

NHK BUNKEN FORUM 2016 Presentations of Research Reports
Symposium: Five Years Since the Great East Japan Earthquake
**The Future of Digital Disaster Archives to
“Pass Down and Utilize”***

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YAMAGUCHI Masaru

NHK Broadcasting Culture Research Institute
Media Research & Studies

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http://www.nhk.or.jp/bunken/research/domestic/pdf/20160701_4.pdf

Abstract

Five years have passed since that day. Some of Northeast Japan's coastal areas that were hit by the Great East Japan Earthquake and Tsunami are witnessing a dramatic change in scenery due to work to raise elevations by up to 10 meters. Data on disaster archives is crucial to reconstruct the affected areas in order to connect the past and the present and envision the future. We already see projects utilizing archived data, for example, along with disaster education apps or real-time information for communication during times of disasters. Meanwhile, another reality is that archives aiming to pass down data to the future are closing down one after another.

This article is based on a summary of a symposium themed 'Five Years Since the Great East Japan Earthquake: The Future of Digital Disaster Archives to "Pass Down and Utilize"' held at the NHK Bunken Forum in March 2016. In addition, the author reports recent moves in disaster mitigation and the media regarding the 2016 Kumamoto Earthquakes that occurred after the forum. At the symposium, the panelists looked into the present state of disaster archives and projected their future based on the keywords "utilization" and "sustainability." Given that universities, municipalities, the national government, and the media are the providers of the archives, who are the users? Who uses the archives, and for what purpose and how? Given that digital archives can be sustainable not only by being browsed but also by being utilized, is it feasible to open them to the public in order to promote utilization? The discussion that delved into these questions was also highly interesting in terms of exploring public access in the digital/Internet age and the roles of the media.

I. Introduction

● What Are Disaster Archives?

Since the Great East Japan Earthquake, a wide range of disaster archives have been created to record the unprecedented disaster of the earthquake, tsunami, and nuclear accident, and to transmit lessons to future generations. Disaster archives collect, preserve, and allow access to photographs and video with time and location data, testimony and administrative response, and other digital data, and are accessible via the Internet.

Photos and video from the 1995 Great Hanshin Earthquake had to be digitized for preservation. However, by the time of the Great East Japan Earthquake, digital cameras, including mobile phone cameras, were widespread. Created at the time of shooting, digital metadata for location and time, suitable for archiving, was available. In addition, high-speed Internet connections have become more widely available, enabling the sharing of large-sized image and video files. Progress and propagation of the Internet and digital data are major factors in enabling not only the national government, local governments, and universities, but also the media, enterprises, NPOs and other organizations to create archives.

Summing up user views on disaster archives, there is demand for the ability not just to

view content, but to utilize it; not just to browse, but to make secondary use of content by downloading it for disaster safety education, and to call up archive data on tablets and other devices for utilization as linked open data, all using sophisticated ICT. The question facing archives is how freely their data may be used, that is, their degree of openness. The utilization of digital archives gives greater meaning to their existence and guarantees their sustainability. In other words, it is important to manage archives for transmission and utilization.

Figure 1. Issues Relating to Disaster Archives

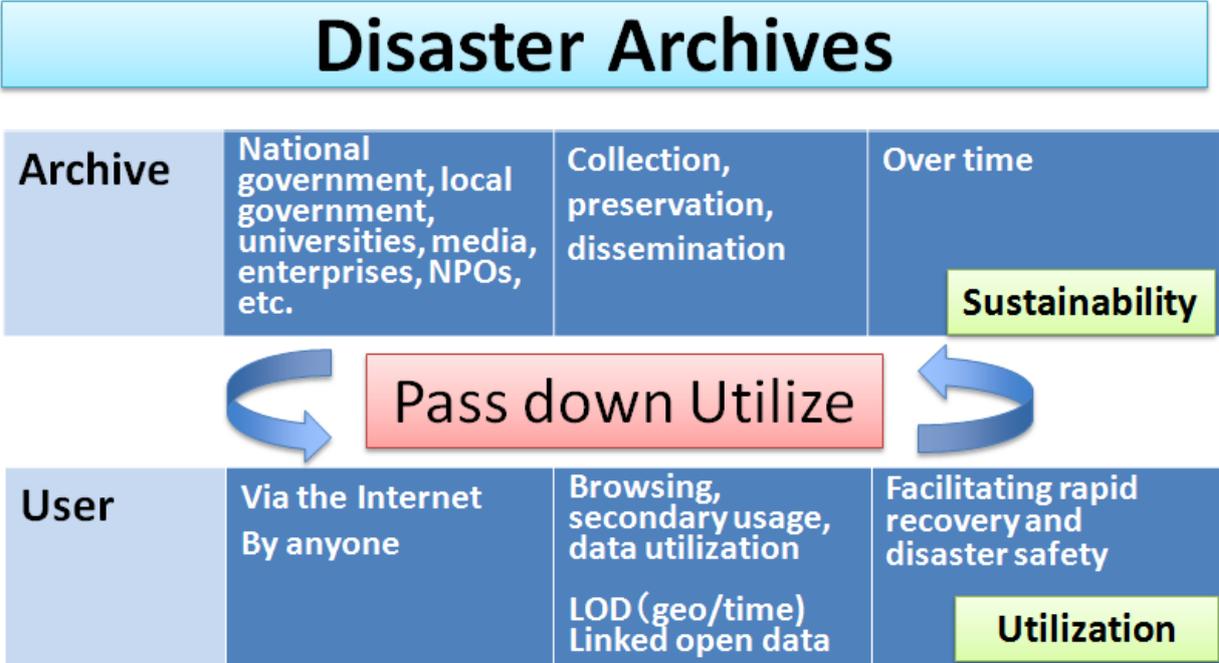


Figure 2. Disaster Archives in the Five Years Since the Great East Japan Earthquake

Five Years of Disaster Archives		
2011. 3	Great East Japan Earthquake	Seven Principles for the Reconstruction Framework Disaster Archive
2012	Started at Tohoku University, Google, Yahoo, NHK, etc.	
2013. 3	Great East Japan Earthquake Archive (Hinagiku)	started at National Diet Library
2014. 3	Termination of government project to promote digitalization of disaster area records	
	9	Closing of submission to the Yahoo Japan Great East Japan Earthquake Photograph Preservation Project
	11	Closure of Rikuzentakata Disaster Archive Navi
2016. 1	Closure of Aomori Archive Systems	
	3	End of Concentrated Reconstruction Period Bunken Symposium "Going Forward: Utilization and Sustainability"

● Five Years of Disaster Archives

Looking back at the course taken by disaster archives over the past five years, for the three years since the disaster, the national government provided financial and other support for archives. This was an initial phase¹⁾ during which archives were created by many organizations. In 2014, however, with the termination of national government or other support, archives began closing and links to archives managed by enterprises became increasingly non-functional. In September 2014, Yahoo Japan stopped soliciting disaster area photographs from the public for its Great East Japan Earthquake Photograph Preservation Project.²⁾ Furthermore, March 2016 marks the end point for the five-year Concentrated Reconstruction Project.

Archives are supposedly created to transmit memories and lessons into the future. Are we applying the lessons of past disasters? Will disaster archives continue to transmit information? To answer these questions, we organized a symposium to look at the present state of archives and project their future.

The keywords for the symposium were “utilization” and “sustainability.” How should archives be utilized for recovery, disaster safety, and disaster mitigation? What roles should be played by national and local government and the media? Radio broadcasting in Japan began two years after the Great Kanto Earthquake of 1923, utilizing the lessons of that disaster. NHK, the national broadcaster, took on the responsibility to “protect the lives and property of the people of Japan.” Through disaster archives, defined as Internet-based disaster safety content services, today’s NHK, which is preparing for the evolution of public broadcasting toward public media,³⁾ has an opportunity to explore the shape of public media in terms of public access and the role demanded of archives in an Internet-connected world.

The two-hour symposium was held on March 3, 2016, in Tokyo’s Chiyoda Broadcasting Hall, with approximately 250 attendees. Panelists included five individuals from academia, local government, national government, and the media who are involved in disaster archive creation and utilization.

- Fumihiko Imamura
(Director, International Research Institute of Disaster Science, Tohoku University)
- Fuminori Ono
(Regional Community Division Manager, General Affairs Department, Tagajo City)
- Yasuko Suwa
(Senior Librarian, Digital Information Department, National Diet Library)
- Hidenori Watanabe
(Associate Professor, Faculty of System Design, Tokyo Metropolitan University)
- Toshio Kuramata
(Senior Producer, Archives Division, Rights & Archives Management Center, NHK)

The sessions were coordinated by Shunya Yoshimi (Professor, University of Tokyo III/GSII), a specialist in community and media issues who has been commenting on the importance of disaster archives since the early stage. The sessions were moderated and summarized by Masaru Yamaguchi (Principal Researcher, Media Research & Studies Division, NHK Broadcasting Culture Research Institute).

The symposium had two sessions. **Session 1, Disaster Archives: Current Status**, consisted of reports concerning current status and pending issues from academia, local and national government, and the media. **Session 2, The Future of Disaster Archives**, focused on data usage, data journalism, disaster studies, and recovery tourism, and the utilization as well as sustainability of disaster archives.

II. Symposium Session 1 Disaster Archives: Current Status

II-1. Disaster Archives and Research on Disasters and Disaster Safety

Tohoku University Archive Project —Michinoku-Shinrokuden⁴⁾



Immediately after the Great East Japan Earthquake, Tohoku University began gathering memories, records, case studies, and findings about the disaster, and established the Michinoku-Shinrokuden to preserve and transmit this information.⁵⁾ The university has taken the lead in disaster archive activities in coordination with local governments and enterprises. At the start of the symposium, Director Fumihiko Imamura of Tohoku University's International Research Institute of Disaster Science reviewed the Michinoku-Shinrokuden's five years of operation based on the theme, "Disaster Archives: Why Now?"



Imamura: The Great East Japan Earthquake was a region-wide compound disaster, with an earthquake, a tsunami, and a nuclear accident. If we compare the disaster to memories of color, the mud and rubble of the tsunami are brown, the secondary fires are red, and the radiation is transparent and colorless. There is no one color for the disaster. The national government's Seven Principles for the Reconstruction Framework specifies in Principal One that disaster archives serve for mourning and the repose of the souls of the dead, as well as for transmission and dissemination of lessons learned. Every day, recovery work proceeds in the disaster areas without full certainty about how to go about rebuilding settlements and communities. A disaster archive is necessary to ascertain what kinds of ways of living, culture, and connections previously existed in a given region.

The goal of an archive from a disaster research standpoint is to apply lessons to a potential large disaster, such as an earthquake with its epicenter in Tokyo or along the Nankai Trough. To achieve that, lessons must be shared, generalized, and implemented throughout

society. It is also necessary to promote pre-recovery⁶⁾ efforts before the disaster happens, so as to speed recovery afterward. Five years have passed since the earthquake disaster. In a mountain-climbing sense, we are only at the third station. We have only just completed compiling archives with records of the disaster. The really hard part of the climb is ahead of us.

II-2. Disaster Archives and Local Government

**Disaster Safety and Mitigation Archives, Historic City of Tagajo
—Tagajo KenBunOku Great East Japan Earthquake Archive in Tagajo⁷⁾**

Participants next watched a video made in coordination with Tohoku University that profiled the efforts of Tagajo, Miyagi in taking the lead to create and utilize a municipal archive for disaster mitigation, recovery, and community building.

Video summary



The *Tagajo KenBunOku* disaster safety and mitigation archive contains approximately 20,000 disaster- and recovery-related browsable photographs and videos with map data. This content can be downloaded for secondary use. The archive also includes individual eyewitness testimony from each of 180 residents that provides guidance for disaster safety and mitigation.

- Telling the story for 1,000 years



The *Nihon Sandai Jitsuroku*, a national history compiled during the Heian Period, as well as *waka* poems from the time, tell how the provincial capital of Tagajo was severely damaged twelve centuries ago in the Sanriku Earthquake of 869. In 2011, 188 people lost their lives to the tsunami out of a municipal population of 63,000. “We want no more victims, ever again. Let us tell the story for a thousand years,” said Kenjiro Kikuchi, the mayor of Tagajo, as he proposed the creation of the archive in February 2013.

- Utilizing archives to foster community



The *Tagajo KenBunOku* is managed by the Regional Community Department of the Tagajo municipal government. The department uses the archive to promote communication between residents and strengthen regional capacity to cope with disasters. For example, participants in the department’s “First Meal” program look at photographs of emergency food distribution as they talk about the first meal they had after the disaster, and share memories of how the community was able to overcome challenges through mutual assistance.

- Establishment of a disaster science course at Tagajo High School



The archive circle is extending to the younger generation, who will carry the future. Students from Tagajo High School have placed markers on city walls and power poles showing the height reached by the tsunami, so people will not forget the disaster. Moreover, in April 2016, the high school was the first in the nation to establish a disaster science course in coordination with university and research organization cooperation. The principal, Hiroshi Koizumi, said, “When classes under the new course create hazard maps in geography class, we want to make active use of the *Tagajo KenBunOku* resource through techniques such as digital mapping of

archive data.” The archive is also an important tool for transmitting experiences of the disaster to the next generation.

We next asked Fuminori Ono, Regional Community Manager in Tagajo’s General Affairs Department, about his goals and his view of the archive, which he manages.

● Sharing Viewpoints in the Community

Yamaguchi: In talking to local government in the disaster areas, what I am hearing is, “We do not have time to create and manage archives in addition to recovery and renewal efforts,” or “Many residents still cannot bear to look at disaster photographs.” Tagajo is making an archive to share memories of overcoming the disaster, rather than an archive of a tragedy, and they are utilizing it. I was very impressed by this.



Ono: Tagajo has made great progress toward recovery. Looking at the city, you might think nothing happened there. But I do not think the psychological damage of losing precious family members will ever heal. For this reason, the Tagajo archive is a way for people to share positive things. In the five years up to now, they have overcome many difficulties, and the archive is a space where they can make that journey together. The archive gives them an opportunity to communicate and share viewpoints. They are very conscious of the need to strengthen the community against future disasters by promoting communication.

● Communicating to the Next Generation

Yamaguchi: These are archive photos of the Tsunami Landmarks Walk created by students from Tagajo High School. This location is known as “Sue no Matsuyama.”



From “Tagajo KenBunOku”

Ono: Perhaps the *Nihon Sandai Jitsuroku* that was shown in the VTR footage could be thought of as the starting point for the archive. The photo of Sue no Matsuyama is another record of the disaster. There is a classical Japanese *waka* poem⁸⁾ that mentions these pines. “Sue no Matsuyama” normally refers to a place of natural beauty, but as a poetic term it can also signify something impossible. If a big tsunami comes, the wave will not inundate the

mountaintop, according to the poem. During the disaster, the tsunami indeed came to just below the peak, but did not inundate it.

Yamaguchi: I also visited the site. On nearby walls and power poles, I saw blue markers placed by Tagajo High School students indicating the height of the inundation.

Not far from Sue no Matsuyama is a group of rocks in a small pond. These are known as the Oki no Ishi, or offshore stones. This is another famous location that has been immortalized in classical Japanese poetry.⁹⁾ Today, the pond is located in a residential area, but originally the stones may have been surrounded by the sea. When you reach the markers placed by the students, it is like traveling back through time to the world of classical poetry. The walking route lets you experience the disaster and cultural history at the same time.¹⁰⁾

Professor Watanabe, you teach at Tokyo Metropolitan University and have worked with high school students and young people to create digital archives. What is your view?



Blue tsunami marker placed by Tagajo High School students

Watanabe: I found the video to be very moving. Digital archives are nothing more or less than a “medium.”¹¹⁾ I very much agreed with the position that the ultimate goal is to use the archive to transcend generations and personal standings to create connections. I would like to ask whether or not you would be interested in the concept of people in different disaster areas communicating with each other by sharing their respective digital archives. For example, people in Banda Aceh, which was affected by the Indian Ocean Earthquake and tsunami, could share their digital archives with residents of Tagajo to create connections. What are your views on this?

Ono: We hope people will share viewpoints, not just those who experienced the Great East Japan Earthquake, but those who did not as well. Natural disasters are recurring phenomena. In collaboration with people outside the disaster area, we hope to consider what actions can be taken to save lives.

● Disaster Safety and Mitigation Archives Spreading Outside Disaster Areas

Yamaguchi: Mr. Ono just used the words “with people outside the disaster area.” In fact, Tagajo’s concept of a disaster safety and mitigation archive extends beyond the disaster area. In April 2015, Mie Prefecture and Mie University established the Mie Disaster Mitigation Archive,¹²⁾ looking ahead to the forecast Nankai Trough earthquake.

The archive contains accounts of the 1944 Tonankai Earthquake, as well as maps and photographs showing the extent of tsunami damage and stone monuments relating to the mid-19th-century Ansei Earthquakes, and even the 1707 Hōei Earthquake, which occurred simultaneously in both the Tokai and Nankai regions. There is information on regional disaster mitigation efforts, tsunami inundation maps, and uniquely digital information resources, such as tsunami animated inundation simulations. It is a disaster safety and

mitigation archive that facilitates preparation for the next disaster.

Professor Imamura, you have been conducting research in collaboration with Tagajo City. What is your view from the standpoint of disaster research?

Figure 3. Disaster safety and mitigation archives spreading outside disaster areas



Photo from “Mie Disaster Mitigation Archive”

Imamura: The Tagajo archive was first used to share experiences and empathy in the community, and Mie Prefecture expressed empathy as well. The spread of empathy is very important when considering disaster safety and mitigation. I think it will be positive if empathy leads to concrete action.

● Status of Local Government Archives

We have seen what Tagajo is doing, but what about the work of other local municipal archives? We investigated the status of such archives in the three affected prefectures.

First, with respect to prefectural archives, Miyagi created an archive in 2015, and Iwate plans to do so in 2016, while Fukushima has no such plans. When asked the reason for this, a Fukushima representative responded that the nuclear disaster remains ongoing, and that the prefecture is requesting the central government to create a national archive facility, not a web-based archive. Looking next at the percentage of local municipalities with archives, 97% of Miyagi municipalities had archives, while Iwate was at 9% and Fukushima at 7%. Miyagi provides support for the creation of municipal archives. Since the outlay associated with archive creation is hard for small municipalities to bear, support from prefectures, universities, and the national government is essential. Iwate plans to coordinate with municipalities on archive creation. When asked about challenges of creating archives, municipalities mentioned difficulties in knowing how to make use of archives, and noted that clearing usage rights and maintaining archives was labor-intensive.

Figure 4. Status of Local Government Archives in Three Affected Prefectures

Status of Local Government Archives in Three Affected Prefectures

	Prefectural archives	Municipal archives	No. of municipalities with archives	Total municipalities	Creation rate
Iwate	Projected for FY2016	Kuji, Noda, Fudai	3	33	9%
Miyagi	2015	Higashimatsushima, Tagajo, Kesenuma	34	35	97%
Fukushima	None	Koriyama, Tomioka, Futaba, Kawauchi (centering on nuclear reactor disaster)	4	59	7%

II-3. Disaster Archives and the Central Government

National Diet Library Great East Japan Earthquake Archive (Hinagiku)¹³⁾

So far we have reviewed archive-related activities by local government. What about national archives?



Hinagiku

Hinagiku is a national portal site to preserve and make available records of the Great East Japan Earthquake on a nationwide basis. The site uses metadata to enable integrated searches of data distributed over multiple archives. The portal went live on March 7, 2013. As of the end of February 2016, there were approximately 3.34 million searchable metadata entries spanning 45 databases of 39 organizations. Access numbers have been rising since its establishment, and are currently around 300,000 per month.

Yasuko Suwa, Chief Librarian at the Electronic Information Department of the National Diet Library, gave a presentation titled “The Role of and Challenges Facing a National Portal and Archive Last Resort.”



Suwa: The national portal site allows horizontal searches of data distributed across a variety of archives. The National Diet Library is also the archive of last resort, in the same way that a central bank is the lender of last resort to other banks. As an archive, the library’s role is to accept content that has nowhere else to go. As an example, the Rikuzentakata Disaster Archive Navi closed down in November 2014. To be specific, this archive was not managed by Rikuzentakata City, but rather, it was a council-style archive intended to verify archive management by the Ministry of Internal Affairs and Communications. Once its funding was terminated after two years, it closed down. The archive content became the responsibility of the library, and we had to

seek out 21 rights holders and clear usage rights with each one. Some individual rights holders did not realize that their photographs were online and could be accessed from anywhere in the world. Ultimately, of the 21 rights holders, two could not be contacted and one failed to respond, which meant that their content could not be included. The archive currently contains 5,404 items, which we are once again making available. I believe that as more archives close down, it will be difficult for the National Diet Library to rescue all of the relevant content, due to staff and budget limitations in such areas as clearing usage rights.

Yamaguchi: Does Hinagiku accept photos and other materials from individuals?

Suwa: In principle, the library does not accept submission from individuals. When we receive inquiries, we direct the person concerned to Google and other archives that do accept such submissions.

II-4. Disaster Archives and the Media

NHK Great East Japan Earthquake Archives¹⁴⁾

The topic next turned to media archives. Newspaper, television, and Internet media companies are creating and making available their own archives of articles, testimony, photos and video.

NHK began making its Great East Japan Earthquake Archive available in March 2012. The archive includes 800 news clips, as well as 600 from a program titled “Where I Was on That Day.” Maps show inundation areas, and testimony includes thumbnail photos of individuals. Clicking on the photo plays video testimony. Toshio Kuramata, who has served as chief producer of the archive since 2014, reported on its current status and challenges.



NHK Great East Japan Earthquake Archives design as of March 2016



Kuramata: During the first month after the archive opened in March 2012, it was accessed more than a million times. But by March 2014, that number had dropped to one sixth. To determine why, we held group interviews with users, who told us among other things that content was difficult to search, and that there was not enough updated information and perspective data. Curation sites are currently popular on the Internet, and in response, we added testimony curation, which displays testimony by type of experience or lesson learned, as well as regional curation presenting content sorted by municipality. In addition, we display video access rankings on the top page. All of these measures are intended to encourage access. The archive was accessed around 200,000 times in March 2015, which I believe indicates that access has stopped declining. However, we may close the archive if access falls further.

In March 2016, we released a new collection of video content¹⁵⁾ relating to the first 72 hours after the earthquake, and will continue working to encourage access.

II-5. Archive Sustainability and Public Access

At the close of Session 1, having heard reports from representatives of academia, local and national government, and the media, we summarized the challenges currently facing archives.



Yamaguchi: One challenge that is coming into view is that when user interest declines or funding is terminated, archives are closing. The National Diet Library is trying to serve as the last resort for accepting material when archives close. However, the library has limited resources for clearing usage rights, etc., and it does not accept submissions from individuals. Yahoo Japan's Photograph Preservation Project stopped accepting individual submissions in 2014. As was stated at the outset, the purpose of archives is to transmit information to future generations, but their sustainability comes with a variety of challenges. I think the question then becomes, who will support digital archives, and how accessible are they to the public?

Professor Yoshimi, as commentator, what was your impression of the first half of the discussion?

Yoshimi: I think this has been very stimulating. First of all, there was a great deal of similarity among the problems and concerns reported by the four entities: Tohoku University, Tagajo City, the National Diet Library, and NHK. I found it interesting that the monthly access figures for the library at around 300,000, and for NHK at around 200,000, were in the same range.

Archives are becoming more prevalent in our society as a very new form of media. They are different from broadcast media. Broadcasts are for watching, while archives are to be utilized. Who uses them, how, and for what purpose is decisively important. Suppose the user is a school. We heard about Tagajo High School, where teachers and students use an archive in the education process. Local communities are another facet. Local residents are using archives for the future of their communities. Archives are also being used for the same



purpose in places like Kochi, Mie, or even Banda Aceh. Japanese people and people outside Japan are not just browsing or utilizing these archives casually. It is significant for archives that people have a goal and are using them with intent.

However, there are three obstacles. One is usage rights, including right of likeness, copyright, and proprietary rights. Unless some limitation is placed on these rights, the material will not be accessible and usable by everyone. Another obstacle is funding. Mr. Yamaguchi mentioned that as interest in archives wanes and funding is reduced, archives are unable to continue operating. The question becomes, how can sustainable approaches be devised? The third obstacle is organizational. Different organizations—libraries, broadcasters, and local governments—are creating archives, but crossing organizational barriers is difficult. How can archived content that has been curated in different ways by different organizations be merged, and not simply searched, at the national level?

Another major question is, who is the ultimate owner of disaster archive content? Does this accumulated content belong to those who now manage it? If the content is opened up and public accessibility enhanced, who will be responsible for hosting it? I would appreciate some discussion of this question.

Yamaguchi: Professor Yoshimi, in your personal opinion, who do you think the disaster archives belong to? Who should ultimately host them?

Yoshimi: The abstract answer to both questions is the public. By this I do not mean just the “masses” or the average citizen.

Yamaguchi: Do you mean society?

Yoshimi: Yes, but that could also mean individuals, which could be students of Tagajo High School, or people in Kochi, or in Taiwan, or Banda Aceh.

This concluded Session 1. Discussion of Yoshimi’s question as to who the archives belong to was left for the second half of Session 2.

III. Symposium Session 2 The Future of Disaster Archives

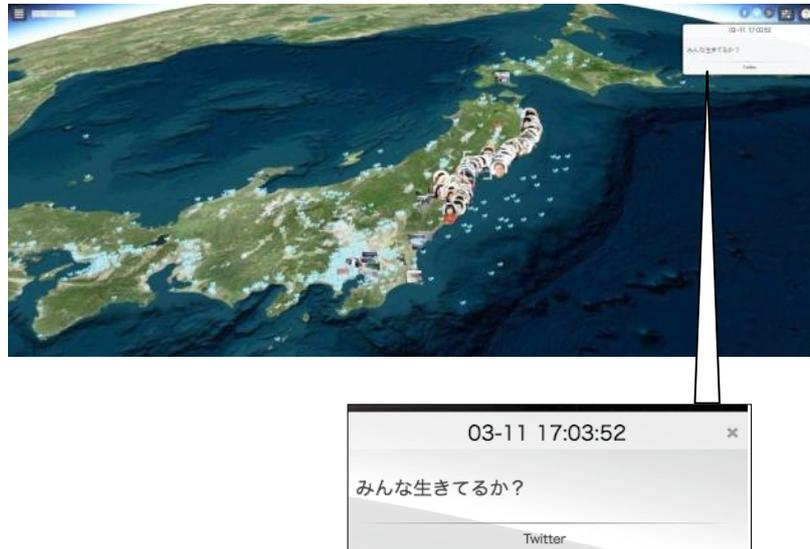
III-1. Possibilities for Data Usage

The second session dealt with the future of disaster archives, with discussion exploring the types of data utilization that are made possible only with digital archives. First, Hidenori Watanabe (Associate Professor, Tokyo Metropolitan University) presented four data architecture examples with the theme, “Spinning the Data and Connecting It to Society.”¹⁶⁾

- **Digital Globe Mapping**

- Spinning Spatial and Temporal Data and Connecting It to Society**

Watanabe's East Japan Earthquake Archive¹⁷⁾ incorporates testimony, still images, and video from four different sources: Twitter, Inc.,¹⁸⁾ Weathernews Inc.,¹⁸⁾ Asahi Shimbun Company,¹⁹⁾ and the FNN Great East Japan Earthquake Archive,²⁰⁾ and maps them onto a digital globe with location and time data. A mouse can be used to view the data while moving through time and space.



The East Japan Earthquake Archive



Watanabe: With just a click, you can learn what a certain individual experienced on the day of the earthquake and how she or he intends to live going forward. The small points visible across the map and over the water are all tweets made on the day of the quake with location data provided by Twitter. Zooming in on the area around the city of Shiogama, we see a single tweet icon. Click on it, and we have March 11, at around five p.m. It simply says, “Is everyone alive?” We are living in an era when feelings that people had on that day are embedded in the Internet.

- **Making Victim Movement Visible: Disaster Analysis**

In March 2016, an archive was launched that was named We Shall Never Forget - Last Movements of Tsunami Disaster Victims.²¹⁾ This archive was created in collaboration with the Iwate Nippo Newspaper and records the movements of individuals after the earthquake until they lost their lives to the tsunami. A point represents a victim, and the line shows the direction they took while attempting to evacuate. Iwate Nippo journalists spent five years interviewing family members and collecting data on 1,300 residents of the prefecture.



We Shall Never Forget is an archive that tracks the movements of people who were lost to the disaster. The lines show victims' movements. They converge on Rikuzentakata Municipal Gymnasium. (Lines have been touched up to show better in grayscale.)
http://iwate.mapping.jp/index_en.html

Watanabe: The many lines you see converging are people moving toward the Rikuzentakata Municipal Gymnasium. Although they all evacuated to this disaster shelter, there were no survivors. Iwate Nippo's main goal in gathering this data was for lessons it teaches. This is evidence of people's actions before they met their end. We just see lines quietly moving, but from them we can learn what to do if a disaster strikes. This is an archive for the future. Looking at the district of Taro in Miyako City, there are only points, not lines. Because of the seawall, no one attempted to escape.

● The Young Encounter Survivors Through Archives

Watanabe's method of creating an archive by mapping data onto a digital globe began with the Nagasaki Archive,²²⁾ a digital archive of atomic bomb survivors. He still conducts workshops using the archive that invite survivors to recount their experiences to young people and to consider ways that the archive can be used.

Watanabe: Atomic bomb survivors can tell their stories to young people, who will listen. Furthermore, they can see their testimony on a map and how it is being transmitted to the world. Young people tend to be uninterested in hearing about the war, but some of them join the workshop because they are interested in the digital archive. What is important is that we can create a place where people of different ages with a variety of levels of interest can gather around a table and talk about the war in a relaxed setting. Perhaps, now that 70 years have passed since the war, we can talk about it in a relaxed way. Last year (2015) there was a similar workshop where Japanese and Indonesian students gathered in Banda Aceh, Indonesia. The workshop dealt with how tsunami memories should be transmitted to the future. Some of the students were very enthusiastic. More than 10 years have passed since the tsunami in Indonesia, and it is becoming possible to talk about memories of the disaster in a relaxed way. Listening earlier to the discussion about Tagajo, I felt that for the Great East Japan Earthquake as well, we have reached a stage where it is becoming a lot easier to discuss the disaster.

Perhaps by layering information from a range of sources onto a digital globe, the organizational barriers cited by Professor Yoshimi can be breached. The most important thing in terms of usability is to collaborate directly in creating the archive. Rather than access statistics, I think the more important question is how many people can collaborate directly.

Yamaguchi: Professor Imamura, how do you view Professor Watanabe's archive from a disaster research standpoint?

Imamura: I was inspired. This has genuine disaster safety value. The archive is useful for casualty-reduction analysis. Actually, we have always had data on natural disasters such as earthquakes and tsunamis, but not on people's movements or about social vulnerabilities. Professor Watanabe's archive shows people's movements at a glance, along with when and where in time and space. And there is something else. Disaster safety is not something for other people. It is for each of us personally. The high school students and young people who make archives in workshops may not have experienced a disaster or war, but they invest themselves in the process and try to create something new. This is related to the idea discussed earlier of moving from empathy to action. I think these efforts are worthy of attention.

Suwa: Professor Watanabe's archive promotes utilization, while our own Hinagiku archive promotes accumulation. It is like a closed-stack library where the books cannot be inspected directly. Still, people also like to be able to wander through a large variety of material in their own way. That experience is important. As such, I feel that both types of archive are necessary.

Ono: Although Tagajo's archive is digital, we convert it back to analog when we use it. We put photographs in displays and distribute printouts of testimony to the community to pass from reader to reader. I think it is very important that individuals be able to make use of digital data in an analog format that feels familiar.

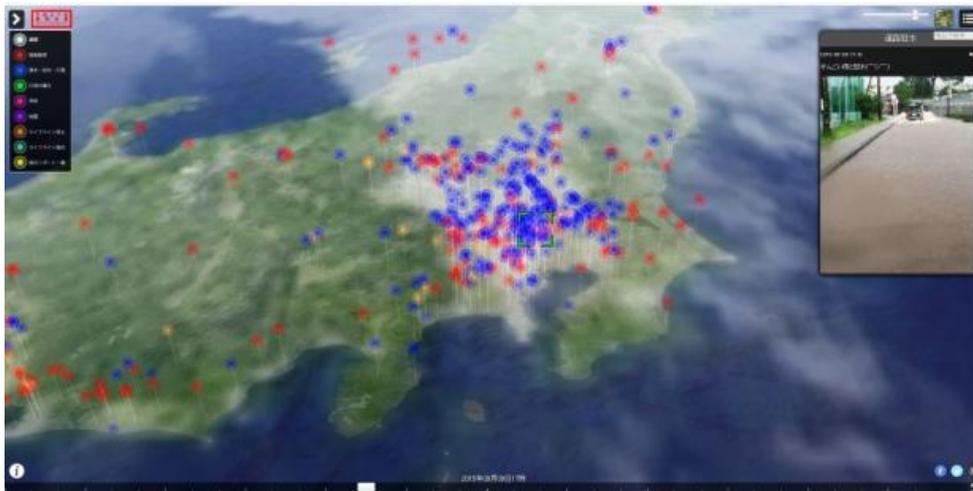
Yoshimi: I thought Professor Watanabe's presentation was wonderful. First, he was able to transform into data the Iwate Nippo journalists' efforts to determine the evacuation route taken by each victim. I was very impressed by that process. Earlier, I mentioned the public as the ultimate owners of the data in disaster archives. Trust is the foundation of the public sphere. So, how is trust established between the person gathering the data, the person who makes it available, and the person who uses it? The process of trust formation establishes the community. The second thing, as Mr. Ono mentioned, is that although one might think digital archives are becoming more and more virtual, in fact the opposite is true. We need to go from virtual to real, or from media-based to face-to-face communication. Our ability to create settings for communication—in local communities, in classrooms and workshops—is tremendously important to digital archives. Third, I felt that the potential for sharing will be necessary for digital archives to develop. How much data can be shared between people in Japan and Indonesia, or atomic bomb survivors and young people, or people from different cultures, generations, and social backgrounds? What is it that creates possibilities for sharing? At a fundamental level, it is the dearly departed who prompt people to share. Our ties to people who passed away in wars and disasters make it possible to create the future. Our sharing is enabled by the departed. In that sense I feel that archives have a future.

Imamura: Professor Yoshimi stated that sharing is enabled by the departed. Indeed, mourning and services for the souls of those lost is one of the Seven Principles for the Reconstruction Framework. In a sense, we are all survivors. We pray that the dead will find peace. More major disasters will occur in the future, in Japan and the rest of the world. What should we survivors do to address this? That, I think, is the real question.

- **Merging with Real-Time Data**

Transmitting Disaster Information

So far we have looked at archives that preserve records of past events. But by mapping real-time data onto a digital globe, we can record and transmit events in the present, including disaster-related information.



Typhoon Realtime Watcher (right side of photo has been enlarged)

Professor Watanabe’s Typhoon Realtime Watcher²³⁾ automatically maps real-time weather data and disaster and weather reports with images from registered members of Weathernews nationwide as linked open data. The photograph is from archived data relating to floods in the Kanto and Tohoku regions in September 2015.

Watanabe: We have seen both real-time data presentation and past data archiving. The service is a digital archive and a news flash system for real-time disaster information. As a digital archive, it can preserve a record of past information, and it can also help mitigate the damage from disasters that are actually happening to us in the present.

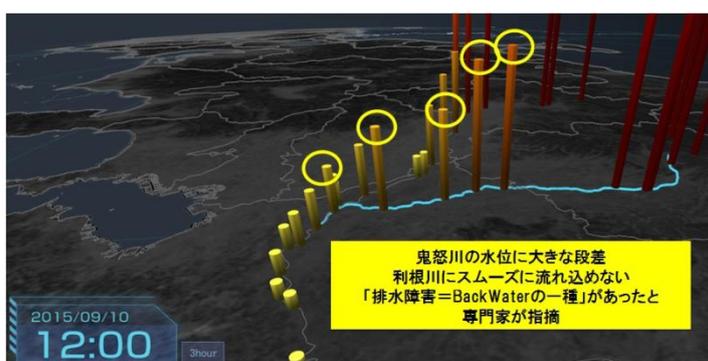
- **Data Journalism: NHK NMAPS**

Based on discussion with Professor Watanabe, NHK developed the NMAPS (News Mashup Advanced Probe System) as a data journalism project. NMAPS can provide early information about impending disasters to viewers from real-time data. It quickly combines all kinds of big data, including spatial and temporal information, and projects weather and other data onto a digital globe. During the 2015 floods in the Kanto and Tohoku regions, the system was used for weather and news broadcasts and for televised analysis and explanation.

The project manager for NMAPS has stated that “Archives are not just for looking back on the past. They are essential for disaster mitigation reporting to achieve preparedness for near-term disasters.”



NMAPS plotted wind direction and formation of precipitation bands in the Kinugawa River Basin during the three-day floods in the Kanto and Tohoku regions in 2015.



NMAPS provided a visual display of the water level of the Kinugawa River during the 2015 floods. This visual information was used for disaster analysis during an NHK Special.

Watanabe: NMAPS was designed for information analysis and communication during television broadcasts. It is positioned to enable information gathered by broadcast staff to be presented rapidly, clearly, and in an easily grasped fashion. I was also struck by a comment that Professor Yoshimi made. We need to have people using Internet archives, in other words, searching them. The answer may be in there somewhere, but people must take a journey through the digital archive in order to discover it. If the archive is complex, that is also fine. Disasters are multifaceted phenomena, and I think it is important to design archives that allow users to go on their own personal journey.

Yamaguchi: In other words, the design concepts for television and the Internet differ. The former is meant to be seen, the latter is meant to be used.

● Using Archive Data for Recovery

Moving on from real-time data, Yamaguchi gave a visual-supported presentation of “The Story of the Ishinomaki Tsunami Info AR,”²⁴⁾ an augmented reality app that integrates

real (current) data and archive data. Many people lost their lives in Ishinomaki, Miyagi, and a mourning park will be created where prayers can be offered for the repose of their souls. An NPO called the Ishinomaki Future Support Association created the app for learning about the disaster and guiding tours of recovery efforts, including within the park. Anyone can download this free app from their smartphone or tablet.



Source: Ishinomaki Future Support Association

If you go to a location and tap the map, the app will call up archive data from the web and allow you to compare what you see with how the area looked immediately after the quake. Survivor testimony is also accessible in text and audio formats. For international visitors, versions in English and Traditional Chinese are also available.



Source: Ishinomaki Future Support Association

When Masaharu Nakagawa of Ishinomaki Future Support Association was considering the effectiveness of an app for reconstruction tourism, he noted that after the introduction of AR apps, user numbers increased for disaster learning programs.²⁵⁾

Yamaguchi: Mr. Ono, I believe you have been observing Ishinomaki closely as another local government that experienced the disaster.

Ono: Ishinomaki suffered truly enormous damage. There is a limit to what government can do, and I think it is very difficult for the residents to carry out reconstruction on their own. With NPO assistance, I think future reconstruction will proceed with more energy. Actually, Tagajo's First Meal program and the city walk during the annual Citizens' Meeting on Disaster Mitigation are being conducted with NPO and Tohoku University assistance. We are very thankful to receive NPO assistance.

Imamura: Disaster recovery requires us to stimulate the local economy by inviting people to come and engage in learning about the disaster and tours. Through augmented reality that links archives to locations, one can move around in time and compare the present to the future plan. It is an opportunity not only for residents but also people from outside the community to consider what is necessary for reconstruction. Mr. Nakagawa and most other NPO members are actually from outside the Tohoku region. We are doing our best, but there are limits to what local people alone can achieve. Fresh thinking and outside input are important. I think this was a good implementation example.

Watanabe: This has been an underlying theme in today's discussion, but people with an interest in a given earthquake will look at a digital archive of that disaster. The question is how many people outside that group we can interest in the topic by using augmented reality and the other tools we are building. I think that will lead to more users and longer life (sustainability) for archives. No one likes to relive these memories. For people born after the disaster in 2011, it is not something close to home. But when you see people on the streets looking at tablets and talking energetically, you may feel like doing the same. It weighs young people down to insist that they always maintain a serious attitude. Instead, I think it is not inappropriate to treat these archives as something interesting. I very much sympathize with that.

III-2. Who Do Archives Belong To?

Opening Up the Use of Data

With Professor Watanabe's archive, NHK's NMAPS, and Ishinomaki's augmented reality app, we saw the contributions and potential of utilizing archive data for disaster safety, mitigation, and recovery. To promote this utilization, it is essential to discuss making the data more open. During the second half of Session 2, the participants returned to the question mentioned by Professor Yoshimi at the end of Session 1: Who do archives ultimately belong to?

Yoshimi: First, I would like to emphasize again that "passive viewing" is from the television era. For archives, utilization and secondary usage are critical. Whether or not people in local communities can use archives for education and disaster safety is a fundamental question for archives. As everyone is aware, NHK holds a huge amount of content. It probably has more content than any other entity in the world in terms of footage from the Great East Japan Earthquake and other disasters of the past. The question then naturally arises, who is the ultimate owner of the content held by NHK, a public broadcaster? Who can use this vast amount of content, and how do they gain access to it? I believe this content should be made freely available for certain uses, including education and disaster safety. How can the obstacles to this be overcome? How should guidelines be drawn up? The question of whether guidelines can be formulated that NHK, local governments, and other public entities can share is critically important to public archives in Japan.

Kuramata: Footage in NHK's Great East Japan Earthquake Archive can be viewed, but under current law, it cannot be downloaded or put to secondary use. NHK does have a Teacher's Library²⁶⁾ that provides selected content on DVD free of charge, subject to usage restrictions. We are also experimenting²⁷⁾ with granting archive access to researchers who wish to analyze footage and write reports. The door is by no means closed, and we are

gradually doing what we can under the present circumstances. But I think a proper legal framework is required for a fully-fledged endeavor in this respect.

Watanabe: The digital archive source code I showed you just now is actually open-source.²⁸⁾ You can find it on GitHub,²⁹⁾ a collaborative repository hosting service with social networking-like functions. What is interesting is the ability to see how many people have downloaded the code and how they are modifying it of their own accord. Look at the number of people who have already downloaded it. HFU is an individual at the Geospatial Information Authority of Japan (GIS). We developed the code in our research section, and now someone from GIS has downloaded it and is using it for further development, without dealing with me at all. This means it is not necessary for our research lab to provide ongoing support to keep the program going. If archive contents or programs are released with a Creative Commons license, many people can then propagate them without concerns over copyright infringement. Even were I to die tomorrow, there would be no problem, probably.

Yamaguchi: By making the data and program open for use by others, an archive will be used on the Internet and its sustainability will be assured. This is different from the broadcast world. Are Creative Commons licenses a means for public access over the Internet?

Watanabe: Yes. Creative Commons licenses are copyright for the Internet, and one can be very specific about which rights are reserved and which are waived. You might require that the name of the copyright holder be cited, or how the content can or cannot be modified in the public domain.³⁰⁾ It is a flexible way to specify rights. If you follow the license, you can use the content freely as well as redistribute it. This means it can be propagated rapidly. I think there will also be overlap with conventional legal frameworks, but I believe NHK should adopt this approach.

Kuramata: Our department has something we call the Creative Library,³¹⁾ although it does not deal with the Great East Japan Earthquake. This library licenses content with copyright agreements very similar to those of Creative Commons, with 5,000 video, sound, and computer graphics clips from NHK that can be downloaded and used freely to make new content. It is a media literacy site, and you can use it to release what you have created.

Yamaguchi: Do you have any future plans to add images from the Great East Japan Earthquake to the Creative Library?

Kuramata: Yes. With the revision of the Broadcasting Law, NHK is conducting internal deliberations about what Internet services are really needed, and this includes considering best approaches for the Creative Library. We are not planning to discontinue it, but rather to use a licensing system similar to Creative Commons, and perhaps add content including images from the disaster. These are things we would like to discuss further.

III-3. Archives 10 Years After the Disaster

The situation facing disaster archives today is different from that of five years ago, when they were first created. As the symposium drew to a close, we asked the participants what the situation for archives would be in another five years, and hopes for their own archives.

Imamura: Since funding is limited, I think the sustainability of archives will depend on how they are perceived. They will be compared on the basis of web access statistics, the way television programs are rated by number of viewers. But the question will be, how much are the archives used? How many times is content downloaded and utilized? I hope we can encourage access by publicizing such statistics and appealing to the public. Previously, university instructors were rated by the number of papers they published. Now they are rated by the number of times they are cited. I hope that in a similar sense, a range of healthy archives will be established within five years.

Ono: The final goals of the recovery and reconstruction plans formulated by local governments that were affected by the disaster are set to be achieved in 2021, 10 years after the disaster. This is very significant. In Tagajo as well, both the “hard” and “soft” varieties of infrastructure needed to protect residents’ lives will be complete to some degree. The *Tagajo KenBunOku* disaster safety and mitigation archive, plans to continuously record and disseminate the city’s progress toward recovery, particularly because we want to express our gratitude toward people all over the country who are supporting residents as they face the challenges of the disaster. I furthermore hope we will be able to say that we turned adversity into advantage and created a community and a city that protect people’s lives and are truly prepared for disasters.

Watanabe: A disaster archive is not something you look at every day. We want people to look at them from time to time. By the time March 11 comes around again, the bookmark will probably be somewhat buried, but you seek it out and access the archive, open it, and explore. “Oh,” you think, “here is some testimony I never even knew about,” and then that year’s day of commemoration is over. I would hope that such archives would find a home with more people, in more PCs and smartphones.

Suwa: I frankly cannot promise what Hinagiku will look like in five years. Not that I think it will disappear, but I am not sure what its relationship will be with other digital archives at the National Diet Library. In any case, it is important that disaster archives exist for a long time. The library always holds on to materials once they come into its possession. We even have records dating back to the transfer of power at the end of the shogunate. As a national entity, the most important mission for us is to ensure that easily-lost digital materials remain accessible and usable for as long as possible.

Kuramata: I cannot promise what NHK’s archive will look like five years down the line either, but I am not worried. Our primary focus until now has been to accumulate a large volume of materials. Going forward, we want to gradually move into the utilization phase. A recent National Diet Library study indicated that the general five-year survival rate for web-based information is only 40%. We want to make sure we exceed that.

Yoshimi: I do not believe it is necessarily a good thing for archives to rely on the central government for funding support. Instead, if public entities such as NHK, local government and NPOs continue to work on their archives, while building a public archive in Japan through a kind of networked approach, I think it would be economically efficient as well as very content-rich. We are planning to establish the Future of Disaster Mitigation Archives Research Association,³²⁾ which will give people with a variety of standpoints an opportunity to gather and discuss the best approaches to disaster archives.

Yamaguchi: With the fifth-year anniversary of the disaster as a milestone, we projected the future of digital archives. The impetus for planning this symposium was our surprise when we discovered that archives created to transmit disaster lessons to future generations were already starting to disappear. The challenge is whether the archives can be utilized, and not simply inspected; and we realized that the Internet has a simple principle, that whatever is not used tends to be weeded out and disappear. How can we utilize the lessons of the earthquake, tsunami, and nuclear accident?

What is required for NHK to fulfill its mission as a public broadcaster—to protect people’s lives and property—on the web? I would like to apply today’s opinions and discussions to research into tomorrow’s disaster safety media. Thank you.

● **Audience Opinions**

- All images taken before and after the disaster by each broadcaster, by the Self-Defense Forces, police, and other governmental entities should be released so the public can verify the actions of the media and the government.
- Personnel development is required to create digital archives and promote their use.
- Utilization of archives in the classroom, like NHK for School,³³⁾ requires provision of archive data and applications, and a hub site for sharing information on the educational benefits of their use.

IV. In Conclusion

Afterward: The 2016 Kumamoto Earthquakes

About six weeks after the forum, on April 14 at 9:26 p.m., an earthquake measuring the maximum of 7 on the Shindo scale struck Kumamoto Prefecture. My smartphone rang and a Yahoo app sent me a push notification. I switched on the television and saw an NHK video feed from Kumamoto City. The camera shook violently as it panned right to show dust rising from Kumamoto Castle. The castle wall had collapsed. Shortly thereafter I looked at my smartphone and saw earthquake footage beneath the message “NHK News Video (Live).”

NHK had begun simulcasting of emergency information over the Internet.³⁴⁾ The web feed was a few seconds later than the broadcast, but it had the power of a broadcast, with images from the scene in near-real time. I thought this was a division of roles between television and the Internet. But the main quake, which struck before dawn on the 16th, quickly dispelled that impression. When I opened my smartphone app, the link for “NHK News Video (Live)” was not displayed. In fact, the Kumamoto earthquakes prompted full-scale news simulcasting by the commercial broadcasters.³⁵⁾ As a result, “NHK News Video” became one of several sources of “Live Video Content,” and the link disappeared from the main screen of the app. In this case, the makers of the app determined what to display.



Smartphone screen after the April 14, 2016 earthquakes in Kumamoto.
At the time of these foreshocks, the NHK News simulcast tab was still visible.

At the end of the symposium, the Internet principle of “use it or lose it” was mentioned. Competition on the Internet is intense. On the web, it may not be easy for NHK to fulfill its mission as a public broadcaster of protecting lives and property.

Looking at Hidenori Watanabe’s Typhoon Realtime Watcher app, one can see that photos with comments about collapsed buildings, landslides, and caved-in roads around Kumamoto were progressively being archived. This proved once more that digital archives are not just about the past. They are a media that can convey disaster information to us living in the present. I would also like to note that at the time, Professor Watanabe was not in Japan; he was at Harvard University doing research. His app worked due to its use of linked open data, with data linking and being processed automatically.

In late March 2016, GIS released its globe application.³⁶⁾ This was the first such app from a government entity, where previously one had to rely on commercial applications such as Google Earth. Disaster and other types of information can be displayed on the new app. Immediately, specialists in seismology and active faults who had traveled to Kumamoto to do research began using the 3D map to share data about damage and the position and changes in exposed faults, and carry out research efficiently.³⁷⁾ Satellite, aerial, and drone images and analytic results from a variety of research organizations, universities, consulting firms, and researchers were added to the map and fed back to the local investigations. This data was archived on the web as disaster information. A disaster archive was being compiled in real time.

The rapid development of such web-based platforms as GIS’s geospatial information systems, including its digital globe, and G-spatial information is bringing down the walls between emergency disaster information transmission and archives; conversely, if digital hazard maps are treated as archive data, and that data is merged with real-time weather, river, tsunami, and other types of data, it would be possible to create an emergency information system that would automatically judge danger levels and warn people in the area with push notifications.³⁸⁾ Just how archives and other digital data, as well as new web-based media,

will contribute to disaster safety and mitigation, how they will develop, and who will ensure their public accessibility and how, will bear continued monitoring.

(Masaru Yamaguchi)

Notes

- 1) In March 2013, NHK Broadcasting Culture Research Institute held a symposium. Nobe, S. and Tanaka, T. (2013). “3.11 shinsai aakaibu katsuyo no kanosei” (“Prospects for the Utilization of 3/11 Disaster Archives”). *Hoso Kenkyu to Chosa* (“The NHK Monthly Report on Broadcast Research”), July, 21–39.
- 2) <http://archive.shinsai.yahoo.co.jp/>
- 3) For details, see NHK Corporate Plan, FY2015–2017.
<http://www3.nhk.or.jp/pr/keiei/plan/pdf/25-27keikaku.pdf>
- 4) <http://shinrokuden.irides.tohoku.ac.jp/>
- 5) Shibayama, A., Sato, S., and Imamura, F. (2012). “*Higashi Nihon daishinsai aakaibu no shushu kara rikatsuyo made no moderu kochiku ni kansuru kenkyu*” (“Research Toward a Model Structure for Compiling and Utilizing Great East Japan Earthquake Archives”), *Nihon Shizen Saigai Gakkai nenji gakujutsu koenkai koen gaiyoshu* (“Proceedings of the Annual Meeting of the Japan Society for Natural Disaster Science), 195–196, etc.
- 6) Yamaguchi, M. (2013). “*Daishinsai kara 2 nen higai sotei wo koete 'jizen fukko' he*” (“Two Years After the East Japan Great Earthquake Disaster: Beyond Damage Estimations to ‘Pre-recovery’”), *Gekkan Fesuku* (“Monthly FESC”) (May, No. 379), 2–7.
- 7) <http://tagajo.irides.tohoku.ac.jp/index>
- 8) *Ogura Hyakunin Isshu* is a classical anthology of one hundred Japanese *waka* poems. The title can be translated as “one hundred people, one poem each.” The poem concerned is as follows:
Our sleeves were wet with tears / As pledges that our love / Will last until over Sue’s Mount of Pines / Ocean waves are breaking.
- 9) Like a rock at sea / At ebb-tide hidden from view / Is my tear-drenched sleeve; / Never for a moment dry / And no one knows it is there.
- 10) Tagajo holds a Citizens’ Meeting on Disaster Mitigation each year in March that includes a walk around the city with citizens and other participants to identify opportunities for enhanced disaster safety.
- 11) “Medium” in Japanese implies an individual or object capable of being possessed by spirits. Here, however, it refers to locations and things that can serve as a locus for people and their personal feelings.
- 12) <http://midori.midimic.jp/>
- 13) <http://kn.ndl.go.jp/>
- 14) <http://www.nhk.or.jp/311shogen/>
- 15) <http://www.nhk.or.jp/311shogen/72hours/>
- 16) Watanabe, H. (2013). “*Deeta wo tsumuide shakai ni tsunagu*” (“Spinning the Data and Connecting It to Society”), *Kodansha Gendai Shinsho* (“Kodansha's New Library of Knowledge”), 268.
- 17) http://shinsai.mapping.jp/index_en.html
- 18) <http://weathernews.jp/>
- 19) http://www.asahi.com/special/quake2011_archive/
- 20) <http://www.fnn-news.com/311/articles/201103120086.html>
The project manager for the “FNN Great East Japan Earthquake Archive: Remembering 3.11” stated that the reason for releasing the archive on YouTube was to transmit lessons from the disaster to people around the world, with the assumption that individuals would download and use content on the condition that they cite the source.
- 21) <http://en.wasurenai.mapping.jp/>
- 22) <http://e.nagasaki.mapping.jp/>

- 23) <http://typhoon.mapping.jp/>
- 24) http://ishinomaki-support.com/category/memory_cat/tsunami-ar/
Ishinomaki Future Support Association
Ishinomaki tsunami densho AR (“Ishinomaki Tsunami Info AR”)
- 25) Nakagawa, M., Ogata, K., Sato, S., Sato, S., Fujima, C. (2015). “*ICT wo katsuyo shita kaso taikengata shinsai gakushu puroguramu no kaihatsu—Higashi Nihon daishinsai de hisai shita Ishinomakishi ni okeru ‘bosai machiaruki’ jissen jirei*” (“Development of Experience-Based Disaster Education Utilizing Information Communication Technology: Practical activity of ‘Ishinomaki Tour—Remembering 3.11’ in the Affected City of the 2011 Great East Japan Earthquake Disaster”), *Chi’iki anzen gakkai ronbunshu* (“Journal of Social Safety Science”), 26, 1–8.
- 26) <http://www.nhk.or.jp/archives/teachers-l/>
- 27) <http://www.nhk.or.jp/archives/en/wwd.html>
- 28) Open-source source code: Refers to making program content freely available so that others can collaborate in creating modifications.
- 29) <https://github.com/wtnv-lab/cesiumGitHubPages>
- 30) That is, public ownership with no intellectual property rights arising from modifying the content.
- 31) <http://www1.nhk.or.jp/creative/en/>
- 32) Professor Yoshimi and experts in a wide range of disciplines, including disaster safety science, information science, sociology, and library information science held an open symposium on March 6, 2016, titled “Archives to Shape the Future: Toward Utilization of Large-scale Disaster Information.” This symposium launched the Future of Disaster Mitigation Archives Research Association, headed by Takashi Mikuriya, professor emeritus, University of Tokyo and vice-chairman of the Reconstruction Design Council in Response to the Great East Japan Earthquake.
- 33) <http://www.nhk.or.jp/school/>
Educational programs, video clips, and other materials are available online for use in school lessons, etc.
- 34) Yamaguchi, M. (2015). “*Kuchinoerabu-jima funka wo NHK ga netto demo chukei: hoso to tsushin ha shinkachu*” (“NHK also Broadcasts the Kuchinoerabu Island Eruption on the Internet: The Evolution of Broadcasting and Communications”), *NHK eko channeru no burogu* (“NHK Eco-Channel Blog”) <http://www.nhk.or.jp/ecochan-blog/600/220592.html>
- 35) Yoshida, N. (2016). “*Media fokasu: Kumamoto jishin de hoso kakkyoku, netto doji haishin ya raibu haishin wo jisshi*” (“Media Focus: Broadcasters Implement Internet Simulcasts and Live Reporting of the Kumamoto Earthquakes”), *Hoso Kenkyu to Chosa* (“The NHK Monthly Report on Broadcast Research”), June, 116
- 36) <http://globe.gsi.go.jp/>
- 37) Kumahara, Y., Gotou, H., Nakata, T., Ishiguro, S., Ishimura, D., Ishiyama, T., Okada, S., Kagohara, K., Kashihara, S., Kaneda, H., Sugito, N., Suzuki, Y., Takenami, D., Tanaka, K., Tanaka, T., Tsutsumi, H., Toda, S., Hirouchi, D., Matsuda, N., Mida, T., Moriki, H., Yoshida, H., Watanabe, M. (2016). “*2016 Kumamoto honjishin ni tomonau chihyojishin danso no bunpu to tokucho*” (“Distribution and Characteristics of Surface Faults Associated with the 2016 Kumamoto Mainshock”), *Nihon Chikyu Wakusei Kagaku Rengo 2016 nen taikai, kinkyu sesshon: 2016 nen Kumamoto honjishin oyobi kanren suru chikaku katsudo koen yoshi* (“JpGU Meeting 2016, Emergency Session: Summaries of Presentations Relating to the 2016 Kumamoto Earthquakes and Related Crustal Activity”)
- 38) For example, with the participation of local government and enterprises, including the cities of Nagoya and Yokkaichi as well as Aichi and Mie Prefectures, Nagoya University is carrying out verification studies on region-specific emergency information transmission using hazard mapping-based disaster information apps (under the direction of Professor Yasuhiro Suzuki, Disaster Mitigation Research Center).