

ANALYSIS ON PUBLIC EARTHQUAKE RISK PERCEPTION : BASED ON QUESTIONNAIRE

**Siquan YANG¹, Hong GAO^{2*}, Liangming LIU³, Liu HE⁴, Chi FAN⁵,
Wei TANG⁶**

ABSTRACT

As an abrupt natural disaster, earthquake makes such vast damages to human community that we must find ways to reduce earthquake risk. However, the devastating consequences and uncontrollability of earthquake bring us many difficulties in dealing with it. Natural disaster risk communication (NDRC) is an effective disaster risk reduction strategy and the gap between the public and the experts on risk perception is one of the main obstacles to NDRC. To explore public risk perception helps reveal the potential factors of risks and provide the basis for effective natural disaster risk communication and management. Through questionnaire, an investigation is conducted on the public's cognition and response to earthquake. The survey shows that people are aware of earthquake in general, but their knowledge of risk is limited. What kinds of risk information are needed and how to release those messages are discussed according to the findings.

Keywords: *Natural disaster risk communication (NDRC); risk perception; earthquake; questionnaire*

Ph. D, Siquan YANG, National Disaster Reduction Center, Ministry of Civil Affairs
of People's Republic of China Zhongmin Building, No.7, Baiguang Road, Xuanwu
District, Beijing, China

yangsiquan@ndrcc.gov.cn

Master candidate, Hong GAO, Corresponding author, School of Remote Sensing and
Information Engineering, No.129, Luoyu Road, Wuhan, Hubei Province, China,
86-27-68778563, 86-27-68778086, gaohongzm@126.com

Ph. D, Liangming LIU, School of Remote Sensing and Information Engineering,
No.129, Luoyu Road, Wuhan, Hubei Province, China, 86-27-68778563,
86-27-68778086, lm_liu69@sohu.com

Bachelor candidate, Liu HE, School of Remote Sensing and Information Engineering,
No.129, Luoyu Road, Wuhan, Hubei Province, China, 86-27-68778563,
86-27-68778086, fefekoko@sina.com

Bachelor candidate, Chi FAN, School of Remote Sensing and Information
Engineering, No.129, Luoyu Road, Wuhan, Hubei Province, China, 86-27-68778563,
86-27-68778086, 835439716@qq.com

Bachelor candidate, Wei TANG, School of Remote Sensing and Information
Engineering, No.129, Luoyu Road, Wuhan, Hubei Province, China, 86-27-68778563,
86-27-68778086, 27363187@qq.com

1 Introduction

Earthquake is a kind of natural disaster which usually bursts out quickly and is hard to control. Millions of quakes are happening around the world each year, some of which may cause enormous personnel casualties and economic loss and even lead to a devastating blow in some areas. On May 12, 2008, the region in Southwest China was hit by a huge quake called Wenchuan Earthquake, which left thousands of dead and displaced people behind. The serious damage caused by the calamity made the public aware of the terribleness of massive quake and also think about how to prevent and reduce natural disaster like earthquake effectively.

The research of natural disaster risk has received more and more attention as the countermeasures are being transformed from “disaster reduction” to “disaster risk reduction”. In order to reduce disaster risks and strengthen public understanding of disaster and risk, natural disaster risk communication is a necessary step in the process of disaster mitigation. The degree of public perception of disaster risks will directly affect their behavior pattern as well as policy-making and action of reducing disaster by government departments. So it is very important to conduct studies on risk perception. Risk perception is a subjective evaluation of dangers, which is based on the integration of risk information such as risk events, risk communication and various influencing factors ^[1]. The differences in risk perception, which lie at the heart of disagreements about the best course of action between technical experts and members of the general public, are the main research contents of risk perception.

Slovic's study on the taxonomy for diverse hazards, using quantitative parameters of psychological measurement to construct a cognitive structure of risks, has a profound effect on the research of risk perception ^[2]. In China, there are relatively few researches on perception of risk and short of thorough and systematic research at present. Xiaofei XIE has preliminarily studied the public risk perception in the perspective of psychology ^[3,4]. Jingyi LI and Qi ZHOU have set up a measurement index system of the national disaster perception level and made a primary analysis of the affecting factors by means of questionnaire from the angle of disaster science ^[5,6].

In order to explore risk perception of the public, this thesis made a research of the public's cognition and response to earthquake disaster through questionnaire, taking the graduate students of Wuhan University as respondents. Based on the analysis results, we try to find out the shortages and deficiencies of risk communication and make some suggestions including what kinds of risk information are needed and how to release those messages to the public.

2 Questionnaire Design

The researches on natural disaster risk perception are mainly based on cognitive psychology and behavior geography. In the former field, cognition is an overall reflection of receiving, storing, processing and using the information of objects within the scope of a person's mind, which includes sensation, perception, understanding, attention, memory, thinking, adaptation and other psychological activities ^[7,8]. The latter aims to explore the relationship between people's extrinsic action and intrinsic psychology and lays emphasis on human environment perception, based on the studies of individual psychological states including sensation, image, recognition, attitude, value, etc ^[9].

Natural disaster risk perception focuses on how people receive knowledge and information in relation to natural disaster risks and the judgmental process of taking actions to reject or accept, fight or prevent natural disasters according to the received information ^[10,11]. Mental activities in the field of

cognitive psychology can be combined to a few elements of risk perception within behavior geography: knowledge, awareness and behavior. The level of people's knowledge about disasters reflects their abilities to deal with disaster information and further shapes the awareness and behaviors of disaster prevention and reduction. The public awareness of disasters is a state of mind after people's processing information and knowledge of disasters and it will directly influence their attitudes and behavioral tendencies. The human behaviors in emergency are the external reflection of disaster perception, which is synthetically affected by the former two factors, but on the other hand, the adjustment of emergency response promotes changes in the other two ones.

Based on the theories mentioned, this paper made a research on earthquake risk perception by way of questionnaire form, in which the main contents includes: the personal data of respondent, theoretical knowledge and awareness of earthquake, emergency response and the view on relief operations. The survey targeted 110 graduates in Wuhan University with the questionnaire. The data were analyzed by statistics with SPSS and EXCEL software. The test of risk perception involved three parts: knowledge, awareness and behavior related to earthquake.

3 Results

3.1 Knowledge of Earthquake

We set some questions relative to attribute properties and spatial distribution of earthquake to estimate the public knowledge level. The questions about earthquake are evaluated by marks, averaging 4.8 points with the full score normalized to 10. In general, public universal knowledge is not enough and there is limited understanding and misunderstanding about the knowledge related to earthquake.

As seen in Figure 1, public understanding degrees of each attribute property of earthquake such as earthquake magnitude, earthquake intensity, focal depth, seismic wave and seismic belt are different. Although the public have a rough understanding of those concepts, they are not clear to the quantitative concept like magnitude and focal depth. Most respondents (85%) incorrectly answered the test item on the energy gap between adjacent magnitudes. It seems that people generally have a good idea about the higher the magnitude, the more severe the earthquake, but not so good an idea of by how much. And we also found that respondents doubted for perceptible earthquake, destructive earthquake, strong earthquake and huge earthquake which are defined according to magnitude, with each related question producing less than 60% correct answers. Thus, they can't judge the damage degree of a quake just from magnitude. In the question about focal depth of most destructive earthquakes, only forty percent of subjects chose the correct option "Less than 70km", which is not as deep as most respondents have thought. It shows that people haven't realized that destructive earthquakes often occur underground very close to the surface of the earth and they have failed to understand the mechanism of earthquake.

In the survey, it was also found that the degree of respondents' concern about earthquake belts and zones is not high. The question on the world's earthquake belts produced 45% correct answers and the question about China's earthquake disaster zones 47% correct. The public are not concerned enough whether they are in the seismic risk.

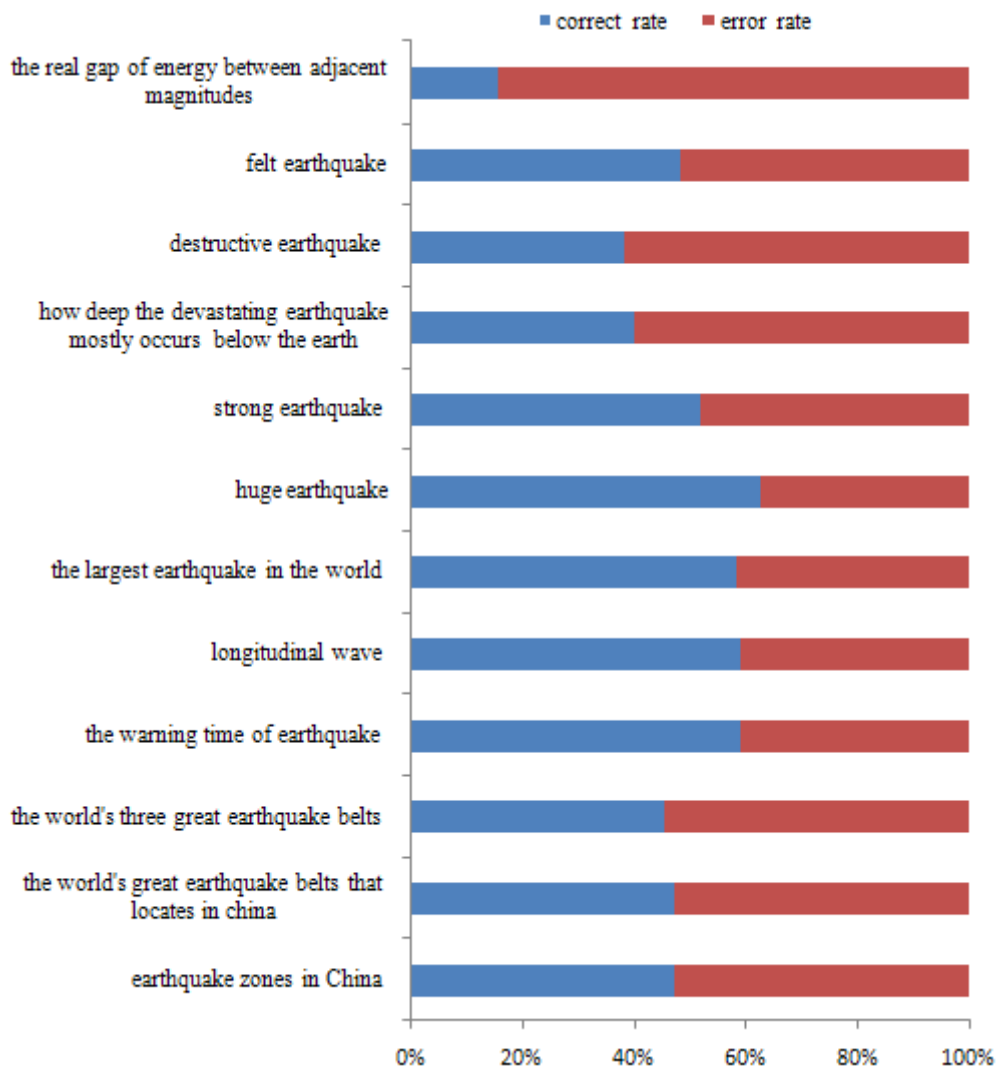


Figure 1. The result of earthquake knowledge level

3.2 Awareness of Earthquake Prevention

In the investigation, almost all respondents, more or less, knew something about earthquake. But only thirty-one percent of them took the initiative to learn while the others just received the relative knowledge passively. Although more than a year has passed since Wenchuan Earthquake, the public still don't pay enough attention to the disaster.

Awareness of earthquake prevention can be reflected in the attitudes and behaviors in reducing and preventing earthquake. So some questions are designed to enquire the participants to evaluate the degree of public consciousness on disaster prevention and mitigation. Table 1 presents measurement indexes of earthquake prevention awareness and scoring. We set the proportions of all options in a question as weights to calculate the composite average score. The weighted evaluation results are shown in Figure 2. The poor scores reflect a low level of earthquake risk cognitive. Frequency analysis shows that almost all respondents (94.5%) had never practiced an escape route or participated in escape drill. Only 22.7% often paid attention to fire equipments and escape routes while 56.4% just occasionally notice those things. When asked "Do you know where the urban emergency shelters are", sixty-five percent of the respondents chose "don't know" and 31.8% chose "know some of them". And

most respondents (75%) had nothing prepared for earthquake at home or in the office. Lack of understanding the value of nip in the bud and having never experienced disasters, the public generally have not converted the awareness of disaster prevention into actions.

In addition, all respondents think the seismic resistant capacity of buildings is very important, but most of them (74%) responded “don’t know” about that. One reason for the situation is most people have little awareness of earthquake prevention and don’t care about the anti-seismic performance of houses. The other reason is that the construction units, building owners and building managers don’t inform building occupants the related information clearly and no laws and regulations force the information to be released. Besides, the right communication channels and platforms for that are also short in the real world.

Table 1. Measurement indexes of earthquake prevention awareness and scoring

Contents		Score
Evacuation plans practicing	Often	0.9
	Sometimes	0.5
	Never	0.1
Fire equipment and escape routes noticing	Often	0.9
	Sometimes	0.5
	Never	0.1
Location of urban emergency shelters understanding	Know all	0.9
	Know some of them	0.5
	Do not know	0.1
Earthquake preparedness at home(in the office)	Make enough preparation	0.9
	Get a little prepared	0.5
	Do not prepare	0.1

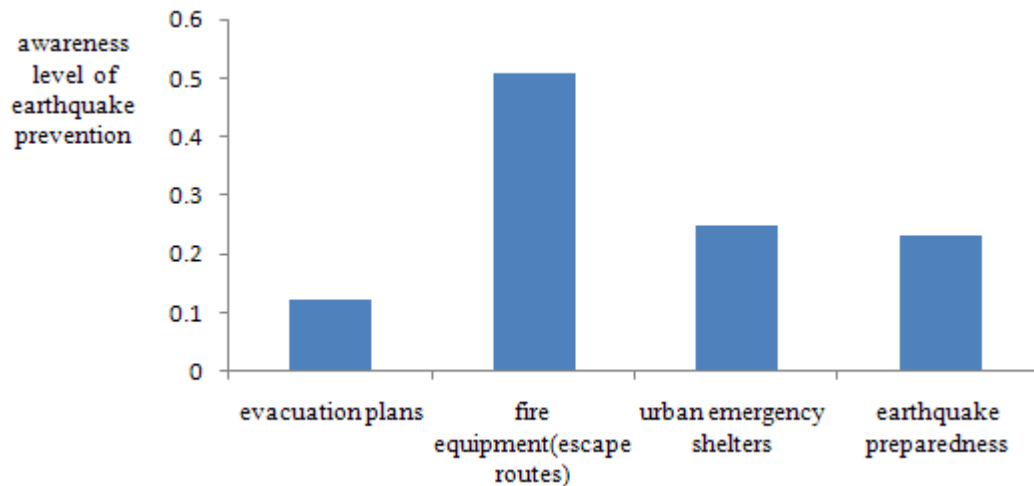


Figure 2. The evaluation result of earthquake prevention awareness

3.3 Reacting Behavior in Emergency

Since the majority of participants are lack of experiences in disasters, emergency response knowledge instead of actual behavior is analyzed. Based on “what-if” scenarios including indoors, outdoors, in the car, in the wild and so on, emergency responses of the interviewees are investigated on

the multiple-choice knowledge test.

The results indicate that public understanding on what to do in different places when earthquake happened was basically right. Almost all respondents could choose one or two correct responses in each question. Overall, the respondents performed better on questions regarding reacting behavior in earthquake than basic theory of earthquake. It is as if they are more concerned about knowledge of emergency response and grasp a better sense of that. However, the respondents did not successfully master many varied measures for survival and choose those methods freely in earthquake. And they also made the wrong choices in some questions. For example, when asked “where will you hide indoors if an earthquake occurs”, a large proportion of the subjects chose the correct responses “under a table or chair” (46.4%), “in the corner” (60.0%), “in the narrow space (storage, kitchen or toilet)” (52.7%) and “by the hard tall wardrobe” (50.9%), respectively. As seen in Table 2, only a few of them chose the other wrong options “close to the window”, “behind the door”, “on the balcony”, “on the bed”, “run to the elevator”, “run to the outside” and “jump off the building”. However, the proportion of the respondents who chose “run to the outside” is larger than the other wrong options. This is probably because they lack earthquake knowledge and are frightened by the quake. The findings in other questions also show the same situation.

Table 2. Where you will hide indoors during an earthquake

Where you will hide indoors during an earthquake	number of mentions	Percentage of mentions (%)
under a table or chair	51	46.4
close to the window	10	9.0
in a corner	66	60.0
in the narrow space(storage, kitchen or toilet)	58	52.7
behind the door	3	2.7
on the balcony	2	1.8
on the bed	1	0.9
by the high and hard wardrobe	56	50.9
run to the outside	23	20.9
run to the elevator	12	10.9
jump off the building	0	0

3.4 Requirement for Earthquake Prevention and Reduction

In the question about earthquake information sources, publicity of school, government or relative departments (54.6%) and teachers' or experts' explanations (40%) are two main ways and 32.7% of the respondents got the related knowledge by accident. At present, publicity and education of earthquake knowledge play an important role in risk communication. In the choice of platforms, TV and Internet account for a large proportion, which is 71.8% and 79.1% respectively. Next is newspaper (47.3%) and magazine (40.9%). With the development of the modern society, electronic platforms like TV and Internet are the most commonly methods used in obtaining information, but non-electronic platforms like newspaper and magazine still occupy a certain proportion.

When asked about the forms of publicity, seventy-eight percent of the subjects chose “documentaries”, 47% chose “disaster knowledge lectures” and 48% chose “quiz activities”, while

only 37% selected “leaflets”. The respondents tend to choose interesting and vivid ways to get disaster knowledge. The questionnaire asked the respondents about the effective measures for earthquake prevention and reduction. 73.6% thought the quality and shock-proof level of domestic construction should be improved. 54.6% chose improving earthquake prediction ability and 53.6% considered practicing emergency escapes and strengthening the national education crisis. When facing nature disaster, the public always give more hope to sophisticated facilities and the development of science technology than to personal improvement.

Most participants are not satisfied with the present disaster prevention learning. As indicated in Figure 3, a large proportion of the respondents thought it was necessary to open disaster mitigation courses (87%) and practice evacuation plans and escape drills (88%). They are eager to more related knowledge and experience on earthquake and other disasters to protect themselves and save the others.

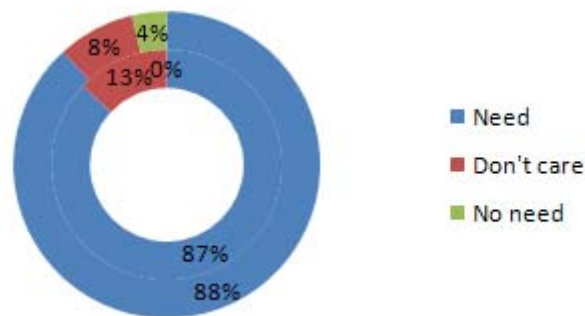


Figure 3. Inner ring: statistics results of attitudes of opening disaster mitigation courses; outer ring: statistics results of attitudes of practicing evacuation plans and escape drills

4 Limitations and Suggestions for Earthquake Risk Communication

4.1 Limitations

The serious human and economic losses caused by Wenchuan Earthquake sounded the alarm to Chinese people. The nation commits to the spread of knowledge about earthquake and takes measures to prevent and reduce disaster. People aspire to learn how to effectively prepare for earthquake and respond to it.

However, big gaps still exist in popularizing the general knowledge of disaster prevention and reduction in China. Firstly, the promotion activities, mainly by way of education, are monotonous and passive, which have not achieved an ideal national level. All the subjects in the survey have high levels of education, but most of them are passive learners and don't have enough knowledge about earthquake. Secondly, TV and Internet are main platforms the respondents use to get information. But those channels can't guarantee the accuracy of related information, effectiveness, timeliness and completeness of the source. Thirdly, the public usually choose the knowledge of disaster reduction and prevention such as the cases of disaster and disaster contingency measures, from the angle of their interests and the usefulness of knowledge. They generally have little interest in fundamental principles of natural disasters such as basic knowledge on disasters, secondary and derived disasters that could happen, and evaluating indicator of the intensity and the situation of disaster, which are advantageous for enhancing disaster prevention awareness and capability. What's more, although most people know some things about earthquake, they just stop at the superficial level, short of understanding the true

implications of earthquake risk. Without full understanding, many people tend to the simple and single selection on risk reduction, which is acceptable but may not be the nearest life-saving straw when earthquake occurs. In a word, the public are lack of awareness of disaster prevention and reduction. They don't pay enough attention to whether they are in disaster risk and get ready for it.

Errors and distortions in public consciousness on disaster prevention and mitigation stimulate the development of areas with frequent disasters, which would expose more life and property to danger and aggravate the vulnerability of hazard bearing body. Therefore, we should awaken people to the risk of hazards and help them establish the right concept of disaster risk and a sense of responsibility through the correct guide of a disaster prevention and alleviation culture.

4.2 Suggestions

Since the gap between the general public's risk subjective perception and the objective reality is caused by the defects of information communication, it's necessary to establish sound risk communication in order to heighten public awareness of risk. Efficient natural disaster risk communication (NDRC) can widen participants' knowledge of disaster, remove the misunderstanding of cause of occurrence from germ, strengthen risk and safety consciousness, and improve their abilities to prevent and mitigate natural disasters.

4.2.1 Communication Contents

Complete and rational information should be conveyed in earthquake risk communication, including basic principles of earthquake and mitigation measures for that.

The measures of reducing and preventing earthquake are the main contents for risk communication. In view of the circumstances that few respondents could grasp multiple measures for survival and choose them freely, various methods of how to prepare for an earthquake and what to do once the ground starts shaking should be released to the public. The training of special skills, disaster prevention drills, scenario simulation and other kinds of practical teaching methods should go along with curriculum and teaching to make the certain skill more impressive and change it into common sense and survival instinct. Make sure that the public can master disaster counter measures completely, which means that they should not only acquire the knowledge about prevention and response activities but also possess practical ability.

Moreover, the fundamental principles of natural disasters like mechanism of earthquake, which can increase understanding of the disaster and help establish anti-disaster awareness and capability, should also be brought into the contents of risk communication and combined closely with risk mitigation measures. Only in this way can the public actually have scientific disaster prevention awareness and proper disaster reduction behaviors.

4.2.2 Communication Styles

Stakeholders do the risk communication and information exchange with each other through different kinds of channels, such as TV, newspaper, broadcast, Internet and mobile phone. Those platforms are the main sources of risk information and play the important part in people's lives. Good risk communication should make effective use of communication platforms to convey rational information.

So the disaster risk management institution should pay more attention to the channel management and improve the information accuracy and real-time performance. For instance, a specific website can be created for disaster information delivery and feedback to ensure the specialty and seriousness of the platform. With the advance of science and technology, more advanced platforms (for example, kinds of terrestrial and satellite-based wire/wireless technologies) can be used in disaster risk communication, but the important role of the traditional platforms can't be ignored. The combination of the two will develop a larger function in risk communication.

The result of risk communication depends on how we interact with each other. On one hand, experts and government should win the trust of the public by supplying the public with trustworthy and adequate information that they are concerned about. On the other hand, the public should be actively involved in risk communication with their wishes to provide the needed help and support to others and society. Only in this way can a pattern of dynamic interaction and active participation be formed.

Through various ways of disaster risk communication, a social culture of safety and disaster prevention shall be established. Then the cultural atmosphere will insert a subtle influence on the public, affect and change their feelings, and help them form an instinct attitude of self-protective need so that injuries and deaths in the disaster can be radically lessened.

5 Conclusion

According to the survey, it is found that public awareness on disaster prevention and mitigation is poor and their knowledge about basic theory and emergency response is limited. But they long to get more knowledge and practices of disaster reduction. Some suggestions and countermeasures are proposed based on the above analysis: courses on universal disaster prevention should be opened and emergency drills should be staged; public psychology defense mechanism should be perfected and a good attitude towards disasters should be set up. Education and publicity concerning disaster reduction should be positioned on knowledge of disasters, awareness of disaster prevention and behavior in emergency. The aim of learning the relative knowledge is to develop an awareness of disaster prevention and it will be finally reflected in public's behavior so that people's risk awareness and self-rescue capacity will be enhanced.

The ultimate aim of risk communication is to help the public overcome panic mentality and reasonably response to risk events. According to public risk perception and attitude, effective risk communication can deepened our knowledge of risk and danger, enhance safety consciousness and help people establish rational behavior patterns of risk perception. Individual risk perception reflects different characteristics due to the effects of sex, age, race, experience and other factors. More investigations and studies should be carried out to further identify the risk factors to provide useful suggestions to effective risk communication.

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Biography of authors

Siquan YANG is served as director of satellite remote sensing national disaster reduction center of China, deputy director of key laboratory of disaster reduction and emergency response engineering of ministry of civil affairs, vice chief designer and director of project management office of operational management and disaster reduction application system engineering environment and disaster monitoring and forecasting of small satellite constellation, expert of second expert committee of national disaster reduction committee, expert in the field of 863 earth observation and navigation, member of fourth China association of remote sensing application, photogrammetry and remote sensing professional committee of China surveying and mapping society, and national satellite meteorology and space weather standardization technical committee, engaging in the operation and research in Space Technology and its application in disaster mitigation, having published more than 30 papers in the field of disaster losses assessment and risk assessment by using Space Technology.

Hong GAO received the B.S. degree in Remote Sensing from Wuhan University, Wuhan, Hubei province, China, in 2009, where she is currently pursuing the Master degree. Her primary research interest is the application of Remote Sensing in risk communication.

Liangming LIU received the B.S. degree in Geo-Information Engineering from Wuhan Technical University of Surveying and Mapping (WTUSM) in 1992 and the M.S. and Ph.D. degrees in Photogrammetric and Remote Sensing from Wuhan University in 1999 and 2004 respectively. He is currently the Professor at School of Remote Sensing and Information Engineering, Wuhan University, Wuhan, Hubei Province, China. His research activities involve: processing and analysis of satellite data, application of remote sensing and GIS technology in field of natural disaster and environment. He founded and is the Chief of Institute of Remote Sensing for Environment and Disaster in Wuhan University.

Liu HE, Chi FAN and Wei TANG are recently pursuing the B.S. degree in Remote Sensing from Wuhan University, Wuhan, Hubei province, China.