UK Centre for Ecology & Hydrology

Summary report on

Workshop on climate adaptation for resilience and sustainability in Thailand

June 5-6, 2024, Bangkok, Thailand

Jointly organized by

UK Centre for Ecology & Hydrology
Chulalongkorn University
King Mongkut's University of Technology Thonburi

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NATIONAL CAPABILITY FOR GLOBAL CHALLENGES

Contents

List of Abbreviations

CU	Chulalongkorn University
DWR	Department of Water Resources
ECAT	Electricity Generating Authority of Thailand
ENSO	El Niño-Southern Oscillation
EO	Earth Observation
G2G	Grid to Grid
GCM	Global Climate Models
HII	Hydro–Informatics Institute
HJ	Hydro Jules
HydroSoS	Hydrological Status and Outlook System
KMUT	King Mongkut's University of Technology Thonburi
NbS	Nature-based solutions
NFM	Natural Flood Management
ONWR	Office of the National Water Resources
RID	Royal Irrigation Department
RS	Remote Sensing
S2S	Sub-seasonal to Seasonal
SM	Soil Moisture
STAR	Strengthening Thailand's Agricultural Drought Resilience
SWOC	Smart Water Operation Centre
TMD	Thai Meteorological Department
UKCEH	UK Centre for Ecology and Hydrology

1. Background

Climate change poses significant challenges globally, impacting ecosystems, economies, and societies. Southeast Asia, including Thailand, faces numerous climate-related risks, such as droughts, sea level rise, flooding, wildfires etc. One of the major themes and focus areas under UKCEH's International Science for Net Zero Plus program is to support climate change adaptation in Southeast Asia. The workshop "Climate Adaptation for Resilience and Sustainability in Thailand" was funded under NC Intl Net Zero program Theme 3B, Task 2 (Grant Code: NE/x006247/1) and was jointly organized by UKCEH, KMUT, and CU on June 5-6, 2024, in Bangkok, Thailand. The workshop aimed to bring together experts from policymaking, academic institutions, research organizations, and governmental agencies from the United Kingdom and Thailand to discuss strategies for climate adaptation and resilience within the Thai context. The workshop has strong participation, with approximately 30 attendees from 10 different organizations. It was highly productive, resulting in concrete next steps to advance the overall project agenda.

2. Objectives

- Foster and promote collaboration between UK and Thai experts in climate adaptation research.
- Identify and prioritize research needs related to climate adaptation and resilience in Thailand.
- Address regional climate challenges, focusing on issues such as droughts, seasonal forecasting, and climate risk assessment.
- Develop actionable short-term and long-term recommendations for policymakers and stakeholders to enhance climate resilience in Thailand.

3. Format of the workshop

The two-day workshop featured a series of expert presentations, round table discussions, and interactive sessions on the first day, focusing on three crucial topics: regional climate challenges, advances in seasonal forecasting, and climate risk assessment. The second day included an in-person field trip and more in-depth meetings. The format was designed to foster deep engagement and ample interaction among the experts.

4. Participating organisations

List of Participating Organisations in Alphabetical Order

1. Asian Institute of Technology Thailand
2. Chiang Mai University
3. Chulalongkorn University
4. Department of Water Resources, Ministry of Environment, Thailand
5. Hydro – Informatics Institute (HII), Thailand
6. King Mongkut's University of Technology Thonburi
7. Office of the National Water Resources, Thailand
8. Royal Irrigation Department, Thailand
9. Thai Meteorological Department
10. The British Embassy in Bangkok
11. Uk Centre for Ecology and Hydrology





5. Day 1 (June 5, 2024): Technical sessions

Day 1 featured three technical sessions in addition to the opening and closing sessions:

- Understanding regional climate challenges with a focus on droughts
- Seasonal forecasting: advances, challenges, and prospects
- Climate change/risk assessment in Southeast Asia

Each of the three technical sessions featured three presentations. Following these presentations, participants were divided into three groups for roundtable discussions, focusing on key questions related to the session's theme. Subsequently, each group summarized and discussed their responses to the questions, promoting collaborative engagement and facilitating in the identification of key conclusions, recommendations, and priorities for action.

5.1 Introduction Session

Dr. Chaiwat Ekkawatpanit (KMUT) warmly welcomed the organizers and participants to the workshop and facilitating introductions among the attendees.

Presentation 1: Mr. Jamie Hannaford (UKCEH) introduced the workshop, outlining its format, aims, and objectives, and provided an overview of the National Capability for Global Challenges and International Science for Net Zero Plus program. He emphasized the comprehensive scope of climate adaptation efforts in Southeast Asia especially in Thailand, and the aim to co-develop a sustainable roadmap over the next two years under the current program. The talk highlighted the importance of addressing challenges in addressing hydrometeorological hazards and water security for resilience and sustainability, underscoring the need to strategize for the future starting from today. He emphasised the workshop's role in fostering collaboration between UKCEH and Thai stakeholders to address urgent climate challenges effectively.

Presentation 2: Mr. Chavit Uttamachai (British Embassy, Bangkok) presented UK Thailand research opportunities and priorities as well as funding opportunities involving the British Council, Royal Society, Academy of Medical Sciences, Royal Academy of Engineering, and British Academy. He highlighted that the four thematic priority areas for research collaboration are: (i) promoting the health of people, animals, and plants; (ii) advancing transformative technology; (iii) building a resilient planet; and (iv) nurturing tomorrow's talent. He also emphasized the importance of understanding the types of organizations eligible for funding and highlighted a research collaboration program in its second year, focusing on Laos and Cambodia, with applications managed through the British Council.

5.2 Session 1: Understanding regional climate challenges with a focus on droughts.

Presentation 1: Dr. Siriwat Boonwichai (ONWR) discussed the state of Thailand's water resources, focusing on aspects such as rainfall, natural flow, groundwater, and the challenges posed by water shortages. He highlighted regional priorities of the water sector such as consumption, ecosystem conservation, and disaster prevention, helping to identify key areas for intervention. Dr. Boonwichai provided an overview of water management principles, national water resources acts, and the structure of water resource management organizations, including tools for managing water during the dry season and forecasting drought risk areas in Thailand.

Presentation 2: Mr. Jamie Hannaford (UKCEH) presented the outcomes from the previous STAR project, which will serve as the foundation for the direction of this NC International initiative. He showcased the previously developed drought monitoring tool for Thailand, explaining how various drought indicators can be combined and evaluated specifically for Thailand. The presentation emphasized the importance of ground-truthing drought conditions to improve the accuracy and effectiveness of drought monitoring.

Presentation 3: Dr. Supattra Visessri (CU) focused on the increasing severity and intensity of droughts in Thailand, particularly in the Chao Phraya River basin. She discussed the impact of climate change on drought characteristics, including the propagation of droughts and the effect of temperature on future droughts. Dr. Supattra also addressed the challenges of predicting droughts and selecting appropriate global climate models for Thailand for future drought assessment.

5.2.1. Discussions and interactions

Question

How do droughts impact various sectors in Thailand, which sectors should be prioritized for intervention, and what local adaptation measures are most effective? Additionally, how can we integrate local and global data for improved drought monitoring, and what are the top three priorities for future actions in drought assessment and management considering recent advancements, local strategies, and stakeholder engagement?

Outcomes:

Droughts significantly affect multiple sectors in Thailand, including agriculture, water resources, energy, and public health. Among these, agriculture is the most severely impacted due to its reliance on consistent water supply, making it a priority for intervention. Effective local adaptation measures include the implementation of sustainable water management practices, demand-side management strategies, and the development of localized risk assessment and communication plans tailored to the specific needs and contexts of affected areas.

Drought monitoring can be enhanced through the integration of locally available datasets with new global-scale data gathered through new methods. This includes the use of soil moisture datasets, satellite products, and other environmental data which can improve the accuracy and scalability of drought assessments. Many efforts have been taken by the National Data Centre, Thailand to improve data availability, quality, and format which is crucial for ground truthing drought monitoring metrices. Earth Observation (EO) data, which, despite their potential, require wider validation and acceptance due to inherent uncertainties.

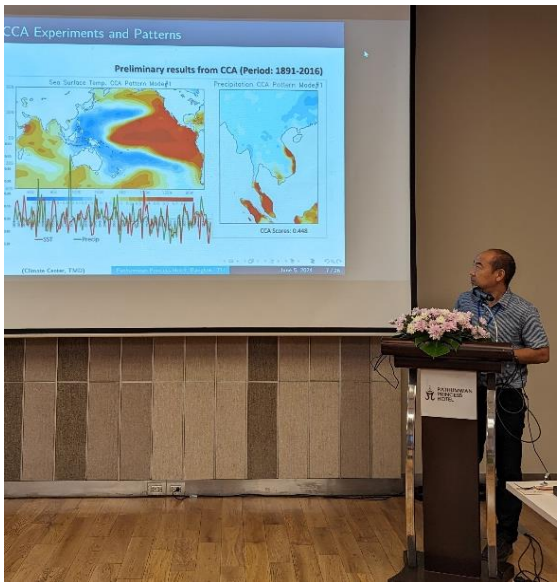
The top three priorities for future actions in drought assessment and management are:

- Implementing sustainable water management practices that consider local demand and involve local stakeholders on data collection, monitoring and end user front.
- Enhancing the identification of risk areas and developing measures adapted to local contexts.
- Improving risk communication to the public through more interactive and engaging methods, ensuring that stakeholders are well informed and can effectively respond to drought conditions.

These priorities emphasize the need for accurate, scalable data, effective communication with stakeholders, and the adoption of new indicators and methods to better understand and manage drought risks.

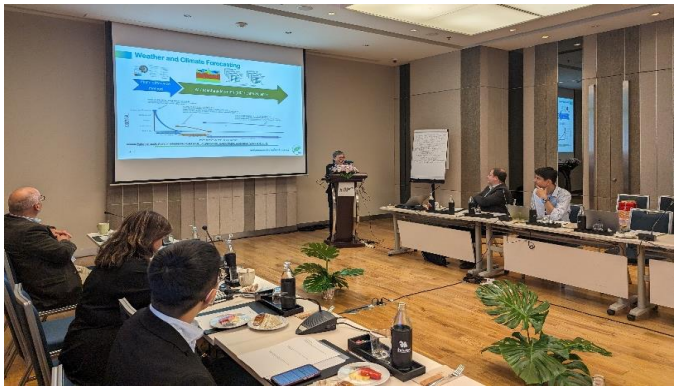
5.3 Session 2: Seasonal forecasting: advances, challenges, and prospects

Presentation 1: Dr. Amulya Chevuturi (UKCEH) began the presentation with UKCEH's HydroSoS initiative, emphasizing its aim of integrating global and local data to enhance hydrological forecasting. One of the relevant components in this is employing ensemble forecasting techniques with bias correction and blending. The project aims to improve upon multi-model forecasts, particularly in streamflow predictions and provide comprehensive hydrological predictions. This can be utilized by the Thai stakeholders to improve their capacity of drought monitoring. The crucial role of local forecasts and observations was highlighted, underscoring their importance in ensuring the accuracy and relevance of predictions for effective water management strategies in Thailand.



Presentation 2: Dr. Chalump Oonariya (TMD) provided an overview of the Thai Meteorological Department's seasonal forecasting system and explained the influence of ENSO on drought prediction in Thailand. The presentation detailed the use of canonical correlation techniques within climate models to better understand and predict these teleconnections. Insights gained from such modelling efforts will not only improve prediction skill but will also be instrumental in developing proactive local drought response strategies that account for climate variability and its impacts on regional water resources.

Presentation 3: Dr. Kanoksri Sarinnapakorn (HII) discussed the complexities of seasonal forecasting, highlighting challenges related to spatial and temporal variability in rainfall in Thailand. The presentation emphasized the integration of teleconnections beyond just ENSO to enhance the understanding of rainfall patterns. The use of machine learning and multivariate analysis was proposed as a means to improve the accuracy and reliability of long-term predictions, thereby enhancing the effectiveness of drought management strategies in the country based on robust forecast information.



5.3.1. Discussions and interactions

Question

What are the current challenges in hydrological forecasting and monitoring, and how can global hydrological forecasting products be adjusted and data sharing initiatives optimized to enhance regional forecasts, considering regional needs and challenges?

Outcomes:

Consolidating global hydrological forecasting products to ensure complete and accurate regional forecasts is a complex endeavour that involves several key considerations and challenges. Global-scale forecasts typically operate at broader spatial and temporal resolutions, which may not capture the fine scale variability and localized factors crucial for regional hydrological dynamics.

One primary challenge is the issue of downscaling, where global forecasts need to be spatially and temporally refined to meet regional requirements. This process involves translating coarse resolution global data into finer scale predictions that align with local hydrological conditions, such as watershed characteristics, land use patterns, and infrastructure impacts. Further, integrating global-scale modelled data with local observations presents significant challenges.

Another challenge lies in data availability and quality. Global hydrological models rely on various input datasets, including precipitation, temperature, land cover, and soil properties, which may exhibit significant variability in accuracy and spatial coverage globally. Integrating diverse datasets from different sources and ensuring their consistency and reliability for regional applications are critical steps in enhancing forecast accuracy.

Furthermore, adapting global forecasts to regional contexts involves understanding and accounting for local hydrological processes and their interactions with climatic drivers. Factors such as seasonal variations, extreme weather events, and human activities (e.g., water management practices, land use changes) can significantly influence sustainable water management and hydrological hazard mitigation, necessitating tailored modelling approaches.

Addressing these challenges requires interdisciplinary collaboration and the application of advanced techniques such as dynamic downscaling, which adjusts global climate model outputs using higher resolution regional climate models. Machine learning approaches can also play a role in improving forecast skill by assimilating observational data, understanding complex relationships, and quantifying prediction uncertainties.

5.4 Session 3: Climate change and risk assessment

Presentation 1: Dr. Srinidhi Jha (UKCEH) discussed the escalating risk of future droughts in a warming world. With rising temperatures exacerbating extremely dry conditions characterized by low precipitation, runoff, and soil moisture. Dr. Jha emphasized the critical role of selecting appropriate drought indicators for projecting these hazards. The presentation addressed uncertainties stemming from model variability, methodological choices, threshold selection, and sample sizes, offering insights into robust drought risk assessments. This is essential for understanding evolving climate scenarios and methodologies crucial for assessing risks, particularly in Southeast Asia.

Presentation 2: Dr. Supapap Patsinghasanee (DWR) focused on water resource management in Thailand's rainfed agriculture amid an impending water crisis. Dr. Patsinghasanee underscored the role of community driven initiatives in enhancing awareness and fostering citizen science. The session explored decentralized systems' impact on local communities, maintaining remote stations, and disseminating timely warnings. Dr. Patsinghasanee advocated for democratizing hydrological and environmental observations to boost resilience against water related challenges in Thailand

5.4.1. Discussions and interactions

Question

How can we enhance climate risk assessment practices and adaptation policies in Southeast Asia to address recent and increasing extreme events, while overcoming technological and methodological challenges, and fostering stakeholder collaboration to swiftly implement innovative solutions such as Nature-based Solutions/Natural Flood Management (NbS/NFM), etc.?

Outcomes:

During the discussion session, the panel addressed critical aspects of climate risk assessment in Southeast Asia, focusing on adaptation policy responses to increasing extreme events and the technological challenges hindering effective risk analysis. Participants highlighted the use of Global Climate Models (GCMs) to analyse specific climate projections for Thailand, although these efforts are currently fragmented across various research organizations and universities. There is a consensus that climate change significantly impacts the region, yet trust in scientific outcomes remains a challenge, affecting communication about risk uncertainties.

Key policy frameworks such as Ecosystem Based Adaptation and Nature-based Solutions (NBS) are in place, but there is a recognized need for more comprehensive data compilation and operational planning. Suggestions included consolidating climate change projection data into a national database to facilitate unified analysis, implementing robust mitigation and adaptation policies, and enhancing science communication to build confidence among policymakers and the public.

The discussion also highlighted technological and methodological challenges in climate change risk analysis, emphasizing the necessity for improved data accessibility at national scales, operational planning frameworks, and effective risk management communication. Stakeholder engagement emerged as a crucial step towards policy formulation and implementation, especially in transitioning from traditional methods to innovative approaches like NBS.

Efforts to optimize risk management and adaptation policies underscored the urgency of swiftly implementing innovative solutions such as NBS and NFM. Top priorities identified

included compiling comprehensive national climate data, developing operational planning guidelines, and enhancing stakeholder engagement for effective policy implementation. Transitioning from long-standing conventional approaches presents challenges yet offers substantial benefits in building resilience against climate uncertainties in the long term.

In conclusion, the integrated approach emphasized during the discussion session highlighted the need for collaborative efforts among researchers, policymakers, and communities to address the multifaceted challenges of climate change in Southeast Asia. By consolidating data, enhancing policy frameworks, and fostering inclusive communication, stakeholders can collectively mitigate risks and adapt to the evolving climate landscape effectively.

5.5 Closing Session

The workshop concluded with a summary of key insights and recommendations. Dr. Srinidhi Jha and Mr. Jamie Hannaford highlighted the importance of collaboration, data sharing, and stakeholder engagement in addressing climate related challenges. Participants expressed their commitment to continued collaboration and knowledge exchange, emphasizing the need for actionable solutions to enhance climate resilience in Thailand.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6. Day 2 (June 6, 2024): Deep dive meeting and field trip

6.1 Visit to Benjakitti Park

The UKCEH team, in collaboration with our Thai partners, visited Benjakitti Park in Bangkok to understand city's one of the Nature-based solutions (NBS) against floods and their potential implementation in other urban areas. Located in the heart of Bangkok, Benjakitti Park is a prime example of blue green infrastructure. This urban sanctuary not only provides a tranquil natural space amidst the city's chaos but also plays a crucial role in mitigating urban floods, ground water recharging and the reducing the urban heat island effect through its innovative NBS.

Bangkok, prone to seasonal flooding exacerbated by rapid urbanization and climate change, faces significant water management challenges. Benjakitti Park transcends its role as a recreational space, embodying the integration of natural elements within urban environments. Its interconnected system of ponds, wetlands, and vegetated areas absorbs excess water during heavy rains, reducing the strain on conventional drainage systems and minimizing flood damage downstream.

The park's design, integrating wetlands and land-vegetated areas, acts as natural sponges that slow down and filter rainwater, enhancing flood resilience while promoting biodiversity. Additionally, aquatic vegetation aids in purifying nutrient rich water.

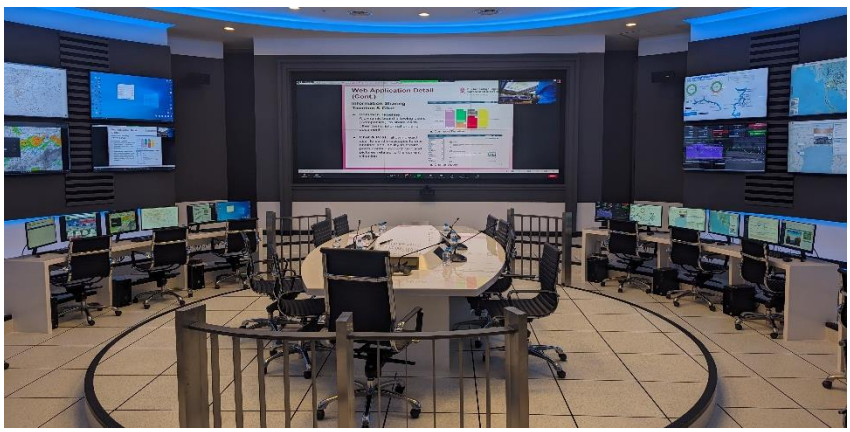
Benjakitti Park also exemplifies the importance of participatory management. Local residents, government agencies, and environmental organizations actively participate in park maintenance and decision making, ensuring interventions align with local needs and priorities. Learnings from this visit can be employed in our global efforts to address climate change more sustainably, which poses significant challenges to ecosystems, economies, and societies.

6.2 Visit to Royal Irrigation Department

During our visit to the Royal Irrigation Department (RID), we were introduced to Thailand's operational water management systems. From our side, we introduced our project team and explored research collaboration opportunities with their team. The discussions focused on utilizing UKCEH's expertise in various sectors of hydrometeorology. We examined the potential application of a drought monitoring tool for long term risk assessment on a national level and assist Thai agencies in more effectively managing risks from both supply and demand perspectives.

A significant demonstration was Smart Water Operation Centre (SWOC), an advanced system used by RID for monitoring, evaluation, data analysis, and decision support systems for water resources in Thailand. The SWOC includes public relations and notification functions, planning and management, results analysis, and proposal options for decision making. We discussed how UKCEH and Thailand could benefit both ways by utilising or enhancing SWOC by integrating more sophisticated hydrological forecasting and analysis tools. By linking real-time monitoring data with historical data, the system can provide detailed insights into operating reservoirs, crop cultivation timeframes, and water demand.

Further discussions included advancing RID's systems to integrate various types of monitoring data, such as rainfall, water levels, and flow rates, with forecast data from radar and numerical weather prediction models. The current goal of RID is to develop a comprehensive GIS database encompassing reservoir data, irrigated areas, and water demand for different categories in which UKCEH can provide its inputs as well as benefit from it on the data availability front.



UKCEH's contributions, particularly in forecasting, can significantly contribute to aid RID's capabilities, providing mutual benefits for both the UK and Thailand in managing water resources and addressing climate-related challenges.

7. Summary and conclusion

The workshop organized by UKCEH in collaboration with Thai partners successfully identified critical issues related to climate resilience and adaptation strategies in Thailand. Day 1 focused on expert presentations and interactive discussion sessions covering regional climate challenges, advances in seasonal forecasting, and climate risk assessment. Discussions highlighted the importance of integrating global and local data for accurate drought monitoring and hydrological forecasting, essential for mitigating climate impacts in Southeast Asia, particularly Thailand. Stakeholders emphasized the need for collaborative efforts to optimize adaptation policies and implement innovative solutions like Nature-based Solutions/ Natural Flood Management (NBS/NFM). Day 2 featured a field trip to Benjakitti Park, showcasing Bangkok's effective blue green infrastructure for urban flood mitigation and biodiversity promotion. The visit underscored the importance of participatory management and community engagement in sustainable urban development. Thailand's Royal Irrigation Department was also visited to explore the potential avenues of collaboration between UKCEH and Thai agencies on the practical implementation of hydrometeorological research.

Moving forward, UKCEH along with Thai partners plans to build upon the workshop outcomes by developing a collaborative research agenda to address priority research needs identified during the technical sessions and meetings. This includes enhancing data-sharing mechanisms between UK and Thai institutions to improve hydrological forecasting and climate risk assessment capabilities. Engagement with policymakers and stakeholders will be prioritized to co-develop and implement climate adaptation strategies tailored to local contexts. Additionally, UKCEH intends to work towards long-term collaboration plans to Thailand's Climate Change Department, Royal Irrigation Department, and Office of the National Water Resources (ONWR). These collaborations will focus on integrating advanced forecasting tools and enhancing resilience against climate-related challenges. These initiatives aim to foster sustainable development and resilience-building efforts in Thailand, contributing to broader global efforts in climate adaptation and mitigation.

7.1 Immediate actions

To effectively start working in this direction, it was suggested that pilot studies over important catchments be conducted before performing a pan-Thailand analysis. The catchments were recommended based on better availability of data and research infrastructure, which can support more confident country or Southeast Asia scale work. The case study catchments suggested are:

- Ping River Basin
- Wang Yom River Basin
- Nan River Basin

Identifying and exploring key topics will help prioritize research efforts and develop targeted solutions for water management challenges. Assessing the potential benefits of integrating seasonal forecasts into dam management practices is crucial. Understanding the impacts of climate change on Thailand's water resources involves initial validations and planning future research steps. This process starts by validating existing climate change models and data specific to Thailand. Based on these validations, further research steps can be planned and implemented to address climate change impacts effectively. Currently, For leveraging

the use of NBS in enhancing climate resilience specifically in these regions we are also working on a review paper with relevant stakeholders.

7.2 Data Sharing

Reliable and comprehensive data is the backbone of effective water resource management. Identifying and leveraging various data sources will enhance bilateral research engagement between UKCEH and Thailand agencies. Immediate action could include exploring river flow data collected by the Royal Irrigation Department and Electricity Generating Authority of Thailand (ECAT). Previous project STAR's data could be utilized for the project with new updates and data acquisition. For drought impact related work, the existing crop yield data frequency should be checked and can be obtained through Geo Informatics and Space Technology Development Agency (GISTDA). Post-drought event reports can provide valuable insights for analysis which can also be accessed with the help of Thai agencies. The quickest step for data access could be leveraging the existing Memorandum of Understanding (MOU) between ONWR and UKCEH.

- ONWR: Colleagues at UKCEH are already collaborating with ONWR to establish G2G projections for Thailand, focusing on soil moisture and river flows.
- Climate Change Department: One of the other avenues could also be to engage with this relatively new department to enhance their understanding and capabilities.
- GISTDA: Collect soil moisture data from SM stations and remote sensing (RS) technology.
- Secure the purchase and licensing of SM data for usage in drought studies, validations for G2G data, and flash drought analysis.
- Consider using GR6J and ESP models for hydrological simulations across Thailand.
- Data from gauging stations on the dams and upstream, managed by ECAT, is crucial.
- Utilize potential funding opportunities or student projects to run these models.
- Leverage hindcast data from the S2S projects at UKCEH or seasonal forecasts for model runs.

7.3 Funding Opportunities

Securing funding is critical for the continuity and success of research projects. Identifying and pursuing relevant opportunities will support the collaboration and execution of projects. Thus, one of the main outcomes of the workshop has been to identify and pursue funding opportunities with our Thai partners, and jointly work on preparing proposals.

- British Embassy Call: Work with Dr. Supattra and Dr. Chaiwat to explore funding opportunities in Laos and Cambodia, particularly involving their students.
- Visiting Scientists: Explore additional funding available via the HydroJULES/ NC International projects for both short- and long-term visits for scientists, especially early career scientists, to work together to collaborate on common research topics, co-develop tools and methods, produce co-authored papers, and jointly participate in workshops. The aim is to implement these plans next year, with preparations beginning now.

7.4 Annexure

7.4.1. List of Participants

Workshop on climate adaptation for resilience and sustainability in Thailand

5 June 2024 at 9.00-16.00

Jamjuree Ballroom A, M Floor, Pathumwan Princess Hotel, Bangkok, Thailand

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Workshop on climate adaptation for resilience and sustainability in Thailand

5 June 2024 at 9.00-16.00

Jamjuree Ballroom A, M Floor, Pathumwan Princess Hotel, Bangkok, Thailand

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