China National Assessment Report on Risk Management and Adaptation of Climate Extremes and Disasters

(Refined Edition)

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QIN Dahe

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ZHANG Jianyun,SHAN Chunchang,SONG Lianchun

Science Press
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Preface

Climate is a part of the natural environment that human beings rely on for survival; climate also serves as an essential fundamental resource for sustainable economic and social development. China is a typical monsoon country, characterized by rich climatic diversity and vast regional climatic differences. It has been widely recognized that understanding, adapting to, using and protecting the climate will help humans to follow a path of harmonious development between man and nature. The Earth's climate system is currently undergoing changes caused by natural events and human activities, with the main feature being global warming. Consequently, sea levels rise, glaciers retreat, and climate extremes occur frequently; these events have an influence on the environment and human survival. Therefore, dealing with climate change has become a global issue related to the sustainability of human existence and human well-being; climate change also has potential effects on national development and economic competitiveness, and is related to global governance and security.

Risk management, as it relates to climate extremes and disasters , is one of the important initiatives the international community needs to address related to climate change, and is also one of the major achievements that people have derived from practices related to dealing with natural disasters for many years. On a scientific level, the Intergovernmental Panel on Climate Change (IPCC) released a special report entitled *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* in 2012. The report provides details including the background and history of weather events and climate extremes as well as observations and projections of vulnerability and disaster losses. In

addition, the report was designed to increase awareness and knowledge of extreme events, disaster risk management and the interactions between disaster management and sustainable development and to reveal the latest achievements related to climate disasters and risk management. On the policy level, at the Third World Climate Conference (WCC-3) risk management of extreme weather events and disasters was taken as a core category of the adaptation to climate change and incorporated into the *Global Framework for Climate Services* (GFCS). At the United Nations Climate Change Conference held in Cancun in 2010, governments worldwide reached a consensus on the core issue of adapting to climate change and related risk management, and adopted the *Cancun Adaptation Framework on Climate Change* , and prepared a climate disaster vulnerability assessment and also advocated the establishment of early warning systems for disastrous weather/climate events and the enhancement of risk assessment as its primary mission.

In the context of global climate change, China faces increasingly exacerbated meteorological disaster risks and situations related to the prevention and reduction of extremely severe disasters. Since the 1960s, China has been experiencing significant changes related to climate extremes. There have been growing number of high-temperature and stormy days, a strengthening of droughts in North and Southwest China, an increasing intensity of typhoons as they reach land, and an increasing number of hazy days. With the gradually expanding effects and increasing magnitude of disasters, which directly result in economic losses. Especially since the 1980s, severe climatic disasters such as droughts and floods have occurred frequently in China, causing the country to incur average yearly economic losses of approximately 200 billion Yuan; these disasters pose serious threats to people's lives, property, and to economic and social development. Studies indicate that China should anticipate facing even higher risks related to climate extremes and disasters, such as heat waves, droughts, and heavy precipitation in the future.

By attaching importance to climate change as well as to the prevention and reduction of disasters, the Chinese government has initiated a local disaster risk management system. Accordingly, the capacities to prevent

and mitigate disasters, monitor meteorological disasters, and improve early warnings, have all been promoted. Meanwhile, a disaster prevention and reduction mechanism featuring "government guidance, inter-departmental coordination and social participation" has been established. Meteorological disaster monitoring and early warning services have been created to span all dimensions of the national economic situation, social development and national security. Because climate extremes and disasters tend to be more complicated and volatile in China, especially when combined with increasing risks created by climate change, dealing with catastrophic situations has become much more difficult. Currently, raising overall awareness of climate extremes and the related response and disaster risk management system has become a pressing issue; this requires enhancing China's capacity to manage new risks and catastrophes. Many challenges remain related to building integrated risk management systems, establishing inter-departmental collaboration and coordination, improving the capacity of infrastructure, securing funding and creating risk transfer mechanisms, as well as issues related to enhancing public participation awareness encouraging and enhancing self-help and mutual aid capacities.

To this end, the China Meteorological Administration (CMA), in collaboration with the Ministry of Civil Affairs, Chinese Academy of Sciences, and some other related ministries, have organized this *China National Assessment Report on Risk Management and Adaptation to Climate Extremes and Disasters* which was compiled by the Author Team led by Academician QIN Dahe, and CMA Deputy Administrator Ms. JIAO Meiyan as head of the Compilation and Writing Committee. This report fully incorporates the latest domestic and international scientific research, leverages state-of-art concepts and experiences from the international community in terms of climatic disaster risk management, fully embodies the characteristics of China's disaster prevention and reduction system, and summarizes and directs strategies for future climatic disaster risk management actions in China. Here, I express my sincere appreciation to the Compilation and Writing Committee and the Author Team for their excellent work, and to relevant ministries for their tremendous support.

I believe that this assessment report will provide useful reference for advancing China's adaptation to climate change and the related management of climate extremes and disaster risks; this report will provide a full range of technical support to governments, business enterprises and the general public in raising awareness and the capacity to prevent and reduce disasters, and make a significant contribution to safeguarding national climate security.

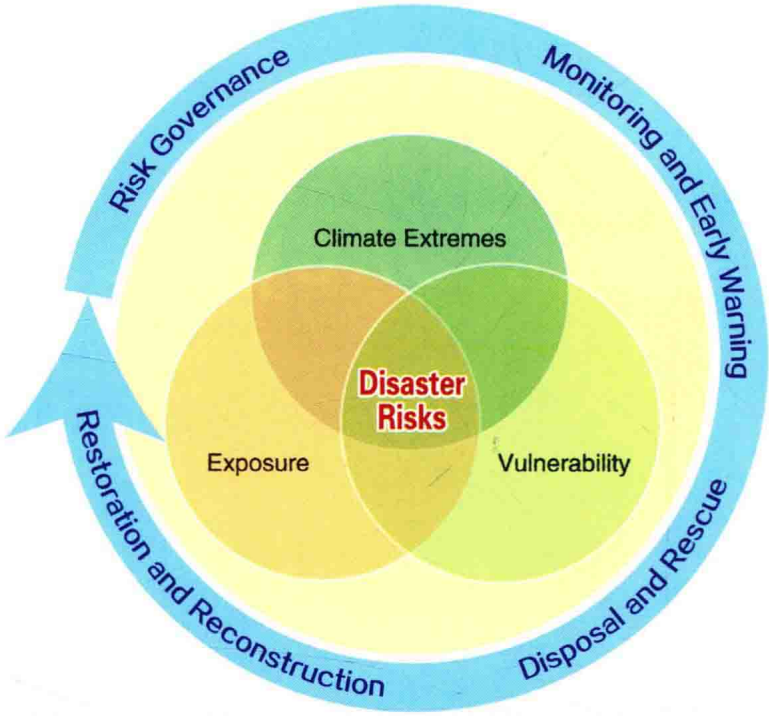
(ZHENG Guoguang)
Administrator, CMA
March 2015

Content

Summary for Policymakers

China is one of the countries which suffer the most serious climate extremes and disasters in the world. Under the background of global climate change, and along with the rapid growth of national economy, gradual expansion of the scale of production and the steady accumulation of social wealth, the losses and damages resulting from weather- and climate-related disasters[1] in China have tended to increase and become exacerbated, which has already become an important factor restricting the sustainable and stable development of economy and society.

Weather- and climate-related disaster risk, depending on the nature of the hazard involved, the exposure and vulnerability of the disaster-bearing body, is directly related to the risk disaster management, monitoring and early warning, the disposition of rescue and relief forces, and the restoration and reconstruction of communities. This type of risk is one of the main elements of climate security (SPM Figure 1).



SPM Figure 1 Schematic diagram of disaster risk management [Figure 1.3]

1 Generally refer to natural disasters induced by specific weather and climate conditions or changes .

Climate security refers to a state in which the change of climate system poses no threat to the survival and development of human society. As a new non-traditional type of security, climate security is closely linked to prevention and reduction of disasters, to addressing climate change issues, and the construction of eco-civilization. Climate security provides an important guarantee related to the security of food supplies, water resources, ecological stability and other aspects in the national security system.

This summary for policymakers introduces the most important findings from the *China National Assessment Report on Risk Management and Adaptation of Climate Extremes and Disaster* . The Assessment Report analyzes the features of climate extremes and disasters in China, assesses their effects and issues related to disaster risk management and adaptation, highlights the latest progress documented in published research and related achievements in disaster risk management both in China and abroad, and finally summarizes and proposes actions and strategy options for disaster risk management in China. The purpose of this report is to enhance public awareness related to addressing climate change and managing disaster risks, to provide scientific and technological support for governments at all levels to help managers to formulate related policies and to provide appropriate actionable information to enterprises, and also to provide basic information for all parts of Chinese society with the goal of improving awareness and the capacity of disaster risk management.

SPM Box 1 Definitions of Basic Concepts

Climate Change: A change in the state of the climate system that can be identified (e.g., by using statistical tests) by changes in the mean, variance and/or statistical distribution of its properties, persisting for decades or even longer. Climate change may be induced by natural variability and/or human activities.

Climate Extremes: The occurrence of a weather or climate event with variable value above (or below) the upper (or lower) limit of the observed threshold of variable values. The occurrence probability is generally lower than 10%.

Exposure: The number of disaster-bearing bodies affected adversely by the hazards or the scope of the adverse effects. The larger the scope/number, the greater the exposure.

Vulnerability: The intrinsic properties of the disaster-bearing body which are determined by its sensitivity to disasters and its capacity to cope with the adverse effects of the physical hazards. The higher the sensitivity, and the weaker the coping capacity, the greater the vulnerability.

Disaster: The changes in normal operations of human society directly or indirectly caused by hazards, resulting in losses and damages.

Management: A comprehensive risk response system in which the whole society is involved, including decision-making, management and execution process.

Adaptation: On social levels, the process of formulating and adopting policies and measures to reduce harm or exploit beneficial opportunities from previously occurring or potential effects; on natural levels, the process of adjustment to the occurrence of adverse effects or new changes. Effective human intervention may enhance the adaptation of natural systems.

Resilience: The ability of a human or natural system to anticipate, absorb, accommodate, or recover from the adverse effects.

SPM Box 2 Disaster Risk Management

Disaster Risk: The likelihood of the occurrence of hazardous natural events and their adverse effects.
Disaster Risk Management: A scientific management system used to mitigate disaster risks through monitoring, identification, simulation, assessment and disposal, with the aim to obtain the maximum level of security at the minimum cost.
Risk Governance: The process of risk identification, assessment, management and communication in which the government interacts with interest-related parties to make decisions in response to anticipated risks.
Integrated Risk Governance: Risk management that coordinates the political, economic, cultural and social elements from a global, regional, multi-hazard, entire-process, all-directional and entire-society perspective. It emphasizes the structural integration of the security fortification, disaster relief, emergency response and risk transfer as well as the functional integration of disaster preparedness, emergency response, restoration and reconstruction through coordination and interactions between government, enterprises, local community and the general public.
Risk Transfer: Relevant means or measures adopted to transfer natural disaster risks from one party to another one or several parties.

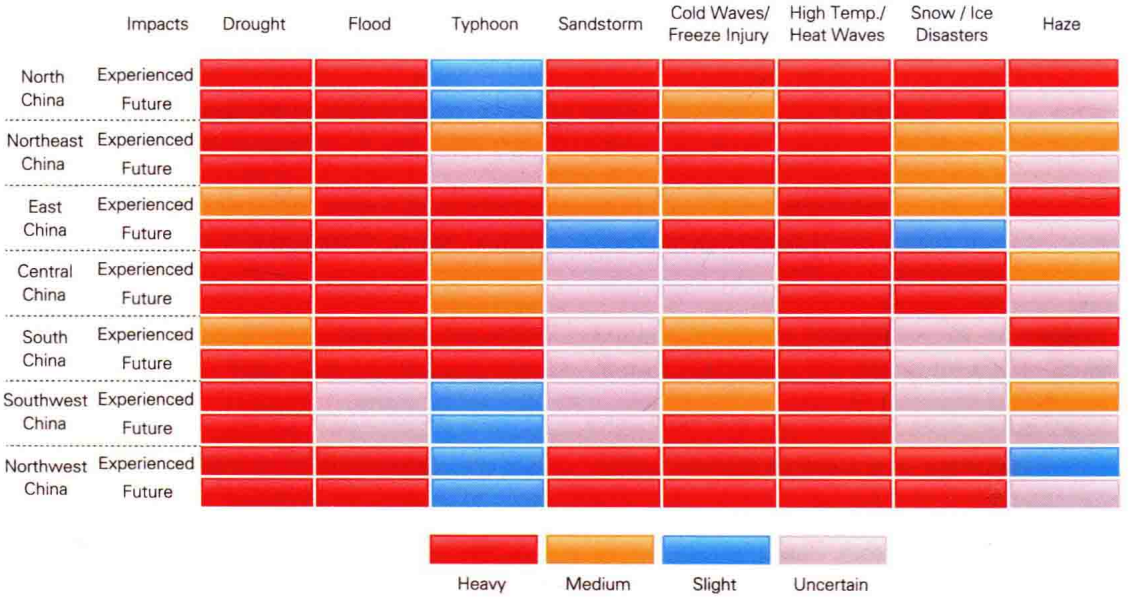
I. Observed and Future Trends in Climate Extremes and Disasters in China

Climate extremes in China feature various types of extremes with high frequency, strong seasonal and regional differences, and a wide range of effects (high confidence). Various climate extremes such as heat waves, droughts, storms, typhoons, sandstorms, cold waves, frost, gales, fog, haze, hail, thunder and lighting, and continuous cloudy rain are prevalent and occur frequently with widespread effects. Climate extremes display prominent regional, seasonal and periodic characteristics, and are often associated with disasters. Areas with a high incidence of extremely high temperatures are concentrated; droughts are distributed in a widespread pattern; extreme precipitation events occur mostly in southern China; typhoons are concentrated seasonally; sandstorms show apparent seasonal variation; frosts and cold waves are strong in northern China while weak in southern China; and gales vary significantly depending on regions. [3.1]

During the past 60 years, climate extremes have changed significantly in China. The numbers of high-temperature days and rainstorm days have increased, and the frequency of exereme low-temperature events has decreased. The tendency toward aridification has strengthened in northern and southwestern China. The intensity of landing typhoons has increased and the number of hazy days has increased (high confidence). On the national scale, there has been a significant increase in annual maximum and minimum temperatures and the number of high-temperature days, and a slight decrease in the number of cold days. The frequency of regional extreme low-temperature events has declined remarkably by 0.6 times per decade, the number of freeze days has decreased significantly by 0.6 days per decade, and the frequency of cold waves has decreased by 0.2 times per decade. From 2007 to 2013, regional and periodic low-temperature and freezing events occurred occasionally. There has been an increase in frequency, intensity and the spatial extent of rainstorms. The tendency toward aridification is prominent in Northeast China, North China and Southwest China, with the number of drought days exceeding the moderate level, and increasing by 24%, 15% and 34%, respectively from 1997 to 2013 compared to 1961-1996. Although there is a decreasing tendency in the number of typhoons generated over the western North Pacific and South China Sea, the intensity of typhoons landing in China has increased significantly. Since the 21st century, half of the landing typhoons presented the maximum wind speed higher than level 12. Also, the amount of precipitation brought by typhoons has increased in eastern China and along the coast of Southeast China. The frequency of sandstorms has tended to decrease. During the 25-year period since 1983, the frequency of sandstorms declined

by 58% compared to the same period before 1983. The average number of haze days has increased significantly in central-eastern China during the winter half year, and the haze causes a notable drop in visibility in North China. The effects of weather- and climate-related disasters have been aggravated continuously, and the disaster risks will be further enhanced in the future (SPM Table 1, SPM Figure 2). [3.3]

The frequency and scope of regional or group-occurring climate extremes have increased in China (high confidence). From 1960 to 2013, China has experienced a total of 784 group-occurring rainstorm events (i.e., 14.5 times per year on average), each of which occurred across at least ten stations. The number of annual group-occurring rainstorm events increased from 13.5 to 17.3 (a 28% increasing). The intensity and extent of rainstorms have also increased. The frequency of regional heat waves over the same period has generally increased, especially in the middle and lower reaches of the Yangtze River Valley and in South China where the annual frequency of heat waves from 1997 to 2008 almost doubled compared to that from 1976 to 1994. [3.4]



SPM Figure 2 Degree of Effects of Climate Extremes and Disasters in Seven Sub-regions of China. Low, medium, heavy and uncertain effects refer to climate extremes or disasters have resulted in small losses or where future risks are comparatively low (low effects), which are in between low and heavy effects (medium), that have resulted in great losses or where future risks are comparatively high (heavy), and where the extent of losses or the level of risks that cannot be estimated (uncertain), respectively. [Modified from Climate and Environment Changes in China: 2012]