The 18th Conference of Asian and African City Planning (AACP2022) Proceedings

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Preface

The Asian and African City Planning Group, The City Planning Institute of Japan organizes “The 18th Conference of Asian and African City Planning 2022 (18th AACP)” on 11th December 2022 at Ito Campus, Kyushu University. The Conference aims to explore the themes on city planning in the Asian and African regions as well as other developing countries through research presentations and information exchange. Researchers, professionals, graduate students, whose interests lie in the related research areas, are all encouraged to attend the meeting to foster close communication.

The Asian City Planning Group would like the theme of Asian and African city planning study as well as city planning in other developing regions to gain noteworthy attention in the field of city planning. The Conference would be an important initial step to realize it. We sincerely hope that the Conference would be a good opportunity to find specific future direction and contribute to active promotion of research network in the field.

The Asian and African City Planning Group,
City Planning Institute of Japan (CPIJ)

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A Comparison Study on Water-related Disasters Information Communication Measures in the Capitals of East and Southeast Asian Countries

Hanfei Wang[1], Michitaka Umemoto[2]

[1] Degree Programs in Systems and Information Engineering, University of Tsukuba, Tsukuba, Japan
[2] Faculty of Engineering, Information and Systems, University of Tsukuba, Tsukuba, Japan

Abstract

The frequency of heavy rainfall which makes the high risk of water-related disasters caused by climate change and the rapid development of urban construction in the East and Southeast Asian regions is increasing. For example, the torrential rains caused floods in many areas in western Japan in July 2018, killing more than 200 people. The death toll from flood disasters in China's Henan Province was 302 people in 2021. According to The International Disaster Database, typhoons, rainstorms, and floods are also considered to be frequent disasters in Southeast Asia. In 2013, Typhoon Yolanda caused 6,300 fatalities and about $2.2 billion in economic damage in the Philippines. As part of the disaster response, East and Southeast Asian countries have developed various disaster information communication measures, which can provide warning information to residents when water-related disasters occur. However, there is a widespread problem that residents cannot understand warning information properly in many countries. Therefore, through water-related disaster prevention plans in the East and Southeast Asian countries and previous studies on disaster information communication, this study summarizes an overall picture of flood or rainstorm warning information communication in the capitals of China, Japan, the Philippines, Malaysia, Singapore, and Indonesia. Then, by comparing announcement criteria, means, and content of information, the characteristic measures of flood or rainstorm warning information communication in each capital city were extracted. And based on the results, this study discussed the findings for the future development of water-related disaster information communication measures in the East and Southeast Asian countries.

Keywords: disaster information communication, water-related disasters, East and Southeast Asia

1. Introduction

The high risk of water-related disasters caused by climate change and the rapid development of urban construction in the East and Southeast Asian regions is increasing. In 2013, a research group from the University of Tokyo and Tokyo Institute of Technology used a climate and flooding model to estimate future changes in flood risk in a global range (Hirabayashi et al., 2013). The results showed a progressively increasing flood risk trend in the Asian region.

Furthermore, according to The International Disaster Database (EM-DAT,2022), water-related disasters are more frequent in East and Southeast Asia. In 2013, Typhoon Yolanda caused 6,300 fatalities and about $2.2 billion in economic damage in the Philippines (NDRRMC, 2013). The torrential rains caused floods in many areas in western Japan in July 2018, killing more than 200 people (NIPPON, 2020). And the death toll from flood disasters in China's Henan Province was 302 people in 2021 (Wan, 2021).

As part of the disaster response, East and Southeast Asian countries have developed various disaster information communication measures, which can provide warning information to residents when water-related disasters occur. However, there is a widespread problem that residents cannot understand warning information properly in many countries. Therefore, it is necessary to further improve water-related disasters information communication measures in East and Southeast Asian countries to contain the damage caused by disasters.

2. Previous Studies

Ishio et al. pointed out the importance of prevention plans that promptly announce disaster evacuation information and indicated the need for information communication using multiple tools6) (Ishio et al., 2015). Megano et al. showed that evacuation information provided by the government strongly influences evacuation decisions7) (Megano et al., 2014). It was also confirmed that content that directly communicates risk facilitates residents' evacuation activities. According to Lin et al. 's research, residents do not have a high understanding of the content of disaster information8) (Lin et al., 2018). Focusing on Typhoon Yolanda, Esteban, et al. pointed out that the content of warnings was difficult to understand9) (Esteban et al., 2014). Rezaldi et al. summarized the disaster information media used in ten ASEAN countries and examined recommended disaster information media for future development (Rezaldi et al., 2020).

3. Current status of water-related disasters information communication in East and Southeast Asian capitals

3.1 Selection of target areas

Asian Development Bank published Asian Water Development Outlook in 2016, which quantitatively assessed the ability of Asian countries and districts to resist and recover from water-related disasters (ADB, 2016). Therefore, for this study, a portion of the assessment scores for East and Southeast Asian countries were extracted as target areas.

The capitals of countries with high scores are selected as target areas after considering the difficulty of obtaining materials. The target areas of East Asia are China and Japan. In addition, the target areas in Southeast Asia are Singapore, Malaysia, the Philippines, and Indonesia. In addition, although the Philippines and Indonesia have low scores, the high frequency of water-related disasters may provide a useful reference for disaster information communication systems and means. Sources of data in each country's capital city were obtained through a literature review of publicly available materials and reports by administrative agencies in each country and JICA.

3.2 Beijing, China

Between 2004 and 2020, 12 times rainstorms caused extensive damage in Beijing (BMS, 2022). As the central administrative department for publishing disaster information, Beijing Emergency Warning Information Release Center is responsible for disseminating disaster information when a meteorological disaster has happened or is likely to occur in Beijing. Beijing Emergency Warning Information Release Center also shares information with other departments and formulates disaster prevention education plans.

a) Announcement criteria

In Beijing, the criteria for announcing rainstorm warnings are 1-hour, 6-hour, and 24-hour precipitation. There are four rainstorm warning signal marks: blue, yellow, orange, and red (BMS, 2013). The blue mark is to warn of rainstorms, the yellow emphasizes preparation for rainstorm response activities. The orange mark means that disaster prevention activities should be implemented immediately, while the red color emphasizes evacuation activities.

b) Means and content of information

In terms of outdoor broadcasting, Beijing only has outdoor announcements in rural areas, and disaster prevention administrative radio is not provided in urban areas. Beijing's community disaster prevention activities are carried out through an administrative organization called "Residents' Committee". To ensure prompt and reliable communication of disaster information, each community has a disaster information officer, who communicates disaster information from authorities to residents. The authority of Beijing also asks cell phone operators to send water-related disaster information to residents by mobile text. And each service application (e.g., Alipay) provides weather information to users. For information communication via the Internet, the authority of Beijing provides residents with information by using the official website, and social media accounts. Also, residents can use weather apps to check weather-related information on their cell phones or computers.

The contents of rainstorm warning information are including signal mark, grade of the rainstorm, expected time, area of the rainstorm, precipitation, the possibility of flooding, and simple disaster prevention action guidance.

3.3 Tokyo, Japan

In Tokyo, flooding that caused serious losses occurred 6 times in typhoons and 24 times in heavy rains from 2010 to 2018, and water-related disasters occur approximately 3 to 4 times per year (BC, 2022). When disasters occur, it is important to establish the Tokyo Metropolitan Disaster Response Headquarters, and take measures on various items such as information gathering, firefighting activities, and rescue (TMG, 2021).

a) Announcement criteria

The Tokyo government issues heavy rain advisories when there is a possibility of flooding damage due to disasters, and heavy rain warnings when serious flooding damage is expected to occur. Those warnings are issued based on surface rainfall index criteria or watershed rainfall index criteria (JMA, 2022).

In 2018, the Japanese administration reexamined the direction of warning announcements from the perspective of "strengthening disaster prevention measures by improving government-led efforts" to “residents take evacuation actions with an awareness of protecting their own lives, while the government provides full support. " (COJ, 2018)

In the expression format of water-related disasters warnings, five colors of hazard distributions are used to provide residents with disaster information on the map, and residents can confirm warnings intuitively.

b) Means and content of information

Tokyo's main outdoor broadcasting means is fixed and mobile disaster prevention administrative radios. The mobile means uses public information vehicles to disseminate information to residents, while the fixed means uses outdoor loudspeakers and door-to-door receivers. In terms of the current situation in Tokyo, it is difficult to install door-to-door receivers in all families, so outdoor loudspeakers are used in many cases (COJ, 2019). Regarding the communication of information by communities, the Tokyo government has collaborated with each municipality to establish local organizations for disaster prevention. The role of organizations is to inform residents where damage is likely to occur and to support people in need of evacuation assistance. In terms of SMS, weather information and emergency mail alerts can be sent to residents by mobile text. The weather information can be automatically received by registering in advance with a cell phone or PC. The emergency mail alerts do not require advance registration and can distribute

information to cell phone users in a specific area free of charge. For information communication means on the Internet, each ward of Tokyo will announce weather and evacuation information using social media. Furthermore, a specialized "Tokyo Disaster Prevention App" has been developed to provide disaster information, including the location of disaster prevention facilities (DPI, 2021).

The specific contents of water-related disasters warning mainly include warning grade, time, area, reason, detailed action requests, and information about evacuation facilities.

3.4 Manila, Philippines

14 times water-related disasters were affecting Manila between 2011 and 2020 (NDRRMC, 2022). Although the frequency of occurrence tends to decrease gradually, the number of affected people is still considered high.

When the disaster occurred, Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) will connect with National Disaster Risk Reduction Management Council (NDRRMC) and send information to the population through PAGASA Regional Services Division and Local DRRMC (JICA, 2012).

a) Announcement criteria

PAGASA has established a rainfall warning system to communicate information to district administrators and residents (PAGASA, 2022). The information is divided into thunderstorm warnings and heavy rain warnings, disseminated warning symbols based on 1 or 3 hours of precipitation as the announcement standard.

b) Means and content of information

For the communication of information by communities, a special social management system called barangay can be used to communicate information to the population. Since the barangay has strong ties with residents, warnings can be sent to residents through barangay leaders by ringing church bells at each location (JICA, 2012). Also, mobile operators in the Philippines are required to send information to residents via SMS at regular intervals upon request of the government (JICA, 2012). Meanwhile, a disaster prevention app called "Batingaw (MIAC, 2015) " has been developed, which can provide information on weather warnings, the location of evacuation facilities, and disaster prevention plans to local people. Residents also can get disaster information from the official Twitter and Facebook accounts of disaster management agencies

The content of Manila's water-related disasters warning includes type, time, area, precipitation, the possibility of flooding, simple disaster prevention instructions, next warning time, and administrative contacts.

3.5 Kuala Lumpur, Malaysia

According to news on water-related disasters between 2011 and 2020, although typhoons caused little damage, heavy rains were likely to occur 2 or 3 times in Kuala Lumpur each year (The Star, 2022).

When heavy rains occurred, the National Disaster Management Agency (NADMA) through the Disaster Management and Relief Committee at each administrative level carries out response activities depending on the magnitude of the disaster (UNDRR, 2020). The Malaysian Meteorological Department (MMD) is responsible for issuing weather forecasts and warnings, while the Malaysian Department of Irrigation and Drainage (DID) issues flood warnings (JICA, 2012).

a) Announcement criteria

Heavy rain warnings in Malaysia use the concept of "Continuous Heavy Rain" which is defined as rainfall exceeding 6 hours in duration with total precipitation above 60 mm to classify the announcement criteria. There are three levels of heavy rain warnings: ALERT, SEVERE, and DANGER (MMD, 2022).

b) Means and content of information

As a means of outdoor broadcasting, the Malaysian administration installed warning sirens along flood-prone rivers and the sirens will be automatically activated when river levels reach a critical point (JICA, 2012). NADMA through MMD and DID uses a "Short Messages System" to communicate disaster warnings to residents via mobile text (JICA, 2012). Also, DID has developed an app called "Infobanjir", which provides real-time information about heavy rain and river water levels (The Official Web of Public Infobanjir, 2022). In addition, MMD and DID provide disaster information to residents through their web homepages and official social media accounts.

The heavy rain warning for Kuala Lumpur includes the level, time, affected areas, and duration of heavy rain.

3.6 Singapore

Singapore experienced 25 times floods caused by heavy rains between 2018 and 2021 (PUB, 2022), indicating that although there were few human casualties, property damages were high.

During the disaster, Meteorological Service Singapore (MSS) observes weather conditions, collects rainfall data, and provides residents with warnings regarding heavy rain. Meanwhile, Public Utilities Board (PUB) monitors water levels in rivers and announces flooding conditions and water level warnings for roads (JICA, 2012).

a) Announcement criteria

Heavy rain warnings in Singapore are classified into three levels: Light, Moderate, and Heavy, and are expressed by a color scale (MMS, 2022).

b) Means and content of information

The Singaporean administration provides an SMS alert service (PUB, 2022) to residents who want to receive heavy rain warnings and information on roads' or rivers' water levels when heavy rain is expected. This service provides information about the location of heavy rain and sends text messages to residents in stages when water levels exceed 50%, 75%, 90%, and 100%. Furthermore, a mobile application called "myENV " (JICA, 2012) has been developed to provide information over the Internet to let users check weather and location information in real-time. MSS and PUB can provide water-related disasters information to residents through web homepages or social media accounts. Particularly, PUB offers precautions and protection guidelines for a variety of situations during heavy rain.

The specifics of the heavy rain warning are including alert level, time, area, and the possibility of flooding.

3.7 Jakarta, Indonesia

Jakarta has been severely impacted by water-related disasters due to the rivers flowing through the city. Then, floods in Jakarta between 2013 and 2020 are mainly caused by heavy rains (ADRC, 2022).

As the central administrative department for issuing information, National Disaster Management Authority (BNPB) will announce evacuation warnings and implement response activities related to flooding, based on information from the Agency for Meteorology, Climatology, and Geophysics (BMKG), and the Ministry of Public Works and Housing (PUPR) (JICA, 2019). BMKG observes and provides weather information to government agencies and mass media. PUPR is responsible for flood management in Indonesia (JICA, 2019).

a) Announcement criteria

The weather forecast and warning information in Jakarta classify rainfall into five categories based on 1-hour and 24-hour precipitation, displaying the information on a map using different color (BPBD, 2022).

b) Means and content of information

In communicating information by SMS, it is stipulated that disaster information in Indonesia is to be communicated to the population through cell phone operators with the highest priority as a "special communication service" (JICA, 2019). Meanwhile, the Indonesian government has developed a special information system called "PetaBencana.id" (JICA, 2019). The system is based on social media and can collect real-time flood information from both the government and resident sides and provide it on the internet. Also, BMKG provides residents with information through the mobile application "Info BMKG " (JICA, 2019).

Flood information in Jakarta includes time, location of the flood, precipitation, and possibility of thunderstorms.

4. Introduction of distinctive measures in water-related disasters information communication

Based on the contents of 3., the characteristic measures for communicating water-related disasters information in East and Southeast Asian country capitals are indicated by (★) in Table 1-1, 1-2 and introduced in 4.

4.1 Characteristic measures regarding warning announcement criteria

a) Surface rainfall index (Tokyo)

Compared to other capital cities, Tokyo does not simply issue warnings based on the precipitation but calculates the extent to which rain accumulates on the ground surface and uses the "surface rainfall index" as the criterion. In the past, Japan Meteorological Agency (JMA) used 1-hour, 3-hour, and 24-hour precipitation to announce warnings, but after a series of disasters such as the heavy rains in Niigata and Fukushima in 2004, JMA abolished the 24-hour precipitation standard and developed watershed rainfall index criteria in 2008 (Ohta et al., 2019). Then, due to the heavy rains in Hiroshima in 2014 and the flooding of the Kinugawa River in 2015, the surface rainfall index was also developed in 2017, and the criteria for announcing heavy rain warnings was changed from 1 and 3 hours of precipitation to surface rainfall index (Ohta et al., 2019).

b) Five colors of hazard distributions (Tokyo)

Based on the lessons learned from Typhoon No. 10 in 2016 and the heavy rain in western Japan in 2018, the government of Japan provided disaster prevention information according to five alert levels, so that residents could understand the meaning of information intuitively. In terms of hazard distributions, the authority has clarified that cities are becoming vulnerable to water-related disasters since 2014 (MLITT, 2015). So, they began providing the hazard distribution of heavy rain warnings in 2017 with the introduction of the surface rainfall index. The reason for the change in the expression format of warnings in Tokyo is thought to be due to the difficulty for residents to understand the prevention information, while the frequency and intensity of disasters are increasing.

c) Purpose of Warning Announcement (Tokyo)

With the heavy rain in western Japan in 2018, the Central Disaster Management Council recognized the problem of the limitations of government-led disaster prevention measures and identified the need for residents to take the lead in disaster prevention measures (COJ, 2018). To solve problems in which information is not linked to residents' prevention and evacuation actions, the direction of disaster prevention was changed from "government-led disaster prevention measures" to "residents take action with the awareness of protecting their own lives, and the government supports the

residents (COJ, 2018)". Therefore, information communication during disasters was also reconsidered to let residents understand easily and promote disaster prevention and evacuation behavior.

Table 1-1. Summary of the status of information dissemination in each capital

	Beijing	Tokyo	Manila
Central Department	Emergency Warning Information Release Center	Metropolitan Disaster Response Headquarters	PAGASA, NDRRMC
Criteria	Precipitation	Surface Rainfall Index (★) Hazard Distribution (★)	Precipitation
Outdoor broadcasting	Outdoor Announcements (rural area only)	Disaster Prevention Administrative Radio (★)	Unknow
Community means	Residents' Committee	Local Organization	Barangay (★)
SMS	Information Text	Emergency Mail Alert (★)	Information Text
Internet	Website, SNS, App	Website, SNS, App	SNS, Batingaw
Content	Mark, Grade, Time, Area, Precipitation, Possibility of Disaster, Simple Guidance	Grade, Time, Area, Reason, Detailed Action Requests (★), Information for Elderly (★)	Type, Time, Area, Precipitation, Possibility of Disaster, Guidance, Next Warning Time, Contacts (★)

Table 1-2. Summary of the status of information dissemination in each capita

	Kuala Lumpur	Singapore	Jakarta
Central Department	NADMA, MMD, DID	MSS, PUB	BNPB, BMKG, PUPR
Criteria	Precipitation	Unknow	Precipitation
Outdoor broadcasting	Siren	Unknow	Unknow
Community means	Unknow	Unknow	Unknow
SMS	Information Text	Water Level Warning Alert (★)	Information Text
Internet	Website, SNS, Infobanjir	Website, SNS, myENV	PetaBencana.id (★), SNS, Info BMKG
Content	Level, Time, Areas, Duration	Level, Time, Area, the Possibility of Disaster	Time, Area, Precipitation, Possibility of Disaster

★: Characteristic measures

4.2 Characteristic measures regarding the means of information communication

a) Disaster prevention administrative radios (Tokyo)

After the Niigata earthquake in 1964 and the Tokachi earthquake in 1968, the Japanese government began to develop disaster prevention administrative radios. The assumption of an earthquake directly hit the Tokyo metropolitan area, has further solidified the need for disaster prevention administrative radio systems as a means of disaster information communication after the Great East Japan earthquake. Furthermore, those radios also can be used during water-related disasters. However, when information is disseminated over outdoor loudspeakers, the sound of rain may make it difficult to hear important disaster prevention information and evacuation instructions (COJ, 2019).

b) Disaster response in Barangays (Manila)

Barangay is the smallest unit of local government under a city or town in the Philippines. In general, barangays within Metro Manila have a population of 5,000 or more. Although the specific situation in Metro Manila cannot be ascertained due to a lack of data, Sowa et al. surveyed community disaster management activities in three barangays in other cities38) (Sowa et al., 2017). They noted that barangay leader grasps the situation of residents through community activities such as updating resident lists during normal times, which resulted in appropriate disaster response.

c) The emergency mail alerts (Tokyo)

The development of emergency mail alerts was prompted by the 2004 Niigata Chuetsu and 2007 Noto Peninsula earthquakes, and the provision of Emergency Earthquake Early Warning to residents began in 2007. Due to the recent

increase in the types and frequency of disasters, water-related disasters information can be communicated. In addition, emergency mail alerts also inform residents of specific evacuation instructions as separate items.

d) Water level warning alerts (Singapore)

In Singapore, PUB has installed sensors in the city's rivers and drainage channels to monitor water levels during heavy rains in order to prevent damage caused by disasters. If water levels exceed 50%, 75%, 90%, and 100%, text messages will be sent to residents automatically (PUB, 2022).

e) Information gathering system based on social media (Jakarta)

Since 2013, the Indonesian government developed a system called "PetaBencana.id" to enhance disaster information, by integrating information from both the administrative and the resident sides. The system can collect real-time flood information announced by the government and residents via social media and show it online. As a specific example, the flooding in Jakarta in 2014 caused 150,000 tweets, which were used by the authority to determine the inundation area in Jakarta city (JICA, 2019).

4.3 Characteristic measures regarding information content

a) Presentation of detailed behavioral guidance (Tokyo)

The Tokyo government posted detailed action guidelines to residents during water-related disasters. Also, Japanese cell phone operators have published the "Guide for Emergency Mail Distribution" (NTT et al., 2021), which defines the basic structure of emergency mail alters. Therefore, according to the context of "who, what, when, where, and how", disaster information can provide specific action guidance such as checking hazard maps. When evacuation is necessary, information about surrounding shelters is also presented to encourage residents to evacuate.

b) Disaster prevention information for the elderly (Tokyo)

The Tokyo government not only provides residents with general information, but also announces various information with a special alert level (alert level 3) for those who need assistance, especially the elderly and disabled residents.

c) Content of next warning time and contact address of authorities (Manila)

In Manila, besides the basic information, the contact address of authorities is also clearly indicated while informing residents of the next warning time.

5. Conclusion

Based on the contents of section 4, we will discuss the findings for the future development of water-related disasters information communication measures in East and Southeast Asian countries from 3 perspectives which are promotion of information understanding, improvement of communication means, and information contents.

5.1 Promotion of understanding information

The technical term "precipitation" is considered difficult for the public to understand as the criteria for issuing warnings. Therefore, it is expected that the development of criteria that better describe disaster risks, concerning the measures taken by the Tokyo government. The clear indication of disaster risks on maps with additional explanations of the warning mark's meanings and corresponding examples of specific situations, will promote residents' understanding of information. Also, the purpose of announcing disaster warnings is not only to convey information to residents but also to let residents be the main implementers of prevention and evacuation activities, and to promote various response actions from the announcement of warnings. It is also essential to provide residents with daily education and raise their awareness of disasters so that they can make use of the information obtained.

5.2 Improvement of communication means

First, weather information and disaster prevention and evacuation instructions should be provided separately to residents so that the information can be more clearly communicated to residents. It is expected to emphasize the actions that should be implemented and encourage residents to engage in disaster prevention activities. Second, the increase in water-related disasters has necessitated the development of new means of information dissemination. Methods that are specialized according to disaster characteristics, such as water level warning alerts in Singapore, provide useful insights into the direction of development of information communication means. Furthermore, to bridge the gap between the government and residents, it seems essential to develop information collection and communication methods that can integrate both types of information. In addition, daily community activities related to disaster prevention will play an important role in improving the effectiveness of information dissemination.

5.3 Improvement of information contents

From the viewpoint of the amount of information, it is important to provide more detailed behavioral guidance on disaster prevention and evacuation, and it is also necessary to further enhance the content according to the fixed context, as in Tokyo. Due to the aging of the population, it is necessary to provide specialized information to the elderly and other people in need of assistance, and it is also essential to add content that can arouse a sense of mutual aid in others. Adding the time for future information announcements and the contact address of authorities to the information content will help to promote interaction between the government and residents, so that the administration can implement more

effective support activities based on the residents' needs.

5.4 Future Works

In conclusion of this paper, we discussed the findings for the future development of water-related disasters information communication measures in East and Southeast Asia. But it is necessary to verify the applicability of each finding depending on the specific social conditions in each city. And the research method used in this paper is mainly a literature review. In the future, supplementary surveys should be conducted to obtain detailed data.

Reference

(1) Hirabayashi, Y., Mahenfran, R., et al. (2013). Global flood risk under climate change, Nature Climate Change Online Edition, 816–821

(2) EM-DAT: The International Disaster Database Public, English, https://public.emdat.be, last accessible date: 2022/10/23

(3) NDRRMC (2013). FINAL REPORT Effects of Typhoon YOLANDA (HAIYAN).

(4) NIPPON: Rain-Related Disasters Becoming More Frequent in Japan, Japan Data, Society, Japanese, https://www.nippon.com/ja/features/h00240/, last accessible date: 2022/10/23

(5) Wan, X.: Henan heavy rainfall killed 302 people, including 292 people killed in Zhengzhou, CCTV China news, CCTV News Client, Chinese, http://m.news.cctv.com/2021/08/02/ARTIIbLGecIrIB59AXPnDYpg210802.shtml, last accessible date: 2022/10/23

(6) Ishio, H., Fukuda, M., Tsutsumi, T., Sawada, Y. (2015). A Study on Effective Methods for Disaster Information Notification, Urban Management: Bulletin of the Faculty of Urban Management, Fukuyama City University, 8, 97-104

(7) Megano, S., Yamaguchi, Y., Iwasaki, Y. (2014). Analysis of the impact of evacuation information on evacuation awareness during floods, the city planning institute of Japan Kansai, 12, 89-92,

(8) Lin, Q., Jin, H., Li, J. (2018). Investigation and Analysis of Effective Dissemination of Early Warning Information of Major Natural Disasters in Beijing, Chinese Meteorological Society.

(9) Esteban, M. et al.: (2014). Study on Disaster Information Dissemination and People's Response for Evacuation – the case of the 2013 typhoon Yolanda (Haiyan)–, Journal of Japan Society of Civil Engineers, Ser. B3 (Ocean Engineering) 70 (2), I_1218-I_1223,

(10) Rezaldi, M. Y. et al. (2020). Disaster Information Media in ASEAN Countries: A Paired Comparison Method, Malaysian Journal of Communication, , p.334-355

(11) Asian Development Bank (2016). Asian Water Development Outlook 2016, 110-111

(12) Beijing Meteorological Service Homepage, Chinese, http://bj.cma.gov.cn, last accessible date: 2022/10/23

(13) Beijing Meteorological Service (2013). Meteorological Disaster Warning Signals Prevention Guide, 1-4

(14) Bureau of Construction: Past Flood Damage Records -Flooding Performance Chart-, Japanese, https://www.kensetsu.metro.tokyo.lg.jp/jigyo/river/suishin/suigai_kiroku/kako.html, last accessible date: 2022/10/23

(15) Tokyo Metropolitan Government (2021). The TMG Plan for Local Disaster Preparedness (Wind and Flood Damage). 137-143

(16) Japan Meteorological Agency: Surface Rainfall Index, Japanese, https://www.jma.go.jp/jma/kishou/know/bosai/hyomenshisu.html, last accessible date: 2022/10/23

(17) Cabinet Office Japan (2018). Working Group on Evacuation from Flood and Landslide Disasters Caused by the Heavy Rainfall in July 2018, 1-36

(18) Cabinet Office Japan (2019). Guidelines for Evacuation Advisories, 33-34

(19) Disaster Prevention Information: Disaster Preparedness Tokyo App, Japanese, https://www.bousai.metro.tokyo.lg.jp/1005744/index.html, last accessible date: 2022/10/23

(20) NDRRMC: Disaster Reports, English, https://ndrrmc.gov.ph/index.php/disaster-reports.html, last accessible date: 2022/10/23

(21) JICA (2012). Data collection survey on ASEAN regional collaboration in disaster management final report: country report: Philippines, Japan International Cooperation Agency: Nippon Koei Co., Ltd.: ALMEC Corp.: Mitsubishi Research Institute, Inc., 5-1 - 5-4

(22) PAGASA: Weather Advisory, GOVPH, English, https://www.pagasa.dost.gov.ph, last accessible date: 2022/10/23

(23) Ministry of Internal Affairs and Communication, CTI Engineering Co., Ltd (2015). The Booklet of Best Practices of resilient ICT systems in the Philippines., 28

(24) The Star: Malaysia News: National, Regional and World News, Star Media Group Berhad, English, https://www.thestar.com.my, last accessible date: 2022/10/23

(25) UN Office for Disaster Risk Reduction (2020). Disaster Risk Reduction in Malaysia, Status Report 2020, 18-22

(26) JICA (2012). Data collection survey on ASEAN regional collaboration in disaster management final report: country report: Malaysia, Japan International Cooperation Agency: Nippon Koei Co., Ltd.: ALMEC Corp.: Mitsubishi Research Institute, Inc., 5-1 - 5-5
(27) MMD: Continuous Heavy Rain Warning Issuance Criteria, MET Malaysia, English, https://www.met.gov.my/en/ramalan/hujan-lebat/, last accessible date: 2022/10/23
(28) The Official Web of Public Infobanjir, English, https://publicinfobanjir.water.gov.my/?lang=en, last accessible date: 2022/10/23
(29) PUB: Recent Flash Floods, Singapore's National Water Agency, English, https://www.pub.gov.sg/drainage/floodmanagement/recentflashfloods, last accessible date: 2022/10/23
(30) JICA (2012). Data collection survey on ASEAN regional collaboration in disaster management final report: country report: Singapore, Japan International Cooperation Agency: Nippon Koei Co., Ltd.: ALMEC Corp.: Mitsubishi Research Institute, Inc., 4-1 - 5-2
(31) MMS: Heavy Rain Warning, English, http://www.weather.gov.sg/warning-heavy-rain/, last accessible date: 2022/10/23
(32) PUB: Subscribe to SMS Alerts, Singapore's National Water Agency, English, https://www.pub.gov.sg/drainage/floodmanagement/subscribesms, last accessible date: 2022/10/23
(33) Asian Disaster Reduction Center: Information on Disaster Risk Reduction of the Member Countries,Indonesia, English, https://www.adrc.asia/nationinformation.php?NationCode=360&Lang=en&NationNum=03, last accessible date: 2022/10/23
(34) JICA (2019). Data collection survey on disaster risk reduction final report, Japan International Cooperation Agency: Yachiyo Engineering Co., Ltd.: Oriental Consultants Global Co., Ltd., 4-33 - 4-90
(35) Twitter: BPBD DKI Jakarta, English, https://twitter.com/BPBDJakarta, last accessible date: 2022/10/23
(36) Ohta, T., Makihara, Y. (2019). Technical Developments for Mitigating Disasters from Inundation and Flood and Dissemination of their Results, Meteorological Society of Japan, Tenki, 66 (11), 723-742.
(37) Ministry of Land, Infrastructure, Transport and Tourism (2015). Disaster Prevention and Mitigation for a New Stage, p.2
(38) Sowa, S., Hokugo, A. (2017). Study of Capacity Development for Disaster Risk Reduction through Barangays' Community Activities in Philippines, Research Center for Urban Safety and Security Kobe University, research paper 21, 131-150,
(39) NTT Docomo, KDDI, Softbank, Rakuten Mobile (2021). Guide for Emergency Mail Distribution, 18.

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編集責任者：蕭 耕偉郎(Kojiro Sho)
編集協力者：小野 悠(Haruka Ono)、柏崎 梢(Kozue Kashiwazaki)

編集担当者：蕭 耕偉郎(Kojiro Sho)
表紙デザイン：二飯田 陽一(Youichi Nihanda)
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分科会委員：城所 哲夫(Tetsuo Kidokoro)、安 相景(Sangkyung An)、福島 茂(Shigeru Fukushima)、西浦 定継(Sadatsugu Nishiura)、瀬田 史彦(Fumihiko Seta)、松行 美帆子(Mihoko Matsuyuki)、志摩 憲寿(Norihisa Shima)、柏崎 梢(Kozue Kashiwazaki)、森川 真樹(Maki Morikawa)、松村 茂久(Shigehisa Matsumura)、林 和眞(Hwajin Lim)、小野 悠(Haruka Ono)、蕭 耕偉郎(Kojiro Sho)
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