the second phase of IHP project (1981-1983), the third phase of IHP project (1984-1989), the fourth phase of IHP project (1990-1995), the fifth phase of IHP project (1996-2001), the sixth phase of IHP project (2002-2007), the seventh phase of IHP project (2008-2013) and eighth phase of IHP project (2014-2021), for the continuation of representative basin studies, the adoption of new techniques of water resources development and management, the hydrological evaluation of urbanization and variations of watershed, including sustainable development in a changing environment, hydrology and water resources development in a vulnerable environment, water interactions of systems at risk and social challenges and water dependencies of systems under stress and societal responses, and water security

with responses to local, regional and global challenges.

Since the beginning of the New Millennium, the Republic of Korea IHP National Committee was reorganised and strengthened to fulfil the IHP activities more effectively and actively. Particularly, the Republic of Korea IHP National Committee has been reorganised to include more members from various water organizations in Korea under the supplement of the legal background from the beginning of 2011. All members of the Committee were from every part of water-related organizations in the country and executive functions are carried out within the Water Resources Bureau, Ministry of Land, Infrastructure and Transport.

The activities of UNESCO's IHD and IHP Programmes in the Republic of Korea began with the representative experimental river basins operation. During the IHD period, the representative experimental river basins were Kyungan river (in the Han river basin), Sin river (in the Nakdong river basin), and Moosim river (in the Keum river basin), and then changed to new river basins with newly equipped hydrologic gaging stations from the beginning of the IHP programme in 1975, respectively. Those selected basins were the Pyungchang river (in the Han River basin), Wicheon stream (in the Nakdong river basin), and Bochung-cheon stream (in the Keum river basin) from 1982 to 2007 (Figure 1). Cheongmi River (in the Han River basin) and Daedong River (in the Keum river basin) watersheds have been introduced as new test basins from 2008, when the seventh phase of IHP (2008-2013) began. And the hydrologic data such as rainfall, evaporation, river stage, groundwater table, discharge, and suspended load have been observed in the aforementioned basins.

Throughout the phases of IHP programmes, research outputs of the Republic of Korea IHP National Committee have contributed significant, useful conclusions not only for domestic water resources management, but also solutions to global water problems and sustainable management. Comprehensive efforts have been made by the Republic of Korea IHP National Committee to achieve the goals prepared by IHP from phase I through phase VIII. Researches have been performed for the topics carefully selected by the committee in order to conform to the themes for the phases in the following IHP Programmes;

- 1965-1974: IHD (Experimental Basins, World Water Balance and Water Resources of the Earth)
- 1975-1980: IHP-I / 1981-1983: IHP-II (Interim phase) / 1984-1989 : IHP-III
- 1990-1995: IHP-IV (Hydrology and Water Resources for Sustainable Development)
- 1996-2001: IHP-V (Hydrology and Water Resources under Vulnerable Environment)
- 2002-2007: IHP-VI (Water Interactions: Systems at Risk and Social Challenges)
- 2008-2013: IHP-VII (Water Dependencies: Systems under Stress and Societal Responses)
- 2014-2021: IHP-VIII (Water Security: Response to Local, Regional and Global Challenges).

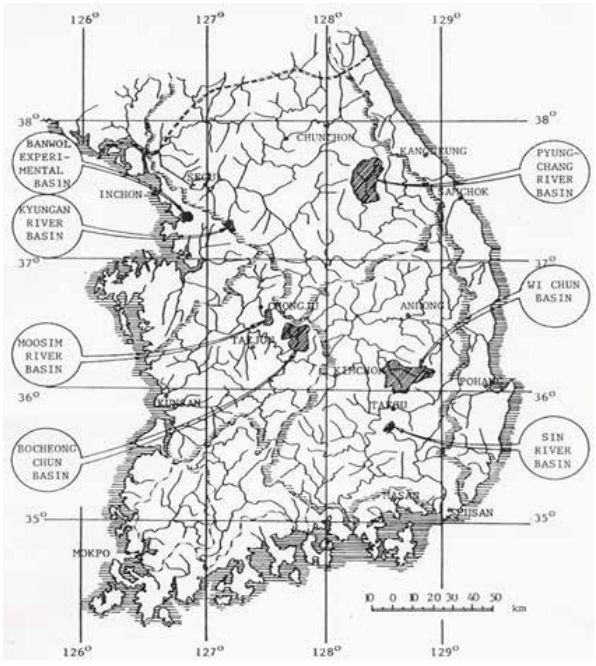


*Figure 6.5.1 Representative and Experimental River Basins in Korea.*
*Figure ©IHP Republic of Korea*

The Republic of Korea IHP National Committee played a key role in establishing the UNESCO IHP Regional Steering Committee in Southeast Asia and the Pacific (RSC-SEAP) and has actively participated in and contributed to its joint research activities such as Catalogue of Rivers, Asia Pacific FRIEND (APFRIEND) and Asia Pacific HELP (AP HELP), and annual RSC meetings like the following:

Catalogue of Rivers: Republic of Korea rivers hydrological data and information were contributed through Vol. I~Vol. V

**AP FRIEND**

ENDEND. V of Korea rivers hydrological data and information were contributed through Vol. I~I~ch as Catalogue of Rivers, Asia Pacific FRIEND (APFRIEND) and Asia Pacific "Discrimination of Hydrologic Zones and Rainfall Runoff Characteristics in Southeast Asia and the Pacific River Basins"

**AP HELP**

Korea HELP river basin (Geumho River Basin) has been operating and its 5-years research projects have been executed with international joint studies with the UNESCO in the process of these studies, and several international conferences and meetings have been organised.

**RSC Meetings**

Hosted the RSC meetings in 1998 in Daegu City and again in 2013 in Gyeongju City in Korea. This 21st RSC meeting in 2013 was held along with the Nakdong River International Water Week and Gyeongju International Water Forum (Na-Ri IWW/IWF 2013).

The Republic of Korea IHP National Committee served and has been serving as a member state of the IHP Intergovernmental Council since 2004, and its Chairman, Professor Soontak LEE, was elected as the Chairperson of the Intergovernmental Council and the IHP Bureau at the 19th Intergovernmental Council and served four years as a IHP Bureau member, including two years as Chairperson and another two years as Ex-officio Vice-chair for the Region-IV (Asia Pacific). During his Chairperson period, he initiated and finalized the formulation of IHP-VIII (2014-2021) Strategic Plan as "Water Security: Responses to Local, Regional and Global Challenges." He also contributed to establishing the IHP Regional Steering Committee (RSC) in Southeast Asia and the Pacific and served as its 3rd Chairman in 1998-2000. Furthermore, he arranged and contributed to more involvement of the IHP Communities in the processes and activities of the 7th World Water Forum which is held in Daegu-Gyeongbuk, Republic of Korea on 12-17 April, 2015 as a Co-chair of International Steering Committee of the 7th World Water Forum.

In conclusion, the Republic of Korea IHP National Committee will continue its active participation and contribution to the global IHP activities more actively than the past previous 50 years and would like to express our sincere congratulations for the 50th anniversary of the UNESCO Water Programmes of IHD and IHP together with our IHP RSC family members.

# Malaysia

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1. The Malaysia International Hydrological Programme (MIHP) has the same objective as most other National Programme Committees and focuses on scientific cooperative programmes in water research, water resources management and water-related educational programme. MIHP's primary objectives are:

    - to act as a Member States for IHP
    - to improve water resources management
    - to act as a catalyst to stimulate cooperation and dialogue in water science and management
    - to promote sustainable development through integrated water resources management
    - to serve as a platform for increasing awareness of global water issues.

2. The National Committee is currently chaired by Dato' Ir. Zainor Rahim Ibrahim, the Director-General of the Department of Irrigation and Drainage (DID), Malaysia. The chairman is assisted by the Honourable Secretary, four permanent executive committee members and another four non-permanent executive member. IHP Malaysia is also supported by three (3) working committees on research, education, training and public information and standardization of hydrological practices. MIHP has a secretariat office at DID Malaysia with two officers fully seconded by DID to oversee the day to day operation of all its programmes and activities. MIHP currently has 40 members from various ministries, departments, research institutions, universities and private entities.

3. Its permanent executive committee (EXCO) is comprised of the Department of Irrigation and Drainage Malaysia (DID), the UNESCO-Humid Tropics Centre Kuala Lumpur (HTC KL), the Malaysia National Commission of UNESCO and the Ministry of Science and Innovation (MoSTI), while the non-permanent executive members are from the Ministry of Natural Resources and Environment (NRE), the Ministry of Education (MOE), the University of Technology Malaysia (UTM) and the Putrajaya Corporation (PPj).

4. The National Committee holds about two to three annual meetings where activities and programmes are reported and future activities are deliberated.

## Activities and Achievement for Period of 2013 – 2015

Activities that were carried out by MIHP over the last three year are those in particular related to the IHP-VI programme. They are usually coordinated from the secretariat's office and implemented by task forces set up specifically for the event. Some key activities that have been organised by MIHP Malaysia over the last three year include:

### a. National World Water Day (WWD) Celebration

The National World Water Day (WWD) Celebration has been organised as an annual event and has traditionally been the responsibility of MIHP. Several activities were carried out in conjunction with the WWD event. For 2015, the event kicked off with a half page WWD Message in two national dailies and was followed by a Round Table Dialogue in which over 100 students from 11 universities took part.

*Figure 6.6.1 WDW 2014 Celebration official launching. Photo © IHP Malaysia*

During this event an exhibition from relevant ministries and agencies was also organised. The official launching of WWD 2015 was carried out in early May 2015 by the Honourable Minister for Natural Resources and Environment. A series of student camps on water watch were also organised in conjunction with the launching. Several other events such as conferences, intellectual speeches, and exhibitions were organised at the state level.

### b. National Water Watch Programme for Young Leaders (WWP4YL)

*Figure 6.6.2 Student Camp activities. Photo © IHP Malaysia*

*Figure 6.6.3 Camps Tasik Banding, Perak. Photo © IHP Malaysia*

In 2014, three programmes involving more than 200 students were held with the objective to help students learn the concept of integrated water resources management in Malaysia. In 2015, four similar events have been and will be organised with one programme especially dedicated to ASPNet schools. This year's events are planned at sites with different water environments such as in Langkawi which has a coastal and marine environment, Taiping, Perak with wetlands and upper catchment aquatics system, Samarahan, Sarawak on Borneo

Island with a lake and wetland ecosystem and in Johor Bharu, Johor with an urban setting. Students will have to go through 8-10 modules covering a wide range of topics, including Water, River and People by LESTARI, UKM; Water and Health Impact by Ministry of Health (MOH), Water Quality using Biological Indicator by DID; Lake and Wetland Management by Putrajaya Corporation; Climate Change by NAHRIM, etc.

**c. Technical Talks**

On an annual basis, three to four technical talk sessions were conducted by IHP Malaysia. For every session, there were two invited speakers. Some of the topics that have been covered throughout these lecture series were:

i. Lake Ecosystem Assessment, Monitoring and Management with emphasis on nutrients response model by Dr. Zati Sharip from NAHRIM
ii. Climate change impact – Malaysia stand by Dr. Gary Parriera from NRE
iii. Ground Water Catchment Management – by Dr. Saim Suratman NAHRIM
iv. Sediment transport field assessment and modelling by Dr. Ismail Abustan (USM)
v. Water Energy Food Nexus by Dr. Hezri Adnan of ISIS Malaysia
vi. Water and Carbon Footprint by Dr. Zainora (UTM)

*Figure 6.6.4 Technical Talk. Photo © IHP Malaysia*

**d. Water-related workshops, trainings and seminars**

*Figure 6.6.5 Water Footprint Training Feb 2015. Photo © IHP Malaysia*

Over the last two year MIHP have also organised several international events. Among others is the International Workshop on Sustainability Science: A Science based Approach to Realise the Future We Want for All, 4-5 April 2013 at Hotel Istana, Kuala Lumpur, Malaysia and the International Workshop on Sustainability Science for Sustainable Development Goals (SDGs), 4-5 March 2015 at Kuala Lumpur Convention Centre (KLCC), Kuala Lumpur, Malaysia. The South East Asia Water Footprint Assessment Training Course was also organised from 24-26 February 2015 in Kuala Lumpur. The training course that was held this year was attended by 40 participants from Malaysia, 7 participants from SEA countries and 1 from Africa.

**e. Water Awareness Events**

MIHP provides support both in term of finance and manpower to the organization of the annual Putrajaya Lake and Wetland Explorace that was held annually since 2011 for university students. In 2014 it has been scaled up to include international participation from universities within ASEAN. This programme was held as part of an initiative towards conserving and managing lake and wetland ecosystems under UNESCO-IHP Ecohydrology Programme where Putrajaya Lake and Wetland has been acknowledged as one of

the UNESCO-IHP Ecohydrology Demo Sites in 2010.


*Figure 6.6.6. Putrajaya Lake and Wetland Explorace 2014*
*Photo © IHP Malaysia*

**f. Exhibitions at Main Events**

To improve its visibility, MIHP also took part in several exhibition events such as Exhibition at National WWD celebration, Malaysia UNESCO Day celebration from 2011, World River Day, World Ocean Day and in many other events organised by DID Malaysia and other partners in Malaysia.

**g. Communication and Publication**

In maintaining communication with everybody that has been involved in MIHP activities, MIHP maintains a web page and a Facebook account and contributes articles for publication on a regular basis in a monthly bulletin published by DID Malaysia. Last year MIHP also published four posters and stickers in its effort to raise awareness on water resources. In 2014, MIHP successfully published a Guide to Hydrological Practices on Estimation of Design Flood Discharges in Malaysia for related entities in the design of water resources and water related projects. Last year MIHP also published four posters and stickers in its effort to raise awareness on water resources.

**h. Others**

MIHP is also involved in various meetings and discussions with UNESCO Office Jakarta, UNESCO Regional Humid Tropic Centre Kuala Lumpur, Malaysian National Commission of UNESCO and other local partners to strengthen its collaboration network. MIHP also supports many other activities organised by its members and partners in Malaysia.

## Activities at regional Level

**1. IHPs Meeting**

Every year, MIHP has, without fail, participated in the Regional Steering Committee (RSC) meetings and other international forums organised by UNESCO and have, on several occasions, participated in meetings in Paris. Malaysia will continue to strongly support all events/activities organised by IHP.

**2. Others**

MIHP also participated in other international meetings and courses organised and supported by UNESCO, such as the following:

- 7th World Water Forum (WWF) in Daegu, Korea 2015
- Strategic Meeting and International Workshop on Tools for Customizing IWRM Guidelines for Water Security in Asia and the Pacific: Challenges and Opportunities for HELP and Ecohydrology 2015
- 13th IAHR/IWA International Conference on Urban Drainage (ICUD) in Borneo 2014
- International Conference on Ecohydrology in Yogyakarta 2014
- UNESCO Symposium on Water Management in Transition Countries as Impacted by Climate and Other Global Changes, Lessons from Paleoclimate, and Regional Issues in Belgrade, Serbia 2014

- 7th World Water Forum (WWF) 2nd Stakeholders Consultation Meeting (SCM) in Gyeongju, Republic of Korea 2014
- Asia Pacific Strategic Meeting on HELP and Ecohydrology in Jakarta, Indonesia 2013
- 9th Steering Committee meeting of IWRM Guidelines at River Basin Level in Jakarta 2013
- International Water Forum on Water Cooperation and 7th World Water Forum of the 2nd Nakdong River International Water Week 2013 (Na-Ri IWW/IWF) in Gyeongju, Republic of Korea 2013

### Current State of The Cooperation with The HELP

During the past three years, MIHP cooperation with IHP has been limited to attending meetings and to responding to invitation to courses organised by IHP. In 2015, MIHP received an allocation of about USD 30,000 from UNESCO through the Malaysia Fund in Trust to organise a three-day Water Footprint Training course for South East Asia. The training was carried out in February 2015 in Kuala Lumpur. For future cooperation, the IHP Bureau and Intergovernmental Council need to set guidance for technical and financial assistance, success stories of projects and activities need to be shared and provide funding and resource support to the IHP National Committees.

### 6.5 Visions for The Future

Our vision for the future is to raise awareness on environmental sustainability through effective water resources management.

Some of primary effort would be directed towards school children especially those in kindergarten, 4th year of primary school and 2nd year of secondary school. Our target is to reach out to 20% of the student population on an annual basis. It is also our hope that we can maintain communication with all those who have been through our activities, especially student leaders who attended the training camps and university student who also participated and used them as a change agent. This objective is now being carried out by the committee on training and public information. Through the committee on standardization of hydrological practices, it is our vision to publish Hydrological Procedure Guidelines or Standards every three years.

We also called for closer cooperation and collaboration between all members of MIHP as these visions can only be achieved through a meaningful partnership. MIHP will also provide input and assistance in the implementation of the National Water Resources Policy to ensure water sustainability and security for Malaysia through effective water resources management. Last but not least, it is our vision to contribute to international community in whatever possible and to contribute Malaysia's dream of becoming a developed nation by 2020.

# Mongolia

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Since its establishment, the Mongolian National IHP Committee is working actively in different fields and made many contributions to the IHP.

The committee organized and participated in numerous national meetings and workshops like "Strengthening Integrated Water Resource Management in Mongolia". The meetings and workshops focused on ground water management, mining and agricultural water supply, as well as the improvement of water governance and the integrated River Basin Management in Mongolia. In addition the Mongolian National IHP Committee participated and hosted several international conferences and workshops and co-organized consultative meetings with UNDP, UNICEF and WHO on case study delivery, water supply and sanitation in rural areas of Mongolia.

A UNESCO Chair on Sustainable Groundwater Management was established in Institute of Geo-ecology under Mongolian Academy of Science in August 2007 with the purpose to promote an integrated system of research, training, information and documentation in the field of groundwater management. Since then the Chair organized conferences, trainings and workshops. The Chair published several documents and papers and supervised research on groundwater monitoring, by establishing a fifth monitoring point along the Tuul River and a monitoring network to collect data on groundwater levels. To support "Water education" in Mongolia, the Chair organized student tours and lessons and supported the exchange of students visiting from Japanese Universities. The distribution of education material for school children, NGO and local governor's officers as well as short training courses and the training of students in foreign Universities in the Netherland, Japan, India and China, also marked an important part on the improvement on "Water education" and public awareness.

The committee implemented the nanotechnology for the treatment of wastewater, which was tested in cooperation with the Keosan centre from Korea. As a valuable part of the "MoMo" project sponsored by the Government of Germany, the Mongolian IHP Committee co-organized field surveys and international workshops such us "Climate change impact on water resources in Kharaa River basin". Within this project 2 master students had the opportunity to study at the Mongolian University of Science and Technology.

In 2008 the committee had the great opportunity to organize the 16th of the annual IHP RSC meetings in Mongolia on "Uncertainties in water resources management: causes, technologies and consequences", with its highlight in the exploration of the hydrological research, protection and water policy in comparison with the experience of Asian and Pacific countries.

In 2011 Mongolia was elected to the IHP Intergovernmental Council for a term of four years during the 36th session of the General Conference and made contributions to the IHP strategy documents of phase VIII.

In 2012 the Dutch project "Development IWRM in Mongolia" as a co-operation of the Mongolian Government and the Government of the Netherlands was successfully ended. It supported a number of meetings and workshops related to the "Strengthening of Integrated Water Resource Management in Mongolia". It also developed the Tuul and Orkhon River basin and improved the capacity building in the water sector.

# Mongolia

## Participation in the IHP Regional Steering Committee Meetings

The Regional Steering Committee of IHP for South East Asia and the Pacific was established in 1993 and the following list shows the Mongolia's participation in the meetings.

1. 15th Regional Steering Committee meeting of IHP in the Philippines (2007)
2. 16th Regional Steering Committee meeting of IHP in Mongolia (2008)
3. 17th Regional Steering Committee meeting of IHP in China (2009)
4. 18th Regional Steering Committee meeting of IHP in Vietnam (2010)
5. 19th Regional Steering Committee meeting of IHP in Japan (2011)
6. 20th Regional Steering Committee meeting of IHP in Malaysia (2012)
7. 21th Regional Steering Committee meeting of IHP in Republic of Korea (2013)
8. 22th Regional Steering Committee meeting of IHP in Indonesia (2014)
9. 23th Regional Steering Committee meeting of IHP in Indonesia (2015)

## Recent Activities

The Mongolian National IHP Committee has continued its work on the national and international level. The organization of several workshops and sessions such as "Adapting to Climate Change: Decreasing the Vulnerability of the Mongolian Water Section" and furthermore the participation and organization of international conference "Water Safety in Asian Countries" and "Environment and Sustainable Development for Mongolia", show the increasing effort for national and international cooperation.

With the support of the committees work students and senior engineers have been trained in the Research and Training Centre of Integrated Water Resources Management in the Netherlands, France, Japan and China to work as water experts.

The Mongolian National IHP Committee was involved in organizing serial workshops on Mongolian Water Resource Management, which was organized by Ministry of Environment, Green Development and Tourism with cooperation with the United States Army Corps of Engineers with the aim of developing an integrated planning model for the Tuul river basin.

## Plan of the Mongolian National IHP Committee for the future

The committee is planning to work with water experts for preparation of professional personnel in the field of water management to support young researchers. This could furthermore be achieved with programme the Interuniversity Cooperation Programme on Hydrology and Water Management (ICP), which gives the participating countries the opportunity to exchange their teachers and students for water management and water science.

Another Preparation Programme for Professional Water Personal would be the committee's involvement in the WaterNet – Capacity Building Network for IWRM. The development of IWRM would be improved through the contribution of WaterNet's members to solve the urgent issues of the management of water supply and fabric sanitation. This is done by using their knowledge and abilities, through the organization of trainings, research work and advocating.

To continue the public's awareness of the value of water, the committee is confident to draw people's attention to the water problem and promote activities that advertise the rational usage of water. For its achievement the committee will support events which draw students' attention to the water problem, for example by organizing trainings, workshops and competitions about water, water usage and sanitation etc. The committee is planning to translate and publish the Strategic Plan of the 8th Phase of IHP (IHP-VIII, 2014 – 2021).

# Myanmar

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The Myanmar National Committee for IHP (MNC-IHP) was organised on 24 March 2003 comprising a Chairman, a Vice Chairman, a Secretary and (17) members from eight Ministries and two City Development Committees.

## Status of IHP Activities

- Monitoring Water Quality of Rivers in Myanmar
- Monitoring the changes of Water resources in Myanmar
- Monitoring the low flow characteristics
- Assessment of the climate change impact on the flood events
- Developing the flood hazard map in order to reduce loss of lives and properties due to flood disaster
- Implementing the hydrological disaster risk management activities by using GIS and Remote Sensing Technologies

## Participation in IHP steering committees/ working groups

Participants from DMH attended the UNESCO-IHP 13th , 14th ,15th ,17th , 18th , 19th , 20th, 21st and 22nd Regional Steering Committee Meetings for Southeast Asia and Pacific during 2005 to 2014.

## Collaboration with other national and international organizations and / or programmes

- Myanmar has been the member country of EANET (Acid Deposition Monitoring Network in East Asia) since 2005. So Myanmar collaborates with EANET's activities.
- Concerning the Water Quality, a Myanmar participant attended the Symposium 'Scientific Technological and Policy Innovation for Improved Water Quality Monitoring in the Post-2015 SDGs Frame work' at Kyoto, Japan from 15 to 18 July 2015. It is organised under UNESCO- IHP International Innovation on Water Quality (IIWG).
- Myanmar is collaborating with ADPC and RIMES (Regional Integrated Multi-Hazard Warning System for Africa and Asia) in the Hydrometeorology, Seismology and Climate Change sectors.
- Training Workshop for Satellite Based Drought Management was held on 15 May 2014 at Nay Pyi Taw, organised by DMH, Asian Development Bank (ADB) and Tokyo University.
- A workshop on the use of remote sensing data for flood warning and management was held on 25-26 June, 2014 organised by DMH, JAXA, ICHARM and UNESCO.

- Flood and Storm Surge Risk Management for Transformation of Urban Management plan In Myanmar was held at Nay Pyi Taw on 16 September 2014, organised by DMH, the Asian Development Bank (ADB) and ICHARM.
- A training on Rainfall Runoff Inundation Model and Storm Surge Model was held on 16-20 February 2015, organised by DMH, the Asian Development Bank (ADB), ICHARM and UNESCO.
- A training on ADB TM3: RRI Model was held at Nay Pyi Taw on 12-14 Mary 2015, organised by ADB, ICHAM, CTI & DMH.
- Flood Forecasting Method using HBV model was hosted by ADPC, in cooperation with the Norwegian University of Science and Technology at Nay Pyi Taw on20 – 31 October 2014.
- A Flood Forecasting Method RRI Model, organised by ADB and ICHARM support technical aids. The training session was held in February 2014.

## Other Initiatives

- Developing the Flood Hazard Map for Mandalay, Bhamo and Katha.
- Five Hydrometry Monitoring Systems were installed in Phaan, Taungoo, Hinthada, Pegu and Shwekyin stations along major rivers in Lower Myanmar area in 2014 and 2015. Some stations will have Hydrometry Monitoring Systems installed in 2016 and 2017.

## Participation in IHP courses

- A member of the DMH attended the Forest Hydrology, the twenty –fourth IHP training course from 23 November to 7 December 2014 in Nagoya, Japan.

## Participation in International Scientific Meeting

The Workshop on Application of Remote Sensing and GIS for Disaster Management from 18 to 22 November 2013, organised by the Japanese Aerospace Exploration Agency-JAXA, Asia Institute of Technology and DMH was held at Nay Pyi Taw, Myanmar.

## Activities foreseen for 2015-2016

- The MNC-IHP will try to implement the water-related activities in line with the themes of IHP.
- IHP national committee will continue to encourage scientific and technical symposia and workshops.
- The members of MNC-IHP will attend the 20th Regional Steering Committee for Southeast Asia and the Pacific.
- The members of MNC-IHP will participate in the international and national activities of IHP.
- The Hydrological Division will upgrade the flood early warning system and flood monitoring system.
- Remote Sensing and GIS Division will produce the flood risk maps and flood assessment maps in order to reduce the loss of life and properties.

*Figure 6.8.1. Hydrometry Monitoring Systems. Photo ©IHP Myanmar*

# New Zealand

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New Zealand (NZ) has been an active member of IHP since the 1960s. The early days of the International Hydrological Decade and IHP coincided with an expansionary phase of NZ hydrology, when substantial investment in large infrastructure such as hydro-electric power schemes were made. In the 1970s, NZ pioneered its own hydrological data processing and archiving system to cope with the characteristics of its major rivers that are braided and unstable, needing frequent updates to stage-discharge relationships. A particularly pleasing aspect is the operational use of this system in many Pacific Island nations and South East Asian countries.

In the 1980s, owing to rapid economic and government changes, NZ's role in IHP was limited. Nevertheless, IHP documentation was helpful in benchmarking our hydrological activities with those of the rest of the world, and in particular introducing data telemetry. With the resurgence of IHP activity in SE Asia in the 1990s, NZ's attendance at IHP's annual Regional Steering Committee (RSC) meetings for SE Asia and the Pacific has become a regular feature. NZ, with Australia, has taken a significant role in running the RSC meetings. From 1999 to 2001, NZ chaired the RSC and hosted the 2000 RSC meeting in Christchurch NZ.

Between 1997 and 2014, NZ contributed to the first five volumes of the Catalogue of Rivers, including leading the fourth volume. During this period, NZ, with support from Japan, played a key role in technical projects on extreme rainfall and flood design methods.

The content of the latest IHP Phase VIII (2014- 2021) is relevant and consistent with NZ government's renewed engagement with water infrastructure development and management. Approaches such as Integrated Water Resource Management and Ecohydrology are central to our programmes such as the Canterbury Water Management Strategy. Ongoing engagement with UNESCO programmes such as FE2W will benefit from greater understanding of holistic approaches that combine social and biophysical sciences alongside a partnership with indigenous interests. In addition to education, these benefits include coordination of science and integration of cultural aspects to provide critical information for use in policy formulation, and to meet multiple economic and environmental targets.

# Pakistan

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## Introduction and Background

The Ministry of Education, Government of Pakistan notified 15-member Pakistan National Committee for International Hydrological Programme (IHP) of UNESCO with its functions in May 1984. The Chairman, Irrigation, Drainage and Flood Control Research Council (IDFCRC), re-named as PCRWR in 1985, was declared as Convener/Chairman of the Committee. Since then, the PCRWR has been working as Secretariat of the Committee in coordination with Pakistan National Commission of UNESCO (PNCU) through International Liaison wing of Ministry of Science and Technology.

The hierarchy at provincial and federal level has been changed with the passage of time by introducing various reforms and amendments in Constitution. New Universities, Institutes, Authorities have also been established which are playing active role. To get benefit from such professional agencies, it has now been proposed to re-constitute the PNC-IHP. Now the proposed ToRs of the committee are as:

- Preparation of National Programme relating to Hydrological activities under the umbrella of the UNESCO International Hydrological Programme (IHP);
- Coordination of the execution of National and International Programmes by the various Organizations concerned with hydrology;
- Suggest measures for the Training of Personnel in Scientific Hydrology; and
- Make recommendations to the appropriate Ministry/Organizations/ Government for guiding the programme in the Country.

The National Committee is currently being chaired by Dr. Muhammad Ashraf, the Chairman, PCRWR. The other members of the committee include:

- The Director General, PCRWR
- The Secretary General, Pakistan National Commission for UNESCO
- The Secretary, Irrigation & Power Department, Government of Punjab
- The Secretary, Irrigation & Power Department, Government of Sindh
- The Secretary, Irrigation & Power Department, Government of KPK
- The Secretary, Irrigation & Power Department, Government of Balochistan
- The Chief Engineering Advisor/Chairman, Federal Flood Commission
- The General Manager (Planning & Design), Water & Power Development Authority
- The Chairman, IRSA
- The Chief (Water Resources Section), Planning, Development and Reforms
- The Joint Scientific Adviser (IL), Ministry of Science & Technology
- The Director General, Pakistan Meteorological Department
- The Executive Director, Global Change Impact Studies Center (GCISC)
- The Director, Centre of Excellence of Water Resources Engineering (CEWRE), Lahore
- The Principal, NUST Institute of Civil Engineering
- The DG, Federal Water Management Cell
- Member, Natural Resource Division, PARC
- The Director, PCRWR

*Figure 6.10.1. Last meeting of the Committee was held on May 7, 2015. Photo ©IHP Pakistan*

## Current Activities

A brief of activities conducting presently and in the recent past is as follows:

**A. Study of Rainwater Harvesting System for Implementation Rationality and Design the System:**

The project is a two year pilot initiative funded by the United Nations Trust Fund for Human Security (UNTFHS). It is a joint UN inter-agency collaboration to bring about improvement of human security situation among rural and disadvantaged populations in Khyber Pakhtunkhwa (KP). Three partnering UN agencies, i.e. UNESCO, UNDP and WHO together with the Government of Khyber Pakhtunkhwa identified Union Council "Musa Zai " being one of the poorest and socially excluded Union Councils of district D. I. Khan for project interventions. The interventions are targeted to mitigate adverse impacts of prolonged internal conflicts in Pakistan by fostering peace and multi-sectoral development at community levels leading to improved human security.

The goal of the project is to reduce adverse human and socioeconomic impact of prolonged internal conflict and resulting terrorism in KP and to foster peace and stability in the region as a whole. The Project objective is to improve social security status of people in conflict-affected areas through enhanced access to health, education and resources for building peace, reconstruction, security and social harmony. Water Security is one of major issues of the project area. For this purpose, rainwater harvesting techniques are being introduced in the selected areas, to improve water availability and socioeconomic conditions thereof.

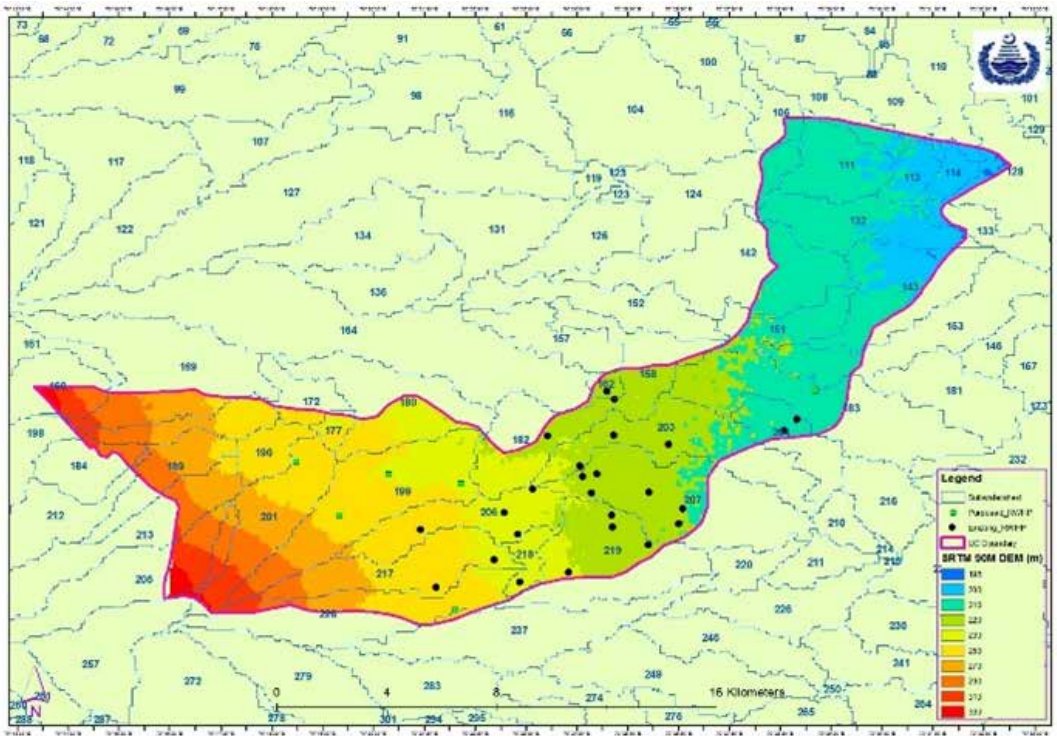


*Figure 6.10.2 Map showing locations of Existing and Proposed Ponds with sub-watersheds. Map ©IHP Pakistan*

## B. Detail Report of the World Water Day, 2015

Community Sitting at Union Council Mousa Zai Sharif, District Dera Ismail Khan: This activity was organized in Govt. Boys High School at Mousa Zai Sharif, D.I. Khan on March 22, 2015, under UNESCO sponsored project "To implement UNTFHS Project Component Concerning Rainwater Harvesting". The different walks of life including academia, journalists, notable NGOS, social worker and local political community members attended the day. The Chief Guest of the event was Mr. Ghazi Nawaz Sherani, Assistant Commissioner, D.I. Khan. Other important dignities included Dr. Azam Khan Alizai, Consultant UNESCO, Sahaibzada Muhammad Tayyab-Local Political Leader, Sahaibzada Amir-District Secretary, Pakistan Red Crescent Society, Mr. Inamullah Khan Ghandapur, Mr. Aziz Ahmed Jan-Steering Committee Member of UNESCO Project, Mr. M. Usman, Engineer ICARDA and Mr. Shafiq-ur-Rehman, Incharge, WQL, D.I. Khan. Altogether 110 participants attended the event.


*Figure 6.10.3a-b Community Meeting on World Water Day 2015. Photo ©IHP Pakistan*

Constitutive Assembly of Pakistan Youth Parliament for Water: First ever meeting of Constitutive Assembly of Pakistan Youth Parliament for Water was held at PCRWR on 26th March, 2015. About 20 young participants belonging to various part of the country participated in the meeting. Mr. Bart Devos, President of Youth Parliament for Water and Ms Mukta Akter, Bangladesh attended the meeting as special guest. While speaking at the inaugural session of the event, Dr. Muhammad Ashraf, Chairman, PCRWR welcomed the participants and ensured full cooperation and support of PCRWR to the Youth of Pakistan. Dr. Akhtar Ali, Senior Water Resources Expert from ADB, Manela who was chief guest of the event spoke to the audience. He highlighted various initiative of ADB for involvement youth in water resources management in the world. The meeting was followed by the World Water Day Walk.

*Figure 6.10.4a-b Constitutive Assembly of Pakistan Youth Parliament for Water. Photo ©IHP Pakistan*

Conference on Water and Sustainable Development – Role of Youth: Analyzing and evaluating the existing water stress situation and the main challenges of water in Pakistan, the subject conference was organized on March 27, 2015 at Planning Commission of Pakistan. Collaborating partners of the event were PCRWR, UNESCO, World Youth Parliament of Water, Pakistan Water Partnership, ICIMOD, Economic Cooperation Organization Science Foundation, ADB, UNICEF, FAO, UN Habitat, Plan International, Muslim Aids, Helping Hands for Relief and Development, GLOF Pakistan, UNDP, RSPN, ICARDA, WHO, Riphah University and Water Aids. During

The event, Sardar M. Tariq, CEO, Pakistan Water Partnership, delivered the message on behalf of President, Islamic Republic of Pakistan, Mr. Bart Devos, President, World Youth Parliament for Water said that access to clean water and sanitation as well as water scarcity were among the most present challenges for young generation. Speaking at the inaugural session Mr. Ahsan Iqbal, Minister of Planning Development and Reforms said that the water is a key element for the socio economic development of any country. He also emphasized that our country is blessed with human capital in the form of youth which comprises about 50% of the population. In her opening remarks, Ms. Vibeke Jensen, Director UNESCO said that UNESCO supports research and concrete projects on water related issues through its IHP, which is the only intergovernmental programme of the UN system denoted to water research, water resource management and education and capacity building. During the seminar, an agreement was singed between World Youth Parliament for Water (WYPW) and Pakistan Youth Parliament for Water (PYPW). The last technical session of the seminar was chaired by Dr. Muhammad Ashraf, Chairman, PCRWR. At the end of this session, all partner organization adopted a joint declaration named as "Islamabad World Water Day Declaration, 2015". At the end, the Chairman, PCRWR and Mr. Bart Devos distributed certificates and souvenir among the participants and partner organization.

**C. Field Study to Characterize the Hydrology of Upper Indus and Kabul Rivers**

During 2012-13, UNESCO launched a project in cooperation with the Government of Japan that aims to upgrade the flood forecasting and early warning systems for Pakistan, and to conduct risk mapping of flood plains along the Indus River. The project includes major activities to upgrade the forecasting software; Integrated Flood Analysis System (IFAS) developed by International Centre for Water Hazard and Risk Management (ICHARM), as basic tool for flood forecasting and warning systems in insufficiently gauged basins. Hydrological models need data of soil hydraulic proprieties and chemical characteristics of soil in addition to topography, landuse and climate. PCRWR collected such data from 100 locations in the Indus and Kabul River watersheds for distributed hydrological modeling.

**D. Mass Awareness**

Launched mass awareness campaign to promote water conservation among water users preparing Urdu booklet on Islamic teachings for conserving water; painting of message in Urdu on water tankers, installing moppies, bill boards and bridge displayed at appropriate locations, launching TV and radio commercials, special supplements in Newspapers, participating in live TV talk shows in Urdu and regional languages, broadcast from TV, airing strolls for Cable network, etc.

**E. Establishment of Category-II Center in Pakistan:**

The PNC-IHP also submitted a proposal in 2006 for establishment of Regional Centre for Water Management Research in Arid Zones in Pakistan (Category II) under the auspices of UNESCO to UNESCO in 2004 for consideration during 16th Session of the Intergovernmental Council of International Hydrological Programme (IHP) of UNESCO which was approved in principle during 17th Session held from 3rd to 7th July, 2006. Thereafter, a two-member team of UNESCO comprising Dr. Abidin Salih, Director UNESCO Tehran Cluster Office and Mr. Jose Alberto, UNESCO Paris office visited Pakistan from 21st to 25th January, 2007 to prepare feasibility report which was approved during 177th Session of the Executive Board of UNESCO, Paris held from 25th September – 11th October, 2007. Materialization of the case could not be made despite passing a time period of about 7 years however, the case is re-activated again with the consultation of UNESCO and Ministry of Science and Technology for signing the agreement with UNESCO.

**F. Meetings/Workshops/Trainings**

A meeting held on 12th November, 2010 at PCRWR, Islamabad with a three-member UNESCO delegation comprising Dr. Gretchen Kalonji, Asstt. Director General for Natural Resources, Dr. Jose Alberto Tejada-Guibert, Secretary, IHP/Director Division of Water Sciences and Prof. Dr. Shahbaz Khan, Chief, Water and Sustainable Development Section, UNESCO Paris Office. The Chairperson, PNC-IHP briefed the delegation about activities of the PNC-IHP and progress regarding establishment of the proposed Category-II Regional Center.

- Engr. Masood Ahmed, Assistant Director, PCRWR participated in International Workshop on "Climate Change and Sustainable Management of Water Resources in the Asia-Pacific-Region" held from 22-24th November, 2011 at Institute of Banking and Finance, Islamabad organized by COMSATS Institute of Information Technology, Higher Education Commission, UNESCO and Commission on Science and Technology for Sustainable Development in the South.
- Participated Engr. Muhammad Farooq, Assistant Director, PCRWR in International Training Workshop on "Stakeholders Capacity Building in Flood Warning and Management" held at National University of Science & Technology (NUST), Islamabad from 20-23 December, 2011 organized by NUST and UNESCO.
- Engr. Ali Bahzad, Assistant Director, PCRWR attended the workshop on "Hydrology Remote Sensing Modeling and Data Assimilation" held from 13-17 July, 2010, at Beijing, China.
- Ms. Rizwana Perveen, Research Officer, PCRWR attended the workshop on "Asia Science Educator Academy 2011 Fostering Innovative STEAM Curricula" held from 30 Novembers to 02 December, 2011 at Seoul, Korea.
- Ms. Saiqa Imran and Ms. Fouzia Altaf got training on "Water Quality Assessment" from UNESCO-IHE Institute of Water Education in Delft, Netherland from 13 February to 2 March, 2012.
- 3rd Steering Committee meeting of Friends of Democratic Pakistan (FODP) Water Sector Task Force (WSTF) held on 29th September, 2011 at Ministry of Water and Power, Islamabad

- 2nd Stakeholders Workshop on "Infrastructure, Institutions for Water Security and Productivity in Pakistan" held on 14th December, 2011 at Islamabad jointly organized by the Ministry of Water and Power, and the WSTF of the FODP

PNC-IHP has established good working relation with ICIMOD under HKH-FRIEND. Many research activities are proposed to be initiated in collaboration with ICIMOD. Meanwhile, the PNC-IHP participated in the following activities of the ICIMOD:

- Dr. A.D. Khan, Director, PCRWR attended International Expert Workshop on "Climate and Environment Change Impact on the Glaciers of the Indus Basin and its Implication on Future Scenario" held from 2-4 July, 2010 at Kathmandu, Nepal.
- Dr. Manzoor Ahmed Malik, Director, PCRWR attended the study workshop on "Climate Change Adaptation, Glacial Melt and Downstream Impacts on Indus Dependent Water Resources and Energy" Jointly organized by ADB and ICIMOD held on 10th August 2010 at Islamabad.
- Dr. A.D. Khan, Director, PCRWR participated in Training Workshop on "Stream Flow Measurement using Fluorescent Tracer" held from 25-27 September 2010 at Islamabad.
- Mr. Naveed Iqbal, Assistant Director, PCRWR participated in Workshop on "Remote Sensing of the Cryosphere-Assessment and Monitoring of Snow and Ice in the HKH Region" held from 4-6 October, 2010 at Katmandu, Nepal.
- Engr. Rashid Aftab, Director, PCRWR participated in Policy Level Information Dissemination Workshop on Cyosphere (Snow and Glacier) Dynamics of the Indus Basin held on 16th March, 2012 in Islamabad.
- Dr. Manzoor Ahmed Malik, Director, PCRWR attended the ICIMOD Pakistan National Consultation Meeting held on 19th March 2012, Islamabad.
- PNC-IHP has also established very good working relationship with Inter-Islamic Network on Water Resources Development and Management (INWRDAM). Professionals of PCRWR are fully benefiting through its training programs. Following activities were carried out:
- Engr. Ishtiaque Rao, Director, Water Resources Research Centre, Quetta attended the Workshop on "Climate Change and Possible Impacts on Water Resources in OIC Countries" held from 25 to 28 October, 2010 in Kuala Lumpur, Malaysia.
- The Chairperson PNC-IHP briefed Dr. Murad Jabay Bino, Executive Director, INWARDAM about the activities carried out in collaboration with nation and international agencies who visited Islamabad on 14th January, 2011.

## Future Challenges

Future challenges specifically in the hydrological sciences are huge. Simple and basic problems have been solved in the last century and now we have to deal with the more complex challenges. The problems however, cannot be solved by a single mind or organization.. It needs collaboration of multi-sectoral professionals with multi-disciplinary approach. The future challenge of the PNC-IHP would be how to bring these minds closer to work with each other for the betterment in the hydrological field.

# Thailand

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## Past activities of Thailand National Committee for IHP

The National Hydrology Committee as Thailand National Committee for International Hydrological Programme (TNC IHP) set up by the Cabinet on 17 December 1963 implement on hydrological sciences and coordinate with UNESCO – IHP. Its main roles are to cooperate with the International Hydrological Programme and concerned international organizations on water resources and promote the cooperation on hydrology within the countries via the events on water resources, natural resources and environment.

Concerning on the UNESCO-IHP Meeting, TNC IHP attended the IHP Intergovernmental Council in Paris for 4 times and also participated in the side events such as poster presentation on the research under the area of hydrology.

## Current Activities and Successful

As the present composition of Thailand National Committee – IHP (TNC-IHP) consists of 18 members from other agencies on water resources and concerned natural resources with their own responsibilities, it is quite difficult to have the meeting of TNC IHP. Anyway, the secretariat of the TNC IHP still pay a lot of attention on the IHP's activities and distribute all activities from UNESCO-IHP or South East Asia and the Pacific to Thai agencies.

THC - IHP has brought the knowledge of several researches and studies, as well as to exchange and share experiences on hydrology to apply in water management. Such as river monitoring and flood forecasting with the telemetry system, the establishment of Early Warning System for flash flood and landslide (EWS), monitoring on The Hydrological Cycle Observation System in the Lower Mekong Basin(Mekong-HYCOS) which are activities at national level in the framework of the IHP.

## Participation in IHP Steering Committees/ Working Groups

The representatives of Thailand participated in the Regional Steering Committee of IHP for South East Asia and the Pacific from the past to present which are very success of the progression on the international activities. These are the best lesson learnt to exchange and sharing the experiences and also keep the best of cooperation and relation for IHP. Many research projects implemented by concerned agencies of Thai government for the fiscal year of 2015 according to the IHP VIII of 6 Themes are Water Related Disasters and Hydrological Changes as above mentioned, Groundwater in a Changing Environment, Addressing Water Scarcity and Quality, Water and Human Settlements of the Future and Water Education Key, for Water Security.

# Thailand

## Collaboration with other national and international organizations and / or programmes

The Ministry of Natural Resources and Environment (MNRE) of Thailand by the Department of Water Resources has highlighted various activities on water resources and environment. Minister of Natural Resources and Environment attended the Ministerial Meeting at the 7th World Water Forum, Republic of Korea. In addition, many activities together with other concerned agencies such as UNESCAP to organize a meeting / events / exhibitions on the occasion of the World Water Day in March 2015 were implemented.

At present, the collaborate with German Agency for International Cooperation(GIZ) under the support by German Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU) to contribute the project on Improved Flood and Drought Prevention through Ecosystem-Based Adaptation in Watershed still implement in the pilot area in the northern and southern Thailand. We do hope that the concept of ecosystem – based adaptation is able to adapt in the other parts of Thailand for the benefits of natural resources.

The Department of Water Resources initiates the guidelines on Conjunctive Water Management with the Department of Groundwater Resources and Royal Irrigation Department, Thailand by using the SOURCE Model for decision support on water resources management with eWater Cooperative Research Center, Australia.

## Vision for the Future

Water Resources Management Vision;

*"Clean water provision for all villages' domestic use, secured production, mitigation of flood damage, standard water quality, and sustainable water management with balanced development and participation from all sectors"*

To accomplish the vision on water resources management, sharing knowledge on hydrology is really important to all parts of Thailand as basic elements on water resources management. From past to present, water resources development contributes to increasing available water sources for Thai people's welfare including agricultural, economic and industrial development. However, an availability of water sources can contribute to only half of overall Thailand's water demand. It is projected that water demand will highly increase resulting in insufficient water supply. In addition, several areas of Thailand are experiencing upstream forest degradation, soil erosion and landslide resulting in drought, frequent and extreme inundated flood in urban and economic areas of Thailand.

Since large water development projects are experiencing difficulty in finding feasible construction site and main waterways are polluted from urban and agricultural effluents, water problems have become severe, affecting people's livelihoods and economic productivity of Thailand both short and long term. As a result, water resources management strategic planning is needed to provide a national framework for water resources management.

According to the above mentioned status of water resources in Thailand, various knowledge on hydrology and water resources management are able to assist water managers in Thailand to implement on water resources management according to the strategies on water resources development and management and the principles on integrated water resources management (IWRM).

# 7 IHD and IHP activities in Southeast Asia and the Pacific by Category 2 Water Centres and UNESCO Chairs

# APCE

## Asia-Pacific Centre for Ecohydrology

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### Introduction

The global water environment has deteriorated and there has been a significant loss of biodiversity worldwide, which severely impacts global ecosystems. Such trends provide ample evidence that conventional approaches to water resources management (based on the application of engineering techniques, sector interventions, and the elimination of such direct threats as point source pollution) are no longer sufficient to minimise the tide of the water crisis Ecohydrology aims to find solutions that, rather than focusing exclusively on technical issues, respond effectively towards sustainable water resource policies and promote social development. Ecohydrology is a new integrative science that involves finding solutions to issues surrounding water, people, and the environment. One of the fundamental concepts involved in Ecohydrology is that the timing and availability of freshwater is intimately linked to ecosystem processes, and the goods and services provided by freshwaters to societies. This means that emphasis is placed on the hydrological cycle and its effects on ecological processes and human well-being.

APCE is a centre category II of UNESCO that focuses on the ecological approach on water resources management for providing sustainable water for people by harnessing science and technology, education and culture. APCE commits to contributing in overcoming current and important issues of national, regional and global interests, such as poverty, climate-change adaptation, and disaster risk reduction.

In achieving the objective, several activities have been planned. These activities benefit from results of past and current research activities conducted by the Indonesian Institute of Science (LIPI) and their partners.

- APCE has developed excellent expertise and experience in the following fields:
- Relationships between ecological pattern and hydrological process;
- Disturbance and dynamics of natural and anthropogenic ecology and hydrology;
- Ecohydrological approaches to biodiversity conservation, environmental management, and ecological restoration;
- Integrating hydrology with ecological planning, design, and architecture, or reverse;
- Transdisciplinary studies of regional sustainability from scopes of Ecohydrology, ecology, or both

## Recent Activities

In the last 5 years, APCE has had many activities:

1. As host for the Integrated Flood Analysis System (IFAS) course in collaboration with ICHARM, the UNESCO Jakarta Office and LIPI. With its different climate characteristics, the Asia and Pacific region, is at risk of hydro-meteorological hazards which are often associated with extreme events. Some countries of this region are vulnerable to floods and the annual flood losses are too high for any government to bear. A technical course was organised based on the framework of the Flood Forecasting and Warning System (FFWS) that was conducted in ten countries (Australia, Cambodia, China, Indonesia, Lao P.D.R, Malaysia, Philippines, Republic of Korea, Thailand and Vietnam. The objective is to enable government agencies to the use of appropriate software (IFAS) for flood forecasting and warning systems that lead to the increasing capacity of managing water resources under climatic variability and the related extremes phenomena. The course involves the provision of national digital GIS data for the model's creation at the target river basin, as well as local hydrological/hydraulic data for run-off analyses and models validation.

*Figure 7.1.1. IFAS course activities. Photo ©APCE*

*Figure 7.1.2. Flooding events in Indonesia. Photo ©APCE*

2. As promoter and developer of DemoSite for Community Based Development on Water Management, in collaboration with the UNESCO Jakarta Office, LIPI, University of Gajah Mada and the Bogor Agriculture Institute. The objective of the DemoSite for ecohydrology development is as a field station in relation to the implementation of ecohydrology concepts in the field. Within the concept of Ecohydrology, the DemoSite ecohydrology campaign is expected to socialise sustainable management of water and to establish a natural laboratory for future development especially that which represents Ecohydrology as a tropical Indonesian concern. Ecohydrology DemoSite development in Indonesia will be directed to a location DemoSite, representing the concept of sustainable management of water resources in several different groups, namely: "DemoSite ecohydrology for the community-basedmanagement of water resources".

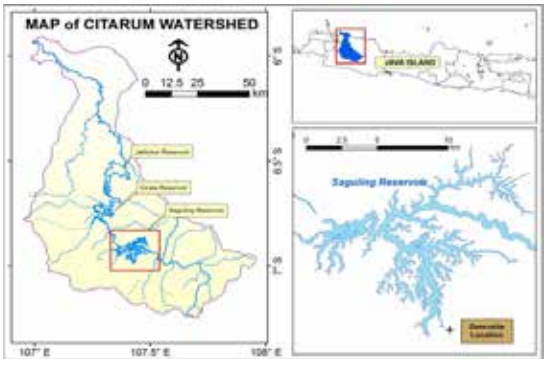


*Figure 7.1.3. Saguling Reservoir Demosite. Photo ©APCE*

*Figure 7.1.4Artificial constructed wetland. Photo ©APCE*

3. As Organizing Committee for the Inauguration of APCE-UNESCO Secretariat building by the Chairman of LIPI in March 25, 2014.

4. As Host for International Conference on Ecohydrology (ICE) 2014 in Yogyakarta – Indonesia, in collaboration with the UNESCO Jakarta Office, LIPI, UGM, Yogyakarta Special Region Province. This conference was in conjunction with the 22nd RSC Meeting of the IHP. The objectives of the International Conference on Ecohydrology 2014 (ICE 2014) was to synthesise information and address knowledge gaps on issues related to critical water environment systems.; for instance, how the ecohydrology and eco-technology could provide low-cost, environmentally sound technology for sustainable water management, especially in the Asia Pacific region.

5. As Host for the IHP Training Course in November 8-9, 2014 in Yogyakarta – Indonesia, in collaboration with the UNESCO Jakarta Office and LIPI. This training course focused on three major objectives: sharing and/or acquiring the latest methods of water and nutrients cycles restoration in the river basin scale by using ecosystem properties as a management tool; providing the understanding of the main ecological and hydrological processes occurring at the river basin; discussing how the hydrological and ecological processes are affected by human activities and climate change, how they interact in time and space, and how Ecohydrology can help implement IWRM at the river basin level. There were a total of 29 participants coming from different countries, of which25 participants were rom Indonesia,Malaysia, Tokyo, Thailand, and Pakistan, whereevery country had a participant from various affiliation.

6. As host for the first meeting of APCE-UNESCO Governing Board in November 12, 2014 in Yogyakarta. The members of GB are: Prof. Dr. Iskandar Zulkarnain (Indonesia), Prof. Dr. Soontak Lee (Korea), Prof. Dr. Kaoru Takara (Japan), Prof. Dr. Quentin Grafton (Australia), Prof. Dr. Shahbaz Khan (UNESCO), Prof. Dr. Hidayat Pawitan (Observer, Indonesia).

*Figure 7.1.5. Inauguration of APCE Secretariat. Photo ©APCE*

*Figure 7.1.6. APCE Building. Photo ©APCE*

*Figure 7.1.7. International Conference on Ecohydrology (ICE) 2014, in Yogyakarta – Indonesia. Photo ©APCE*


*Figure 7.1.8. First Governing Board Member Meeting of APCE. Photo ©APCE*

7. APCE attended the Strategic Meeting and International Workshop of UNESCO, Jakarta 11-12 March 2015 as Keynote speaker.
8. APCE Contributed to the World Water Day Workshop on March 24 in Jakarta as Keynote Speaker.
9. APCE attended the World Water Forum in Daegu Korea in April 2015.
10. APCE attended UNESCO Water Centres and Chaired Meeting in Malaysia in June 2015.
11. Promoted joint research project in collaboration with UNESCO Jakarta, and several Universities:
    a. Advanced Development of Ecohydrology Demonstration Site in the Saguling Reservoir, the Upper Citarum River basin, Indonesia.
    b. Study on the implementation of Ecohydrology approach and avoided deforestation in Peatland Rewetting and Conservation in Ex-Mega Rice Project location: Cases on food crops areas and on oil palm plantations areas.
12. Promoted and developed appropriate technology to provide clean water in marginal areas in collaboration with LIPI. IPAG60: Alternative Technology to provide clean water in peatland area.

*Figure 7.1.9. IPAG 60 : from peatwater to clean water. Photo ©APCE*

*Figure 7.1.10. Clean water produced by local people with IPAG60. Photo ©APCE*

## Next Activities

In order to support the IHP Phase VIII programmes, APCE-UNESCO will focus on developing understanding and practices of Ecohydrology through research, training and knowledge exchanges, information systems and public awareness, mainly on theme 5 related to Ecohydrology, engineering harmony for a sustainable world by:

1. Promoting local resources based onEcohydrological research.
2. Strengthening local capacity to adopt Ecohydrological concept and approach.
3. Providing easy access to local resources based on Ecohydrological information and knowledge.
4. Enhancing public awareness of local resources based on Ecohydrological practices.

## Collaboration

APCE – UNESCO promote and develop collaboration with different institutions :

- UNESCO Jakarta Office
- ICHARM, Japan
- HTC Kuala Lumpur, Malaysia
- ANU & University of Canberra, Australia
- University of Quensland Australia
- Kyoto University
- ILEC, Japan
- UGM, Yogyakarta – Indonesia
- IPB, Bogor – Indonesia
- UNLAM, Banjarmasin, Indonesia
- University of Palangkaraya, Indonesia
- Ministry of Environment and Forestry
- Ministry of Public Work and Housing
- ICUWRM, Tehran – Iran

# HTCKL
## Humid Tropics Centre Kuala Lumpur

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### Background

UNESCO-IHP V was established as a response to global and regional water issues and the recommended actions of Chapter 18 of Agenda 21 (UNCED 1992). It sets out to strengthen the bonds between scientific research, application and education. Based on these needs, the Regional Humid Tropics Hydrology and Water Resources Centre for South-East Asia and the Pacific (HTC Kuala Lumpur) was established in 1999 as a regional centre to manage and coordinate related activities in hydrology and water resources management in the humid tropics.

The objectives of HTC Kuala Lumpur are to promote a conducive atmosphere for collaboration through technology and information exchange, education and science, to increase scientific and technological knowledge about the hydrological cycle and to promote and increase scientific and technological knowledge about urban storm water management, ecohydrology, humid tropics and water education. The focal areas of HTC Kuala Lumpur are Integrated Water Resources Management (IWRM), Urban Storm water Management, Ecohydrology, River Waste Water Management, Humid Tropics and Water Education. The scope of activities includes applied research, advising, continuing education, and software development.

### Past Activities and Past Achievement of IHP

Since then, HTC Kuala Lumpur has organised and been involved in various activities and programmes in the areas of research & development, disseminating activities, capacity building and networking. These activities and programmes are in line and parallel with the framework of UNESCO International Hydrological Programme (IHP), Millennium Development Goals and national policy. The objectives of the programmes are to highlight the diverse issues and problems pertaining to hydrology and water resources and to find the best solutions to overcome them.

R&D are being carried out through collaboration and networking with local universities and under the R&D committee of Malaysian National IHP. The Centre focused on capacity building through seminars, conferences, workshops and also training courses. The Centre also acted as catalyst in carrying out regional and international collaborations, such as jointly

organising a four day Training Workshop on Flash Flood Risk Assessment and Mitigation Strategies with ICHARM-Japan and RCUWM-Tehran.

HTC Kuala Lumpur also contributed to the four cross-cutting programmes i.e. UNESCO SWITCH-in-Asia, Urban Water Management; AP FRIEND (Asia Pacific Flow Regimes from International Experimental and Network Data); UNESCO-HELP (Hydrology for the Environment, Life and Policy) the Langat River Basin; and IWRM (Integrated Water Resources Management). With regard to the SWITCH-in-Asia Urban Water Management, HTC Kuala Lumpur has constructed a demonstration project of MSMA-Integrated Stormwater Management Ecohydrology (MSMA-ISME) project at its compound. This MSMA-ISME covers all aspects of integrated urban water cycle management, which consists of rainwater harvesting system, green roof system, bio-retention system, porous pavement, grey water reuse system and constructed wetlands. It is the best-practice approach that provides sustainable management and improvement of water quality entering urban rivers from urban regions. Besides this, HTC Kuala Lumpur also contribute data for AP FRIEND and supports UNESCO-HELP River Basin (Langat River) by Upscaling ISME at HTC Kuala Lumpur to a catchment level at Langat River Basin. The main target is to improve Langat River Basin from the present stage E-Evolving to the next level stage O-Operating.

### Current State of Cooperation with IHP

HTC Kuala Lumpur supports several themes under the UNESCO IHP-VIII Strategic Plan (2014-2021); "Water Security: Responses to Local and Global Challenges" and the themes and focal areas of Themes 1, 3, 4. 5 and 6. The main focuses are in storm water management, ecohydrology, river management, waste water management and water education.

The current R&D projects with local universities include Development of Decision Support System for Storm water Management Ecohydrology, Study on Performance of Gross Pollutant Trapping Device Vs Life-Cycle Cost and Gross Pollutant Management Strategies, River Rejuvenation for Social and Water Ecosystem Project, Point Source Waste Water Management, Application of A Stepped Solar Still System for Domestic Water Desalination and Improving River Water Quality for Domestic and Drinking Water, Artificial Bio-Macropore for Storm water Management, and A Novel Approach to Reuse Alum Sludge in Manufacturing of Building Material Using Admixtures and Thermal Curing. The Water Education examples are IWRM and Ecohydrology Syllabus for Asia-Pacific & Africa Region.

Recently, through the Malaysia Fund in Trust (MFIT), HTC Kuala Lumpur together with partners from APCE, RC-IRBM, UNESCO Jakarta and local universities has successfully secured a project 'Comparative Studies of Applying Ecohydrology and IWRM for Upscaling Water Security in Asia and Africa through UNESCO Category 2 Water Centres'. This project focuses on developing modular curricular water education and strategies in water management through various activities of applying Ecohydrology, IWRM and science education for sustainable development, The curricular will be applicable within Asia-Pacific and Africa with the main activities centred on Langat–HELP Basin. This project will create a platform for the collaboration and exchange of scientific, technical and policy relevant information between Asian and African Category-2 water centres.

The Director of HTC Kuala Lumpur has actively participated in UNESCO Programmes such as:

a. Lecture at Training Course on Ecohydrology: A Tool for IWRM Implementation at the River Basin Level, 8 – 9 November 2014, Yogyakarta

b. Meeting of Water Related UNESCO Category II Centres Koblenz, Germany, 15 to 17 December 2014

c. International UNESCO-PAGASA-IFI Workshop "Enhancing Resilience against Multi-Hazards through Effective Mitigation Systems and Adaptation Strategies, Quezon City, Philippines, 24-26 February 2015

d. Regional Dialogue on Sustainable Science Policy to Support The Post – 2015 Development Agenda, KLCC, Kuala Lumpur, Malaysia, 4-5 March 2015

e. Strategic Meeting and Workshop on Tools for Customizing IWRM Guidelines for Water Security in Asia and the Pacific: Challenges and Opportunities for HELP and Ecohydrology, 11 – 12 March 2015, Grand Kemang Hotel, Jakarta, Indonesia

f. 7th World Water Forum 2015, April, 14 – 17 2015, Daegu & Gyeongbuk, Rep. Of Korea

g. Water Seminar 2015 in conjunction with World Water Day 2015. Theme: Water and Sustainable Development, 27th April 2015, Rizqun Hotel, Bandar Seri Begawan, Brunei

h. 15th International Convention on Melaka Twin Cities 2015: Future Green Cities", 29-30 April 2015, Equatorial Hotel Melaka, Malaysia.

In order to ensure sustainability in the knowledge and technical capability as well as to disseminate knowledge gained from research activities, HTC Kuala Lumpur has published six technical reports in relation with MSMA-Integrated Storm water Management Ecohydrology components.

## Visions for the Future

HTC Kuala Lumpur will continue to carry out and coordinate the implementation of hydrological and water resource research projects, through networking with similar centres for the exchange of scientific information on research results and organizing training courses for knowledge and technology transfer.

With regard to Strategic Plan IHP-VIII (Water Security: Responses to Local, Regional and Global Challenges), HTC Kuala Lumpur will continue to contribute to storm water management, Ecohydrology, river basin management, waste water management, eco-biotechnology for sustainable urban/ rural water management through its R&D programmes and through the four cross-cutting programmes i.e. UNESCO SWITCH-in-Asia; AP FRIEND and UNESCO-HELP (Hydrology for the Environment, Life and Policy) the Langat River Basin and IWRM.

HTC Kuala Lumpur hopes that there will be more collaborative programmes in the field of research and development for sustainable water solutions with other water centres, since local approaches and techniques can contribute to water protection and conservation.

# ICHARM

## International Centre for Water Hazard and Risk Management

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### Background

Climate change is likely to result in increases in the frequency or intensity of extreme weather events. It is imperative that a good understanding is developed of how climate change affects the events that are reflected in hydrological extremes and how practitioners in water resources management deal with them. The world is struggling with water-related disasters, such as floods, droughts and windstorms, which have been a primary source of disaster damage worldwide in recent years. After 1980, in particular, they account for about 80% of all natural disasters, affecting 96% of the natural disaster victims around the world. Based on a long history of fighting and overcoming water-related disasters and a consequent wealth of knowledge and experience as well as sophisticated technology in Japan, 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 subsequently adopted at the UNESCO general meeting in October 2005. The International Centre for Water Hazard and Risk Management (ICHARM) under the auspices of UNESCO was officially established as a UNESCO category II center and a part of the Public Works Research Institute of Japan on March 6, 2006. The agreement on ICHARM between the government of Japan and UNESCO was renewed on July 23, 2013.

### ICHARM Activities

ICHARM's mission is to serve as the Global Centre of Excellence for water hazard and risk management by observing and analyzing natural and social phenomena, developing methodologies and tools, building capacities, creating knowledge networks, and disseminating lessons and information in order to assist governments and all stakeholders in managing 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. We envision a Center of Excellence housing a group of world leading researchers and superior facilities and knowledge base, all of which are committed to i) innovative research, ii) effective capacity building, and iii) efficient information networking. Standing on these three pillars as follows, ICHARM will globally serve as a knowledge hub for best national and local practices and as an advisor in practical policy making.

i. Innovative research: High-quality outcomes, such as the Integrated Flood Analysis System (IFAS) and Rainfall-Runoff-Inundation (RRI) model, and a wide scope of knowledge establish ICHARM as a global leader and resourceful partner for promoting water-related risk management through field projects and trainings.

ii. Effective capacity building: Through provision of cutting-edge training which emphasizes local capacity to develop and apply advanced knowledge and solutions, ICHARM supports a global network of exemplary practitioners of water-related hazard and risk management. ICHARM's network, like 84 M.Sc. from 24 countries and two Ph.D from two countries (as of 2014), has been integrated seamlessly with its research activities.

iii. Efficient information networking: To support powerful and comprehensive opinions which guide water-related hazard and risk management solutions, ICHARM emphasizes localism, i.e., project implementations tailored to local needs and conditions, by creating an efficient worldwide information network such as through the secretariat of International Flood Initiative, collaborated with UNESCO, WMO, UNU and UNISDR etc.

## Development and dissemination of Integrated Flood Analysis System (IFAS)

The Integrated Flood Analysis System (IFAS) is designed to help create a runoff analysis model easily by using topographic and land-use data which cover almost the entire globe and are available free of charge via the Internet.

With IFAS alone, users can conduct a series of tasks necessary for runoff analysis including data acquisition, model creation, rainfall-runoff analysis and result display. With an additional module named Auto-IFAS, the system is capable of executing automatic functions such as downloading satellite rainfall information, loading ground rainfall information, performing runoff calculation, and issuing a warning. With these functions, users can built a real-time flood forecasting and warning system though they are minimal for a device with such a purpose.

IFAS with this additional module is very useful even in areas with limited Internet access. It can perform calculation while collecting data regularly according to a predetermined time schedule. In this way, the network and the computer can avoid being overloaded with information processing, which thus enables fast runoff calculation and quick flood forecasting and warning.

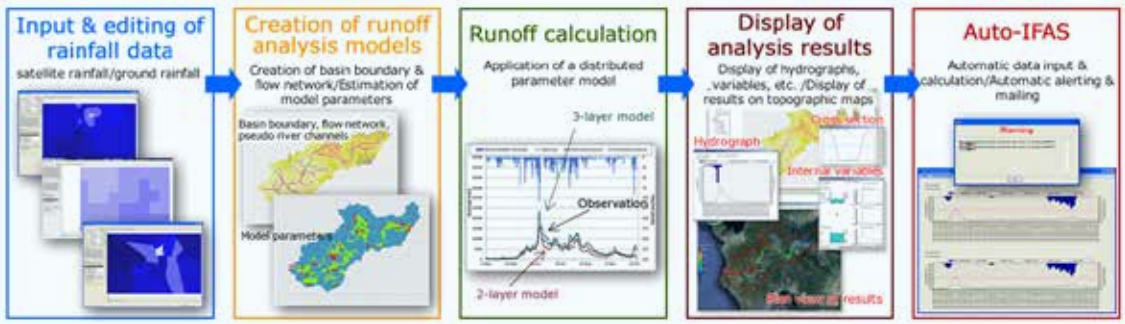
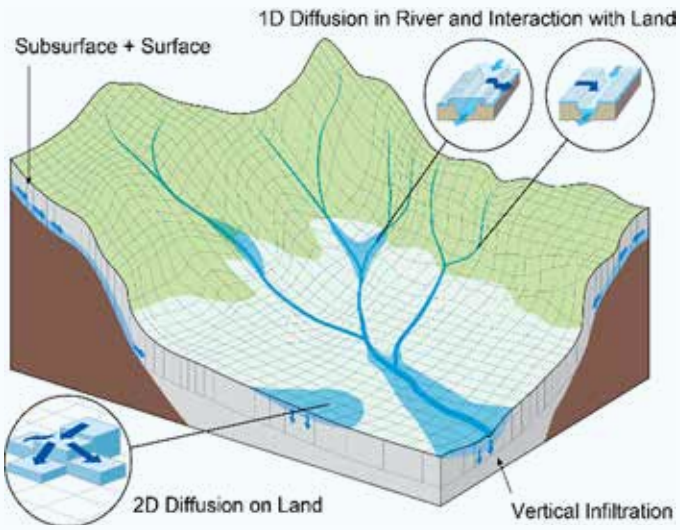



*Figure 7.3.1. The IFAS execute file is downloadable free of charge on at: http://www.icharm.pwri.go.jp/research/ifas/*
*Figure ©ICHARM*

## Development of RRI model




To predict the behavior of large-scale inundation in low-lying areas in a short period of time, ICHARM has been developing a new numerical model called Rainfall-Runoff-Inundation (RRI) model. The model simulates various hydrologic processes including rainfall-runoff, stream-flow discharge, and inundation over floodplains in an integrated manner.

The RRI model is expected to help assess future flood risk for various regions with different climate conditions, for example, based on climate change projections. Similar to the IFAS system, the model is also applicable to large-scale flood prediction on a near real-time basis by using satellite-based topography, land-use and rainfall information.

The RRI model was awarded for its excellence in 2013 by the Japan Society of Civil Engineers and by the Japan Institute of Country-ology and Engineering. The ICHARM researcher who developed the model also received 2013 Young Scientists' Prize for his outstanding performance from MEXT Minister.

## UNESCO Pakistan project

In late July 2010, northern Pakistan received a record monsoon rainfall and suffered huge damage from the worst flood in the past 80 years.

As a part of the restoration effort from this flood disaster, UNESCO started a project called "Strategic Strengthening of Flood Warning and Management Capacity of Pakistan" in July 2011. ICHARM was assigned to two of the three components in this comprehensive project: technical assistance and capacity development. In the first component, ICHARM assisted the Pakistani government in the development and implementation of "Indus-IFAS" and the production of flood hazard maps. In the other component, ICHARM provided the opportunity to participate in its M.Sc. program and short-term training programs for personnel of the Pakistan Meteorological Department, the Pakistan Space and Upper Atmosphere Research Commission and other governmental agencies.

## The SOUSEI program

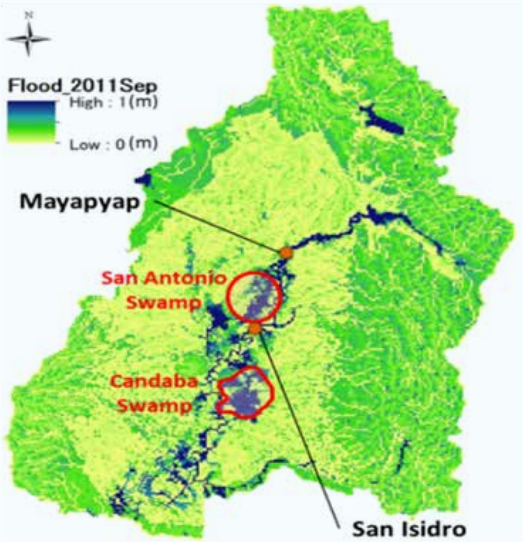



*Figure 7.3.2 Results from inundation analysis of the Pampanga river basin by using the RRI model. Map ©ICHARM*

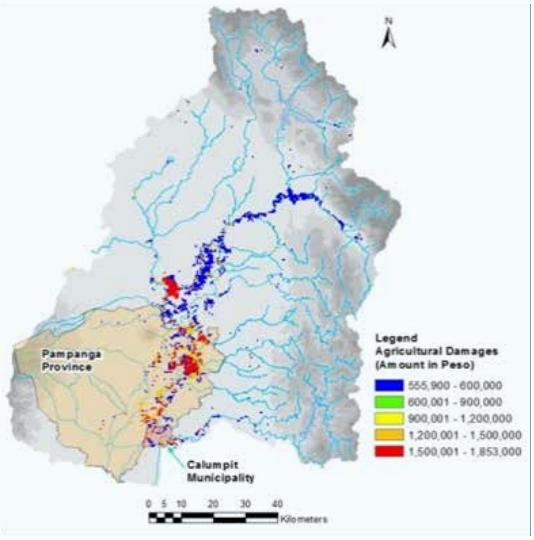



*Figure 7.3.3 Results of estimated agricultural damage in the Pampanga river basin . Map ©ICHARM*

ICHARM has been a member institute of an MEXT 5-year research project, "Program for Risk Information on Climate Change (SOUSEI program)," since 2012. In this project, we are working on the development of a quantitative method to project possible changes in flood/drought risks around the world and in five Asian river basins due to global warming and to evaluate resulting socio-economic impacts. We project risk changes based on the fifth-generation of CMIP climate projections with uncertainties.

More specifically, we aim to develop a locally-tailored method to use flood/drought hazard projections based on basin-scale GCM projections calculated with uncertainties, as well as basic technology to evaluate flood/drought risks. The five target river basins selected for this project are those of Indus (Pakistan), Chao Phraya (Thailand), Solo (Indonesia), Mekong (Cambodia), and Pampanga (the Philippines).

## Education and training programs

ICHARM has been providing training programs that empower both individuals and organizations in disaster management. ICHARM also offers post-training follow-up activities, such as seminars for ex-trainees in their countries, to grasp their facing issues and establish new training courses.

*Figure 7.3.4 Thirteen graduates '14 on their disaster risk reduction voyages as ICHARM ambassadors. Photo ©ICHARM*

1. Short-term training program: Participants learn knowledge and technologies relevant to water-related disaster risk management for a period of several days or weeks. Training courses are typically conducted in cooperation with JICA. We started "Capacity Development for Flood Risk Management with IFAS" from FY2012.
2. 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 administrators in flood management in developing countries. Students attend lectures, practices and field trips in the first half and work on a Master's thesis in the latter half. As of September 2014, a total of 90 students graduated with a master's degree in disaster management.
3. Ph.D. program: Ph.D. program, "Disaster Management Program," has been provided since 2010 in collaboration with GRIPS. As of October 2014, seven students from Nepal, Bangladesh, Guatemala and Venezuela are enrolled at the program.
4. Follow-up activity: Post-training seminars and other workshops and meetings are occasionally organized mainly to support ex-trainees' activities in their countries. enrolled at the program.

## Future Challenges with IHP

The post-2015 framework (Sendai Framework) for disaster risk reduction (DRR) was adopted at the Third World Conference on DRR in March 2015 in Japan, which represented a unique opportunity for countries to adopt a concise, focused, forward-looking and action-oriented DRR framework (UNISDR 2015). States also reiterated their commitment to DRR and the building of resilience to disasters to be addressed with a renewed sense of urgency in the context of sustainable development and poverty eradication and, as appropriate, to be integrated into policies, plans, programs, and budgets at all levels and considered within relevant frameworks. National targets and indicators will contribute to the achievement of the outcome and goal of this framework. The framework emphasizes the role of science and technology as the first of these four priorities, "Understanding disaster risk" lists as actions to promote the collection, analysis, management and use of data, the assessment of disaster risk, the use of geospatial information, and disaster-related education, dissemination and awareness raising. Referring to the Tokyo Statement (IRDR 2015) regarding a new science and technology that consolidates DRR and sustainable development, the efforts by international institutes including ICHARM will need to:

- adopt a common methodology on data collection and economic analysis of disasters which can be practiced by national and local platforms to realize evidence-based policy making on disaster risk reduction that can be practiced globally
- enhance numerical pre-assessments of damages by various hazards based on inter-disciplinary knowledge to formulate preventive policies and strategies, and
- fully share these valuable "best practices" of disaster risk reduction that are based on scientific findings.

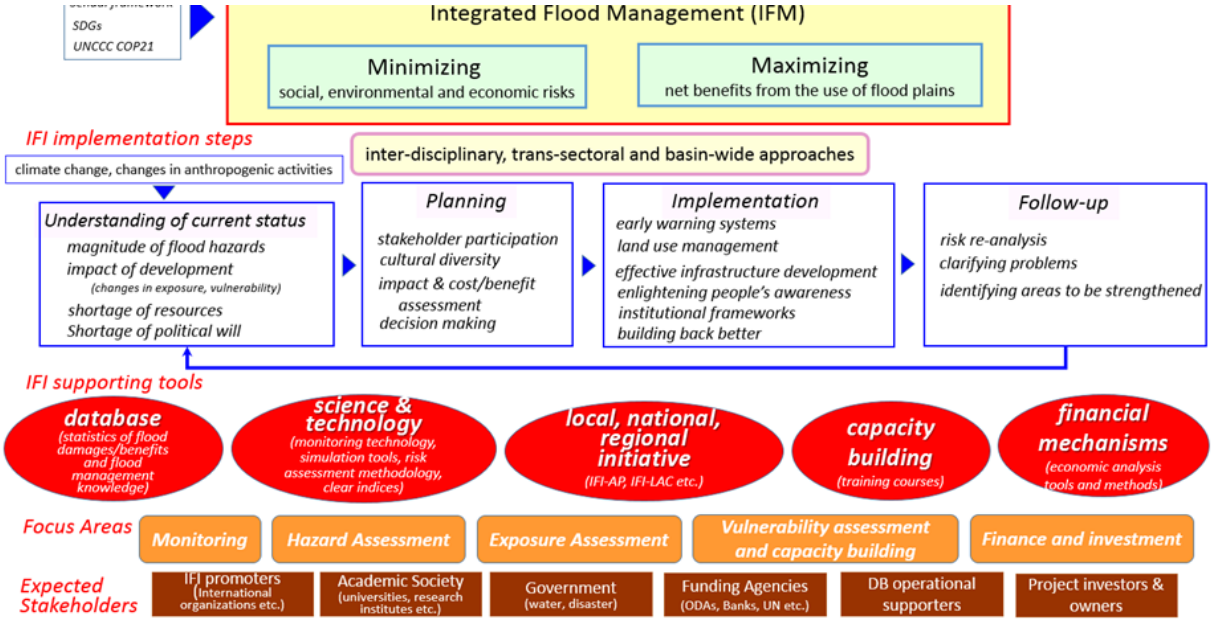



*Figure 7.3.5 IFI Strategic Structure. Figure ©ICHARM*

The exchange and management of data, information and knowledge will be facilitated through cooperative networks, such as UNESCO's International Hydrological Programme's (IHP) National Committees and Water Centers under the auspices of UNESCO. ICHARM expects IHP to gain leadership immediately through IHP VIII and far beyond through collaborative efforts in close harmony with national and local practices, especially in Theme 1 water-related disasters (UNESCO IHP eighth phase). Standing on the three pillars listed above, ICHARM is honoured to play an important role there as a knowledge hub and as an advisor for policy makers and practitioners.

In this context, the International Flood Initiative (IFI), of which ICHARM takes the secretariat in close collaboration with UNESCO, WMO, UNU, UNISDR, IAHS and IAHR, has promoted an integrated approach to flood management to take advantage of floods and use of floodplains while reducing the social, environmental and economic risks since 2005. The initiative objective is to build the capacity building necessary to understand and better respond to flood hazards, vulnerabilities and benefits as an important evolutionary link in the transition between implementation of global development goals like SDGs, as well as disaster risk reduction activities. ICHARM is now preparing for a new regional mechanism to facilitate the integrated flood management in Asia Pacific region through monitoring, assessment and capacity building.

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