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Research paper

A Review of Key Activities in Hydro Meteorological Disaster Management

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Abstract

One of the most highlighted issues in the developing world of the 21st century is the hydrometeorological disasters. Developed and developing nations are all affected by the more prominent climate change. There has been a rise in disaster occurrences over the past decade that this has caused more attention to be given to the topic of disaster management especially to floods. The scale of these disaster events has also intensified and have broken past records with more destructive disasters. This paper intends to review the activities related to hydrometeorological disaster. Key activities are broken down into three different phases, namely pre-disaster, during disaster and post-disaster. Understanding the activities involved is pertinent to not only the lead agencies and non-governmental organizations but plays a bigger role for the vulnerable communities. In the past, communities were the last group to be participative in disaster risk reduction efforts. Today, communities are being engaged from early stage to empower them to be resilient towards the possibility of facing future flood disaster. Evacuation planning and logistics arrangement are key activities prior to the occurrence of any disaster which will ease the implementation of search and rescue operations. However during disaster, it is important for the early warning system to be functioning to alert the affected communities. People also need to be aware of the outbreak of diseases during flood disaster. Finally, post-disaster efforts focuses more on the restoration of damaged infrastructure as well as the mental state of the affected victims. Understanding these key activities will increase the awareness of stakeholders in reducing loss of life and minimizing damages towards properties.

Keywords: *Activities; Disaster; Flood; Hydrometeorological*

1. Introduction

Disaster can happen anywhere and at an unpredictable time. There is no way to predict when the next disaster will strike, but preparing for a disaster is very likely [1]. When a disaster happens, victims will have needs that are needed to be taken care of urgently. This is why disaster management is important for management teams to be readily equipped to deliver necessities quickly and efficiently. Malaysia is a fortunate country to be situated geographically away from the Pacific Ring of Fire [2]. This means that Malaysia is safe from many natural disasters such as volcano eruption, earthquakes and typhoons. However, Malaysia is not a disaster-free nation and is still plagued with hydrometeorological disasters such as flooding and droughts [3]. In fact, almost every year Malaysia have been preparing for the monsoon season that often leads to heavy rainfall and potential flash floods. Past occurrences have caused huge amounts of property damages as well as loss of lives. These events can big negative impact on the nation's economy as well as the sway of confidence of the people towards the government.

With that said, more funding is being allocated to disaster management to lessen the negative effects of flooding in Malaysia [4]. There has also been an increase in government and NGOs activities in assuring supplies and help are ready to be mobilized to flood victims. In an event of a disaster, the coordination of flood relief workers, medical and food suppliers are vital in assuring the basic needs of victims are being provided. There must also be a coordination between the first responders, emergency management personals and public officers to support emergency activities [5]. Additionally, instead of giving additional helping hands, uncoordinated volunteers could possibly cause obstruction of relief works. An unorganized disaster management system would also cause prolonged save and rescue operation that will correlate with the increase in expenses [6]. Therefore, a balanced ground should be identified in order to minimize the damages caused by the disaster and to maximize the efficiency of disaster relief activities. Despite all these coordinated efforts are in place, affected community seems to be less knowledgeable on the surrounding issues related to facing disaster in Malaysia. Hence, any preparation and planning programs conducted by lead agencies and non-governmental organizations should include community as part of stakeholders in order to better empower them to be resilient when disaster strikes. It is envisaged that collaboration between these parties will contribute towards reducing the number of fatalities during a disaster. Therefore, a comprehensive understanding of the phases involved prior, during and post disaster are important to educate what should be done and how to get things done for the greater cause of saving the vulnerable population.

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2. Definition of Hydrometeorological Disaster

Hydrometeorological disaster is defined as a hydrological and meteorological phenomenon that involves an energy and water transfer between land and the lower atmosphere [7]. Some of the common hydrometeorological disasters include events such as floods, tropical storms and droughts. A flood is often associated with water that submerges land as a result of overflowing of water bodies. This can be the result of excess inflow of water from precipitation, melting of ice or obstruction of water flow. Tropical storms are fast moving rotating systems with a low-pressure centre, strong winds; spiral arrangement of thunderstorms accompanied by heavy rain and occurs at low-level atmosphere. This occurrence is usually due to difference in air pressure and wind movement that have intensify with recent global warming. Droughts occur when there is lack in precipitation or presence of water for an extended period. Droughts are also caused by increase in global temperature that aids evaporation and air movements that chases away rain clouds. Malaysia has been witnessing worsening floods over the past decade. With the increase in the severity of these disasters, many researchers have looked into ways to improve and prepare for the next flood disaster [8, 9]. The UN International Strategy for Disaster Reduction 2007 states that the concept of disaster risk reduction is a practice to minimize disaster risk by using systematic efforts to investigate factors that cause disaster. These factors are to reduce hazard exposure, reduce the vulnerabilities of property and people, land and environmental management, and improve preparedness for disaster [10]. This disaster risk reduction strategy has changed over the years but the core plan has persisted. In Malaysia, Malaysian Red Crescent Society (MRCS) has established a Disaster Management Centre in Kuala Lumpur together with three other sub-centres in Penang, Kota Bharu and Johor Bharu [11]. These centres are equipped with personals and equipment that are ready for emergencies.

3. Occurrence of Flood Disaster

Floods are the most common hydrometeorological disaster known to mankind, but yet being the most devastating and costly disaster [12]. The causes of this event is usually due to heavy or prolonged rain. The rain causes the ground to be saturated and a flash flood can occur suddenly when water are unable to disperse on the surface [13]. To make matters worse, urbanization have made many concrete jungles, making surface runoff even more prominent [14]. Development have also increase the rate of deforestation that leads to more occurrences of soil erosion and mudslides [15].

A flood could come in many different forms. Flash floods are floods that occur within six hours from a large volume of excess water [16]. This can be sourced by heavy rainfall, tropical cyclones, river obstruction or even dam failure. River floods on the other hand is due to a catchment of water not able to cope with a rising amount of water [17]. Sources of this could be rainfall, melting of ice, landslides or even dam failure. This type of flood can continue for few days or even weeks. The third type of flood is costal floods. Costal floods are mainly from cyclonic activities such as hurricanes or tropical cyclone [18]. These types of flood are cause by strong winds and waves that pushes water bodies inland. Another type of flood is the urban flood, which originated from urbanization [19]. The cause of this flood is the unavailability of ground surface to absorb rainfall. Streets can become rapid moving water bodies while basements can be death traps as they are bring filled with flood waters. Another rare but fatal flood is ice jam [20]. This is mainly flood caused by obstruction from natural sources such as ice or human activities such as logging and rubbish pile up. The obstruction cause water bodies to overflow or divert flow to unexpected regions. Lastly, in colder climate countries, flood cause by melting of glacial outburst have become more common with the effect of climate change. Glaciers can melt rapidly with the slightest change in temperature [21]. Due to the melting rate of ice and snow the accumulation of water in water bodies can rise rapidly resulting to sudden discharge of water and debris downstream.

3.1. Depth of Water

The depth of floodwater is a measure of the level of water from its normal level. In some cases, the depth of water is a measured from surface to the lowest point [22]. Buildings, plants and humans have different degree of tolerance to flood water. This is determined by the depth of water above them.

3.2. Duration

Duration is the time of floodwater rises and falls. The duration in which flood waters rises can cause loss of lives if short and similarly with duration of flood water falling to be long [23]. The damaged done to structures, properties and plants correlates closely with the time taken for floodwater to arrive and recedes.

3.3. Velocity

The velocity is the measure of floodwater flow. The speed of the water that comes and goes can lead to severe destruction and loss of lives. Moving water carries great force that can cause erosion of soil, uproot trees and infrastructures, and even sweep away living beings such as livestock and humans. Rapid floodwater can also damage building foundation, support structures and cause turbulence in river channels [24].

3.2. Frequency of Occurrences

Another property of flood is the degree if occurrences in a specific region. The measure of occurrences take a long period of time [25]. The frequency of flood can cause the underlying ground to become saturated, thus increasing the risk of an event of flooding. Rapid occurrences of flood can also cause blockage of drainage due to debris carried by floodwaters [26]. Multiple occurrences of flood can also cause property damage and reducing the overall quality of properties in flood prone areas.

3.2. Seasonality

Most tropical countries experience heavy rainfall in seasons. These repetitive occurrences can cause potential flooding especially in developing area. In rural areas, seasonal flooding can affect plantation and production of food [27]. Moreover, seasonal flooding can cause economic slowdown and divert the country's resources into disaster management [28].

4. Causes of Flooding in Malaysia

The country Malaysia is located at a strategic location between the Indian and Pacific Ocean. Due to the increase in global temperature, Malaysia in both Semenanjung and Borneo is witnessing higher precipitation during their wet seasons [29, 30]. Most of the flood that occur are due to natural causes such as cyclical monsoon, which results to heavy rainfall during the months of October to March [31]. Flood is the result of inadequate capacity of the rivers and catchment to contain huge volume of water [13]. As a result, excess water overflows banks and flood surrounding low areas. This event of flooding is worsen and accompanied by heavy rain.

Forest trees acts as a natural interception for precipitation. Trees are also responsible in removing moisture in soils and enhancing infiltration [32]. Due to deforestation for development, the natural cycle balance is disturbed resulting to an increase in ground water [33]. In some cases, heavy precipitation causes erosion and landslides, which results to displacement of land mass into rivers and

lakes [34]. Consequently, water basins begin to shallow and reduces its capacity to hold water.
The flash flood occurrences in Malaysia is due to the inadequate drainage system in urban areas [35]. Drainage systems acts as a channel in urban areas replacing natural channels such as streams and forest that have been cut down for development. Weakened infiltration from precipitation results to more frequent surface runoffs in urban areas [36]. Another cause of flooding is due to obstruction of flow. Natural causes such as high tides can retard river flow [37]. Events such as landslides could also block off river flows. Human activities such as logging can cause obstruction of flow in rivers. Rubbish in rivers can also cause build-ups thus, causing a restriction of water flow [26].

5. Hydrometeorological Key Activities

Hydrometeorological activities are defined as activities in the area of meteorology, hydrology and other fields aimed at the production of hydrometeorological data [38]. Hydrometeorological activities have become a significant importance in the modern world as related disasters have been occurring more frequently due to climate change [39]. Most hydrometeorological centres are formed with the purpose of researching and reporting hydrometeorological events to other bodies to respond effectively during a disaster event. Some of the activities conducted by hydrometeorological centres are to conduct data collection from hydrometeorological monitoring sites [40]. Once the data is collected, it is being processed and analysed for reporting. Besides that, the centres are also responsible for conducting maintenance to all machines and keeping an updated profile in monitoring activities. Centres will use the information obtained to make a hydrometeorological forecast, analyse regional climate changes and give consultation to agricultural businesses. Moreover, the hydrometeorological data is also sent to state agencies or other entities to make decision making in terms of emergency preparedness [41]. Hydrometeorological activities can be further broken down into three main timelines being pre-disaster, during disaster and post-disaster as shown in Figure 1. All three events are equally important in order to provide necessary help to disaster-struck victims as well as to synergize all authorities in order to work efficiently.

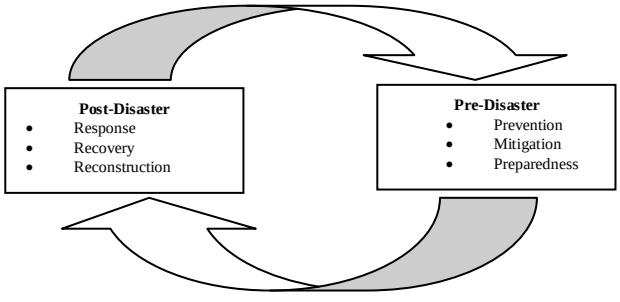


Fig. 1: Pre and post-disaster activities (adapted from [16])

4.1. Pre-Disaster

Pre-disaster usually involves the forecasting of disastrous events that are about to happen. This can be from the environmental survey, trend prediction and the use of real-time devices to monitor high-risk areas [42]. In terms of the flood disaster, forecasting of annual or seasonal patterns is vital in predicting the next major flood. Besides that, flood maps and drainage basin capacity can be useful information to calculate the time and damages of a flood event [43].

Pre-disaster management also includes disaster preventive measures such as the establishment of dams, slope maintenance and flood proofing control [44]. Additionally, community-based disaster management procedures can be established for locals to know the steps needed to be taken if a disaster event were to occur [45]. Communities should be aware of the safest route to a shelter and have set aside evacuation kits.
Having complete logistics or effective supply chains established might significantly improve disaster preparedness [46]. This reduces the time and costs to provide supplies if a disaster event were to happen. However, this task requires proper planning and analysis to develop a contingency plan that can be carried out immediately during a catastrophe event. This is to ensure that supplier is transported effectively to high demand areas [47].
Lastly, pre-disaster control from the side of authorities may include the controlling of land usage at high-risk areas as well as the preparation of search and rescue operations [48]. This includes limiting development nearby high-risk zones or providing infrastructures and facilities to minimize damages and loss of lives. Planning for a natural disaster is always the best defence rather than to react.

4.2. During Disaster

The most important task during a disaster is to save as many lives as possible. When a disaster strike, response and coordination must be like a clockwork [49]. The first task during a disaster is to inform communities and authorities using early warning system of an incoming disaster to prepare evacuation procedures [50].
Evacuation during a disaster event includes staying safe and moving to lower risk areas or even to places for easier rescue operations. Authorities are expected to mobilize quickly with sufficient equipment and transportation to meet the demands during a flood disaster [51]. As for the victims, many are encouraged to stay calm and follow instructions. Communities should also be aware of the dangers of contaminated water and should never use or drink floodwaters [52]. Waterborne diseases such as, Hepatitis A, cholera, typhoid fever and leptospirosis could be equally or more deadly than the flood. Floodwaters could also carry vector-borne diseases such as dengue and malaria that could potentially cause more harm and loss of lives [53].
Communities should be aware that swimming in floodwaters can cause severe infection and poses a risk of drowning. Most of these dangers during flood disaster can be prevented by educating and providing vaccination to disaster victims [54].

4.3. Post-Disaster

There is a thin line between during disaster and post-disaster management. This is because relief efforts take place simultaneously with search and rescue operations. In post-disaster management, the response is said to be one of the most important areas to maximize resources to in relief and rescue operations [55]. This is mainly because rescue operations are time-centric in order to save as many lives as possible. With the passing minute, the chances of finding survivals reduces.
The response includes the decision and action that takes places after a disaster event that includes relief, rehabilitation and reconstruction works [56]. Necessary supplies have to be delivered effectively to victims. Rehabilitation is also vital to cater to emotional and physical distress [57]. Finally, reconstruction of infrastructures such as roads, power lines and buildings could significantly restore the quality of life.
Finally, yet importantly, post-disaster activities include the act of restoration and reconstruction [58]. Restoration may be in the form of mental health of victims by giving assurance and help in forms of monetary aid to rebuild communities. Reconstruction is a simple act of building back destroyed homes and infrastructure to restore to normal state.

6. Conclusions

With the increase in frequency and intensity of destructive disaster, more attention is needed to be given to disaster management. Disaster occurrences can be hard to predict but mitigation and preventive procedures can be done to mild the effect of the disaster. This paper reviewed three main event timeline that is pre-disaster, during disaster and post-disaster. Pre-disaster activities include prevention and mitigation whereas during disaster includes preparedness. Lastly, post-disaster activities are towards early response, recovery and rehabilitation of victims. From the review, many steps and efforts are found and viable to provide assistant to communities that may or have been affected by the disaster. This review also states critical activities needed to be optimized that are essential to the survival of disaster victims.

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References

[1] Casey-Lockyer M & Myers S, "Disability Integration Throughout The Disaster Cycle of Prepare, Respond and Recover. *Journal of Business Continuity & Emergency Planning*, Vol. 10, No. 3, (2017), pp. 249-258.

[2] Ghazaly ZM, Rahim MA, Mohd Nasir MA, Isa NF, Mohammad Zaki MF, Hassan Z & Ismail Z, Potential of Soil Liquefaction at Perlis, Northern Region of Malaysia, *AIP Conference Proceedings*, (2017).

[3] Crescent MR, Malaysia: Flash Floods - Nov 2017, (2017), available online: https://reliefweb.int/disaster/fl-2017-000166-mys, last visit 30.11.2017

[4] Rani, WNMWM, *Climate and Disaster Resilient Cities: Challenges for Malaysia*, (2017).

[5] Buttke D, Vagi S, Bayleyegn T, Schnall A, Morrison M, Allen M & Wolkin A, Communication, Information Seeking, and Evacuation Plans for a Disaster using Community Assessment for Public Health Emergency Response in the Gulf Coast Counties of Alabama and Mississippi, *Journal of Emergency Management*, Vol. 11, No. 3, (2011), pp. 213-223.

[6] Levie F, Burke CM & Lannon J, Filling the Gaps: An Investigation of Project Governance in a Non-governmental Organisation's Response to the Haiti Earthquake Disaster, *International Journal of Project Management*, Vol. 35, No. 5, (2017), pp. 875-888.

[7] Krek A, Stont Z & Ulyanova M, Alongshore Bed Load Transport in the Southeastern Part of the Baltic Sea Under Changing Hydrometeorological Conditions: Recent Decadal Data, *Regional Studies in Marine Science*, Vol. 7, (2016), pp.81-87.

[8] Leman AM, Rahman A, Salleh M, Baba I, Johnson SC & Feriyanto D, Development of Inter Agency Information System for Flood Catastrophic Preparedness in Malaysia, *ARPN Journal of Engineering and Applied Sciences*, Vol. 11, No. 14, (2016), pp. 8726-8732.

[9] Ludin SM & Arbon PA, Improving Community Disaster Resilience through Scorecard Self-testing, *Disaster Prevention and Management: An International Journal*, Vol. 26, No. 1, (2017), pp.13-27.

[10] Munene MB, Swartling AG & Thomalla F, Adaptive Governance as a Catalyst for Transforming the Relationship Between Development and Disaster Risk through the Sendai Framework? *International Journal of Disaster Risk Reduction*, Vol. 28 (2018), pp. 653-663.

[11] Hashim NL, Hanif H, Hussain A, Che Pa & Yusof Y, A Requirement Model of an Adaptive Emergency Evacuation Center Management, *Knowledge Management International Conference (KMICe)* (2016), 29 – 30 August 2016, Chiang Mai, Thailand.

[12] Subbotina, K. and N. Agrawal, *Natural Disasters and Health Risks of First Responders*, in *Asia-Pacific Security Challenges*. 2018, Springer. p. 85-122.

[13] Sulaiman, J. and S.H. Wahab, *Heavy Rainfall Forecasting Model Using Artificial Neural Network for Flood Prone Area*, in *IT Convergence and Security 2017*. 2018, Springer. p. 68-76

[14] Ligtenberg, J., *Runoff changes due to urbanization: A review*. 2017

[15] Lee, B.X., *Causes and cures VIII: Environmental violence.* Aggression and violent behavior, 2016. 30: p. 105-109.

[16] Service, N.W. *Flash Flooding Definition*. 2017; Available from: http://www.weather.gov/phi/FlashFloodingDefinition

[17] Arnell, N.W. and S.N. Gosling, *The impacts of climate change on river flood risk at the global scale.* Climatic Change, 2016. 134(3): p. 387-401

[18] Wong, T.E., A.M. Bakker, and K. Keller, *Impacts of Antarctic fast dynamics on sea-level projections and coastal flood defense.* Climatic Change, 2017. 144(2): p. 347-364

[19] Bathrellos, G., et al., *Urban flood hazard assessment in the basin of Athens Metropolitan city, Greece.* Environmental Earth Sciences, 2016. 75(4): p. 319

[20] De Coste, M., Y. She, and J. Blackburn, *Incorporating the effects of upstream ice jam releases in the prediction of flood levels in the Hay River delta, Canada.* Canadian Journal of Civil Engineering, 2017. 44(8): p. 643-651

[21] Dayton, P.K., et al., *Unusual coastal flood impacts in Salmon Valley, McMurdo Sound, Antarctica.* Antarctic Science, 2016. 28(4): p. 269-275

[22] Nair, B.B. and S. Rao. *Flood water depth estimation—A survey*. in *Computational Intelligence and Computing Research (ICCIC), 2016 IEEE International Conference on*. 2016. IEEE

[23] Paul, B.K. and S. Mahmood, *Selected physical parameters as determinants of flood fatalities in Bangladesh, 1972–2013.* Natural Hazards, 2016. 83(3): p. 1703-1715

[24] Asano, Y. and T. Uchida, *Detailed documentation of dynamic changes in flow depth and surface velocity during a large flood in a steep mountain stream.* Journal of Hydrology, 2016. 541: p. 127-135.

[25] Archer, D.R., G. Parkin, and H.J. Fowler, *Assessing long term flash flooding frequency using historical information.* Hydrology Research, 2017. 48(1): p. 1-16

[26] Marchi, L., *Linking Debris Flows and Landslides to Large Floods in Gravel-Bed Rivers.* Gravel-Bed Rivers: Process and Disasters, 2017: p. 467.

[27] Klaus, S., et al., *Large-scale, seasonal flood risk analysis for agricultural crops in Germany.* Environmental Earth Sciences, 2016. 75(18): p. 1289.

[28] Mechler, R., *Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost–benefit analysis.* Natural Hazards, 2016. 81(3): p. 2121-2147.

[29] Tan, M.L., et al., *Changes in precipitation extremes over the Kelantan River Basin, Malaysia.* International Journal of Climatology, 2017. 37(10): p. 3780-3797.

[30] Hussain, M., et al., *Projected changes in temperature and precipitation in Sarawak state of Malaysia for selected CMIP5 climate scenarios.* International Journal of Sustainable Development and Planning, 2017. 12(8): p. 1299-1311.

[31] Sulaiman, N.H., et al., *Relationship of rainfall distribution and water level on major flood 2014 in Pahang River Basin, Malaysia.* EnvironmentAsia, 2017. 10(1): p. 1-8.

[32] Berland, A., et al., *The role of trees in urban stormwater management.* Landscape and Urban Planning, 2017. 162: p. 167-177.

[33] Tan-Soo, J.-S., et al., *Econometric evidence on forest ecosystem services: deforestation and flooding in Malaysia.* Environmental and resource economics, 2016. 63(1): p. 25-44.

[34] Lateh, H. and J. Ahmad, *Landslide issues in Penang, Malaysia: Students' environmental knowledge, attitude and practice.* Geografia-Malaysian Journal of Society and Space, 2017. 7(4).

[35] Mohd, T., et al., *A Model to Determine the Degree of Housing Damage for Flood-Affected Area: A Preliminary Study*, in *ISFRAM 2015*. 2016, Springer. p. 57-66.

[36] Yahya, H., A.A. Latif, and M.N. Ahmad. *A preliminary study of the construction of ontology-based flood management systems*. in *Student Project Conference (ICT-ISPC), 2017 6th ICT International*. 2017. IEEE.

[37] Hoitink, A., et al., *Tidal controls on river delta morphology.* Nature Geoscience, 2017. 10(9): p. 637-645.

[38] Sorooshian S, Lawford R, Try P, Rossow W, Roads J, Polcher J & Schiffer R, Water and Energy Cycles: Investigating the Links, *World Meteorological Organization Bulletin*, Vol. 54, No. 2, (2005), pp. 58-64.

[39] Arnell NW & Gosling SN, The Impacts of Climate Change on River Flood Risk at the Global Scale, *Climatic Change*, Vol. 134, No. 3, (2016), pp. 387-401.
[40] Walker D, Forsythe N, Parkin G & Gowing J, Filling the Observational Void: Scientific Value and Quantitative Validation of Hydrometeorological Data from a Community-based Monitoring Programme, *Journal of Hydrology*, Vol. 538, (2016), pp. 713-725.
[41] Petropoulos GP & Islam T (2017), Remote Sensing of Hydrometeorological Hazards, *CRC Press*.
[42] He F & Zhuang J, Balancing Pre-disaster Preparedness and Post-disaster Relief, *European Journal of Operational Research*, Vol. 252, No. 1, (2016), pp. 246-256.
[43] Oloruntoba R, Sridharan R & Davison G, A Proposed Framework of Key Activities and Processes in the Preparedness and Recovery Phases of Disaster Management, *Disasters*, Vol. 42, No. 3, (2018), pp. 541-570.
[44] Sein KK & Myint T, Flood Hazard Mapping using Hydraulic Model and GIS: A Case Study in Mandalay City, Myanmar, *Aim and Scope*, Vol. 15, (2016).
[45] Tahir W, Jani J, Endut IR, Mukri M, Kordi NE & Ali NEM, Flood Disaster Management in Malaysia: Standard Operating Procedures (SOPs) Review, *ISFRAM 2015*, (2016), pp. 31-43.
[46] Ridzuan AA, Kadir MJH, Yaacob S, Oktari RS, Zainol NAM, & Zain MM, Community Resilience Elements and Community Preparedness at Bukit Antarabangsa. *AIP Conference Proceedings*, (2017).
[47] Ruan J, Chan FTS, Zhu F, & Shi Y, A Visualization Review of Disaster Logistics Research from 2001 to 2015, *ICIC express letters*, (2017).
[48] Wood E, Lamb R, Warren S, Hunter N, Tawn J, Allan R, & Laeger S, Development of Large Scale Inland Flood Scenarios for Disaster Response Planning Based on Spatial/temporal Conditional Probability Analysis, *E3S Web of Conferences*, (2016).
[49] Liu J & Shi Z-w, Quantifying Land-use Change Impacts on the Dynamic Evolution of Flood Vulnerability, *Land Use Policy*, Vol. 65, (2017), pp. 198-210.
[50] Stevens J, Saving Lives with Fewer Discussions. Coordination between Military and Non-military Organisations during Disaster Relief Operations, Master's thesis, Open Universiteit Nederland, (2017).
[51] Aparicio-Effen M, Arana-Pardo I, Aparicio J, Ocampo M, Roque S, & Nagy GJ, A Successful Early Warning System for Hydroclimatic Extreme Events: The Case of La Paz City Mega Landslide, *Climate Change Adaptation in Latin America*, (2018).
[52] Manandhar MD, Varughese G, Howitt AM, & Kelly E, Disaster Preparedness and Response during Political Transition in Nepal: Assessing Civil and Military Roles in the Aftermath of the 2015 Earthquakes (2017), available online: https://think-asia.org/handle/11540/6909, last visit 22.12.2017.
[53] Thongtaeparak W, Pratchyapruit WO, Kotanivong S, Sirithanakit N, Thunyaharn S, Rangsin R, & Theethansiri W, Prevalence of and Risk Factors for Skin Diseases Among Army Personnel and Flood Victims During the 2011 Floods in Thailand, *Disaster Medicine and Public Health Preparedness*, Vol. 10, No. 4, (2016), pp. 570-575.
[54] Saulnier DD, Ribacke KB & Schreeb J von, No Calm after the Storm: A Systematic Review of Human Health Following Flood and Storm Disasters, *Prehospital and Disaster Medicine*, Vol. 32, No. 5, (2017), pp. 568-579.
[55] Nifa FAA, Abbas SR, Lin CK & Othman SN, Developing a Disaster Education Program for Community Safety and Resilience: The Preliminary Phase, *AIP Conference Proceedings*, (2017).
[56] Persson ES, Flood Response Using Complementary Early Warning Information, *Journal of Contingencies and Crisis Management*, Vol. 24, No. 4, (2016), pp. 253-263.
[57] Shafiaia S & Khalidb MS, Flood Disaster Management in Malaysia: A Review of Issues of Flood Disaster Relief During and Post-Disaster, *The European Proceedings of Social & Behavioural Sciences EpSBS*, (2016).
[58] Sa'ad FM, Perveen A, Daud NAM, Shah MNIMA, Arip BM, Abdullah CAC, & Yusof HM, Reliability of Empowerment Module for Authorities, Community Leader, House Leader and Individuals in Action for Integrated Flood Disaster in Malaysia, *Indian Journal of Public Health Research & Development*, Vol. 7, No. 4, (2016).., 7(4), pp. 304-309.