



## The Roles of Archiving in Earthquake Studies: The Case of the Great East Japan Earthquake

A. Shibayama<sup>(1)</sup>, S. Boret<sup>(2)</sup>, S. Sato<sup>(3)</sup>, F. Imamura<sup>(4)</sup>

<sup>(1)</sup> Associate Professor, Tohoku University, shibayama@irides.tohoku.ac.jp

<sup>(2)</sup> Assistant Professor, Tohoku University, boret@irides.tohoku.ac.jp

<sup>(3)</sup> Assistant Professor, Tohoku University, ssato@irides.tohoku.ac.jp

<sup>(4)</sup> Professor, Tohoku University, imamura@irides.tohoku.ac.jp

### Abstract

This paper discusses the experience and benefit of digital archives for earthquake engineering and studies. Following the Great East Japan Earthquake (GEJE), the International Research Institute of Disaster Science (IRIDeS) created a digital archives project, namely Michinoku Shinrokuden. Its multi-layered mission is to collect a vast and comprehensive amount of records, draw lessons enhancing disaster reduction and mitigation, and provide material for disaster education and E-learning. With the support of its international and national network, this project has also the ambition to become a key actor in the design, promotion and dissemination of global standards for disaster archives. In addition to preserving and sharing these records, the research staff of Michinoku Shinrokuden endeavours to help drawing lessons to improve our understanding, prevention and memory of earthquakes and tsunamis. These lessons aim at contributing to the policy and practical measures adopted for reduction of disaster risk within and outside Japan. Finally, the papers concludes with an overview of the local and global standards developed at Michinoku Shinrokuden for the development of disaster archives in Japan and beyond. Through this study, we hope to show how digital archives might best serve the interest of earthquake engineering and its broader community.

*Keywords: digital archives; disaster risk reduction;*

## 1. Introduction

Scientists and other disaster experts have constantly drawn from experience and knowledge of past catastrophes to improve disaster prevention and risk reduction measures. They also inform future generations about the experiences gained and by handing down the stories from this event. Such approach leads to some extent to a reduction of the risk and the damage caused by future large-scale earthquakes but its impact remain limited due to the fragmented character of the data recorded. However, the case of the Great East Japan Earthquake (GEJE) represents a shift in our capacity to record and understand disasters. The GEJE is an unprecedented large-scale earthquake, direct damage spread across all of eastern Japan. If we include the indirect damage, we understand that its impacts are of a national and a global scale. The experiences we gained from the damages caused by this earthquake equals the magnitude of the devastation. The digital technology commonly available in Japan enabled thousands of individuals to record the aftermath of the GEJE. Collecting this enormous number of experiences and passing them on to future generations is therefore a vital task. What is important here is not only simply recording the experiences of the earthquake, but also interpreting the earthquake disaster records as material to learn from, utilizing them for the restoration of disaster-stricken areas, revival and disaster prevention and disaster mitigation activities. To this effect, Tohoku University created the Great East Japan Earthquake Archive, Michinoku Shinrokuden, in 2012. This project has since collected and organized records from the disaster and attempts to establish a methodology to utilize this information. In this paper, we discuss the methods used for collecting and organizing these records, as well as the construction of the search system meant to promote the utilization of these earthquake disaster records.

## 2. About the Disaster Archives

The discussion about the ‘disaster archives’ in this paper includes disaster-related knowledge and teachings, as well as the collection, preservation, and utilization of these records. A term similar to disaster archives is ‘disaster big data’. Disaster big data refers to the body of information necessary for disaster prevention and mitigation, and emergency treatment and restoration from the time immediately following the disaster. The main difference between disaster archives and disaster big data is the respective nature of the data handled. Disaster archives manages digital records including SNS and photographic and video footage, as well as analog documents including record magazines and publications, and handles relics and physical remains. In contrast, disaster big data deals only with digital records and is a component of disaster archives. The latter handles all information from disaster big data that focuses on data from the time immediately following the disaster, as well as records from prior to the disaster to the revival.

The concept of disaster archives was not recently created. In fact, we can refer to the collections in libraries and museums of disaster-related documents such as books and record magazines as disaster archives. Following the trend in recent years that has seen the evolution of the internet and an increase in digital material, the move toward material storage to digital archives is becoming mainstream, and the institutions implementing this are beginning to exceed the frame of libraries and museums. For example, Kobe University Library contrains the Great Hanshin-Awaji Earthquake Disaster Materials Collection for the disaster that occurred there in 1995[1]. Likewise, there is the Chuestsu Disaster Archives for the 2004 Mid-Niigata Prefecture Earthquake[2]. These precedents can be considered to be representative of disaster archives.

### 2.1 Earthquake Disaster Archive Trends in the Great East Japan Earthquake

Following the GEJE, a Reconstruction Design of Seven Principles was proposed at the Reconstruction Design Council on June 25, 2011. Principle one states: “We shall record the disaster for eternity, including through the creation of memorial forests and monuments, and we shall have the disaster scientifically analyzed by a broad range of scholars to draw lessons that will be shared with the world and passed down to posterity.” [3] This principle saw the construction of a number of disaster archives. Examples include disaster archives built by the library group centered around the National Diet Library[4] and disaster-stricken areas, research institutions such as Tohoku Gakuin[5], Iwaki Meisei University[5], Japan Society of Civil Engineers[6], and the National Research Institute for Earth Science[7] and Disaster Resilience, media such as the Japan Broadcasting

Corporation (NHK) [8] and Kahoku Shimpō Publishing Co. [9], private enterprises such as Google[10] or Yahoo! JAPAN[11], municipalities such as Tagajo City in Miyagi Prefecture[12], Koriyama City in Fukushima Prefecture[13], Kuji city, Noda village, and Fudai village in Iwate Prefecture[14]. Different from past earthquake disasters, the framework for the present disaster archives takes into consideration a number of factors, such as the extensive and profound damage caused by the disaster, the difficulty for only one system or institution to collect all earthquake-related records, people's desire to transmit lessons to future generations, and the large number of earthquake records that were created due to the spread of digital technology.

Phases of the disaster archives process can be divided into collecting, organizing, preserving, and exhibiting materials in a contents holder in each institution as well as a portal site operating system that allows cross-searching between contents holders. Typical portal sites include the National Diet Library's 'Hinagiku' ('Daisy') [4] and Harvard University Reishauer Institute of Japanese Studies 'The Digital Archive of Japan's 2011 Disasters' [15]. The majority of others are contents holders only. The National Diet Library's 'Hinagiku' has collaborated with dozens of institutions and, to date, the number of registered disaster-related documents of the Great East Japan Earthquake is approximately one million. Registered contents include materials from immediately after the earthquake to the recovery and reconstruction, including photographs, testimonies, visual and audio recordings, administrative sentences; over half of the material are photographic records. These disaster-related data are used in disaster prevention education and reconstruction tourism, publications, media, and research materials. Finally, we note that there are three main types of disaster archives depending on their modes of construction: 1) disaster archives using conventional means to gather material; 2) disaster archives storing large amounts of earthquake records, and 3) disaster archives passing on disaster-related records to future generations.

### 3. Michinoku Shinrokuden: The Great East Japan Earthquake Archive Project

The International Research Institute of Disaster Science (IRIDeS) at Tohoku University launched Michinoku Shinrokuden in September, 2011, shortly after the idea was conceived in April, 2011. As the leaders of this project, we have been working in collaboration with over 130 national and international industrial, governmental, academic, and citizen groups. Together, we developed Michinoku Shinrokuden not only to collect and aggregate memories, records, case histories, and knowledge related to the disaster from the time immediately following the earthquake to reconstruction and revival, but also to share and pass on to national and international communities.

#### 3.1 About the Michinoku Shinrokuden

The name 'Michinoku Shinrokuden' comes from the meaning of the desire to "transmit ('den') the records ('roku') of the earthquake disaster ('shin')." Michinoku is the former name given to the area of Tohoku. This name translates the fact that, through this project, we aim to gather knowledge of historic disasters in the past up to the Great East Japan Earthquake from a variety of perspectives, to expand interdisciplinary research, and promote the provision of knowledge to contribute to the clarification of the reality of the situation, restoration and reconstruction following the Great East Japan Earthquake. Our goal is to utilize information collected through these means to develop a way of studying the measures and management of low-frequency catastrophic disasters like the Tokai, Tonankai, and Nankai earthquakes, which are expected in the near future.

The momentum and activities of this project, Michinoku Shinrokuden, draws on the following ten basic principles: 1) Without denying any possibilities, collect a variety of information from a wide range of fields; 2) Collect from the past, present, and future of the devastated areas; 3) Disseminate knowledge to facilitate immediate utilization for disaster prevention and mitigation; 4) Allow growth and development of the archives through communication with its users; 5) Continuously record the recovery and reconstruction process of the devastated areas, from coastal to inland; 6) Actively collaborate with other disaster archives and effective services; 7) Aim for the global standard of disaster archives; 8) Collaborate with governments, companies, and research institutions in their efforts in disaster prevention and mitigation; 9) Provide information that contributes to disaster prevention and mitigation education; 10) Create jobs in the Tohoku region through archive-related activities.

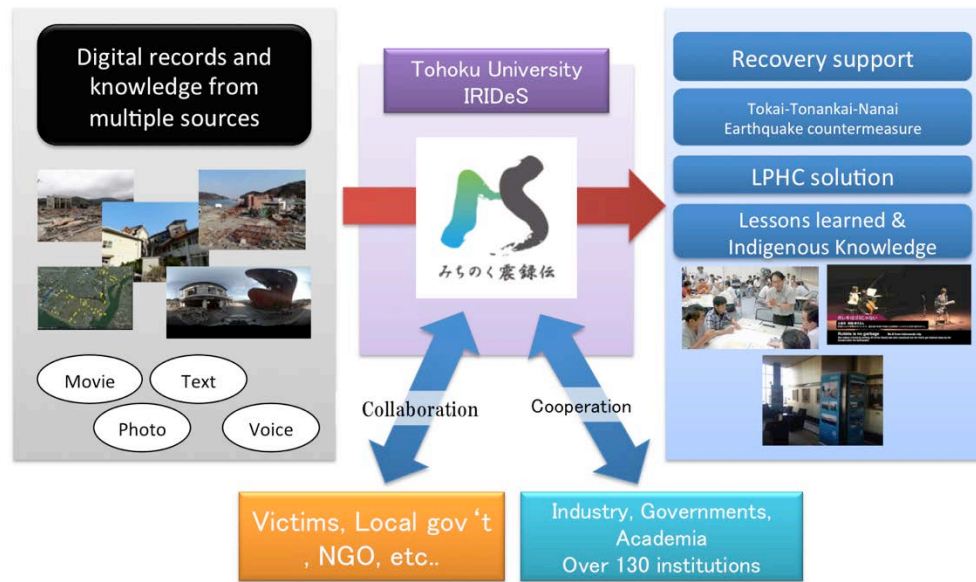


Fig.1 Project conceptual diagram of Michinoku Shinrokuden

### 3.2 Disaster Record Collection Through the Cooperation with Industries, Governments, Citizens and Institutions

When thinking about the aftermath of the Great East Japan Earthquake, it has become essential to understand how best to collect disaster records from an event that affected the whole planet. At Michinoku Shinrokuden, it soon became clear that the most viable solution was to collaborate with industries, governments, citizens, and institutions.

The academic laboratory of Michinoku Shinrokuden includes members with a variety of expertise, including science, engineering, geology, psychology, information science, economics, medicine and history. Researchers from such a wide range of fields collect Great East Japan Earthquake-related observations and records from a variety of perspectives. In addition, they carry out interdisciplinary research integrating a variety of specializations and creating new target study areas, further expanding the range of the collection. Knowledge of the ‘reality’ of the Great East Japan Earthquake contributes to elucidating and reconstructing, resulting in a further accumulation of information. The critical roles of academics comprise the collection of a wide range of information which they then utilize to accumulate research results. However, the information collected by academics mostly delves deeply into one particular event or aspect of the disaster, making it is difficult to collect comprehensive evidence.

The perspectives of governments and industries become essential in order to complete the perspective of academic and widen our range of data collection. For local governments, the most important information was brought by the records of the emergency responses as well as those of the reconstruction processes, all of which were collected by individual ministries and government offices. Michinoku Shinrokuden strives to collect such information through the cooperation with the Ministry of Internal Affairs and Communication, and Ministry of Education, Culture, Sports, Science, and Technology, and affected local governments of Sendai City and Tagajo City in Miyagi Prefecture. In addition, we are cooperating with the National Diet Library and affected local governments in order to preserve official documents and collect records of past disasters. In elucidating the Great East Japan Earthquake, a variety of researchers and their knowledge become important. We have developed partnership with the Japan Science and Technology Agency to collect information from scientific sources including academic papers. We have also worked together with the Sendai International Relations Association and the Reischauer Institute of Japanese Studies at Harvard University with which we collected

communication from expats living in Japan as well as earthquake disaster records from the viewpoints of people experiencing GEJE from overseas. For all these partners, it became manifest that there is a necessity to make this body of information available for scientific research as well as for general use.

With regards to our work with the private sector, we are collecting information from the perspectives of businesses such as IT companies, consulting companies, surveying companies, investigation relations companies, publishing and printing companies, mass media and advertising companies. For example, we are conducting voluntary surveys with research companies, collecting aerial photographs and records from local disaster situations, as well as diffusing questionnaires among disaster-stricken area residents which cannot normally be obtained through government investigations. We are implementing the analysis of articles from both local media such as Kahoku shimpō that tirelessly documented the situation, as well as media from outside disaster area such as Shinano Mainichi Newspaper, to see how the Great East Japan Earthquake was seen from outside the affected area. In cooperation with these industries, we are attempting to continuously keep and interpret the records of the different stages of the aftermath of GEJE.

Finally, some of the most valuable information for future disaster prevention and mitigation come from common citizens from around the country. This particular data include their personal experiences, memories and documentations of the events of GEJE, the immediate aftermath, the rehabilitation and reconstruction of the affected area. Michinoku Shinrokuden employs one person from each of the 15 towns and villages of the coastal region of Miyagi Prefecture. These employees form the “Michinoku Imawo Tsutaetai” (Michinoku Talk about the Situation Today), which was established with the cooperation of the Japan Society and Technology Agency and the Survey Research Center, in order to investigate and record from the perspectives of local citizens, the up-to-date realities of the disaster stricken areas, as well as what they would like to convey to posterity.

Through the broad approach of Michinoku Shinrokuden, we believe that industries, governments, citizens, and academics have the ability of collect a wide range of memories, records, case studies, and knowledge.

### 3.3 Challenges of Earthquake-Related Record Collection

Many earthquake-related records were obtained in from Great East Japan Earthquake. However, within these records are portraits or copyrighted material, which pose a legal challenge. A few such examples and problems are discussed in the following sections.

#### 1) TV Media

Many videos preserving the actual experiences suffered by the victims as the disaster unfolded do exist. Examples include videos of the tsunami, the situation of the evacuation centers, and interviews with survivors. The contents of these records not only have scientific value, but they are also vital for residents and local governments to explain the realities of the situation. Despite their value, there are complex rights regulating the use of televised content and the use of this certain content is prohibited. Let us take victim interviews as an example. Firstly, there are the portrait rights of disaster victims and other private copyright. Secondly, there is also copyright on the material managed and edited by the production company. Thirdly, the material once handed to the television station from the production company engenders additional copyrights and broadcast rights for television stations. The processing of rights is therefore conducted through these three different stages. As a result, when wishing to provide other organizations with this material, it is necessary to process the rights in all three stages in addition to the reproduction rights. Such complicated procedure makes it extremely difficult to collect and make available easily great quantities of televised materials. Finally, television stations have their own methods of archiving, therefore meaning that due to earthquake-related coverage records being semi-permanently stored, the material will not be lost. In the future, in order to gain access of televised contents freely, there is a need for the development of laws and a way to be able to utilize this material for research and general use.

Dealing with issues of copyrights and contents is an essential part of archiving disasters. Although earthquake archiving organizations cannot archive this material, there are examples in which television stations publish their own archives on the internet, and here it is possible to view material currently aired as well as from the time of



the earthquake. These include Japan Broadcasting Corporations' "3.11 Great East Japan Earthquake Archive" [8], and Fuji News Network (FNN)'s "FNN Great East Japan Earthquake Archives" [18].

## 2) Newspaper Media

Like television media, newspapers have published a lot of disaster-related information. Newspaper media are important records of the disaster that enable scientists and other research to follow the daily experience and transformation following disasters. However, much of the newspaper contents end up being commercial. Therefore, even if the usage rights may be purchased, there remains the problem of our inability to publish the material online that still exists. Additionally, newspaper records present the same copyrights discussed in the context of televised materials and portrait rights of individuals in photographs may arise. To our knowledge, the only disaster archive example open to the public is the "Kahoku Shimpo Earthquake Archives" [9].

## 3) Corporate Ownership of Earthquake-Related Records

Many companies were affected by the earthquake. Each of these companies owns its own records including photographs and written documents containing disaster-related activities carried out on-site. Some also have revised their manuals for disaster preparedness and response. The contents are important records for developing future tsunami and earthquake disaster prevention and mitigation measures, and may reduce corporate losses in the next disaster through the sharing of company experiences. However, these records cannot be easily exposed due the inclusion of information related to intellectual property and corporate loss. This problem proves to be a major barrier. They also not only possess photographs of the affected companies themselves, but also of the emergency restoration of buildings and roads in which companies participated. With such photographs, copyright permission of the photographer, and building owners and managers also become an issue to consider.

## 4) Other Issues

Apart from the already mentioned copyright and portrait rights, our experiences shows that the problem of destroying or discarding earthquake records without realizing their value also limits our access to data. For example, significant earthquake records, once considered important at the time of the disaster are sometimes lost during the succession to the new manager and a changeover of personnel. Furthermore, primary sources used to create publishing material are sometimes discarded when deemed unnecessary. In order to reduce the loss of valuable materials, the Cabinet Office of Japan provided each administrative office with the Great East Japan Earthquake directive "On Administrative Document Handling" (April 10, 2012) [16]. This document outlines the necessary retention period of administrative documents related to the Great East Japan Earthquake, and the high likelihood of them being regarded as material for historical archives and municipalities are requested not to destroy these documents[17].

# 4. How to Organize the Utilization of Earthquake-Related Records

While dealing with these particular hurdles, Michinoku Shinrokuden and its partners have collected hundreds of thousands of earthquake-related records. These records include photographic images and video recordings, testimonies and voice recordings. These hundreds of thousands of items are to be used in various ways, such as disaster prevention education, earthquake sightseeing tours, and storytelling. To this end, we must organize the records, and establish a way to easily find relevant records. Texts and other written format, such as testimonies and administrative documents can be easily found through a full-text search. However, photographs and video footage, desired images can only be searched unless metadata has been assigned to them. The creation of this meta data has represented one of the most significant challenges for the archiving of GEJE.

## 4.1 Investigation of the Method of Metadata Application to Disaster-related Images

There are two methods of applying metadata to earthquake-related images. One is mechanical and the other is by manual. Mechanical collection of metadata utilizes the EXIF data (date and location of filming), imbedded within the video itself. A machine automatically draws this information from the image to create the metadata. This reduces the amount of manual work that needs to be done. The method of manual metadata imparting is

done because there is metadata that cannot be drawn mechanically, such as the contents of the images, and it therefore must be analyzed and collected by hand. For example, when identifying buildings affected by the tsunami within the images, we can use “disaster building” and “rubble” as metadata. However, there is an issue with manually collected metadata. In order to obtain the most accurate metadata on an image, it is best to have the photographer or the videographer compile the subject matter of the disaster-related images. However, it is a heavy burden for the photographer or videographer to impart the metadata him/herself. Additionally, if the work of the photographer or videographer increases as a result, he/she will likely hesitate to provide disaster-related images to the archives. Therefore, rather than the photographer or videographer providing the metadata, we verified that a third party was able to supply the metadata for the photographs and video footage.

In order improve our building of metadata, we performed an experiment in which participants imparted metadata on disaster images. The participants were informed that their basic task would be organizing earthquake-related images but were given no further instructions with regards to methods and the pictures taken. The keywords provided by participants for the image shown in Fig. 2 included “tsunami damage”, “salt damage”, and “ruins”. They identified the grove in the distance as “coastal grove”, or “tidal levee grove”. The keywords provided by the participants of the study matched the photographer’s own description of the “tidal levee grove washed away by the tsunami”. However, this experiment also shows that participants relied on a high level of speculation and association with their knowledge of the disaster. For instance, the photograph does not give any information about the proximity of the ocean and thus makes it impossible to affirm with certitude if this area is a tsunami inundation zone. This particular information tells that metadata granted by a third party runs the risk of being incorrect information, causing reputation damage of the archives itself, and this may also lead to disadvantaging the affected areas. During the same experiment, we provided the photograph of temples and shrines located in a disaster area of Sendai City (see Fig. 3). We found through our research that, although keywords could be drawn from the content of the photo, there were cases in which some keywords were not provided. We found that this is due to a judgment difference on what is considered to be a correct keyword as well as a lack of knowledge about the area shown. Taking the above mentioned results, we established a policy for metadata provision for earthquake-related images (see Table 1).



“Keyword granted by speculation”

Tsunami damage, Salt damage, Ruins, Coastal grove, Tidal levee grove, Field, Ground, Vacant lot, etc.

“Facts which can be identified from the photo will be utilized as keywords”

Ground, Tree, Forest

Fig. 2 Ex. 1 of evaluate the quality and integrity of the tag



“Keyword granted by speculation”

Temples and shrines, Shrine, Kshitigarbha, Guard frame, Namiwake shrine

“Facts which can be identified from the photo will be utilized as keywords”

Gizo, Fence, Sendai city, Offering of flowers, Building, Sacred Shinto straw festoon, Namiwake shrine, Signboard, Offertory box, Guard frame

Fig. 3 Ex. 2 of evaluate the quality and integrity of the tag

Table.1 Metadata Grant Policy for Earthquake-Related Images

Policy	Description/Examples
Only facts identified from the photo will be utilized as keywords	<ul style="list-style-type: none"> <li>-Object/Item name can be seen in the photograph</li> <li>-Words/Characters which can be read from the photograph</li> </ul>
Ambiguous and uncertain information will not be utilized as keywords	<ul style="list-style-type: none"> <li>-For photographs in which location is not confirmed, when devastated and non-devastated areas cannot be divided or differentiated.</li> <li>-For photographs for the time when the photograph was taken is not confirmed, including whether the photograph was taken before or after the earthquake (for example, in photographs where building damage is not visible).</li> <li>-Do not use 'damaged', or 'devastated' as keywords in cases when it is not possible to determine whether or not the earthquake or other events caused the apparent damage.</li> <li>-Only experts are able to determine the degree of damage. Do not use keywords such as, 'total destruction', 'partial destruction', etc to indicate the degree of damage in building structures.</li> </ul>
Keywords composed of 2 or more terms shall not be split	<ul style="list-style-type: none"> <li>-If 'Namiwake Shrine' is the given keyword, it will remain as such in the metadata base.</li> </ul>

## 4.2 Issues Related to the Application of Metadata to Earthquake-Related Images

Metadata application to earthquake-related images revealed the following additional issues.

### 1) Variation in Vocabulary Use

One of the challenges of metadata assignment relates to the variation in vocabulary used by participants. To be specific, we found a great variation within the choice of written forms, using the various Japanese script interchangeably (hiragana, katakana, and kanji), as well as synonyms to describe the same item; they use the terms 'motorcycle', 'motorbike', 'automatic two-wheeler', and 'vehicle' for the same motorcycle. One of the solutions to control for such variation is to limit the number of keywords. The problem with this simple method is that it narrows down the scope of the search for end-users. Therefore, the most appropriate tool would be a thesaurus of disaster-related vocabulary, but such thesaurus does not yet exist. Increased variation also occurs as new vocabulary items appear following specific disasters. For instance, the Great East Japan Earthquake has led to the emergence of new vocabulary items specific to complex disasters, such as, 'radiation', and 'decontamination'. The complexity of the vocabulary used for the construction of meta data calls for a mechanism that is innovative, wide in scope and has the capacity to be readily updated.

### 2) Metadata of Specialized Terminology

From the researcher's point of view, the inability to utilize specialized terminology becomes an issue. Assuming the metadata will be used by researchers and experts, it is necessary to allow some degree of usage of specialized terms. Even in this case, it is necessary for those familiar with the region or the field to assign appropriate terminology. Using specialized terminology provides the formidable advantage of increasing the search ability and efficacy of metadata by drawing from the vocabulary found in papers and technical books of disaster studies. This connection between the records and the existing literature can also lead to a new discovery about earthquake-related records.

## 5. The Construction of a Web Search System for Earthquake-Related Records

Web search systems of earthquake-related records allow for common web user to access any material available by browsing the web. In addition, we implemented an application programming interface (API) in order to



collaborate and share the earthquake-related records with other institutions. When building this system, we gave priority to open sourcing for most of the program as well as its sustainability by ensuring its usability by any future archiving organizations in the future.

Fig. 4 shows the initial screen of our web search system. Typically, museum and library archives have a search box for a simple search, and another for an advanced search. In our system, the initial page provides only a single search box offering rapid and efficient access. The advanced search box is provided along with the first results and allow for narrowing down the search. In addition, we included a function below the search box that displays commonly used keywords, making our system user-friendly. This option allows first time users to easily find commonly used search words. As shown at the center of Fig. 5, thumbnails of the search results are displayed as a list. Displayed in accordance with the search results, the left-hand side of the screen shows 'keywords', 'time', and 'place (location information)'. Keywords are displayed in order of usage frequency. When clicked, keywords are added to the search word list narrowing further the results. For instance, if one enters the word 'tsunami', the results corresponding to this keyword appear along with other used keywords, in order of frequency. These include 'buildings (number of items)', 'damage (number of items)'. Clicking on 'buildings' automatically focusses the search results to include records containing both 'tsunami' and 'buildings'. Apart from such keywords, results can be refined by indicating a specific time and place. Location information or place names included in the title or keywords of the earthquake-related records appear separately from that of the name of the municipality. Rather actual dates, time is classified in different periods such as 'pre-earthquake', 'post-disaster', 'one month after', and 'six months after'. The lower part of Fig. 5 shows a screen shot of advanced search results, following the display list of search results as well as the contents on left-hand side, a map on the right-hand side, and toward the bottom of the screen, the title, creation date, author, address, and keywords.

In addition to our data, our web search system is conceived to provide information and access to material available in our archiving partners. By using the external collaboration API, we are attempting to share about 120,000 earthquake-related records with the National Diet Library's 'Hinagiku' and Harvard University's 'JDA'. In addition, we are working together with archive groups such as NHK Great East Japan Archives in order to provide earthquake-related records provided by outside sources. Finally, the foundation concepts of these systems have been utilized by other archiving systems, such as Kahoku Shimpō's Earthquake Disaster Archives and Tagajo City's 'Tagajo Kenbunoku' archives in Miyagi prefecture.

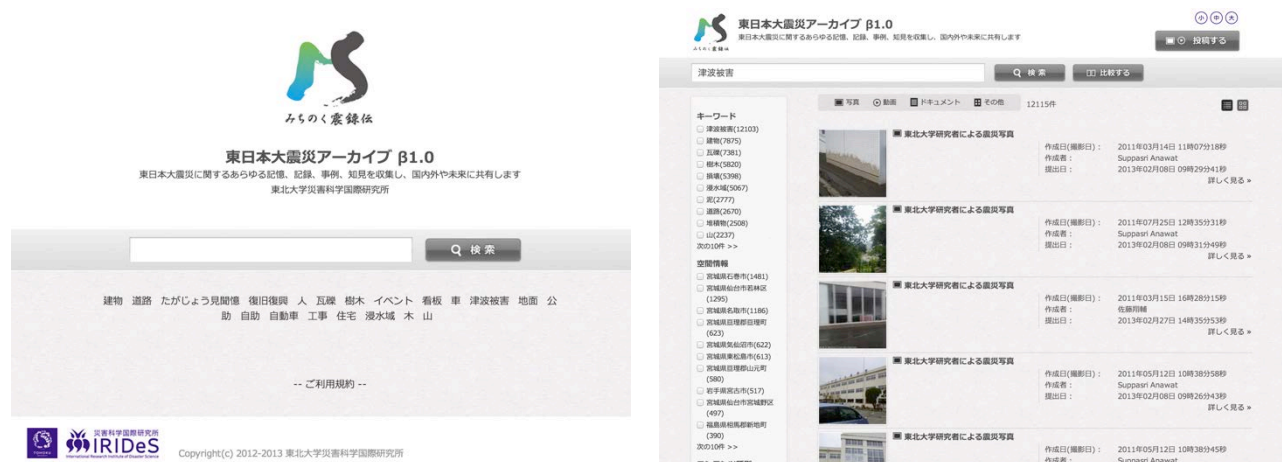


Fig. 4 Web Search System for the Utilization of the Earthquake-Related Records

## 6. Example of Earthquake-Related Record Utilization

During the past five years that followed the earthquake, Michinoku Shinrokuden has been utilizing the earthquake-related records through a variety of activities. We have held events and activities such as storytelling symposiums, kataritsugi (events for the transmission of disaster experiences), classes that use earthquake-related archived material, held in collaboration with Harvard University, and disaster reconstruction sightseeing tours in the affected areas. Storytelling symposium and kataritsugi use some of the 3,000 testimonies from disaster victims to draw the lessons to be passed on to future generations. Since their creation in 2013, the number of participants to the storytelling symposium and kataritsugi has been steadily increasing and has now reached more than 1,000 per year. Through collaboration with Harvard University, teachers of disaster archives and their students utilize the 120,000 records from the disaster-related contained at Michinoku Shinrokuden and Waku Editor, a presentation generation system created by Harvard University. During these classes, students choose a topic and select relevant earthquake-related records, which they then arrange within Waku Editor. These organized materials can also be published on the Harvard University JDA website. The results of this research is presented during presentations during student exchanges. In addition to the use of digital archives in the classroom, these visits provide the opportunity to share the realities of the Great East Japan Earthquake from both the perspectives of both Harvard and Tohoku students. Finally, Michinoku Shinrokuden has contributed to the organization of disaster sightseeing tours. Although these tours are held in the affected areas, the challenge is to provide an understanding of the realities at the time of the earthquake in a landscape that has undergone dramatic change through the ongoing processes of rehabilitation and reconstruction. To overcome these difficulties, we use new technology such as Augmented Reality glasses. AR-glasses contain screens which allow the diffusion of digital images to the viewer. We hope that through this virtual reality to give a sense of the realities of the situation at the time of the earthquake and thus increase awareness of disaster prevention. All these efforts to share the experiences and lessons of the GEJE are complemented by punctual workshops on for disaster prevention and education.

## 7. Conclusion

This paper outlined earthquake-related record collection and organization for the Great East Japan Earthquake Archives Project Michinoku Shinrokuden, as well as the construction of the search system for promoting the utilization of these earthquake records. In the future, along with the development of this natural disaster archive initiative, our ambition is to utilize the knowledge accumulated over the past five years to support the construction of municipality archives for the Great East Japan Earthquake and the DATA Project of the Aceh Tsunami Museum in Banda Aceh City, Indonesia.

## 8. References

- [1] Kobe University Library, Great Hanshin-Awaji Earthquake Disaster Materials Collection, <http://www.lib.kobe-u.ac.jp/eqb/e-aisatu.html> (Accessed, 1 April 2016)
- [2] The Chuestsu Disaster Archives for the 2004 Mid-Niigata Prefecture Earthquake(in Japanese only), <http://map.c-bosai-anzen-kikou.jp/> (Accessed, 1 April 2016)
- [3] The Reconstruction Design Council in response to the Great East Japan Earthquake (25 June 2011), Towards Reconstruction “Hope beyond the Disaster”, <http://www.cas.go.jp/jp/fukkou/english/pdf/report20110625.pdf> (Accessed, 1 April 2016)
- [4] National Diet Library, NDL Great East Japan Earthquake Archive “Hinagiku”, <http://kn.ndl.go.jp/node?language=en> (Accessed, 1 April 2016)
- [5] Tohoku Gakuin, Remembering 3.11(in Japanese only), <http://archive311.tohoku-gakuin.jp/>(Accessed, 1 April 2016)

- [6] Japan Society of Civil Engineers, Great East Japan Earthquake Archive(in Japanese only), <http://www.jsce.or.jp/library/eq20110311/index.shtml> (Accessed, 1 April 2016)
- [7] National Research Institute for Earth Science, 311 Marugoto Archive(in Japanese only), <http://311archives.jp/> (Accessed, 1 April 2016)
- [8] NHK, Remembering 3.11 Great East Japan Earthquake Archive, <http://www9.nhk.or.jp/311shogen/en/> (Accessed, 1 April 2016)
- [9] Kahoku Shimpō Publishing Co., Kahoku Shimpō Disaster Archive, <http://kahoku-archive.shinrokuden.irides.tohoku.ac.jp/> (Accessed, 1 April 2016)
- [10] Google, Memories for the future, <https://www.miraikioku.com/en/> (Accessed, 1 April 2016)
- [11] Yahoo! JAPAN, East Japan Earthquake Picture Project, <http://archive.shinsai.yahoo.co.jp/> (Accessed, 1 April 2016)
- [12] Tagajo City in Miyagi Prefecture, Tagajo Kenbunoku(in Japanese only), <http://tagajo.irides.tohoku.ac.jp/> (Accessed, 1 April 2016)
- [13] Koriyama City in Fukushima Prefecture, Koriyama Disaster Archive(in Japanese only), <http://shinsai.koriyama-archive.jp/> (Accessed, 1 April 2016)
- [14] Kuji city Noda village, and Fudai village in Iwate Prefecture, Kuji-Noda-Fudai Disaster Archive(in Japanese), <http://knf-archive.city.kuji.iwate.jp/> (Accessed, 1 April 2016)
- [15] Harvard University Reishauer Institute of Japanese Studies, The Digital Archive of Japan's 2011 Disasters, <http://www.jdarchive.org/en/home> (Accessed, 1 April 2016)
- [16] National Archives of Japan, 2012 National Institute of the National Archives operational report, material 3-2 (in Japanese only), <http://www.archives.go.jp/information/data24.html> (Accessed, 1 April 2016)
- [17] Iwate Prefecture, The collection and utilization of earthquake and tsunami-related material, notification of storage and earthquake tsunami related documents(in Japanese only), [http://www.pref.iwate.jp/dbps\\_data/\\_material/\\_files/000/000/044/702/guideline.pdf](http://www.pref.iwate.jp/dbps_data/_material/_files/000/000/044/702/guideline.pdf) (Accessed, 1 April 2016)
- [18] Fuji News Network, FNN Great East Japan Earthquake Archives, <http://www.fnn-news.com/en/311/articles/201103120086.html> (Accessed, 1 April 2016)