FLOOD & DROUGHT MANAGEMENT TOOLS

Flood and Drought Symposium Report

23 November 2015

United Nations Convention Centre

Bangkok, Thailand

DRAFT

Table of Contents

DRAFT

1. Executive summary / รายงานสรุปสำหรับผู้บริหาร

There is a growing sense of urgency around the need to improve resilience within river basins, and for this to become a critical part of water management plans. The increased frequency and unpredictability of floods and droughts is a priority concern across scales from transboundary to local, along with the other multiple drivers that cause depletion and degradation of shared water resources.

The Flood and Drought Management Tools (FDMT) project (http://fdmt.iwlearn.org/) is financed by the Global Environment Facility (GEF) International Waters (IW) and implemented by UNEP, with the International Water Association (IWA) and DHI as executing agencies. The project is developing a computer software-based decision support system (DSS) with tools to support planning from the transboundary basin to water utility level by including better information on floods and droughts. The project is being implemented from 2014 - 2018, and 3 pilot basins (Volta, Lake Victoria and Chao Phraya) have been identified for development and testing of the DSS.

Understanding how to use and apply the information developed through the DSS is seen as a vital aspect of the future operational use and sustainability of the FDMT project. Therefore capacity development with key stakeholders (e.g. basin organisation and utilities) focusing on what the information from the DSS means and how to apply across different scales is an important step; a step in the right direction to ensure the future use of the developed methodology.

As the DSS is developed, the project is holding a series of awareness workshops for commissioners, senior advisors, policy makers and decision makers, across scales, to:

- Provide an overview of the relevance of the DSS for providing scientifically sound information for managing floods and drought
- Explain the meaning and relevance of the DSS outputs
- Develop an understanding of how to use and apply the information in decision making
- Develop and implement follow up mechanisms to continue to engage the target group

In partnership with CapNet and the Hydro and Agro Informatics Institute (HAII), DHI and the International Water Association (IWA) organised a 1 day Flood and Drought Symposium on November 23, 2015, to bring together high level representatives from national and international institutions to enhance the levels of understanding around the inclusion of information about floods, droughts and future scenarios into planning across scales. The event gave participants the opportunity to discuss and recognise improved approaches for preparedness and response to extreme events (such as floods and droughts) at the basin to water utility levels. The event took place at the United Nations Conference Centre in Bangkok, Thailand.

The Symposium made it clear that the impacts of flood and drought events are significant in terms of cost for recovery and on society. Planning for disasters in no longer an option but a must and key to the success is improving our planning capacity around extreme events. The symposium highlighted how planning for flood and drought management can benefit from technical tools to ensure more informed decision making, but these tools should not be developed for the sake of tools, they should be developed to help address issues.

Based on the evidence provided in the international case studies and by the national institutes working on both flood and drought management, progress is being made in the field, with new developments in technology and planning approaches to respond and prepare ourselves for future extreme events. While tools integrated within a DSS is valuable for in enhancing our ability to minimise risks and mitigate the impacts associated to climate change, mobilising support, building capacity and working with all stakeholders (collaboration) is as relevant as the potential technology can provide. We all feel the impacts of extreme events. We need to be talking at a particular level, with all stakeholders (consumers, engineers, social scientists, etc.) about the need and urgency of extreme events; try to bring more people on the journey. The challenges around water management live at different levels and with different stakeholders. We need to move beyond reacting during crises to managing water on a daily basis.

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Presentations from the event can be downloaded via the project website here: http://fdmt.iwlearn.org/en/en/events/flood-and-drought-symposium.

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ปัจจุบันนี้ความจำเป็นเร่งด่วนในการปรับปรุงความยืดหยุ่นภายในลุ่มน้ำมีเพิ่มมากขึ้นและยังเป็นส่วนสำคัญส่วนหนึ่งในการวางแผนบริหารจัดการน้ำ
การเพิ่มขึ้นของความถี่และความไม่แน่นอนของการเกิดน้ำท่วมและภัยแล้งเป็นประเด็นสำคัญที่ต้องพิจารณาทั้งในระดับข้ามพรมแดนและท้องถิ่น รวมถึงปัจจัยที่เกี่ยวข้องอื่น ๆ
ที่ทำให้เกิดการลดลงและการเสื่อมสภาพของแหล่งน้ำที่ใช้ร่วมกัน

โครงการจัดทำเครื่องมือในการบริหารจัดการน้ำท่วมและภัยแล้ง (http://fdmt.iwlearn.org/)
ได้รับเงินทุนจากกองทุนสิ่งแวดล้อมโลก (Global Environment Facility, GEF) ด้านน้ำระหว่างประเทศ
(International Waters, IW)และดำเนินการโดยโครงการสิ่งแวดล้อมแห่งสหประชาชาติ (United Nations Environment Programme, UNEP) โดยมีสมาคมน้ำนานาชาติ (International Water Association, IWA) และ DHI เป็นหน่วยงานปฏิบัติงานสำหรับโครงการ
โครงการนี้ได้พัฒนาโปรแกรมคอมพิวเตอร์สำหรับระบบสนับสนุนการตัดสินใจ (Decision Support System, DSS)
ที่มีเครื่องมือสนับสนุนการวางแผนสำหรับระดับลุ่มน้ำระหว่างประเทศจนถึงระดับการผลิตน้ำประปา
รวมถึงข้อมูลน้ำท่วมและภัยแล้ง โครงการนี้มีระยะเวลาดำเนินการระหว่างปีพ.ศ. 2557-2561 ในลุ่มน้ำนำร่องทั้ง 3 แห่ง คือ ลุ่มน้ำโวลต้า (Volta) ทะเลสาบวิคตอเรีย (Lake Victoria) และลุ่มน้ำเจ้าพระยา
เพื่อทำการพัฒนาและทดสอบระบบสนับสนุนการตัดสินใจ

การศึกษาทำความเข้าใจวิธีการใช้งานระบบสนับสนุนการตัดสินใจมีความสำคัญสำหรับการใช้งานและดำเนินการในอนาคตและยังส่งผลถึงความยั่งยืนของโครงการจัดทำเครื่องมือในการบริหารจัดการน้ำท่วมและภัยแล้ง
ดังนั้นการพัฒนาขีดความสามารถผู้ที่มีส่วนได้ส่วนเสียที่สำคัญ อาทิเช่น
หน่วยงานลุ่มน้ำและหน่วยงานระบบสาธารณูปโภค
โดยเน้นถึงการเข้าใจความหมายของข้อมูลจากระบบสนับสนุนการตัดสินใจและการนำไปใช้งานในระดับต่างๆ
จึงเป็นขั้นตอนสำคัญ
แต่ละขั้นตอนในทิศทางที่ถูกต้องเพื่อที่จะให้มั่นใจได้ว่าจะมีการนำวิธีการที่พัฒนาขึ้นไปใช้งานในอนาคต

เนื่องจากระบบสนับสนุนการตัดสินใจได้ถูกพัฒนาขึ้นใหม่
ทางโครงการจะจัดการประชุมเชิงปฏิบัติการเพื่อสร้างความตระหนักให้แก่คณะกรรมมธิการ ที่ปรึกษาอาวุโส ผู้กำหนดนโยบาย ผู้มีอำนาจตัดสินใจ และอื่นๆ

- เพื่ออธิบายโดยสรุปถึงความเกี่ยวข้องของระบบสนับสนุนการตัดสินใจ
  เพื่อใช้เป็นเครื่องมือบริหารจัดการน้ำท่วมและภัยแล้ง
  เพื่อให้ข้อมูลที่ถูกต้องทางวิทยาศาสตร์สำหรับการบริหารจัดการน้ำท่วมและภัยแล้ง
- เพื่ออธิบายถึงความหมายและความเกี่ยวข้องของผลลัพธ์จากระบบสนับสนุนการตัดสินใจ
- เพื่อพัฒนาความรู้ความเข้าใจในวิธีการและการนำข้อมูลไปใช้ในกระบวนการตัดสินใจ
- เพื่อพัฒนาและดำเนินการกระบวนการติดตาม เพื่อให้มีการมีส่วนร่วมของกลุ่มเป้าหมายมีความต่อเนื่อง

DHI และ IWA โดยความร่วมมือกับ CapNet และสถาบันสารสนเทศทรัพยากรน้ำและการเกษตร (สสนก.)
ได้จัดการประชุมวิชาการนานาชาติเรื่องน้ำท่วมและภัยแล้งขึ้นในวันที่ 23 พฤศจิกายน 2558
เพื่อให้ผู้แทนระดับสูงจากหน่วยงานทั้งในประเทศและต่างประเทศทั้งหลายได้มาประชุมร่วมกันเพื่อที่จะยกระดับความรู้ความเข้าใจในผนวกข้อมูลน้ำท่วม
ภัยแล้งและสถานการณ์ที่อาจเกิดขึ้นในอนาคตเข้าไปในกระบวนการวางแผนในระดับต่างๆ
และยังเป็นโอกาสให้ผู้เข้าร่วมประชุมได้แลกเปลี่ยนความคิดเห็นและรับทราบวิธีการที่ปรับปรุงขึ้นสำหรับการเตรียมความพร้อมและรับมือกับสถานการณ์รุนแรงที่อาจเกิดขึ้น (เช่น น้ำท่วมและภัยแล้ง)
ที่ระดับลุ่มน้ำจนถึงระดับระบบสาธารณูปโภคน้ำ การประชุมครั้งนี้ได้จัดขึ้นที่ศูนย์การประชุมแห่งสหประชาชาติ (United Nations Conference Centre) กรุงเทพมหานคร

การประชุมวิชาการนานาชาติครั้งนี้ได้ชี้ให้เห็นว่าผลกระทบที่เกิดขึ้นจากสถานการณ์น้ำท่วมและภัยแล้งมีความสำคัญในแง่ของค่าใช้จ่ายในการฟื้นฟูและต่อสังคม
การวางแผนสำหรับภัยพิบัติไม่ได้เป็นทางเลือกอีกต่อไปแต่จำเป็นต้องมีและปัจจัยสำคัญที่จะนำไปสู่ความสำเร็จคือการปรับปรุงความสามารถในการวางแผนสำหรับรับมือกับสถานการณ์รุนแรง

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การประชุมได้เน้นถึงประโยชน์ที่ได้รับจากเครื่องมือทางเทคนิคในการวางแผนสำหรับบริหารจัดการน้ำท่วมและภัยแ
ล้งเพื่อให้มั่นใจได้ว่ากระบวนการตัดสินใจมีข้อมูลที่มากเพียงพอ
แต่เครื่องมือเหล่านี้ไม่ควรจะถูกพัฒนาขึ้นมาโดยไม่มีประโยชน์
เครื่องมือควรจะถูกพัฒนาขึ้นเพื่อช่วยในการจัดการกับปัญหา

จากข้อมูลที่นำเสนอในกรณีศึกษาจากประเทศต่างๆและจากหน่วยงานในประเทศที่ทำงานเกี่ยวกับการจัดการน้ำท่ว
มและภัยแล้ง
ความก้าวหน้าจะเกิดขึ้นในพื้นที่ในการพัฒนาเทคโนโลยีใหม่และวิธีการวางแผนเพื่อรับมือและเตรียมตัวสำหรับเหตุ
การณ์รุนแรงในอนาคต
ในขณะที่เครื่องมือที่ถูกผนวกไว้ในระบบสนับสนุนการตัดสินใจเพิ่มสามารถในการลดความเสี่ยงและลดผลกระทบที่
เกิดขึ้นจากการเปลี่ยนแปลงสภาพภูมิอากาศ การสนับสนุน
การเพิ่มศักยภาพและทำงานร่วมกับผู้มีส่วนได้ส่วนเสียต่างๆ (ความร่วมมือ)
มีความเกี่ยวข้องกันกับเทคโนโลยีที่มีศักยภาพ ทุกคนสามารถรับรู้ได้ถึงผลกระทบที่เกิดจากเหตุการณ์รุนแรงต่างๆ
เราจึงจำเปนต้องพูดคุยถึงระดับต่างๆ โดยเฉพาะ กับผู้มีส่วนได้ส่วนเสียทั้งหมด (ผู้บริโภค วิศวกร นักสังคม
และอื่นๆ) เกี่ยวกับความจำเป็นและความเร่ด่วนของเหตุการณ์รุนแรง พยายามที่จะดึงคนเข้ามามีส่วนร่วมให้มากขึ้น
ความท้าทายที่เกิดขึ้นในการบริหารจัดการน้ำมีความแตกต่างกันที่ระดับต่างๆ
และความแตกต่างของผู้มีส่วนได้ส่วนเสีย
เราจำเป็นต้องก้าวไปข้างหน้าเพื่อที่จะรับมือกับวิกฤตในการจัดการน้ำในชีวิตประจำวัน

การบรรยายต่างๆจากการประชุมวิชาการนานาชาติสามารถดาวน์โหลดได้จากเว็บไซต์ของโครงการ
http://fdmt.iwlearn.org/en/en/events/flood-and-drought-symposium.

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2. Project background

The Flood and Drought Management Tool (FDMT) project is funded by the Global Environment Facility (GEF) International Waters (IW) and implemented by UNEP, with the International Water Association (IWA) and DHI as the executing agencies. The project is developing methodologies and tools within a decision support system (DSS) to facilitate the inclusion of information about floods, droughts and future scenarios into Integrated Water Resources Management (IWRM) planning, Water Safety Planning (WSP), Transboundary Diagnostic Analyses (TDA) and Strategic Action Plans (SAP). The project is being implemented from 2014 - 2018, and 3 pilot basins (Volta, Lake Victoria and Chao Phraya) have been identified for development and testing of the DSS.

The project is responding to a growing sense of urgency around the need to improve resilience within river basins, and for this to become a critical part of water management plans. Consequently, the IW focal area of the GEF has identified the increased frequency and unpredictability of floods and droughts as a priority concern in transboundary contexts, along with the other multiple drivers that cause depletion and degradation of shared water resources.

Based on these issues, the project is developing a decision support system that supports the integration of information on floods and droughts into planning across scales. The project will integrate information on climate including floods and droughts for planning at both transboundary and national basin and local (specifically water utilities) levels by providing tools for both scales within a single DSS.

The DSS being developed is a computer software-based system containing a number of ‘tools’ with different technical functionality. The DSS is being tested and validated with available data at both basin and local levels in the 3 pilot basins; however it will be available for all other GEF IW basins. This also includes training modules available at the end of the project to ensure that methods can be applied to other basins. The aim is to develop an approach that interfaces with existing planning practices including TDA/SAP, IWRM planning or WSP.

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3. Flood and Drought Symposium

3.1 Overview of Symposium

Understanding how to use and apply the information being developed through the DSS is seen as a vital aspect of the future operational use and sustainability of the Flood and Drought Management Tools project. Therefore, capacity development with key stakeholders focusing on what the information from the DSS means and how to apply this information across different scales is an important step.

The project is holding a series of awareness workshops for commissioners, senior advisors, policy makers, decision makers, etc. to provide the following:

- Overview of the relevance of the DSS in providing scientifically sound information for managing floods and drought
- Develop an understanding of how to use and apply the information (output) for decision making
- Develop and implement follow up mechanisms to continue to engage the target group

Objective and outcomes

The objective of the Symposium in Bangkok was to enhance the levels of understanding by those focusing on water management, including utilities, government advisors, research institutes, and decision makers of the capabilities and potential uses of the FDMT DSS in supporting planning around flood and drought management.

The expected outcome of the Symposium was to improve target stakeholder's understanding on how information from a DSS can be used in decision making around flood and drought management planning across scales. For the project, this is an opportunity to ensure that the outcomes from the DSS are imbedded into the actual workflow, and position the DSS as a tool to be used in decision making. It will also ensure high level buy-in, making sure that efforts made on the ground are not undermined by choices made by decision makers.

Target group

The target group of this awareness workshop are institutes and groups of people working on addressing the impacts of climate change. Workshop attendees are high level representatives, for example, utilities, government agencies, research institutes, etc., who can influence decision making. A full list of (invited) participants can be found in Annex 4.

3.2 Flood and Drought Symposium: Understanding the value of a DSS

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On November 23rd, 2015, the FDMT project held the Flood and Drought Symposium in partnership with CapNet and the Hydro and Agro Informatics Institute (HAII) at the United Nations Conference Centre, Bangkok, Thailand.

To reduce poverty, we need to address vulnerability. Heads of states approving the SDGs need to make a link to disaster risk reduction (e.g. ensuring flood and drought are on the agenda). These were the opening remarks by Mr. Kaveh Zahedi (Regional Director, UNEP). The impacts of flood and drought events are very significant. Compared to the past it has become harder to predict extreme events and therefore prepare for the impacts Climate in the Asia Pacific region has been changing, temperatures have been higher, rainfall more variable and more extreme. This has resulted in some of the most damaging disasters in recent decades for the region. 8 out of the top 10 top countries hit by extreme events are from the Asia Pacific region. The costs are high and the impact on human welfare significant. Planning for disasters in no longer an option but a must, solutions will come from integrated approaches, linking, for example, ecosystem services with built infrastructure, to address the impact of extreme events. Key to the success is improving our planning capacity around flood and droughts. Dr. Pichet Durongkeveroj keynote addressed how planning for flood and drought management can benefit from technical tools to ensure more informed decision making. Tools should not be developed for the sake of tools. They should be developed to help address current issues. Dr. Pichet's keynote set the stage for the remainder of the day.

Katharine Cross (Programmes Manager, IWA) provided and overview of the Flood and Drought Management Tools project, highlighting the increasing frequency and severity of flood and drought events and a need to improve resilience within basins and for this to become a critical part of water management plans. The overview underlined the benefits of having a scientific approach to decision making using a decision support system with tools to support technical activities within flood and drought planning.

"Turning [the] lofty goals into practical reality is the task ahead of us in [he Flood and Drought Management Tools project] and during the Symposium" (Kaveh Zahedi, Regional Director, UNEP)

International case studies

- *Global Climate Change–Integration, Coherence and Governance (Taiwan Experience)*
  Prof. Hong Yuan Lee, National Taiwan University, Republic of China (Taiwan)

  Taiwan experiences natural disaster on a regular basis, and the population have learnt to live with this, but the situation is becoming more severe. Extreme floods are occurring every 2 years and drought events every 9 years. The impacts are significant requiring high costs to re-develop infrastructure (e.g. road networks). A better way of managing water is on site and through smart urban design (e.g. combining urban planning and drainage).

Consequently, there was a need for a paradigm shift to change the mind-set of researchers, decision makers, etc. and build capacity and cooperation between the local and central government. A 20 year plan was introduced to re-locate the population and infrastructure as most are in high risk areas. There are many ministries involved and partnerships between different agencies in implementing the plan.

Key to the process is public dialogue to keep stakeholders engaged (participatory planning), encouraging collaboration and showing the benefits. For example, by addressing flood issues can help increase the land price and this in turn benefits the people as their land value increases. Of course ensuring integration and collaboration between various departments and ministries is always a challenge as there is a push and pull for power. Each institution has its own agenda. However, the solution lies in conveying the right message. In Taiwan, everyone knows about floods, so awareness exists ensuring that the water issue becomes the priority, even the Prime Minister sees it as very important to put on the agenda. The government has the practice of inviting university professors to be part of relevant ministries to bridge the gap between science and policy, and bring research to the forefront. This has helped tremendously in integrating various sectors.

As part of the plan, Taiwan wants to ensure that all villages have the capacity to survive on their own for 7 days. Each village has a disaster mitigation map, and they know how to read the maps and how to respond (e.g. who to contact, what measures to take, etc.). A partnership was established between NTU university and local government to show how to develop the disaster maps, how to read the maps and how they can use this to formulate an action plan. Furthermore, all villages were fitted with a communication system as maintaining communication with the villages is important.

This process took 3 years, but the results show that they are better prepared. They ensured the participation of all relevant stakeholders in the process to reach the level they are at now. The success was a result of integration, coherence and good governance

- *Australia's Water Management Modelling Framework, linking policy and modelling for drought management*
  Dr. Robert Carr, CEO eWater Solutions, Australia

  In Australia, water is an in-country transboundary issue, a resource shared across state governments. The southern part of the country is getting drier and north is getting wetter. The climate shift is changing the management of water resources in Australia to a more bottom up approach. The variability of the climate requires a more adaptation to naturally deal with the changes. It took Australia 25 years to realise the onset of a drought period. Droughts tend to creep up slowly; the resilience process needs to be started early. There is now a lot of experience in Australia as they have gone through a learning process to manage their situation.

  Models and data drive decision philosophies. There is a need to move away from perception to base decision on facts to ensure sufficient certainty. However you need to know what is enough, in terms of information, to formulate a sound policy. Modellers will always want more and more data, but there should be a limit.

  Currently, water is managed in Australia through water accounting and sharing policies. Ownership of water in a reservoir is not property of the government but those downstream of the reservoir are shareholders. The water market is a free market. Trading of water is between the buyer and the seller. The government takes a transfer fee (cost recovery) of AUD 50-100, not for profit. They act as water brokers where a trade between buyer and seller must be accepted by the government in order to ensure there is no third party (compliance model).

  The IWRM tools are used beyond their usual function to also help identify ownership sectors as an additional governance layer; who owns the water at what point in the cycle. Access to water for those who do not have land rights should not be a restriction to try this concept. Pilot studies can be carried out to see the suitability and important is to get the concept and adapt to the local situation; not replicate the Australian example.

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Adoption of a model is more than just a technical issue; it also involves a change in policy. The DSS used by eWater is based on embedding policy into the model to ensure that it becomes the expression of what will happen and use that to engage stakeholders and change policies around the management of water. It is about building resilience by embedding drought management policies into the software.

- *Satellite-Based Drought, Flood, and Food Security Monitoring System in Asia*
  Dr. Shinichi Takashima, Remote Sensing Technology Center (RESTEC), Japan

  Regional data is important for the work that is being done locally, however it is difficult to get consistent information as it is costly.

  In Japan, a number of indicators (rainfall, inundation, drought, soil moisture, etc.) based on validated information have been identified to monitor flood and droughts. These are based on satellite information. Since the implementation of satellite remote sensing in Japan t, its use has been restructured to develop applications for social benefits, for example various services, capacity development for water and agriculture and related areas.

  With a changing climate resulting in more frequent and severe events (e.g. drought, desertification, flooding), there is increasing damage to agricultural productivity and human wellbeing. Satellite remote sensing will provide a means to develop countermeasure strategies. Satellite data can provide a number of observations from meteorological conditions levels to land use changes.

  This is especially relevant as the Asian region is experiencing increasing flood and drought events. It is important to understand such events to inform policy making on food security. Using the benefits of satellite remote sensing data RESTEC will continue its work on developing services, applications and capacity development for water and agriculture (and related sectors). This will be done using current indicators while integrating new ones, such as yield estimation and short- and long-term forecasting.

Panel discussion

Managing flood and drought events

- Can you say what the general weather characteristics is for Thailand and can you tell us the current rainfall situation (extreme weathers) in Thailand, especially severe drought in 2015. What can TMD do to support flood and drought management? *Ms. Patchara Petvirojchai, TMD*

  Thailand is located in the tropical zone. Flooding results from the storms during the rainy season from May to October. In the southern part of Thailand, storms are short term. This year, there was only one typhoon. In fact 2015 has seen little rainfall in Thailand, resulting in a drought.

  TMD have their own forecast system which they use to make decisions regarding water management. Short-term forecasting is based on radar and satellite (support from Japan and the USA), providing information every 10 minutes. There is also support from Philippine for water management and climate and seasonal forecast for the short- and long-term.

  TMD has developed a number of tools and this year the capacity of the spectrometer will enable them to go in depth (80-90%). They are putting a great deal of effort to develop smart information, smart observations, smart forecasting, and bring that information to the people.

- Can you describe the current drought in Thailand? How big is the impact? Are there any measures the Thai government has implemented, who makes decisions and how are decisions are made? *Mr. Somchit Amnatsan, RID*

  Thailand has experienced drought periods in the past. In 1994 the amount of water was over 2 million cubic meters. In the Chao Phraya there are two dams and not enough water. The use of water needed to be reduced. In 2010, the drought period forced the postponement of the seasonal rice plantation. The latest drought in 2015 forced the government to announce to farmers not to grow a second crop of rice due to limited water availability, however people are still planting.

  In May 2015 there was 55% lower water level than normal, and in June 2015, 43%. There is not enough rainfall but also the water retention is not sufficient. Furthermore, the use of water has increased. In the off season, this has become a major concern.

  There are measures in place in terms of campaigning, additional income generating activities, alternative crops, decision making, etc. The process is there, and a committee has been established to take up the responsibility of monitoring and evaluating the water situation. The committee consists of 10 organisations including TMD, EGAT, WRC, RID etc. They work together to give the big picture; the forecast and what the situation will be – long term forecasting.

  Water for different needs must also be considered. This was conveyed to the government for a long time so that they can put in place measures to tackle the drought impacts first and foremost. RID is talking to the relevant people to get their help and cooperation to deal with the current situation.

- For flooding, can you share with us the decision making processes, is this similar or different for drought? Has the Thai government set priorities for flood and drought issues? What is the current status of the DSS system for flood and drought management in Thailand? *Dr. Sutat Weesakul, HAII*

  The Hydro and Agro Informatics (HAII) Institute has an ad-hoc structure to deal with drought, but this is not a long-term solution. The difference with floods is that it is more a macro level issue and HAII has a better picture and experience with this extreme event. The thought process is how to keep the water for the various sectors that take longer to recover from the absence of water. There is a need to optimise the water that is available for each sector. The agriculture sector needs to define the optimisation of water better, for example scheduled water distribution. This is more small-scale water management for the situation in Thailand. For drought management, there needs to be an improvement in water storage management. Relying on just natural water resources is not enough.

  Since the floods four years ago, the government has improved its understanding of flood and monitoring process. Specific changes since 2011 has been increased awareness and

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understanding form HAII on the need for a better data base to manage information and have more integration between different agencies. This has worked well. Last year, HAII put more emphasis on the database and expanded from 13 to 30 agencies. They have moved from a more ad hoc management approach to long-term management based on the existing database. For example, weather forecasting for short- and middle-term. HAII also provides information to other departments and receives information in return. Furthermore, there is data on water management for the irrigation zone, water security and water safety for the industrial sector (MWA, PWA), warning (disaster warning), and information on water for power generation (which EGAT in charge of).

There is a need to provide the picture for the peak season, thereafter, establishing a long-term picture for economic and social reasons. However, the current database needs to be expanded in order to develop a sound long-term development plan for Thailand. This is what they are working towards.

- In the short-term, what can we tell the public to encourage or to change their behaviour in order to reduce risks from flood and drought in future? Based on the international case studies, do you see any possibility or lessons that can be learnt for Thailand? *Dr. Prasert Sirinapaporn, ONEP*
  UN conventions on environment should be the principles or guideline by which institutions operate. The climate change master plan for Thailand was agreed on by cabinet in September 2015. This Master plan for the next 30 years emphasises that Thailand needs to be more resilient to climate change. Short-, mid- and long-term planning are considered as well as expanding capacity development.

  Climate change is the root of many issues: food security, human security on natural resources, tourism, etc. Thailand needs a comprehensive management strategy that involves the public and private sector working together, sharing data, identifying the water users, etc. to better plan for water management, and this should also integrate meteorological data. Furthermore, policy around water management under different basins (also extending to agriculture, trade, consumption of citizens) needs to promote the integrative use of both surface and ground water for systematic water consumption.

  There are several other challenges ONEP faces with regards to floods and droughts. Land use in the area needs to be better monitored, using a participatory approach, including other sectors such as urban planning and improving reservoir areas. Furthermore, under the adaptation approach there is a need to work on reducing the impact of disasters by focusing on actives in up- and downstream areas. This can include, reforestation, monitoring agricultural areas, implementing soil and water management, maintain infrastructure to protect ecosystem (preparedness), assess risk to forecast the impact and prepare.

  Furthermore, an alert network is needed at the national and local level using sufficient local and technical knowledge to improve the use of forecasting information and give a more accurate picture to farmers. With this available, conveying the situation can be more accurate and the correct measures can be put in place to provide assistance to, for example, farmers or communities.

Take home messages from international case studies
Taiwan is a good example of how knowledge (including good scientific data) is used in making the right decisions at the operational level. In Bangkok, elements from Taiwan are being adapted to their situation.

Forecasting is not done well. The FDMT Decision Support System can help fill this gap. However, social and economic impacts need to be considered within a DSS and there needs to be cooperation from the community. If they are asked not to grow rice, then they need to listen. However these decisions should also take into consideration the socio-economic constraints of farmers who do not have an alternative income source. This is the issue, it goes beyond just the management of water, looking at the laws and policies need to be considered and community socio-economic dimensions.

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DHI and IWA should consider this point while developing the DSS. It is better to address the root cause of a problem, then the enforcement of the law can be done and help make the process of water management easier.

Audience comments
In certain cases, natural infrastructure is integrated into the existing infrastructure network. In Thailand, irrigation accounts for 20 % of water use to cover 20 percent of agricultural land, the rest is covered by rainfed agriculture. There are reservoirs and irrigation systems which serves water for all purposes. However, most engineering is conventional. In some circumstances, it depends on the physical condition of the river. There is not much thought concerning natural infrastructure, from HAII's experience, they employ the use of built infrastructure to divert water for storage during dry season, and they use very small investments to move the water to the storage area. This can been seen as a constraint If there is money you do one thing, but if there is no money you need to find a different approach. The best use of natural infrastructure in Thailand is at the community (micro) level. The people have to rely on the nature, they are in the rainfed area, so they need to understand how to use nature to minimise the cost.

Bottom line is that the victims of the problem should be able to deal with the situation. It should not be about what we can provide them but we should understand the situation they face, the consequences and what can be done to improve this. The government cannot find a solution for everyone, and this needs to be made clear to all.

Furthermore, certainly the participation of the public is crucial, just as important is the integration of water related institutions that need to learn how to work together. Integration is not coming to a meeting and leaving the discussion there. They need to focus on what benefits the people and not their institution.

The participatory approach is not an Asian tradition, but Asia needs to change. A holistic approach is needed, not just engineering, not just planning, not just regulation, but all sectors integrated. By solving one problem, another arises. A holistic approach integrating various institutions and department does not happen overnight. In Taiwan it was a process that took up to 3-4 years.

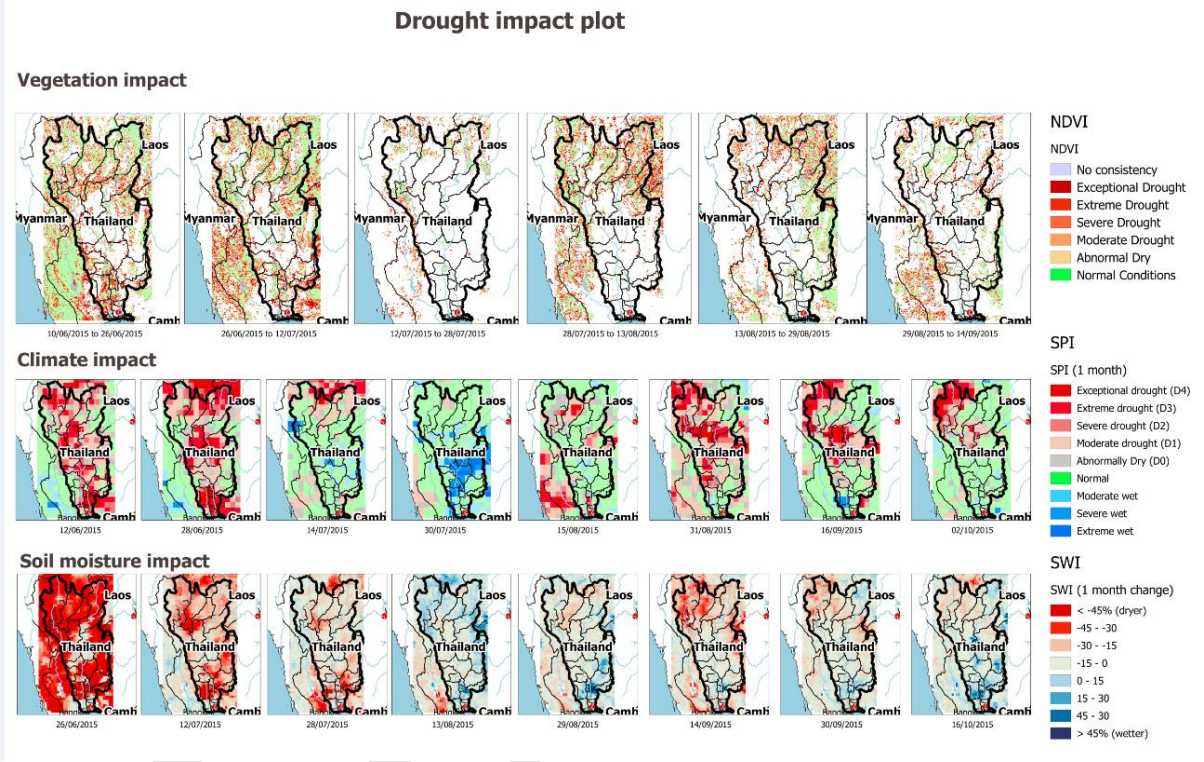
Flood and drought management – DSS in more detail
The DSS contains technical tools which analyse and visualise information. This information is then used by decision makers to make sound choices around flood and drought planning.

The current ongoing development of the DSS has been on drought management. Remotes sensing is being used as it has a global (and regional) coverage, data is freely available, it is near real-time and there are many data sets available for the last 10 to 15 years. Though this approach, drought indices have been developed to compare the current situation with the normal (average) historical condition.

The project addresses three types of drought:

- Meteorological drought: Rainfall and potential evaporation (using Tropical Rainfall Measuring Mission (TRMM) to estimate the change in rainfall) – the use of GPM will replace TRMM once there is sufficient historical data (this has a higher resolution)
- Hydrological drought: Look at soil moisture (using Soil Water Index (SWI) to estimate changes to the moisture content in the upper soil layers)
- Agricultural drought: Vegetation cover (using Normalized Difference Vegetation Index (NDVI) to estimate the vegetation growth)

A common point for the above indices is their potential use to help categorise situations; e.g. drought classification. For example, NDVI indicates vegetation cover and analyses how the current situation compares to the normal (or average) historical condition; comparing whether the conditions over time are above or below the normal mean. If vegetating is low, this will be flagged with a red colour indicating a certain level of drought (there are 5 classes of drought form normal to exceptional drought).



The Asian Disaster Preparedness Centre (ADCP) is in the process of developing a drought information system for the Mekong. There are a lot of synergies with the FDMT project. This emphasises the need for cooperation between institutions (and projects) as this can be a useful means to influence institutes to uptake approaches being recommended.

Drought

- The ESCAP/RESAP Regional Drought Mechanism
  Ms. Kelly Hayden, ESCAP
  Drought is different in Asia-Pacific region compared to other parts of the world. As such, it is often under-reported and receives inadequate attention.

  The Regional Drought Mechanism was established to:
  - Provide the access to in-season EO satellite data and products
  - Impart specialised capacity development training
  - Establish the sustained institutional partnership and networks for the regular flow of information and knowledge as well as technology transfer.

The mechanism covers 62 countries running for 2 years and has a strong focus on collaboration and cooperation in the region

A response will be different based on the context and economic capacity of the country. In order to respond there should be different measures to reflect the varying capacities. The mechanism is extremely flexible so each country can use the mechanism based on their context specific capacity and the situation in their country. At this stage it focuses on monitoring and early warning.

- Dry season planning and management
  Mr. Somchit Amnatsan, RID
  During the dry season, Thailand estimates the water availability by forecasting the inflow and water supply potential. There is a Joint Management Committee consisting of 10 agencies (local institutions, RID and related agencies). They are tasked with monitor and analyse the water situation in Thailand. Monitoring the water situation is most ideal at the local scale compared to the national scale. This is case because Thailand consists of 22 provinces and 1.4 million hectares of irrigated areas.

  Formulation of a water allocation plan for all sectors has been formulated, identifying priority sectors with regards to water distribution:
  1. Consumption, water works
  2. Conservation of ecology; driving of sea water, driving of waste water, river bank protection
  3. Reservation for consumption and conservation of ecology in early period of rainy season
  4. Agriculture
  5. Industries

  The water allocation plan is reported to the government for policy making. The current 2015/2016 plan for the Chao Phraya Basin will reserve 1,347 million cubic meters of water from the early period of the next rainy season for consumption and conservation of ecology.

  This year there is water shortage in Thailand. Measures have been taken to effectively manage water during the dry period such. For example, water control gates which receive water from Chao Phraya River will be periodically opened to receive the water for consumption use only, and placing restrictions on water allocation for irrigation. Another measure was to reduce the number of fish ponds, shrimp ponds in irrigated areas and decrease the amount of fish cages in various rivers. These measures will carry on till the next year.

  Ensuring that users comply with the management plans of water is a big challenge. Farmers, for example, are consuming more water than forecasted, so water which was reserved for minimum of 2 years will only last a year. It is a challenge to control the water consumption of consumers. As with this year, efforts at the local level to raise awareness on the current situation has been unsuccessful.

  Furthermore, there is a need for information from the meteorological department as well as information on sea level rise, as there are issues of saline intrusion, to properly understand the situation and plan. Fresh water is needed to counteract the intrusion and ensure tap water quality is of the right standard.

  For the challenge Thailand is facing, RID has good plans and tools on decision making, but they need to find a way to implement those plans at the local level otherwise they are pointless.

Flood

- Flood Forecasting in Thailand. Today and Tomorrow
  Mr. Finn Hansen, DHI
  There are multiple competing objectives at different time scales, several institutions and stakeholders. These make it complex to address the challenges we face (e.g. water scarcity, floods, poor water quality, poor institutional and human capacity, etc.)

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What is needed is to combine the competing objectives, collaborate with the various institutions and stakeholders to look and address the challenge. Capacity development needs to also be done with running models to ensure continuity.

Combining the various models also needs to include the various time schedules. In flood forecasting we look at hours and days but need to combine information from months, years and decades. This is where the future is, looking at optimisation, seasonal forecasting and planning; looking at all types of decision making around climate conditions.

- Flood management from the perspective of a reservoir operator
  Mr. Nutthavutthi Chamchang, EGAT

  River information enables EGAT to know how much water can be released and guarantee that water will not spill over the river banks.

  Thailand has several mechanisms to address the wet and dry season. In the wet season, there is a committee (consisting of 10 organisations, of which EGAT is one) in place to monitor and analyse potential flood situations. During the dry season, there is a committee to monitor and analyse the situation and Dry Season Plantation Committee.

  EGAT uses various tools for water management, including telemetering, weather forecasting, river information and river limitation. Information that EGAT collects is shared to ensure communities are aware if flooding will occur.

  What is needed is a long-term smart forecasting system (1-3 months), and integrated information database and country level 'War Room' where integrated information is shared and single command decisions are made.

Water Safety Plan (WSP)

- WSP Asia Network
  Ms. Sushmita Mandal, IWA
  WSP is a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer, with the aim of consistently ensuring the safety and acceptability of a drinking-water supply. Simply put the process identifies the hazards and risks in the supply system, how to fix the hazards and risks, and checking that these hazards and risks are fixed.

  It is very important for utilities to understand that the WSP process goes beyond the conventional boundaries of the utility. It demands utility interaction with the catchment and relevant stakeholders in the catchment. This is an important aspect of WSP, integrating information and knowledge across institutions. It is important that all institutions and groups of people within the system work together in order to understand how the activities of others affect the water (quality and quantity), as this impacts the capacity of the utility to produce and supply water.

  The WSP Asia Network was launched to strengthen network outreach in order to promote the WSP approach in the Asia region. While the WSP approach is a broad model that should be contextualised for utilities specific situation, a WSP portal exists which provides a platform to share information on WSP practices which utilities can view and use for their conditions. The portal provides a forum in which you can search for certain solutions to a problem.

- WSP implementation in Thailand
  Mr. Serm Huekkhuntod, PWA
  WSP was implemented within PWA starting in 2008 in partnership with Ranhill Utilities Berhad of Malaysia. This was the first phase running for a year. This was followed by a 2 year second phase in partnership with K-Water (Korea Water Resources Corporation).

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WSP was retained in the strategic plan of the Provincial Waterworks Authority (PWA) to run until 2016.They continue to engage with international organisations to help scale up their efforts in implementing WSP across the country.

As PWA is responsible for the whole country, they have faced a few issues in the implementation of WSP. As the area they cover is large, each region has its own characteristic; issues are therefore different: e.g. water quality is different in different regions due to varying community activities pollute the water in different ways.

- Drinking Water Quality Management of MWA
  Ms. Siwilai Kitpitak, MWA
  The Metropolitan Waterworks Authority (WMA) is a state-owned enterprise that covers the Bangkok metropolitan area, roughly 10 million users. WMA withdraws water from the Chao Phraya Basin and Mae Klong Basin.

  There is real time monitoring of raw water. Samples are collected to monitor changes and what variables need to be focused on. Water quality monitoring is routine for every step of collection treatment and distribution.

  MWA has a newly launched Water Quality Integrated Centre with real time water quality monitoring system (with 50 monitoring stations).

Audience comments
During drought periods an important element to consider is salinity. Less raw water will result in more saline intrusion which impacts the quality of water and increasing cost for treatment. Both PWA and MWA rely on natural water resources, which are often polluted. For PWA, creating their own water source (like EGAT have their own system), is financially not an option as it requires a lot of money (investment), which they do not have. PWA focus (short-term|) is to increase the capacity of tap water production and distribution. This can be achieved by using water from reservoirs for irrigation or private and public wells to complement their existing sources, however the planning around this needs to be better defined. The WSP approach is very inclusive which helps their efforts in getting the

necessary raw water. Therefore the issue of saline intrusion and looking to other sources is on their agenda and is being addressed. The case is not very different for MWA. Furthermore, they join several meetings, are part of sub committees, they engage at the policy level and they use these platforms to bring forward this idea of creating their own source, but in which way is not clear. Abstracting water from the Chao Phraya is not enough, and so to create their own source has been brought forward.

Salinity in some periods is very high. If the levels increase again; and they probably will, there is a project with RID and the military unit to use water form one area and diverting this to counteract the salinity or to use that water for tap water production.

Conclusion and wrap-up

- *Inge Wallage, IWA*

  We leave from here and go back to our daily lives, we all work in our specific disciplines, but when there is a flood or drought, it is comes on everyone's minds. What is needed is to develop a water narrative. We need to be talking a particular level, even with consumers about the needs and urgency of extreme events; try to bring more people on the journey.

  The challenges around water management live at different levels and with different stakeholders, We need to move beyond reacting during crises to managing water on a daily basis.

Annex 1 – Agenda

English version

Time	Item
08:00-08:45	Registration
08:45-09:00	Welcome speech *Mr. Kaveh Zahedi, Regional Director, UNEP*
09:00-09:30	**Keynote** "Improved planning for flood and drought management through informed decision making including use of technical tools" *Dr. Pichet DurongKeveroj, Minister of Science and Technology, Thailand*
09:30-09:45	Flood and Drought Management Tools project overview *Ms. Katharine Cross, IWA*
09:45- 10:15	Break
10:15-11:45	**International Case studies** Global Climate Change–Integration, Coherence and Governance (Taiwan Experience) *Prof. Hong Yuan Lee, National Taiwan University, Republic of China (Taiwan)* Australia's Water Management Modelling Framework, linking policy and modelling for drought management *Dr. Robert Carr, CEO eWater Solutions, Australia* Satellite-Based Drought, Flood, and Food Security Monitoring System in Asia *Dr. Shinichi Takashima, Remote Sensing Technology Center (RESTEC), Japan* Moderator: *Dr. Ganesh Pangare, IWA*
11:45-12:45	**Panel discussion -** How decisions are made to deal with drought and flood events. **Panelists:** Dr. Sutat Weesakul, HAII Mr. Somchit Amnatsan, RID Dr. Prasert Sirinapaporn, ONEP Ms. Patchara Petvirojchai, TMD Moderator: *Dr. Surajate Boonya-aroonnet*
12:45-14:00	Lunch
14:00-14:30	In depth: Flood and Drought Management Tools project *Mr. Oluf Jessen, DHI*
14:30 – 15:00	**Drought session:** The ESCAP/RESAP Regional Drought Mechanism *Ms. Kelly Hayden, ESCAP* Dry season planning and management *Mr. Somchit Amnatsan, RID* Moderator: Dr. Somchai Chonwattana, DHI
15:00-15:30	**Flood session:** Flood Forecasting *Mr. Finn Hansen, DHI* Flood management from the perspective of a reservoir operator *Mr. Nutthavutthi Chamchang, EGAT* Moderator: *Dr. Somchai Chonwattana, DHI*

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Time	Item
15:30-16:00	Break
16:00-16:45	**WSP:** WSP Asia Network *Ms. Sushmita Mandal, IWA* WSP implementation in Thailand *Mr. Serm Huekkhuntod, PWA* Drinking Water Quality Management of MWA *Ms. Siwilai Kitpitak, MWA* Moderator: *Ms. Katharine Cross*
16:45 – 17:00	Conclusions and wrap-up *Inge Wallage, IWA*

Thai version

เวลา	รายละเอียด
๐๘.๐๐ – ๐๘.๔๕ น.	ลงทะเบียน
๐๘.๔๕ – ๐๙.๐๐ น.	กล่าวต้อนรับ โดย *Mr. Kaveh Zahedi, Regional Director, United Nations Environment Programme (UNEP)*
๐๙.๐๐ – ๐๙.๓๐ น.	กล่าวเปิดงาน และ ปาฐกถาพิเศษ เรื่อง การบูรณาการฐานข้อมูลน้ำและภูมิอากาศของประเทศไทย โดย *ดร. พิเชฐ ดุรงคเวโรจน์ รัฐมนตรีว่าการกระทรวงวิทยาศาสตร์และเทคโนโลยี* *ประธานกรรมการบูรณาการฐานข้อมูลน้ำและภูมิอากาศแห่งชาติ*
๐๙.๓๐ – ๐๙.๔๕ น.	นำเสนอภาพรวมของโครงการจัดทำเครื่องมือในการจัดการปัญหาน้ำท่วมและภัยแล้ง โดย *Ms. Katharine Cross Programme Manager, International Water Association (IWA) Asia-Pacific Region Bangkok, Thailand*
๐๙.๔๕ – ๑๐.๑๕ น.	พักรับประทานอาหารว่าง
๑๐.๑๕ – ๑๑.๔๕ น.	นำเสนอกรณีศึกษาจากต่างประเทศ - Global Climate Change–Integration, Coherence and Governance (Taiwan Experience) *Prof. Hong-Yuan Lee, Dept. of Civil Engineering, National Taiwan University* - Australia's Water Management Modelling Framework, linking policy and modelling for drought management *Dr. Robert Carr, CEO, eWater Solutions, Australia* - Satellite-Based Drought, Flood, and Food Security Monitoring System in Asia *Dr. Shin-ichi Takashima, General Manager Strategic Planning and Management Department, Remote Sensing Technology Center of Japan (RESTEC)* ดำเนินรายการโดย *Dr. Ganesh Pangare, Regional Director Asia, IWA*
๑๑.๔๕ – ๑๒.๔๕ น.	เสวนา เรื่อง การรับมือสถานการณ์น้ำท่วมและภัยแล้งในประเทศไทย โดย *ดร.สุทัศน์ วีสกุล รองผู้อำนวยการสถาบันสารสนเทศทรัพยากรน้ำและการเกษตร (องค์การมหาชน)* *นายสมจิต อำนาจศาล หัวหน้ากลุ่มงานจัดสรรน้ำ สำนักบริหารจัดการน้ำและอุทกวิทยา กรมชลประทาน* *ดร. ประเสริฐ ศิรินภาพร* *ผู้อำนวยการสำนักงานประสานการจัดการเปลี่ยนแปลงสภาพภูมิอากาศ* *สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม* *นางสาวพัชรา เพชรวิโรจน์ชัย ผู้อำนวยการส่วนวิจัยและความร่วมมือทางวิชาการ กรมอุตุนิยมวิทยา*

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เวลา	รายละเอียด
	ดำเนินการเสวนาโดย *ดร. สุรเจตส์ บุญญาอรุณเนตร, สสนก.*
๑๒.๔๕ – ๑๔.๐๐ น.	รับประทานอาหารกลางวัน
๑๔.๐๐ – ๑๔.๓๐ น.	เจาะลึกโครงการจัดทำเครื่องมือในการจัดการปัญหาน้ำท่วมและภัยแล้ง โดย *Mr. Oluf Jessen Project manager on the F&D project , DHI , Denmark*
๑๔.๓๐ – ๑๕.๐๐ น.	การบริหารจัดการสถานการณ์ภัยแล้ง โดย *Ms. Kelly Hayden ผู้แทนจาก UNESCAP* *นายสมจิต อำนาจศาล หัวหน้ากลุ่มงานจัดสรรน้ำ สำนักบริหารจัดการน้ำและอุทกวิทยา กรมชลประทาน* ดำเนินรายการโดย *ดร. สมชาย ชนวัฒนา DHI ประจำประเทศไทย*
๑๕.๐๐ – ๑๕.๓๐ น.	การบริหารจัดการสถานการณ์น้ำท่วม โดย *Mr. Finn Hansen, Senior Hydraulic Engineer, DHI, Denmark* *นายณัฐวุฒิ แจ่มแจ้ง ผู้อำนวยการเขื่อนภูมิพล การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย* ดำเนินรายการโดย *ดร. สมชาย ชนวัฒนา DHI ประจำประเทศไทย*
๑๕.๓๐ – ๑๖.๐๐ น.	พักรับประทานอาหารว่าง
๑๖.๐๐ – ๑๖.๔๕ น.	Water Safety Planning (WSP) โดย *Ms. Sushmita Mandal , International Water Association (IWA)* *นายเสริม หึกขุนทด ผู้อำนวยการการประปาส่วนภูมิภาคเขต ๖ การประปาส่วนภูมิภาค* *นางศิริไล กิจพิทักษ์ ผู้เชี่ยวชาญการประปานครหลวงระดับ ๘ การประปานครหลวง* ดำเนินรายการโดย *นางสาวลลิตา รัมมนต์, IWA*
๑๖.๔๕ – ๑๗.๐๐ น.	สรุปการสัมมนา *Ms. Inge Wallage, IWA*

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Annex 2 – Communication material and media outreach

A series of communication material and media content have been developed around the Symposium. Below is a list of developed material. This information is also available via the project website (http://fdmt.iwlearn.org/)

Presentations from the Flood and Drought symposium
http://fdmt.iwlearn.org/en/en/events/flood-and-drought-symposium.

Press release
Why Planning for Floods and Droughts?

News and media
UN hosts Flood and Drought Symposium (video)

Why Planning for Floods and Droughts (news)

C-151126004087 - Daily News: เครื่องมือในการจัดการปัญหาน้ำท่วมและน้ำแล้ง (news)

B-151128038039 - Matichon: ยูเอ็นชี้อากาศพลิกเอลนิโญเปลี่ยนหลัง เมษาฝนมาตามปกติ (news)

Blog
First Impressions: Mapping Flood and Drought for Better Preparedness and Planning

Poster and information sheets
Project information sheet

Chao Phraya information sheet [eng] [th]

Drought information sheet

Drought posters

- Project overview
- Water Safety Planning
- Drought management
- Drought monitoring system

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Annex 3 – Panel questions

English version

No	Questions/Topics	Description	Speakers
1	General weather characteristics in Thailand	Some foreigners may not be familiar with Thailand's weather conditions. This will help them to have a good background about water situation in Thailand.	TMD 5 minutes 11:45-11:50
2	Can you tell us the current rainfall situation, extreme weathers in Thailand, especially severe drought in 2015. What TMD can do to support flood and drought management?	This is to identify the climate factors that influence the weather extremes in Thailand. What are the reasons? What are the tools being used? Any gaps for DSS tool development?	TMD 5 minutes 11:50-11:55
3	Can you describe the current drought in Thailand? How big is the impact?	RID operates major reservoirs in the country and works closely with Ministry of Agriculture and Cooperatives. This year we have limited water supply and RID can tell the relevant numbers comparing to the history to show how severe of the 2015 drought.	RID 5 minutes 11:55-12:00
4	Any measures the Thai government has implemented, who and how decisions are made?	Thai government has announced the crisis for the Chao Phraya River Basin and only water supply for domestic use is secured but not for the farmers. RID will also describe how information or tools that are being used to make the decisions.	RID 5 minutes 12:00-12:05
5	For flooding, can you share with us that the decision making processes or players are similar or different from the drought?	On the other hand, Thailand also experiences flooding. Thailand has infrastructures that can manage only 20% of total runoff. Another 80% are taken care by local communities. The difference is the size of affected areas. Drought usually occurs in a small area while flooding affects a bigger area. Therefore the organization and tool are different.	HAII 5 minutes 12:05-12:10
6	Thai government has set priority for flood and drought issues. What is the current status of DSS system for flood and drought management in Thailand?	Since 2011, water-related problems are top priority for Thai government. HAII was appointed by government to create a centralized data system called NHC (National Hydroinformatics and Climate Data Center). 13 agencies are the initial members and will be extended to 30 agencies to cover all water management and development aspects.	HAII 5 minutes 12:10-12:15
7	Flood and drought will be more severe in future due to global warming, at policy level what are key preparations or national policies implemented to handle this?	Climate change is an uncertainty for future flood and drought management. At national policy level, ONEP is a key agency for to set a national policy and masterplan for climate change and also implementation for sustainable future. What are challenges or obstacles for a successful implementation? Any missing data, information or tools to support ONEP.	ONEP 5 minutes 12:15-12:20
8	In short term, what we can tell the public to encourage or change behaviors to reduce risks from flood and	This will give practical ideas for audiences that some actions can be done to secure the future on flood and drought management. Example from adaptations and mitigations will be given.	ONEP 5 minutes 12:20-12:25

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	drought in future?		
9	From previous international case studies, do you see any possibility or lesson learnt from them?	This will create a connection to the previous session that Thailand can be benefit from our international experts. Also any suggestions or extra requirements to tell the DSS tool developers (DHI/IWA)?	HAII 5 minutes 12:25-12:30
10	Next year Thailand will surely have a drought problem what do you expect to get very soon from DSS developers?	This will show that the outputs from DSS tool can actually help Thailand for the coming drought next year.	RID 5 minutes 12:30-12:35
			QA + wrap+ spare 10 minutes 12:35-12:45

Thai version

ลำดับที่	คำถาม	คำอธิบายเพิ่มเติม	ผู้บรรยาย
1	ลักษณะอากาศของประเทศไทยเป็นอย่างไร	อุทกภัยหรือภัยแล้งนั้นเริ่มจากฝน ผู้เข้าร่วมส่วนใหญ่เป็นชาวต่างชาติอาจยังไม่คุ้นเคยกับลักษณะอากาศของประเทศไทยจึงอยากให้ปูพื้นตรงส่วนนี้ก่อนครับ	กรมอุตุนิยมวิทยา 5 นาที 11:45-11:50
2	ช่วยวิเคราะห์สาเหตุสถานการณ์ฝนน้อยในปัจจุบันและบทบาทของกรมอุตุฯ ในการสนับสนุนข้อมูลเพื่อการจัดการน้ำท่วม-น้ำแล้ง	สร้างความเข้าใจว่าฝนนั้นเป็นปัจจัยที่ควบคุมไม่ได้ ดังนั้นการรับมือคือต้องเตรียมความพร้อม การพัฒนาเครื่องมือต่างๆ สนับสนุนการตัดสินใจ	กรมอุตุนิยมวิทยา 5 นาที 11:50-11:55
3	ภัยแล้งปีนี้มีความรุนแรงอยู่ในระดับใด	เพื่อชี้ให้เห็นถึงขนาดของปัญหาในปัจจุบันเมื่อเทียบกับเหตุการณ์ที่ผ่านมา ปริมาณน้ำในเขื่อน ความยากลำบากในการสร้างความร่วมมือกับผู้ใช้น้ำ	กรมชลประทาน 5 นาที 11:55-12:00
4	ขั้นตอนรับมือกับภัยแล้งปีนี้หรือกระบวนการตัดสินใจเป็นอย่างไร และใครเป็นผู้ตัดสินใจ	ยกตัวอย่างเหตุการณ์ปัจจุบันว่าประเทศไทยมีขั้นตอนการรับมืออย่างไร กระบวนการตัดสินใจมีปัญหาอุปสรรคอย่างไร ข้อมูล การวิเคราะห์ เครื่องมือ เพียงพอกับการตัดสินใจหรือไม่	กรมชลประทาน 5 นาที 12:00-12:05
5	กรณีอุทกภัยของไทยนั้น การรับมือหรือกระบวนการตัดสินใจนั้นเหมือนหรือแตกต่างจากกรณีภัยแล้งอย่างไรบ้าง	ลักษณะของภัยนั้นประเทศไทยถึงแม้จะมีปริมาณฝนมากกว่าหลายประเทศ แต่เราสามารถจัดการได้เพียง 20% เท่านั้น ภัยแล้งจะเกิดเป็นจุดๆ แต่อุทกภัยจะเป็นพื้นที่กว้าง องค์กรและรูปแบบการจัดการก็แตกต่างกัน	สสนก. 5 นาที 12:05-12:10
6	ระบบข้อมูลและระบบสนันสนุนการจัดการน้ำท่วมและน้ำแล้งนั้นปัจจุบันประเทศไทยมีความพร้อมอยู่ในระดับใด	ตั้งแต่ปี 2554 เป็นต้นมาน้ำเป็นเรื่องที่รัฐบาลให้ความสำคัญ รัฐบาลได้มอบหมายให้ สสนก.จัดทำคลังข้อมูลน้ำและภูมิอากาศแห่งชาติ และในปัจจุบันรัฐบาลก็ยังผลักดันต่อไปด้วยการสร้างระบบสนับสนุนการตัดสินใจที่จะเชื่อมโยงการทำงานให้ครบทั้ง 30 หน่วยงานโดยแบ่งการวิเคราะห์ความพอเพียงของการใช้ข้อมูลเพื่อจัดการน้ำเป็น 9 ด้าน โดย กระทรวงวิทย์ฯ เป็นเจ้าภาพ	สสนก. 5 นาที 12:10-12:15
7	ในอนาคตปัญหาน้ำท่วม-น้ำแล้งจะยังคงอยู่และมีแนวโน้มรุนแรงขึ้นเนื่องจากการเปลี่ยนแปลงสภาพภูมิอากาศ ประเทศไทยมีนโยบายหรือการดำเนินการด้านการในเรื่องนี้อย่างไร เพื่อลดผลกระทบบ้าง	Climate change จะทำให้สถานการณ์ฝนเปลี่ยนไป ปัญหาภัยแล้ง และน้ำท่วมจะจัดการยากขึ้น ในระดับนโยบายนั้นประเทศไทยมีการเตรียมการเพื่อรับมือหรือมีแผนอย่างไรกับเรื่องนี้ เช่น แผนแม่บทรองรับการเปลี่ยนแปลงสภาพภูมิอากาศ ความท้าทายในการนำแผนไปสู่การปฏิบัติเพื่อให้เกิดผลอย่างรูปธรรม ข้อมูลองค์ความรู้ หรือเครื่องมืออะไรที่เรายังขาดและต้องการเพื่อการวางแผนได้เหมาะสม	สผ. 5 นาที 12:15-12:20
8	ในระยะสั้นเราสามารถทำอะไรได้บ้าง เพื่อจัดการน้ำ อุทกภัยและภัยแล้ง	การปรับตัวและการลดผลกระทบ (adaptation and mitigation) ต่อผลกระทบจากการเปลี่ยนแปลงสภาพภูมิอากาศเป็นเรื่องสำคัญ อาจยกตัวอย่างการปรับตัว/การลดผลกระทบที่สามารถนำไปประยุกต์ใช้ได้ทันทีในสถานการณ์ปัจจุบัน	สผ. 5 นาที 12:20-12:25
9	ประเทศไทยสามารถใช้ความ	เพื่อให้เกิดความเชื่อมโยงกับ 3 กรณีศึกษาข้างบน	สสนก.

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	สำเร็จจาก ไต้หวัน ออสเตรเลีย หรือญี่ปุ่น ได้หรือไม่อย่างไร	มีอะไรฝากไปยังผู้พัฒนาเรื่องน้ำท่วมในโครงการ IWA นี้	5 นาที 12:25-12:30
10	ปีหน้าประเทศไทยจะประสบปัญหาภัยแล้ง กรมชลประทานมีอะไรอยากจะให้ผู้พัฒนาโครงการ IWA เร่งดำเนินการบ้าง	และจะมี requirement อะไรเพิ่มเติมไปยังผู้พัฒนาในโครงการ IWA นี้	กรมชลประทาน 5 นาที 12:30-12:35
			ซักถาม+สรุป+เผื่อเหลือเผื่อขาด 10 นาที 12:35-12:45

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