Utilization of Social Media at the Times of Natural Disasters in Japan

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Abstract. The cloud computing society where everyone can access the Internet using various information tools has already been developed all over the world, and it is the times of IoT (Internet of Things) and IoE (Internet of Everything). Additionally, as the digital infrastructures are toughened in the effective measures for disaster prevention and reduction around the world, the importance of information and communication technology (ICT) and internet environment is widely recognized, especially in recent Japan. The present study aims to describe the utilization and issues of social media at the time of the heavy-rain disaster in southern Kyusyu, Japan in 2020. At the time of the above disaster, social media is utilized as powerful tools to submit and gather the information related to the disaster by the general public in addition to the central and local governments and scientists. However, it was not possible for all of the local governments to effectively utilize social media for many reasons, such as human resources and information literacy of the staff. Based on the real cases during disasters, it is desirable that each local government should promote the setting of rules for utilizing Twitter in particular, according to the local situations beforehand.

1 INTRODUCTION

The cloud computing society where everyone can access the Internet using various information tools has been already developed all over the world, and it is the times of IoT (Internet of Things) and IoE (Internet of Everything) when various things were connected to the Internet. Under such a circumstance, social media such as Twitter, Facebook and YouTube are widespreading as familiar information and communication tools in the world. Additionally, as later mentioned in sections 2 and 3, social media, in addition to geographic information systems (GIS) are actively utilized as powerful digital infrastructures at times of disasters, and they are included into the systems as the measures for disaster prevention and reduction.

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On the other hand, in recent years, because the occurrence frequency of meteorological disasters such as typhoon, local heavy rain and heavy snow in addition to earthquake and volcanic eruption tremendously increased, it is the most important issue to adopt the effective measures for disaster prevention and reduction around the world. Additionally, as later mentioned in section 3, the digital infrastructures are toughened in the above measures, and the importance of information and communication technology (ICT) and internet environment is widely recognized especially in recent Japan. Because, in Japan, torrential rains during the rainy season and typhoons in summer and autumn caused other issues including flood, landslides and slope failure in particular. As a result, agricultural products would be seriously damaged, and precious lives and property would be lost at worst.

Yamamoto (2020) [1] described the utilization of ICT as a digital infrastructure concerning disaster countermeasures at the time of the heavy-rain disaster in western Japan in 2018, demonstrated the usefulness of social media and GIS as tools to effectively provide important information before, during and after the times of disasters, and presented the potential utilization and issues of Twitter as a familiar digital infrastructure. Based on the results of Yamamoto (2020) [1], the present study aims to describe the utilization and issues of social media at the time of the heavy-rain disaster in southern Kyusyu in 2020.

2 RELATED WORK

The preceding studies on the utilization of social media at the times of natural disasters are divided into two study fields, namely; (1) studies on the use of social media, and (2) studies on the analysis of the information on social media. The following will introduce the major preceding studies in the above two academic areas, and demonstrate the novelty of the present study in comparison with the others.

In (1) studies on the use of social media, Alexander (2014) [2] reviewed the actual and potential use of social media in emergency, disaster and crisis situations. Houston et al. (2015) [3] developed a functional framework for the use of social media in disaster planning, response and research based on the comprehensive review of online, official and scientific literature. Palen et al. (2017) [4] surveyed the rapid rise of social media in a range of disaster experiences, reviewing topics of citizen reporting, community-oriented computing, distributed problem solving, and digital volunteerism as forms of socio-technical innovation, as well as topics of situational awareness and veracity as opportunities and challenges that arise from the social media data deluge. Lovali et al. (2019) [5] investigated how social media were used during a flood disaster managed by public affairs officers, and offered the recommendation to improve disaster communication via social media including dedicated staff and resources, evaluation, symmetry and the use of ethical communication to quell rumors or misinformation during a disaster. Imran et al. (2020) [6] highlighted various applications and opportunities of social media multimodal data, latest advancements, current challenges, and future directions for the crisis informatics and other related research fields.

In (2) studies on the analysis of the information on social media, Albuquerque et al. (2015) [7] presented an approach to enhance the identification of relevant messages from social media that relies upon the relations between georeferenced social media messages as volunteered geographic information (VGI) and geographic features of flood phenomena as derived from authoritative data. Xiao et al. (2015) [8] developed a novel model to explain the number of tweets by mass, material, access and motivation (MMAM), and showed that empirical analysis of tweets about Hurricane Sandy that attacked the east coasts of the United State (U.S.) and Canada in 2012 in New York City largely confirmed the model. Kryvasheyev et al. (2016) [9] presented a multiscale analysis of Twitter activity before, during and after Hurricane Sandy. Wang et al. (2017) [10] reviewed how existing studies

analyze four dimensions (space, time, content and network), summarized common techniques for mining these dimensions, and then suggested some methods accordingly. Jamali et al. (2019) [11] introduced a multi-step methodology for analyzing social media data during the post-disaster recovery phase of Hurricane Sandy.

The present study is closely related to (1) studies on the use of social media. Comparing the prior studies mentioned above, the present study demonstrates the novelty, verifying the potential utilization of social media as a digital infrastructure concerning disaster countermeasures in Japan. Additionally, in this academic area, Enomoto et al. (2013) [12] and Yamada et al. (2019) [13] just targeted Twitter among social media. However, as explained in the latter sections, the present study takes up social media of ICT as a digital infrastructure, and indicates the potential utilization in disaster countermeasures, considering the characteristics of information communication environment and methods, and referring to the results of survey on the utilization of ICT at the times of past large-scale natural disasters in Japan.

3 UTILIZATION OF SOCIAL MEDIA AND GIS AT THE TIME OF DISASTERS

3.1 Utilization of Social Media at the Time of the Great East Japan Earthquake

According to Yamamoto (2017) [14], various initiatives have been taken to minimize information vacuums as the Great East Japan Earthquake (2011) caused immense damage to digital infrastructures, and a broad area was left blank in terms of information communication immediately after the earthquake and its secondary disasters including tsunami. Due to the widespread and immense damage caused by the above disasters, new types of media such as social media were actively utilized, and individuals can send detailed information without the limitations of mass media. In particular, individuals on social media can send information from both PCs and mobile information terminals, and that enabled the damage situation to be widely communicated toward all over the world before mass media can enter the damaged area. This is made possible by the spread of various social media in which individuals can send and receive information in multiple forms by combining images, movies, voice recordings in addition to texts. In this way, social media has become part of the disaster information sharing system (L-Alert), and has fulfilled an important role in the diversification and layering of information communication methods.

3.2 Policies for the Utilization of Social Media in Recent Japan

The Committee for Policy Planning on Disaster Management Final Report of the Central Disaster Management Council (2012) [15] indicated the need to gather information from private media including social media, as governments have its limitations in gathering information. Similarly, as the utilization of geographical space information (G space information) can be extremely effective in the coherence in situational awareness and decision-making support, the necessity of progressing maintenance and sharing of static information during normal times as well as development of a system to promptly gather dynamic information were also indicated. Additionally, the development of GIS is considered to be promoted in order to support disaster countermeasures in the Master Plan for Disaster Prevention (2016) [16] as well. Therefore, social media, which has been deeply rooted into our daily life and can rapidly spread information, and GIS, which enables the consolidation and sharing of information using digital maps, have become an important foundation of all

general infrastructures as a digital infrastructure in recent Japan and are considered to fulfil a vital role in disaster countermeasures.

Regarding social media, the Cabinet Secretariat published and distributed the guidebook on the utilization of social networking services (SNS) for disaster response in 2017 [17], local governments are encouraged to utilize SNS at the times of disasters. In fact, as a famous example of the utilization of SNS by a local government, it can be introduced that Nagano Prefecture conducted information gathering and rescue activities using Twitter at the times of Typhoon Hagibis in October 2019. Nagano Prefecture used their official account for disaster prevention information as a tool to gather rescue request information, and encouraged users that need be rescued to submit tweets with images, location information, and the hashtag “#TyphoonHagibisDamageinNagano” resulting in 50 cases of tweets leading to successful rescues (Yamamoto, 2020) [18]. Based on these real cases during disasters, each local government can promote the setting of rules for utilizing Twitter according to the local situation beforehand. Additionally, in 2020, Koshigaya City, Saitama Prefecture set up the operation standard of the use of hashtag included into tweets.

4 OUTLINES OF THE HEAVY-RAIN DISASTER IN SOUTHERN KYUSHU IN 2020

In July, 2020, the flood, which occurred in southern Kyusyu including Kumamoto, Kagoshima and Oita Prefectures and was caused by torrential rain, washed out many residences and buildings. The central government dispatched approximately 10,000 Self-Defense Force (SDF) personnel to southern Kyusyu. Fig. 1 shows the location of the above three prefectures and the Kuma River in the southern part of Kumamoto Prefecture. Especially in Kumamoto Prefecture, the Kuma River, which is one of rapid streams in Japan and flows through the southern part, has overflowed in 13 places. 14 people have been found without vital signs at a nursing home in a flooded area near the Kuma River in Hitoyoshi City, Kumamoto Prefecture.

However, as torrential rains and typhoons often flooded the Kuma River and great damages happened, the countermeasures against such disasters have been undertaken from the past. Specifically, as a result from the flood in the lower basin of the Kuma River in the 1960's, the Ministry of Construction announced the plan to build a dam over the Kawabegawa River that is one of the tributary rivers of the Kuma River. However, the general public and scientists had been taking objection to the construction of the dam in all parts of Japan for a long time. As a result, the governor of Kumamoto Prefecture finally withdrew the plan to build the dam in 2008. Nevertheless, due the flood caused by the heavy-rain disaster in southern Kyusyu in 2020, the governor of Kumamoto Prefecture restarted examining the plan to build the dam over the Kawabegawa River as the specific measures for flood control and water utilization. At present, in Kumamoto Prefecture, the governor, the general public and scientists discuss whether it is necessary to build a dam over the Kawabegawa River.

Based on the experiences and lessons from the past weather-related natural disasters in Japan, the Meteorological Agency and the academic societies specialized in climate and natural disasters alerted the general public in southern Kyusyu a few days before the torrential rain, and the residents in southern Kyusyu finished the preparation to evacuate beforehand. Therefore, though the flood caused a lot of damage, there is little human damage in this area. However, new issues have come to the front. First of all, due to the influences of COVID-19 epidemic, it is essential to take sanitary measures in evacuation shelters. Secondly, in the case of torrential rains, it is necessary for the residents to vertically take evacuation action to public and private buildings, and their relatives' residences on elevated places.

Fig. 1. Location of southern Kyushu (Kumamoto and Kagoshima Prefectures).

5 UTILIZATION OF SOCIAL MEDIA AT THE TIME OF THE HEAVY-RAIN DISASTER IN SOUTHERN KYUSHU IN 2020

5.1 Utilization of Social Media

Makino et al. (2018, 2019) [19, 20] integrated multiple systems including social media and Web-GIS to develop a spatiotemporal information system. When a tremendously heavy rain occurred in southern Kyushu in July, 2020, various kind of information related to the disaster and its damages using social media was accumulated and displayed on the digital map included in the function of social media mapping of the above spatiotemporal information system.

For representative examples, Fig. 2 shows the information related to the seriously damaged area in Yatsushiro City, Kumamoto Prefecture, which was submitted using YouTube. Additionally, Fig. 3 reported the information related to the real situation after the disaster in Kuma Village, Kumamoto Prefecture, which was submitted using Twitter. The torrential rain and flood caused a lot of damage in the basin of Kuma River including Yatsushiro City that is located in the lower reaches, and Kuma Village that is located in the middle reaches. Otherwise, Fig. 4 shows the information related to the seriously damaged area in Hita City, Oita Prefecture, which was submitted using Twitter. Large-scale floods have frequently attacked the basin of Chikugo River including Hita City in the past.

Fig. 2. Information related to the seriously damaged area in Yatsushiro City, Kumamoto Prefecture using YouTube.

Fig. 3. Information related to the real situation after the disaster in Kuma Village, Kumamoto Prefecture using Twitter.

Fig. 4. Information related to the seriously damaged area in Hita City, Oita Prefecture using Twitter.

5.2 Utilization of Twitter

At the time of the heavy-rain disaster in southern Kyusyu in 2020, the Twitter Japan proposed the use of tweets for rescue requests, and submitted the example tweet in easy-to-understand manner from the account of Twitter lifeline. The hashtags used in tweets related to the heavy-rain disaster in southern Kyusyu in 2020 can be organized as shown in Table 1. Table 1 clearly indicates that the attached hashtags changed with the passing of time. In terms of the characteristics of hashtags, (1) multiple different hashtags indicating the same content were randomly created, (2) almost all tweets had hashtags and many had multiple hashtags, (3) most tweets contained the hashtags of specific local areas affected by the disaster in addition to the hashtags related to the situation at the time of disaster and calls for help. However, due to the COVID-19 epidemic, as clearly illustrated in Table 1, it can be found the hashtags related to the disease immediately after the disaster.

Table 1. Kinds of hashtags related the heavy-rain disaster in southern Kyushu in 2020.

Hashtags during and immediately after the disaster	
Disaster situation	#disaster #landslidedisaster #landslides #gravel #mudslides #pouringrain #heavydownpour #flooddamage #riverflooding #torrentialrain #heavyrainfall #highflow #raindangerous #raindamage #heavyraindisaster #heavyraindamage #long-termrain #flooding #heavyrain #submergence #onthevergeofsubmergence #submergedcar #house #floodbelowfloorlevel #driftingwastes #springwater #unpredictablesituation #compositedisaster #bankrip #damages #mud
Evacuation	#evacuation #(affectedlocalgovernment(prefecture/city/town))evacuation #evacuationcall #evacuationorder #emergencywarning

	#heavyrainfallwarning #heavyrainfallemergencywarning #earlywarning #actionforprotectionof our lives #evacuationtohouse #ultimatewarning
Rescue requests and cooperation	(Including tweets obviously on someone's behalf based on the context) #rescuerequests #rescuerequestsforOkayama #rescuerequestsforHiroshima #rescuerequestsforEhime #rescuerequestsforMabicho #(disaster)rescue #(disaster)relief #SOS #Pleasehelp #HELP #Landslideshelp #helplandslides #helpheavyrain #missing(person) #safetyunknown
Specific locations of the affected areas	#affectedareasoftheheavyraindisasterinsouthernKyushu2020 #(affectedlocalgovernment(prefecture/city/town)) #(specificlocations(schools and other facilities that are designated as evacuation centers and hospitals)) #(specificlocations(districts and rivers)) #(specificlocations(districts and rivers))flood
Information communication	(Including tweets without hashtags but contain requests to be retweeted) #pleaseretweet #retweet #RT #PleaseRT #warnings #currentsituationnotreported
Hashtags from immediately after the disaster	
Name of the disaster	#HeavyraindisastersouthernKyushu2020 #HeavyrainsouthernKyushu2020 #disaster southernKyushu2020Floods #2020JapanFloods # southernKyushu2020disaster #heavyrain2020
Support	#(disaster)restoration #(disaster)recovery #medicalcare #DMAT #watersupply #(disaster)volunteer #volunteerswanted #volunteershope #evacuationsite #(specificevacuationsite) #(disaster)support #reliefsupplies(specific supplies) #drinkingwater #cooperationforreconstruction #sympathetic chord #sludgescraper #cleaning #wewillsendsupplies #bath #shower #disastervictims #affectedareas #Letthisreachthedisastervictims #helpingeachother #search #readyserviceprogramatdisasters #SDF(dispatched)
Evacuation destination	#evacuationsites #specificevacuationsites #temporaryhouse #evacuationwithpets #petevacuation #COVID-19 #allergicreaction
Encouragement	#StaystrongKyusyu #Staystrong(affected local government (city/town)) #Wecanbeattheheavyrain #expressmysympathies #Peacebewithyou
Donation and contributions	#2020JapanFloodsfund #2020JapanFloodsdisasterrestorationsupportfund #Yahoointernetdonation #cloudfunding
Designated disasters	#tremendouscatastrophe #designatedtremendouscatastrophe #designatedspecifieddisaster
Post-disaster issues	#wateroutage #poweroutage #heatstroke #severeheat #infections #sterilization #traffic #lackofmanpower #lackofwater #roadclosures #(disaster)theft #crimepevention #trafficin(affected local government (city/town)) #donationfrauds #chainemails #falserumors #violence
Gratitude	#Iwasrescued #gratitude #thankyou #thanktomedical professionals #thanktoSDF
Pets	#pets(in affected areas) #(pet food)

In Oita Prefecture, some areas are damaged by the torrential rain at that time. Oita Prefectural Government set the staff in charge of SNS and used their official Twitter account for disaster prevention information as a tool to gather the information concerning rescue request and safety confirmation of the residents. This effort resulted in 10 cases of tweets leading to successful rescues and safety confirmation of the residents. However, Kumamoto Prefectural Government just submitted various information using the official email account and website, not using SNS at all. Especially in southern parts of Kumamoto Prefecture, wide areas were seriously damaged and precious lives and property were lost in the basins of the Kuma River.

6 CONCLUSION

Based on the results of Yamamoto (2020) [1], the present study described the utilization and issues of social media at the heavy-rain disaster in southern Kyusyu in 2020. First of all, section 3 described the utilization of social media at the time of the Great East Japan Earthquake, and introduced the policies for the utilization of social media in recent Japan. Next, section 4 mentioned the outlines of the heavy-rain disaster in southern Kyusyu in 2020, and described the floods that attacked Kumamoto Prefecture in particular. Additionally, section 5 illustrated the utilization of social media at the time of the heavy-rain disaster in southern Kyushu in 2020, focusing on Twitter.

At the time of torrential rain in southern Kyusyu in 2020, social media is utilized as powerful tools to submit and gather the information related to the disaster by the general public in addition to the central and local governments. In fact, Oita Prefectural Government set the staff in charge of SNS and used their official Twitter account for disaster prevention information as a tool to gather the information concerning rescue request and safety confirmation of the residents. This effort resulted in 10 cases of tweets leading to successful rescues and safety confirmation of the residents.

However, it was not possible for all of the local governments to effectively utilize social media for many reasons such as human resources and information literacy of the staff at the heavy-rain disaster in southern Kyusyu in 2020. Thus, it is an important issue to make use of the information on social media for rescue in the real space. Based on the real cases during disasters, it is desirable that each local government should promote the setting of rules for utilizing Twitter in particular, according to the local situations beforehand.

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