Nombor 16 Number

buletinseadpri

pusat kajian bencana asia tenggara
southeast asia disaster prevention research initiative

JUNE 2018

Kakitangan SEADPRI-UKM / *SEADPRI-UKM Staff*

Pengerusi / *Chair*
Assoc. Prof. Dr. Sarah Aziz Abdul Ghani Aziz

Penyelaras Program Bencana Iklim / *Coordinator of Climatic Hazards Programme*
Prof. Dr. Joy Jacqueline Pereira

Penyelaras Program Bencana Geologi / *Coordinator of Geological Hazards Programme*
Dr. Lim Choun Sian

Penyelaras Program Bencana Teknologi / *Coordinator of Technological Hazards Programme*
Dr. Tan Ling Ling

Felo Penyelidik / *Research Fellows*
Emeritus Prof. Dato' Dr. Ibrahim Komoo
Prof. Dr. Joy Jacqueline Pereira
Prof. Dr. Lee Yook Heng
Assoc. Prof. Dr. Sarah Aziz Abdul Ghani Aziz
Dr. Tan Ling Ling
Dr. Nurfashareena Muhamad
Dr. Lim Choun Sian

Sistem Sokongan Penyelidikan / *Research Support System*
Mohd Khairul Zain Ismail
Siti Khadijah Satari
Mohd Faizol Markom

Sistem Sokongan Pentadbiran / *Management Support System*
Tengku Nor Kirana M.Y. Anuar
Noor Shafirah Ramli

Visi SEADPRI *Vision*

Peneraju penyelidikan dan perkongsian ilmu berinovatif secara syumul mengenai bencana

Leader in innovative research and knowledge sharing on holistic disaster prevention

www.ukm.my/seadpri

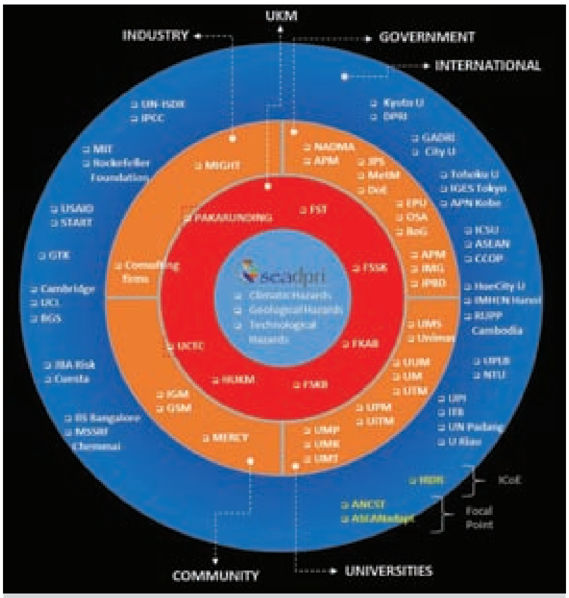
A Decade of Interfacing Science with Policy for DRR

Sedekad Menghubungkan Sains dan Polisi bagi DRR

Pada 1 Jun 2018 menandakan bahawa sedekad penubuhan SEADPRI-UKM, yang mana awal penubuhannya dipacu oleh keperluan untuk mengembleng pakar-pakar daripada pelbagai latar belakang penyelidikan dan latihan, bagi menangani isu berkaitan bencana, termasuklah risiko dan peluang bagi membina daya tahan, bukan sahaja tertumpu kepada Malaysia, bahkan di rantau Asia Tenggara. Idea itu kemudiannya menjadi realiti, langkah-langkah pengurangan risiko bencana memerlukan integrasi dan hubungkait sains dan dasar, dan SEADPRI telah berusaha sejak penubuhannya, untuk menerjemahkan 'percakapan sains' kepada 'percakapan dasar' dan sebaliknya. Tulang belakangnya terletak pada tiga program penyelidikan utama, yang membentuk gegelung; Bencana Iklim, Bencana Geologi dan Bencana Teknologi, yang dilihat secara bebas dan secara kolektif, serta berterusan menyambung semula ke dalam gelung yang berfungsi untuk mengukuhkan sumbangan kepada korpus pengetahuan dan amalan DRR. Ini seterusnya membantu memastikan peralihan terus dibuat untuk tadbir urus DRR yang lebih baik.

Perjalanan SEADPRI-UKM sepanjang menjelajah dekad pertama, telah menyaksikan terjemahan Pelan Tindakan Rangka Kerja Hyogo (2005-2015) di Malaysia dan di rantau Asia Tenggara, dan diteruskan dengan menggunapakai Rangka Kerja Sendai untuk Pengurangan Risiko Bencana (2015-2030). Ini membantu menyusun pelbagai aktiviti penyelidikan, pembangunan keupayaan dan program jangkauan, yang mungkin dilakukan melalui perkongsian dan kerjasama yang berpikiran seperti yang telah membuka peluang untuk SEADPRI UKM untuk memberi perkhidmatan yang lebih baik. Ini adalah perkongsian dan kerjasama dengan pelbagai pihak berkepentingan, yang telah membolehkan interaksi strategik dibangunkan, untuk lebih memahami dan menangani pelbagai bentuk bencana dan dinamik serta risiko yang terlibat, sambil membentuk cadangan untuk campur tangan pihak berkepentingan dan langkah-langkah DRR yang berkesan. Hasil yang sama penting dari interaksi ini adalah peningkatan kepakaran, kemahiran dan bakat, untuk membantu menguatkan brigade DRR.

Pada tahun 2016, SEADPRI-UKM telah diiktiraf oleh *Integrated Research on Disaster Risk Programme (IRDR)*, yang ditaja bersama *International Council for Science (ICSU), International Social Science Council (ISSC)* dan *United Nations Office for Disaster Risk Reduction (UNISDR)* sebagai Pusat Kecemerlangan Antarabangsa IRDR (ICoE) untuk Risiko Bencana dan Iklim Ekstrim. Di peringkat global, SEADPRI-UKM kini berada dalam kumpulan kelompok 16 ICoEs, yang bermatlamat untuk memajukan aktiviti dan program saintifik dalam wilayah yang diwakili oleh ICoE masing-masing, dalam kes ini, rantau Asia Tenggara, yang memberi tumpuan kepada menguatkan input tempatan untuk menangani perkara berkaitan DRR di rantau ini. SEADPRI-UKM juga akan terus memanfaatkan rangka kerja perkongsian ini untuk memajukan lagi kerja yang berkaitan dengan DRR.



National and international partners of SEADPRI-UKM have helped to expand its reach in Malaysia and South East Asia. ***(Graphic by Lim Choun Sian)***

June 1st, 2018 marks the first decade of SEADPRI-UKM's establishment, it's creation driven by the need to bring together experts from multiple disciplinary backgrounds and training, to further the cause of addressing disasters, it's risks and the opportunities to build resilience in Malaysia and South East Asia. The idea then still rings true, disaster risk reduction measures requires the integration and interfacing of science and policy, and SEADPRI has strived, from the very day it was formed, to translate 'science speak' to 'policy speak' and vice versa. Her backbone rests on three key research programmes, that form a loop; geological hazards, climatic hazards and technological hazards, which are looked at independently and collectively, continuously feeding back into the loop that serves to strengthen contribution to the DRR corpus of knowledge and practice. This in turn helps ensure that shifts are continuously made for better-informed DRR governance.

SEADPRI-UKM's journey traversing the first decade saw the translation of the Hyogo Framework Action Plan (2005-2015) in Malaysia and South East Asia, to the adoption of the Sendai Framework for Disaster Risk Reduction (2015-2030). This helped structure the various research undertakings, capacity building and outreach programmes, made possible through like minded partnerships and collaborations, that has opened avenues for SEADPRI-UKM to better serve the cause.

Bersambung ke mukasurat 2
Continued on page 2

Continued from Page 1

SEADPRI-UKM terus teguh menyokong keperluan untuk bekerjasama dan berkolaborasi, memandangkan terdapat kekuatan yang hebat untuk diambil daripada kepelbagaian yang wujud pada dekad yang lalu, serta jalan untuk memupuk dan melibatkan pertukaran telah diwujudkan menerusi pelbagai pengaturan, baik melalui mekanisme penyelarasan atau sumbangan institusi berstruktur. Ini termasuk di mana SEADPRI-UKM menyediakan bantuan penyelarasan kepada *Asian Network on Climate Science and Technology (ANCST)* yang ditubuhkan secara atas talian pada tahun 2013, dengan pembiayaan permulaan dari *CMEDT- Malaysian Commonwealth Studies Centre, Cambridge* [www.ancst.org]; dan rangkaian atas talian *ASEAN Partner Institutions on Climate Change Adaptation (ASEANadapt)*, yang secara rasmi diperakui oleh *ASEAN Working Group on Climate Change (AWGCC)* pada Mesyuarat ke-7 pada 21 Julai 2016 di Kuala Lumpur [www.aseanadapt.org].

SEADPRI-UKM juga terlibat dengan beberapa rangkaian penyelidikan dan platform antarabangsa lain seperti UNISDR Asia Science and Technology Academia Advisory Group (ASTAAG), Intergovernmental Panel on Climate Change (IPCC) dan Alliance Global Research Institute of Disaster (GADRI). Di peringkat nasional, SEADPRI-UKM terus menyokong Pelan Tindakan dan Pelan Kebangsaan mengenai Pengurangan Risiko Bencana (myDRR). Dekad berikutnya akan melihat SEADPRI bekerja lebih keras untuk membentuk perkongsian dan kerjasama, untuk memupuk hubungan dan jaringan, untuk memastikan bahawa DRR akan terus menjadi teras dalam pembangunan negara dan serantau.

It is these partnerships and collaborations with various stakeholders, that have allowed for strategic interactions to be developed, in order to better understand and address the multifactorial and dynamic nature of disasters and the risks involved, whilst shaping recommendations for effective DRR interventions and measures. The other equally important outcome of these interactions is the enhancement of expertise, skills and talents, to help strengthen the DRR brigade.

In 2016, SEADPRI-UKM was acknowledged by the Integrated Research on Disaster Risk Programme (IRDR), jointly sponsored by International Council for Science (ICSU), International Social Science Council (ISSC) and the United Nations Office for Disaster Risk Reduction (UNISDR) as an IRDR International Centre of Excellence (ICoE) for Disaster Risk and Climate Extremes. Globally, SEADPRI-UKM now sits within a group of 16 ICoEs, guided by the goal of furthering scientific activities and programmes within the respective regions the ICoE represents, in this case, the South East Asian region, focusing on strengthening localised inputs to address regional DRR related matters. SEADPRI-UKM will continue to capitalise on this partnership framework to further advance work related on DRR.

SEADPRI-UKM continues to stands firm on the need to partner and collaborate, as there is great strength to be drawn from diversity, and in the past decade avenues to foster and engage exchanges have manifested through various arrangements, be it through coordinative mechanisms or structured institutional contributions. This includes where SEADPRI-UKM provides coordinating assistance to the virtual self-organising Asian Network on Climate Science and Technology (ANCST), established in 2013 with seed funding from the CMEDT-Malaysian Commonwealth Studies Centre, Cambridge [www.ancst.org]; and the virtual network of ASEAN Partner Institutions on Climate Change Adaptation (ASEANadapt), which was formally recognised by the ASEAN Working Group on Climate Change (AWGCC) at its 7th Meeting on 21 July 2016 in Kuala Lumpur [www.asean-adapt.org].

SEADPRI-UKM is also active in several research networks and platforms such as the UNISDR Asia Science Technology Academia Advisory Group (ASTAAG), Intergovernmental Panel on Climate Change (IPCC) and the Global Alliance of Disaster Research Institutes (GADRI). At home SEADPRI-UKM continues to support the National Platform and Action Plan on Disaster Risk Reduction (myDRR). The following decade will see SEADPRI working even harder to form partnerships and collaborations, to further foster linkages and networks, so as to ensure that DRR will continue to remain the mainstay in national and regional development.

ASSOC. PROF. DR. SARAH AZIZ ABDUL GHANI AZIZ
Pengerusi SEADPRI-UKM | *Chair of SEADPRI-UKM*


Photo by IRDR

TOP:

IRDR ICoE commemorative plaque was received as part of the recognition for ICoE-SEADPRI-UKM on 30 November 2016.

BOTTOM:

*Dr. Lim Choun Sian **(far left, first row)**, liaison officer of ICoE-SEADPRI-UKM presented the achievements of 2017 at the 19th IRDR Scientific Committee Meeting in Beijing, China, on 15-16 April 2018. Prof. Joy Jacqueline Pereira and Mr. Mohd Khairul Zain Ismail also attended the meeting.*

Article

Advancing Flood Risk Management and Mitigation in Malaysia

*Mohd Khairul Zain Ismail[1], Siti Khadijah Satari[1], Gerald Sundaraj[2] & Joy Jacqueline Pereira[1]

[1]Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Universiti Kebangsaan Malaysia
[2]Construction Industry Development Board Malaysia (CIDB)

*[Email: zainkhairul@gmail.com]

Abstract: Floods and landslides are likely to rise further due to unpredictable weather patterns brought about by climate change. In addressing the problems caused by climate-driven hazards that are affecting the wellbeing of its people, the Malaysian government has shown great interest in continuing efforts to address this issue. Urban flood mitigation through structural and non-structural measures has become a central aspect of infrastructure planning in Malaysia. Conventional drainage cannot bear the current pressure from the massive urban development surrounding it. Flood warning systems such as Atmospheric Model-Based Rainfall and Flood Forecasting (AMRFF), Integrated Flood Forecasting and River Monitoring (IFFRM), and Integrated Flood Forecasting and Warning System were installed in the East Coast of Malaysia, to minimize the lag time in which information reaches the public when floods happen. Initiatives such as Urban Storm Water Management (MSMA) and Sustainable Urban Drainage System (SUDS) could become alternatives in solving urban flooding, thus contributing to national resilience building and infrastructure in the future.

Keywords: Disaster risk reduction, flood, flood risk management, flood mitigation, resilience.

INTRODUCTION

Floods are a natural phenomenon, and are influenced by rainfall, capacity of rivers, river and sea level rise, geology of the catchment area which consists of porous and non-porous material, ground water level, and hard surface (for urban area) and soft surface (for rural area). There is a need to understand the basics of river flooding. The basics should cover river catchment area and river hydrograph, which way a drop of rain will move and flow on to the sea. In river hydrograph, the graph shows time on the bottom axis, and plots on this the amount of rainfall and the level of water in a river. It shows the time lag of rainfall to river level rise. In river flooding, it is also important to understand the river level; it shows normal flow level and flood flow, which includes water level during summer, spring or fall, and during floods.

Engineers and hydrologists use the Manning equation to measure the flow of the river; the slope of the river, channel roughness, hydraulic radius and river flow are used to do this. The formula is used to estimate the average velocity of water flowing in an open channel in locations where it is not practical to construct a weir or flume to measure water flow with greater accuracy. By using this equation, the normal flows and flood flows could be calculated. Another example is using the Hard Sum, which is normally used to calculate the amount of discharge water flowing m3/sec. Therefore, the 'Stage Discharge' curve is vital in managing floods (Somers, 2015).

For tidal flooding, the factors affecting flooding include spring and neap high water level times, onshore and offshore wind direction, onshore features, and also surge tide. Other factors, include the tide cycle, which is high water level twice a day, but the height is linked to the sun and moon. Therefore, the tide table could provide the level of the high tide. All of this could affect the beach line, wetlands, and mangroves.

Human activities also can cause floods. Such activities increase the frequency and intensity of flooding. These activities include development on flood plains, badly coordinated drainage systems, uncontrolled urbanization, and change of land use patterns such as deforestation, which could lead to restriction of river flows, and less space for flooding.

Man-made factors such as development or the urbanisation of the catchment areas will speed up the run-offs causing flash floods and more frequent floods. The Institution of Civil Engineers (ICE) United Kingdom produced a report following the 2000 autumn flooding in the UK, which stated that flooding is a natural phenomenon and the rivers need floodplains (Somers, 2015). In summary, we need to learn how to live with rivers and make space for flooding.

There are 5 types of flooding:

1. *Tidal flooding*
   Normally tidal flooding comes from the sea. The influencing factor includes high tide levels, wind direction, and pressure surges.

2. *Fluvial flooding*
   Fluvial flooding only happens in rivers. The main influencing factors are rainfall, catchment surface (concrete/natural), and geology (includes porosity).

3. *Groundwater flooding*
   Groundwater flooding is linked to the geology of the area. For example in the south of England where there is chalk rock over an impervious rock and the water table rises nearer the surface during wet weather. This type of flooding is also influenced by rainfall and river level.

4. *Surface water flooding*
   The main influencing factor includes blockage, or the inabilty to discharge water, and or, the capacity of old drains.

5. *Sewerage flooding*
   Sewerage flooding is normally influenced by blocked sewerage discharge.

Regardless of the cause of the flood, the impacts are harmful to people, resulting in loss of life, stress and illness, with flood victims undergoing trauma and anxiety. Floods also damage property and critical infrastructures. Flooding not only affects the actual area involved, but also affects adjacent areas and leads to loss of trade, restricted traffic flow, and does have grave impacts on the local economy. With regards to pollution, flooding leaves vast amounts of dirty, polluted mud and slurry that have to be cleared up.

FLOOD MITIGATION IN MALAYSIA

Infrastructure plays a key role in the resilience, competitiveness and prosperity of nations. Resilience against flooding should be a key consideration in infrastructure planning in Malaysia (Pollalis, 2015).

Article

Flooding is a significant natural hazard in Malaysia, which arises from natural causes as well as human-induced activities, due to globalisation and accelerated development in the country. Other natural hazards in Malaysia are storms, landslides, wildfires, droughts, earthquakes, and mass movement (dry). However, more than 85.4% of people have been reported to be affected by flooding, followed by 7.5% by storms and 5% by epidemics. [Source: http://www.preventionweb.net/english/countries/statistics/?cid=105].

The floods from December 2014 to January 2015 affected the lives of many Malaysians. This year-end downpour and resulting floods were the worst ever in the country's history, affecting more than half a million people; damages to public infrastructure alone were estimated at RM2.851 billion (PMO, 2015). Areas that had never experienced floods before were also inundated, with floodwaters rising to unprecedented levels. The Government of Malaysia has spent more than RM893 million for mitigation projects. During this period, 3.5% of palm oil plantation lands were affected, which resulted in output dropping by 20%.

Malaysia has been under high risk of flooding due to its geographical location within the monsoon region, with heavy and regular rainfall during the local tropical wet season. In terms of geomorphology, Malaysia has a length of coastline plus inland water bodies. The effect of tidal backwater and the overflowing of river capacity also contributed to the December 2014 flooding.

With regard to climate change and extreme weather conditions, more is expected in the future (2025-2050) as higher maximum and lower minimum rainfalls are already being recorded. The Department of Drainage and Irrigation Malaysia (DID) has reported that estimated one-hour rainfall intensity figures for the period of 2000-2007 have increased by 17% compared with the 1970s' values.

Human-induced causes have also led to this flooding event. Large-scale land use modification and high deforestation rates, obstruction of rivers, increased run off rates due to impervious urban areas, and loss of flood storage because of development into flood plains and drainage corridors have become major issues. Examples of other causes that could also contribute towards flooding are inadequate drainage systems or failure of localized improvement works to extend downstream flow, bridges and culverts being under-sized or blocked by debris build-up, disposal of solid waste, and siltation in waterways from land clearing operations.

Flooding is a significant natural hazard in Malaysia, which arises from natural causes as well as human-induced activities, due to globalisation and accelerated development in the country. Other natural hazards in Malaysia are storms, landslides, wildfires, droughts, earthquakes, and mass movement (dry). However, more than 85.4% of people have been reported to be affected by flooding, followed by 7.5% by storms and 5% by epidemics. [Source: http://www.preventionweb.net/english/countries/statistics/?cid=105].

The floods from December 2014 to January 2015 affected the lives of many Malaysians. This year-end downpour and resulting floods were the worst ever in the country's history, affecting more than half a million people; damages to public infrastructure alone were estimated at RM2.851 billion (PMO, 2015).

Areas that had never experienced floods before were also inundated, with floodwaters rising to unprecedented levels. The Government of Malaysia has spent more than RM893 million for mitigation projects. During this period, 3.5% of palm oil plantation lands were affected, which resulted in output dropping by 20%.

Malaysia has been under high risk of flooding due to its geographical location within the monsoon region, with heavy and regular rainfall during the local tropical wet season. In terms of geomorphology, Malaysia has a length of coastline plus inland water bodies. The effect of tidal backwater and the overflowing of river capacity also contributed to the December 2014 flooding.

With regard to climate change and extreme weather conditions, more is expected in the future (2025-2050) as higher maximum and lower minimum rainfalls are already being recorded. The Department of Drainage and Irrigation Malaysia (DID) has reported that estimated one-hour rainfall intensity figures for the period of 2000-2007 have increased by 17% compared with the 1970s' values.

Human-induced causes have also led to this flooding event. Large-scale land use modification and high deforestation rates, obstruction of rivers, increased run off rates due to impervious urban areas, and loss of flood storage because of development into flood plains and drainage corridors have become major issues. Examples of other causes that could also contribute towards flooding are inadequate drainage systems or failure of localized improvement works to extend downstream flow, bridges and culverts being under-sized or blocked by debris build-up, disposal of solid waste, and siltation in waterways from land clearing operations.

The structural measures conducted by the Department of Drainage and Irrigation Malaysia (DID) include construction of barrages, river bunds, pump houses, diversions, ponds, river improvement works, infrastructure works, and dams. As for non-structural measures, the DID has developed a Flood Hazard Map and conducted Master Plan Studies on River Basins and Flood Mitigation, and the development of a Drainage Master Plan Study. Other measures include compliance with laws, acts, and guidelines, awareness campaigns and education programmes, flood forecasting and warning, relocation, and catchment management (development control; land preservation; and high land use management). For flood proofing, additional aspects that should be considered are the possibility of wet and dry proofing, and also regulation through building codes and practices. The main functions of flood proofing are loss reduction, structural integrity, and continuous functioning of facilities.

With regards to the December 2014 floods in East Coast of Malaysia, the DID has suggested structural and non-structural measures, especially for Kelantan state. For Nenggiri and Lebir Dams, the DID suggested using a flood diversion through Pengkalan Datu River. Other suggestions include floodwalls and levee along Kelantan River and the use of paddy planting schemes as designated flooding area for temporary storage. There is also a need to upgrade the flood monitoring and warning systems, as well as to produce flood hazard and risk maps, and implement area zoning for development planning.

Article

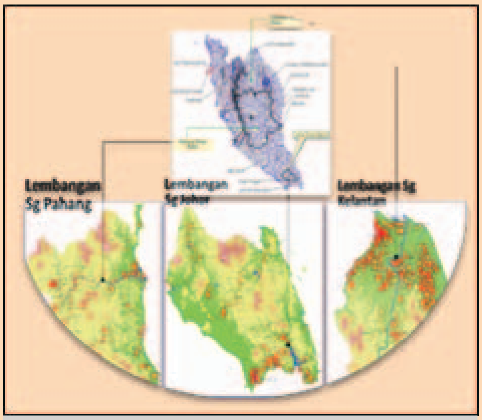


Figure 1: Atmospheric Model-Based Rainfall and Flood Forecasting (AMRFF) (Source: Wan Sulaiman, 2015).

Recent initiatives conducted by the DID which involves lead-time is using Atmospheric Model-Based Rainfall and Flood Forecasting (AMRFF) (Figure 1). This model is used for three river basins in Malaysia, which are in Pahang, Kelantan and Johor. The main objective of this model is to provide flood flow forecasting every six hours, with a three-day lead-time, at hourly time increments. The second model is Integrated Flood Forecasting and River Monitoring (IFFRM) for Klang Valley (Figure 2). The main purpose of this model is to provide forecasts for the Klang River Basin with one to four hours' lead-time. The third model used by the DID is Integrated Flood Forecasting and Warning System for the Muda River Basin (Figure 3). This is to provide flood-flow forecasting every six hours, for Sg. Muda with a two-day lead-time, at hourly time increments (Wan Sulaiman, 2015).

CHALLENGES IN FLOOD RISK MANAGEMENT

Complexity of Stakeholders

Due to the variety and diversity of stakeholders and proposals, the decision-making process on flood management is crucial. Prioritization of strategies and goals is not always the same for governmental agencies and local authorities. In other words, the implementation is not as good as analysis. The main challenge is whether efforts are coordinated, or even conflicting and resulting in the inefficient use of resources.

Complexity of Flood Causes

Flooding as a phenomenon, and by extension flood management, has an elevated degree of complexity; the causes of floods, natural or human-induced are complex. The natural causes include geographical location, geomorphology, localised continuous rainfall, tidal backwater effects, inadequate river capacity, and rainfall increase due to climate change. Climate change and land use changes are always the main human-induced causes; this includes logging, obstruction or constriction of rivers, increased run off due to urbanisation, development extension into flood plains and drainage corridors, inadequate drainage systems and failure of localised drainage, constriction of bridges and culverts, and also siltation in waterway channels from indiscriminate land-clearing operations. The risk here is that mitigation efforts often focus on a single aspect of the phenomenon with little success.

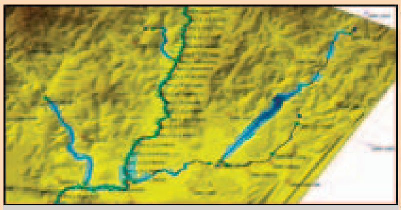



Figure 2: Integrated Flood Forecasting and River Monitoring (IFFRM) for Klang Valley (Source: Wan Sulaiman, 2015).

Figure 3: Integrated Flood Forecasting and Warning System for Muda River Basin (Source: Wan Sulaiman, 2015).

Complexity of Infrastructure Systems

It is important to have resilient cities and neighbourhoods to conserve and enhance the health of natural systems (including climate) and areas of environmental significance, and manage the impacts of climate change. Our individual and collective health is intricately tied to the health of air, water, land, and climate. How we choose to live, how we choose to move around, how we develop land, all have an impact on the quality of the air we breathe, the water we drink, and the weather we experience. Cities and neighbourhoods need to develop in a way that conserves and enhances the quality of the water flow and supply; likewise for the quality of air and land. Climate is, increasingly, a key driver for transforming our development patterns and living choices. Action on this front is imperative.

The integration between infrastructure systems and natural systems should be given close attention to increase resilience and reduce the environmental impact of infrastructure development. This integration should be aligned to deliver data, tools, and information (e.g., physical, ecological, economic, etc.) in easily accessible formats to facilitate informed action by stakeholders. This to ensure that the government can provide useful and timely technical assistance and information to enable sound leadership and decision-making. The government should also be involved with stakeholders to identify and prioritize additional data, mapping, decision-support tools, and other technical needs for recovery actions.

Improving better understanding of risks and consequences among decision-makers will help promote risk-informed decisions that consider the best available information, and future, often uncertain, changes in the natural and built environments, including the effects of climate change, land-use change, and coastal development.

Article

Evolution of flood risk management concept

The concept of flood risk management has been widely incorporated over the past decade (Figure 4). In many cases, this conceptual acceptance has resulted in changes to decision-making practices, highlighting risk management as potentially more complex, but more efficient and effective in delivering multiple goals, than a traditional engineering standards-based approach.

In particular, the development of strategic flood risk management is supporting the emergence of a longer term, catchment-wide perspective. The decision process is based on a clear trade-off on the whole life-cycle risks reduced, opportunities promoted and the resources required. In doing so, the advantages of adopting a portfolio of integrated multisector responses (including structural and non-structural measures as well as policy instruments), have since paid off.

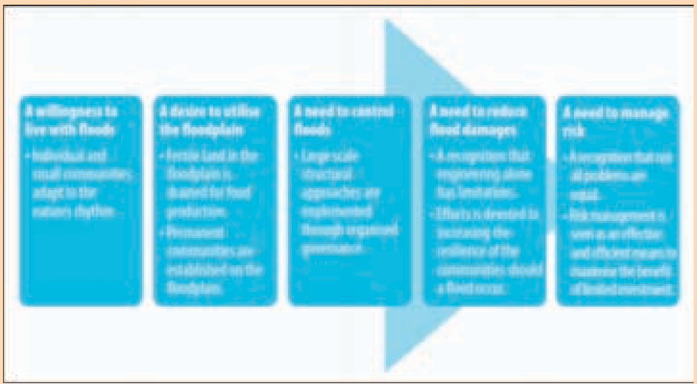


Figure 4: The evolution of flood risk management. (Source: Sayers et al, 2013)

TOWARDS AN INTEGRATED APPROACH IN MALAYSIA

Flooding, water shortage and water pollution are inter-related, and national issues. While we are blessed with such abundant natural water resources (3000mm/year on average), more than 4.5 times the world average, having too much is related to urban drainage management in Malaysia. The weather and human activities contribute towards flooding in the country. Weather events include excess water from heavy monsoon rainfall and tidal effects (supermoon), while human activities include deforestation, Time of Concentration (TC) reduction, and sedimentation.

Flash floods in urban areas have been a long-standing issue here. A rainfall of more than 100mm per day is enough to cause flooding in urban areas but not in rural or forested areas. Polluted urban rivers, sediment deposition in river channels, water supply crisis, demand for development projects are among the issues that can cause flash floods in urban areas.

Conventional drainage could not help solve these problems. Conventional design such as rapid disposal of stormwater is a conveyance-oriented approach and only tackles localised issues, and transfers the problem downstream. Therefore, Urban Storm Water Management (MSMA) developed by the DID focused on quantity and quality management strategies of stormwater management (Azazi, 2015). It monitored discharge from post-development uncontrolled run-off, pre-development uncontrolled run-off, and post-development uncontrolled run-off by detention.

Sustainable Urban Drainage System (SUDS) could be an alternative water resource. Through SUDS, the green areas can be increased, and provided treatment. Besides reduced run-offs, SUDS will also increase filtration for drainage. Therefore, through SUDS, there will be less pollution and fewer floods. SUDS also will operate more usefully, and provide more water during dry-weather flow or El Nino.

CONCLUDING REMARKS

Human-induced activities have contributed to development on flood plains, badly coordinated drainage systems, uncontrolled urbanisation, and change of land use patterns such as deforestation, which result in the restriction of river flow and reduced flood plains. Man-made factors such as development or the urbanisation of the catchment areas will increase run-offs causing flash floods and higher floods. Conventional drainage cannot help solve these problems. Thus, successful initiatives such as Urban Storm Water Management (MSMA) and Sustainable Urban Drainage System (SUDS) could become the alternatives to solving the problem of urban flooding in the future.

REFERENCES

Azazi, Z., 2015. Sustainable urban stormwater management – towards solving water security issues in Malaysia. Paper presented at CIDB Seminar on Ensuring Climate Resilience of Buildings and Infrastructure: Towards Sustainable Infrastructure, 7-8 April 2015, Kuala Lumpur.

Sayers, P., Galloway, Y. L.i, G., Penning-Rowsell, E., Shen, F., Wen, K., Chen, Y., and Le Quesne, T., 2013. Flood risk management: A strategic approach. Paris, UNESCO. ISBN 978-92-3-001159-8.

Somers, R., 2015. Flood risk management strategic planning & the relevance to Malaysia. Paper presented at CIDB Seminar on Ensuring Climate Resilience of Buildings and Infrastructure: Towards Sustainable Infrastructure, 7 April 2015, Kuala Lumpur.

Prime Minister's Office (PMO), 2015. Official statement by Tan Sri Muhyiddin Mohd Yassin, Deputy Prime Minister, at the Third United Nations World Conference on Disaster Risk Reduction, Sendai, Japan. http://www.preventionweb.net/english/policies/v.php?id=43994&-cid=105. Retrieved on 12 June 2015.

Pollalis, S.N., 2015. Planning sustainable infrastructure. Paper presented at CIDB Seminar on Ensuring Climate Resilience of Buildings and Infrastructure: Towards Sustainable Infrastructure, 7 April 2015, Kuala Lumpur.

Wan Sulaiman, W.I., 2015. Best practices in flood prevention and mitigation measures: Towards sustainable developments and environment. Paper presented at CIDB Seminar on Ensuring Climate Resilience of Buildings and Infrastructure: Towards Sustainable Infrastructure, 7 April 2015, Kuala Lumpur.

This is a report from the "Seminar on Ensuring Climate Resilience of Buildings and Infrastructure towards Sustainable Infrastructure: Towards Sustainable Infrastructure", organised by CIDB Malaysia, SEADPRI-UKM and other partners on 7-8 April 2015, at The Saujana Hotel Kuala Lumpur.

Article

Optical Sensor Based on Immobilized Nitrite−Degrading Microorganism on Acrylic Microspheres for Visual Quantitation of Nitrite

*Ling Ling Tan[1], Siti Nur Syazni Mohd Zuki[1,2], Nina Suhaity Azmi[2], Lee Yook Heng[1], Kwok Feng Chong[2] & Saiful Nizam Tajuddin[2]

[1] *Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Universiti Kebangsaan Malaysia*
[2] *Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang*
*[Email: lingling@ukm.edu.my]

Abstract: A microspheres-based microbial optosensor for NO2- ion quantitation was constructed by using immobilized Raoutella planticola (R. planticola), the bacterium expressing NAD(P)H nitrite reductase (NiR) enzyme, which was isolated from local edible bird's nest (EBN) via microbial technique. The whole cells and the lipophilic Nile Blue chromoionophore (NBC) were physically adsorbed on the self-adhesive photocurable poly(n-butyl acrylate-co-N-acryloxysuccinimide) [poly(nBA-NAS)] microspheres, whilst the reduced co-enzyme NAD(P)H was covalently immobilized on the succinimide-functionalized acrylic microspheres via peptide link to produce a reagentless nitrite biosensing system. As the microbial bio-optode responded to nitrite through colour change from blue to pink, a facile reflectometric approach was adopted to measure reflectance intensity at 639 nm, before and after reaction with nitrite at optimum pH 8. The optosensor could quantify NO2- ion concentration within a dynamic linear response range of 0.5-400 mg L-1 with a limit of detection (LOD) of 0.2 mg L-1. The large surface area to volume ratio of the acrylic microspheres allowed solid-state diffusional mass transfer of the substrate to occur at micro-bio-optode surface, and an equilibrium response was achieved within five minutes.

Keywords: Nitrite, Raoutella planticola, Edible Bird's Nest, Optode, Reflectance.

INTRODUCTION

According to the Malaysian Food Regulation (1985), the maximum permitted limit for nitrite in food is about 200 mg L-1, and the national legal limit for NO2- ion in EBN is about 30 mg L-1. The permissible level of NO2- ion in both drinking and natural waters is <10 mg L-1 as per Malaysian Ministry of Health limit, and <0.1 mg L-1 NO2- ion is advocated by the World Health Organization for drinking water (Ellis et al. 1998; Rosa et al. 2002; WHO 2011). Various analytical techniques with different detection principles for the determination of nitrite have been developed during the past 15 years. Analytical parameters such as matrix, detection limits and detection range were determined for different practical purposes. Spectrophotometric Griess test is the simplest established standard method for NO2- ion detection. The Griess diazotization method for nitrite assay has high sensitivity and can be used in measuring as low as 0.5 μM NO2- ion. Nevertheless, this method requires careful control of the pH of each reaction step and is susceptible to strong oxidants and dyeing interferences. Other traditional methods rely on the use of instruments such as gas chromatography–mass spectrophotometer (GC-MS), high performance liquid chromatography (HPLC) and ion chromatography (IC), which cannot give real-time response, is expensive, time-consuming, subject to interferences and not likely for on-site detection purposes. Therefore, it is of significant need for devices that are capable of measuring nitrite concentration in-situ, rapidly and without reagents, sample pretreatment or extraction step.

Optical NO2- ion biosensor based on cytochrome cd1 nitrite reductase immobilized in isothiocyanato controlled pore glass beads has been previously reported because of its high specificity towards NO2- ion and no cross-reactivity with other anions present in the water. The diffuse reflectance optical enzyme bio-optode showed high sensitivity to NO2- ion down to micromolar levels, and suitable to be adopted in the surveillance of potable water quality (Rosa et al. 2002). UV-Vis spectrophotometric bio-optode has also been constructed for optical NO2- ion determination by immobilizing the cytochrome cd1 nitrite reductase enzyme in sol-gel matrix on a glass substrate via dipping approach. The inert and biocompatible sol-gel immobilization support prevented partial or total loss of enzyme physiological activity, and that the bio-optode remained stable for several months (Da Silva et al. 2004).

DEVELOPMENT OF WHOLE CELL BIO-OPTODE FOR VISUAL QUANTITATION OF NITRITE ION

In this study, an optical whole cell micro-bio-optode based on Nile Blue chromoionophore (NBC) pH optode was fabricated in tandem with immobilized nitrite-degrading bacterium, Raoutella planticola (R. planticola) expressing NAD(P)H nitrite reductase (NiR) enzyme on the copolymer of N-acryloxysuccinimide-co-acrylate microspheres for NO2- ion detection. The self-adhesive succinimide-modified polyacrylate microspheres were used as the carrier matrix for NAD(P)H co-enzyme via amide covalent bond, and the bacterial cells as well as the proton selective chromoionophore were immobilized at the poly(n-butyl acrylate-co-N-acryloxysuccinimide) [poly(nBA-NAS)] microspheres surface via physical adsorption. As the NiR enzyme catalyzed the reduction of NO2- ion to ammonium hydroxide (NH4OH), the NAD(P)H cofactor was immediately oxidized to NAD(P)+. The resulting hydroxide (OH-) ions led to a large pH change of the optode microspheres film, and a colour change from blue to pink can be perceived as the immobilized NBC underwent deprotonation process, which could be quantified by reflectometric technique.

The bio-optode design and the enzymatic reaction involved in the nitrite detection is illustrated in Figure 1. The bacterial cells were attached at the surface of the copolymer microspheres in order to avoid loss of the enzyme physiological activity, and the use of three-dimensional microspheres immobilization matrix facilitated the small analytes to diffuse before reaching the biological phase. Therefore, the overall analytical performance of the proposed microbial optosensor was tremendously enhanced compared to previously reported optical nitrite biosensors based on two-dimensional substrate.

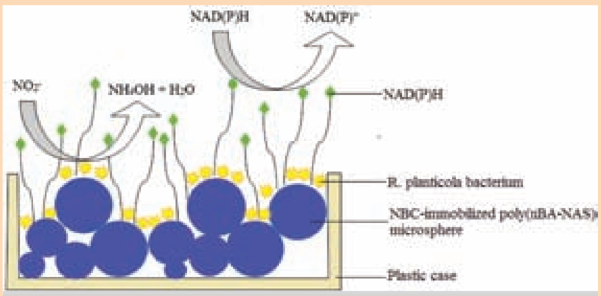


Figure 1. The schematic design of the reflectance nitrite bio-optode based on nitrite-degrading microorganism, NAD(P)H co-enzyme and NBC pH indicator co-immobilized on the surface of poly(nBA-NAS) microspheres.

Article

The microbial bio-optode in the protonated state remained blue in colour and absorbed the incident light transmitted from the feed fiber, thus attenuated the reflected light intensity from the measurand surface to the return fiber, and gave a maximum reflectance intensity at 750 nm (Figure 2). Upon exposure to 100 mg L-1 NO2- ion at pH 8, the bio-optode reflected higher light intensity at 720 nm as the immobilized chromoionophore underwent deprotonation reaction and changed to bright pink colour. This was attributed to the dissociation of H+ ion of the immobilized NBC during enzymatic reduction of nitrite to NH4OH by the immobilized nitrite-degrading microorganism expressing NiR enzyme (Alqasaimeh et al. 2007; Mi & Bakker 2000; Sooksawat et al. 2011), and that the optical whole cell bio-optode demonstrated higher reflectance response as its colour changed to a brighter one. Rather than absorb light, the pink-coloured bio-optode reflected most of the light struck on the substrate surface after partial absorption and multiple scattering within the medium. A control experiment was held by exposing the NBC-immobilized acrylic microspheres without immobilized bacterial cells and co-enzyme to the same NO2- ion concentration and pH condition, and a low reflectance intensity, which resembled the microbial bio-optode before reaction with NO2- ion was obtained due to no distinct colour change observed. The response curve of the bacterium-based bio-optode towards a wide NO2- ion concentration detection range from 0.5-600 mg L-1 in 0.1 M K-phosphate buffer at pH 8 and 639 nm shows dramatic reflectance response increment with the increasing of the NO2- ion concentration between 0.5 mg L-1 and 400 mg L-1, and the reaction became constant thereafter until 600 mg L-1 NO2- ion. At low NO2- ion concentration, the available reactive sites on the bio-optode surface were partially reacted and led to partial protonation of the immobilized NBC (blue colour). In the presence of higher NO2- ion concentration, the high enzymatic reaction rate taking part at the bio-optode surface resulted in the formation of the deprotonated bio-optode (bright pink colour). Further increasing the NO2- ion concentration up to 600 mg L-1 did not show to further enhance the reflectance signal, which indicates that the bio-functionalized micro-spheres surface has entirely deprotonated as a result of the nitrification reaction by the immobilized R. planticola bacteria. Each bio-optode response was taken at 5 min after the reaction between bio-optode and NO2- ion commenced. Figure 3 shows the visual colour change of the proposed microbial optosensor towards different nitrite concentrations. As the proposed nitrite micro-bio-optode involved visible colour change, and that the NO2- ion concentration can be determined by visual colour inspection, hence it can be used as a portable colorimetric test-kit for on-site rapid detection on nitrite levels in food and environmental samples.

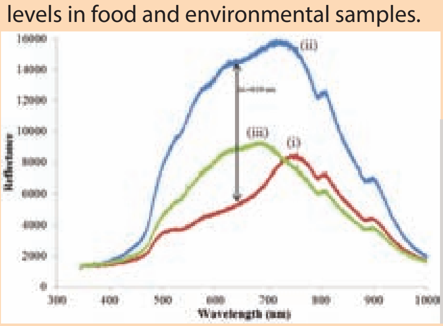


Figure 2. Reflectance spectra of the microbial bio-optode (i) before and (ii) after reaction with 100 mg L-1 NO2- ion at pH 8 and (iii) NBC-immobilized poly(nBA-NAS) microspheres without immobilized bacterial cells and co-enzyme in the presence of 100 mg L-1 NO2- ion (pH 8).

Figure 3. The visual colour change of the reflectometric microbial bio-optode towards the detection of different NO2- ion concentrations.

The effect of potential interfering ions at different concentration levels towards bio-optode reflectance response was investigated using Ca2+, Mg2+, Fe2+, Fe3+, K+, NH4+ and NO3- ions. These ions were chosen because they may co-exist with the target NO2- ion in food, water and environmental samples. The reflectometric microbial bio-optode was found to be specific to NO2- ion detection, whereby the bio-optode acquired significant reflectance response that is proportional to the increasing of the NO2- ion concentration, and showed negligible inconsistent results at low reflectance signal levels upon exposure to some other foreign ions at various concentrations (Ghauri & Thomas 1994). As the microbial bio-optode gave a three-fold higher reflectance signal towards nitrite compared to those potential interferents in the same concentration range from 10-500 mg L-1, this signifies the high selectivity of the developed bio-optode towards NO2- ion determination.

CONCLUDING REMARKS

The poly(nBA-NAS) microspheres-based microbial nitrite bio-optode showed a well-defined reflectance change at the working wavelength of 639 nm with a broad dynamic linear range from 0.5-400 mg L-1, and that high level of dilution may not be required upon in-situ nitrite screening. The average reproducibility RSD obtained at <2.0% implied that the preparation of the microbial bio-optodes were highly reproducible with the proposed fabrication method. The poly (nBA-NAS) micro-spheres-based microbial bio-optode showed facile approach for optical NO2- ion determination. The usage of R. planticola bacterium, the intracellular enzyme expression system, which can be isolated from EBN allowed the fabrication of economical sensing device. The small size of the developed bio-optode requires only small portions of analyte aliquots to affect the enzymatic reaction. As the nitrite bio-optode based on intracellular enzyme expression system involved a distinct colour change, nitrite assay by visual colour inspection would offer a more user-friendly on-site analysis measure for the surveillance of food and water quality.

REFERENCES:

Alqasaimeh, M.S., Lee, Y.H. & Musa, A. 2007. A urea biosensor from stacked sol-gel films with immobilized Nile Blue chromoionophore and urease enzyme. Sensors 7: 2251-2262.

Da Silva, S., Shan, D. & Cosnier, S. 2004. Improvement of biosensor performances for nitrate determination using a new hydrophilic poly (pyrrole-viologen) film. Sensors & Actuators, B: Chemical 103: 397–402.

Ellis, G., Adatia, I.A.N., Yazdanpanah, M. & Makela, S.K. 1998. Nitrite and nitrate analyses: a clinical biochemistry perspective. Clinical Biochemistry 31: 195–220.

Ghauri, M.S., Thomas, J.D. 1994. Evaluation of an ammonium ionophore for use in poly(vinyl chloride) membrane ion-selective electrodes: solvent mediator effects. The Analyst 119: 2323–2326.

Mi, Y. & Bakker, E. 2000. Ion binding properties of the lipophilic H+ chromoiono-phore ETH 5294 in solvent polymeric sensing membranes as determined with segmented sandwich membranes, Electrochemical and Solid State Letters 3: 159–161.

Rosa, C., Cruz, H., Vidal, M. & Oliva, A. 2002. Optical biosensor based on nitrite reductase immobilised in controlled pore glass. Biosensors and Bioelectronics 17: 45–52.

Sooksawat, D., Aeungmaitrepirom, W. & Ngeontae, T. 2011. Tuntulani, Logic gates from ion-selective bulk optodes. New Journal of Chemistry 35: 345.

WHO. 2011. Nitrate and Nitrite in Drinking-water. World Health Organization. URL: (http://www.who.int/water_sanitation_health/dwq/chemicals/ni-tratenitrite2ndadd.pdf) (access: January 2015).

This is an abbreviation of the article published in Sensors and Actuators B: Chemical. Further information can be found at https://-doi.org/10.1016/j.snb.2017.09.102

Research Note

Advancing Subsurface Development for Sustainable Futures

Elanni Affandi[1], Ng Tham Fatt[1] & Ferdaus Ahmad[2]

[1] *Department of Geology, Faculty of Science, Universiti Malaya*
[2] *Department of Mineral and Geoscience Malaysia*

The workshop on Urban Geology of Kuala Lumpur was held on 23-24 January 2018 at The Everly Putrajaya, Malaysia. The event was jointly organised by the Department of Mineral and Geoscience Malaysia (JMG), British Geological Survey (BGS) and SEADPRI-UKM in collaboration with the Newton-Ungku Omar Fund (NUOF) Project Partners. Sixty participants from various local agencies came together to share knowledge and discuss current issues on subsurface geology for the future development of Kuala Lumpur. The attendees included those from JMG, Kuala Lumpur City Hall (DBKL), Universiti Kebangsaan Malaysia (UKM), University of Malaya (UM), Universiti Tenaga Nasional (UNITEN), University of Nottingham Malaysia, Public Works Department (JKR), PlanMalaysia and Selangor Housing and Real Property Board, among others. The workshop commenced with an opening session followed by a technical session and two training sessions where participants were able to gain in-depth knowledge on this subject.

The ultimate aim of this joint-workshop under the JMG-BGS Official Development Assistance (ODA) Project: Geoscience for Sustainable Futures is to construct the framework and lay the foundation for the Kuala Lumpur Urban Geology project. This workshop initiated the tentative project where they focus on sharing knowledge and good practices in relation to data acquisition, management and delivery, 3D modelling and geoscience communication. The workshop commenced with welcoming remarks delivered by YBhg. Dato' Shahar Effendi Abdullah Azizi, the Director General of JMG. The official opening was graced by YBhg. Datuk Ir. Dr. Haji Hamim bin Samuri, Deputy Minister at the Ministry of Natural Resources and Environment Malaysia (NRE). The BGS-ODA programme on Geoscience for Sustainable Futures: Resilience of Asian Cities supports the creation of an Asian urban hub of good practices and guidance, underpinned by a series of 'lighthouse' and 'follower' city studies to share and integrate learning where it supports four sustainable development goals, and covers three cities in Asia: Kuala Lumpur, Hanoi and Bangalore/Amaravati. Kuala Lumpur is selected as a `lighthouse' city study as a "Platform for Subsurface Development" (Smith, 2018).

The KL Urban Geology project focuses on Kuala Lumpur as the pilot under the aegis of the City Hall of Kuala Lumpur (DBKL). DBKL being one of the main project partners is the key end-user of the project. Currently, there is a gap in communication and understanding between geoscientists and decision-makers (planners, engineers, policy-makers) regarding the subsurface. DBKL has several ongoing projects that will become the pillar of KL urbanization, focusing on economic growth, urban growth and urban transit in realising their vision to become a first class, equitable and sustainable city by 2020 (Mohd, 2018). However, the high demand for land use and urban activities to support the growing city's population continue to exert stress as space becomes more limited. The alpha world city could live up to its maximum potential only by delivering an integrated, multidisciplinary approach to the use of underground space to support the rate of urbanization we see today. To address the concerns of DBKL, especially in relation to the priority needs on the city's future development, the urban subsurface itself should be a central component of Kuala Lumpur's plans for a sustainable and resilient future city.

This pioneer project in Malaysia aims to highlight issues regarding the subsurface by exploring, promoting and improving the use of subsurface urban planning where ground risk could be minimized due to unforeseen ground conditions. The outcome would help to provide vital information for spatial planning policy while increasing the awareness of decision-makers regarding the subsurface environment. The mapping exercise conducted during the workshop was helpful to get the ball rolling. The main idea was to produce a mind map of linkages that represent responsibilities, collaborations and influence the potential partners have on one another, and to explore the interactions between pressures, stresses and opportunities that can be used to frame an integrated project in relation to the subsurface of Kuala Lumpur. Essentially, the idea of developing the subsurface in Kuala Lumpur could then be a priority for developers, given that proper and effective planning to build a sustainable city is done where both the surface and subsurface planning are harmoniously executed.

Overall, the participants were content with the outcomes of the workshop and have generated new collaborations beyond the project. Various subsurface-related challenges and opportunities were discussed in an open and integrated way during this workshop, which enabled the team to generate ideas for the project development while working towards the implementation of the city's vision for 2020. The event has instilled awareness and provided ample knowledge of the subsurface geology of Kuala Lumpur whilst promoting better communication between subsurface specialists and non-experts.

Reference

Mohd, M.N, 2018. A Future Vision for Kuala Lumpur. Presentation Slides, Workshop on Urban Geology of Kuala Lumpur, 23 March 2018, The Everly Putrajaya, Malaysia.

Smith, M., 2018. Geoscience for Sustainable Futures: Developing Resilience in Asian Cities. Presentation Slides, Workshop on Urban Geology of Kuala Lumpur, 23 March 2018, The Everly Putrajaya, Malaysia.

Climatic Hazards Programme

International Conference on Atmospheric Chemistry and Climate Change 2018

Azliyana Azhari[1], Murnira Othman[2] & Mohd Talib Latif[2]
[1] SEADPRI-Universiti Kebangsaan Malaysia
[2] Faculty of Science and Technology, Universiti Kebangsaan Malaysia

Professor Dr Peter Brimblecombe giving his keynote speech.

Held at Pusat Siswazah, Universiti Kebangsaan Malaysia (UKM) on 27-28 March 2018, the International Conference on Atmospheric Chemistry and Climate Changa (ICACCCA 2018) was jointly organised by SEADPRI and Institute for Environment and Development (LESTARI) UKM, and supported by the Asian Network on Climate Science and Technology (ANCST) with collaboration from the Faculty of Science and Technology (FST) UKM, Institute of Climate Change (IPI) UKM, Institute of Ocean and Earth Science (IOES) University Malaya, Meteorological Department of Malaysia (MetMalaysia), Department of Environment (DOE) Malaysia, and Monsoon Asia and Oceania Networking Group (IGAC-MANGO). The ICACCCA 2018 was attended by 130 participants from Malaysia, Singapore, Thailand, Indonesia, Taiwan, Pakistan, Bangladesh, Japan, United Kingdom and United States of America. They comprised researchers, academicians, members from government agencies and private sectors, and students. It was organised to provide an opportunity to share knowledge and expertise in atmospheric composition and climate change research.

The two-day conference hosted three keynote speakers, 30 oral presentations and 20 posters with discussions on topics including emissions and pollutant composition, greenhouse gases, tropospheric ozone, biomass burning episodes, sea-atmosphere interaction, effects of pollution on regional weather and climate, long-range transport of atmospheric pollutants, air pollutants and climate change, and the health and legal aspects of atmospheric composition and climate change.

The three keynote speakers were Professor Dr. Peter Brimblecombe (Hong Kong City University), Professor Dr. Fredolin Tangang (UKM) and Dr. Hiroshi Tanimoto (National Institute of Environmental Studies, Japan). Prof. Dr Peter Brimblecombe's address was entitled Effects and Changes in Emission and Climate on Air Pollution; it covered the importance of the relative balance between pollutant emissions and climate in which there would be a need to examine a complex pattern of change that can override earlier generalised claims that pollutants will necessarily increase in the future. Prof. Dr. Fredolin Tangang spoke on Climate Change and Climate Variability: From Global to Regional on Science, Impacts, Solutions and Challenges and highlighed key findings of the Fifth Assessment Report (AR5) of the Inter-governmental Panel on Climate Change (IPCC) on the science, impact and mitigation efforts required to halt and slow down climate change, and what actions the country must take to avoid severe impacts in the future. Dr. Hiroshi Tanimoto delivered on Atmospheric Chemistry Research and International Collaborations: The International Global Atmospheric Chemistry (IGAC) Project and the IGAC Monsoon Asia and Oceania Networking Group (MANGO). He discussed the IGAC MANGO aims to enhance communication and collaborations between scientists, and explore opportunities for funding and infrastructure to foster scientific research, capacity building, and regional collaborations.

The oral presentations were divided into six sessions involving researchers from various backgrounds. They included Dr. Warradorn Phairuang (Prince Songkhla University, Thailand), Dr. Shani Tiwari (Nagoya Universiti, Japan) and Dr. Paul Griffith (Cambridge University, UK). The involvement of young scientists and postgraduate students from various countries and institutions including India, Japan, Thailand and Malaysia in the oral and poster presentations was encouraged, giving them the opportunity to introduce their research work. It was a good platform for the young researchers to discuss and collaborate with researchers from other countries. At the end of the conference, a panel discussion was moderated by Prof. Dr. Joy Jacqueline Pereira, ANCST Director and Principal Fellow of SEADPRI with panelists Dr. Hiroshi Tanimoto, Dr. James Crawford (NASA Langley Research Centre) and Prof. Dr. Abdus Salam (University of Dhaka, Bangladesh). The discussion focused on the future of atmospheric sciences and climate change research, and how environmental matters are a shared problem among countries in the same region. It was agreed that the collaboration of researchers, young scientists and resources are crucial for understanding and resolving this issue.

As atmospheric composition and climate change effects are not limited to the environment alone, a more holistic approach in discussing the impact of environmental issues on other risks including health and exposures, is necessary. It all comes down to the implementation of research into policies and collaboration between researchers from different backgrounds. ANCST as a virtual platform for Asian scientists, can bring together all the cohorts of atmospheric chemistry and climate change in the region to address this common goal.

Geological Hazards Programme

Disaster Resilient Cities: Landslide and Karst Susceptibility Assessment

Nurfashareena Muhamad
SEADPRI-Universiti Kebangsaan Malaysia


Photo by Mohd Faizol Markom

Dr. Helen Reeves, Dr. Christian Arnhard and Dr. Vanessa Banks ***(front row, left table)*** shared their experience at the workshop.


Photo by Mohd Faizol Markom

Group discussion led by Dr. Vanessa Banks on Kuala Lumpur Limestone Karst Conditioning.

On 1 March 2018, a workshop on Landslide and Karst Susceptibility Assessment was held at the Pulse Grande Hotel, Putrajaya. It was jointly organised by the Geological Society of Malaysia (GSM), SEADPRI-UKM and other Newton-Ungku Omar Fund (NUOF) project partners. The 67 participants were from various local organisations like the City Hall of Kuala Lumpur (DBKL) and State Disaster Management Unit of Selangor, as well as geoscientists from Universiti Kebangsaan Malaysia (UKM), University of Malaya (UM), Universiti Tenaga Nasional (UNITEN), and Institute of Geology Malaysia (IGM). Also present were representatives from the private sector.

This one-day workshop was split into two main sessions: the Landslide Hazards and Karstic Hazards sessions. They were led by NUOF project members from British Geological Survey (BGS) and covered the processes that cause landslides and karstic hazards in Kuala Lumpur as well as the experiences and methodologies applied in countries such as the UK. The event commenced with a presentation from Dr. Christian Arnhardt of BGS with an overview of the languages used, terminologies and definitions in the context of landslides, susceptibility, hazards and risks. The presentation highlighted different susceptibility and hazard assessment methods which are dependent on the scale of study, the availability of data and the data quality. This was then followed by the Malaysian approach presented by Dr. Frederick F. Tating from the Department of Mineral and Geoscience Malaysia.

The Landslide Hazards session led by Dr. Helen Reeves and Dr. Christian Arnhardt of BGS revolved around landslide inventories and methodologies of landslide susceptibility in different countries including the UK. The first part of the session emphasized the comprehension of landslide types and triggers as well as the importance of the inventories. This was followed by a fruitful discussion on the Malaysian landslide inventories, exploring the similarities and differences between UK and Malaysia, ways of utilizing the NUOF project to decide on a suitable methodology for Malaysia as well data sharing and planning in in this country. The second part of this session described the methodologies developed by BGS to define and assess the landslide susceptibility. The importance of dividing mapped areas into different geological formations and processes that drive landsliding was proven through the effectiveness and applicability of the BGS GeoSure methodology at the UK national scale. A Q&A session followed which addressed the opinions and issues of the scale of study, and methods used for landslide susceptibility assessment.

Dr. Vanessa Banks of BGS led the Karst Hazards Session which centered on karst terminology, processes, karst event inventories and methodologies for karstic hazard assessment and susceptibility. A case study of the Peak District was presented to show ground conditions of surface and subsurface karst, and hazard assessment of the area. Participants were divided into four groups for a brief discussion on the karst processes and hazard assessment for Kuala Lumpur. The discussion has enabled participants to exchange knowledge on the processes and conditioning factors for the karst of Kuala Lumpur Limestone as well as the quality of available maps to assess the relationship of karst and structures. The last part of this session briefly discussed the karst inventories and the BGS approaches for karstic hazard susceptibility which include the domains approach and the GeoSure methodology. Participants highlighted many issues and made suggestions on the karst hazard susceptibility assessment. These include an overview of the extreme and complex classification of karst in Malaysia, the limitations in interpreting the relationship between karst and structures, as well as the importance of karst hazard susceptibility maps. The workshop concluded with a fruitful gathering of issues involved and recommendations on how to move towards the production of reliable landslide and karstic hazard susceptibility maps. This will advance the work of the Geological Hazards Programme in support of disaster risk reduction.

Technological Hazards Programme

Sustainable Agriculture and Chemical Hazards in Agricultural Commodities

Tan Ling Ling

SEADPRI-Universiti Kebangsaan Malaysia

Agricultural applications such as insecticides, herbicides, fungicides, algicides, etc. as crop protection products may put individuals at risk of health effects from pesticides. ***(Google Image)***

The effects of climate change on our ecosystems are already severe and widespread. Ensuring food security in the face of climate change is one of the more daunting challenges facing humankind. How are we going to feed 9.3 billion people in 2050 as climate change depletes available land and water? How to produce more food with fewer resources?

Sustainable agriculture can make a vital contribution to ensuring food security. In simple terms, sustainable agriculture is the production of food, fibre or other plant or animal products using farming techniques that protect the environment, public health, human communities and animal welfare. The aims of sustainable agriculture include producing safe and healthy food, conserving natural resources, ensuring economic viability, delivering services for the ecosystem, improving quality of life in farm lands and ensuring animal welfare.

Food security is not just about producing enough rice; it covers the need for safe and nutritious foods. Advancing sustainable agriculture for production of safe, quality and affordable food will require investing more in monitoring agricultural and food systems. The major inputs of heavy metals (e.g. lead, cadmium, arsenic, mercury) into agricultural systems are fertilizers, organic wastes such as manures and industrial by-products which are toxic to wildlife, livestock, and humans. Besides, agricultural applications such as insecticides, herbicides, fungicides, algicides, etc. as crop protection products may also put individuals at risk of health effects from pesticides. The use of antibiotics in poultry production has significantly increased animal health by lowering mortality and the incidence of diseases. Antibiotics also have largely contributed to increased productivity of farms. However, the antibiotic usage as feed additives for poultry are associated with antibiotic resistance mechanisms in humans and animals that can easily be spread within microbial communities.

The monitoring of human exposure to various chemicals via food intake is traditionally performed by lab-based methods. Although highly reliable, lab-based methods very often are costly, require skills to execute and not to mention that they are time consuming. Traditional traceability of chemical contaminants in agricultural produce rely, to a high degree, on the use of laboratory-scale instruments such as gas chromatography–mass spectrophotometer (GC-MS), high performance liquid chromatography (HPLC) and ion chromatography (IC), fourier transform infrared spectroscopy (FTIR), inductively coupled plasma atomic emission spectrometry (ICP-AES), inductively coupled plasma mass spectrometry (ICP-MS), sequential injection analysis (SIA), etc. which are unlikely to provide real-time response. Therefore, there is a significant need for devices capable of carrying out in situ rapid assessment of chemical contaminants in agricultural products without the use of reagents, sample pre-treatment or extraction step along the food chain from the farm to the consumer.

There are now very limited resources for enforcement bodies on food contaminants to totally ensure that humans are not overly exposed to toxic chemicals via food because the use of chemicals in foods is ever increasing. Chemosensor and biosensor techniques have been extensively explored alongside with the increasing demand for fast response on-site analysis in order to replace the conventional instrumental methods. These portable devices allow rapid and on-site testing of food quality, especially for a simple and rapid assessment of food contaminants. The creation of such new technology will enable the consumers to participate directly in food quality monitoring. The outcome will lead to more participation of consumers in food safety surveillance and hence more efficient control in human exposure to food contaminants. The direct participation of the stakeholders will ensure that the maintenance of food safety is sustainable. The Technological Hazards Programme is exploring an initiative to advance chemosensor and biosensor techniques to facilitate monitoring of human exposure to chemical pollutants via food intake.

Activities

Kesedaran Hak Harta Intelek

Tan Ling Ling & Mohd Faizol Markom
SEADPRI-Universiti Kebangsaan Malaysia

Bengkel Kesedaran Hak Harta Intelek telah diadakan pada 19 Julai 2017 di Bilik Mesyuarat LESTARI, Institut Alam Sekitar dan Pembangunan (LESTARI), UKM Bangi.

Program Bencana Teknologi, Pusat Kajian Bencana Asia Tenggara (SEADPRI-UKM) dengan kerjasama Pusat Inovasi Kolaboratif (PIK), UKM telah menganjurkan bengkel kesedaran hak harta intelek pada 19 Julai 2017 bertempat di Bilik Mesyuarat LESTARI, Institut Alam Sekitar dan Pembangunan (LESTARI), UKM. Tujuan bengkel ini diadakan adalah untuk memberikan pendedahan kepada Warga LESTARI terhadap sistem e-Intellectual Property Rights (e-IPR) dan reka cipta/hasil penyelidikan yang boleh dilindungi di bawah pelbagai kategori harta intelek. Di samping itu, penyertaan juga dialu-alukan kepada semua kakitangan bukan akademik yang ingin menambah ilmu pengetahuan mengenai pengurusan harta intelek yang akan ditawarkan pada bengkel ini.

PIK merupakan pejabat pemindahan teknologi UKM. Objektif pejabat PIK termasuk memangkinkan inovasi dan menjana nilai dari harta intelek yang dihasilkan dari penyelidikan. Ia berfungsi menguruskan perlindungan harta intelek, pembangunan produk, pemindahan teknologi dan pengkomersilan harta intelek UKM yang melibatkan kolaborasi dengan fakulti/institut/pusat di UKM serta lain-lain organisasi di luar UKM.

Ejen harta intelek, Encik Muhd. Irfan Mustaqim Awang dari Pro IP Sdn Bhd telah dijemput sebagai penceramah untuk menyampaikan taklimat berkaitan kesedaran hak harta intelek kepada Warga LESTARI. Skop taklimat tersebut termasuk bagaimana Pro IP Sdn Bhd melindungi harta intelek dan penjelasan mengenai jenis perlindungan harta intelek. Sesi ceramah tersebut kemudiannya diikuti dengan taklimat oleh Pegawai Inovasi dari PIK mengenai pengenalan kepada sistem e-IPR dan cara untuk mendaftarkan harta intelek melalui sistem di atas talian.

Activities

The Sendai Framework Monitor – Inaugural Training in Malaysia

Mohd Khairul Zain Ismail[1], Bibi Zarina Che Omar[2] & Che Siti Noor Koh Poh Lee @ Che Mamat[2]
[1]*SEADPRI-Universiti Kebangsaan Malaysia*
[2] *National Disaster Management Agency, Prime Minister's Department*

Participants at the workshop, inaugurated by the Director General of NADMA Malaysia, were mainly from agencies and ministries.

Together with technical support from SEADPRI-UKM and the United Nations International Strategy for Disaster Reduction (UNISDR) Asia & Pacific Regional Office, the National Disaster Management Agency in the Prime Minister's Department of Malaysia (NADMA Malaysia) successfully organised the Sendai Framework Monitor (SFM) Orientation and Training Workshop on 19-20 March 2018, at Puri Pujangga, UKM Bangi. It was inaugurated by YBhg. Dato' Abdul Rashid Harun, Director General of NADMA Malaysia. The participants were mainly from agencies and ministries that were identified previously during the National SFDRR Readiness Review Workshop held on 6 March 2017, as a lead for data custodian and proxy agencies according to the Sendai Framework indicators. The workshop was conducted by the honorary guest Mr. Timothy Wilcox, Programme Officer for Asia and Pacific, UNISDR Asia and Pacific Regional Office.

The workshop was the first national training conducted using the Sendai Framework Monitor (SFM) System in the world, since its inauguration on 6 December 2017 by UNISDR. This workshop was designed purposely for Malaysia to learn about the current work on the SFM System and its data entry, analytical capabilities as well as its application at the global, regional, national and local levels, in achieving the Global Targets of the Sendai Framework. This will enable all the relevant agencies in the country to support NADMA Malaysia as the country's focal point for reporting progress at the global platform in implementing the Sendai Framework.

The first cycle of the SFM reporting started on 1 March 2018. It focused on disaster data for the year of 2017 for Target A to Target E only. A snapshot of the first SFM cycle reporting in 2018 will be presented to the High-Level Political Forum on Sustainable Development (HLPF) to be held in July 2018.

Activities

Science and Technology for Disaster Risk Reduction

Mohd Khairul Zain Ismail[1], Bibi Zarina Che Omar[2] & Joy Jacqueline Pereira[1]

[1]SEADPRI-Universiti Kebangsaan Malaysia
[2] National Disaster Management Agency (NADMA), Prime Minister's Department

The Sendai Framework emphasizes the role of science and technology in reducing disaster risks. The Framework prioritizes the development and dissemination of science-based risk knowledge, methodologies and tools on DRR through existing networks and platforms. It also seeks to strengthen research institution interface between science and policy nexus at local, regional and global platform, to support four priority areas as underlined under the Sendai Framework.

The Second Asian Science and Technology Conference for Disaster Risk Reduction (ASTCDRR) was held on 17-18 April 2018 at Xinhai Jin Jiang Hotel, Beijing, China. The two-day conference provided an opportunity to the science, research, academia community in Asia to continue the much-needed science-policy dialogue to ensure that implementation of DRR measures at all levels are soundly based on science and technology. It was organised by UNISDR with support from IRDR and other partners with aims to renew the commitment to the accelerated implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 as the pivotal means to achieve the goals of sustainable development and resilience. The conference generated an outcome document, which reaffirmed the importance of the 12 actions identified in the First Asian Science and Technology Conference for Disaster Risk Reduction, which was held at Bangkok, Thailand in 2016.

Prof. Dr. Joy Jacqueline Pereira of SEADPRI-UKM was invited to deliver a keynote paper entitled Science, Technology and Innovation for Implementing the Sendai Framework and Bridging Disaster Risk Reduction to Climate Change Adaptation at this conference. Almost 300 experts and scholars from Asia, with 20 different stakeholders from 225 different countries and regions, seven UN agencies and almost 150 research institutes attended the event.

Typhoon Risk Assessment for Coastal Cities

Fasihah Mohd Yusof

SEADPRI-Universiti Kebangsaan Malaysia

SEADPRI-Forum 2018 was held on 14 May 2018 at Puri Pujangga, UKM Bangi. This forum is an annual flagship event of SEADPRI-UKM. Titled Typhoon Risk Assessment for Coastal Cities, the forum was delivered by Professor Johnny Chan from City University of Hong Kong. The topic was chosen primarily to share experiences and showcase beneficial methodology regarding the impact-based hazards modelling in other countries, especially in China. A total of 20 participants comprising meteorology officers from the Meteorological Department of Malaysia (MetMalaysia) and graduate researchers attended. The forum commenced with warm welcome remarks by Associate Professor Dr. Sarah Aziz Ghani Aziz, Chair of SEADPRI-UKM and was moderated by Mr. Muhammad Helmi Abdullah, Director of Research and Technical Development at MetMalaysia.

Prof. Johnny Chan began his presentation with an overview of the catastrophic typhoon events in China. He described how Typhoon Hato had badly impacted Macau in August 2017 resulting in casualties and severe infrastructure damage. Heavy rains with strong winds coupled with a storm surge had amplified the severity of the damage in most of the coastal areas. About a year before this incident, in September 2016, Typhoon Meranti, a Category 5 typhoon, had affected many major coastal cities, especially in China; this region suffered a total economic loss of more than USD$1 billion. Prof. Johnny Chan also briefly discussed the magnitude and severity of Typhoon Rammasun that hit China and Philippines in 2014. Severe property damage, economic loss as well as innumerable casualties were left in the wake of typhoons experienced by many regions for decades. As a result of all this, Prof. Johnny Chan pointed out that the idea of building a disaster-resilient city has now come under the spotlight. The ability of a city to respond to any natural disaster and how fast they can recover from post-event consequences are fast becoming major concerns in typhoon risk assessment, especially for resilience factors. Other important attendant factors such as potential exposure and vulnerability also have to be taken into consideration in typhoon risk index development.

He also spelt out that to quantify the risk, researchers can consider other factors such as strong winds, heavy rains and storm surges as sources of damage caused. In issuing potential exposure factors, Prof. Johnny Chan further elaborated that the Destructive Potential Index, DPI, was developed using the maximum wind velocity in cubic unit to quantify the risk in a more easy-to-understand and universal method for classifying typhoon events. Participants of this forum were then enlightened on the spatial distribution methodologies using Geographical Information System (GIS) platform to visualize the index developed from the typhoon risk modelling. A very informative display of the typhoon risk map along China's coastline, such as in Guangdong, Fujian, Zhejiang, Jiangsu and Shandong, were accurately presented in a very interactive and eye-catching manner.

Prof. Johnny Chan critically discussed and answered enquiries raised with a note that although Malaysia is not a typhoon-prone country, methodologies presented could be very beneficial towards an implementation of other related climatological hazard risk assessments in Malaysia. He also suggested that the models developed by his team could be subjected to any necessary amendment to customize and accommodate Malaysia's social, institutional and climatological status. In a nutshell, this forum has enabled participants to gather knowledge, understand issues as well as recommendations better, so as to move towards the production of reliable hazards risk assessment studies in Malaysia.

Third Asian Science and Technology Conference for Disaster Risk Reduction to be hosted in Kuala Lumpur in 2020

Mohd Khairul Zain Ismail[1], Bibi Zarina Che Omar[2] & Joy Jacqueline Pereira[1]

[1] SEADPRI-Universiti Kebangsaan Malaysia
[2] National Disaster Management Agency (NADMA), Prime Minister's Department

Asia's science, technology and academia community met during the First Asian Science and Technology Conference for Disaster Risk Reduction (ASTCDRR) held in August 2016 in Bangkok, Thailand. The First ASTCDRR was organised by the Hydro and Agro Informatics Institute (HAII) of the Royal Thai Government, UNISDR, Ministry of Science and Technology of Thailand, Asia Science and Technology Academia Advisory Group (ASTAAG), Integrated Research on Disaster Risk (IRDR), Future Earth and other scientific organizations and networks. The recommendation of the conference were presented at the 2016 Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) held in New Delhi, India. Here, they agreed to hold such a conference every two years, before the Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR). The ASTCDRR is held to ensure that science and technology has an influence on the implementation and monitoring of the Sendai Framework on Disaster Risk Reduction (2015) in Asia.

Photo by Lim Choun Sian

YBhg. Dato' Muhammad Yusuf Wazir delivered the next host country remarks during the closing ceremony at the 2018 ASCTDRR in Beijing.

The Second ASTCDRR was held in April 2018 in Beijing, China. The event was organised by the Expert Committee of National Commission for Disaster Reduction and Ministry of Civil Affairs of the People's Republic of China, Beijing Normal University, ASTAAG and UNISDR. The aims were to review progress on the outcome of the first conference as well as to assess the implementation of the Sendai Framework priorities with science and evidence-based approach. The findings of the conference will be presented at the 2018 AMCDRR in Ulaanbaatar, Mongolia on 3-6 July 2018.

At the closing ceremony of the Second Conference, the Deputy Director General of NADMA Malaysia YBhg. Dato' Muhammad Yusuf Wazir, announced that the Third Asian Science and Technology Conference for Disaster Risk Reduction will be held in Kuala Lumpur, Malaysia in 2020. The 2020 ASTCDRR will be organised by NADMA Malaysia, Scientific Expert Panel on Disaster Risk Reduction (SEP), SEADPRI-UKM, Asia Science and Technology Academia Advisory Group (ASTAAG) and UNISDR.

10th Anniversary 2008-2018
IRDR ICoE
seadpri
southeast asia disaster prevention research initiative

Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM)
Universiti Kebangsaan Malaysia (UKM), 43600 UKM Bangi, MALAYSIA
Tel : +603 8921 4852/4853 Fax : +603 8927 5629 Email : seadpri@ukm.edu.my Website : www.ukm.my/seadpri

ISSN 2180 - 1142
9 771985 988003