

Paper:

Comparative Analysis of Earthquake Emergency Response in China and Japan Based on Timeline: 311 Earthquake vs 512 Earthquake

Xiaoxia Du^{*1}, Jun Zhang^{*1}, Jianhua Xu^{*1}, Zhuan He^{*1}, Junyan Lai^{*1}, Yigang Li^{*1,†}, Reo Kimura^{*2}, Haruo Hayashi^{*3}, Masafumi Hosokawa^{*4}, and Yukihisa Sakurada^{*2}

^{*1}National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

E-mail: duxx_bj@126.com

^{*2}School of Human Science and Environment, Hyogo University, Himeji, Japan

^{*3}Disaster Prevention Research Institute, Kyoto University, Kyoto, Japan

^{*4}Earthquake and National Disaster Laboratory, National Research Institute of Fire and Disaster, Tokyo, Japan

†Corresponding author, E-mail: liyig@263.net

[Received October 24, 2014; accepted January 28, 2015]

A devastating M_s 8.0 earthquake hit Wenchuan County, Sichuan Province, China, on May 12, 2008. A similarly destructive M_w 9.0 earthquake hit east-coast Miyagi Prefecture, Japan, on March 11, 2011. The governments of both countries took rapid, effective emergency response measures, gaining invaluable experience and learning precious lessons. To compare detailed emergency responses during these earthquakes and share lessons, this paper uses timeline analysis focusing on the levels of the two earthquakes, summarizing key emergency response measures focusing on emergency command center setup and operation, rescue force deployment and dispatch, emergency victim housing and resettlement, and public information reporting and release based on a time sequence. It also comparatively analyzes and sorts their implementation and timing and studies the similarities and differences of the two earthquakes. This paper also analyzes the advantages and disadvantages of emergency response measures taken by both nations, considering the background of emergency management systems to share experiences and provide references on future disaster emergency response work to improve abilities and progress in earthquake response.

Keywords: timeline, earthquake, emergency response, comparative analysis

1. Background

A magnitude 8.0 (M_s) earthquake with a focal depth of 14 km hit Yingxiu Town, Wenchuan County, Sichuan Province, China (31.0°N, 103.4°E), at 14:28 CST on May 12, 2008. The earthquake killed 69,227, injured 374,643, and left 17,923 missing as of October 2008. The affected area covered 440,400 km² and involved direct economic loss of 845.1 billion yuan. The Chinese gov-

ernment was widely recognized following the disaster as taking rapid, effective measures in command and coordination, rescue and assistance and resettlement and information release. Shortcomings were also found in a lack of disaster prevention and mitigation awareness and preparations.

A powerful magnitude 9.0 earthquake about 130 km off the Pacific coast of Tohoku, Japan (38.1°N, 142.9°E), hit at 14:46 JST on March 11, 2011, with a focal depth of 24 km. The earthquake triggered powerful tsunamis, and the two combined caused 15,776 deaths, 5,927 injured and 4,460 missing as of August 31, 2011. Direct losses were estimated at 16.9 trillion yen. The tsunami caused floods and damaged ports and power stations, including the Fukushima Daiichi Nuclear Power Plant. During the overall recovery process, Japanese central and local governments systematically implemented emergency responses and rescues. The late disclosure of nuclear leakage at the Fukushima Plant also imposed severe challenges on Japanese society.

Although the two catastrophes caused tremendous losses, they also provided precious emergency response experience. To compare specific actions taken by both nations and to learn from mutual experience, this paper focuses on timeline analysis and studies Sichuan Province and Miyagi Prefecture to sort out specific response measures in a time sequence including setup and operation of the Emergency Operation Command Center, allocating and dispatching rescue forces, providing shelters and resettlement to victims, and reporting and releasing information. Emergency response measures are compared and analyzed and common points and differences studied. Based on the resulting information and considering differences in emergency management systems in China and Japan, this paper also analyzes the advantages and disadvantages of the two governments in emergency response and provides experience and references for future earthquake emergency response in dealing with earthquakes.

Table 1. Emergency operation command center setup and operations.

Task	512 Wenchuan Earthquake Sichuan Province	311 Japan Earthquake (Miyagi Prefecture)
Set up Details	10 minutes after EQ, Provincial HQs set up and emergency meeting held	When EQ occurred, The Prime Minister's Residence HQs set up
	10 minutes after EQ, HQs of Chengdu Military Region set up	When EQ occurred, Prefecture Disaster Countermeasures HQs set up
	8 hours after EQ, National HQs set up	4 minutes after EQ, Defense ministry set up Disaster Countermeasures HQs
	In the evening of May 12, Provincial Field Command Post set up	28 minutes after EQ, Cabinet set up Disaster Countermeasures HQs
Running Details	40 minutes after EQ, Commander rushed to the affected area and made 7 relief work instructions on the way	16 minutes after EQ, HQs request rescue assistance from SDF
	8 hours after EQ, HQs issued an emergency notice about disaster relief work	24 minutes after EQ, HQs held the liaison meeting
	From 2 days after EQ, HQs held Press Conference daily, routine meeting twice a day	44 minutes after EQ, HQs held 1 st meeting
	2 days after EQ, HQs held a meeting to conduct important instructions of State Council and issued a notice on donation activity	50 minutes after EQ, HQs request the State to dispose rescue teams from
	3 days after EQ, HQs issued an emergency notice on disease control and donations statistics	2 hours after EQ, HQs held 2 nd meeting
	4 days after EQ, HQs ordered to implement traffic control of some roads	3 hours after EQ, General Affairs Department of HQs transferred
		1-2 days after EQ, HQs held 4 meetings per day
		3-4 days after EQ, held 3 meetings totally
	5 days after EQ, held 2 meetings per day	

2. Methods

Using timeline analysis, case studies and comparisons, this paper explores important emergency response measures in the two earthquakes and emergency response processes and timelines. Emergency response work and tasks vary greatly in different post-earthquake stages, which should be prioritized based on actual area needs. Timeline analysis sorts response processes according to time sequence and relates tasks to owners and implementation time, displaying them in figures and tables. Then emergency response tasks are analyzed in different time slots and conducts comparative analysis on tasks, actual needs and requirements of emergency plans, so as to provide references, guidance and recovery measure suggestions in future emergency response and disaster recovery. Case study mainly focuses on the two earthquakes, first conducting intra-case study to understand emergency response process, characteristics, experience and lessons of each earthquake and master details and key factors of the whole earthquake emergency response process; then conducting cross-case study to conclude experience and lessons of earthquake emergency response, study models and characteristics of emergency response under different backgrounds. Comparative analysis compares key measures during the two earthquake emergency response processes to explore universal and special rules to deal with earthquakes catastrophes.

3. Comparative Analysis of Earthquake Emergency Response

After the 2008 Wenchuan earthquake, governments and departments at all levels in China responded quickly to establish an Earthquake Relief Command Center, organized and dispatched forces to rescue, aid and relocate victims. After the 2011 Great East Japan earthquake, Japanese governments at all levels and related agencies set up a Disaster Countermeasures Headquarters took emergency rescue and recovery measures. The comparative analysis of emergency response measures in the establishment and running of the Emergency Operation Command Center, the allocation and dispatch of rescue force, the emergency shelter and resettlement of victims, and the report and release of public information are detailed in the sections that follow.

3.1. Emergency Operation Command Center Setup and Operation

Strong, effective emergency command systems are critical to timely, viable, effective emergency decisions and operations responding to earthquake disasters. After the Wenchuan earthquake, a strong emergency command system was built through cooperation by central and local governments and departments from the army to local governments in a few hours and running speedily. Similar efforts followed after the East Japan earthquake. The Disaster Countermeasures Headquarters was quickly set up to organize disaster relief operations based on previously prepared disaster plans. These are detailed in **Table 1**.

Table 2. Military forces and rescue operations.

Time	512 Wenchuan Earthquake Sichuan Province	311 Japan Earthquake (Miyagi Prefecture)
0-2 h after EQ	After EQ, the Central Military Commission immediately mobilized the military forces	4 minutes after EQ, Self-defense Department set up Disaster Countermeasures HQs
	8 minutes after EQ, Chengdu military area deployed about 6100 persons to the hit area and commanded the reserve militia to act	15 minutes after EQ, SDF transmitted disaster situation video through helicopter
	Established military steering group and set up Field Joint Command Center	44 minutes after EQ, SDD held 1 st meeting
2 h-24 h after EQ	7 hours after EQ, 150 armed forces were deployed with 7 large-duty loader	3 hours after EQ, Disaster Dispatch Order of Large Scale was issued. Air rescue forces was set up and deployed
	10 hours after EQ, nearly 20,000 PLA and armed forces arrived at the hit area, HQs of General Staff issued command of disaster relief and mobilized 34,000 forces	4 hours after EQ, Dispatch Order was issued in response to the nuclear accident.
	16 hours after EQ, 22 persons small group arrived at the epicenter-Yingxiu.	8 hours after EQ, the order of reinforcement was issued
		24 hours after EQ, SDF deployed 20,000 people, 190 airplanes and 45 warships
24 h after EQ-the end of rescue	2 days after EQ, deployed 30,000 armed forces equipped with tools and appliances	2 days after EQ, Joint Mission Team was build up, land, sea and air of SDF began joint rescue
	3 days after EQ, the troops arrived at all the stricken towns for relief. More than 30,000 reserve militia rescue in seriously hit area	3 days after EQ, established Coordination Office between Japan and USA to conduct joint operation.
	4 days after EQ, 100,000 armed forces worked in the hit area	6 days after EQ, recruit reserve SDF, and set up the liaison & adjustment office
	Throughout the whole relief period, the military dispatched 150,000 people covering 20 branches of army services.	Since April, several focused searches were carried out to search the missing victims.
		Up to July, SDF deployed 1,058 million people, 50,000 helicopters and 4,900 warships

3.1.1. Emergency Operation Command Center setup

The Sichuan Province government set up a Wenchuan Earthquake Emergency Operation Command Headquarters in Chengdu City and a Field Operation Command Post in Dujiangyan City, which was divided into 8 groups, i.e., a headquarters office and medical, transportation, communication, water conservation, relief supplies, media and overseas rescue coordination groups. Worst-hit area frontline command posts set up in six cities were responsible for commanding and coordinating relief operations. Later after the earthquake, housing resettlement, partner assistance coordination, recovery and reconstruction planning, production recovery and supervision and inspection groups were added as needed to implement corresponding work. In the East Japan earthquake, the Miyagi Prefecture government set up a Disaster Countermeasures Headquarters divided into operation, strategy, information, communication, media and general affairs, emergency rescue, helicopter, shelter, and liaison groups. Groups were then set up to raise relief supplies and relief supplies and relief supplies allocation groups were added to conduct corresponding work. A Field Disaster Countermeasures Headquarters was set up 16 hours after the earthquake to organize and command relief operations.

3.1.2. Emergency Operation Command Center Operations

Basic working rules and regulations were set up and implemented when the Wenchuan earthquake headquarters worked to ensure a smooth command process, including 24 hour emergency duties, daily routine meetings, information collection and reporting, consultations on major issues, daily work briefings and other temporary rules. After headquarters was set up, the commander issued a directive requiring that all provincial leadership be divided into 3 units – one at the six Worst-hit Area Frontline Command Posts, one at the Field Operation Command Post in Dujiangyan, and one at the Emergency Operation Command Headquarters in Chengdu. Provincial headquarters hold regular twice-daily meetings to coordinate and arrange relief work and also set up mechanisms of close relations, communication and coordination – quick disposal of military forces, police and other command centers – to ensure that the command system runs smoothly, orderly and effectively. In the case of the East Japan earthquake, the Miyagi Prefecture Disaster Countermeasures Headquarters rapidly implemented disaster relief operations based on provisions of local disaster prevention plans and related laws and regulations. In the initial stage after the earthquake, the headquarters quickly collected disaster situation information, requested timely as-

Table 3. Postquake professional rescue forces operating in seriously hit areas.

Time	512 Wenchuan Earthquake Sichuan Province	311 Japan Earthquake (Miyagi Prefecture)
0-2 h after EQ	5 minutes after EQ, Chengdu firefighting branch of 800 persons was deployed	When EQ occurred, 12 local firefighting HQs took action
	9 minutes after EQ, Sichuan USAR team convened and were ready to deploy	14 minutes after EQ, Sendai firefighting air forces conducted rescue in Sendai city.
	12 minutes after EQ, Mianyang firefighting branch deployed 75 persons for SAR operation	44 minutes after EQ, Sendai firefighting bureau requested for emergency rescue
	17 minutes after EQ, Deyang firefighting branch deployed 180 people for SAR operation	50 minutes after EQ, Miyagi firefighting Rescue Coordination HQs was set up
	72 minutes after EQ, CISAR was deployed	54 minutes after EQ, firefighting rescue teams deployed
	2 hours after EQ, Sichuan Safety Monitoring Bureau issued rescue order to Mine & HazMAT Rescue team	77 minutes after EQ, Internal Affairs Ministry deployed Sapporo rescue team
2 h-24 h after EQ	7hours after EQ, Sichuan General Fire Brigade deployed forces to reinforce Beichuan	7hours after EQ, Tokyo Fire Department Command rescue team arrived and acted
	8 hours after EQ, CISAR team of 184 people arrived and headed to Duijiangyan for rescue	10 hours after EQ, 12 local firefighting HQs deployed 2664 people for rescue operation
	8 hours after EQ, 6 Mine & HazMAT Rescue teams of Sichuan were deployed	10 hours after EQ, all firefighting mission deployed 11,728 people for rescue operation
	11 hours after EQ, 4 Mine & HazMAT Rescue teams deployed to Shifang, Mianzhu, etc.	15 hours after EQ, firefighting team of Toyama arrived at Natori for rescue
	12 hours after EQ, Ministry of Public Security Fire Department mobilized 1,182 people	17 hours after EQ, Sapporo firefighting command rescue team arrived
24 h after EQ-the end of rescue	20 hours after EQ, the third batch of Mine & HazMAT Rescue teams arrived.	24 hours after EQ, firefighting department deployed 363 teams, 30406 persons and rescued 4094 victims in total
	1.5 days after EQ, Ministry of Public Security Fire Department mobilized the second batch of rescue forces including 5070 persons	2 days after EQ, firefighting teams of Kanagawa, Shimane, Mie arrived at Miyagi
	2 days after EQ, Chengdu USAR team of 50 members and 3 dogs arrived at Beichuan	5 days after EQ, firefighting team of Kumamoto prefecture arrived
	2 days after EQ, 7718 professional rescue crew of firefighting departments all arrived	Up to the end of May, firefighting departments deployed 297,604 people in total and rescued 6,679 survivors, including land forces and air forces
	2.5 days after EQ, Ministry of Public Security Fire Department mobilized the third batch	

sistance, released the announcement of shelters and organized field rescue operation. On March 11, the headquarters held on 4 meetings and transferred the General Affairs Department to a suitable place based on actual needs. The routine meeting and press conference system was set up, the Self-Defense Forces Contact and Coordination Center was set up, and a liaison and coordination system was set up with the SDF, police, fire protection, and other headquarters. All relief forces communicated and coordinated their activities through participating in headquarters meetings and sharing information, then jointly implemented relief operations.

3.2. Rescue Force Allocation and Dispatch

After the two earthquakes, governments from both countries mobilized available resources, deploying military forces and USAR teams carrying rescue equipment. Due to differences in national administrative systems and emergence response mechanisms, rescue operations from China and Japan had different features. Their rescue resources and efforts in seriously stricken areas such as

Sichuan Province and Miyagi Prefecture are detailed in the sections that follow.

3.2.1. Military Rescue Force

After the Wenchuan earthquake, almost all military forces were immediately mobilized for relief operations. Deployed into affected areas by air, rail, highway, and sea, they analyzed disaster situations, repaired roads, evacuated and otherwise assisted victims, and played a tremendous, irreplaceable role in relief operations. After the east Japan earthquake, the Japanese government mobilized and deployed police, self-defense and maritime security headquarters forces to analyze disaster situations, rescue victims, search for the missing and assist victims. Military rescue forces and operations in Sichuan and Miyagi are listed in **Table 2**.

3.2.2. Professional Rescue Force and USAR Teams

Professional rescue forces following the Wenchuan earthquake consisted of three parts – national and local

Table 4. Wenchuan earthquake rescue operations by overseas teams.

Teams	Operations	Effect
Hong Kong	On May 14, Hong kong deployed 3 USAR and Medical teams, etc. The USAR team arrived in Hanwang to rescue on May 15; Air service team arrived on May 17 and transported casualties with helicopter, hunted for the trapped victims in mountainous area, carried rescuers and materials. They were sent out for 26 times, rescued 96 victims and transported 119 rescuers.	Totally, 281 foreign rescue forces carried out USAR and medical aid operations in Qingchuan, Beichuan, Mianzhu, Shifang and Dujiangyan, and rescued 1 survivor and 76 bodies.
Macao	On May 23, Medical Aid team of 20 volunteers arrived and provided medical service in Chengdu; on June 10, the second medical team and supplies arrived at Chengdu and headed to Nanchong for rescue	
Taiwan	On May 16, Red Cross Rescue team arrived in Chengdu, and then headed to Mianzhu and Hanwang for rescue on the next day; on May 20, the Red Cross Medical team of 37 people deployed to Deyang	
Japan	As the first arrived international USAR team, more than 60 members rescued at Qingchuan County and Beichuan county	
Singapore	On May 16, the team arrived in Chengdu and deployed to Hongbai town on the next day for rescue operation	
South Korea	41 team members conducted USAR operation in Hongda Chemical Factory of Yinghua town and rescued 16 bodies of victims	
Russia	On May 16, the team arrived at Chengdu and deployed to Hanwang Town for rescue. Then they arrived at Dujiangyan in the morning of May 17 and rescued one survivor	

earthquake USAR teams, fire brigade and police rescue teams, and mine & Hazmat rescue teams – involving over 20,000 personnel. These professional teams were capable and efficient, enabling the rescue of trapped victims in places where other rescue forces could not go. Although the number of rescued victims was fewer than for other forces, they played a very important role in rescue operations. In the East Japan earthquake, professional rescue forces consisted of fire institution land and air branches from nationwide. These forces were divided into local firefighting headquarters, firefighting mission, firefighting support units, emergency firefighting teams, and air force units to take action in affected areas, including investigating disaster situations, mobilizing evacuation efforts and saving victims' lives. Professional rescue forces dispatched in Sichuan province and Miyagi are listed in **Table 3**.

3.2.3. Overseas Rescue Forces

After the Wenchuan earthquake, Japan, Russia, South Korea and Singapore deployed USAR teams to affected areas. Hong Kong, Macau and Taiwan also dispatched rescue forces. A total of 218 overseas rescuers worked in affected areas of Sichuan to implement USAR operations and medical aid, as detailed in **Table 4**. After the East Japan earthquake, China, South Korea and other countries deployed international USAR teams to affected areas. A total of 668 professional USAR team members from 12 countries worked with search dogs and rescue equipment conducting rescue operations in the worst affected areas, as detailed in **Fig. 1**.

Dispatch timing of rescue efforts during the two earthquakes based on the above analysis are shown in **Fig. 2**.

3.3. Emergency Victim Refuge and Resettlement

The setup of refuges and resettlement of huge numbers of victims became extremely difficult following the two earthquakes. China and Japan adopted various measures for evacuating and resettling victims as analyzed and compared below.

3.3.1. Emergency Refuge and Resettlement

After the Wenchuan earthquake, emergency refuge and resettlement efforts were mainly local and nearby – tents were pitched in town areas and public facilities including sports stadiums, cultural centers, schools and parks were opened up to resettle victims in urban areas. Shacks were built in rural areas. In addition to 26 shelters in Chengdu City, Mianyang City's Jiuzhou Stadium was also used as a temporary shelter, but these shelters were far too few to meet actual needs. Massive numbers of victims unable to be resettled locally or nearby had to resettle on their own, which required a huge number of tents. In tent shelters that had relatively concentrated populations, provisional management committees were set up based on the population scale. The committee was responsible for registering victims and issuing them videos and goods, determining needs and collecting suggestions. These resettlement sites were densely populated, however, resulting in a lack of living facilities whose unhealthy management and organization rendered them unlivable, and substandard and shortlived. Government authorities organized special resettlement for special groups such as older victims who had lost children, younger victims who had lost parents and victims who were handicapped and had lost families.

Many shelters for survivors of the Great East Japan earthquake were located in schools and stadiums. The Miyagi Prefectural Office also became a shelter, disaster relief command and lodging area. Support for ar-

No.	Country	Members	Canines	Date	Site
1	Korean Rescue Team	107	2	14th,Mar	Sendai City
2	Singapore Rescue Team	5	5	12th,Mar	Fukushima Prefecture
3	German Rescue Team	43	3	13th,Mar	Miyagi Prefecture
4	Swiss Rescue Team	27	6	13th,Mar	Miyagi Prefecture
5	U.S. Fairfax Rescue team	72	6	13th,Mar	Ofunato City
6	Australia Rescue Team	72	2	14th,Mar	Miyagi Prefecture
7	New Zealand Rescue Team	45	0	13th,Mar	Miyagi Prefecture
8	China Rescue Team	15	0	13th,Mar	Ofunato City
9	British Rescue Team	63	2	13th,Mar	Ofunato City
10	France Rescue Team	63	2	13th,Mar	Ofunato City
11	Mexico Rescue Team	12	6	13th,Mar	Miyagi Prefecture
12	Russia Rescue Team	72	6	13th,Mar	Sendai City
13	U.S. International Development Agency(Los Angeles)	72	6	13th,Mar	Ofunato City

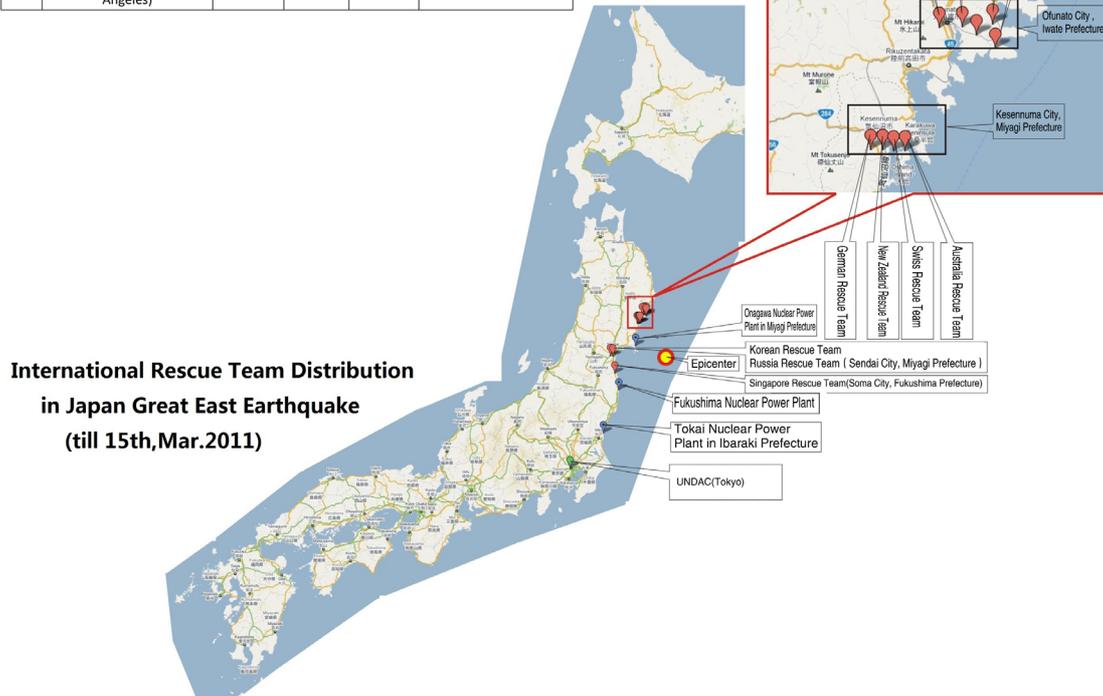


Fig. 1. Distribution of international aid teams in the Japan earthquake.

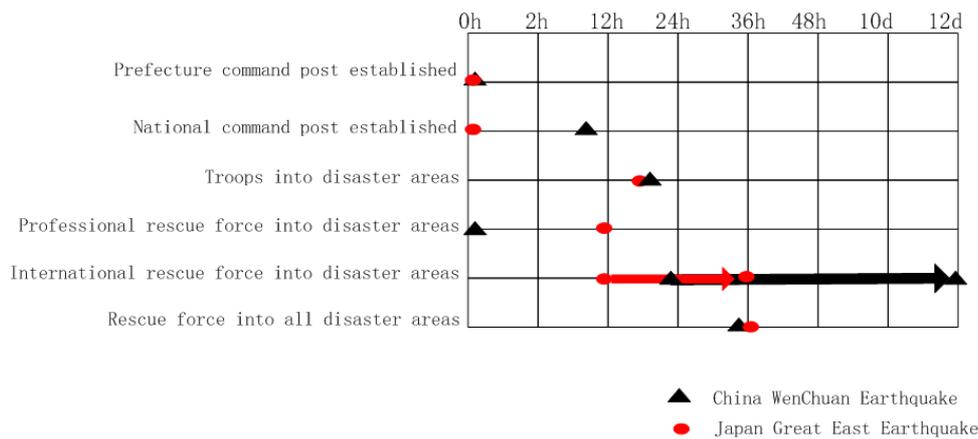


Fig. 2. Comparison of rescue efforts.

ranging shelters and victims was supposed to have been conducted by the Local Administration Division, but its administrative functions were paralyzed when the Local Administration Division office building and staff were adversely affected by the disaster. The county government thus took charge. By March 14, the number of emer-

gency shelters reached 1,183 and the refugee population reached 320,885. Supporting activities included supplying food and water, relief goods and bathroom facilities. People in shelters and volunteers made rice balls (onigiri) and box lunches to be distributed to refugees. When, as time passed, refugees' needs changed, post-quake sup-

Table 5. Emergency earthquake refuge and resettlement in China and Japan.

Time	512 Wenchuan Earthquake Sichuan Province	311 Japan Earthquake (Miyagi Prefecture)
1 st day after EQ	After EQ, governments instantly organized victims to take refuge in open areas	12 minutes after EQ, sent written orders of taking refuge used satellite wireless fax
	Department of Civil Affairs of Sichuan urgently allocated 3,500 tents	28 minutes after EQ, sent orders of refuge again used satellite wireless fax
	National Development Reform Commission, State Administration of Grain and Ministry of Finance jointly issued notices to use the goods of Chengdu subsidiary of Central grain reserve to support disaster relief.	The government collected information about the use of schools and stadiums as shelters. The government accepted homeless victims and provided them with food.
2 nd to 4 th days after EQ	On May 13, Mianyang Jiuzhou Stadium as a temporary shelter to resettle people of as much as 380,000 per day.	On March 12, Consumer Society collected emergency goods and supplied to each cities and towns; applied to provide fuels for urban lifeline institutions; started to allocate goods supply by coordinating with stores
	On May 14, the first batch of rescue helicopters carried relief goods to Wenchuan	On March 12, Ministry of Health, Labor and Welfare issued notices on expenditures of welfare facilities and people who need nursing in shelters
	On May 14, National Light Industry Council advocated enterprises to ensure sources and supplies of relief goods.	On March 12, government entrusted commodity house trading association to provide vacant house information.
	On May 15, Central Military Committee mobilized military strategic reserves and transported goods and equipments	On March 12, with the support of Niigata, 2,420 provisional toilets were provided
	Up to May 15, Ministry of Railway arranged 179 special trains to transport relief goods. Up to May 16, China National Petrol Corporate sent over 3,000 tons of petroleum products to heavily stricken areas	On March 14, government applied to the Assembling Building Association. for building 10,000 provisional houses
5 th to 7 th days after EQ	Up to May 17, Department of Civil Affairs allocated over 100,000 tents, 220,000 quilts, and 170,000 cotton-padded clothes; the Ministry of Commerce sent 2.16 million boxes of water, 290,000 boxes of instant noodles. 290 tons of cookies, 60 tons of ham, 5,000 tents, 210,000 lanterns.	On March 15, Truck Association put forward relief goods transport proposals according to the convention; shelters took proper care of the disabled and release name lists of victims; asked for grazed rice supply from Ministry of Agriculture, Forestry and Fishery,
	Up to May 19, the Red Cross allocated 18,510 tents, National Development Reform Committee and Department of Civil Affairs organized 75 tent-producers in 18 provinces & cities to speed up to produce tents	On March 16, nutrient food provided by food manufacturers was distributed to each local administrative division. On March 17, sent psychological consultants On March 18, started to supply fuels

port mainly meant providing food, drinkable water, blankets, medicines and other life-support goods. After things had settling down, victims increasingly needed necessities such as underwear, personal items and baths, so the government organized personnel to survey of refugees need and provide better support.

3.3.2. Relief-Supply Transportation

The fact of severe insufficient storage of relief goods imposed a huge burden on emergency resettlement. Both earthquakes saw problems such as serious shortages in storage for relief goods in the initial stage, excessive amounts of relief goods and unsmooth distribution in the intermediate stage. During the Wenchuan earthquake, the Mianyang Repository had only 200 quilts, fewer than 200 tents despite a need for 600,000. Faced with such large gaps, the Civil Affairs Department allocated and transported goods from other repositories, but this still did not narrow the gap, so the central government had to ask enterprises to speed up tent production. By the intermediate stage of disaster relief, great numbers of instant

noodles, drinkable water, cookies and other food piled up in Dujiangyan, imposing even more pressure on management and storage, even as many other areas lacked needed relief goods. To ensure the timely collection, safe allocation and storage and fair distribution of relief goods, systems were set up for goods reception, storage, inspection, distribution and supervision. The Sichuan Provincial Department of Commerce set up an Earthquake Relief and Goods Protection Group divided into goods source, allocation and transport and reception groups to arrange, allocate and transport and receive goods, which added greatly in support of resettlement and the lives of victims.

During the East Japan earthquake, the government allocated emergency goods in coordination with the Miyagi Coordination Combined Union and convenience stores for allocating and supplying food and requesting rice allocation and supply from higher levels. The initial post-earthquake stage was plagued by a serious shortage of relief goods. Due to damage to communication and road systems, the wide range of stricken areas and scattered victims, relief goods were not distributed in time. Insuffi-

cient supplies of fuel delayed vehicles from getting in and out of disaster-stricken areas and victims had difficulty keeping warm in the frigid weather – situation lasting long periods. By the fifth day after the earthquake, government staff members had taken charge of collecting and allocating goods to victims, commanding logistic bases, entrusting trucking associations to transport goods from logistic bases to goods distribution centers of local administration divisions and classifying, managing and distributing relief goods. Self Defense Forces also took responsibility of transporting goods from distribution centers to shelters. Through these mechanisms, transporting relief goods to shelters was made increasingly efficient, helping to ensure that victims' needs were met. Emergency refuge and resettlement efforts in Sichuan and Miyagi during are detailed in **Table 5**.

3.4. Public Information Reporting and Release

Government agencies and the media reported and released public information comprehensively, systematically and in a timely manner regarding on earthquake, disaster, and rescue status progress. **Table 6** lists some representative measures for reporting and release within the first 30 hours of the two temblors.

3.4.1. Information Release and Report Timing

The government issued warnings of the East Japan earthquake and tsunami 73 seconds before they actually struck. Japan's national broadcaster NHK reported the earthquake and broadcast scenes of the shake within the 17 seconds following the earthquake's occurrence. Wenchuan had no early earthquake warning system, so news of it was first released 17 minutes after it struck, and it was one hour later that telephone connections could be made with the affected area. News release and reporting was thus slightly later in China than in Japan. NHK was a public media and legal reporting institution having nine bases equipped with dozens of helicopters, so NHK helicopters took off immediately and sent back first-hand information. Japan's disaster-warning system provided time for publicity of early warning information. During the Wenchuan earthquake, the Xinhua News Agency and CCTV, as representatives of mainstream media groups, played a positive role in shaping public opinion, but the media need to gain time for information release and reporting in catastrophes. Time was therefore needed to gain experience in an effective response to major calamities and to draw on Japan's disaster reporting practices to improve related systems and mechanisms.

3.4.2. Reporting and Publishing of Casualties

Timely, accurate release of disaster casualties demonstrates the national capacity of public information reporting. There were sporadic statistics and reports about casualties within the first 30 hours of the Wenchuan earthquake, and the two official reports noted in **Table 6** were broadcasting all types of media. From the second day after the earthquake, the State Council released the latest

data on casualties to the public through TV and other press networks, newspapers, broadcasting and text messages in a timely, authoritative, creditable way daily. Dozens of reports on casualties were made within the first 30 hours of the East Japan earthquake, with six reports cited the most listed in **Table 6**. We concluded from this data that reports by the Japanese media differed greatly, for example, from Japanese police. It is even fair to say that the government lacked unified and authoritative publication of casualties throughout the first 30 hours following the quake. The powerful tsunami that also followed made it difficult to collect numbers of casualties in a timely way. Given the circumstances of incomplete and incorrect information, however, the government should consider the issue of speaking uniformly when it came to information reports.

3.4.3. Convening of Press Conferences

Press conferences are an authoritative way to release information. As indicated in **Table 6**, both the Chinese and Japanese governments attached great importance to press conferences, i.e., within the 30 hours following the temblor, the Japanese government held 4 press conferences in response to the public's concerns, and the Chinese government held 6 press conferences at several levels.

Regarding press conference timing, the China Earthquake Administration's first press conference came two hours after the quake, whereas it took Japan three hours to do the same thing. Regarding these levels, the national government held one press conference about 26 hours later. As to the contents, the three conferences within the first six hours mainly focused on determining the magnitude and denying rumors. Not until the afternoon of May 13 – over 24 hours after the quake, did the Sichuan Province government convened two press conferences introducing disastrous status in detail, together with the impact scope, general disaster relief measures and assistance from all parties.

In contrast, the Japanese government provided briefings on details of the basic disaster situation and related measures 14 hours after the catastrophe. Japan was thus quicker in making information public but fell behind China in dealing with rumors.

4. Conclusions

4.1. Emergency Operation Command Center Setup and Operation

The establishment of the Emergency Operation Command Center during the two earthquakes was relatively quick. In the case of the East Japan earthquake, setup and operations were more normative and procedural, in strict accordance with the provisions of laws and regulations, and was also adjusted based on experience with historic earthquakes. Based on cooperation agreements in normal times, the emergency command process in disaster relief operations was smooth and orderly. In the case of the

Table 6. Public earthquake information reporting and release.

Time	China	Japan
Before EQ		Released early warning on EQ and tsunami.
EQ occurred		All TV stations halted original broadcasting plan and started reporting earthquake.
30 m after EQ	CEIC released EQ information to the world through the Xinhua News Agency	Japan Meteorological Agency issued warning of tsunami to 37 coastal municipalities
	CCTV reported EQ with rolling sub-titles	NHK issued tsunami warning to the world in Japanese, Chinese and English NHK reported disaster situation by 24 hours
1 h after EQ	CNR and CCTV immediately interred cut the EQ information, live broadcasted program and connected the affected areas by telephone.	East Japan Railway Company announced that all new main lines were closed
2 h after EQ	CEA held a press conference to confirm the EQ magnitude.	NHK announced that the earthquake had already caused huge casualties.
	Xinhua network posted news about the important instructions of the Sate Council CCTV reported the event around the clock	
3 h after EQ	CEA held 2 nd press conference to dispelled the earthquake rumor	Prime Minister held 1 st press conference and called on the public to watch government information from the media
	National Tourism Administration issued the Emergency Notice on Banning Tourism in the affected Areas	Al Jazeera reported that at least 8 deaths had been confirmed.
4 h after EQ	Xinhua network reported 107 deaths and 34 injuries according to Ministry of Civil Affairs	Asahi Shimbun reported the breakdown of No.1, 2 reactor of Fukushima Daiichi for fear of nuclear leaking.
	China Meteorological Administration initiated Level II emergency response; National Meteorological Center of CMA broadcasted showery rain.	Prime Minister delivered a speech on TV that part of nuclear plants had stopped running automatically and no leaking of radioactive materials had been found.
6 h after EQ	CEA convened 3 rd press conference and reconfirmed the EQ magnitude and denied the EQ rumors in Beijing and other areas.	Failing to confirm the existence of nuclear leaking, Premier issued Announcement on Nuclear Emergency, persuading residents in 2 km radius of No.1 nuclear plant to refuge
8 h after EQ	The Transportation Bureau of the Ministry of Public Security issued emergency notice on the emergent management of road traffic.	The number of deaths climbed to 59
		Foreign Minister met the journalists, asking the US military in Japan for assistance
		Kyodo News Agency reported the deaths might exceed 1000.
10 h after EQ	Sichuan HQs released 8533 deaths partly estimated Premier arrived in the affected areas and instructed to recovery communication, traffic, and electricity as early as possible	Asahi Shimbun quoted the statistics of National Police Agency of Japan that the death number were 133,530 people were missing and 722 injured.
14 h after EQ		Press conference held to brief on situation about EQ, disaster and relief measures
16 h after EQ		Premier ordered and recommended the residents in 10 km to refuge
		Kyodo News Agency quoted the news from police that 217 deaths and 681 missing
18 h after EQ	Sichuan HQs issued emergency notice and required to implement relief work	Premier declared Announcement on Nuclear Emergency for Fukushima No.2 nuclear plant and recognized the nuclear leaking
24 h after EQ	Sichuan Earthquake Bureau held 1 st press conference	
26 h after EQ	National HQs held press conference to release disaster situation and relief work.	
28 h after EQ	Sichuan HQs held 1 st press conference and released disaster situation and relief work	HQs refuted rumors on the Internet and ordered media to report information actually
30 h after EQ		Press conference held in Prime Minister's Residence

Wenchuan earthquake, the Emergency Operation Command Center was set up quickly and running in an orderly fashion, which played an important role in overall disaster relief operations. Although responsibilities of different command centers were ambiguous and coordination and cooperation among them was less than ideal in the beginning, the command process became increasingly effective and orderly as communication, cooperation and coordination grew. The emergency command system should thus be enhanced from the aspects of standardization and normalization.

4.2. Rescue Force Allocation and Dispatch

Earthquake rescue operations show that military and professional rescue teams are irreplaceable in responding to earthquakes. The capabilities of the Japan Self-Defense Forces in collecting information on a disaster situation using helicopters are laudable. It is worth noting that requests for rescue assistance and dispatch orders for rescue teams are standard and procedural in Japan. The rescue forces were well organized and more flexible and disciplined and had greater capacity in China, which provided powerful support during disaster relief operations. Regarding rescue forces, the professional technology and equipment remained a weak point among USAR teams in China, especially in mechanisms for mobilization and dispatch, whose efficiency and speed must be improved. USAR teams arrived late and played a limited role in the Wenchuan earthquake, whereas all international USAR teams arrived in the first three days of the quake and played a certain role in relief operations in the East Japan earthquake. This means that mechanisms of international assistance acceptance and coordination should be built up and strengthened to enable international USAR teams, which have advanced rescue equipment, skills and experience, to play a greater role.

4.3. Emergency Victims Refuge and Resettlement

Both the Chinese and Japanese governments took various measures to evacuate and resettle affected people in a timely and orderly manner following the two earthquakes. Japan's experience in emergency evacuation and resettlement could be worth learning and referencing for China, especially in evacuation instructions issued immediately after an earthquake, the instructions and signs for evacuation routes, the opening and running of shelters, etc. Thanks to Japan's comprehensive shelter system, most people affected by the quake were resettled in shelters and few relief tents were needed. Shelters in affected areas following the Wenchuan earthquake were insufficient, preventing most victims from being resettled locally and nearby, so many relief tents were needed. Reserving of relief supplies was insufficient initially after the earthquake in both countries and relief supplies were too many to be distributed in the intermediate period after the earthquake, which should be avoided in the future. The transportation and distribution of relief supplies should be implemented

through appropriate measures and based on the requirements of victims.

4.4. Public Information Reporting and Release

The governments and media of both China and Japan played important roles in reporting and releasing information to the public during both earthquakes. The time information was reported and released was slightly later in China than in Japan – a difference mainly attributable to the usual disaster reporting mechanisms and quality of media in reporting emergency status and information. Japan's disaster warning system supported the timely release of information. The release of casualties indicates the good cooperation between the Chinese government and the media, and information release was open, transparent, timely and accurate. In the initial period after earthquake, in contrast, the Japanese government lacked unified authoritative release of information on casualties. Press conferences by the Japanese government were held more quickly in the initial period after the earthquake. The press conference about the overall disaster situation and relief developments by the Chinese government were slightly later, but the Chinese government was quicker and more efficient in releasing news about responding to and dealing with rumors. It is also worth noting the application and use of new media such as micro-blog, twitter, WeChat, etc. during the East Japan earthquake. More attention should thus be paid to new media in future disaster information reporting and release and their applications should be enhanced.

4.5. Suggestions on Implementing Disaster Prevention and Mitigation

The comparisons above of China and Japan in disaster analysis, as we can see, demonstrate that no matter what specific national conditions may be in the face of earthquakes catastrophes, disaster prevention and mitigation have much in common in the two countries. First, the disaster prevention and mitigation system should be in the form of legal regulations, emergency disposal of individual links, clear in the process of crisis handling, in the form of government departments at all levels to establish and fulfill their responsibilities – establish monitoring and early warning mechanisms, implementing good emergency preparedness including emergency supplies, teams, shelters, exercise, information, and coordination. Promoting the construction of government emergency command systems, the formation of docking between superior and subordinate and department contact, connectivity, information sharing, resource sharing and emergency command systems are needed in both nations.

Acknowledgements

This paper is supported by Strategic Japanese-Chinese Cooperative Program on "Earthquake Disaster Mitigation," No. 2012DFG20510.

References:

- [1] S. Wenzhuang and H. Jiansheng, "Analysis on emergency response measures of Japan earthquake catastrophe," Journal of China Emergency Management, Issue 2, pp. 54-56, 2012.
- [2] G. Wei, "Research on emergency management of Wenchuan Earthquake," Sichuan People Press, 2009.
- [3] Japan Miyagi Prefectural Office, "Reflection on disaster response by Miyagi Prefecture Office for Great East Japan Earthquake," Japan Finite Association Ambulance Department (2011), Japan Earthquake Revelation, Social Sciences Academic Press, 2013.
- [4] Q. Guosheng, "Professional rescue cases of Wenchuan Earthquake," Seismological Press, 2009.
- [5] H. Takenaka, "Revelation of Japan 311 Earthquake – Compound disaster and crisis management," Xinhua Press, 2012.
- [6] H. Lijiang, "Emergency rescue system of earthquake in China and Japan: A comparative study," Nanjing University of Aeronautics and Astronautics, 2012.
- [7] S. Yi, "Sichuan provincial government act quickly to implement disaster relief work," Journal of Inside Sichuan, Issue 5, pp. 10-12, 2008.
- [8] Z. Duo, "Comparative study on Chinese and Japanese earthquake information dissemination mechanism," Huazhong Normal University, 2011.
- [9] L. Tao, "Comparative study on report of major incident – 512 Wenchuan earthquake in China vs 311 Japan earthquake," Journal of Voice & Screen World, Issue 9, pp. 63-65, 2011.
- [10] S. Ruirui, "Comparative analysis of television disaster report," Nanchang University, 2012.



Name:
Xiaoxia Du

Affiliation:
Senior Engineer, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

Brief Career:
2005- National Earthquake Response Support Service CEA

Selected Publications:

- "Inspiration and advice hazard analysis of building earthquake damage characteristic during Yutian M7.3 Earthquake," Technology for Earthquake Disaster Prevention, Vol.3, pp. 487-495, 2014.
- "Experience and thought on the International table top exercise in Padang," China Emergency Rescue, Vol.3, pp. 41-43, 2013.



Name:
Jun Zhang

Affiliation:
Engineer, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

Brief Career:
2006- National Earthquake Response Support Service CEA

Selected Publications:

- "Research on Local Governments' Disposal Principle in Emergency Response," Journal of Catastrophology, Vol.29, No.1, pp. 182-187, 2014.
- "Research on Media response strategies of the government in earthquake disaster disposal," Collected papers of the tenth anniversary of NERSS, Earthquake Press, pp. 204-208, 2014.



Name:
Jianhua Xu

Affiliation:
Senior Engineer, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

Brief Career:
2006- National Earthquake Response Support Service CEA

Selected Publications:

- "Analysis on Minxian-Zhangxian M6.6 Earthquake emergency response measures," Journal of Catastrophology, Vol.29, No.3, pp. 188-191, 2014.
- "Earthquake emergency drill desktop research and implementation based on the deduction of software," Collected papers of the tenth anniversary of NERSS, Earthquake Press, pp. 175-182, 2014.



Name:
Zhuan He

Affiliation:
Engineer, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

Brief Career:
2013- National Earthquake Response Support Service CEA



Name:
Junyan Lai

Affiliation:
Engineer, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
1, Yuquan West Street, Beijing 100049, China

Brief Career:
2007- Technology Dept., National Earthquake Response Support Service, China Earthquake Administration

Selected Publications:

- Planning of emergency sheltering system in new-built community, technology for earthquake disaster prevention
- Design of ICT-based network of onsite coordination in earthquake, computer engineering design
- Disaster investigation system design based on WiFi direct technology, computer engineering design

Academic Societies & Scientific Organizations:

- China Association for Public Safety (CAPS)



Name:
Yigang Li

Affiliation:
Professor, National Earthquake Response Support Service (NERSS), China Earthquake Administration (CEA)

Address:
No. 1, Yuquan West Street, Shijingshan District, Beijing, China

Brief Career:
2000-2005 Institute of Geology, China Earthquake Administration
2005- National Earthquake Response Support Service CEA

Selected Publications:

- “Optimized allocation model of rescue power in earthquake-stricken area,” *Journal of Natural Disasters*, Vol.2, No.3, pp. 150-154, 2012.
- “Study of Indicators for Earthquake Emergency and Rescue Capability and Its Evaluation Method,” *Technology for Earthquake Disaster Prevention*, Vol.2, No.2, pp. 172-179, 2011.

Academic Societies & Scientific Organizations:

- China Committee for Integrated Research on Disaster Risk (IRDR CHINA)



Name:
Haruo Hayashi

Affiliation:
Professor, Ph.D. (UCLA), Research Center for Disaster Reduction System (DRS), Disaster Prevention Research Institute (DPRI), Kyoto University

Address:
Gokasho, Uji-shi, Kyoto 611-0011, Japan

Brief Career:
1996-present Professor, Disaster Prevention Research Institute, Kyoto University

Selected Publications:

- Kyoto University/NTT Resilience Joint Research Group (H. Hayashi et al.), “Trial for the Disaster Resilience Society – Come over the Great East Japan Earthquake Disaster,” Nikkei BP Consulting, Inc., 2012 (in Japanese).

Academic Societies & Scientific Organizations:

- Institute for Social Safety Science (ISSS)
- Japan Society for Natural Disaster Science (JSNDS)
- Japan Emergency Management Association (JEMA)



Name:
Reo Kimura

Affiliation:
Associate Professor, Ph.D., Graduate School of Human Science and Environment, University of Hyogo

Address:
1-1-12, Shinzaike-honcho, Himeji, Hyogo 670-0092, Japan

Brief Career:
1994-1998 School of Human Science, Waseda University
1998-2003 Graduate School of Informatics, Kyoto University
2003-2009 Assistant Professor, Graduate School of Environmental Studies, Nagoya University
2009-2011 Associate Professor, Graduate School of Environmental and Disaster Research, Fuji Tokoha University

Selected Publications:

- “Recovery and Reconstruction Calendar,” *Journal of Disaster Research*, Vol.2, No.6, pp. 465-474, 2007.
- “Development of the method of clarifying the life reconstruction process based on the random sampled social surveys of the victims – Recovery and reconstruction calendar –,” *Proc. of the Int. Emergency Management Society (TIEMS) 17th Annual Conf.*, pp. 168-178, 2010.
- “Implementation and operation of a cloud-based participatory damage recognition system to obtain a common operational picture that supports a quick disaster response,” *Int. Journal for Infonomics (IJ)*, Special Issue Vol.1, Issue 1, pp. 834-840, 2013.
- “Current status and issues of life recovery process three years after the Great East Japan Earthquake questionnaire based on subjective estimate of victims using life recovery calendar method,” *Journal of Disaster Research*, Vol.9, No.sp, pp. 673-689, 2014.

Academic Societies & Scientific Organizations:

- Japan Institute of Social Safety Science (JISSS)
- Japan Society for Natural Disaster Science (JSNDS)
- Japanese Psychological Association (JPA)
- Japanese Society of Social Psychology (JSSP)
- Japan Sociological Society (JSS)
- Seismological Society of Japan (SSJ)
- Japan Society of Civil Engineering (JSCE)



Name:
Masafumi Hosokawa

Affiliation:
Executive Researcher, Dr. Eng., National Research Institute of Fire and Disaster

Address:
4-34-1-1-110, Jindaiji-higashi-cho, Choufu-shi, Tokyo 182-0012, Japan

Brief Career:
2003-2004 Assistant Division Chief of Fire and Disaster Management Agency

Selected Publications:

- M. Hosokawa, B. Jeong, and O. Takizawa, “Earthquake risk evaluation using landforms processed by unsupervised classification method,” *Proceedings of the 2010 IEEE International Geoscience and Remote Sensing Symposium*, pp. 4572-4575, July 25, 2010.

Academic Societies & Scientific Organizations:

- Institute of Electronics, Information and Communication Engineer (IEICE)
- Remote Sensing Society of Japan (RSSJ)



Name:
Yukihisa Sakurada

Affiliation:
Researcher, Research Center for Disaster Reduction Systems, Disaster Prevention Research Institute, Kyoto University

Address:
Gokasho, Uji-shi, Kyoto 611-0011, Japan

Brief Career:
1970-2004 Joined Japan International Cooperation Agency
2004-2010 Vice President of Japan International Cooperation System
2010-2013 Chief Adviser of Japan-China Cooperation Project for Earthquake Response Support Capacity, JICA