

# SUMMARY REPORT

## ASEAN Hydroinformatics Data Centre (AHC)

September 2019

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### INTRODUCTION

ASEAN Hydroinformatics Data Centre (AHC), proposed by Hydro - Informatics Institute (HII), Thailand, has been approved as a new centre under Sub-Committee on Microelectronics and Information Technology (SCMIT) at the 72<sup>nd</sup> Meeting of the ASEAN Committee on Science, Technology, and Innovation (COSTI-72) on 24<sup>th</sup> May 2017, Brunei Darussalam. Furthermore, the Terms of Reference (TOR) of AHC was approved at the COSTI-74 on 10 – 11 May 2018, Chiang Mai, Thailand.

The AHC project is a platform to support data connectivity from ASEAN's water, weather and disaster related agencies. ASEAN member states can also share their knowledge and technology that could support AHC in data sharing toward its future operation and implementation.

### Summary of AHC Activity

#### 1. Nomination of Members

- a. After the approval of TOR, Hydro – Informatics Institute (HII), Ministry of Higher Education, Science, Research and Innovation (MHESI), Thailand, as a secretariat of the centre has contacted ASEAN Secretariat through National COSTI Chairman for the nomination of AHC members from all AMS. As of 15<sup>th</sup> September 2019, the nominated member for AHC is as following:

Country	Names and Contact Details
Brunei Darussalam	<u>Lead Member:</u> <i>(to be updated)</i>  <u>Key Opinion Leader(s):</u> <i>(to be updated)</i>
Cambodia	<u>Lead Member:</u> <b>Mr. MOK Khemera</b> Director Department of e-Government of General Department of ICT Ministry of Posts and Telecommunications T: +855 16989885 E: <a href="mailto:khemera-mok@mptc.gov.kh">khemera-mok@mptc.gov.kh</a>  <u>Key Opinion Leader(s):</u> <b>Mr. HOEUNG Kimsay</b> Chief of Industrial Environment Office & National COSTI Secretariat Focal Point (Alternate)

Country	Names and Contact Details
	Department of Techniques, Science and Technology Ministry of Industry and Handicraft (MIH) #45, Preah Norodom Blvd., Khan Daun Penh, Phnom Penh, Cambodia T: 855-69-38 91 38 M: 855-77-977 727 E: <a href="mailto:hoeungkimsay@yahoo.com">hoeungkimsay@yahoo.com</a>
Indonesia	<u>Lead Member:</u> <b>Dr. Adam Pamudji Raharjo,</b> Education and Research staff, Research Group Coordinator on Hydroinformatics, Faculty of Civil Engineering, University of Gadjah Mada, Indonesia T: +628121741289 E: <a href="mailto:adam.pamudji.rahardjo@ugm.ac.id">adam.pamudji.rahardjo@ugm.ac.id</a> , <a href="mailto:adam.pamudji.r@gmail.com">adam.pamudji.r@gmail.com</a>  <u>Key Opinion Leader(s):</u> <b>Dr. Andung Bayu Sekaranom,</b> Faculty of Geography, University of Gadjah Mada, Indonesia T: +625112570072 E: <a href="mailto:andungbayu@geo.ugm.ac.id">andungbayu@geo.ugm.ac.id</a>
Lao PDR	<u>Lead Member:</u> <b>Mr. Saysongkham PHANOUVONG</b> Deputy Director General Technology Computer and Electronics Institute Ministry of Science and Technology T: +856-20-55569874 Fax +856-21-213472 E: <a href="mailto:sphanouvong@gmail.com">sphanouvong@gmail.com</a>  <u>Key Opinion Leader(s):</u> <b>Mr. Maity SIRIRATH</b> Acting Director of Center for Research and Development of Internet of Things, Technology Computer and Electronics Institute Ministry of Science and Technology T: +856-21-213-470-144 Fax +856-21-213-472 E: <a href="mailto:maity20@yahoo.com">maity20@yahoo.com</a>  <b>Mr. Bounhieng SOUVANNAHANE</b> Deputy Director of Hydrology Division Department of Meteorology and Hydrology Ministry of Natural Resource and Environment T: +856-20-55833273 Fax +856-21-223446 E: <a href="mailto:bounhiengsouvannahne@gmail.com">bounhiengsouvannahne@gmail.com</a>
Malaysia	<u>Lead Member:</u> <b>Prof. Dr. Edy Tonnizam Mohamad</b> Director Centre of Tropical Geoengineering (GEOTROPIK) Universiti Teknologi Malaysia, 81310, Johor Baru, Johor, Malaysia T: 019-7172167; 075531767 F: 075531633

Country	Names and Contact Details
	<p>E: <a href="mailto:edy@utm.my">edy@utm.my</a></p> <p><u>Key Opinion Leader(s):</u>  <b>Dr. Azlin binti Ahmad</b>  Senior Lecturer  Faculty of Computer and Mathematical Sciences  Universiti Teknologi MARA, 40450 Shah Alam Selangor  T: +6012-2596948  F: +603-55435501  E: <a href="mailto:axlin@tmsk.uitm.edu.my">axlin@tmsk.uitm.edu.my</a></p> <p><b>Dr. Kumeresan A. Danapalasingam</b>  Senior Lecturer  Center for Artificial Intelligence &amp; Robotics  School of Electrical Engineering, Universiti Teknologi Malaysia, 81310,  Johor Baru, Johor, Malaysia  T: +60107032619  E: <a href="mailto:kumeresan@utm.my">kumeresan@utm.my</a></p>
Myanmar	<p><u>Lead Member:</u>  <b>Mr. Htun Lwin Oo</b>  Directorate of Water Resources and Improvement of River System  T: +95-92013271  Fax +95-1-290230  E: <a href="mailto:winhlaing34@gmail.com">winhlaing34@gmail.com</a></p> <p><u>Key Opinion Leader(s):</u>  <b>Dr. Myint Thein</b>  Rector  Yangon Technological University  Ministry of Education  Gyogone, Insein, Yangon, Myanmar</p> <p><b>Win Hlaing</b>  Deputy Director General</p> <p><b>Aung Myo Khaing</b>  Director for Planning and Research  T: 095-9-5150213, 95-1-290840  F: 95-1-290230  E: <a href="mailto:aungmyokhaing.77@gmail.com">aungmyokhaing.77@gmail.com</a></p> <p><b>Dr. Win Win Zin</b>  Professor  T: 95-9-5003274  E: <a href="mailto:winwinzin@yту.edu.mm">winwinzin@yту.edu.mm</a></p>
Philippines	<p><u>Lead Member:</u>  <b>Dr. Vicente Malano,</b>  Philippine Atmospheric, Geophysical and Astronomical Services  Administration (PAGASA), Department of Science and Technology  (DOST)</p> <p><u>Key Opinion Leader(s):</u>  <b>Dr. Enrico Paringit,</b></p>

Country	Names and Contact Details
	<p>Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD), Department of Science and Technology (DOST)</p> <p><b>Dr. Joel Joseph S. Marciano Jr.,</b> Advanced Science and Technolgy Institute (ASTI), Department of Science and Technology (DOST) E: <a href="mailto:j.marciano@asti.dost.gov.ph">j.marciano@asti.dost.gov.ph</a></p>
Singapore	<p><u>Lead Member:</u> <b>Prof. Ng Wun Jern</b> Professor Environmental Bio-innovations Group (EBIG) School of Civil and Environmental Engineering Nanyang Technology University, Singapore Scientific Advisor Ministry of Environment and Water Resources T: +65-67904736 E: <a href="mailto:WJNG@NTU.EDU.SG">WJNG@NTU.EDU.SG</a></p> <p><u>Key Opinion Leader(s):</u> <b>Prof. Adrian Law,</b> Nanyang Technology University and Environmental Process Modelling Centre, EPMC (A NEWRI Centre of Excellence) T: +65-6790-5296 E: <a href="mailto:CWKLAW@ntu.edu.sg">CWKLAW@ntu.edu.sg</a></p>
Thailand	<p><u>Lead Member:</u> <b>Dr. Sutat Weesakul</b> Director Hydro – Informatics Institute (HII), Ministry of Higher Education, Science, Research and Innovation, Thailand T: +668-1489-8794 E: <a href="mailto:sutat@hii.or.th">sutat@hii.or.th</a>, <a href="mailto:iaf@hii.or.th">iaf@hii.or.th</a></p> <p><u>Key Opinion Leader(s):</u> Mr. Atthapong Chantanumate Office of National Water Resources, Thailand T: +666-5519-6196 E: <a href="mailto:atpong@hotmail.com">atpong@hotmail.com</a></p>
Viet Nam	<p><u>Lead Member:</u> <b>Dr. Huynh Thi Lan Huong,</b> Viet Nam Institute of Meteorology, Hydrology and Climate Change (IMHEN), Ministry of Natural Resources and Environment (MONRE) T: +84-912119740, +84-4-3835-9491 Fax +84-4-3885-5993 E: <a href="mailto:huynhlanhuong@gmail.com">huynhlanhuong@gmail.com</a> , <a href="mailto:huong.huynhlan@imh.ac.vn">huong.huynhlan@imh.ac.vn</a></p> <p><u>Key Opinion Leader(s):</u> <b>Mr. Nguyen The Hoang Anh,</b> Institute of Information Technology (IOIT), Vietnam Academy of Science and Technology (VAST) T: +84-24-3971-5063 Fax +84-24-3756-4217</p>

Country	Names and Contact Details
	E: <a href="mailto:nt.hoanganh@ioit.ac.vn">nt.hoanganh@ioit.ac.vn</a>  <b>Dr. Nguyen Quang Hung,</b> Faculty of Hydrology, Meteorology, and Oceanography, Vietnam National University T: +84-38584943, +84-913502727 E: <a href="mailto:nguyengyanghung@gmail.com">nguyengyanghung@gmail.com</a> , <a href="mailto:hungng@hus.edu.vn">hungng@hus.edu.vn</a>

## 2. The First Meeting of ASEAN Hydroinformatics Data Centre (AHC)

- a. The First AHC Meeting was organized on 18 March 2019 at Kappa room, Pullman Bangkok King Power hotel, Bangkok, Thailand. The Meeting was chaired by Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology (MOST), Thailand. The full report of the First AHC Meeting appears as ANNEX 1.
- b. The Meeting was attended by delegates from the Kingdom of Cambodia, the Republic of Indonesia, the Lao People's Democratic Republic, Malaysia, the Republic of the Union of Myanmar, the Republic of the Philippines, the Republic of Singapore, the Kingdom of Thailand and the Socialist Republic of Viet Nam. Representatives from HII were also in attendance.
- c. Introduction to AHC
  - i. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, introduced the background and history of the initiation of AHC to the Meeting.
  - ii. Dr. Royboon Rassameethes, Deputy Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, introduced the endorsed Terms of Reference (TOR) of AHC to the Meeting.
- d. Election of Chairman and Vice-Chairman
  - i. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, was elected as Chairman of AHC.
  - ii. Dr. Ng Wun Jern, Professor, Environmental Bio-innovations Group (EBiG), School of Civil and Environmental Engineering, Nanyang Technological University, Singapore, was elected as Vice-Chair of AHC.
- e. Contributions and Needs from Member Countries
  - i. All Member defined contributions and needs from their own country to the AHC. The Meeting discussed on three main focuses of the AHC, which are; 1) Knowledge Sharing 2) Technology Matching and 3) Capacity Building. The Members will focus on common technologies that have been implemented in many countries, such as telemetry technology.

- ii. Each country delivered draft information on the contributed technologies to the AHC and will further discuss within their own country to formally develop their own work plan. The contributions and needs from each country are appeared as ANNEX 2.

f. Meeting Format

- i. The Meeting agreed to meet twice a year via video conference and face-to-face. The Meeting place will be informed by AHC Chairman and Secretariat team.

**3. AHC-related Activities**

a. AHC meeting with Vietnamese Members

- i. The appointment of Vietnamese lead members and a KOL for the AHC has been confirmed on July 2019 after the First AHC Meeting in March 2019.
- ii. On 11<sup>th</sup> September 2019, AHC Chairman and secretariat team from HII visited Vietnamese members for the introduction of AHC and discussion on the future plan, contributions and needs of Vietnam. Vietnamese members have summarized their contributions and needs as appeared in ANNEX 2.

b. Capacity Building in Lao PDR and Myanmar

- i. HII, as a member of AHC, involved in capacity development project sponsored by The Coca-Cola Foundation and The World Bank Group in Lao PDR and Myanmar respectively. The details of activities are as follows:

*1. Joint Research and Development Project on Science and Technology Usage for Water Resource Management in Ban Yai Nacharoen, Sangthong District, Vientiane, Lao PDR*

In response to AHC frameworks: knowledge sharing, technology matching, and capacity building, this project mainly focuses on the transfer of technology and knowledge of Thailand on the implementation of science and technology for water resources management at community level with support from The Coca-Cola Foundation. It is the scale up of Thailand's good practices on Community Water Resource Management by the adaptation of science and technology to other countries, especially the country with similar background like ASEAN.

*2. Ayeyarwady Integrated River Basin Management (AIRBM) Project, Myanmar – Development of the Ayeyarwady Decision Support System and Basin Master Plan*

The project is funded by World Bank to Myanmar government for developing the institutions and tools needed to enable informed decision making in the management of Myanmar's water resources and to implement integrated river basin management of the Ayeyarwady Basin. AIRBM project involved with many local, international, regional, as well as global agencies, for example DWIR, DHI, HII, and World Bank. Role of HII in AIRBM project is to demonstrate the application of STI, for example MIKE HYDRO BASIN, and 1-Dimensional Hydrodynamic Modelling which helps strengthening Myanmar's capacity in water resource management.

### **Future Plan**

Next meeting will be organized in Thailand on December 2019 as a back-to-back with the "International Conference on Policies, Laws and Regulations for Water Resources Management in Southeast Asia Countries" organized by Konrad Adenauer Stiftung and water-related agencies in Thailand.

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## **ANNEX 1: Report of the First AHC Meeting**

### **SUMMARY REPORT**

#### **The First ASEAN Hydroinformatics Data Centre (AHC) Meeting**

18 March 2019, Bangkok, Thailand

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#### **INTRODUCTION**

4. ASEAN Hydroinformatics Data Centre (AHC), proposed by Hydro - Informatics Institute (HII), Thailand, has been approved as a new centre under Sub-Committee on Microelectronics and Information Technology (SCMIT) at the 72<sup>nd</sup> Meeting of the ASEAN Committee on Science and Technology (COST-72) on 24<sup>th</sup> May 2017, Brunei Darussalam. Furthermore, the Terms of Reference (TOR) of AHC was approved at the COST-74 on 10 – 11 May 2018, Chiang Mai, Thailand.
5. The AHC project will be a platform to support data connectivity from ASEAN's water, weather and disaster related agencies. ASEAN member states can also share their knowledge and technology that could support AHC in data sharing toward its future operation and implementation.
6. The First Meeting of ASEAN Hydroinformatics Data Centre (AHC) was organized on 18 March 2019 at Kappa room, Pullman Bangkok King Power hotel, Bangkok, Thailand. The Meeting was chaired by Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology (MOST), Thailand.
7. The Meeting was attended by delegates from the Kingdom of Cambodia, the Republic of Indonesia, the Lao People's Democratic Republic, Malaysia, the Republic of the Union of Myanmar, the Republic of the Philippines, the Republic of Singapore, the Kingdom of Thailand and the Socialist Republic of Viet Nam. Representatives from HII were also in attendance. The list of delegates appears as ANNEX 1.

#### **AGENDA ITEM 1: WELCOME REMARKS**

8. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology (MOST), Thailand warmly welcomed the participants in attending the First AHC Member Meeting in Bangkok, Thailand. He expressed his confidence that AHC will be an ASEAN platform to move forward together in sharing, accelerating, and strengthening regional collaboration.
9. The Meeting noted the welcome remarks by Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology, Thailand. He expressed sincere appreciation to the Ministry of Science and Technology (MOST) of Thailand for the



arrangement and hospitality provided to all the participants and to AMSs during various activities hosted by MOST Thailand to enhance STI collaboration in the region.

## **AGENDA ITEM 2: INTRODUCTION**

10. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, invite all participants to introduced themselves to the Meeting.
11. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, introduced the background and history of the initiation of AHC to the Meeting.
12. Dr. Royboon Rassameethes, Deputy Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, introduced the endorsed Terms of Reference (TOR) of AHC to the Meeting.
13. The Meeting acknowledged the background and TOR of AHC. All members will share non-confidential knowledge/data, technology, and knowledge to the centre. The Meeting noted that the TOR can be amended according to comments from the floor. However, the revised TOR must be approved through SCMIT and ASEAN Committee on Science, Technology, and Innovation (ASEAN COSTI).

## **AGENDA ITEM 3: ELECTION OF CHAIRMAN AND VICE-CHAIRMAN**

14. Dr. Sutat Weesakul, Director, Hydro - Informatics Institute (HII), Ministry of Science and Technology of Thailand, was elected as Chairman of AHC.
15. Dr. Ng Wun Jern, Professor, Environmental Bio-innovations Group (EBiG), School of Civil and Environmental Engineering, Nanyang Technological University, Singapore, was elected as Vice-Chair of AHC.

## **AGENDA ITEM 4: CONTRIBUTIONS AND NEEDS FROM MEMBER COUNTRIES**

16. All Member defined contributions from their own country to the AHC. The Meeting discussed on three main focuses of the AHC, which are; 1) Knowledge Sharing 2) Technology Matching and 3) Capacity Building. The Members will focus on common technologies that have been implemented in many countries, such as telemetry technology.
17. Each country delivered draft information on the contributed technologies to the AHC and will further discuss within their own country to formally develop their own work plan. The contributions and needs from each country are appeared as ANNEX 2.

**AGENDA ITEM 5: MEETING FORMAT**

18. The Meeting agreed to meet twice a year via video conference and face-to-face. The Meeting place will be informed by AHC Chairman and Secretariat team.

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**ANNEX 1: List of Delegates for the First ASEAN Hydroinformatics Data Centre (AHC) Meeting**

Country	Position	Delegates
Cambodia	Lead Member	Mr. MOK Khemera, Department of e-Government of General Department of ICT, Ministry of Posts and Telecommunications
	Key Opinion Leader	Mr. HOEUNG Kimsay, National Committee on Science and Technology, Ministry of Industry and Handicraft
Indonesia	Lead Member	Dr. Adam Pamudji Raharjo, Education and Research staff, Research Group Coordinator on Hydroinformatics, Faculty of Civil Engineering, University of Gadjah Mada, Indonesia
	Key Opinion Leader	Dr. Andung Bayu Sekaranom, Faculty of Geography, University of Gadjah Mada, Indonesia
	Partner	Dr. Hidayat, Natural Hazard Division, Indonesian Institute of Sciences (LIPI)
	Partner	Hartanto Sanjaya, Center of Technology for Regional Resources Development, Agency for the Assessment and Application of Technology
	Partner	Dr. Ketut Wikantika, Center for Remote Sensing, Bandung Institute of Technology (ITB)
Lao PDR	Lead Member	Mr. Saysongkham PHANOUVONG, Institute of Technology Computer and Electronic
	Key Opinion Leader	Mr. Maity SIRIRATH, Technology Computer and Electronics Institute
	Key Opinion Leader	Mr. Bounhieng SOUVANNAHANE, Department of Meteorology and Hydrology
Malaysia	Lead Member	Prof. Dr. Edy Tonnizam Mohamad, Centre of Tropical Geoengineering, University Teknologi Malaysia
	Key Opinion Leader	Assoc. Prof. Dr. Ahmad Athif Bin Mohd Faudzi, Center for Artificial Intelligence & Robotics, Universiti Teknologi Malaysia
	Key Opinion Leader	Dr Azlin binti Ahmad, Universiti Teknologi MARA
Myanmar	Lead Member	Mr. Kyaw Soe for Mr. Win Hliang, Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport and Communications (MOTC)
	Key Opinion Leader	Mr. Sein Lwin for Mr. Aung Myo Khaing, Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport and Communications (MOTC)
	Key Opinion Leader	Win Win Zin, Yangon Technological University, Ministry of Education
Philippines	Key Opinion Leader	Dr. Joel S. Marciano Jr., DOST-ASTI on data and computing infrastructure
Singapore	Lead Member	Prof. Ng Wun Jern, Nanyang Technology University
Thailand	Lead Member	Dr. Sutat Weesakul, Hydro - Informatics Institute (HII)
	Key Opinion Leader	Dr. Somkiat Apipattanavis, Expert on Planning and Project, Office of National Water Resources

Country	Position	Delegates
Vietnam	Lead Member	Dr. Huynh Thi Lan Huong, Deputy Director General, Viet Nam Institute of Meteorology, Hydrology and Climate Change, Ministry of Natural Resources and Environment
	Key Opinion Leader	Nguyen The Hoang Anh, Assistant to Director, Institute of Information Technology (IOIT), Vietnam Academy of Science and Technology (VAST)
	Key Opinion Leader	Dr. Nguyen Quang Hung, Faculty of Hydrology, Meteorology, and Oceanography, Vietnam National University

### Other Participants

- 1) Representatives from Hydro - Informatics Institute (HII), Ministry of Science and Technology, Thailand
- 2) Representatives from National Electronics and Computer Technology Center (NECTEC), Ministry of Science and Technology, Thailand

Representative from Friends in Need (of "PA") Volunteers Foundation, Thai Red Cross

## ANNEX 2: Contribution and Needs from Member Countries

### Contributions from AHC Members

Countries	Knowledge Sharing	Technology Matching	Capacity Building
Brunei			
Cambodia	<ul style="list-style-type: none"> <li>- Governance</li> </ul>	<ul style="list-style-type: none"> <li>- Define common software to manage hydroinformation for AMS</li> <li>- Define sharing system platform for AHC</li> <li>- Define technology development standard</li> </ul>	<ul style="list-style-type: none"> <li>- Co-creation using standard technology</li> <li>- Joint development resource such as manpower</li> </ul>
Indonesia	<ul style="list-style-type: none"> <li>- Disaster management</li> <li>- Community-based sustainable telemetry system</li> </ul>	<ul style="list-style-type: none"> <li>- Modeling</li> <li>- Simple telemetry system</li> <li>- Asia-Pacific Center for Ecohydrology (UNESCO CAT-2 ())</li> </ul>	<ul style="list-style-type: none"> <li>- Sediment-related disaster management (Primary/Secondary Volcanic disaster) - Training</li> </ul>
Lao PDR	<ul style="list-style-type: none"> <li>- Software for lower Mekong (from MRC) on water level &amp; rainfall</li> </ul>	<ul style="list-style-type: none"> <li>- Manual/Auto Telemetry (HYMET software)</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>
Malaysia	<ul style="list-style-type: none"> <li>- Open database (open government data) freely access for public/ researcher. Also allowed to use the data for other purposes, especially research. <a href="http://www.data.gov.my/">http://www.data.gov.my/</a></li> </ul>	<ul style="list-style-type: none"> <li>- MDEC (Malaysia Digital Economy Corporation) initiated ADAX (ASEAN Data Analytics Exchanged), focus on developing talents in order to support ir4.0 – the national agenda. - have many data scientist that can do analytics</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>
Myanmar	<ul style="list-style-type: none"> <li>- Experiences on disaster encounter</li> </ul>	<ul style="list-style-type: none"> <li>- Hydromet station</li> </ul>	<ul style="list-style-type: none"> <li>- Modeling capacity (hydraulic, flood management)</li> </ul>
Philippines	<ul style="list-style-type: none"> <li>- DRRM</li> <li>- Data use policy/ Data management and integration practices</li> <li>- KOL (Joel) will confirm with responsible Philippines agencies on the participation of Philippines</li> </ul>	<ul style="list-style-type: none"> <li>- Sensor network (including connectivity)</li> </ul>	<ul style="list-style-type: none"> <li>- GIS</li> <li>- Remote sensing</li> <li>- Data science &amp; analytic (machine learning &amp; AI)</li> </ul>
Singapore	<ul style="list-style-type: none"> <li>- Non-Technical: structure of flood control program, governance</li> </ul>	<ul style="list-style-type: none"> <li>- Mathematical model &amp; visualization (urban situation)</li> <li>- Sensors on/off shore</li> </ul>	<ul style="list-style-type: none"> <li>- IHL</li> <li>- Technical - Nanyang</li> <li>- Nontechnical – ministry</li> </ul>

Countries	Knowledge Sharing	Technology Matching	Capacity Building
	<ul style="list-style-type: none"> <li>- Share urban water management and its good practices</li> </ul>	<ul style="list-style-type: none"> <li>- Desalination</li> <li>- Water reclamation</li> </ul>	
Thailand	<ul style="list-style-type: none"> <li>- CWRM</li> <li>- Development of water/weather/disaster risk data system</li> <li>- Info from ThaiWater.net</li> </ul>	<ul style="list-style-type: none"> <li>- Transfer suitable technology (e.g. simple &amp; easy Telemetry station)</li> <li>- QGIS (low-cost software) via good practices site</li> </ul>	<ul style="list-style-type: none"> <li>- Prioritize CB needed</li> <li>- Training + Budget support (need the right organization/ person)</li> </ul>
Vietnam	<ul style="list-style-type: none"> <li>- Share hydroinformatics from MRC &amp; Vietnam (Share project and experiences)</li> <li>- Experience on hydrometeorology modeling (IMHEN)</li> <li>- Near real time drought warning (IMHEN)</li> <li>- Machine learning (IOIT)</li> <li>- Remote sensing data</li> <li>- Big data and deep learning (IOIT)</li> <li>- Image and text processing (IOIT)</li> <li>- Text mining (IOIT)</li> <li>- Visualization (IOIT)</li> </ul>	<ul style="list-style-type: none"> <li>- Telemetry from Semi &amp; Automatic (+regulation)</li> <li>- ICT Technology (IOIT)</li> </ul>	<ul style="list-style-type: none"> <li>- Research results</li> <li>- Modeling capacity (weather forecast, hydraulic, flood management, flash flood) (IMHEN)</li> <li>- Data assimilation (IMHEN)</li> </ul>

### Needs from AHC Members

Countries	Knowledge Sharing	Technology Matching	Capacity Building
Brunei	-	-	-
Cambodia	<ul style="list-style-type: none"> <li>- Success of Thailand (data base or connectivity protocol)</li> </ul>	<ul style="list-style-type: none"> <li>- Create common data format for AHC</li> </ul>	-
Lao PDR	-	<ul style="list-style-type: none"> <li>- Weather modeling/ water management</li> <li>- Low-cost Hardware</li> </ul>	<ul style="list-style-type: none"> <li>- Data &amp; Modeling software</li> <li>- Weather modeling software</li> <li>- Water management Modeling system</li> <li>- Data integration (law &amp; regulations)</li> </ul>
Malaysia	<ul style="list-style-type: none"> <li>- Flood &amp; Drought Management</li> <li>- Rain/ Haze/ Groundwater</li> </ul>	<ul style="list-style-type: none"> <li>- Software – modeling (water &amp; underground water), prediction,</li> </ul>	<ul style="list-style-type: none"> <li>- Sharing facility in terms of modeling/ software/ prediction/ WRM</li> </ul>

Countries	Knowledge Sharing	Technology Matching	Capacity Building
		water desalination/ treatment	
Myanmar	-	-	- Capacity building for Hydroinformatics Center (HIC)
Philippines	- DRRM - Data use policy/ Data management and integration practices	- Sensor network (including connectivity)	- GIS - Remote sensing - Data science & analytic (machine learning & AI)
Singapore	- Weather data - Geological data - Historical data - Storm surge - Urban agriculture	-	-
Thailand	- Technology from other countries on flood, drought disaster	-	-
Vietnam	- Technology (ICT) from other countries on natural disaster	- AI - Standard of transferring data format	- The development on Thaiwater.net