



Research on the Current Situation of Natural Disaster Investigation and Evaluation

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Abstract. Natural disaster is one of the important factors threatening the safety of human life and property, natural disaster investigation and assessment can effectively help human beings to understand the mechanism of natural disasters, the response process and the level of ability to defend against natural disasters, and at present, China's natural disaster investigation has not yet formed a standardized process, there are limitations in the existing norms and technical methods, and the focus of the disaster investigation and assessment is not prominent. This article compares literature and materials, organizes existing investigation and evaluation standards and relevant cases, analyzes the current situation and existing problems of natural disaster investigation and evaluation, and puts forward relevant suggestions. This article is recommended that investigation and assessment workers to better carry out disaster defense for the purpose of analyzing the causes of disasters from both natural and human factors, objectively assessing disaster losses and response process, and improving disaster defense capabilities from multiple perspectives such as disaster management, regional construction planning, and disaster emergency response.

Keywords: disaster investigation and assessment, defense process assessment, disaster loss assessment

1 Introduction

In the past two decades, China suffered the 2008 Wenchuan earthquake[1], 2010 Zhouqu mudslide[2], 2012 Beijing flooding, 2020 southern floods, 2021 Zhengzhou rainstorms[3] and other major disaster events, earthquakes, water conservancy, meteorology, forestry, civil affairs and other departments and industries in the process of natural disaster defense and investigation and assessment over the years formed a large number of technical specifications for various types of assessment contains The various types of assessments include the contents and working methods of on-site investigations of different types of disasters, as well as the main points of investigation and quantitative assessment methods of housing, crops, economic and other disaster

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losses, which provide a reference basis for various types of disaster investigations and statistics, and loss assessment, but are less involved in the assessment of the process of disaster defense and response. With the frequent occurrence of extreme disasters, a series of problems in the process of disaster response management have been exposed. At the national level, there is an urgent need for standardized technical processes and indicator methods for disaster investigation and assessment[4-6]. After the Zhengzhou 7.20 Extremely Heavy Rainstorm Disaster, the investigation team of the State Council, in addition to the approval of disaster losses, conducted a comprehensive investigation and assessment of the disaster response process, which provided a large number of references for future disaster prevention and control and a replicable technical process for the development of disaster investigation and assessment work.

This paper combs through the existing technical specifications of disaster investigation and assessment and related cases in China, analyzes and compares the work content and methods of disaster investigation and assessment, and puts forward the work idea of disaster investigation and assessment for the purpose of improving the level of disaster defense in the hope that it will provide more support for the research of disaster investigation and assessment.

2 Status of natural disaster investigation and assessment

2.1 Content of investigation and assessment work

Since the Wenchuan earthquake in 2008, China has organized a number of natural disaster investigations and assessments, with different focuses (Table 1), mainly including the basic situation of the disaster, losses, causes of the disaster, and the process of disaster relief.

Table 1. Natural disaster survey and assessment cases

time	point	Type of disaster	Content of the survey and evaluation
Sept. 16, 2018	Shenzhen	Typhoon "Mangkut"	Disaster situation, Weak links in disaster prevention, Citizen's awareness of disaster prevention
August 23, 2017	Macao	Typhoon Hato	Local disaster situation, casualties, losses and disaster relief measures[3][6]
June 10, 2019	Lianping County, Heyuan City	flood disaster	Disaster Characteristics, Causes of Floods, Disaster Defense and Response, Experiences in Responding to Disasters, Disaster Victims, etc[7]
March 15, 2019	Linfen City, Shanxi Province	landslide	The geographic location and site conditions of the landslide, how the landslide occurred, the situation at the landslide site, the casualties and property damage, the causes of the landslide, and the emergency response.

July 17-23, 2021	Zhengzhou, Henan	rainstorm	The process of development of rainstorms, the process and causes of flooding, the damage caused by the disaster and casualties, Zhengzhou flood control system, the current situation and existing problems, disaster disposal.
August 9-11, 2019	Ningguo City	Typhoon L ekima	Disaster losses and impacts, disaster response, disaster reconstruction and recovery, analysis of disaster causes, and assessment of disaster prevention, mitigation and relief capacity.
August 13, 2020	Shandong Province	Flood disaster	Disaster Situation, Prevention and Emergency Preparedness, Monitoring and Early Warning, Emergency Disposal and Rescue, Lessons Learned and Suggestions for Improvement Measures.
July 1-10, 2020	Wuyishan City, Nanping City	Flood disaster	disaster information, rainfall and flood relations, disaster-causing factors, disaster conditions, vulnerability of disaster-bearing bodies, and defense measures[8]

2.2 Status of normative documents

In the process of various survey and assessment work, national civil affairs, meteorology, forestry and grassland management departments have summarized their work experience and issued a large number of technical specifications for survey and assessment, and this paper has sorted out the relevant technical specifications. Some of the specifications define indicators related to natural disasters, such as GBT 24438.1-2009, GBT 26376-2010, GB/T 28921-2012, GBT 24438.2-2012, and GBT 24438.2-2012; some of the specifications introduce methods for survey and assessment of losses of disaster-bearing bodies, such as QX/T 107-2009, QX/T 101-2009, GB/T 28225-2011, QX/T 168-2012, QX/T 168-2012, QX/T 182-2013, QX/T 167-2012, QX/T 183-2013, MZ/T 043-2013, MZ/T 044-2013, LY/T 2408-2015, MZ/T 066-2016, QX/T 583-2020 and so on. In addition, researches also summarized relevant norms in the field of earthquake disasters, geological disasters, water and drought disasters, meteorological disasters, marine disasters, forest and grass fires. The various types of norms focus on the calculation of disaster losses and the classification of disaster levels, and less on the work content and working methods of investigation and assessment

In April 2021, the Beijing Municipal Emergency Management Bureau issued the local standard "DB11/T 1906-2021 Guidelines for Natural Disaster Investigation and Assessment", which makes detailed provisions on the workflow of natural disaster investigation and assessment, the content of investigation, the content of analyzing and assessing, the conclusion of analyzing and assessing, and the content of report preparation. The Guidelines stipulate that the investigation and assessment of natural disasters in Beijing shall carry out a detailed investigation of the basic situation of the

disaster, prevention and emergency preparedness, monitoring and early warning, and emergency treatment and rescue, analyze and assess the deficiencies in the process of carrying out these tasks, make relevant conclusions, and prepare an investigation and assessment report. The Compass provides a detailed list of the matters to be evaluated, forming a disaster defense process as the main investigation and evaluation index.

2.3 Survey evaluation methodology

With the development of science and technology as well as the increasingly in-depth research on natural disasters by scholars at home and abroad, there is a wide variety of data analysis methods for natural disaster investigation and assessment[9-11,13-15] , and the actual operational methods of investigation and assessment generally include but are not limited to data collection, site survey, household survey, seminar exchange, questionnaire survey, comparative analysis, and conferencing and research and judgment[3]. This paper compares the common field survey and data analysis and assessment methods (Tables2). Due to the differences in disaster characteristics and affected regions, the selection of investigation and assessment methods is adapted to local conditions, and it is difficult to unify the natural disaster investigation and assessment methods through normative documents, which requires investigators to follow the actual situation of the disaster and the abundance of data obtained in the process of data analysis and assessment of the disaster situation, and to choose the appropriate data analysis methods, and to realistically restore the process of disaster occurrence and development, in order to ensure that the conclusions are accurate and reasonable. In order to ensure that the conclusions are accurate and reasonable, and thus provide a correct basis for the next decision-making.

Table 2. Comparison of data analysis methods

Types of methods	Advantages	Cons	Applicable scenarios
Statistical analysis	Many kinds of methods, mature technology, more scientific, accurate and objective	The requirement of data accuracy is high, and the amount of data required is large	There are a lot of data support of all kinds of data comparison and statistics
Big Data analysis	It can go deep into the data, dig the correlation between various isolated data, and intuitively display the data analysis results	Need a lot of data support; The data collection workload is large, and the data quality control is difficult	The historical data is rich, the status quo survey data is in the dynamic update, and the source is wide, and the data volume is large

Multi-source remote sensing data analysis	Improve the spatial resolution and resolution of images, improve the precision of plane mapping, classification accuracy and reliability, enhance the ability of interpretation and dynamic monitoring, reduce the ambiguity, and effectively improve the utilization of remote sensing image data	It is difficult to extract and fuse data features, and it is easy to ignore hidden effective information	The analysis and research of surface deformation, inundation depth and regional disaster bearing body damage caused by disasters
Comparative analysis of Cases	The method is simple and easy to master, can directly show the disaster analysis process, and has realistic effectiveness	There are technical limitations and cognitive biases of previous researchers, and the specific situation and non-reproducibility make it more difficult to summarize	We have mastered a large number of case materials similar to the disaster area and the current situation
Numerical Simulation	It can make full use of the existing data, simulate the disaster scene from multiple angles, simulate the occurrence and development process of the disaster forward and backward, and explore the causes of the disaster	The accuracy and accuracy have certain deviations from the real situation, and a mature disaster mechanism model is required	Disaster theory research is relatively mature analysis of the occurrence process of various disasters; Pre-assessment of secondary and derivative disasters
Analytic Hierarchy Process	It is simple and practical, and requires less quantitative data and information	There are few quantitative data and many qualitative components, which are not convincing. When there are too many indicators, the data statistics are large, and the weight is difficult to determine. The exact method of eigenvalue and eigenvector is complicated	Evaluation index system analysis; Weight formulation, etc.
Decision tree method	The analysis idea is clear and the image of the decision result is clear	The decision or classification result is sensitive to the threshold value, and the knowledge intelligibility is poor	Regional remote sensing disaster information extraction; Construction of evaluation index system

Expert decision method	It is simple and feasible, and can be applied to a variety of fields	It relies too much on expert experience and requires high professional skills of experts	Evaluation index selection, weight analysis, emergency decision-making, etc
sensitivity analysis	Key indicators for determining the impact of disasters	It mainly relies on analysts to analyze and judge based on subjective experience, which is one-sided.	Study of changes in uncertainties and analysis of key impact indicators for disasters
fuzzy evaluation method	The results are clear and systematic in nature, and better able to address ambiguous and difficult-to-quantify issues	Over-reliance on subjective experience	Comprehensive disaster index assessment

3 Observations and recommendations for the investigation and assessment of natural disasters

3.1 Investigation and evaluation of causes of disasters

The investigation of the cause of the disaster is the first work of the whole disaster investigation and assessment work, the investigator should be from the disaster area of topography, meteorology and hydrology, geological structure, vegetation cover, historical disasters, disaster defense process and other perspectives for the analysis of the cause of the disaster, through the comparison of the historical disaster situation to measure the possibility of the occurrence of the disaster and the magnitude of the impact. The occurrence of natural disasters is inevitably caused by sudden changes in the natural environment, but the magnitude of the impact of disasters is closely related to the human defense process. The monitoring and early warning equipment, information platform construction, shelter construction and use, construction and maintenance of disaster prevention and mitigation engineering facilities in the disaster-affected areas, as well as the relevant departments and the public's defense measures, emergency response, implementation of the emergency plan, rescue and evacuation of the disaster when the disaster strikes, will have a great impact on the magnitude of the disaster impact and losses. Therefore, in the process of investigating the causes of disasters, attention should be paid to both natural and man-made factors, and the impact of disasters should be analyzed objectively and reasonably, so as to provide effective reference for future disaster response.

3.2 Disaster damage assessment

There are already a large number of technical specifications for disaster loss assessment, but there are still a large number of problems in the process of disaster statistics, with a lack of uniform standards for estimating the losses of different disaster-affected persons, and a great deal of variation in the reporting of losses for the same

category of disaster-affected persons. In addition, in the process of disaster survey and statistics, the statistics of disaster loss categories are not the same, which brings difficulties in comparing time and space. Some disaster categories, such as earthquakes and meteorological disasters, do not only use statistical methods to calculate disaster losses, but also conduct modeling calculations to estimate regional disaster losses on the surface, and the results of different modeling calculations vary greatly[11]. Therefore, it is necessary to set up a unified specification for disaster loss survey to quantify the losses of different disaster-bearing entities, which can provide better data support for subsequent disaster research and defense.

3.3 Disaster defense process assessment

At present, disaster investigation and assessment has not formed a unified standardized process [12]. Researches can not only assess the disaster losses, the ultimate purpose of disaster investigation and assessment is to better carry out disaster defense, to ensure that the next disaster can be effectively responded to when it comes to minimize the casualties and losses brought about by the disaster.2021 After Zhengzhou's catastrophic rainstorm disaster, the State Council organized a disaster investigation and assessment, investigated and assessed the disaster defense process, which is a good reference for future disaster investigation and assessment. Assessment, which investigated and assessed the disaster defense process, which is a good reference for future disaster investigation and assessment. The assessment of disaster emergency response and disaster prevention and mitigation management capacity and the assessment of urban infrastructure defense capacity can use numerical simulation methods to establish a model of the physical mechanism of the impact of the disaster, superimpose the emergency response and disaster prevention and mitigation emergency response and disposal process, and simulate the disaster that has occurred in different infrastructure defense standards It can simulate the differences in disaster impacts generated by the occurred disasters in different infrastructure defense standards, disaster prevention and mitigation processes, assess the level of emergency response and disaster prevention and mitigation capacity of the disaster-affected places, identify shortcomings and deficiencies, and put forward opinions and suggestions from various perspectives, such as disaster management, regional construction planning, and so on.

4 Conclusion

This paper analyzes the existing technical specifications for disaster investigation and assessment and relevant examples of investigation and assessment, analyzes the contents and methods of disaster investigation and assessment, and puts forward relevant recommendations, and obtains the following conclusions:

There are more norms for natural disaster investigation and assessment in China, but more attention is paid to disaster damage investigation and assessment, and less to disaster defense and response process investigation.

In the early years, disaster investigation and assessment work focused more on the investigation and assessment of disaster losses, but in recent years, it has begun to shift to the process of disaster defense, and the goal of disaster investigation and assessment is more focused on the construction of disaster prevention and mitigation systems.

Disaster investigation and assessment should aim to better carry out disaster defense, analyze the causes of disasters from both natural and man-made factors, objectively investigate and assess disaster losses and the defense process in comparison with historical disasters, and improve disaster defense capabilities from multiple perspectives, such as disaster management, regional construction planning, and disaster emergency response.

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