

中国自然灾害系统地图集

ATLAS OF NATURAL DISASTER SYSTEM OF CHINA

史培军 主编
Chief Editor: Shi Peijun

MINI-MAXIMIZATION

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序

自然灾害是人类实现可持续发展的重要限制因素,减轻自然灾害对人类所造成的危害是世界各国共同追求的目标。

20世纪90年代被联合国命名为“国际减灾十年”。21世纪伊始,联合国继续深化和实施国际减灾战略计划。这两个国际减灾计划都特别强调了减灾活动中科学研究的价值、政府和非政府组织的积极支持,以及保险公司和再保险公司的重要参与。

政府在制订国家宏观减灾规划中起着不可替代的作用;非政府组织在筹集减灾资源和宣传普及减灾知识等方面发挥着突出的作用;而保险公司和再保险公司是分散和防范灾害风险的一支重要力量,他们在支持经济建设和促进社会发展中的作用有目共睹,得到了世界各国的认可。科学研究不仅为制订减灾规划提供了坚实的科学依据,而且通过灾害预测、灾害风险评价和减灾工程设计等途径发挥着其在减灾中的关键作用。

中国是世界上自然灾害最严重的国家之一。每年各种自然灾害给国家和社会都造成了无法衡量的人员伤亡和经济损失。中国政府采取了多种多样的措施抵御和防范自然灾害并与之进行着坚持不懈的斗争,然而,一种更为有效和专业的防灾机制仍然有待开发。中国目前的保险水平较低,自然灾害造成的保险损失还很小。但是随着经济发展和保险市场不断成熟,这一情况必将改变。

自从上个世纪90年代初中国实施改革开放的政策以来,瑞士再保险公司就一直密切注视着中国这个伟大的国家,关注着这个国家经济的快速增长。为了体现我们对中国市场的信心和承诺,我公司相继于1996年和1997年在北京和上海分别设立了代表处。进而在1999年4月,作为第一家外国再保险公司,率先向中国的保险监管机构呈交了设立分公司的正式申请。2002年7月,在中国成功加入世界贸易组织后,经中国保险监督管理委员会批准,我公司获准在华筹建瑞士再保险公司中国分公司,预计该分公司将于2003年开始营业。

作为世界上领先的再保险公司之一,瑞士再保险公司一直致力于国际减灾事业,并且把向客户和公众传播自然灾害保险的专业技术和知识作为公司的首要职责。对中国市场的承诺和长期投资也激励我们认真严肃地关注当前困扰中国的巨灾问题。

为此,瑞士再保险公司于1999年4月与北京师范大学签署合作协议,共同建立了“瑞士再保险公司/北京师范大学灾害风险与保险研究中心”,并由此拉开了我公司与北京师范大学友好合作的序幕。该研究中心的宗旨在于,通过对中国自然灾害深入和系统的研究,结合保险和再保险的应用,开发出有效管理和控制自然灾害风险的方法和手段。

四年来,该中心相继完成了多项有关中国主要自然灾害风险的课题。目前,该中心正在进行

的项目是“中国地震风险评估模型”。这些广泛而深入的研究有助于加深理解中国自然灾害风险的区域分布、风险状况和动态变化以及发展规律，也为中国乃至世界保险和再保险业提供了重要的科学价值。

北京师范大学作为一所国际知名的高等学府，在教育和科研事业中培养了数以万计的优秀人才，为中国的振兴和令人瞩目的发展作出了卓越的贡献。这所大学也是中国第一所系统研究减灾并培养这方面专业人才的大学。作为北京师范大学的一名荣誉教授和瑞士再保险公司的董事长，我于2002年9月参加了北京师范大学在北京人民大会堂隆重举行的百年校庆，亲眼目睹了这所名校在中国教育界的崇高地位。

瑞士再保险公司的宗旨之一就是支持社会进步。为了充分体现瑞士再保险公司对中国市场的承诺和对中国减灾事业的支持，我公司决定出资资助出版《中国自然灾害系统地图集》（中英文版）。这本地图集不仅反映了瑞士再保险公司和北京师范大学四年合作的丰硕成果，同时也收集了北京师范大学近15年来开展多项中国自然灾害研究所取得的宝贵数据。

《中国自然灾害系统地图集》全面地展现了中国主要自然灾害的形成规律、特征、区域分布格局以及动态变化过程。它的问世为保险和再保险业研究、开发切实可行的巨灾风险保障提供了科学的参考价值。同时，我深信这本地图集的科学与实践重要性对于中国乃至全世界意义深远。

值此机会，我热烈祝贺这本地图集的出版，并衷心感谢所有参与这本地图集出版工程的各位专家、教授和相关人士。最后，祝愿中国和世界减灾事业取得更大的成就！

彼德·弗斯特莫撒

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FOREWORD

Natural catastrophes are major impediments to sustainable development. The reduction of natural disasters is therefore a common goal pursued by every country in the world.

The United Nations designated the 1990s as the International Decade for Natural Disaster Reduction; and as we enter the 21st century, the UN continues to build on this initiative. These natural disaster reduction campaigns place particular emphasis on the value of scientific research, the participation of governments and non-governmental organisations (NGOs); and importantly, the involvement of insurance and reinsurance companies.

Governments play a unique role in macro-level planning for disaster reduction, whereas NGOs play an outstanding role in resource collection for disaster mitigation, and in publicising the relevant knowledge. Re/insurers are a key force in risk diversification and risk prevention, whose significant role in backing up economic growth and social development is recognised worldwide. Scientific research of course provides the solid foundation needed, and plays a pivotal role in disaster reduction via prediction and assessment, as well as disaster prevention and reduction engineering.

China is highly exposed to natural perils, which cause immeasurable economic loss and human suffering each year. While an effective and professional mechanism in dealing with catastrophe is still being developed, the Chinese government has taken a variety of measures to fight and prevent natural catastrophes. Thus far, due to very low insurance penetration, insurance loss in China resulting from natural perils has been insignificant. This, however, will change as the market matures.

From as far back as the early 1990s, when China adopted its open-door policy and underwent economic reform, Swiss Re has been closely observing the rapid economic growth in this great country. To demonstrate our confidence in, and commitment to, the China market, Swiss Re opened its representative offices in Beijing and Shanghai in 1996 and 1997, respectively. Furthermore, in April 1999, Swiss Re became the first international reinsurer to apply to the Chinese regulator for a branch operational licence. Along with China's successful accession to the WTO, in July 2002, Swiss Re obtained approval from the China Insurance Regulatory Commission (CIRC) to start preparations for its Swiss Re China Branch, which we expect to start operating in 2003.

Swiss Reinsurance Company, as one of the world's leading reinsurers, has been highly active in managing issues related to natural catastrophe risks, and has put a high priority on communicating that expertise to clients and the public alike. Our commitment and long-term investment in the Chinese market also impel us to look seriously into the issues that confront China today.

Thus, in April 1999, Swiss Re signed a cooperation agreement with the Beijing Normal University (BNU) to jointly set up the "Research Centre for Natural Catastrophe Exposure and Insurance", which became the curtain raiser for friendly cooperation between Swiss Re and the BNU. The research centre's objective is to study natural catastrophes in China and develop means of managing substantial natural catastrophe losses through insurance and reinsurance.

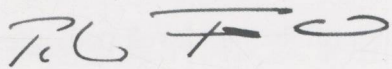
Over the past four years, the Research Centre has recorded a number of accomplishments in the study and research of major natural catastrophes, including the current project on *Risk Assessment Model of Earthquake in China*. These comprehensive and in-depth studies and research projects help us to better understand China's natural catastrophes in terms of regional distribution, exposures and changes, as well as rules. In addition, the research outcome brings important scientific value to the Chinese (and global) insurance/reinsurance industry.

As an internationally renowned institution of higher learning, Beijing Normal University (BNU), has cultivated thousands of superior talents in the noble course of education and scientific research. Moreover, it has made outstanding contributions to the country's remarkable development and revitalisation. BNU was the first university in China to systematically study natural disaster reduction and to have trained professionals in this special area. As Honorary Professor of Beijing Normal University and Chairman of the Board of Directors of Swiss Re, I witnessed the university's position of high esteem within China's educational circles, when attending BNU's grand centennial anniversary celebration in the Great Hall of the People in Beijing in September 2002.

Supporting social progress is a guiding principle within Swiss Re. To demonstrate Swiss Re's commitment to the Chinese market and the undertaking of China's natural disaster reduction, Swiss Re has decided to provide financial sponsorship towards the publication of the *Atlas of Natural Disaster System of China*, published in both Chinese and English. This publication reflects not only the fruitful achievements of Swiss Re's and BNU's cooperation over the past four years, but is also the result of 15 years spent collecting valuable data on China's natural perils.

This atlas provides comprehensive information on China's major natural perils, its formation, characteristics, regional distribution, dynamic changes, etc. In addition, it provides scientific reference value to the insurance and reinsurance industry in their efforts to develop a viable solution for natural catastrophe protection. I am convinced that the scientific and practical significance of this atlas to China and the world as a whole will be profound and lasting.

On this occasion, I would like to extend my warmest congratulations on the publication of this atlas and convey my sincere appreciation to all the experts, professors and relevant persons who participated in this project. Last but not least, I wish for continued great achievements in the course of natural disaster reduction in China and the world as a whole.



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前 言

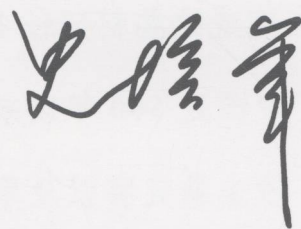
伴随联合国国际减轻自然灾害十年（IDNDR）活动以及国际减灾战略（ISDR）的实施，减灾作为实施区域可持续发展的重要途径，已引起学术界、经济与社会各界的高度重视。作为减灾实践的科学基础，灾害研究愈来愈受到自然科学家、社会学家以及工程专家的关注，他们在全球、区域或地方等不同的空间尺度上，开展了灾害形成机制的研究，并将灾害的形成与资源的开发，特别是自然资源的开发紧密地联系起来，以便于从本质上揭示灾害形成机理与发展过程。为此，北京师范大学环境演变与自然灾害教育部重点实验室、资源科学研究所、资源与环境科学系，在教育部、科技部、国家自然科学基金委员会、民政部、中国人民保险公司、中国气象局、中国地震局、水利部、国土资源部、中国科学院、农业部、国家林业局、国家环境保护总局等部门的大力支持下，从1988年开始，在已故中国科学院院士周廷儒教授、时任北京师范大学教务长的张兰生教授、地理系主任赵济教授、邬翊光教授的指导和关怀下，组织师生开展了一系列灾害系统的综合研究，15年来先后承担了国家级、省部级以及国内外保险与再保险企业委托研究的课题50多项。在完成这些科研任务的同时，始终坚持建设中国自然灾害数据库。到2002年，实验室基本完成了中国近500年以来各种主要自然灾害的数据库，其中地震灾害、水灾、台风灾害、雪灾、雹灾、沙尘暴灾害以及旱灾、地质灾害、水土流失、草地退化等灾种的数据库的相继使用，为国家制订“全国减灾规划”起到了重要作用。在这些数据库的支持下，于1992年编绘出版了《中国自然灾害地图集》（中、英文版）。这本地图集的出版，对我国参与国际减轻自然灾害十年（1989~1999年）活动、推动我国减灾工作和灾害学科的建设，都起到了十分重要的作用，受到社会各界的好评。

1998年夏季，在中国长江流域发生特大洪涝灾害后，瑞士再保险公司北京代表处与北京师范大学环境演变与自然灾害教育部重点实验室加快了合作步伐。1998年年底，在瑞士再保险公司举办的风险管理研讨会上，实验室就中国洪水灾害问题进行了系统的介绍，受到了与会专家的好评。在此基础上，北京师范大学与瑞士再保险公司于1999年4月在北京签署了合作协议，共建“瑞士再保险公司/北京师范大学灾害风险与保险研究中心”，由此揭开了北京师范大学与瑞士再保险公司长期友好合作的序幕。

四年来，该中心相继完成了由北京师范大学与瑞士再保险公司共同确定的有关自然灾害的多项课题。目前正在进行的课题是“中国地震风险评估模型”。这些研究成果对加深中国自然灾害及风险分布区域分异规律的理解，以及拓展保险公司和再保险公司在我国的保险与再保险业务都具有重要的科学价值。在这些工作基础上，2002年瑞士再保险公司出资资助《中国自然灾害系

统地图集》(中英文版)的出版。这本地图集不仅是双方四年来合作的基础成果,而且也是北京师范大学师生15年来在多项中国自然灾害研究中所取得的宝贵成果。图集全面展现了中国主要自然灾害的形成规律、区域分异格局以及动态变化过程。本图集的问世,将不仅对促进中国的减灾事业、进一步探讨区域自然灾害发生与发展规律有重要价值,而且对中国乃至世界保险与再保险界开展中国业务也有很高的参考价值。

在此,我们感谢多年来应聘担任北京师范大学环境演变与自然灾害教育部重点实验室学术委员会的各届委员和学术顾问,感谢参与这本地图集出版工程的所有专家,尤其是瑞士再保险公司北京代表处的首席代表高璁先生、代表杨彬女士,以及瑞士再保险公司行政局成员、亚洲部首席执行官皮埃尔·奥赞多,瑞士再保险公司亚洲部行政局成员、中国地区总经理韩润南,瑞士再保险公司亚洲部巨灾风险经理贺路慈先生。我们还要特别感谢瑞士再保险公司董事长、北京师范大学荣誉教授彼德·弗斯特莫撒教授。正是由于他们的大力支持,才能使这项合作顺利开展,并取得一系列重要成果。



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PREFACE

Academics, economists and communities worldwide are paying greater attention to disaster reduction as an important means towards achieve sustainable development, thanks to the activities of the United Nations International Decade for Natural Disaster Reduction (IDNDR) and the implementation of the International Strategy for Disaster Reduction (ISDR).

Increasingly, natural and social scientists, as well as engineering experts, are looking to disaster research as a scientific base for devising disaster reduction measures. They have started to study the mechanisms behind the formation of disasters at global, regional or local levels, with special emphasis on the relationship between disaster formation and the development of natural and other resources, thus revealing the fundamental system of disaster formation and its evolution.

Dedicated to this cause since 1988, three key constituents of the Beijing Normal University, namely the Key Laboratory of Environmental Change and Natural Disaster of the Ministry of Education, the Institute of Resources Science and the Department of Resources and Environmental Sciences, have carried out a series of comprehensive studies on disaster systems, and successfully undertaken more than 50 scientific projects either at national, provincial and ministry levels, or mandated by local and overseas insurance or reinsurance companies.

We are grateful for the support of the Ministry of Education, the Ministry of Science and Technology, the National Natural Science Foundation, the Ministry of Civil Affairs, the People's Insurance Company of China, the China Meteorological Administration, the China Seismology Bureau, the Ministry of Water Resources, the Ministry of Land and Resources, the Chinese Academy of Sciences, the Ministry of Agriculture, the State Forestry Administration and the State Bureau of Environment Protection, and the National Bureau of Statistics. We also benefited from the guidance and regard of the late Professor Zhou Tingru, Academician of the Chinese Academy of Sciences; Professor Zhang Lansheng, former Dean of Studies of the Beijing University of Education; and Professor Zhao Ji and Professor Wu Yiguang, the two former heads of the Department of Geography of Beijing Normal University.

While relentlessly engaging in the series of integrated studies, the Key Laboratory has stayed committed to establishing a *Database of Natural Disaster in China*. By 2002, it had basically completed the databases of major natural disasters in China over the past 500 years, to include earthquake, flood, typhoon, snow, hail, dust storms, drought, geological disaster, water and soil erosion, grassland degradation, etc., all of which play an important role in the formulation of *National Disaster Reduction Planning*. With the support of these databases, the *Atlas of Natural Disaster in China* (in Chinese and English) was compiled and published in 1992, and are demonstrations of China's active participation in IDNDR (1989–1999) activities. The atlas also won tremendous social acclaim as it has been instrumental in the promotion of disaster reduction efforts and the development of disaster studies in the country.

In the summer of 1998, consequent to serious flooding along the banks of the Changjiang (Yangtze R.) River in China, the Beijing Representative Office of Swiss Reinsurance (Swiss Re) and the Laboratory decided to step up cooperation. At the end of the same year, at a Risk Management Workshop organized by Swiss Re's Beijing Office, the Laboratory gave a systematic presentation on the flood disaster problem in China and received favorable comments from participating experts. Building on this partnership, the University and Swiss Re signed a cooperative agreement in March 1999 in Beijing to jointly establish the "Swiss Re/Beijing Normal University Research Centre for Catastrophe Exposure and Insurance", marking the beginning of long term cooperation between the two parties.

Over the past four years, the Center has successfully completed a number of projects of joint interest. It is currently working on a project titled *Risk Assessment Model of Earthquake Disaster in China*. Besides facilitating the thorough understanding of natural disasters in China and the regional differentials in risk distribution, these findings also serve as significant scientific reference for insurance or reinsurance companies who plan to expand their business in China. Strengthening the partnership further, Swiss Re agreed in 2002 to sponsor the publication of the *Atlas of Natural Disaster System of China* (in Chinese and English). The publication is not merely the fruit of four-year's cooperation

between the two partners, but also demonstrated the invaluable achievements of the teachers and students of the Beijing Normal University in natural disasters research in China over the past 15 years.

The Atlas gives a comprehensive presentation of the mechanism governing the formation of major natural disasters in China, regional differentials and the dynamics of disaster development. The Atlas is of great valuable not only in assisting the promotion of disaster reduction in China and the further investigation of regional natural disaster occurrence and evolvement patterns, but also as reference for both local and overseas insurance and reinsurance companies to develop their business in China.

We wish to thank all members and advisors of the Academic Committee of the Laboratory of Environmental Change and Natural Disaster for their contributions over the years. Our thanks go also to all the experts who helped to put the Atlas together, in particular those from Swiss Re including Mr. Eric Gao and Mrs. Yang Bin, Chief Representative and Representative, respectively, of its Beijing Office, Mr. Pierre Ozendo, Swiss Re Executive Board Member and Chief Executive of its Asia Division, Mr. Franz Josef Hahn, Member of the Executive Team of its Asia Division and Head of China Markets, and Mr. Luzi Hitz, Catastrophe Risk Manager of its Asia Division. Last but not least, our heartfelt thanks to Professor Peter Forstmoser, Chairman of the Board of Swiss Re and an Honorary Professor of the Beijing Normal University. It is with Swiss Re's generous support that we were able to successfully start the project and attain such bountiful achievements.

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