

PROGRAMME BOOK

More than 15 Industrial Papers

CPD Points
MBOT : 8 CPD
BEM : 5 CPD



The 5th
INTERNATIONAL
CONFERENCE ON

WATER RESOURCES

“Innovating for Resilience and Enhanced
Preparedness to Water-Related Challenges”

23-25
NOVEMBER 2021

VIRTUAL CONFERENCE

Papers will be published for conference proceedings as IHP-VIII TECHNICAL DOCUMENTS IN HYDROLOGY by UNESCO.

Selected papers will be published in:

- *Scopus indexed Journal: Water Conservation and Management*
- *Scopus indexed Book Series: Lecture Notes in Civil Engineering by Springer Nature*

FOR REGISTRATION, PLEASE VISIT :



<https://seminar.utmspace.edu.my/icwr2021>

Organised by :



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FOREWORD BY

MINISTER OF ENVIRONMENT AND WATER, MALAYSIA



Bismillahir Rahmanir Rahim.

Assalamualaikum warahmatullahi wabarakatuh.

It is a great honour and pleasure for me to welcome all participants to the 5th International Conference on Water Resources (ICWR 2021) with the theme "Innovating for Resilience and Enhanced Preparedness to Water-Related Challenges."

People require water for a wide range of activities essential to their livelihoods. In some cases, issues such as water scarcity, adverse water quality, flooding and environmental problems have crossed the threshold of irreversibility in certain countries. However, the growing demand for different water needs for agriculture, recreation, hydropower, domestic and industries require integrated management in terms of people's livelihoods. Integrated Water Resources Management (IWRM) is required to minimise the discrepancy between the people's needs and the design and management of water services. The IWRM will assist us to achieve our main objectives, which are to provide sufficient clean water, to reduce the risk of flooding and to enhance environmental conservation. This is in line with Malaysian's vision through Ministry of Environment and Water to spearhead the management of its portfolio through sustainability for the wellbeing of the nation.

With the adoption of the 2030 Agenda for Sustainable Development by the UN General Assembly in September 2015, water now commands special focus in the global agenda. Out of 17 Sustainable Development Goals (SDGs), we can see that SDG 2 - Zero Hunger, and SDG 6 - Clean Water and Sanitation, are essentially about sustaining the availability of food and improving hygiene of which water resources features directly and prominently. It is the Ministry's mission to lead the integrated management of water, land and natural resources through efficient optimisation of resources in line with the national policies, laws and international commitments such as the SDG's target.

Thus, the hosting of the ICWR 2021 is indeed timely and relevant. I am confident this conference will serve as an effective platform to discuss research findings, success stories, new methodologies in planning and design, and other matter in water and environmental security. I hope ICWR 2021 will facilitate continuous networking for the sharing of knowledge and expertise as well as to stimulate international cooperation in these issues.

Due to the Covid-19 pandemic which affected the whole world, this seminar need to be held virtually. Therefore, I would like to express my gratitude to Humid Tropics Centre Kuala Lumpur (HTC KL), Department of Irrigation and Drainage Malaysia (DID) and Universiti Teknologi Malaysia (UTM) in collaboration with the Ministry of Environment and Water (KASA) and all universities, both local and international agencies for their initiative and efforts in organising this conference.

I wish for the fruitful deliberations from all participants towards achieving the objectives of the ICWR 2021.

YB DATO' SRI TUAN IBRAHIM BIN TUAN MAN
Minister of Environment and Water, Malaysia

FOREWORD BY

DIRECTOR GENERAL DEPARTMENT OF IRRIGATION AND DRAINAGE, MALAYSIA



Assalamualaikum and Greetings to All

On behalf of Organizing Committee of the “International Conference on Water Resources”, it is indeed my honour and privilege to welcome you all, for this prestigious “The 5th International Conference on Water Resources 2021”. I would like to congratulate to all participants in making them available during this hard time ever.

Despite significant scientific advances in water resources engineering over the last few decades, the knowledge on practice gap still exists. Results shows that the priority areas have not change but new action have taken place in mission to realign the targets of the vision. Scientific Research and Innovation, Water Education in the Fourth Industrial Revolution, Bridging the Data-Knowledge Gap, Inclusive Water Management under Conditions of Global Change, and Water Governance Based on Science for Mitigation, Adaptation and Resilience are pillars in the five current topics need to be synergised from each pillar strategically.

The 5th ICWR 2021 with a theme “Innovating for Resilience and Enhanced Preparedness to Water Related Challenges” is one of the important programs under the vision and mission of the Department of Irrigation and Drainage Strategic Plan (2021-2025). Global Climate Change has led us to understand more on the ecosystem to save our water resources for livelihood. Engineers, scientists, environmentalist, economists and academicians navigate to understand these challenges. Engineering and Sciences on river hydrology and hydraulic, dam engineering, coastal and inland planning and design remain unattached due to gaps in enabling environment. To that subject and due to lack of understanding why it is so importance to attend this conference. I am sure, you are coming across the comparable problems and other challenges in your profession practice.

As an engineer and professionals, I think, the conference theme of “Innovating for Resilience and Enhanced Preparedness to Water Related Challenges” could contribute towards addressing this knowledge to practice gap, through providing a scientific exchange platform. A distinguished panel of international expert in water engineering would be sharing their latest research and practice perspectives during this conference, which I hope, would be applicable in your daily practice. I believe that, sharing of your experience practice perspectives with regional/global experts, would further make this conference rich in its content, with a win-win situation for all.

I wish you all an engaging and productive conference participation!

YBHG. DATO' IR. NOR HISHAM BIN MOHAD GHAZALI

Director General

Department of Irrigation and Drainage, Malaysia

FOREWORD BY

VICE CHANCELLOR
UNIVERSITI TEKNOLOGI MALAYSIA



Assalamualaikum warahmatullahi wabarakatuh and Greetings to All.

It is an honour to welcome all respected guests, participants and sponsors to the 5th International Conference on Water Resources ICWR 2021. This is the first time the conference is being held virtually, with the four previous conferences held in Langkawi Island. ICWR 2021 is jointly organised by Universiti Teknologi Malaysia (UTM) and the Department of Irrigation and Drainage Malaysia (DID). I would like to thank our collaborators, the Ministry of Environment and Water (KASA) and Humid Tropics Centre (HTC), for their cooperation and efforts in organising this conference.

The ICWR 2021 theme of “Innovating for resilience and enhanced preparedness to water-related challenges” is timely because water-related challenges have proven to be complex and call for long-term solutions with commitment from all sectors. The creation of a new framework in 2020 under the Decade of Action by the United Nations to accelerate sustainable solutions for the next nine years has shown that previously implemented actions were not quite at the pace required to meet the SDG 6 targets by 2030, which is to ensure the availability and sustainable management of water and sanitation for all through concerted and accelerated actions by stakeholders at all levels.

As such, resilient solutions and enhanced preparedness through innovative approaches shall be explored by sharing knowledge in water resource management. UTM is willing to share experiences and insights related to Research & Development (R&D) towards effective and best water resource management practices and collaborate with professional institutions and industrial players to achieve excellence in this field.

I hope this collaboration will continue to progress and this conference will be a successful one. A note of thanks must go to the organising committee for their remarkable dedication and efforts in making this joint conference a success.

To all distinguished guests and participants, have a fruitful and rewarding conference.

Thank you.

Best wishes,
PROF. DATUK TS. DR. AHMAD FAUZI BIN ISMAIL
Vice Chancellor
Universiti Teknologi Malaysia (UTM)

FOREWORD BY

CHAIRMEN OF ORGANISING COMMITTEE



On behalf of the organising committee, it is our great pleasure to welcome all distinguished guests and participants to the 5th International Conference on Water Resources (ICWR 2021). The ICWR 2021, is jointly organised by Universiti Teknologi Malaysia (UTM), Humid Tropics Centre (HTC), Department of Irrigation and Drainage Malaysia (DID) and The Malaysian National Commission for UNESCO. This is the first time that the conference is held virtually as previous four series from 2009 to 2018 were organised in Langkawi Island. This conference is also one of the MoU activities between UTM and DID. The theme for this conference is “Innovating for Resilience and Enhanced Preparedness to Water-Related Challenges”.

ICWR 2021 aims to bring together the academics, scientists, engineers, researchers, water managers, government officials and practitioners from a wide range of disciplines, working on water resources and sustainability science to collaborate, communicate and share their experiences and research findings. ICWR 2021 has invited five distinguished keynote speakers, and five invited speakers from academics, researchers, and from industrial players. They are well established experts in their fields. Apart from that, there are 70 technical papers that will be presented during the conference.

The conference chairmen would like to express deep appreciation and gratitude to the taskforce, scientific and technical committee, staff of the School of Civil Engineering, UTMSPACE and DID Malaysia for their hard work in organising this conference. Our appreciation also goes to those who are directly or indirectly involved in ICWR 2021 for making it a successful conference.

We would like to thank the sponsors, supporting organisations and various contributors for their generous support towards this conference, and for joining us in this conference. Special thanks to distinguished speakers and paper presenters for sharing their knowledge and insights. It is our sincere hope that we will benefit from ICWR 2021 and experience memorable moments.

Thank you.

- 1) ASSOC. PROF. IR. TS. DR. MOHAMAD HIDAYAT BIN JAMAL**
School of Civil Engineering,
Universiti Teknologi Malaysia
- 2) TUAN HAJI MOHAMAD NAZIF BIN DAUD**
Director Humid Tropics Centre,
Department of Irrigation and Drainage, Malaysia



TENTATIVE PROGRAMME

TUESDAY | 23 NOVEMBER 2021

TIME	TUESDAY (23/11/2021)	
8:30am - 9:00am	Registration	
9.00am -9.30am	Keynote Speaker 1 : YBhg. Dato' Seri. Ir. Dr. Zaini bin Ujang Secretary General Minister of Ministry of Environment and Water	
9.40am - 10.10am	Keynote Speaker 2 : YBhg. Dato' Ir. Nor Hisham bin Mohd Ghazali Director General Department of Irrigation and Drainage	
10.10am - 10.20am	Break	
10.20am 11.30am	Opening Ceremony	
	Introduction by Master of Ceremony	
	Welcoming Speech by Chairperson of ICWR 2021	
	Officiating Speech by Minister of Ministry of Environment and Water YB Dato' Sri Tuan Ibrahim bin Tuan Man	
	End of Opening Ceremony	
	Virtual Room 1	Virtual Room 2
	Session A1	Session A2
11:30am-11:40am	ID 03: PREDICTION OF INDUSTRIAL WATER CONSUMPTION - BLUE WATER FOOTPRINT IN KUANTAN RIVER BASIN Edriyana Abd Aziz, Syazwan Nizam Moni, Jothi Letchumy Mahendra and Noraini Yusof	ID 34: DEVELOPMENT OF DEPTH-AREA-DURATION (DAD) CURVES FOR KUANTAN RIVER BASIN Norasman Othman, Nurul Farhana Abu Manshor and Shairul Rohaziawati Samat
11:40am-11:50am	ID 04: STATISTICAL AND TREND ANALYSIS OF ANNUAL MAXIMUM DAILY RAINFALL (AMDR) FOR KUCHING CITY, SARAWAK, MALAYSIA Charles Hin Joo Bong, San Chuin Liew, Maureen Negin, Edna Ruji Matthew and Darmesah Gabda	ID 52: BIBLIOMETRIC ANALYSIS OF GLOBAL RESEARCH ON PROBABLE MAXIMUM PRECIPITATION ESTIMATION USING SCOPUS DATABASE Rasnavi Paramasivam, Nor Eliza Alias, Sitti Asmah Hassan and Fara Aiza Md Sanin
11:50am-12:00pm	ID 23: REDUCING UNCERTAINTIES IN INFILTRATION MODEL USING SCS-CN FOR MIXED LAND USE CATCHMENT Abd Jalil Hassan, Sobri Harun, Tarmizi Ismail, and H. Zulkarnain	ID 53: WATER DISTRIBUTION SYSTEM MODELLING IN PASIR GUDANG, JOHOR WITH EPANET Jun Hao Lee, Ponselvi Jeevaragagam and Nikita Khairina Max Mulwan
12:00pm-12:10pm	ID 25: GAMMA DISTRIBUTION TO RAINFALL DATA AT KUANTAN RIVER BASIN Nadiatul Adilah Ahmad Abdul Ghani, Azlyna Senawi and Roshan Subramaniam	ID 65: DEVELOPMENT OF THE NATIONAL WATER BALANCE MANAGEMENT SYSTEM (NAWABS) FOR THE PERAK, KURAU AND KERIAN RIVER BASINS Asnor Muizan Ishak, Asmadi Ahmad, Nur Atikah Abdullah, Umi Aisha Abdul Karim, Mohammad Muzani Mohammad Husni, James Lau and Nor Ghani Md. Nor

12:10pm-12:20pm	<p>ID 28: MULTIVARIATE STATISTICAL ANALYSIS OF MORPHOMETRIC PARAMETERS IN WATERSHEDS OF PERU</p> <p>Maiquel López Silva, Dayma Carmenates Hernández, Isamis Sao Cancio, Antonio Valderrama Romero and Pedro Huamaní Navarrete</p>	<p>ID 69: MANAGING DISPUTES IN WATER MANAGEMENT CONTRACTS: THE DID PERSPECTIVE</p> <p>Ruaidah Idris, Farah Yasmin Tasmiran and Nurhayati Ab Manan</p>
12:20pm-12:45pm	Question and answer session	Question and answer session
12:45pm-12:15pm	Break	
	Session B1	Session B2
2:15pm-2:25pm	<p>ID 73: MALAYSIAN RIVER PROJECT MANAGEMENT WITH MASLAHAH FROM THE TECHNICAL DEPARTMENT PERSPECTIVE</p> <p>Muhamad Rosdi Senam and Rapiyah Mohd Zaini</p>	<p>ID 60: CHARACTERISTIC OF STORMWATER QUALITY USING BIOECODS IN JKR PILOT PROJECTS</p> <p>Sanisah Sulaiman, Noor Ezlyn Othman, Atikah Abdul Hamid, Nor Azazi Zakaria and Chun Kiat Chang</p>
2:25pm-2:35pm	<p>ID 27: PERMEABILITY AND MECHANICAL PROPERTIES OF PERVIOUS CONCRETE CURBE WITH DIFFERENT AGGREGATE SIZES</p> <p>Canarisa Nipi Ah Lian, Mohamad Hidayat Jamal and Zulkiflee Ibrahim</p>	<p>ID 21: DEVELOPMENT OF LOW-COST TECHNOLOGY FOR MONITORING OF SOIL MOISTURE AND RECYCLING RAINWATER FOR IRRIGATION</p> <p>Siti Nurhayati Mohd Ali and Nuryazmeen Farhan Haron</p>
2:35pm-2:45pm	<p>ID 41: FLOOD RISK ASSESSMENT CONSIDERING THE EFFECT OF COVID-19 PANDEMIC IN THE MUNICIPALITY OF BALAYAN, BATANGAS</p> <p>Cris Edward Monjardin, Fernando Andre Cala, Donald Cedrick Po and Mike Andrean Sy</p>	<p>ID 84: ISLAMIC INSTITUTIONAL ARRANGEMENTS OF THE AFLAJ SYSTEMS MAINTENANCE IN SULTANATE OF OMAN: OPERATION OF THE DIFFERENT AFLAJ TYPE CASE STUDY</p> <p>Ahmed Al-Marhoudi and Jasni Sulong</p>
2:45pm-2:55pm	<p>ID 47: INVESTIGATING SWAT MODEL EFFICIENCY TO DETERMINE WATER BALANCE COMPONENTS (CASE STUDY: SUNGAI MUDA WATERSHED)</p> <p>Mohd Syazwan Faisal Mohd, Mohamad Hidayat Jamal, Juneng Liew and Khairul Anuar Mohamad</p>	<p>ID 32: HYDROLOGICAL DROUGHT EVALUATION ON STREAMFLOW DROUGHT INDEX (SDI) IN UPSTREAM AND DOWNSTREAM AREA OF LAMPAO RESERVOIR, NORTHEAST OF THAILAND</p> <p>Kowit Boonrawd, Jirawat Supakosol and Haris Prasanchum</p>
2:55pm-3:05pm	<p>ID 48: A REVIEW ON HEAVY DUTY MOBILE FLOOD WALL BARRIER: WAY FORWARD FOR MALAYSIA</p> <p>Mohamad Nazif Daud, Norlida Mohd Dom, Woon Yang Tan, Cha Yao Tan, Xin Yi Chong, Chow Hock Lim, Chung Lim Law and Fang Yenn Teo</p>	<p>ID 67: A HOLISTIC APPROACH FOR ESTABLISHING RESILIENT DAMS FOR MALAYSIA</p> <p>Lariyah Mohd Sidek, Hidayah Basri, Mohammad Marufuzzaman, Norziana Jamil, Zeitney Karmilla Kaman, Muhammad Izzat Azhar Khebir, Siti Mariam Allias Omar and Mohd Hazri Mohd Khambali</p>
3:05pm-3:30pm	Question and answer session	Question and answer session

	Session B3	Session B4
3:40pm-3:50pm	<p>ID 72: CHALLENGES IN MANAGING MULTIFUNCTIONAL DAM: A CASE STUDY OF SEMBRONG DAM IN ENSURING THE SAFETY OF THE DAM WHILE MAINTAINING THE NEEDS FOR FLOOD PROTECTIONS AND WATER RESOURCES</p> <p>Rozman Mohamad, Zakiyyah Muhammad, Mohd Hazri Moh Khambali and Engku Ahmad Khalil Azhar Engku Mohamed</p>	<p>ID 80: MODELLING WAVE RUN-UP AT A CORAL REEF ISLAND IN MALDIVES USING XBEACH</p> <p>Maumoon Saleem, Mohamad Hidayat Jamal, Daeng Siti Maimunah Ishak and Nor Suhaila Rahim</p>
3:50pm-4:00pm	<p>ID 76: SEEPAGE ANALYSIS OF BATU DAM : COMPARISON OF FIELD DATA AND NUMERICAL ANALYSIS</p> <p>Larifah Mohd Sidik, Nor Hisham Mohd Ghazali, Mohd Azmi Ismail, Rozman Mohamad and Mohd Hazri Moh Khambali</p>	<p>ID 39: SALINITY BEHAVIOR AND INTRUSION IN KELANTAN RIVER ESTUARY</p> <p>Nur Athirah Mohamad, Ilya Khairanis Othman, Mohamad Hidayat Jamal, Radzuan Sa'ari, Kogila Vani and Mohamad Faizal Ahmad</p>
4:00pm-4:10pm	<p>ID 85: MODELLING OF AN EMBANKMENT FAILURE USING FLOW-3D</p> <p>Zainab Mohamed Yusof, Zebedee Anak Leslie Shirling, Ahmad Khairi Abd. Wahab, Zulhilmi Ismail and Shahabuddin Amerudin</p>	<p>ID 46: HYDRODYNAMIC ASSESSMENT ON THE IMPACTS OF SEA LEVEL RISE AT THE KELANTAN SHORELINES AND DELTA, MALAYSIA</p> <p>Hin Lee Lee, Anthony Dunstan, Abdullah Ikmalzatul, Ahmad Anizawati, Rahim Aidah and Jamal Mohamad Hidayat</p>
4:10pm-4:20pm	<p>ID 10: HYBRID CURRENT TURBINE AND SOLAR CELL RENEWABLE ENERGY DEVICE</p> <p>Azrul Aminur Rahman Yunus, Adi Maimun, Mohammad Hidayat Jamal and Nursahliza Muhamat Yain</p>	<p>ID 66: POTENTIAL DEVELOPMENT OF COASTAL RESERVOIR IN MALAYSIA</p> <p>Muhammad Rizal Razali, Ahmad Farhan Hamzah, Ilya Othman, Hin Lee Lee, Noor Shahida Rosli, Wan Ahmad Hafiz Wan Mohd Azhary, Anizawati Ahmad, Saiful Bahri Hamzah and Mohamad Hidayat Jamal</p>
4:20pm-4:30pm	<p>ID 19: SANDY BEACH RESPONSES TO SEA LEVEL RISE: COMPARISON POTENTIAL COASTAL INUNDATION MAPS USING STATIC AND NUMERICAL MODEL FOR IBAI RIVER, MALAYSIA CASE STUDY</p> <p>Yannie Benson, Lee Hin Lee, Ahmad Khairi Abd. Wahab, Khairul Anuar Mohamad, Dunstan Anthony Pereira, Ikmalzatul Abdullah and Mohamad Hidayat Jamal</p>	<p>ID 70: CHALLENGES IN MANAGING THE COASTAL ZONE IN MALAYSIA</p> <p>Lokman Amir Hamzah and Mahran Mahamud</p>
4:30pm-4:40pm	<p>ID 86: SUSTAINABLE STORMWATER MANAGEMENT: DEVELOPING STORMWATER MANAGEMENT AND DRAINAGE MASTER PLAN FOR SERIAN, SARAWAK</p> <p>Ir. R. Salleh, K.Y. Wong, Ir. Judy J.K. Kueh, Ir. T. Sulaiman and Ir. Hjh. A. Ainan</p>	<p>ID 87 : INTEGRATED RIVER BASIN MANAGEMENT (IRBM) IN MALAYSIA</p> <p>Shamsiah Omar^{1*}, C.L. Wong² and Jamil Shaari³</p>
4:30pm - 4:55pm	Question and answer session	Question and answer session

WEDNESDAY | 24 NOVEMBER 2021

TIME	WEDNESDAY (24/11/2021)	
9:00am - 9:30am	Keynote Speaker 3 : Professor Dr. Tetsuya Sumi Kyoto University, Japan Title : Integrated Flood and Sediment Management in River Basins for Sustainable Development	
9:30am - 10:00am	Keynote Speaker 4 : Assoc. Prof. Dr. Shamsuddin Shahid Universiti Teknologi Malaysia Title : Adaption to Climate Change Impacts on Irrigated Agriculture	
	Virtual Room 1	Virtual Room 2
	Session C1	Session C2
10:10am-10:20am	ID 38: ASSESSMENT OF COASTAL VULNERABILITY INDEX UNDER STORM SURGE AND SEA LEVEL RISE IMPACT ON THE EAST COAST OF JOHOR Norzana Mohd Anuar, Siti Habibah Shafiai, Teh Hee Min and Ahmad Mustafa Hashim	ID 12: PROJECTION OF FUTURE THERMAL BIOCLIMATIC INDICATORS IN EGYPT ADDRESSING PARIS AGREEMENT GLOBAL WARMING GOALS Mohammed Magdy Hamed, Mohamed Nashwan and Shamsuddin Shahid
10:20am-10:30am	ID 81: Modelling Wave Run-Up at A Coral Reef Island in Maldives Using XBEACH Muhammad Nur Aiman Roslan, Teh Hee Min and Faris Ali Hamood Al-Towayti	ID 17: VALIDATION OF GRIDDED DATA SET OVER SEMI-ARID REGION OF SYRIA Rajab Homsy, Shamsuddin Shahid, Tarmizi Ismail, Jam Shahzaib Khan, Zafar Iqbal and Atif Muhammad Ali
10:30am-10:40am	ID 82: NUMERICAL STUDY OF WAVE GROUPS IN WIND-SWELL SEAS Ahmed Mohamed Mansoor and Mohamed Latheef	ID 18: TREND ANALYSIS OF TERRESTRIAL WATER AVAILABILITY IN THE AMU DARYA RIVER BASIN UNDER CLIMATE CHANGE Obaidullah Salehie, Tarmizi Ismail and Shamsuddin Shahid
10:40am-10:50am	ID 83: MODELLING OF WAVE RUNUP AND OVERTOPPING OVER ACCROPODE II BREAKWATER Viknesvaran Krishnan, Mohamad Hidayat Jamal and Mohd Ridza Mohd Haniffah	ID 49: ASSESSING THE IMPACT OF CLIMATE CHANGE ON FLOOD CHARACTERISTICS AT LANGAT RIVER BASIN USING RAINFALL RUNOFF INUNDATION (RRI) MODEL Ummi Hani Mahamad Anuar, Nor Eliza Alias, Kamarul Azlan Mohd Nasir, Rahmah Mohd Lokoman and Muhammad Wafiy Adli Ramli
10:50am-11:00am	ID 16: UNDERSTANDING VARIABILITY OF GROUNDWATER POTENTIALS IN WESTERN SOKOTO BASIN: IMPLICATIONS FOR SUSTAINABLE GROUNDWATER DEVELOPMENT Saadu Umar Wali, Noraliani Alias and Sobri Harun	ID 50: IMPACT OF SEA LEVEL RISE AND ADAPTATIONS FOR PENINSULAR MALAYSIA SHORELINE Lee Lee Hin, Dunstan Anthony , Khairul AnuarMohamad, Amri Md Shah , Yannie Benson, Ahmad Hafiz Azhary Wan, Muhammad Rizal Razali and Saiful Bahri Hamzah
11:00pm-11:25pm	Question and answer session	Question and answer session

	Session C3	Session C4
11:30am-11:40am	<p>ID 57: ANALYSING IMPACT OF CLIMATE CHANGE ON HYDROLOGICAL TREND IN KELANTAN RIVER BASIN USING HEC-HMS COUPLED WITH SDSM</p> <p>Muhammad Zahran Syahmi Armain, Zulkarnain Hassan, Mohd Remy Rozainy Mohd Arif Zainol, Sobri Harun, Ain Nihla Kamarudzama and Salwa Mohd Zaini Makhtar</p>	<p>ID 05: REMOVAL OF AMMONIACAL NITROGEN FROM AQUEOUS SOLUTION USING CLINOPTILOLITE AS ADSORBENT</p> <p>Najihahsuhada Abi Jihat and Mohd Hafiz Puteh</p>
11:40am-11:50am	<p>ID 06: UTILISING AERIAL MAPPING APPROACH ON DAM DISASTER RISK REDUCTION</p> <p>Rahsidi Sabri Muda, Izawati Tukiman, Ahmad Fadhli Mamat, Mohamad Hidayat Jamal and Fatin Shahira Abdullah</p>	<p>ID 31: WORKABILITY ON PHYSICAL PROPERTIES FOR GRAY WATER H-FILTERS AS CONTROL AT SOURCE</p> <p>Sabariah Musa, Radin Maya Saphira Radin Mohamed and Nurhannah Nazirah Hasib</p>
11:50am-12:00pm	<p>ID 22: THE APPLICATION OF THE KRIGING METHOD IN THE DEBRIS AND MUDFLOW WARNING SYSTEM (DMFWS)</p> <p>Abdul Razak Bahrom, Mohd Zaharifudin Muhamad Ali and Norlida Mohd Dom</p>	<p>ID 40: WATER QUALITY INDENTIFICATION OF KEY PUBLIC CONCERNS USING SENTIMENT ANALYSIS AND TOPIC MODELLING</p> <p>Dwijendranath Dwivedi, Ghanashyama Mahanty and Anilkumar Guntipalli Vemareddy</p>
12:00pm-12:10pm	<p>ID 51: OPEN DATA APPLICATION TO EVALUATE EXPOSURE OF WILDFIRE TO WATER RESOURCES: JOHOR AREA CASE STUDY</p> <p>Fara Aiza Md Sanin, Nor Eliza Alias, Kasturi Devi Kanniah, Mariyana Aida Abdul Kadir, Izni Izzati Mohamad and Rasnavi Paramasivam</p>	<p>ID 42: DETERMINATION OF THE RELATIONSHIP BETWEEN RIVER ECOSYSTEMS AND BENTHIC MACROINVERTEBRATE ECOLOGICAL INDICES AS A BASIS FOR RIVER HEALTH ASSESSMENT</p> <p>Aweng Eh Rak, Sharifah Aisyah Syed Omar, Mohammed Abdu Salam and Mior Izuddin Baharuddin</p>
12:10pm-12:20pm	<p>ID 77: COMMUNICATION, EDUCATION AND PUBLIC AWARENESS PROGRAM (CEPA) IN FLOOD FORECASTING AND WARNING PROGRAM (PRAB)</p> <p>Salwa Ramly</p>	<p>ID 45: PHYSICAL AND CHEMICAL VARIABILITY OF MANGROVE ISLAND: A CASE STUDY OF PULAU KUKUP, JOHOR</p> <p>Abdul Al-Hafis Abdul Rahman Lim, Mohamad Hidayat Jamal, Daeng Siti Maimunah Ishak, Shamila Azman, Myzairah Hamdzah and Nor Suhaila Rahim</p>
12:20pm-12:45pm	Question and answer session	Question and answer session
12:45pm - 2:15pm	Break	
	Session D1	Session D2
2:15pm-2:25pm	<p>ID 61: MARINE DEBRIS AND CLEAN COAST INDEX ON THE BEACH OF PANTAI NAVY LABUAN, WILAYAH PERSEKUTUAN LABUAN, MALAYSIA</p> <p>Diyana Hazierah Abdullah, Norasikin Saman, Nurfarhain Mohamed Rusli, Mohd Rizalman Mohd Ali and Shazwin Mat Taib</p>	<p>ID 54: NUMERICAL ANALYSIS OF FLOW CHARACTERISTICS FOR IDEALISED Y-SHAPED CHANNELS</p> <p>Zi Xin Foh, Cha Yao Tan, Mohd Ridza Mohd Haniffah, Erwan Hafizi Kasiman and Fang Yenn Teo</p>
2:25pm-2:35pm	<p>ID 07: THE INFLUENCE OF VEGETATED ALTERNATE BAR ON FLOW RESISTANCE IN AN ALLUVIAL STRAIGHT CHANNEL</p> <p>Mohd Zulkhairi Mat Salleh, Zulkiflee Ibrahim, Radzuan Saari, Muhammad Effandi Mohd Shariff and Mazlin Jumain</p>	<p>ID 56: LABORATORY INVESTIGATIONS ON POROUS CONCRETE DRAINAGE SYSTEMS PERFORMANCE</p> <p>Feroz Hanif Mohamed Ahmad, Mohamad Hidayat Jamal, Abdul Rahman Mohd Sam, Nuryazmeen Farhan Haron and Canarisa Nipi Ah Lian</p>

2:35pm-2:45pm	<p>ID 09: SHORT TIMESCALE RIVERBANK EROSION AND BANK STABILITY OF SG. BERNAM USING BANK STABILITY AND TOE EROSION MODEL (BSTEM)</p> <p>Azlinda Saadon, Zulkiflee Ibrahim and Mohamed Fuad Said Khamis</p>	<p>ID 58: A MATHEMATICAL STUDY OF THE RELATION BETWEEN FLOWRATES, FROUDE NUMBER, BED WIDTH IN DIVIDING OPEN CHANNEL FLOW</p> <p>Puteri Nadia Shafiqah Harmizi, Iskandar Shah Mohd Zawawi, Mohd Ridza Mohd Haniffah and Taufiq Khairi Ahmad Khairuddin</p>
2:45pm-2:55pm	<p>ID 20: SALINE WATER AND FRESHWATER INTERACTIONS IN A NARROW MEANDERING CHANNEL</p> <p>Mazlin Jumain, Zulkiflee Ibrahim, Wan Nor Afiqa Wan Mustafah Kamal, Sharifah Nurfarain Syed Abdul Jabar, Md.Ridzuan Makhtar, Noorarbana Abd Rani, Nurfarhain Mohamed Rusli and Mohd Zulkhairi Mat Salleh</p>	<p>ID 63: MACHINE LEARNING ALGORITHMS WITH MINIMUM HYDRO- METEOROLOGICAL DATA FOR MONTHLY STREAMFLOW FORECASTING OF KURAU RIVER, MALAYSIA</p> <p>Muhammad Adib Mohd Nasir and Sobri Harun</p>
2:55pm-3:05pm	<p>ID 36: 3D SIMULATION ON 90 DEGREE OFF-TAKE BRANCHING CHANNEL WITH SEPARATION ZONES</p> <p>Siti Aimi Asyarah Zakaria, Mohd Ridza Mohd Haniffah, Amyrhul Abu Bakar, M Faizal Ahmad and Iskandar Shah Mohd Zawawi</p>	<p>ID 64: TRENDS IN POTENTIAL EVAPOTRANSPIRATION IN PENINSULAR MALAYSIA IN RELATION TO GEOGRAPHY AND TOPOGRAPHY</p> <p>Sahar Hadi Pour and Shamsuddin Shahid</p>
3:05pm-3:30pm	Question and answer session	Question and answer session
3:30pm - 5:00pm	<p style="text-align: center;">Invited Speaker Session</p> <p style="text-align: center;">Assoc. Prof. Dr. Ton van den Bremer Department of Engineering Science, University of Oxford Title : The Role of Waves in Transporting Marine Litter</p> <p style="text-align: center;">Professor Dr. Ping Ping Luo Chang' An University, China Title : Assessment of Flood Disaster Under the Extreme Rainfall</p> <p style="text-align: center;">Ir. Ts. Dr. Safari bin Hj Mat Desa River Basin Research Center National Hydraulic Research Institute of Malaysia (NAHRIM)</p> <p style="text-align: center;">Title : "Hydraulic Modelling Similitude for Maritime Infrastructure in Malaysia"</p>	

THURSDAY | 25 NOVEMBER 2021

TIME	THURSDAY (25/11/2021)	
9:00am - 9:30am	Keynote Speaker 5 : Mr. Nor Zamri bin Sondor Selangor Waters Management Authority (LUAS) Title : Development of Hybrid off River Augmentation Storage (Horas) in Selangor, Malaysia	
	Virtual Room 1	Virtual Room 2
	Session E1	Session E2
9:35am-9:45am	ID 71: ANALYSIS OF PAN EVAPORATION DATA IN PENINSULAR MALAYSIA Ir. Hj. Bibi Zarina Che Omar, Mohd Faizul Mustapha, Ir. Surdiman Zahuri Sulaiman, Ir. Muhamad Khosim Hj. Ikhsan and Roslan Sahat	ID 68: PREDICTION OF FLOW STRUCTURE IN AXIAL FLOW SUBMERSIBLE PUMPS DURING INTAKE BY NUMERICAL SIMULATION Tajul Ariffin Norizan, Hapida Ghazali, Rosazlan Abu Seman and Zambri Harun
9:45am-9:55am	ID 75: EVALUATION OF FILTERED WATER QUALITY IN EXTENSIVE GREEN ROOF WITH LIMESTONE AS GROWTH SUBSTRATE Nurul Hana Mokhtar Kamal, Nuridah Sabtu and Rosnani Alkarimiah	ID 74: COMPARISON OF DRAG MODELS IN SHALLOW FLOW FOR SPHERICAL PARTICLE TRAJECTORY Lavine Wong, Mohamad Hidayat Jamal and Erwan Hafizi Kasiman
9:55am-10:05am	ID 24: APPLICATION OF BUILDING INFORMATION MODELLING (BIM) TECHNOLOGY IN DRAINAGE SYSTEM USING AUTODESK INFRAWORKS 360 SOFTWARE King Kuok Kuok, Kia Wee Kingston Tan, Po Chan Chiu, Mei Yun Chin, Md. Rezzaur Rahman and Muhammad Khusairy Bakri	ID 78: SWAT APPLICATION FOR GADJAHWONG RIVER STREAMFLOW SIMULATION Pradipta Nandi Wardhana and Sofwatul Izzah
10:05am-10:15am	ID 35: CFD MODELLING OF PARTIALLY SUBMERGED ORIFICE USING FLOW-3D Anas S. Ghamam, Mohammed A. Abohatem, Mohd Ridza Mohd Haniffah and Ilya K. Othman	ID 79: OUTPUT UPDATING OF PHYSICALLY BASED MODEL FOR UPPER THAMES RIVER WATERSHED WITH NEURAL NETWORK Ponselvi Jeevaragagam and Slobodan Simonovic
10:15am-10:25am	ID 43: THE APPLICATION OF STATISTICAL ANOVA, LSD AND RSM TO AGRO-BASED FILTER DESIGN OPTIMIZATION Awang Nasrizal Awang Ali, Jason Lowell Jitolis, Juferi Idris, Nazaruddin Abdul Taha and Nurmin Bolong	Question and answer session
10:25am-10:50am	Question and answer session	
11:00am -12:00pm	Invited Speaker: Ir. Dr. Asnor Muizan Ishak Subject Matter Expert, Chief Section for Technical Advice, Hydrology and Water Resources Division Department of Irrigation and Drainage Ir. Arman bin Mokhtar Deputy Director (Subject Matter Expert - Coastal Engineering) Coastal Zone Management Division Department of Irrigation and Drainage	
12:00pm -12:30pm	Closing Ceremony : UTM	

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The background features abstract geometric shapes in various shades of blue. On the left, there are several vertical lines of varying lengths that create a sense of depth and movement. The overall design is clean and modern, with a focus on geometric forms and a limited color palette.

INTEGRATED RIVER BASIN MANAGEMENT

ID 03: PREDICTION OF INDUSTRIAL WATER CONSUMPTION - BLUE WATER FOOTPRINT IN KUANTAN RIVER BASIN

E. A. Aziz¹, S. N. Moni^{1*}, M. J. Letchumy², N. Yusoff¹ and S. Z. Zabir¹

¹ Department of Civil Engineering, College of Engineering, Gambang Campus, Universiti Malaysia Pahang, 26300, Kuantan, Pahang, Malaysia
syazwanizam@gmail.co11*, edriyana@ump.edu.my1, nyirdina10@gmail.com1

² Innovative Manufacturing, Mechatronics and Sports Laboratory, Faculty of Manufacturing & Mechatronics Engineering Technology, Universiti Malaysia Pahang, Universiti Malaysia Pahang, Pekan, 26600, Pahang, Malaysia
jothi9314@gmail.com2

Industrial and agricultural sectors have been recognised as sectors attributed to the world most water consumption that may lead to the creation of water scarcity in Malaysia. The beginning of water scarcity event may be manifested by repeating water shortages occurrences at many places, owing to poor water management. Water footprint assessment has been accepted as a tool to account the amount of freshwater being consumed for goods and services we used. In this study, appropriation of freshwater of water consumed for industrial sector within Kuantan River Basin is accounted. The accounting of blue water footprint (WF_{blue}) was performed individually on to the Water Treatment Plant (WTP) available in the Kuantan River Basin and the trend was successfully defined; WF_{blue} of Semambu industrial area showed an increased trend from 2015 to 2019 while the Panching industrial area showed a decreasing trend. In attempted to predict the trend by using ANN, both industrial areas showed an increased trend. In addition to that, the significant factor that influenced the accounting of WF_{blue} was able to be defined based on social, economy and environmental. It can be deduced that an increasing light industrial activities contribute to the increasing calculation blue water footprint as well as the prediction trend. Thus, it is important for the industrial activities to well manage the proportion of water resource as industrial activities have been the main contributor to the unsustainability of Kuantan River Basin water resources.

Keywords: water footprint, blue water footprint, recurrent neural network, water footprint Prediction

ID 04: STATISTICAL AND TREND ANALYSIS OF ANNUAL MAXIMUM DAILY RAINFALL (AMDR) FOR KUCHING CITY, SARAWAK, MALAYSIA

C. H. J. Bong^{1*}, S. C. Liew², M. Negin³, E. M. Ruji⁴ and D. Gabda⁵

¹ Faculty of Engineering, Universiti Malaysia Sarawak, Malaysia
bhjcharles@unimas.my1*

² Faculty of Engineering, Computing & Science, Swinburne University of Technology Sarawak Campus, Malaysia
scliew@swinburne.edu.my2

³ Faculty of Civil Engineering, Universiti Teknologi MARA Sarawak, Malaysia
maureenegin@uitm.edu.my3

⁴ Department of Irrigation and Drainage Sarawak, Malaysia
ednamr@sarawak.gov.my4

⁵ Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Malaysia
darmesah@ums.edu.my5

Kuching city and its surrounding urban areas frequently experience extreme high annual maximum daily rainfall (AMDR) events resulting in flash flood events. This study aims to carry out statistical and trend analysis of extreme AMDR events for Kuching Airport rainfall station (as a representative rainfall station for Kuching city) for the year 1975 to 2017. The analysis of the AMDR involves measures of variability, frequency of occurrence according to month, linear regression plot and empirical frequency analysis. From the analysis, the AMDR was found to have high variability with a value of 36.9% and the month of January has the highest occurrence of AMDR with 53.5% of the total data. Findings from the linear regression plot has shown that the AMDR has a slight decreasing trend over the past four decades though the trend was not significant. Based on the drainage design capacity of Kuching city, AMDR of magnitude 180 mm was identified as a threshold. Events with daily rainfall more than 180 mm were considered as extreme high events which causes flooding in Kuching city. The results of empirical frequency analysis showed that the return period of flooding event with daily rainfall exceeding 180 mm was 2.69 years. The occurrence probability of the flood event at least once in 1, 2, 3, 4 and 5 years was 0.37, 0.60, 0.75, 0.84 and 0.90 respectively. This study contributed to the understanding of magnitude and frequency of extreme high AMDR which could lead to flooding events in Kuching city. This could help policymaker in planning for flood mitigation and management strategies in Kuching city and also in preparation for any impact of climate change.

Keywords: annual maximum daily rainfall, climate change, extreme events, rainfall trend, urban drainage

ID 23: REDUCING UNCERTAINTIES IN INFILTRATION MODEL USING SCS-CN FOR MIXED LAND USE CATCHMENT

A. J. Hassan 1,2 *, S. Harun 1, T. Ismail 1, H. Zulkarnain 2

1 School of Civil Engineering, Faculty of Engineering, University Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
abdjalil.hassan@gmail.com^{1,2*}

2 RiverNet Consulting Sdn. Bhd. No3, Lot 2816, Jalan Sri Gambut, Syeksen 32, 40460 Shah Alam, Selangor, Malaysia

Infiltration model is used to estimate the amount of rainwater infiltrate to the soil to produce surface runoff from the excess rainfall. Factors which govern the computation of infiltration includes the soil type, land use/cover and antecedent moisture condition. One of the popular methods to estimate the infiltration i.e., the surface runoff is Soil Conservation Services (SCS) method which was developed by Natural Resources Conservation Services (NRCS) or previously known as Soil Conservation Services. The method has an advantage since it can be used for various land use and soil type using a single parameter of Curve Number (CN). Even though the method provides wide range of value for different land use, it may not be suitable on catchment scaled due to land use heterogeneity. For mixed land use, averaging the CN value for whole catchment may produce different runoff estimation as compared to individual land use calculation within the catchment. The difference is mainly influenced by the percentage of the dominant land use. The higher the percentage of the dominant land use, the lesser the difference. For large catchment with mixed land use, breaking down the basin into smaller subcatchment will reduce the error of averaging effect and was demonstrated for Sg Ketil catchment in Kedah State. GIS tools were applied to the catchment to ease the computation of individual land use. This paper discusses on the effect of subcatchment delineation to improve the CN estimation on catchment scaled. It shows that when the catchment is divided into smaller subcatchment based on second level tributaries, the dominant land use of more than 80% in basin increased to 50% of the whole catchment. This indicates that the computation of runoff shall improve as compared to the weighted averaging method.

Keywords: rainfall runoff, infiltration model, SCS-CN, catchment delineation, dominant land use

ID 25: GAMMA DISTRIBUTION TO RAINFALL DATA AT KUANTAN RIVER BASIN

Nadiatul Adilah Ahmad Abdul Ghani^{1*}, Azlyna Senawi^{2,3} and Roshan Subramaniam¹

1 Department of Civil Engineering, College Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

nadiatul@ump.edu.my^{1*}, roshanmacz5@gmail.com¹

2 Centre for Mathematical Sciences, College of Computing and Applied Sciences, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia

azlyna@ump.edu.my^{2,3}

3 Centre for Software Development & Integrated Computing, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia

Rainfall data can be very useful for decision makers in developing precautionary strategy to mitigate the impact of climate change in a variety of ways, such as forecasting floods, projecting dry spells, and managing water resources. Prior to the data being utilised, it is critical to determine the best fit probability distribution of the data. Only after this has been done, it is possible to obtain reliable analysis and results. In this study, the feasibility of fitting the data with normal distribution was investigated. The investigation specifically used peak monthly values of rainfall data from ten hydrological stations of the Kuantan River Basin during the year 1975 to 2017. To assess the possibility of fitting the data to the normal and Gamma distributions, four different test statistics were employed: Skewness, excess kurtosis, Kolmogorov-Smirnov and Shapiro-Wilk. Results obtained show that normal distribution fits well with the annual daily maximum rainfall data for only two hydrological stations but normal distribution is not a good fit for the seasonal daily maximum rainfall case for all stations involved. Gamma 1P distribution was found to be not an ideal fit for both annual and seasonal data for all stations but Gamma 2P on contrary was discovered to fit well for all stations except one station. The findings of the study are anticipated to improved rainfall forecasting in the future.

Keywords: Rainfall, Kuantan river basin, Normal distribution, Gamma Distribution, Kolmogorov-Smirnov, skewness

ID 28: MULTIVARIATE STATISTICAL ANALYSIS OF MORPHOMETRIC PARAMETERS IN WATERSHEDS OF PERU

M. López-Silva^{1*}, D. Carmenates-Hernandez¹, I. Sao-Cancio², A. Valderrama-Romero³, P. Huamaní-Navarrete¹

¹ Ricardo Palma University/Engineering Faculty, Perú.
maiquel.lopez@urp.edu.pe^{1*}, dayma.carmenates@urp.edu.pe¹, phuamani@urp.edu.pe¹

² MEDELHI/Natural Sciences Area, Ecuador.
saoisamis@gmail.com²

³ National University of Cañete/Soil and Water Laboratory, Perú.
avalderrama@undc.edu.pe³

Peru is a country recognized for its natural resources, but it is the third most vulnerable country, different research projects have predicted natural. The objective of the research was to hold out the Multivariate Statistical Analysis to 91 hydrographic basins of Peru to get homogeneous water characteristics in different regions. Twenty morphometric parameters were determined to characterize the watersheds in qualitative and quantitative terms. The principal component analysis was applied including Factor analysis, Hierarchical Cluster analysis in R and Ward's method. It had been obtained that 75.52% of the hydrographic basins studied are favoured by morphometric parameters that contribute to a high frequency of streams, which allows adequate use of water resources. The steep slopes are vulnerable basins product to their immediate hydrological response and water erosion, which means a greater need for hydraulic works. Six main components were defined that specify 94.58% of the entire variance denominated as geometric, shape, drainage and relief factors. The results of the Cluster Analysis showed that 35% of the watersheds have homogeneous zones within the geometric and shape factor, while 65% within the drainage and relief factor.

Keywords: Climate Change, Cluster Analysis, Factor analysis, Principal Component, River.

ID 34: DEVELOPMENT OF DEPTH-AREA-DURATION (DAD) CURVES FOR KUANTAN RIVER BASIN

Norasman Othman^{1*}, Nurul Farhana Abu Manshor² and Shairul Rohaziawati Samat¹

¹ Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, Malaysia
norasman@ump.edu.my^{1*}, shairul@ump.edu.my¹

² College of Engineering, Universiti Malaysia Pahang, Malaysia
farhanamanshor98@gmail.com²

Depth-Area-Duration (DAD) analysis is a procedure to determine the maximum amount of rainfall of different durations over a range of areas. DAD analysis also referred as DAD curves forms an important aspect of hydrological study. In this study, the DAD curves for the Kuantan River Basin (KRB) were developed for durations of 1, 2 and 3-day. The rainfall data from Department of Irrigation and Drainage Malaysia (DID) were collected for eight stations in KRB to determine maximum daily rainfall. The selected maximum rainfall data for each rainfall duration were extracted afterward. The analysis was performed using isohyetal maps initially generated by the Inverse Distance Weighting (IDW) method to calculate the average of maximum rainfall depths for each rainfall duration. Since the maximum rainfall was required, the initial DAD curves for each duration were combined to produce a final DAD curve, which is mainly the maximum depth-area curve for the corresponding duration. This step was repeated for all durations, resulting in three final DAD curves, for each of the time duration. By using this procedure, the average maximum rainfall for the basin area up to 1700 km² can be estimated.

Keywords: Rainfall, Depth-Area-Duration curves, Isohyetal map, Kuantan River Basin

ID 52: BIBLIOMETRIC ANALYSIS OF GLOBAL RESEARCH ON PROBABLE MAXIMUM PRECIPITATION ESTIMATION USING SCOPUS DATABASE

Rasnavi Paramasivam1*, Nor Eliza Alias1,2, Sitti Asmah Hassan2, Fara Aiza Md Sanin1

1 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, rasnavi2@graduate.utm.my1*, noreliza@utm.my1,2, sasmah@utm.my1, faraaiza@graduate.utm.my1
2 Centre for Environmental Sustainability and Water Security (IPASA), Research Institute for Sustainable Environment (RISE), Universiti Teknologi Malaysia,

Climate change impact on the intensity of extreme precipitation is very significant nowadays. The impact of extreme rainfall events causes increase in flood frequencies and risk of dam failure. Therefore, the analysis of extreme events is required for future risk reduction assessment. Probable maximum precipitation (PMP) estimation has received a positive attention among engineers in the design of water engineering. Therefore, understanding the methods that is most suitable for the estimation and broadening collaboration networks are important for advanced research development. In this bibliometric study, our aim was to evaluate the global research trends in PMP estimation based on publication outputs, co-authorships among authors and affiliated countries, and co-occurrences of author keywords. 234 journal articles which were published between 1953-2020 were rectified using the Scopus database. From the analysis, it is found that after 2010, the publications of articles regarding PMP estimation had shown significant increase, resulting in the steady increase in the cumulative total publications until present. Most of the global total publications were contributed by researchers from United States, India, Canada, United Kingdom, China and other 30 countries. In conclusion, recent progress in PMP estimation method includes Hershfield method and Hydrometeorological method.

Keywords: Bibliometric analysis; Probable maximum precipitation; Scopus database

ID 53: WATER DISTRIBUTION SYSTEM MODELLING IN PASIR GUDANG, JOHOR WITH EPANET

J. H. Lee1, P. Jeevaragagam2*, N. K. Max Mulwan3, A. Aris4, M. Anjang Ahmad5

1,3 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia

jun.hao@graduate.utm.my1, nikitakhairina@graduate.utm.my3

2,4 Department of Water and Environmental Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia

ponselvi@utm.my2*, azmi.aris@utm.my4

5 Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

mustafa@uthm.edu.my5

This paper presents a water distribution network to determine the water demand for each area in Pasir Gudang by using EPANET software. The requirements for this study are Pasir Gudang water distribution layout, demand based on each area, elevation of tank locations with pipe length and diameter of the pipes. The actual water demand, elevation of tank with its pipe length were obtained from Ranhill SAJ Sdn Bhd. The water distribution network that presents in EPANET software consists of 26 water tanks, 38 junctions, 65 pipes and one water treatment plant. The water demand of the modelling estimate to be 215,160 m³ per day. The overall demand of water consumption is 215,160 m³ per day but the required demand that obtained from Ranhill SAJ Sdn Bhd estimated to 206,070 m³ per day. Therefore, there was no shortage of water in Pasir Gudang area.

Keywords: water distribution network, water demand, EPANET

ID 65: DEVELOPMENT OF THE NATIONAL WATER BALANCE MANAGEMENT SYSTEM (NAWABS) FOR THE PERAK, KURAU AND KERIAN RIVER BASINS

AM Ishak¹, A. Ahmad¹, N.A. Abdullah², U.A. Abdul Karim², M.M. Mohammad Husni², Dr. J. Lau² and N.G Md. Nor²,

¹ Department of Irrigation and Drainage, Kuala Lumpur, Malaysia.

drasnor@water.gov.my¹, asmadi_ahmad@water.gov.my¹

² Megaconsult Sdn. Bhd. Kuala Lumpur, Malaysia.

tykahabdullah@gmail.com², umiaishakarim@gmail.com², muzani.megaconsult@gmail.com², james.megaconsult@gmail.com², norghani1@yahoo.com²

Water resources in Malaysia faces significant challenges from changing climate, growing populations, increased water demands and pollution. In daily operations, river basin managers and stakeholders face difficult decisions in balancing the short and long term demands with the available and predicted supplies in the basin. This paper presents the background and development of the NAWABS Sungai Perak, Kurau and Kerian. The NAWABS system has been developed to study the overall water balance of the three catchments in an integrated manner. It considers satellite rainfall, climate predictions, surface, river and groundwater systems. It also considers the full cycle water demand including the demands of potable water, irrigation (padi and non-padi crop), livestock, fisheries and tourism. The issues of Water, Energy and Food (WEF), environmental flow requirements and landuse planning is also considered.

Keywords: Water Balance Model, Drought Forecasting, Decision Support System, Water Management

ID 69: MANAGING DISPUTES IN WATER MANAGEMENT CONTRACTS: THE DID PERSPECTIVE

Sr Ruaidah binti Idris^{1*}, Farah Yasmin binti Tasmiran¹, Nurhayati binti Abdul Manan¹

¹ Director of Quantity Surveying and Contract Management Division, Department of Irrigation and Drainage, Malaysia
ruaidah@jkr.gov.my^{1*}, farahyasmin@water.gov.my¹, yatimanan@jkr.gov.my¹

Disputes are common problems in the construction industry and water management projects are of no exception. In order to minimise the problem, it is imperative to identify the disputes and conflict arising in the industry. Thus, the objective of this paper is to highlight the common disputes and issues between the Contractor and the Government. In the DID context, the common types of disputes often faced are temporary work and issues on unforeseeable hydrological conditions. To elaborate further on the disputes, sample cases and projects are identified and this paper further outlines steps or actions to overcome them. Therefore, it is very important to manage them for better and efficient completion of the projects. This paper is expected to be of assistance in the management of conflict and disputes in upcoming DID projects.

Keywords: Department of Irrigation and Drainage (DID), Disputes, Managing Disputes, Temporary Work, Unforeseeable Hydrological Conditions.

ID 73: Malaysian River Project Management With Masalah From The Technical Department Perspective

Muhamad Rosdi Senam¹, Rapiah Mohd Zaini²

¹ Jabatan Pengairan dan Saliran Malaysia, Jalan Sultan Salahuddin, 50336 Kuala Lumpur, Malaysia
mrosdis@jkr.gov.my¹

² Faculty of Management, Multimedia University 63100 Cyberjaya, Selangor, Malaysia
rapiah@mmu.edu.my²

River projects implementation in Malaysia is led by Jabatan Pengairan dan Saliran (JPS) or the Department of Drainage and Irrigation. River, water and its preciousness are mentioned in many verses in Qur'an as well as in the Hadith. Indeed, the phenomena of the creation of rainfall from the cloud before touching down to the earth to provide sustenance to all creations including mankind are also stated. Thus, water has a special position in Islam and Muslims lives that it can be best reflected in the obligatory ablution prior to performing five times daily prayer. However, project delivery continuously confronting issues and challenges in an increasingly stringent, dynamic, complex business requirements, time consuming Planning and approval processes with many uncertainties and risks involved. With project delays , cost overruns and issues relating to quality, public expectation, ethics, integrity, the effective governance of such public projects are questionable. On the other hand, the persistent efforts by the Government of Malaysia towards the practice of Islamic principles are prominent. Indeed, Islam is a way of life than merely a religion that it covers all facets of affairs and lifes. It provides the most comprehensive guidance in all spheres including project management. Project management needs new approach that to be enriched with extra dimension of spiritual, tauhid, human driven to give „soul' aims not only achieving the worldly project objectives and success but the ultimate success in the Hereafter. This paper proposes the application Project Management with Masalah to achieve both successes. The methodology employs multiple approaches; literature review, the preliminary concept has been presented in two seminars and a workshop session.

Keywords: River Projects, Project Management, Islamic Principle, Maslaha, Project Success.

ID 86: SUSTAINABLE STORMWATER MANAGEMENT: DEVELOPING STORMWATER MANAGEMENT AND DRAINAGE MASTER PLAN FOR SERIAN, SARAWAK

Ir. R. Salleh¹ , K.Y. Wong¹ , Ir. Judy J.K. Kueh² , Ir. T. Sulaiman¹ and Ir. Hj. A. Ainan¹

¹Division of Stormwater Management, Department of Irrigation and Drainage
² G&P Professional (Sarawak) Sdn. Bhd.

The Department of Irrigation and Drainage Malaysia has completed a study in 2021 to develop the Stormwater Management and Drainage Master Plan or Pelan Induk Saliran Mesra Alam (PISMA) for Serian, Sarawak. The PISMA Serian provides a comprehensive and long-term solution for the control of urban stormwater quantity and quality issues. It is expected to mitigate the flooding and water pollution problem due to urban development. In this study, extensive data have been collected at-site to analyze the root cause of the problems. Hydrologic analysis and hydraulic modelling were conducted for 2020 landuse scenario to assess the existing drainage capacity. Structural and nonstructural measures were designed based on the 2050 landuse scenario to control the stormwater runoff and water quality. The study has also developed a GIS-based Stormwater Asset Inventory to facilitate long term operation and maintenance.

Keywords: Sustainable stormwater management; Stormwater Management and Drainage Master Plan; Pelan Induk Saliran Mesra Alam; PISMA; design of structural and non-structural measures

ID 87: INTEGRATED RIVER BASIN MANAGEMENT (IRBM) IN MALAYSIA

Shamsiah Omar^{1*}, C.L. Wong² and Jamil Shaari³

1 Deputy Director, River Basin Management Division, Department of Irrigation and Drainage, Malaysia

cheshamsiah@water.gov.my^{1*}

2 Senior Principal Assistant Director, River Basin Management Division, Department of Irrigation and Drainage, Malaysia

wongcl@water.gov.my²

3 Director, River Basin Management Division, Department of Irrigation and Drainage, Malaysia

jamil@water.gov.my³

Malaysia is still experiencing a vigorous and rapid land development process. Land development requires a careful and comprehensive planning process to ensure that a development can be implemented without significant negative impact on humans and the environment. With rapid urbanisation and industrialisation, problems and issues related to rivers and the river environment are expected to intensify. River basins need to be managed in an integrated and holistic manner. The integrated river basin management (IRBM) approach is through the process of coordination, management, development and conservation of water, land and related resources covering various sectors regardless of administrative boundaries within a river basin. Failure of water resources planning in land development will cause huge impact on the environment such as water scarcity, water resources pollution, floods and environmental destruction. This will directly or indirectly affect the economy, investment and the well-being of the people.

Keywords: integrated river basin management; water resources

The background features abstract blue geometric shapes and lines. On the left, there are several vertical lines of varying lengths that appear to be part of a larger structure. On the right, there are more vertical lines, some of which are grouped together. The overall design is clean and modern, with a focus on blue and white colors.

FLOOD MANAGEMENT AND MITIGATION

ID 27: PERMEABILITY AND MECHANICAL PROPERTIES OF PERVIOUS CONCRETE CURBE WITH DIFFERENT AGGREGATE SIZES

C.N.A Lian^{1*}, M.H. Jamal² and Z. Ibrahim²

¹ Post-Graduate Student, Department of Hydraulics and Hydrology, Faculty of Civil Engineering, Universiti Teknologi Malaysia, Skudai, Malaysia
nipi@graduate.utm.my^{1*}

² Senior Lecturer, Department of Hydraulics and Hydrology, Faculty of Civil Engineering, Universiti Teknologi Malaysia, Skudai, Malaysia
mhidayat@utm.my, zulkfe@utm.my

Pervious concrete is an environmentally friendly material that can be a feasible option in solving urban drainage problems and mitigating climate change. This research aims to evaluate the mechanical and hydraulics properties of pervious concrete with different aggregate sizes and propose the acceptable aggregate size for road curb. Pervious concrete mixes are prepared with single-sized aggregates (4.75, 8, 12.5 and 16mm) with constant aggregate cement and water-cement ratios. Furthermore, a series of tests were conducted in this study, such as compressive strength, porosity, and permeability. The experimental result showed that the size of coarse aggregate affects the strength and permeability of the specimens. The permeability and porosity decrease as the aggregate size increases. The smaller aggregate size is beneficial to increase the 28 days compressive strength of pervious concrete. Linear regression relationships were developed to establish relationships between porosity and compressive strength and porosity and permeability. The obtained result showed that the aggregate size of 8mm performed better than the others in all assessments and could be applied on pervious concrete curb.

Keywords: Pervious concrete, road curb, permeability, compressive strength, porosity, aggregate size

ID 41: FLOOD RISK ASSESSMENT CONSIDERING THE EFFECT OF COVID-19 PANDEMIC IN THE MUNICIPALITY OF BALAYAN, BATANGAS

C E F. Monjardin^{1*}, F A R. Cala¹, D C D. Po¹ and M A M. Sy¹

¹ School of Civil, Environmental, & Geological Engineering, Mapua University, Philippines
cefmonjardin@mapua.edu.ph^{1*}, farcala@mymail.mapua.edu.ph¹, dcdpo@mymail.mapua.edu.ph¹, mamsy@mymail.mapua.edu.ph¹

The constant threats brought upon by hydrometeorological hazards alongside the COVID-19 pandemic have rendered traditional flood risk assessments ineffective in aiding developers and policymakers in establishing proper intervention measures. With the numerous large-scale disasters that have occurred in the Philippines during this pandemic, it has been reported that an alarmingly transmissible virus rampant throughout the country oftentimes causes the neglect or mis-prioritization of personal preservation measures in times of disarray. By utilizing the definitive findings established in the preceding study, the Flood Risk Assessment for Mitigation and Effective Response Project, this research furthers literature by defining the different considerations that significantly affect flood risk. The overall study determines related parameters for flooding, which were obtained from the preceding study, and for COVID-19 to be utilized to establish the flood risk assessment. Along with the considerations made for COVID-19, it was observed that both Hospital Bed Capacity and Viral Load addresses the risk stemming from the pandemic. Through this, the researchers established a flood risk assessment for Balayan, Batangas while considering the effects of COVID-19 pandemic. The flood risk assessment utilizes the following tools: 1) the Analytical Hierarchy Process to provide relative numerical weights, and 2) the ArcGIS to generate an overall risk map for the Region of Interest set within Balayan. Furthermore, the relative numerical weights were also necessary to produce an aggregated result of risk levels in generating the overall Risk index map. As a result, the COVID-19 parameters thus validate the conflicting objectives when addressing risk derived from COVID-19 with flood occurrences. This instance was similarly observed to occur between the newly established peri-pandemic risk map as opposed to the pre-pandemic risk map as well. For this reason, a participatory approach to mitigate the intersection of community health resilience and disaster risk reduction justifies the applications of the Sendai Framework for Disaster Risk Reduction which is supported by Health Emergency and Disaster Risk Management.

Keywords: Flood Risk Assessment, COVID-19 Pandemic, Analytical Hierarchy Process, ArcGIS, Sendai Framework for Disaster Risk Reduction

ID 47: INVESTIGATING SWAT MODEL EFFICIENCY TO DETERMINE WATER BALANCE COMPONENTS (CASE STUDY: SUNGAI MUDA WATERSHED)

Mohd Syazwan Faisal bin Mohd^{1*}, Mohamad Hidayat bin Jamal², Khairul Anuar bin Mohamad¹, Liew Juneng³

¹National Water Research Institute of Malaysia, Malaysia
syazwan@nahrim.gov.my^{1*}, khairulanuar@nahrim.gov.m¹

²School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia
mhidayat@utm.my²

³Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Malaysia
juneng@ukm.edu.my³

Sungai Muda watershed is one of the most important watershed which serve as a source of water supply for the agriculture, domestic sector, fishery, and hydropower. In this study, water balance components were simulated using the SWAT hydrological model to investigate the model efficiency and its ability to use as a water balance simulator in the Sungai Muda Watershed. The SWAT model was calibrated for ten years (1981-1990) with a value of the coefficient of determination, $R^2=0.76$. Then, the model was validated for ten years (1997-2006) in which it gives $R^2=0.71$. Finally, the calibrated SWAT model was used to simulate the water balance components of Sungai Muda watershed. The results showed that 42% of precipitation enters the atmosphere through evapotranspiration and approximately 30% of it goes to the waterway as the surface runoff and lateral flow while 28 % of water entered the soil layers as the underground water. The results of this research showed the acceptable performance of the SWAT model to simulate the water balance in Sungai Muda watershed and the model can be used for water resources planning in this study area.

Keywords: Sungai Muda, Watershed, Water Balance, SWAT Model

ID 48: A REVIEW ON HEAVY DUTY MOBILE FLOOD WALL BARRIER: WAY FORWARD FOR MALAYSIA

Mohamad Nazif Daud¹, Norlida Mohd Dom¹, Woon Yang Tan^{1*}, Cha Yao Tan², Xin Yi Chong², Chow Hock Lim², Chung Lim Law², Fang Yenn Teo^{2*}

¹ Humid Tropics Centre Kuala Lumpur, Department of Irrigation and Drainage, 5040480 Kuala Lumpur
nazif@water.gov.my¹, norlidamd@water.gov.my¹, wyang@water.gov.my^{1*}

² Faculty of Science and Engineering, University of Nottingham Malaysia, 43500 Semenyih, Selangor, Malaysia
keey5tcy@nottingham.edu.my², khyy5cxy@nottingham.edu.my², limchowhock@gmail.com², chung-lim.law@nottingham.edu.my², fangyenn.teo@nottingham.edu.my^{2*}

Climate change is a global phenomenon which leads extreme weather event such as higher rainfall frequency and intensity with adverse impacts on the extent and severity of flooding. In Malaysia, there is an increasing trend on extreme rainfall event and short temporal rainfall, particularly during inter-monsoon season. Various types of structural and non-structural measures have been implemented to mitigate flooding throughout the country, and in recent years the impacts of climate change have been taken into consideration to cater for future flood events. Some major flood mitigation projects such as SMART tunnel and Sri Johor flood detention pond were constructed and funded by the Government, and these flood protection measures are usually costly and time consuming. In order to protect private properties and public premises from flooding, Mobile Flood Wall Barrier (MFWB) has been found to be more suitable as it is less costly, fast to deploy and does not require large space. For buildings such as factories and commercial shops that have larger entrances, they would require heavy duty type of MFWB as compared to those for residential buildings. Heavy duty MFWB has better ability to withstand higher hydrostatic pressure from floodwater, hence suitable for public premises and buildings in industrial and commercial areas. In this paper, various types of heavy duty MFWB and their application will be presented and discussed. Some international standards for testing are listed and the types of testing also explained. Based on the review, the mobility characteristic indicates the heavy MFWB can be installed temporary to prevent flooding and removed easily to ensure no interruption to the daily activities after the flood event. There are many potential advantages for flood protection, in particular the way forward for Malaysia.

Keywords: Heavy Duty, Mobile Flood Wall Barrier, Flood Protection System

ID 60: CHARACTERISTIC OF STORMWATER QUALITY USING BIOECODS IN JKR PILOT PROJECTS

Sanisah Sulaiman^{1*}, Noor Ezlyn Othman², Atikah Abdul Hamid³, Nor Azazi Zakaria⁴ and Chun Kiat Chang⁵

1 Senior Civil Engineer, Civil and Structural Branch, Public Works Department (JKR), Malaysia
sanisah@jkr.gov.my^{1*}

2 Senior Civil Engineer, Civil and Structural Design Section of Kedah Public Works Department, Public Works Department of Malaysia

noorezlyn@jkr.gov.my²

3 Design Director, Civil and Structural Branch, Public Works Department of Malaysia
atikah@jkr.gov.my³

4 Director & Professor, River Engineering and Urban Drainage Research Centre (REDAC),
Universiti Sains Malaysia
redac01@usm.my⁴

5 Senior Lecturer, River Engineering and Urban Drainage Research Centre (REDAC), Universiti Sains Malaysia
redac10@usm.my⁵

The effectiveness of Bioecological Drainage System (BIOECODS) in term of improving water quality is crucial as it denotes one of the key objectives of sustainable drainage system. This research aimed to evaluate the performance of stormwater quality using BIOECODS as compared to conventional drainage system. For this purpose, a pilot project was implemented at the District Police Headquarters at Pasir Mas, Kelantan (IPD Pasir Mas), Kelantan. Stormwater samples were collected at 6 sampling points identified within the study area. The ten water quality parameters tested were Ammoniacal Nitrogen (NH₃-N), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolve Oxygen (DO), pH, Total Dissolve Solids (TDS), Total Suspended Solids (TSS), Turbidity, Total Phosphorus (TP) and Temperature. The result has proven the effectiveness of this system by significant reduction in water quality parameters concentration, i.e. BOD, COD, TDS, NH₃-N, pH and temperature. However, TSS, TDS and DO showed significant increment. Overall results has also shown that all the parameters complied with Class IIA and Class IIB, National Water Quality Standard for Malaysia before the runoff is discharged via discharge point as per approved by Local Authority. However, additional data are required to validate the effectiveness of this system in removing storm water runoff pollutant.

Keywords: BIOECODS; water quality; JKR pilot project; drainage system.

The background features abstract blue geometric shapes and lines. On the left, there are several vertical lines of varying heights and a large blue triangle pointing downwards. On the right, there are more vertical lines and a large blue triangle pointing upwards. The overall design is clean and modern.

WATER FOR FOOD SECURITY

ID 21: DEVELOPMENT OF LOW-COST TECHNOLOGY FOR MONITORING OF SOIL MOISTURE AND RECYCLING RAINWATER FOR IRRIGATION

Siti Nurhayati Mohd Ali¹ and Nuryazmeen Farhan Haron^{1*}

¹ School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
ctnurhayatii@gmail.com¹, nuryazmeen@uitm.edu.my^{1*}

Water is a vital resource for agriculture. Sustainable water supply is essential for meeting cocoa production demand and profit for cocoa farmers in Sabak Bernam, Selangor. The research describes the design and modelling of an automated irrigation system using the Arduino IDE and Proteus software. The hardware system is designed by connecting with an Arduino UNO, which is cost-efficient for the farmers. The suggested system is designed to water the plants automatically and utilise rainwater collected from a Rainwater Harvesting System (RWHS) to water cocoa seedlings. The automated irrigation system is a fully functioning prototype that includes a soil moisture sensor, LCD, a relay, and a water pump. This research has been tested for different soil moisture conditions of 20%, 40%, 60%, 80% and 100%. When the soil moisture sensor is placed on the soil, it displays the moisture percentage, voltage, and status on the LCD. By this development of an automatic irrigation system, a farmer can harvest water to great extent and use it afterwards. The development of an automatic irrigation system is to sort out a solution there is necessity of continuous monitoring of the soil water levels and to conserve water to prevent future water crisis. It was determined that both results from the simulation and hardware verification successfully corresponds with the automatic irrigation system operation as desired.

Keywords: Rainwater harvesting system (RWHS), automatic irrigation system, Arduino UNO, climate change, cocoa production

ID 84: ISLAMIC INSTITUTIONAL ARRANGEMENTS OF THE AFLAJ SYSTEMS MAINTENANCE IN SULTANATE OF OMAN: OPERATION OF THE DIFFERENT AFLAJ TYPE CASE STUDY

Mr. Al-Marshoudi, Ahmed S^{1*}, Dr. Jasni Sulong^{1*}

¹ Islamic School, School of Humanities University Sains Malaysia, 11800 Pulau Pinang, Malaysia
almarshoudi4@gmail.com^{1*}, jasni@usm.my^{1*}

The aflaj (singular falaj) among the most ancient system inherited within cultural Omani-historical list, not only collect/extract water from alluvial aquifers, but characterized by holding traditional knowledge/institutional arrangements based upon Muslim jurist view. This paper used a sample to capture the physical-extraction variation among these three aflaj (daudi, ghaili and ayni) in the aim to examine and document the historical methodology undertaken to develop different institutional arrangements. It has been believed that the physical variation of these three extraction processes contributed greatly upon the historical development of the institutional arrangements. Hence, an attempt is made to answer the following research question 'To what extent did the development of the aflaj institutional arrangements reflect upon the original physical variation collection/extraction process? Although there exist three water-extraction processes in Oman, the finding clearly classified the three aflaj types with respect to institution for maintenance into two main categories: 1) more complex and hold a number of sophisticated components or being prone to damage because its main water source constructed near oasis which cause severe damage from the occasional heavy rain flood. These forced the local to develop institution based on water market were identified of being away from flooded areas and hence require less financial support for maintenance. Hence, the survey provided evidence by which places daudi and ghaili within the first category and ayni system in the other.

Keywords: institutional arrangements, scarcity, water allocation, water rights

The background features abstract blue geometric shapes and vertical lines. On the left, there are several thin vertical lines of varying heights, some of which are part of a larger blue shape that extends towards the center. On the right, there are more thin vertical lines, also of varying heights, some of which are part of a larger blue shape that extends towards the center. The overall design is clean and modern, with a focus on geometric forms and a color palette of various shades of blue.

DAM, LAKE AND RESERVOIRS

ID 32: HYDROLOGICAL DROUGHT EVALUATION ON STREAMFLOW DROUGHT INDEX (SDI) IN UPSTREAM AND DOWNSTREAM AREA OF LAMPAO RESERVOIR, NORTHEAST OF THAILAND

Kowit Boonrawd^{1*}, Jirawat Supakosol¹ and Haris Prasanchum²

¹ Department of Civil Engineering, Faculty of Industrial and Technology, Rajamangala University of Technology Isan, Sakonnakhon Campus, Sakonnakhon, Thailand
kowitz.bo@rmuti.ac.th^{1*}, jirawat.su@rmuti.ac.th¹

² Department of Civil Engineering, Faculty of Engineering, Rajamangala University of Technology Isan, Khon Kaen Campus, Khon Kaen, Thailand
haris.pr@rmuti.ac.th²

Drought is a widespread natural phenomenon throughout the world. It occurs at a time when streamflow availability in the watershed shows a trend that is lower than the annual average, causing insufficient demand and affecting the reservoir's water resource management. The objective of this study was to determine the occurrence of hydrologic drought related to streamflow using the Streamflow Drought Index (SDI) of the Lampao Reservoir in Northeastern Thailand between 1983-2019. The SDI values were calculated over time periods of 3, 6, 9 and 12 months, comparing the upstream area above the reservoir at the observed station E65 and the downstream area of the reservoir with regulate over water allocation at the observed station E75, respectively. The results of hydrological drought analysis using SDI in both areas showed trends in the same direction. At Stations E65 and E75, the number of months of drought-phenomena ranged between 40.2%-48.1% of all months. The SDI values were mainly expressed in Mild Drought between 22.8%-34.9%, while the Extreme Drought of both points are clearly visible in the calculations from the 9-Month and 12-Month periods, which indicating the number of months occurring between 4.4%-6.2% of all months. In addition, the SDI at the upstream area illustrates a higher chance of drought than the downstream area due to reservoir management. The methodology and results obtained from this study are expected to be used as statistical data for decision-making in drought mitigation planning during the recurrence period. Including the determination of appropriate measures to manage reservoirs and water resources in the watershed area.

Keywords: Hydrological drought; Streamflow; Streamflow Drought Index; Lampao Reservoir; Watershed management

ID 67: A HOLISTIC APPROACH FOR ESTABLISHING RESILIENT DAMS FOR MALAYSIA

Lariyah Mohd Sidek¹, Hidayah Basri^{1*}, Mohammad Marufuzzaman¹, Norziana Jamil², Zeitley Karmilla Kaman³, Muhammad Izzat Azhar Khebir¹, Siti Mariam Alias Omar¹, Mohd Hazri bin Moh Khambali⁴

¹ Institute of Energy Infrastructure, Universiti Tenaga Nasional, Malaysia
Lariyah@uniten.edu.my¹, Bhidayah@uniten.edu.my^{1*}, smariam.alias@gmail.com¹ and izzat.azhar@uniten.edu.my¹

² College of Computing and Informatics, Universiti Tenaga Nasional, Malaysia
Norziana@uniten.edu.my²

³ Institute of Energy Policy and Research (IEPRE), Universiti Tenaga Nasional, Malaysia
Zeitley@uniten.edu.my³

⁴ Department of Irrigation and Drainage, Malaysia
mohdhazri@water.gov.my⁴

The dam related disaster caused thousands of people's lives and billions of property damages in the world and in Malaysia. The loss of life and property damages is mostly happened due to dam failure and the lack of timely evacuation procedures. Currently, insufficient integrated and comprehensive researches are being done, including the impact of dam failures. The interconnection and interdependence of these elements are vital to ensure holistic solution for dam safety. In this research, we proposed a resilient and intelligent dam safety management program that integrates engineering, cybersecurity and socioeconomic elements to minimize the risks of dam failure. A comparatively new approach named as Risk-Informed Decision-Making is proposed in this research which will use the likelihood of loading, dam fragility, and consequences of failure to estimate the risk related to Batu dam. Investigation of cyber security in dam data will be portrayed to assist in strengthening the security of dam control system against sophisticated attacks such as APT. Finally, an effective evacuation procedure will be proposed to complete the holistic solution that benefits the nations, dam owners and other related authorities but more importantly it will help keep the community safe.

Keywords: RIDM; cybersecurity; dam failure consequences; batu dam.

ID 72: CHALLENGES IN MANAGING MULTIFUNCTIONAL DAM: A CASE STUDY OF SEMBRONG DAM IN ENSURING THE SAFETY OF THE DAM WHILE MAINTAINING THE NEEDS FOR FLOOD PROTECTIONS AND WATER RESOURCES

Mohamad. R1, Muhammad.Z1, Moh Khambali. M.H1, Engku Mohamed.E.A.K.A1

1 Department of Irrigation & Drainage (DID) Malaysia
rozman@water.gov.my1, zakiyyah@water.gov.my1, mohdhazri@water.gov.my1, khalil @water.gov.my1

When a dam is being considered, there's usually a primary purpose. But are there also secondary purposes that can benefit the local and wider community. Multipurpose dams combine two or more functions of traditional single-purpose dams into one dam infrastructure project. Dams, by their very nature, create risks. Although these risks may be minimal, they can increase substantially without proper maintenance. Many minor signs which can be symptomatic of larger problems may go unnoticed for a variety of reasons. The responsibility for the safety of the dam is placed on relevant dam owners whether they are agencies of State or Federal Government or private companies appointed by the dam owner. Dam owners are responsible for ensuring the safety of their dams. Proper operation and good maintenance is essential in ensuring the continued viability and safety of a dam and its appurtenant structures. Sembrong dam is classified as a large dam and primarily designed for flood control and water supply. Its construction began in 1981 and completed at a cost of RM 24 million. The dam is built for the purpose of flood mitigation and providing for domestic water supply. The challenge is to balance the needs of both function at the same time. The 2021 bathymetric survey data found that the sedimentation has increased by almost 10 percent. The continuous accumulation of sediment near the penstock could hinder the operation of gate. Other than that, seepage that has occurred several times in recent years is an incident that needs to be taken seriously. The presence of seepage has raised questions, regarding the integrity of the dam especially in terms of the stability, strength and safety of the dam. To deal with these problems, the operation of a reservoir should not present undue risk to people and property and the environment either at the upstream and downstream of the dam. In this regard, DID will ensure that the dam and reservoir operational plans are appropriate and provide sufficient margin safety to the dam under all loading conditions and foreseeable operational scenarios.

Keywords: Embankment, Appurtenances Structure, Dam Failure, Dam Safety Management, Dam Operation and Maintenance, Dam Surveillance, Dam Operator, Water Resources, Flood Protection.

ID 76: SEEPAGE ANALYSIS OF BATU DAM : COMPARISON OF FIELD DATA AND NUMERICAL ANALYSIS

L. Mohd Sidik1*, A. Kasa2, N. H. M. Ghazali1, M.A. Ismail1, R. Mohamad1 and M.H.M. Khambali1

1 Department of Irrigation and Drainage, Malaysia
larifah@water.gov.my1*, hisham@water.gov.my1, azmiismail@water.gov.my1, rozman@water.gov.my1, hazri@water.gov.my1

2 Faculty of Built Environment and Engineering, Universiti Kebangsaan Malaysia
anuar@eng.ukm.edu.my2

This is In recent years, the demands of raw water are increasing along with the growth of economic and population. Hence, the need for construction and operation of dams is one of the solutions for the management of water resources problem. Stability of embankment should be taken into consideration to evaluate the safety in retaining water behind. Safety of the dam is mostly based on numerous measurable components for instance seepage flowrate, pore water pressure and deformation of the embankment. Seepage and slope stability is the primary and most important reason to ascertain the overall safety behaviour of the dams. This research study was conducted, with the objective to evaluate static condition seepage and slope stability performances of Batu dam which located outskirts of Kuala Lumpur capital city. The numerical solution Geostudio-2012 software was employed to analyse the seepage using finite element method, SEEP/W for three different cases of reservoir level operations; normal and flooded condition. Sensitivity analysis on hydraulic conductivity of material were done and calibrated to minimize the relative error of simulation SEEP/W, where the comparison observed field data and predicted value were also carried out. In seepage analysis such as leakage flow rate, pore water distribution and location of phreatic line are determined using the SEEP/W. The result of seepage analysis shows the clay core affectively lowered the phreatic surface and no piping failure shown in the result. Hence, the total seepage flux was acceptable and within the permissible limit. The result of model analysis indicate the higher water level within the reservoir shall increase the seepage which resulted in reduction of shear strength of material, hence FoS also decreased.

Keywords: Earth Dam, Dam Safety, Seepage, Slope stability, Pore water pressure

ID85: MODELLING OF AN EMBANKMENT FAILURE USING FLOW-3D

Zainab, M.Y1*, Zebedee, A. L. S.2 and Ahmad Khairi, A. W.3, Zulhilmi, I.3 ,Shahabuddin, A.4

1 Eco-Hydrology, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia
zainabyusof@utm.my1*

2 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia
zebedeeless@gmail.com2

3 Centre for River and Coastal Engineering (CRCE), Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia
akhairi@utm.my3 ; zulhilmi@utm.my3

4 Department of Geoinformation, Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia, Malaysia
shahabuddin@utm.my4

Embankment dam failures are concerning to many people in the society today, including dam engineers, federal, state, and local officials. The effects of dam failure may cause more harm than good; leading to the losses of lives, properties being damage, economic and environmental issues. The embankment dam breaching is a complex process between hydraulics and soil erosion processes that requires an analysis of hydrodynamic parameters such as breach outflow hydrograph, peak outflow rate and failure time, and geometric parameters; breach depth, and top breach width. With the aid of simulation techniques such as Computational Fluid Dynamics (CFD), it is possible to understand the behaviour of embankment breaching processes. In this paper, modelling of embankment breaching using FLOW-3D allow modellers to open doors to plenty of experiments to breaching in the near future. This paper focuses in analyzing the modelling breaching embankment for different sediment sizes of embankment material to investigate the patterns of breached outflow, breach width dan breach depth. Moreover, the study also investigates the hydrostatic pressure, free surface elevation and shear stress on embankment during the breaching failure processes.

Keywords: embankment failure; FLOW-3D; hydrodynamics model; breaching patterns

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COASTAL ENGINEERING AND MANAGEMENT

ID 10: HYBRID CURRENT TURBINE AND SOLAR CELL RENEWABLE ENERGY DEVICE

Azrul Aminur Rahman Yunus¹, Adi Maimun Abd Malik¹, Mohammad Hidayat Jamal² and Nursahliza Muhamat Yain¹

1 Marine Technology Centre, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, Malaysia
azrulamnurrahman@graduate.utm.my^{1*}, adi@mail.fkm.utm.my¹,
nursahliza2@graduate.utm.my¹

2 Centre for Coastal and Ocean Engineering, Universiti Teknologi Malaysia, Malaysia E-mail: mhidayat@utm.my²

Renewable energy has always grabbed attention to innovation and as a means of reducing the use of fossil fuel in generating energy. One of the sources yet firm establishes to explore is ocean energy. Due to the low current speeds in Malaysia, hybrid renewable energy has been proposed to support the amount of power on generating energy from the ocean. Thus, the purpose of this study is to evaluate the effectiveness of a Low-Speed Vertical Axis Current Turbine (LSVACT) with solar cell photovoltaic (PV) in providing minimum power demands in Malaysia. The Low-Speed Vertical Axis Current Turbine (LSVACT) is a small-scale hydro turbine power that is suitable for low-speed current flow as its vertical axis design allows it to easily absorb power from any incoming water direction. However, the ideal current speed which is at 2.25 m/s can be suitable/effective for a few potential places in Malaysia. This study evaluated the potential current speed in one of the potential areas in Malaysia using Delft-3D simulation. For solar energy, evaluated by record day-to-day power output by the solar panel. The results of the simulation were then converted into power generation, together with the results of Solar Panels and batteries storage capacity. Two LSVACTs with four Solar Panels and 1250 Ah were suggested to generate a power during Inter Monsoon Period while two LSVACTs with six Solar Panels and 1500 Ah were suggested to generate the power during the Monsoon Period. The design system can generate and supply enough energy for a system cycle.

Keywords: Renewable Energy, low-speed current turbine, solar cell, hybrid system and Delft3D Simulation.

ID 19: SANDY BEACH RESPONSES TO SEA LEVEL RISE: COMPARISON POTENTIAL COASTAL INUNDATION MAPS USING STATIC AND NUMERICAL MODEL FOR IBAI RIVER, MALAYSIA CASE STUDY

Y. A. Benson, ^{1,2*}, H. L. Lee^{1*}, M. H. Jamal^{2,3}, D. Anthony Pereira¹, A. K. Abd Wahab^{2,3}, K. A. Mohamad¹, and I. Abdullah¹

1 Coastal Management and Oceanography Research Centre, National Water Research Institute of Malaysia (NAHRIM),
Selangor, Malaysia

arowanlee@gmail.com^{1,2*}, hlllee@nahrim.gov.my^{1*}, khairulanuar@nahrim.gov.my¹, dunstan@nahrim.gov.my¹,
ikmalzatul@nahrim.gov.my¹

2 Centre for Coastal and Ocean Engineering (COEI), Universiti Teknologi Malaysia (UTM), Johore, Malaysia
akhairi@utm.my^{2,3}, mhidayat@utm.my^{2,3}

3 School of Civil Engineering, Engineering Faculty, Universiti Teknologi Malaysia (UTM), Johore, Malaysia

Low-lying sandy beaches are vulnerable to coastal flooding due to rising sea levels and storm surge generated from offshore during the monsoon season. This study attempted to evaluate the overland flooding caused by sea level rise at Ibai River estuary. Static and numerical computer model approaches were used to determine the inland-flooded areas by time horizon of the year 2100 with Representative Concentration Pathway (RCP) 8.5 scenario. Land elevation level, river and nearshore bathymetry, current flows and water level fluctuations are measured during dry season. The predicted rate of low-lying coastal flooding induced by SLR is 2.5 times greater than using numerical hydrodynamic model approach compared to result given by a static model. In addition, the advantage of using numerical model method able to help water manager in identifying flooding levels and tidal current speed magnitudes. This study helps increase the understanding for coastal management on potential coastal flood mapping related to sea level rise by providing tools and information in local coastal flood risks and make cost-effective mitigation decisions.

Keywords: Sea Level Rise, Cold Surge, Static Model, Numerical Model, Potential Coastal Inundation Map

ID 38: ASSESSMENT OF COASTAL VULNERABILITY INDEX UNDER STORM SURGE AND SEA LEVEL RISE IMPACT ON THE EAST COAST OF JOHOR

N. Mohd Anuar^{1,2}, S. H. Shafiai¹, H. M. Teh¹ and A. M. Hashim³

¹ Department of Civil Engineering and Environmental, Universiti Teknologi PETRONAS, Malaysia
wajina04@gmail.com^{1,2}, sitihabibah.shafiai@utp.edu.my¹, heemin.teh@utp.edu.my¹

² Faculty of Engineering and Quantity Surveying, INTI International University, Malaysia

³ Global Water Consultants Sdn. Bhd., Malaysia
amustafahashim@gmail.com³

East Johor is characterized by an embayed coastline between headlands facing the South China Sea. Like any other countries and regions with coastal lowland areas, the threat of climate change especially sea level rise (SLR) and storm surge (SS) are considered the millennium challenges to the east coast of Johor (EJ). The coupled climate effect is rarely investigated and acknowledged theoretically or numerically, which called for an immediate attention to identify the dual SS-SLR impact on the vulnerability of the coast and the feasible protection required. The present study adopted the fundamental Physical Vulnerability Index (PVI) to assess the coastal vulnerability for EJ. Through hydrodynamic modelling of typhoon-induced surge, SS height is extracted for several scenarios of a single storm track in different wind speed and SLR projections. The utilization of a survey data, land use and lithology maps are anticipated to assist in providing the vulnerability indicators for physical variable, such as coastal slope and elevation, coastline landforms or features and marine depth, as well as the SS and SLR. The weight and scores for PVI are calculated using the analytical hierarchy process (AHP) method, an improvement to the methodology for assessing the vulnerability of a coast of interest. A coastal vulnerability cartograph is developed to demarcate the two distinctive districts of the east Johor with five specific vulnerable ranks from very low (1), low (2), medium (3), high (4) and very high risk (5). Based on the SS model, the increased in typhoon wind speed is unparalleled with SS height. But the rise in sea level intensify the surge magnitude which exaggerated the already vulnerable of the unprotected coast. In other words, changes in vulnerability correlates to severity in damage and an increase in SS-SLR has its inherent risk to coastal communities. Thus, coastal protective measures, from shoreline to offshore barriers is an essential consideration to be exercised to decrease future coastal flood risk and erosion along the coastal lowland area of east Johor.

Keywords: sea level rise, storm surge, hydrodynamic, exposure, vulnerability assessment, ranking

ID 39: SALINITY BEHAVIOR AND INTRUSION IN KELANTAN RIVER ESTUARY

N. A. Mohamad^{1*}, I. K. Othman^{1,2}, M. H. Jamal^{1,2}, R. Sa'ari¹, K.V. Annamala^{1,3}
and M.F. Ahmad¹

¹ Department of Water and Environmental Engineering, School of Civil Engineering, Faculty of Engineering,
UTM, Malaysia.

tyra.mohamad90@gmail.com^{1*}, ilya@utm.my^{1,2}, mhidayat@utm.my^{1,2}, radzuans@utm.my¹,
kogila@utm.my^{1,3}, faizal_9273@yahoo.com¹

² Center for Coastal and Ocean Engineering (COEI), UTM, Malaysia.

³ Centre for Environmental Sustainability & Water Security (IPASA), UTM, Malaysia.

An estuary is a unique environment influenced by tidal and freshwater mixing. Saltwater intrusion during the wet season is less studied in Kelantan River despite occasional flooding from high tides. Thus, this study presents one month's water level measurements at three locations and two days horizontal, vertical and longitudinal salinity profile measurements at seven cross-sections along approximately 11 km upstream of Kelantan River estuary. Salinity measurements were taken using the YSI Water Quality meter by moving boat method before the North-East Monsoon in October 2015. The maximum tidal range computed from water level data is around 1.32m on average and can be classified as microtide, characterised by delta formation from upland discharged sediments. The vertical salinity profile was measured every 0.5 m water depth and the inflection point where mixing starts to occur increases from around 2m at the river mouth to 4.5m at 8.3km upstream. The longitudinal salinity structure indicates Kelantan estuary as salt wedge with maximum saltwater intrusion around 9 km upstream. The data provides a preliminary understanding of longitudinal and vertical salinity structure. During wet and dry seasons, higher or lower river discharge may alter the mixing process and saltwater intrusion length.

Keywords: Kelantan River Estuary, saltwater intrusion, estuary classification, monsoon

ID 46: HYDRODYNAMIC ASSESSMENT ON THE IMPACTS OF SEA LEVEL RISE AT THE KELANTAN SHORELINES AND DELTA, MALAYSIA

Hin Lee Lee^{1*}, Dunstan Anthony¹, I. Abdullah¹, A. Ahmad¹, A. Rahim², M.H. Jamal³

¹ National Water Research Institute of Malaysia (NAHRIM)/ Coastal & Oceanography Research Centre
hllee@nahrim.gov.my^{1*}, dunstan@nahrim.gov.my¹, ikmalzatul@nahrim.gov.my¹, anizawati@nahrim.gov.my¹

² Universiti Kebangsaan Malaysia (UKM) / Earth Observation Centre, Institute of Climate Change.
aidahnahrim@gmail.com²

³ Universiti Teknologi Malaysia (UTM)/ Faculty of Engineering
mhidayat@utm.my³

Maritime coast has potential risk of being significantly prone towards sinusoidal magnitudes of Sea Level Rise (SLR) phenomenon, especially the low-lying coastal area and river estuaries. Numerical model tools used to analyse the effect of sea level rise with scenario Representative Concentration Pathway (RCP8.5) chosen as the assessment parameters on Kelantan shoreline and delta areas. Primary physical oceanography data consist of tidal elevation, wave parameters, current properties and bathymetry were collected to support the model configuration. Numerical model result illustrated that Kelantan Delta, rivers and low-lying areas adjacent to riverine will severely affected by higher sea level and current speed magnitudes. Average differences of tidal elevation and current speed ranging from 101 to 104 % and 97 to 99% respectively. Projection on the inundation potential in the inland vicinities due to sea level rise are essential to delineate the affected territories and identify flood prone area. Based on the numerical findings, mitigation, adaptation and awareness program could be outline in order to minimize the socio-economics impacts towards the local communities.

Keywords: Sea Level Rise, Numerical Model, Tidal Elevation, Current Speed, Inundation

ID 66: POTENTIAL DEVELOPMENT OF COASTAL RESERVOIR IN MALAYSIA

M.R. Razali^{1*}, A.F. Hamzah², I.K. Othman³, H.L. Lee¹, N.S. Rosli⁴, W.A.H. W.M. Azhary¹, A. Ahmad¹, S.B. Hamzah¹, M.H. Jamal³

¹ Coastal & Oceanography Research Centre, National Water Research Institute of Malaysia (NAHRIM), Seri Kembangan, Selangor, Malaysia

mrizal@nahrim.gov.my^{1*}, hllee@nahrim.gov.my¹, wanhafiz@nahrim.gov.my¹, saifulbahri@nahrim.gov.my¹, anizawati@nahrim.gov.my¹

² Hydraulic & Instrumentation Laboratory, National Water Research Institute of Malaysia (NAHRIM), Seri Kembangan, Selangor, Malaysia

ahmadfarhan@nahrim.gov.my²

³ Center for Coastal and Offshore Engineering (COE), School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM), Skudai, Johor, Malaysia

ilya@utm.my³, mhidayat@utm.my³

⁴ Corporate Planning Division, National Water Research Institute of Malaysia (NAHRIM), Seri Kembangan, Selangor, Malaysia

shahida@nahrim.gov.my⁴

Malaysia is a tropical country in Southeast Asia with a consistent trend of annual rainfall and river flow pattern. The vast river networks provide sufficient supply for establishing a coastal reservoir study which in time with the government's goal to explore additional raw water storage and supply options. This paper reviews the current state of knowledge, technical aspects and studies about coastal reservoirs worldwide. Feasibility studies are ongoing with promising findings despite the probability of high cost on the reservoir embankment and water supply. This paper finds out that the embankment design and reservoir operation must cater for the climate change impacts such as rising sea level, variable streamflow discharge during extreme and extended droughts, floods and water quality problems. The paper provides also an evaluation of Malaysian coastal conditions in terms of their potentials for developing coastal reservoirs. Although various technical aspects require further research current state of knowledge and technology are sufficient.

Keywords: coastal reservoir; freshwater; water resources; shoreline; downstream

ID 70: CHALLENGES IN MANAGING THE COASTAL ZONE IN MALAYSIA

L.A. Hamzah1*, M. Mahamud1

1 Division of Coastal Zone Management, Department of Irrigation and Drainage, Malaysia
lokman@water.gov.my1*, mahran@water.gov.my1

Coastal zone normally defined from a geomorphological, biological and juridical point of view. A lot of challenges being faced by Department of Irrigation and Drainage (DID) as the sole technical agency in Malaysia that provides the engineering solution for the most common disasters related to coastal zone such as erosion, sedimentation of river mouth and coastal flooding. Coastal management not only requires scientifically based knowledge but also working hand in hand with various stakeholders underpinned by knowledge on the integrated behaviour of coastal system. There are guidelines and studies that available at this time to ensure the sustainable development in coastal zone as well as reduction of coastal erosion risk and the needs of expensive coastal protection scheme but there are also obstacles faced by DID that makes the implementation of these guidelines becomes more challenging. Typically DID implements strategy that consists two main approaches of which are have the own purpose to tackle each of every coastal related issues.

Keywords: Coastal zone; coastal management; erosion; sedimentation; coastal flooding

ID 80: MODELLING WAVE RUN-UP AT A CORAL REEF ISLAND IN MALDIVES USING XBEACH

M. Saleem1, M.H. Jamal1,2*, D.S.M. Ishak2,3 and N.S. Rahim2,3

1 Department of Water and Environmental Engineering, School of Civil Engineering, Universiti Teknologi Malaysia
saleem.m@graduate.utm.my1, mhidayat@utm.my1*

2 Centre for River and Coastal Engineering (CRCE), Universiti Teknologi Malaysia
maimunah.kl@utm.my2,3, nsuhaila@utm.my2,3

3 Research Institute for Sustainable Environment (RISE), Universiti Teknologi Malaysia

Coastal inundation due to wave run-up and overtopping of low-lying coral reef islands are expected to increase in the coming decades due to climate change and anthropogenic coastal modifications. This paper presents the results of the study focused on wave run-up at Maradhoofoeydhoo island situated in the southernmost atoll of Maldives. The level of run-up was modelled using the XBeach Surfbeat numerical model taking into account sea-level rise predictions of Representative Concentration Pathway (RCP) 2.6 at high tides. The findings of the study show that the threshold significant wave height that can cause substantial overtopping of the coastal ridge decreases from 3.0 m at the baseline sea level to 2.0 m with a sea-level rise of +0.7 m at Mean High Water tide.

Keywords: Coral reef, island, sea-level rise, inundation, run-up, numerical modelling, XBeach

ID 82: NUMERICAL STUDY OF WAVE GROUPS IN WIND-SWELL SEAS

A.M. Mansoor1*, Dr. M. Latheef1

1 Civil and Environmental Engineering, Universiti Teknologi PETRONAS, Malaysia
mohamed_25561@utp.edu.my1*, mohamed.latheef@utp.edu.my1

One of the largest contributing factors considered in any assessment of offshore structures, are the extreme wave forces that impact offshore platforms and hence predicting them is important for safety and economical design. For computing these wave forces, a good description of the underlying wavefield is an important pre-requisite. This paper concerns the study of focused wave groups in such mixed sea states. These focused wave events are considered as representative of the largest events that occur in a random sea state. A fully non-linear Higher Order Spectral (HOS) solver was adopted to simulate the wave groups and investigate the physical mechanisms that govern the evolution of these events. This HOS solver is a highly validated and efficient solver capable of simulating near-breaking wave events. For the near breaking uni-directional wave groups in deep- water conditions considered in the present work, it was seen that irrespective of the relative strength of the swell and wind component, the maximum crests obtained were much larger than those predicted by the commonly adopted linear and second order solutions. Further analysis revealed that the third order resonant interactions that alter the underlying free wave components is responsible for these larger crests. Considering these resonant interactions further, it was revealed that the steepness of the underlying wave group has a positive correlation with the highest crest elevation achieved. However, the most important parameter that determines the amplification was found to be bandwidth; the smaller the bandwidth, the larger the resonant interactions and hence the larger the crest elevation obtained. More importantly, it was found that for the mixed seas, once steepness and bandwidth are taken into consideration, the level of nonlinear amplification of the crests was independent of the shape of the underlying wave spectrum.

Keywords: Focused waves; non-linear waves; unidirectional waves; resonant interactions; wave spectrum; double-peaked spectra; numerical wave modelling; extreme ocean waves

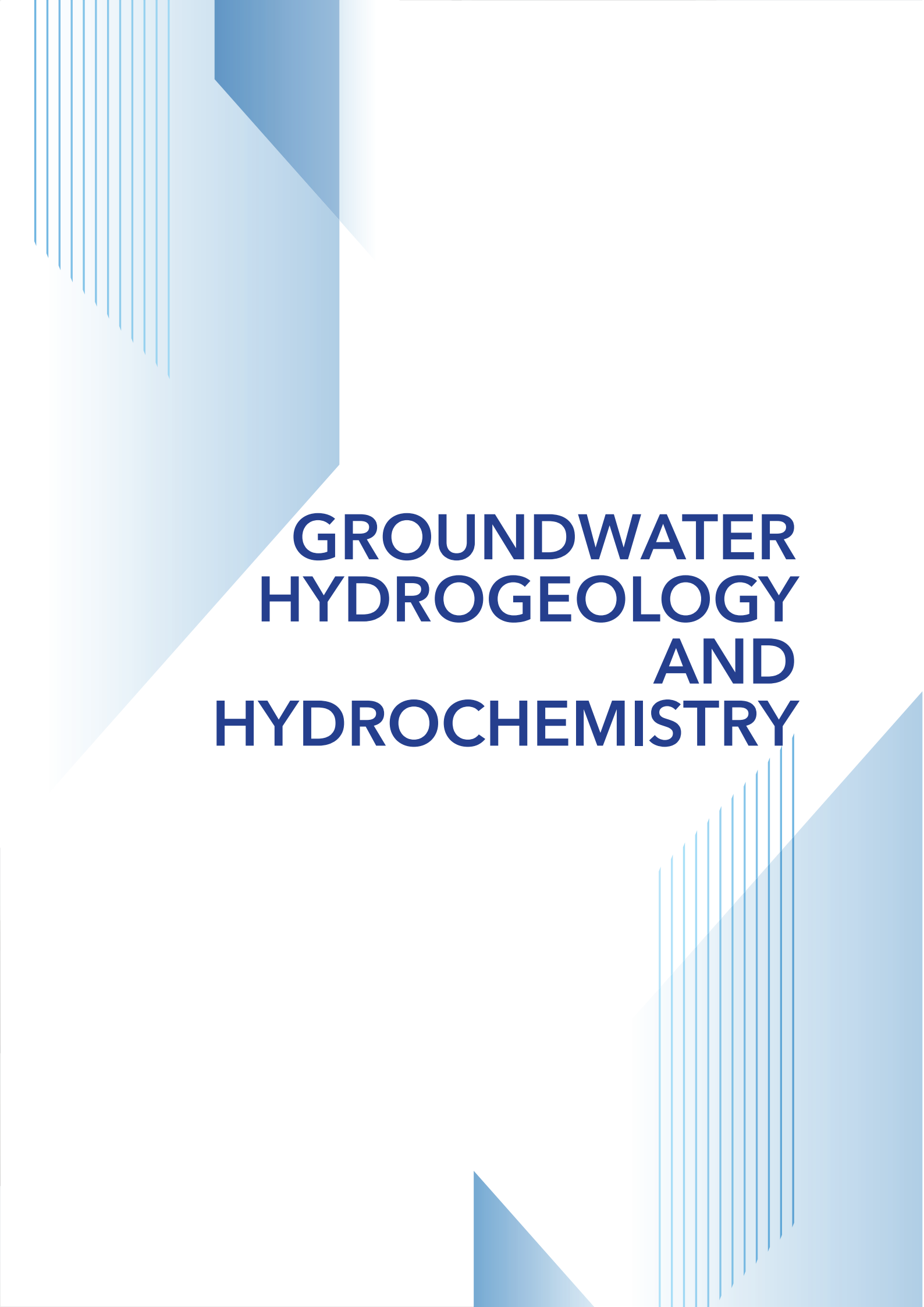
ID 83: MODELLING OF WAVE RUNUP And OVERTOPPING OVER ACCROPODE II BREAKWATER

VK Krishnasamy1*, MH Jamal1* and MR Haniffah1*

1 School of Civil Engineering, Universiti Teknologi Malaysia, Malaysia.
viknesvaran1977@graduate.utm.my1*, mhidayat@utm.my1*, mridza@utm.my1*

This paper discusses a numerical model in a study of wave overtopping on a single layer armour unit (Accropode II) breakwater in order to understand the efficiency of the breakwater design by analyzing the wave run-up and wave overtopping and comparing with the physical model results and also additional simulation in different crest heights of the breakwater. The numerical model used is FLOW 3D. The prototype was physically modelled and tested in HR Wallingford laboratory in 2012. In the current research, FLOW 3D is used to provide approximate wave runup and overtopping over the breakwater structure. There are three breakwaters of different heights (1.2m, 1.3m, and 1.4m) had been made in order to achieve the objective of the project. Hence, the numerical simulations were carried out and compared with the experimental results. Based on the observation of the preliminary simulation, the results show a decrease of overtopping in the numerical study. Therefore, further investigations need to be carried out to improve the simulation results and compare them with the experimental results for result verification.

Keywords: Numerical model, Computational Fluid Dynamic (CFD), Breakwater, Physical model, wave runup



**GROUNDWATER
HYDROGEOLOGY
AND
HYDROCHEMISTRY**

ID 16: UNDERSTANDING VARIABILITY OF GROUNDWATER POTENTIALS IN WESTERN SOKOTO BASIN: IMPLICATIONS FOR SUSTAINABLE GROUNDWATER DEVELOPMENT

Saadu Umar Wali^{1,2}, Noraliani Binti Alias¹, Sobri Bin Harun¹

¹ Department of Water and Environmental Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia

saadu.umar@graduate.utm.my^{1,2}, noraliani@utm.my¹, sobriharun@utm.my¹

² Department of Geography, Federal University Birnin Kebbi. P.M.B. 1057, Kebbi State, Nigeria.

This study evaluates groundwater potential's variability using hydrogeological data from 113 boreholes in the western Sokoto basin. The data comprised of static water level (Swl), pumping test (Pt), pumping water level (Pwl), estimated yield (Ey), and hand pump setting (Hps). Data were obtained from the Department for Rural Water Supply and Sanitation (RWASSA) Birnin Kebbi. Multivariate analysis - Factor analysis (FA) was applied to analysed data. The FA indicated that most of the variability in groundwater is explained by variation in estimated yields. Boreholes sited in the Basement Complex section are characterised by lower yields than those in the Cretaceous and Tertiary sediments. Although the Gwandu formation is the most prolific aquifer, boreholes tapping the Illo formation are equally characterised by good water yield. Thus, the two aquifers present an excellent groundwater development potential that can be harnessed for large-scale irrigation, municipal and industrial uses. However, the lack of groundwater development restrictions driven by increased groundwater withdrawals has present a tremendous challenge for groundwater resources' sustainable development. Thus, a policy guiding groundwater management is recommended.

Keywords: Pre-Cretaceous Basement Complex; Cretaceous and Tertiary Sediments; Static Water Level, Estimated Yield; Factor Analysis; Groundwater Management



CLIMATE CHANGE, POLLUTION AND URBANISATION

ID 12: PROJECTION OF FUTURE THERMAL BIOCLIMATIC INDICATORS IN EGYPT ADDRESSING PARIS AGREEMENT GLOBAL WARMING GOALS

Mohammed Magdy Hamed 1,3*, Mohamed Salem Nashwan 2, Shamsuddin Shahid 3

- 1 Construction and Building Engineering Department, College of Engineering and Technology, Arab Academy for Science, Technology and Maritime Transport (AASTMT), B 2401 Smart Village, 12577, Giza, Egypt
mohammedhamed@graduate.utm.my1,3*
- 2 Construction and Building Engineering Department, College of Engineering and Technology, Arab Academy for Science, Technology and Maritime Transport (AASTMT), 2033 Elhorria, Cairo, Egypt
m.salem@aast.edu2
- 3 Department of Hydraulics and Hydrology, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM), 81310 Skudai, Johor, Malaysia
sshahid@utm.my3

This study aims at understanding how regional thermal bioclimatic indicators shall change in response to emission reduction under the Paris agreements' goals to limit global warming to 1.5 and 2.0°C. Thus, a multi-model ensemble (MME) mean was developed using eight CMIP6 global climate models to project the future changes (2020 - 2100) in eleven bioclimatic indicators over Egypt for two shared socioeconomic pathways (SSP) scenarios, SSP1-1.9 and SSP1-2.6, representing 1.5 and 2.0°C warming, respectively. The historical bioclimatic results indicated that the most vulnerable region was south and southeast, which faced the highest value in many bioclimatic indicators. The future scenarios obtained different distribution, which the highest increase was located in the north and northeast of Egypt in many indicators. The annual mean temperature in Egypt increased by 1.30°C in SSP1-1.9 and by 1.53°C in SSP1-2.6, especially in the southeast region, while the daily temperature variation decreased in this region and increased by 0.15°C in the north. The change in summer maximum temperature varied between 1.26 and 2.14°C, while the change in winter minimum temperature varied between 0.9 and 1.5°C.

Keywords: CMIP6, Climate Change, Bioclimatic, SSP, Paris Agreement

ID 17: VALIDATION OF GRIDDED DATA SET OVER SEMI-ARID REGION OF SYRIA

Rajab Homsy1, Shamsuddin Shahid1, Tarmizi Ismail1, Jam Shahzaib Khan 1,2, Zafar Iqbal1*, and Atif Muhammad Ali3

- 1 School of Civil Engineering, Faculty of Engineering UniversitiTeknologi Malaysia (UTM), 81310 Johor Bahru
Eng.Rajabhomsy@gmail.com1, sshahid@utm.my1, tarmiziismail@utm.my1, jam_shahzaib@hotmail.com1,2, zafar.thalvi@gmail.com1*
- 2 Department of Civil Engineering Quaid e Awam University of Science and Technology, Nawabshah, Pakistan
- 3 College of Hydrology and Water Resources, Hohai University, Nanjing, China
Atifbaloch.AA@gmail.com3

Arid and semi-arid regions are particularly susceptible to climate change. However, precipitation and temperature reliable data for the long term are unavailable in many developing regions mainly in the conflict-affected regions of the world. Gridded Climate Data (GCD), in recent years, has emerged as a reliable data sets in the scientific community especially for the remote regions of the world. The reliability and accuracy of these data sets vary from region to region; therefore, these data sets need to be validated using observed station data. Therefore, in this study, the GCD of precipitation global precipitation climatology center (GPCC) and temperature climate research unit (CRU) is validated using various statistical and spatial analysis over Syria. The Quality of the observed data has been checked by the double mass curve. The Gridded data set was compared with the observed by time-series and residual analysis. CDF and PDF were plotted for the evaluation of GCD along with the comparison of the spatial distribution of precipitation and temperature. The double mass curve results showed that the annual rainfall time series showed no breakpoint in the graph representing the consistency of the observed data of various stations. The PDF and CDF of the observed and GPCC data were plotted to find the relationship of the GPCC with the observed data. The R2, PBIAS, NRMSE, NSE and md of GPCC with observed data shows that at the various station the gridded data is in close relationship with the gridded data, which strengthens the hypothesis that the GPCC can perform well over Syria. Time series analysis of 50 years (1951-2010) was compared along with the residual of each station. The comparison showed that the GPCC data matched well with the observed data with a slight under or overestimation at some stations. The spatial distribution of the annual mean rainfall over Syria was plotted for the observed as well as GPCC data. The spatial distribution of the GPCC was much more similar in most part of the country which represents the ability of the gridded data to replicate the annual mean precipitation over most part of the country.

Keywords; Gridded data Validation, Climate Change, GPCC, CRU

ID 18: TREND ANALYSIS OF TERRESTRIAL WATER AVAILABILITY IN THE AMU DARYA RIVER BASIN UNDER CLIMATE CHANGE

Obaidullah Salehie^{1,2}, Tarmizi bin Ismail¹, Shamsuddin Shahid¹

¹ Department of Hydraulics and Hydrology, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM), 81310 Skudai, Johor, Malaysia

salehie1985@graduate.utm.my^{1,2}, tarmiziismail@utm.my¹, sshahid@utm.my¹

² Faculty of Environment, Kabul University, Kabul, Afghanistan

Amu Darya River basin is one of Central Asia's largest international transboundary river basins, gradually experiencing more water stress due to increased human interventions and climate change. The objective of this study was to find trends in water availability in the Amu Darya basin. For this purpose, the Jet Propulsion Laboratory (JPL) data as one of the solutions of Gravity Recovery and Climate Experiment (GRACE) with a high spatial resolution of 0.5° was used. The results of variability in Terrestrial Water Storage (TWS) show higher variability (≥ 30 cm) in the Tundra and warm-dry continental climate and gradually decreasing towards the hot-summer Mediterranean climate zone. In contrast, the spatial variability is low towards the west and northwest of the basin, which means water resource reliability increases in the steppe and cold desert climate zone. The trend analysis results revealed a higher decrease in water availability in the Tundra and warm dry continental climate zones and the delta region of the basin with a negative value ranging from 0.04 to -0.08 cm/year. Therefore, the results indicate that GRACE could be applied successfully for a large-scale basin with a diverse climate condition.

Keywords: Gravity Recovery and Climate Experiment, terrestrial water storage, resiliency, Amu Darya River basin.

ID 49: ASSESSING THE IMPACT OF CLIMATE CHANGE ON FLOOD CHARACTERISTICS AT LANGAT RIVER BASIN USING RAINFALL RUNOFF INUNDATION (RRI) MODEL

Anuar¹, N E Alias^{1,2*}, K A Mohd Nasir¹, R Mohd Lokoman³ and M W A Ramli¹

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia
umihunny@gmail.com¹, noreliza@utm.my^{1,2*}, kamarul.azlan@yahoo.com¹, mwadli2@gmail.com¹

² Centre for Environmental Sustainability and Water Security (IPASA), Universiti Teknologi Malaysia, Malaysia

³ Department of Mathematics, Faculty of Science, Universiti Teknologi Malaysia, Malaysia
rahmah.mohdlokoman@gmail.com³

Flood modelling is one of popular tools in flood management. It can simulate flood depth and streamflow at different sections of the studied area enabling hydrologist to have better understanding on the flood especially with the impact of climate change. This study aims to understand the flood impact due to climate change in a basin scale using Rainfall-Runoff Inundation (RRI) model. Langat River Basin in Selangor, Malaysia is selected due to its location and urbanised area. The RRI were set up and calibrated based on observed data obtained from Department of Irrigation and Drainage (DID) Malaysia, topographic data from HydroSHEDS at 15 arc-second and landuse data from PLANMalaysia. The projected climate data (2080-2099) were extracted from Non-Hydrostatic Regional Climate Model (NHRCM) developed by Meteorological Research Institute (MRI) under the worst case scenario, RCP8.5. The maximum 1-day rainfall at 100-year ARI were chosen as the rainfall input in RRI. It is found that the rainfall intensities in projected 100-year ARI shows a decrement by 6.4% to 12.4% at most area in Langat River Basin. This has cause the peak streamflow in Langat River to reduce by 6.8% and peak flood depth to change by $\pm 3\%$ in the future. Thus, it can be inferred that due to climate change, the peak streamflow and flood depth at Langat River Basin is reduce in the future though the impact is low. *Keywords: climate change; flood modelling; rainfall-runoff inundation model; streamflow*

Keywords: climate change; flood modelling; rainfall-runoff inundation model; streamflow

ID 50: IMPACT OF SEA LEVEL RISE AND ADAPTATIONS FOR PENINSULAR MALAYSIA SHORELINE

Hin Lee Lee^{1a}, Dunstan Anthony^{2a}, K.A. Mohamad^{3a}, A.M. Shah^{4a&b}, Y.A Benson^{5a&c}, W.A.H. Azhary^{6a}, M. R. Razali^{7a}, S.B. Hamzah^{8a&d}

1a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
hllee@nahrim.gov.my1a

2a National Water Research Institute of Malaysia (NAHRIM)/ Coastal & Oceanography Research Centre
dunstan@nahrim.gov.my2a

3a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
khairulanuar@nahrim.gov.my3a

4a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
amri@nahrim.gov.my4a&4b

4b The University of Western Australia (UWA), Perth / Ocean Graduate School, UWA Ocean Institute

5a National Water Research Institute of Malaysia (NAHRIM) / Coastal Management & Oceanography Research Centre
yannie@nahrim.gov.my5a&5c

5c Center For Coastal and Ocean Engineering (COEI), Universiti Teknologi Malaysia (UTM) Johor

6a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
wanhafiz@nahrim.gov.my6a

7a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
mrizal@nahrim.gov.my7a

8a National Water Research Institute of Malaysia (NAHRIM)/ Coastal Management & Oceanography Research Centre
saiful@nahrim.gov.my8a&8d

8d Department of Civil Engineering, Universiti Putra Malaysia

More than 90% of the anthropogenic heat produced in the global system are stored in the ocean. This has led to amplification of Sea Level Rise (SLR) rate threatening the coastal communities. SLR projections for Malaysia shorelines were assessed using AR5 (5th Assessment Report for Intergovernmental Panel on Climate Change (IPCC)). It has indicated different magnitude of projected SLR along Malaysia shorelines ranging between 0.67 m - 0.74 m for scenario RCP 8.5 (Representative Concentration Pathway, RCP) in the year 2100. Global information system (GIS) tool were used to analyze and produced the inundation potential risk maps for Malaysia shorelines. The static model generated using GIS illustrates low-lying areas within the territorial waters of Strait of Malacca are more vulnerable compared to the eastern stretches of Peninsular Malaysia. The inundation risk maps reported in this paper will evidently able to assist and supplement information for local authorities and implementing agencies towards integrating climate change impacts in future coastal protection, mitigation and developments agenda.

Keywords: Anthropogenic Heat, Coastal, Sea Level Rise, AR5, Inundation Potential, Low-lying Areas, GIS

ID 57: ANALYSING IMPACT OF CLIMATE CHANGE ON HYDROLOGICAL TREND IN KELANTAN RIVER BASIN USING HEC-HMS COUPLED WITH SDSM

Muhammad Zahran Syahmi Armain¹, Zulkarnain Hassan^{2*}, Mohd Remy Rozainy Mohd Arif Zainol³, Sobri Harun⁴, Ain Nihla Kamarudzama⁵, and Salwa Mohd Zaini Makhtar⁶

^{1,2,5,6} Faculty of Civil Engineering Technology, Universiti Malaysia Perlis (UniMAP), Kompleks Pusat Pengajian Jejawi 3, 02600 Arau, Perlis, Malaysia.,

zahransyahmi11@gmail.com¹, zulkarnainh@unimap.edu.my^{2*}, ainnihla@unimap.edu.my⁵, salwa@unimap.edu.my⁶
³ School of Civil Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Pulau Pinang, Malaysia.

ceremy@usm.my³

⁴ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.
sobriharun@utm.my⁴

Climate change dramatically alters many hydrologic systems, which affects the availability of water and leads to runoff and river discharge. This study assessed the effects of the future scenario of climate change on the monthly river discharge of the Kelantan River basin, Malaysia. Statistical DownScaling model (SDSM) was used to downscale the rainfall from large climate variables of the second-generation Canadian Earth System Model (CanESM2) under the Representative Concentration Pathways of 8.5 (RCP 8.5) and project future river discharge using the Hydrologic Modeling System (HEC-HMS). From this study, the monthly rainfall and river discharge over the Kelantan River basin will be significantly reduced in the future by 30% and 50% compared to the current period.

Keywords: rainfall; hydrology; statistical downscaling model; HEC-HMS; CanESM2



DISASTER RISK REDUCTION

ID 06: UTILISING AERIAL MAPPING APPROACH ON DAM DISASTER RISK REDUCTION

R.S. Muda^{1*}, I.Tukiman², A.F. Mamat¹, M.H. Jamal³, F.S. Abdullah¹

¹ Civil and GIS Unit, Department of Generation, TNB Research Sdn Bhd, Malaysia
rahsidism@tnb.com.my^{1*}, fadhli.mamat@tnb.com.my¹, ffaezynn@yahoo.com¹

² KAED, International Islamic University Malaysia, Malaysia,
izawati@iium.edu.my²

³ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru, Johor
mhidayat@utm.my³

In a disaster-prone area, the preparation and readiness of the population at risk are important for disaster risk reduction. Some countries prepare for disaster by proposing a periodic evacuation exercise to establish community preparedness for the potential disaster threats in the area. Still, the extent of the practice dictates the level of community readiness and understanding of the disaster. There are numerous ways of planning an emergency evacuation for a disaster ranging from a simple desktop review to the detailed mathematical algorithm of evacuation components. This paper share the experience of applying aerial mapping with the Geographic Information System (GIS) overlay method to support the simulation exercise and evacuation planning for dam disaster risk reduction (DRR). Aerial mapping provide current site conditions for better site assessment. Once the flood hazard map is produced, the evacuation planning could materialise through an actual field exercise to gauge its effectiveness, complementing and improving ground observation methods. A theoretical framework of this approach is significant as guidance for evacuation planning during an emergency.

Keywords: dam failure; disaster risk reduction; aerial mapping; flood hazard map; dam related disaster

ID 22: THE APPLICATION OF THE KRIGING METHOD IN THE DEBRIS AND MUDFLOW WARNING SYSTEM (DMFWS)

A.R Bahrom¹, M.Z.M Ali^{2*} and N.M Dom³

¹ Principle, Servis EDA Sdn. Bhd., 17 Jalan Daud, Kg. Baru, 50300 Kuala Lumpur.
razak@serveda.com¹

^{2*} Principle Assistant Director, Jabatan Pengairan dan Saliran Malaysia, Jalan Sultan Salahuddin, Kuala Lumpur 50626, Malaysia.

zaharifudin@water.gov.my^{2*}

³ Deputy Director, Humid Tropic Centre Kuala Lumpur, Jabatan Pengairan dan Saliran Malaysia, Jalan Sultan Salahuddin, Kuala Lumpur 50626, Malaysia
norlidamd@water.gov.my³

For technical managers of natural disasters in Malaysia, real-time rainfall is an essential component to forecast disaster events accurately. However, the lack of full and complete real-time rainfall data on a timely basis makes this task difficult. While there are many contributing factors for this dilemma, the focus of this paper is to determine an alternative to the occurrence of missing data and the estimates of rainfall for ungauged area. The methodology describes the process entailed in filling in the missing data until the actual real-time data arrives, albeit late. The paper explains how the Kriging method applied to determine the statistical hourly rainfall for a rainfall station based on its historical data of at least 10 years. Each hour rainfall throughout the year is based on its historical values. The application of Kriging method is successfully applied to a Jabatan Pengairan dan Saliran (JPS) Malaysia forecasting system called the Debris and Mudflow Warning System (DMFWS), which forecasts debris and mud flow events in Cameron Highlands. This paper details the method to estimate the ungauged point rainfall and infilling missing data for DMFWS application.

Keywords: Cameron Highlands, debris and mudflow, kriging method

ID 51: OPEN DATA APPLICATION TO EVALUATE EXPOSURE OF WILDFIRE TO WATER RESOURCES: JOHOR AREA CASE STUDY

Fara Aiza Md Sanin^{1*}, Nor Eliza Alias^{1,2*}, Kasturi Devi Kanniah³, Mariyana Aida Abdul Kadir¹, Izni Izzati Mohamad¹, Rasnavi Paramasivam¹

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor.
faraaiza@graduate.utm.my^{1*}, noreliza@utm.my^{1,2*}, mariyanaida@utm.my¹, eznee007@gmail.com¹,
rasnavi2@graduate.utm.my¹

² Centre for Environmental Sustainability and Water Security (IPASA), Universiti Teknologi
Malaysia, 81310 Johor Bahru, Johor.

³ Department of Geoinformation, Faculty of Built Environment & Surveying, Universiti Teknologi Malaysia, 81310 Johor
Bahru, Johor, Malaysia.
kasturi@utm.my³

Climate change impacted wildfire events as well as water availability. Exposure of water resources to a wildfire can reduce water quality supplied to humans and resulting health problems. On the other hand, water resources such as rivers and ponds are essential in wildfire firefighting. This paper intended to discuss the exposure of wildfire to water resources by using spatial analysis. Johor state is selected as a study area due to high numbers of wildfire and water demand. Fire data collected by MODIS from 2000-2020 has been used to create a hotspot map. Water resources and waterbody data originated from Jabatan Ukur dan Pemetaan Malaysia was used to create distance analysis. 5 class exposure level has been set to show the degree of closeness of water resources to wildfire hotspot area. The wildfire water exposure map shows that 7% of the Johor water area is medium-level exposure. Only 1% Johor water area was exposed to a high level of wildfire. Most of the streams are at very low-level exposure. Lebam dam at Bandar Penawar Kota Tinggi, Machap dam at Simpang Renggam Keluang and Labong dam at Endau Mersing are three dam that exposed at level 3. In the other direction, the overlay map of hotspot with water stream and body helps prepare wildfire response. This paper only provides a preliminary result; an in-depth study needs to be conducted for precise outcomes and assessments.

Keywords: Water sources, Wildfire, Exposure

ID 77: COMMUNICATION, EDUCATION AND PUBLIC AWARENESS PROGRAM (CEPA) IN FLOOD FORECASTING AND WARNING PROGRAM (PRAB)

Salwa Ramly^{1*}

¹ Pusat Ramalan dan Amaran Banjir Negara (PRABN), Department of Irrigation and Drainage, Malaysia
salwa@water.gov.my^{1*}

In Malaysia, flood management including the provision of structural and non-structural measures for flood mitigation is under the jurisdiction of the Department of Irrigation and Drainage (JPS). In order to create effective flood management, the integration of these two approaches is necessary. DID has developed a systematic flood warning system called the Flood Forecasting and Warning Program (PRAB) under the National Flood Forecasting and Warning Center (PRABN). One of the project components in PRAB is Communication, Education and Public Awareness Program (CEPA) for the Kelantan, Terengganu, and Pahang River Basins under PRAB Phase 1. The National Flood Forecasting and Warning Program (PRAB) is implemented by Department of Irrigation and Drainage Malaysia with the aim of strengthening the flood warning and forecasting system in Malaysia. The PRAB program has targeted several transformational shifts in the existing flood forecasting and warning system to the more advanced ones and will have a significant impact on the public. Kempen Amaran dan Ramalan Infobanjir (KARIB) or The Flood Warning and Forecasting Information Campaign (KARIB) is a campaign program in PRAB. KARIB aims to empower the community through the latest information and knowledge to face the monsoon floods. Also, to educate the public about the PRAB flood warning and forecast system through various exciting activities. The target groups for KARIB are communities, Educational Institutions, Government Agencies, and NGOs.

Keywords: Non-structural measures; Flood Forecasting; Flood Warning; CEPA;



ENVIRONMENTAL SCIENCE AND MANAGEMENT

ID 05: REMOVAL OF AMMONIACAL NITROGEN FROM AQUEOUS SOLUTION USING CLINOPTILOLITE AS ADSORBENT

Najihahada Abi Jihat1*, Mohd. Hafiz Puteh 1,2

1 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM), 81310 Johor Bahru, Johor, Malaysia.

najihahada2@graduate.utm.my1* , mhafizputeh@utm.my1,2

2 Centre for Environmental Sustainability and Water Security (IPASA), Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.

Removal of ammoniacal nitrogen from aqueous solution using clinoptilolite was investigated by influence factors of particle size, initial concentration, contact time, and adsorbent dosage. One-factor-at-a-time (OFAT) approach was used for experimental design to obtain maximized ammoniacal nitrogen removal and rate of ammoniacal nitrogen adsorption of clinoptilolite from aqueous solutions. Adsorption isotherm then was analysed by using Langmuir and Freundlich model to determine the relationship between adsorption and adsorbate surface. The results show that smaller clinoptilolite particle size gives a higher rate of removal of ammoniacal nitrogen and adsorption capacity which are 66.67% and 9.39 mg/g respectively. The initial concentration of 100 mg/l gives better removal and adsorptions with a higher contact time which is at 60 minutes. Based on the comparison of data, the rate of ammoniacal nitrogen adsorption by clinoptilolite was well-fitted with Freundlich isotherm instead of Langmuir isotherm. The study found that clinoptilolite with the smallest particle size was more efficient in removing ammoniacal nitrogen and procure a high rate of ammoniacal nitrogen adsorption.

Keywords: Zeolite; ammoniacal nitrogen; clinoptilolite; particle size; adsorption isotherm

ID 31: WORKABILITY ON PHYSICAL PROPERTIES FOR GRAY WATER H-FILTERS AS CONTROL AT SOURCE

S. Musa1,2*, D.N. H. Awang Affendi1, N. N. Hasib1, N. S. Ramlee1, R. M. S. Radin Mohamed1 and A. Abu Bakar1

1 Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

sabariah@uthm.edu.my1,2*, maya@uthm.edu.my1, af180165@siswa.uthm.edu.my1

2 Eco-Hydro Technology Research Centre (Eco-Hytech), Faculty of Civil Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400 Johor, Malaysia.

Grey water can be defined as home-made wastewater such as water from the bathroom, hand sink, laundry, kitchen sink except waste water from toilet. River pollution occurs due to the activity of a person in each house such as removal the grey water directly without any filtering media. The purpose of this study is to determine the performance of the H filter design due to the filter materials. The materials that use in this filtration system are wood charcoal, gravel and fine sand with the size 10 mm and 1.18 mm. The sampling location was at a restaurant in Taman Universiti and samples were taken directly from the gray water source before running out of the main channel. Samples were tested in terms of effectiveness and volume of grey water beyond the H-filter capacity level. Water quality was measured according to the selected parameters namely acidity and alkalinity (pH), turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD) and ammonia. While performance is seen at optimal volume according to the quality of waste water produced. The results of the study show that the H-filter application has the potential to reduce the contamination rate with a change in pH value of 9.9%, reduction of turbine decomposition value by 92.1%, dissolved oxygen absorption by 48.3%, changes in BOD value by 20% and ammonia by 29%. The H-Filter is also capable of holding volume up to 120 to 150 liters with the help of media filtering. As such, the use of H-Filters can reduce the rate of river air pollution around the home and water filtration systems are used safer, more accessible and user friendly.

Keywords: grey water, H-filter, water quality, pollution

ID 40: WATER QUALITY IDENTIFICATION OF KEY PUBLIC CONCERNS USING SENTIMENT ANALYSIS AND TOPIC MODELLING

Dwijendra nath dwivedi^{1*}, Ghanshyama Mahanty², Anilkumar Vemareddy³

¹ Krakow university of Economics, Rakowicka 27, Kraków, 31-510, Poland
dwivedy@gmail.com^{1*}

² Department of Analytical and Applied Economics Utkal University, Bhubaneswar, India
ghanamahanty@gmail.com²

³ University of Agricultural Sciences, Bangalore
gv.anilkumar02@gmail.com³

Public opinion can be critical inputs to the policy makers regarding the critical issues related to environment such as water quality. Idea is to collect user opinions from social network sites to perform an effective sentiment analysis that can enable policy makes to gain insights from public participation. The objective of the paper is to analyze twitter data to extract sentiments and opinions in unstructured text. We attempted to use contextual text analytics to categories the twitter data to understand the positive or negative sentiments for the water quality challenges and wish to highlight the key concerns. text clustering has also been performed on positive and negative sentiments to understand the key themes behind the concern of people. We have followed two-step processes. In the first step, we have identified positive and negative sentiments from Twitter feeds. Text blog uses naive Bayes (probabilistic algorithms that use Bayes's Theorem to predict a text's category) classifier to assess a sentence's polarity. It generates a score ranging between -1 (strongly negative) to +1 (strongly Positive). In the second step, we perform the topic extraction that discovers the keywords in sentiments that capture the text's recurring theme and is widely used to analyze large sets of sentiments to identify the most common topics quickly and efficiently. In terms of methodology, we have applied latent semantic analysis and singular Value Decomposition for text clustering. Clustering divides observations into a data set into different clusters or groups so that the words within a group are similar and the comments between the groups are dissimilar. In-text mining context, clustering divides the collection of tweets into various groups based on the presence of similar themes.

Keywords: Water quality, drinking water, water pollution, Sentiment Analytics, Twitter, Text Clustering, Topic Modeling

ID 42: DETERMINATION OF THE RELATIONSHIP BETWEEN RIVER ECOSYSTEMS AND BENTHIC MACROINVERTEBRATE ECOLOGICAL INDICES AS A BASIS FOR RIVER HEALTH ASSESSMENT

Aweng Eh Rak¹, Sharifah Aisyah Syed Omar¹, Muhammad Abdul Salam² and Mior Izuddin Baharuddin³

¹ Faculty of Earth Science, Universiti Malaysia Kelantan, Malaysia
aweng@umk.edu.my¹, shaisyah.syedomar@gmail.com¹

² Department of Environmental Science and Disaster Management, Faculty of Science, Bangladesh
s_salam1978@yahoo.com²

³ Department of Environment Perak, Perak
4mib@doe.gov.my³

The physical and chemical component commonly used for monitoring and rehabilitating the river in Malaysia has not proven to be successful. Therefore, this study aims to identify relationship between river ecosystems and benthic macroinvertebrate ecological indices as a basis for river health assessment. Three rivers selected in Johor to assess the benthic macroinvertebrates, water quality and river habitat using standard method. The results found that ecological indices of benthic macroinvertebrates have a correlation with all river ecosystem elements. This shows that benthic macroinvertebrates can be used as bio-indicator to assess river health.

Keywords: river health, river rehabilitation, river ecosystems, ecological index, biological indicator

ID 45: PHYSICAL AND CHEMICAL VARIABILITY OF MANGROVE ISLAND: A CASE STUDY OF PULAU KUKUP, JOHOR

Abdul Al-Hafis Abdul Rahman Lim¹, Mohamad Hidayat Jamal^{1,2,3}, Daeng Siti Maimunah Ishak^{3,4}, Shamila Azman^{1,2}, Myzairah Hamzah⁴, Nor Suhaila Rahim^{3,4}

1 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
abdulhafis@gmail.com¹, mhidayat@utm.my^{1,2,3}, shamila@utm.my^{1,2}

2 Department of Water and Environment Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia

3 Centre for River and Engineering, Research Inst. For Sustainable Environment, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
maimunah.kl@utm.my^{3,4}, myzairah@utm.my⁴, nsuhaila@utm.my^{3,4}

This paper highlights a review preliminary study on the species distribution using spatial analysis at the mangrove area. This is due to the following two facts that the mangrove forests are more extended patches than terrestrial forests, while the field data collection of the mangrove habitat is more difficult. Fourteen sampling plots were established at the study area to determine the variability of physical and chemical element of the soil. This study highlights the application of interpolation process within ArcGIS spatial analysis to interpolate the value of elements where the field data collection is inaccessible. Number of tests were conducted on common soil physical and chemical parameters such as salinity, pH, conductivity, nutrient, and particle size distribution of soil. The results indicate that the soil characteristic is mostly suitable for *Brugueira cylindrica* and *Rhizophora mucronata* due to the high number of sapling species found in the plots. Further data collection needs to be conducted for a better interpolation output for the future studies.

Keywords: mangroves species, distribution, spatial analysis, physical and chemical parameters



SANITATION AND WASTE MANAGEMENT

ID 61: MARINE DEBRIS AND CLEAN COAST INDEX ON THE BEACH OF PANTAI NAVY LABUAN, WILAYAH PERSEKUTUAN LABUAN, MALAYSIA

Diyana Hazierah Abdullah¹, Norasikin Saman¹, Nurfarhain Mohamed Rusli^{1,2}, Mohd Rizalman Mohd Ali³ and Shazwin Mat Taib^{1,3*}

1 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, UTM Johor Bahru, Johor, MALAYSIA. diyana2797@gmail.com¹, norasikinsaman26@gmail.com¹

2 Centre of Lipid Engineering & Applied Research (CLEAR), Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, MALAYSIA. nurfarhain@utm.my^{1,2}

3 Spritzer Berhad, No.1, Jalan Sitar 33/6, Seksyen 33, 40400 Shah Alam, Selangor, MALAYSIA. rizalman@spritzer.com.my³, shazwin@utm.my^{1,3}

4 UTM Campus Sustainability (UTMCS), Block M38, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, MALAYSIA.

Marine debris is described as any solid materials such as cigarette butts, plastic bottles, food wrappers, plastic bags, glass bottles, and foam containers that are directly discharged into the marine and coastal ecosystems, or carried over by the wind, river, or pluvial systems. Marine debris issues are recognized as a major stressor on the marine and coastal ecosystem around the world, including Malaysia. In this study, coast cleanliness in Wilayah Persekutuan Labuan coastal area was evaluated. The extent of the effects of marine debris and beach cleanliness was assessed using Clean-Coast Index (CCI). The marine debris was collected for two days during northeast monsoon season, at the same coastal area around Navy Beach, Labuan (coordinates of 5.2759, 115.2587) using the transect survey method. Marine Debris Tracker application was used to record the type of debris found and categorized by type of material. The number of debris collected from two days of the survey was 361 items, where 73 items were found for the first day and the remaining 288 items were found during the second day of the survey. 61.6 % of the total debris found on day 1 of the survey was categorized as plastic items. A number of debris collected from the second day of the survey was significantly higher than the first day, where 56.6 % of the debris was categorized as lumber types, 24 % was plastic and 18.8 % was categorized item. A high number of wood sticks were found as it was believed that this item was stranded at the survey area to the rain and strong winds a day before the sampling was done. Effect of weather and time selection for the debris collection contributed significant results towards the number of debris and its types. The value of CCI in this study was 1.27, so the coastal area of Navy Beach, Labuan can be considered as 'very clean according to the CCI index value.

Keywords: Marine debris, Debris composition, Malaysia's beach, Navy beac, Clean-coastal index, transect survey

The background features abstract blue geometric shapes and lines. On the left, there are several vertical lines of varying lengths that appear to be part of a larger structure. On the right, there are more vertical lines, some of which are grouped together, creating a sense of depth and perspective. The overall design is clean and modern, with a focus on blue tones and geometric forms.

HYDRO-ENVIRONMENT

ID 07: THE INFLUENCE OF VEGETATED ALTERNATE BAR ON FLOW RESISTANCE IN AN ALLUVIAL STRAIGHT CHANNEL

M. Z. M. Salleh^{1,2*}, Z. Ibrahim², R. Saari², M. E. Mohd Shariff², M. Jumain²

¹ School of Civil Engineering, College of Engineering, Universiti Teknologi MARA Pasir Gudang, Johor, Malaysia.
kayzul00@gmail.com^{1,2*}

² School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia,
81310 UTM Johor Bahru, Johor, Malaysia
zulkfe@utm.my², radzuans@utm.my², fendi9525@gmail.com², mazlin@utm.my²

In recent decades, the role of vegetation in river hydrodynamics has become important attention to researchers. The study of vegetation is difficult as various parameters need to be considered. In addition, it is more complex when the vegetation and bedform acted together such as a vegetated alternate bar. This bed feature significantly affects the river characteristic especially on bed roughness and flow resistance. However, the detail on their impacts is insufficient for us to be interpreted. This study analyzes the interaction of vegetation and alternate bar to the flow resistance in an alluvial river. The study aims to investigate the bed roughness coefficient impacted by the vegetated alternate bar. The flume channel of 10 m long and 1 m wide was used in the experiment with bed sediment size 0.8 mm. The obtained results revealed that the friction factor and Manning's roughness coefficient were significantly increased on the vegetated alternate bar than the other areas in the channel. The higher bed roughness coefficients increased flow resistance thus reduced flow velocity.

Keywords: alternate bar, vegetation, flow resistance, bed form, straight channel.

ID 09: SHORT TIMESCALE RIVERBANK EROSION AND BANK STABILITY OF SG. BERNAM USING BANK STABILITY AND TOE EROSION MODEL (BSTEM)

Azlinda Saadon^{1*}, Zulkiflee Ibrahim² and Mohamed Fuad Said Khamis³

¹ School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.
azlindasaadon@uitm.edu.my^{1*}

² School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.
zulkfe@utm.my²

³ Faculty of Engineering, Built Environment and Information Technology, SEGi University, Kota Damansara PJU 5, 47810 Petaling Jaya, Selangor Darul Ehsan

Riverbank erosion is significantly affected by the integration between hydraulic action of flowing water and geotechnical stability of the bank. This soil-water interaction is a complex process, requires in-depth understanding and integration between both factors that lead to fluvial erosion and geotechnical failures. This study was carried out to evaluate the short timescale riverbank stability using the Bank Stability and Toe Erosion Model (BSTEM) by integrating both factors. The model was applied to the selected reach susceptible to bank erosion along Sg. Bernam, between state of Selangor and Perak. Fieldwork measurements were conducted for two consecutive months at the selected sampling point included riverbank profile, soil sample, hydraulic parameters, and vegetation properties. Various scenarios applied to the model in quantifying the magnitude of erosion and bank stability of Sg. Bernam. The first scenario was on the effect on vegetative cover to the eroded bank. The second scenario involved the effect of water table where the eroded bank under dry condition, partially saturated, and fully saturated comprising the effect of tension cracks. The bank stability analysis quantifies the Factor of Safety (FoS) of the bank based on three modes of stability, which is stable, conditionally stable, and unstable. Results showed that the FoS of both right and left banks improved with vegetative cover for the scenario without and with tension crack. On average, the right bank indicates unstable compared to left bank, with FoS ranging from 0.25 to 0.72, with lateral retreat between 28 cm to 77 cm. Although the left bank shows more stable in terms of the FoS, the erosion length ranging between 28 cm to 72 cm. Results from various scenarios indicated that BSTEM model successfully analyzed and quantified the short timescale riverbank toe erosion and the factor of safety of the eroded banks.

Keywords: Riverbank erosion, bank stability and toe erosion model, BSTEM, Sg. Bernam.

ID 20: SALINE WATER AND FRESHWATER INTERACTIONS IN A NARROW MEANDERING CHANNEL

Mazlin Jumain^{1*}, Zulkiflee Ibrahim¹, Wan Nor Afiqa Wan Mustafah Kamal¹, Sharifah Nurfarain Syed Abdul Jabar¹, Md.Ridzuan Makhtar¹, Noorarbania Abd Rani¹, Nurfarhain Mohamed Rusli² and Mohd Zulkhairi Mat Salleh³

¹ School of Civil Engineering, Faculty of Engineering, UTM Johor Bahru, Malaysia
mazlin@utm.my^{1*}, zulkfe@utm.my¹, wannorafiq@graduate.utm.my¹, s.nurfarain@graduate.utm.my¹, ridzuanmakhtar@utm.my¹, noorarbania@utm.my¹

² Centre of Lipids Engineering and Applied Research, School of Biosciences and Medical Engineering, Faculty Engineering, UTM Johor Bahru, Malaysia
nurfarhain@utm.my²

³ Faculty of Civil Engineering, Universiti Teknologi MARA Pasir Gudang Campus, Johor, Malaysia
kayzul00@gmail.com³

Saltwater intrusion has been a global issue in water resources management and ecological engineering. This phenomenon leads to problems such as encroachment into water intake zone, loss of freshwater vegetation and disturbance to aquatic life habitat. Undeniably climate change increases the saline water flow into the river system. The meandering rivers are common, and the hydraulics is more complex than straight rivers. An experimental hydraulic research was carried out in the Universiti Teknologi Malaysia to elucidate the hydrodynamic interactions between saline water and freshwater in a narrow meandering channel. The spatio-temporal salinity profiles along the river are discussed in this paper. The findings prevailed a typical characteristic of a salt-wedge estuary and indicated the processes of estuarine mixing. As the saltwater flows upstream, the salinity level drops due to dilution process. Freshwater discharge also significantly influenced the fresh-saline waters mixing. Velocity of saline water, decreased up to 25% when freshwater discharge increased. Furthermore, the interaction between freshwater and saline water in a narrow meandering river might be influenced by the flow resistance induced by the channel boundaries and meander planform itself.

Keywords: saline water; freshwater; meandering channel; experimental hydraulics; mixing

ID 36: 3D SIMULATION ON 90 DEGREE OFF-TAKE BRANCHING CHANNEL WITH SEPARATION ZONES

Siti Aimi Asyarah Zakaria^{1*}, Mohd Ridza Mohd Haniffah¹, Amyrhul Abu Bakar¹, M Faizal Ahmad¹, and Iskandar Shah Mohd Zawawi²

¹ Department of Water and Environment Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

sitiaimiasyarah@gmail.com^{1*}, mridza@utm.my¹, amyrhul@utm.my¹, faizal_9273@yahoo.com¹

² Centre for Mathematics Studies, Faculty of Computer & Mathematical Sciences, Universiti Technology MARA, Shah Alam, Malaysia.
iskandarshah@uitm.edu.my²

Flow separation occurs often in river diversion, particularly in branch channels. Flow separation could reduce the flow capability of the channel. The separation is generally seen through its separation area, which is influenced by a number of factors such as off-take angles, discharge ratios, and channel widths. The study was conducted through computational modelling of FLOW-3D to create a relationship between discharge ratio, which is the ratio of the flowrate in the branch channel to the flowrate in the main channel, with the size of the separation area. The model domain was setup with a channel bifurcating into two, the main channel downstream and a channel representing the river diversion at a 90 degree angle. The model was first validated with previous laboratory work. Then, three discharge ratios were simulated, which are 0.21, 0.49 and 0.70. The layers within the depth of the water were also investigated to understand whether the separation area is homogenous within the water depth via the vertical confinement product. The length of separation area was observed for a few layers within the water depth. The results shows that the separation area is homogenous within the water depth and a single depth can be applied to represent the whole channel. As for the separation area, the result shows a good agreement with previous work. The length of separation zone decreases as discharge ratio increases.

Keywords: river diversion, branching channel, flow separation, FLOW-3D

ID 54: NUMERICAL ANALYSIS OF FLOW CHARACTERISTICS FOR IDEALISED Y-SHAPED CHANNELS

Zi Xin Foh¹, Cha Yao Tan^{2*}, Mohd Ridza Mohd Haniffah³, Erwan Hafizi Kasiman⁴, and Fang Yenn Teo^{5*}

^{1,2,5} Faculty of Science and Engineering, University of Nottingham Malaysia, 43500
Semenyih, Selangor, Malaysia

efyzf1@nottingham.edu.my¹, keey5tcy@nottingham.edu.my^{2*}, fangyenn.teo@nottingham.edu.my^{5*}

^{3,4} School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia,
81310 Johor Bahru, Johor, Malaysia

mridza@utm.my³, erwanhafizi@utm.my⁴

Channel confluence and bifurcation flows are common phenomena in a natural river. Understanding of the characteristics of these dividing flows can help engineers to make decisions on flood risk reductions. In this study, a numerical model has been applied for idealised Y-shaped channels in both cross sections of rectangular and trapezoidal. InfoWorks ICM software is used to run the numerical analysis on the proposed model. The model included a main channel at upstream with bifurcated angle of 45° at each downstream channels. A series of simulations have been carried out to investigate the effects of various flow characteristics to the water depths and flow velocities. These characteristics are manning's roughness coefficient, width of channel, and shape of channel cross section. The results shown that the increases in manning's roughness coefficients have caused decreases in flow velocities and increase in water depths for both rectangular and trapezoidal cross sections. Furthermore, increases in channel widths have caused decreases in flow velocities and water depths for both rectangular and trapezoidal cross sections. In addition, rectangular cross section showed lower flow velocities and water depths compared to trapezoidal cross section. The findings from this study may provide a good understanding of the flow characteristics in a bifurcation river to mitigate floods.

Keywords: Y-shaped channel; bifurcation; numerical modeling

ID 56: LABORATORY INVESTIGATIONS ON POROUS CONCRETE DRAINAGE SYSTEMS PERFORMANCE

Feroz Hanif Mohamed Ahmad^{1*}, Mohamad Hidayat Jamal¹, Abdul Rahman Mohd Sam¹, Nuryazmeen Farhan Haron²
and Canarisa Nipi Ah Lian¹

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
ferozhanifahmad@gmail.com^{1*}, mhidayat@utm.my¹, abdrahman@utm.my¹, canarisanipi_al@yahoo.com¹

² School of Civil Engineering, College of Engineering, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor,
Malaysia

nuryazmeen@uitm.edu.my²

This research aimed to determine the performance of porous concrete drainage systems, which is focusing on porous concrete permeability and compressive strength. The laboratory investigations have been successfully conducted following appropriate standards and concerned to research for drain cover and cube sample tests with different porous concrete aggregate sizes of 8 mm and 16 mm. Meanwhile, the porous concrete performance of 4 mm and 12 mm aggregate sizes have been estimated based on linear regression analysis of 8 mm and 16 mm for cube sample and drain cover sample, respectively. From the findings, it shows that, the highest permeability rate for both cube (20.71 mm/s) and cover drain (8.11 mm/s) samples of 16 mm aggregate size with the highest porosity as compared to other aggregates sizes. The permeability and the porosity increase with the increase of aggregate size. However, the compressive strength decreases as the aggregate size increases, where the compressive strength for 8 mm aggregate size is 3.87 MPa higher than compressive strength for 16 mm aggregate size (3.28 MPa). Thus, the aggregate with a bigger size is good in terms of porous and permeability, but low in terms of compressive strength.

Keywords: porous concrete; drainage system; permeability; compressive strength; porous concrete performance

ID 58: A MATHEMATICAL STUDY OF THE RELATION BETWEEN FLOWRATES, FROUDE NUMBER, BED WIDTH IN DIVIDING OPEN CHANNEL FLOW

Puteri Nadia Shafiqah Harmizi¹, Iskandar Shah Mohd Zawawi^{2*}, Mohd Ridza Mohd Haniffah³ and Taufiq Khairi Ahmad Khairudin⁴

^{1,2} Faculty of Computer and Mathematical Sciences, Kompleks Al-Khawarizmi, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
puterinadaharmizi@gmail.com¹, iskandarshah@uitm.edu.my^{2*}

³ Department of Water and Environment Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
mridza@utm.my³

⁴ Faculty of Science, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia
taufiq@utm.my⁴

Open-channel with branches makes the channel flow more complex and difficult to analyse due to the complex variables and large number of geometric properties related to the junction. The aim of this paper is to employ the mathematical model to investigate the relation between flowrate, Froude number and bed width in the dividing open-channel flow. Several assumptions have been made and input values to compute the solutions are taken from the literature. Maple software is performed to solve the general equation of dividing flow. The results conclude that there is a linear relationship between flowrates, Froude number and bed width ratio with certain dividing angles.

Keywords: Open-channel; dividing flow; flowrate ratio; Froude number; bed width

ID 63: MACHINE LEARNING ALGORITHMS WITH MINIMUM HYDRO-METEOROLOGICAL DATA FOR MONTHLY STREAMFLOW FORECASTING OF KURAU RIVER, MALAYSIA

M. N. M. Adib^{1,2*} and S. Harun¹

¹ School of Civil Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia
muhammadadib.mn@graduate.utm.my^{1,2}, sobriharun@utm.my¹

² Department of Biological and Agricultural Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

Forecasting monthly streamflow is crucial in water resources management to access the possible future streamflows patterns. It becomes vital where streamflow of Kurau River is the primary water source to irrigate the large-scale rice scheme of Kerian, Perak, coupled with future climate change uncertainty. In this context, machine learning algorithms have received outstanding attention due to their high accuracy in forecasting through high-speed input-output data processing of self-learning from physical processes. In this study, two machine learning algorithms, support vector regression (SVR) and random forest (RF), were considered to forecast the streamflow of Kurau River in Malaysia using gauged hydro-meteorological dataset for the period from 1976 to 2005. The prediction of monthly streamflows were based on minimum hydro-meteorological data such as rainfall, minimum and maximum temperature, relative humidity, and wind speed. A comparative study is executed to evaluate the performance of SVR and RF. The results of machine learning models were compared to assess the efficiency of the model to make predictions by using correlation coefficient (R), mean absolute error (MAE), and root mean square error (RMSE) between the predicted and observed streamflow. The results show that RF outperformed the SVR in the training and testing phases. In measurable terms, the excellence of RF over the SVR model in the training phase was demonstrated by $R^2 = 0.95$ and 0.66 , $MAE = 2.15$ and 4.71 , $RMSE = 2.75$ and 6.48 , respectively, while in the testing phase, $R^2 = 0.72$ and 0.71 , $MAE = 5.43$ and 5.63 , $RMSE = 7.17$ and 7.34 , respectively. The results have proven that the machine learning algorithms, especially the RF model, can be implemented for forecasting streamflow by using only hydro-meteorological data with high accuracy, which will improve future water resources management.

Keywords: support vector regression, random forest, forecasting, streamflow, Kurau River

ID 64: TRENDS IN POTENTIAL EVAPOTRANSPIRATION IN PENINSULAR MALAYSIA IN RELATION TO GEOGRAPHY AND TOPOGRAPHY

Sahar Hadi Pour^{1*} and Shamsuddin Shahid ¹

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia (UTM), Johor
hpsahar@utm.my^{1*}, sshahid@utm.my¹

Evapotranspiration is an important hydrological variable, particularly in irrigation, drainage and hydrologic purposes. Potential evapotranspiration (ET_o) trends vary significantly in different parts of the world due to the conflicting changes in the climatic factors that characterize ET_o. This study investigated variability in ET_o trends in relation to topography or location (near to coast) for tropical peninsular Malaysia. The innovative trend analysis (ITA) was conducted to understand the variations in changes. The ITA revealed that the rise in minimum temperature followed by wind speed is the major cause of increasing ET_o in peninsular Malaysia. Results showed no clear relation between trends in potential evapotranspiration to geography and topography. However, there may be some geographical variation of ET_o, which demands further exploration using more observed data or gridded climate data.

Keywords: Potential evapotranspiration; Innovative trend test; Peninsular Malaysia; spatial variability

ID 71: ANALYSIS OF PAN EVAPORATION DATA IN PENINSULAR MALAYSIA

B. Z. Che Omar^{1*}, M. F. Mustapha¹, S. Z. Sulaiman¹, M. K. Ikhsan² dan R. Sahat²

¹ Department of Irrigation and Drainage (DID), Malaysia,
bbzarina@water.gov.my^{1*}, faizul@water.gov.my¹, surdiman@water.gov.my¹
² Menara Teknik, Country
khosimme3@gmail.com², sahatroslans@gmail.com²

This paper attempts to highlight the findings of the direct method of measurement for evaporation on the daily manual pan evaporation data collection and availability analysis from the pan evaporation data provided by the Department of Irrigation and Drainage (DID) Malaysia using the U.S. Class 'A' evaporation pan stations located in Peninsular Malaysia. It also aims to review and analyse the average daily pan evaporation at 14 evaporation stations for the year 2015, monthly and annual pan evaporation data at five evaporation stations for the years 2011 to 2015 in Peninsular Malaysia with the data provided by DID Malaysia through a 5-year trend analysis and will discuss on the current issues pertaining to the pan evaporation data collection practices. The findings will later identify, propose and recommend on the best approach to improve the pan evaporation data information standards with reference to the latest World Meteorological Organization (WMO) guidelines and practices as well as the local standards and technology available in the market.

Keywords: evaporation pan, pan evaporation, evaporation, evaporation data

ID 75: EVALUATION OF FILTERED WATER QUALITY IN EXTENSIVE GREEN ROOF WITH LIMESTONE AS GROWTH SUBSTRATE

M. A. Ramli¹ , C. L. Cheng¹ , F. N. Rosli¹, N. Sabtu¹ , R. Alkarimiah¹ , N.H. Mokhtar Kamal^{1*}
¹ School of Civil Engineering, Universiti Sains Malaysia, 14300 Nibong Tebal, Penang, Malaysia
cehana@usm.my1*, nsabtu@usm.my1, cerosnani@usm.my1

Vegetated roof application has been increasing as a sustainable development system component that can mitigate peak stormwater input. The water captured by a vegetated roof is usually redirected and stored in a storage tank(s) before released into storm drains. However, most of the study that assessed the drained water found that these waters are rich in nitrogen and phosphorus due to the leaching from the vegetation. The elevated nutrient in the water can influence algal growth in the tank and the subsequent piping system, in the long term due to the accumulation in the system. Reflecting this, this research looked at specifically the design characteristics of extensive green roof substrate, by comparing limestone of different sizes as porous media using physical model. The filtering capacity of the limestone and its efficiency in treating rainwater were investigated. Two sizes of limestone were studied, fine (1.18 – 2 mm) and coarse (5 – 10 mm) limestone. The permeability of coarse limestone was higher compared to fine limestone, thus allowing better infiltration of rainwater in the media. On the infiltrated water quality, several parameters were tested to determine the efficiency of limestone in treating the rainwater. The parameters were turbidity, colour, pH, chemical oxygen demand (COD), iron, zinc, total Kjeldahl nitrogen and total phosphorus. By using limestone, pH of the initially slightly acidic rainwater was increased to pH of 6.25 – 7.62. From this study, it can be concluded that fine limestone was more effective in improving the harvested rainwater quality compared to using coarse limestone due the larger surface area and longer contact time between the limestone and the rainwater itself.

Keywords: Extensive roof design, porous media, rainwater filtration, rainwater quality, growth substrate.

The background features abstract geometric shapes in various shades of blue. On the left, there are several vertical lines of varying lengths that create a sense of depth and perspective. The overall design is clean and modern, with a focus on geometric forms and a color palette of blues and whites.

MATHEMATICS AND COMPUTING

ID 24: APPLICATION OF BUILDING INFORMATION MODELLING (BIM) TECHNOLOGY IN DRAINAGE SYSTEM USING AUTODESK INFRAWORKS 360 SOFTWARE

King Kuok KUOK1*, Kia Wee Kingston TAN1 and Po Chan CHIU2, Mei Yun CHIN1, Md. Rezaur Rahman3, Muhammad Khusairy Bin Bakri3

1 Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak Campus, 93350 Kuching, Sarawak, Malaysia

kkuok@swinburne.edu.my1*, 100077279@students.swinburne.edu.my1

2 Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

chiupochan@gmail.com2

3 Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

With the rapid progression and urban development of Samarahan district in recent years, the increase in population has resulted in an increase in residential and commercial development areas. The increased number of physical drainage drawings submitted for new development areas is difficult to manage and handle by relevant authorities, particularly the Department of Irrigation and Drainage (DID). As such, this research is being conducted to determine the feasibility of Building Information Technology (BIM) to create a proper drainage inventory system capable of accurately listing and recording current drainage information through the use of Autodesk InfraWorks 360 software. This inventory system will be employed to examine and validate corresponding drainage parameters based on the recorded information and demonstrate the adequacy of existing drainage systems. This software was chosen for its novelty, as it has not been used in Malaysia. Taman Uni-Central, a residential neighbourhood in Kota Samarahan, has been chosen for this case study. Drainage data, such as drainage size and length, invert level, is entered into GIS-integrated Model Builder in Autodesk InfraWorks 360. Autodesk InfraWorks 360 will conduct a preliminary analysis, including watershed analysis, to delineate the catchment area and drainage performance inspections at rainfall intensities of 2, 5, 10, 20, and 50 years (ARI). Since InfraWorks is a limited conceptual design software, the InfraWorks model will be exported into Autodesk Civil3D to conduct a more extensive hydraulic analysis. The results show that full integration of these two Autodesk software packages had created a proper inventory system of existing drainage information and simulated its sufficiency in catering surcharge runoff from the new development area at the upper catchment. Therefore, InfraWorks is highly recommended to be adopted by relevant authorities, especially in approving drainage engineering drawings.

Keywords: Building Information Modelling (BIM), Inventory management system, Autodesk InfraWorks 360, Autodesk Civil3D, Average Recurrence Interval

ID 35: CFD MODELLING OF PARTIALLY SUBMERGED ORIFICE USING FLOW-3D

Anas S. Ghamam1*, Mohammed A. Abohatem1, Mohd Ridza Bin Mohd Haniffah1, Ilya K. Othman1,2

1 School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia

saganas2@live.utm.my1*, aaamohammed22@live.utm.my1, mridza@utm.my1, ilya@utm.my1,2

2 Center for Coastal and Ocean Engineering (COEI), School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia

An orifice is a small opening of any cross-section, which allows the fluid to flow through. Generally, orifices are used as flow control and measuring devices and classified based on their sizes, shapes, and flow conditions. For partially submerged orifice, relatively few studies provide analytical results because it is highly dependent on the orifice's geometry and the net flow head available. The purpose of this study is to determine the relationship between the flow rate and the pressure head of a circular orifice in partially submerged flow conditions using FLOW-3D software. Three cases were considered: Case A, a classical free flowing circular orifice for validation, Case B, varying upstream and downstream water depth at weir flow conditions; and Case C, partially submerged circular orifice with varying upstream water levels and constant downstream water level at the centre of the orifice. A strong linear relation is obtained between the upstream water level and the flowrate through the orifice for Cases A and C, while the relationship remains valid for Case B unless the water depths exceed the invert of the circle in the downstream. The percentage of difference in weir flow past orifice between the model and equations derived from previous studies are within 20% with regression value of 0.99 for all water level difference, except for a couple of cases with small water level differences, in which the flow is very complex and finer meshes are needed. Meanwhile, the percentage error of orifice flow in case C reduces as the head difference reduces with a regression value of 0.96.

Keywords: orifice flow; weir flow; circular orifice; partially submerged; Computational Fluid Dynamics CFD; FLOW-3D

ID 43: THE APPLICATION OF STATISTICAL ANOVA, LSD AND RSM TO AGRO-BASED FILTER DESIGN OPTIMIZATION

A. Nasrizal A.A.^{1,2}, Jason Lowell J.¹, J. Idris³, Nazaruddin A.T.¹, N. Bolong¹

¹ Faculty of Engineering, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Malaysia.

awang295@uitm.edu.my^{1,2}, jasonlowelljitolis97@gmail.com¹, nazardin@ums.edu.my¹, nurmin@ums.edu.my¹

² Faculty of Civil Engineering, Universiti Teknologi MARA, Cawangan Sarawak, 94300 Kota Samarahan, Malaysia

³ Faculty of Chemical Engineering, Universiti Teknologi MARA, Cawangan Sarawak, 94300 Kota Samarahan, Malaysia
juferi@uitm.edu.my³

Filtration is one of the practical technologies for water and wastewater treatment. Yet, such a technique involves various factors considered in the design, including capital costs, electricity consumption, labour force, and technical operations to ensure optimal performance. The process of filtration process has become economically and environmentally feasible with the emerging of agro-based filter media. However, more works are still required to ensure successful implementation. This paper evaluates filter design efficiency using analysis of variance (ANOVA) and least significant difference (LSD) test. It proposes a framework to optimize the agro-based filter design with response surface methodology (RSM); by utilizing secondary data from historical works. The findings show that both responses in Case 1 are significant ($p \leq 0.05$) in TSS and turbidity removal. Then the filter x8 in Case 2 produced the highest removal efficiency (TSS= 39.61 ± 1.64 ; turbidity= 32.55 ± 2.84). As for Case 3, a 3-D surface plot was plotted for three response variables: configuration, loading rate, and turbidity. Hence, it suggests the potential of the agro-based filter as sustainable alternatives.

Keywords: agricultural wastes, filter design, optimization, response surface methodology, statistical analysis

ID 68: PREDICTION OF FLOW STRUCTURE IN AXIAL FLOW SUBMERSIBLE PUMPS DURING INTAKE BY NUMERICAL SIMULATION

T. A. Norizan^{1*}, H. Ghazali¹, R. Abu Seman¹ and Z. Harun²

¹ Mechanical and Electrical Services Division, Department of Irrigation and Drainage, Malaysia

tajul@water.gov.my^{1*}, hapida@water.gov.my¹, rosazlan@water.gov.my¹

² Faculty of Engineering and Built Environment, National University of Malaysia, Malaysia
zambri@ukm.edu.my²

Intake flow is the main factor that determines the functionality of submersible pumps which withdraw fluid in sumps. It is important that the prediction of flow characteristics of the pump intake is made prior to the construction of the pumping system to identify any hydraulic problem that may arise after installation. Computational fluid dynamics (CFD) is one of the methods that are commonly used to carry out analysis of fluid flow for such applications. In this study, the flow structure in an axial flow submersible pump during intake is analyzed using a commercial CFD software. A numerical model of the pump with single bay intake sump was constructed and simulated with boundary conditions associated to typical on-site pumping operation. Data from experiments were used to validate the results and the analysis was performed by evaluating the numerical results from the aspects of vortex formation, flow vorticity and uniformity. The results showed that the characteristics of the intake flow derived from the numerical simulation are in agreement with the experimental results.

Keywords: pump intake flow; pump sump model; computational fluid dynamics

ID 74: COMPARISON OF DRAG MODELS IN SHALLOW FLOW FOR SPHERICAL PARTICLE TRAJECTORY

Lavine Wong^{1*}, Mohamad Hidayat bin Jamal^{1,2} and Erwan Hafizi Kasiman^{1,3}

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
wlavine2@live.utm.my^{1*}, mhidayat@utm.my^{1,2}, erwanhafizi@utm.my^{1,3}

² Centre for Coastal and Ocean Engineering (COEI), Universiti Teknologi Malaysia

³ Research Institute for Sustainable Environment (RISE), Universiti Teknologi Malaysia

The transport of floating debris has been subject of various studies in recent years. Numerical models have play an important role in predicting the trajectory movement of floating objects. One significant force in prediction of floating objects motion is the drag force. Many empirical methods of drag coefficient (CD) have emerged over the years to estimate the drag force of spherical particles. This study aims to simulate different CD of spherical particle trajectory. The simulation is compared between a Eulerian-Lagrangian one way coupling method with a discrete element model (DEM). The results shows that existing formulas overestimates the trajectory of the floating object when observed with DEM numerical solution.

Keywords: floating debris, drag coefficient, spherical particle, Eulerian-Lagrangian, one-way coupling

ID 78: SWAT APPLICATION FOR GADJAHWONG RIVER STREAMFLOW SIMULATION

PN Wardhana^{1*} and S Izzah^{1*}

¹ Civil Engineering, Universitas Islam Indonesia, Yogyakarta, Indonesia
pradipta.nw@uii.ac.id^{1*}, 16511227@students.uui.ac.id^{1*}

Gadjahwong River flows along Daerah Istimewa Yogyakarta (DIY) that is located in southern of Java Island. Moreover, Gadjahwong River has important role for water supply purpose especially for agriculture activities. On the other hand, DIY is seeing 1.18% population growth each year. The population surge influences land cover change automatically that can seize continuous discharge of Gadjahwong River continuous discharge. Therefore, continuous discharge simulation is needed to be conducted for assessing Gadjahwong River water availability. Soil and Water Assessment Tool (SWAT) was employed for modelling Gadjahwong River streamflow discharge. The simulation result discharge was compared toward observed data acquired at AWLR Wonokromo by using NSE and R2 statistical parameter. Finally, the statistical parameter was applied to justify quality of simulation. Findings showed that daily time step yielded 0.61 of NSE value, 0.79 of R2 value, and -2.41% PBIAS value.

Keywords: Soil Water Assessment Tool (SWAT), River Streamflow Simulation, Gajahwong River

ID 79: OUTPUT UPDATING OF PHYSICALLY BASED MODEL FOR UPPER THAMES RIVER WATERSHED WITH NEURAL NETWORK

P. Jeevaragagam^{1*}, Slobodan P. Simonovic²

¹ Department of Water and Environmental Engineering, School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia.
ponselvi@utm.my^{1*}

² Department of Civil and Environmental Engineering, University of Western Ontario.
simonovic@uwo.ca²

This study presents a procedure of output updating for the physically based model of the Upper Thames River watershed, Ontario, Canada. Beside streamflow and precipitation (rainfall and snowmelt), the procedure uses other available meteorological variables as inputs, which are not employed in the calibration of the HEC-HMS model. Usually, the main hydrological processes involved in transformation of precipitation into runoff are mathematically expressed using a set of key variables. Some of the meteorological variables may be off limit values for obtaining optimal state variables and parameters of the hydrological model during model calibration, which relies on a wide range of streamflow values to achieve a higher model performance. In this study, the Levenberg-Marquardt neural network with Bayesian regularization is coupled with the HEC-HMS model to provide more accurate streamflow values for a large range of streamflow hydrographs for gauged and ungauged sites of Upper Thames River watershed. The neural network model is found capable of generating a well-generalized network with given input and output datasets.

Keywords: neural network; Bayesian; hydrometeorology; hydrological model; HEC-HMS

