

中国重大自然灾害

ATLAS OF MAJOR NATURAL
DISASTERS AND SOCIETY
RESPONDING TO THEM
IN CHINA

与社会图集

科技部国家计委国家经贸委灾害综合研究组 主编
广州地理研究所 协编

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· 广 州 ·

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Compiled by

Integrated Research Group on Disasters under Ministry of Science and
Technology, State Development and Planning Commission,
State Economic and Trade Commission of PRC

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内容简介

本图集是由水利部、中国气象局、中国地震局、国家海洋局、国土资源部、农业部、国家林业局等部门的专家在对洪涝、气象、地震、海洋、地质、农、林等七大类自然灾害调查研究的基础上, 以灾害的自然和社会双重属性为纲, 统一规范, 统一标准, 综合分析编制的。

本图集以平面图和时序图为主, 系统反映了中国主要自然灾害的危险性与危害性的时空分布; 中国历史时期的自然灾害概况; 中国自然灾害对社会经济的影响和危害; 中国减灾工作现状; 中国自然灾害形成的自然与社会条件及发展趋势和区域灾害风险预测。然后在考虑中国灾情和国情的基础上, 结合增强国家可持续发展能力的需要, 提出了较全面的综合减灾系统工程对策。

本图集具有资料性、图像化、可视易读等特点, 可供从事减灾事业的灾害管理人员、科技人员和社会各界关心减灾与发展的人士参考。

Brief Introduction

The Atlas is compiled by the experts from Ministry of Water Resources of PRC, China Meteorological Administration, China Seismological Bureau, State Oceanic Administration, Ministry of Land and Resources of PRC, Ministry of Agriculture of PRC, State Administration of Forestry on the basis of their investigations and studies of floods and waterlogging, meteorological disasters, earthquake hazards, sea disasters, geologic hazards, agrobiohazards, and hazards to forests in China on a guiding principle of dual, the natural and the social, attributes of disasters under a unified specification, uniform scaling, and integrated analysis.

The Atlas consists mainly of plane maps and time sequence graphics, which systematically reflect the temporal-spatial distributions of risk and hazardousness from major natural disasters in China, outline of natural disasters in China in historic times, impact and damages of natural disasters on the society and economy in China, current status of disaster reduction work in China, natural and social conditions for formation of natural disasters, their development tendency, and prediction of regional disaster risk. A more complete systematic engineering for integrated disaster reduction is proposed on the basis of consideration of disaster situation and national conditions in combination with the needs for improving the capability for sustainable development in China.

The Atlas is characterized by a wealth of data, visual illustrations, and readability. It is designed to be a reference for disaster managers, those scientists, technicians, teachers, and students, who are engaged in disaster reduction, and personages of all circles of society concerned themselves with the disaster reduction and sustainable development.

中国重大自然灾害与社会图集

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序

当前科学技术的飞速发展推动着人类社会的进步,而社会的进步反过来又对科学技术提出了更高的要求,如此相互推动、相互依存,必然使社会前进的车轮越转越快。与此同时,人类追求高品位的生活对地球有限的承载力造成了严峻的挑战,有时甚至陷入了盲目发展而“自掘坟墓”的状态。工业革命以来,高速发展的生产力推动了社会经济车轮的不断加速运转,但也导致了社会、人口、资源、环境、灾害等因素之间的不协调,造成了生态环境濒临崩溃的危机。形成这种矛盾的核心在于人类尚欠缺对社会发展的自我控制能力和对自然的适应与维护能力,而解决方法则在于善于处理人类对自身和自然的辩证管理。

自然灾害,特别是突发性的自然灾害,是对矛盾——人类行为和自然动态之间相互作用最为猝然和剧烈的现象,它对社会经济可持续发展的破坏也最为直观。自然灾害是人类安全和社会稳定的大敌,也是影响社会可持续发展的重要制约因素。但由于重大自然灾害往往几年、甚至几十年才发生一次,故容易被人们忽视,导致对防灾减灾工作的持久性和整体性思虑不周。同时,由于当前的科技水平尚不能很好地对未来几年至十几年的自然灾害风险进行科学的预测、预报,造成有限的防灾减灾投入无法集中使用在将会发生灾害地区的防灾减灾工作中,以致自然灾害的损失越来越大。20世纪90年代,自然灾害年均直接经济损失已达1000亿元以上(按1990年人民币可比价折算),而间接经济损失更是几倍甚至十几倍于直接损失,这个触目惊心的数字再也不能等闲视之了。

中国是世界上自然灾害种类最多、受灾面积最大和受灾人口最多的国家。但至今为止,有关自然灾害的防治、管理、教育以及科学研究,大都还以单灾、单类的灾害为主,没有对各类自然灾害进行综合考虑,因而影响了各级政府在设计经济与社会发展计划和规划时对防灾减灾工作的统筹安排。造成这种局面的根源在于人们对中国自然灾害的整体观念尚未形成和缺乏综合认识。为了认识中国自然灾害的总况,研究综合减灾对策,1990年由原国家科委、国家计委、国家经贸委联合组织了由气象、海洋、地质、地震、水利、农业、林业等七个部门的专家组成的中国重大自然灾害综合研究组,目的就是开展多部门、多学科的交叉综合研究,提高对中国自然灾害的整体认识,探索综合减灾的道路。经过五年的艰苦工作,完成了《中国重大自然灾害及减灾对策》(总论)和(分论)的研究报告。在此基础上,又扩展补充了历史上重大灾害和近年的自然灾害,从而完成了对20世纪中国全部(包括台湾的部分灾害)重大自然灾害事件以及历史上分代灾害史料的系统分析与总结,提出了对自然灾害综合性和规律性的一些看法,揭示了自然灾害乃至相关的自然环境变异对社会的直接危害和间接影响。这是灾害学研究中,自然科学和社会科学的一次较为系统和完整的结合,是对自然灾害所具有的自然属性和社会属性的全面阐述。1997年开始,为进一步推进关于“中国自然灾害整体观念”形成和深化的认识,便于国家、省、市各

级综合部门的灾害管理,便于社会关于自然灾害的整体性综合教育,又开创性地进行图文并茂的《中国重大自然灾害与社会图集》(以下简称《图集》)的研究与编辑。

策划采用《图集》的形式表现自然灾害的规律和社会减灾对策,目的是期望以生动、形象的表达加深读者对自然灾害的感性认识,以言简意赅的论理文字强化读者的防灾减灾意识。

通览《图集》,大致有几个特点:①以图表为主,展示了大量的灾情资料,包括我国各个不同历史阶段、不同精度的统计资料,直观和客观地显示了中国自然灾害的分布与演变的实况。②综合地表达了各单灾种的空间分布,并以“灾度”这一概念统一各类灾害的评估标准,从而在同一衡量标准的基础上,揭示了自然灾害的综合分布规律,划分了全国强、中、弱灾度分布区,这是十分有利于各级政府制定经济与社会发展规划的基础资料。③直观地阐述了自然灾害对社会经济发展的制约关系,从中可以看出可持续发展必须充分重视正面和负面的各种因素,充分认识正面和负面因素之间的辩证关系。④生动地表达了灾害所具有的“自然”与“社会”双重属性,这是“社会发展学”中的新观念。⑤以减灾系统工程的方式表达了综合减灾的途径和具体措施,并紧密结合社会发展和管理,构成了自然灾害整体观和综合减灾的基础框架。

总之,《图集》综合反映了我国重大自然灾害的发展、演化过程和时空分布规律,提出了从单灾减灾走向综合减灾,从部门减灾向全社会系统减灾,从灾害管理到社会可持续发展,从灾害意识的教育到灾害文化的形成等新的减灾思维和观点,它具有很强的史料价值和学术价值,并易于阅读和参考。希望它能成为关心社会发展与减灾安全的政府官员和减灾管理人员、科研人员、学生乃至社会民众喜爱的一本图集。

专此为序。

靳楠

2002年10月28日

PREFACE

At present, high-speed development of science and technology promotes the human society advance forward, whereas the social progress in turn makes higher demands of science and technology, so they promote each other and depend on each other and hence propel the wheel of social progress run faster and faster forward. Meanwhile, the high-quality living standard that mankind seeks gives a rigorous challenge to the limited supporting capability of the Earth, sometimes even a blind development would "fall into a situation for itself destruction". Since the Industrial Revolution, high-speed development of production has pushed the wheel of society and economy to run uninterruptedly forward, but it resulted in an imbalance between the society, population, resources, environment, disasters and other factors and hence led to a crisis of ecological environment being in imminent collapse. The core of this contradiction is that mankind lacks of the self-controlling ability in social development and the capability for adapting to and protecting the nature. But the way to solve the contradiction is to well treat the dialectic management on the mankind itself and the nature.

Natural disasters, in particular, the suddenly occurring natural disasters, are the most abrupt and dramatic phenomena resulting from the interaction between human behaviors and natural agents in the contradiction and the most visual damages to the sustainable development of society and economy. Natural disasters are the major enemy of human safety and social stability and also the important factors constraining the sustainable development of society. The major natural disaster is easily ignored, as it often occurs once several even to tens years, and hence the work on disaster prevention and reduction cannot be persisted and the holistic planning cannot be thorough. Meanwhile, the science and technology at current level can not well predict and forecast the natural disaster risks for future several to tens years, so the limited investment in disaster prevention and reduction can not be fully concentrated onto the work on disaster relief in an area where a future disaster could occur, so that the damage from the disaster may be larger and larger. During the 1990s, annual economic losses directly from natural disasters reached more than 100 billion yuan (estimated at 1990 RMB constant prices), while the indirect economic losses are several to tens times more than the direct losses. These startling figures should not be regarded as unimportant.

China is a country affected by most types of natural disasters, the largest disaster-affected area and largest number of afflicted

population in the world. However, up to now, disaster prevention and controlling, management, education and scientific research were mostly focused on single and individual disasters, no an integrated plan on all types of natural disasters was made and hence could not enable all levels of government to make an overall planning for disaster prevention and reduction when they are working out economic-social development plan and program. The root cause for this situation is the lack of holistic conception and comprehensive knowledge of natural disasters in China.

In order to understand the general situation of natural disasters in China and to work out an integrated disaster reduction strategy, the State Science and Technology Commission, State Planning Commission, and State Economic and Trade Commission jointly organized an Integrated Research Group on Major Natural Disasters in China consisting of specialists from seven departments, such as from the departments of meteorology, oceanography, geology, seismology, water conservancy, agriculture, and forestry in 1990, with its aim to develop a multi-department, multi-disciplinary, integrated research on natural disasters in China, to improve the overall knowledge of the disasters, and to search out an approach to integrated disaster reduction. After five-year arduous work, the research group has finished its research report *Major Natural Disasters and Disaster Reduction Strategy in China (Introduction)* and *(Special Topic Parts)*. On this basis, an additional research was conducted on the major disasters in history and natural disasters during past years. Thus, a systematic analysis and a summary of all major natural disaster events (including part of disasters in Taiwan) in the whole China during the 20th century and the historical data of disasters in the feudal dynasties of old China were performed, some opinions on the composite characters and the regularities of natural disasters were suggested, and the direct damages from and the indirect effects of the natural disasters and the relevant natural environmental variations on society were analyzed. It is a result of more systematic and integral combination of natural science with social science in catastrophological research and gives an overall description of natural and social attributes of natural disasters. Since 1997, in order to further promote formulation and in-depth understanding of "the holistic conception of natural disasters in China", for the convenience of state, provincial, and municipal integrated departments to carry out disaster management, and for the convenience of the society to implement comprehensive education on the integrity of natural

disasters, the *Atlas of Major Natural Disasters and Society Responding to Them in China* with both excellent pictures and abundant text has been initiatively studied and compiled.

Planning to represent the regularities of natural disasters and the social disaster reduction strategies in the form of the *Atlas* is aimed to expect that the readers can get a deeper perceptual knowledge of natural disasters in the vivid and figured expressions in the *Atlas* and improve the awareness of disaster prevention and reduction in the concise and comprehensive theoretical descriptions.

After an overall review of the *Atlas* we can roughly find the following its specific characteristics: ① Maps, graphics and tables are dominant. They demonstrate a good deal of data of disaster effects, including statistic data of disasters in China in different historical stages and at different accuracies, and visually and objectively reflect the distribution and evolution of natural disasters in China. ② The spatial distribution of single and individual disasters is compositely shown and a concept of "hazardousness" is applied as a unified criterion to evaluation of all types of disasters, and hence the integrated distribution regularities of natural disasters are revealed at the same measure and the areas with high, middle and low hazardousness are determined, respectively. These results provide the basic data favorable for all levels of government in working out plan of economic and social development. ③ A constraining effect of natural disasters on social-economic development is visually elucidated. It can be seen that for the sustainable development, it is necessary to fully pay attention to various positive and negative factors and to fully understand the dialectic relation between the positive and the

negative factors. ④ The dual attributes, "natural" and "social" attributes, of disasters are vividly expressed. These are the new concepts in "science of social development". ⑤ An integrated approach to disaster reduction and the concrete measures are expressed in the form of systematic engineering and are closely combined with social development and integrated management, and hence formed a holistic view of natural disasters and a basic framework of integrated disaster reduction.

In general, the *Atlas* compositely reflects the development, evolutionary process and temporal-spatial distribution regularities of major natural disasters in China and shows a thinking and a viewpoint of disaster reduction, from single disaster reduction to integrated disaster reduction, from separated disaster reduction to the whole-society systematic disaster reduction, from disaster management to sustainable development of society, and from education of disaster awareness to formation of disaster culture. Therefore, the *Atlas* is of great value in historical data and scientific results and is easy to read and refer. It is hoped that the *Atlas* will be a readable book, which government officers, disaster reduction managers, scientific workers, teachers and students, and social public concerning themselves with social development and disaster reduction like to read.

The preface is specially written to the *Atlas*.

Deng Nan
May 28, 2002

编图说明

一、编图的目的和意义

中国是世界上自然灾害最严重的国家之一,灾害种类多,频率高,强度大,影响面广,损失严重。影响中国的主要自然灾害有洪涝、气象、地震、海洋、地质、农业生物和森林灾害等七大类30余种。据初步统计,中国70%以上的人口、80%以上的城市和主要经济产业活动遭受着多种灾害的严重威胁。1949年以来,因灾直接死亡人口61万人,直接经济损失约30 000亿元(按1990年人民币可比价折算,下同);20世纪80年代以来,年灾害损失一般为国内生产总值(GDP)的3%~6%,占财政收入的30%左右,比美、日等国高出数十倍。中国因灾死亡人数近年虽已大幅度减少,但与世界其他国家相比仍较严重,1990~1995年,中国年均死亡6 772人,居世界第5位。

据研究,21世纪初,中国自然灾害将进一步趋于严重,对社会经济发展的影响将更加广泛、深远,而减灾能力却难以大幅度提高,故需调动各方面的力量进行综合减灾,使减灾成为社会各界的共同责任,推动减灾社会化。

为了减轻自然灾害损失,保障国家经济建设和社会可持续发展,必须研究灾害的自然与社会双重属性,认识中国自然灾害的时空分布特点和发生、发展规律,并从自然与社会两个方面采取措施减轻灾害。要做到这些,最重要的一点是提高全社会的减灾意识与减灾能力,动员社会各方面参与减灾事业,推动减灾社会化、产业化。要达到这一目的,除了进行深入的自然灾害与社会问题研究外,还必须采取通俗的、大众喜闻乐见的形式进行灾害与减灾知识的科学普及和教育。

为此,在人类跨入新世纪之际,在科学技术部、中国21世纪议程管理中心的领导下及中国灾害防御协会的支持下,由科技部国家计委国家经贸委灾害综合研究组组织中国地震局、中国气象局、国土资源部、国家海洋局、水利部、农业部、林业部、中国科学院及一些大专院校的专家共同编制了这部《图集》,旨在以图文结合的形式展示中国自然灾害的灾情与基本规律,论述自然灾害对社会经济和可持续发展的影响,总结新中国成立以来取得的减灾成就,展望未来自然灾害发展趋势,并提出相应的减灾对策。希望能引起社会各界的广泛关注,以期在提高全社会减灾意识与减灾能力的基础上,将中国的减灾事业提高到一个新的水平,为保障中国社会经济建设安全,促进可持续发展发挥作用。

二、编创过程

1. 立项过程

自1989年,国家科委国家计委国家经贸委自然灾害综合研究组(简称三委自然灾害综合研究组。1999年更名为科技部国家计委国家经贸委灾害综合研究组,简称三部委灾害综合研究

组)成立以来,在原中华人民共和国科学技术委员会、国家发展计划委员会、国家经济贸易委员会领导下和原国家地震局、国家海洋局、中国气象局、中华人民共和国水利部、中华人民共和国地质矿产部、中华人民共和国农业部和中华人民共和国林业部的共同支持下,“八五”期间对中国各类重大自然灾害的灾情、特点、规律进行了系统的调查研究,提出了社会减灾对策。“九五”期间,又在上述各部门和中国21世纪议程管理中心的领导支持下,进行了中国综合减灾能力的调研和城市与农村示范区减灾工作的推动及灾害等级和灾情统计标准化研究及灾害态势分析工作。在中国人民保险公司支持下,开展了中国自然灾害区划与保险区划研究与制图。先后编著与合著了《中国重大自然灾害及减灾对策》(总论、分论、年表)及《中国灾害研究丛书》和《中国减灾社会化的探索与推动》等20多部有关自然灾害与社会的科学著作,编制了比例尺为1:600万的7大类自然灾害的灾害分布图和《中国自然灾害保险风险系列图》。之后,本组研究课题又得到了科学技术部与中国21世纪议程管理中心的支持,列为国家重点科技攻关项目“中国21世纪议程实施能力建设”之专题“综合减灾与示范”及“中国自然灾害及其对社会经济影响的分布规律研究”和“九五”国家重点科技攻关项目“中国可持续发展信息共享示范”研究。同时在马宗晋院士指导下,由广东华组织有关专家,充分汇总了三委自然灾害综合研究组及有关部局的相关资料和国家统计局及民政部的大量统计资料,进行了系统分析、评估和综合研究,编写出版了专著《灾害·社会·减灾·发展——中国百年自然灾害态势与21世纪减灾策略分析》。同时开展了《中国重大自然灾害与社会图集》的研究与编图工作,首先对我国各类自然灾害的灾情资料进行了汇总和可比性数字化处理,对各类自然灾害的区域危险性、危害性进行了评估,在充分认识各类自然灾害的活动程度、时空分布规律和对社会经济危害程度的基础上,提出了减灾系统工程对策。在此基础上,为了易于读者阅读、利于社会传播和便于民众普及教育,由广东优秀科技专著出版基金会资助,在广东科技出版社大力支持和广州地理研究所的精心协助下,探索出了图文并茂的《中国重大自然灾害与社会图集》之表达方式,该表达方式既是传统学术专著形式的改革,更是专题地图表示方法的一种创新。

2. 编稿图的创作

编稿图的创作分三个步骤进行:

(1) 根据《图集》的宗旨与要求,经多部门专家反复酝酿与讨论,1998年6月由马宗晋院士提出了编图纲要,据此,高庆华设计了编图计划,并具体拟定了8编120组图的具体内容和图式及编图要求。要求每一组图反映或论述一个有关灾害或减灾的主题内容,一般由一张主图和若干张插图、附表及文字说明组成,同时提供数据表。在刘惠敏、苏桂武协助下,组织有关部门的专家从1999年3月开始了编稿草图(或原图)的创作。分工

与完成编图情况如下:

洪涝灾害编图组 吕娟、郭树、周魁一。编创了洪水灾害与减灾图6组。

气象灾害编图组 张宝元、李翠金。编创了气象灾害与减灾图6组,并为减灾环境图提供了资料。

地震灾害编图组 李志强、聂高众、刘惠敏、曲国胜、李亦纲、高建国、陈建英。编创了地震灾害与减灾图8组。

地质灾害编图组 张业成、张春山、高庆昭、胡景江、张梁、王景明、葛中远等。编创了地质灾害与减灾图8组。

海洋灾害编图组 杨华庭、张春山。编创了海洋灾害图3组。

农业生物灾害编图组 张克诚、叶志华、程延年、冯玉香、程登发。编创了农业灾害与减灾图4组。

森林灾害编图组 刘开玲、赵文霞、张锡洋。编创了森林灾害与减灾图5组,并为减灾环境图提供了资料。

中国历史时期自然灾害编图组 毕子威、高庆华、张业成、胡景江、苏桂武。编创了反映隋唐以前、隋唐、宋、元、明、清、中华民国时期自然灾害分布及中国自然灾害历史演变特征的8组图。

综合编图组 负责人高庆华、张业成。该组分工如下:张业成、高庆华、张春山、胡景江、李祥根、高庆昭、张梁等编创了减灾环境图10组,自然灾害损失程度图7组,全国自然灾害概况及自然灾害对社会影响图15组,灾害风险预测图3组,减灾能力分析图4组,减灾社会化管理图10组。高建国承担了重大灾分布、灾害对社会经济影响、抗灾救灾分级标准及四川广元减灾示范等有关图件的编创任务,为历史灾害、抗灾救灾等图组提供了资料。陈建英编创了世界灾害分布图和中国减灾现状图4组。聂高众编创了灾害信息系统图 and 立法现状图。

要特别感谢的是中国科学院的周成虎、崔承禹、王超、朱博勤,国土资源部的李光伟,湖北地震局的谢广林,中国人民保险公司的富重光和四川省广元市救灾办公室的有关同志,他们为编创本图集,提供了宝贵资料。为了使《图集》更加通俗、生动,具有可读性,还转载了一些期刊、图册、画册上的照片,对原作者在此一并致谢。

1999年9月25日,各组按计划提交了编稿草图。

(2) 1999年9月26日开始,由高庆华等首先进行了《图集》总体结构与图序的设计,然后对编稿草图进行了筛选、重组、审核、修改和增补。为了说明中国自然灾害的减灾环境、各类自然灾害的灾情和历史概况、灾害对社会经济的影响、中国未来的灾害风险、中国减灾已取得的巨大成就和中国的减灾能力以及减灾对策等,将作者提供的大量编稿草图,汇编为8编100组图,形成了编稿图的第一稿。

(3) 编图、协编和出版三方于1999年10月中旬对编稿图第一稿进行了协调、审查,并细化了编图规范和图式。此后,在高庆华领导组织下,同张业成、刘惠敏、苏桂武、陈建英等对编稿图第一稿再次进行实际资料的审核、精选,根据出版要求,重新整合为72组图,高庆华等撰写了编图说明和各编图说明,并由沈德富译成英文,形成了编稿图第二稿。

(4) 2000年9月广东科技出版社汪伯延及广州地理研究所刘慧屏、叶树宁、许剑清等对编稿图第二稿进行了审阅与整编,整理成序编和6个专题编,共57个图组,由主编马宗晋、高庆华审定,形成了编稿图第三稿。此后又经作者、统编、协编、主编与责任编辑反复研究,三易其稿后,于2003年3月完成了出版底图。

3. 专题地图的制作

本《图集》是一本集科学性和科普性于一身的综合性专题图集。其包含的信息量十分庞大,覆盖面非常广阔,信息源的渠道众多,编制过程较为复杂。为了既形象直观,又系统地、综合地反映我国各种自然灾害的特点、分布规律及其区域差异,以新颖、独到和引人入胜的方式,为广大读者提供所需的有用信息,依照图集总体设计的要求和科学性、实用性、艺术性的原则,对图集资料的准确性、现实性、底图和比例尺系统的选择,版面配置,表示方法等各方面进行了反复审核和试验。

(1) 审稿与定稿

本《图集》专题内容广泛,参与编辑的专家面广、专业多,编稿草图采用的原始资料详略不一。为此,制作编稿图时对上述问题进行了审定:①资料的可靠性、现实性;②地图、照片、图表和文字内容、指标是否正确适宜;③计量单位及表示方法是否符合标准,是否与国际接轨;④专题内容的表示及其与地理要素的配置关系是否正确和清楚;⑤制图单元和图例设计是否合理;⑥表示方法的逻辑性和艺术性。通过审定,对编稿原稿进行了筛选和补充,图表统计资料一般都补充到2000年。

(2) 版面总体设计

本《图集》的特点是地图、表格、照片和文字说明共存,内容丰富多样,层次复杂多样。全《图集》共分编、图组、图幅3个等级,其中编、图组都有表达主题的编名、图组名。按系统性、合理性和统一协调性的原则,对编、图组、图幅的排列顺序作了多次调整,对每个具体图幅的版面设计则注意到了照片、图表、文字说明与地图的相互关系,以最佳的总体效果确定各项内容所占的空间比率和平面位置,使其融合为一个有机的整体。版面既整洁有序、赏心悦目,又不拘一格、灵活多样、生动活泼。

(3) 表示方法

为保证《图集》的系统性和统一协调性,对《图集》的底图比例尺系统,地理要素的选取,各级标题的字体、字号、色彩和图、表、照片,文字的标题均经多次制作试验作统一规定。

1) 底图系统

《图集》中的中国地理底图均为双标准纬线等角圆锥投影,其国界系按照中国地图出版社1996年4月第2版1:400万《中华人民共和国地图》绘制,香港、澳门特别行政区和重庆直辖市界线均按最新资料制作。为更恰当、更合理地展示图集专题内容,本《图集》采用了以下比例尺系统:主图组(展开页)为1:1 500万,历史图组为1:2 400万,小于单页图幅为1:3 000万;小1/4页图幅为1:6 500万和1:5 000万。

2) 底图地理要素选取

地理要素中水系等是底图的骨架,对底图和专题内容起着决定性的作用,是展示各种自然灾害分布规律的依据。对不同比例尺系统的图幅,在水系、地名等各种地理要素的选取上,采用了详略程度不同的标准。历史图组的底图要素,特别是水系名称、地名等,采用了古今同时标名,以便于对照。对反映区域性或局部地区自然灾害的图幅,则绘制了专用底图。南海诸岛在中国地图上一般都以附图的形式配置在图幅的右下角,但为提高阅读效果,在条件许可情况下,尽量不以附图的形式出现,显示我国疆域的完整性。

3) 专题内容的表达

随着计算机制图技术水平的不断提高,各种新颖独到的表示方法正逐渐影响着传统的地图集专题内容的表达。本图集所显示

的专题内容类型多,范围广,统计指标复杂,表达专题内容的方式多。根据这一特点,我们在表示方法的设计上,既保持一些传统的优秀表示方法,又试用了部分动感的创意手段,尽可能使图例符号更加形象生动,以增强感染力;对柱状、圆形、扇形、饼状等各种结构性图形,试用变形、重组或突出等手法,创建新的类型;增加线划注记的种类,采用丰富的色彩组合和变化模式,加强色彩的立体和动感效果;对统计分级面状设色,除保持传统的普色外,还试用了每个色块由边缘向中心从深到浅逐渐过渡的表现手法以及由低到高版块逐级上升的处理模式,改变传统普色平铺直叙的平淡感觉,增强三维空间的艺术效果。表示方法的改进可提高图集信息的负载量,增强信息传输的效果,加强作品的艺术感染力。

三、主要内容与服务对象

《图集》的主要内容是以自然灾害的自然与社会双重属性作为主要基调,论述中国自然灾害的灾情、特点、规律;分析自然灾害对社会经济和可持续发展的危害和影响;总结新中国减灾工作的成就和减灾能力;预测21世纪初中国自然灾害的发展趋势和灾害风险;提出系统的减灾对策。该图集是一部科学研究成果,系统反映了以下基本观点:

- (1) 中国是世界上自然灾害最严重的国家之一。
- (2) 中国自然灾害种类多、强度大、频次高、损失重、时空分布不均。
- (3) 自古以来,中国各个朝代都遭受着自然灾害的严重危害。
- (4) 自然灾害对社会影响面广,危害日趋严重,是社会进步、经济增长和可持续发展的重大制约因素。
- (5) 中国自然灾害的减灾环境既有自然因素也有社会因素。初步分析,21世纪初期中国将面临严重的自然灾害风险。
- (6) 新中国成立以来,取得了巨大的减灾成就。但面对严峻的灾害形势,亟待提高综合减灾能力。
- (7) 减灾是一项全民参与的社会发展事业。为了更有效地减轻自然灾害,必须进行减灾系统工程建设;推进减灾社会化、产业化,包括监测、预测、预报系统建设;兴建防灾工程与治理生态环境;抗灾、防灾和灾害应急体系建设;高新科学技术应用与减灾科技体系建设;保险与防灾抗损;减灾信息系统建设;减灾立法与减灾规划;灾害综合管理系统建设;国际交流与合作等。

本《图集》编创的最终目的是使社会各界,特别是灾害管理机构和各级领导充分了解我国灾情,从国家安全和可持续发展高度,认识自然灾害对社会经济的危害及减灾的必要性。以期在提高全社会减灾意识和减灾能力的前提下,实施科学的减灾对策,实现经济建设和减灾同步发展。遵照“减负等于加正”的经济学法则,将减灾作为新的经济增长点。保障人民生命财产安全和社会安定,实现我国可持续发展的宏图大业。

本《图集》尽管采用图和表等形象易懂的形式,但并不是一本一般灾害知识的普及读本,编创时注意了内容专业性 with 形式普及性的结合。其内容涉及领域的广度几乎包含了灾害与减灾的所有问题。在灾害科学研究的深度上,已从灾情调查、资料统计阶段,提高到了对灾害危险性、灾害危害性、灾害风险分析评估的新阶段。并提出了自然灾害双重属性、自然灾害系统、灾变、灾度、灾害风险、灾害区别、综合减灾系统工程、减灾综合能力评估和减灾社会化、产业化等一系列新概念、新思维。对从事灾害科学研究和减灾管理人员也将有所启迪。

本《图集》不仅是三部委灾害综合研究组多年来对自然灾害调查研究成果的汇集、综合与发展,而且集中了多部门、多学科许多专家的最新资料和最新研究成果,基本上反应了中国自然灾害的状况、中国减灾的现状和21世纪初中国减灾的策略;基本展示了中国目前自然灾害科学的研究水平,并作了前瞻性的探索。可以供国内外从事减灾的各界人士参考,有利于进一步加强国内与国际交流与合作,共同推动我国及国际减灾活动的开展,使21世纪的世界更安全、更美好。

四、问题与展望

《图集》的内容跨越自然科学与社会科学两大体系,涉及地质学、地震学、地理学、气候气象学、海洋科学、水科学、农业科学、森林科学、环境科学、地球科学、天文学以及经济学、统计学、保障学、社会学、管理学等诸多方面。中国地域广大,历史悠久,因此,对灾害与社会有关的资料收集工作量极为庞大,虽然动员了七大灾害管理部门的专家同心协力进行了十几年的调查研究,但遗漏仍难避免。特别是许多地区缺乏或根本没有原始记录,就使得地区之间对应资料的完整程度差异很大。尤其需要指出的是缺乏西藏自治区、台湾省、香港特别行政区、澳门特别行政区的大部分灾情资料,这是本《图集》的一个不足。

中国自然灾害种类多,长期以来处于分类研究和分部门管理的局面。不仅在对各类灾害的研究内容、研究深度上差异很大,而且没有统一的灾情统计标准,致使各部门、地方和国家灾害统计资料不统一,这无疑增加了综合研究的难度,影响了综合研究成果的深度。这是我国灾情统计一个亟待解决的问题。为此,本《图集》使用的资料基本上是统计系统或其他专业部门的权威性资料。但在少数情况下,如“文化大革命”的十年,由于没有国家统计资料,使用了一些单位或个人资料予以补充。

减灾能力的区域评价是本《图集》的一项创新成果,并且在评价指标体系中对工程性与非工程性减灾能力都作了全面的评价。但其基础数据来自不同途径,在防灾工程方面,采用的是其设计能力,对现在的实际能力没有进行现场考察;在非工程性方面采用的是抽样统计资料。因此,关于我国减灾能力的评估是亟待开展的一项庞大的、基础性的调查研究工作,本《图集》只是初步反映了一个梗概的轮廓,详细的调研工作有待进一步完成。

灾害风险评价是制定减灾对策和社会经济发展规划的基础,其主要评价指标是未来灾害的危险性预测、未来社会承灾体的脆弱性预测及未来减灾能力和社会经济状况预测,这些问题都是世界性的难题。近年来,三部委灾害综合研究组及许多部门的专家虽对这些问题进行了大量的研究与探索,但均未达到十分精确的程度,综合预测预报仍是灾害科学今后一项重要的研究课题。

综前所述,本《图集》是在多部门、多学科的几十位专家共同努力之下完成的。由于部门、学科不同,在成果反映的形式和风格上各不相同,虽然在编辑过程中经多次统编、加工、修改,但仍有未完全协调之处。

值得指出的是,存在的问题和不足之处,也是我国灾害科学研究和减灾工作的薄弱环节。正是由于存在这些问题和不足,恰好从另一个侧面反映了灾害科学研究与实践具有广阔的发展前景。我们相信,通过社会各界,特别是灾害管理人员、灾害科研人员及各级领导,充分了解和高度重视我国自然灾害以及灾害科学与减灾工作存在的问题和不足,并采取有力措施,加强这些方面的工作,定能促进我国社会减灾事业和灾害科学跨上一个新台阶,为我国社会安定、繁荣和可持续发展作出更大贡献。

EXPLANATION OF THE ATLAS COMPILATION

I. Purposes and Meanings of the *Atlas* Compilation

China is one of the countries affected by natural disasters most seriously in the world. The natural disasters are of many types, high frequency, and high intensity. They have had extensive effects and caused great losses and damages. There are more than 30 kinds of seven types of major natural disasters in China, such as floods-waterlogging, meteorological disasters, earthquake hazards, sea disasters, geologic hazards, agrobiohazards, and hazards to forests. A preliminary statistics shows that more than 70% of population in China and more than 80% of cities and main economic and industrial centers are severely threatened by many types of disasters. Since 1949, disasters have directly killed 610 000 people and caused direct economic losses of about 3 000 billion yuan (at 1990 RMB constant prices, the same hereinafter). Since 1980s, annual losses caused by disasters are generally 3%-6% of gross domestic product (GDP) or around 30% of revenue, tens times more than those in the United States and Japan. Number of deaths caused by disasters is also larger than that in most other countries, though it has largely reduced in the last years. During 1990-1995, annual average number of deaths due to disasters is 6772 in China, occupying 5th place in the world.

A study indicates that natural disasters will tend to be further heavy in China in the early 21st century and their impacts on social-economic development will be more extensive and far-reaching. But the disaster reduction capability is hard to be largely improved. Therefore, it is necessary to mobilize all forces to undertake an integrated disaster reduction and to hold all the levels of society collectively responsible for it, so as to promote the socialization of disaster reduction.

In order to reduce the losses from natural disasters and to ensure the national economic construction and the sustainable development of society, it is necessary to study both natural and social attributes of natural disasters, to understand the temporal-spatial distribution characteristics of natural disasters in China and the regularities of their generation and development, and to take measures for disaster reduction in natural and social aspects. For accomplishing these works, it is important to improve the disaster reduction awareness and disaster reduction capability of the whole society, to mobilize all levels of society to take part into disaster

reduction undertakings, and to promote the socialization and industrialization of disaster reduction. In order to attain this purpose, it is necessary to take the popular, people-loved forms for popularization and education of scientific knowledge of disasters and disaster reduction, in addition to in-depth study of natural disasters and social problems.

For this purpose, as mankind enters the 21st century, the Integrated Research Group on Disasters under Ministry of Science and Technology, State Development and Planning Commission, State Economic and Trade Commission of PRC has organized experts from China Seismological Bureau, China Meteorological Administration, Ministry of Land and Resources, Ministry of Water Resources, State Oceanic Administration, Ministry of Agriculture, Ministry of Forestry, Chinese Academy of Sciences, and universities and colleges to jointly compile the *Atlas* under the leadership of Ministry of Science and Technology and the Administrative Center for China's Agenda 21 and under the support by China Association for Disaster Prevention. The *Atlas* is aimed at illustrating the effects and the basic regularities of natural disasters in China in the form of maps and graphics in combination with texts, treating the impact of natural disasters on society, economy and their sustainable development, summing up the achievements in disaster reduction scored since the founding of People's Republic, prospecting the development trend of natural disasters in the future, and suggesting the relevant disaster reduction strategy. It is wished that the *Atlas* could attract many attentions of all circles of the society and expected that on the basis of improving the public awareness of disaster reduction and the capability for disaster reduction, the disaster reduction undertakings will certainly attain a new level and will play its role in ensuring safe social-economic construction in China and advancing the sustainable development.

II. Process of the *Atlas* Compilation

1. Setup of the *Atlas* compilation project

In 1989, after the organization of the Integrated Research Group on Natural Disasters under the State Science and Technology Commission, State Planning Commission and State Economic and Trade Commission (called the Integrated Research Group on Natural Disasters under Three Commissions for short, and re-

named the Integrated Research Group on Natural Disasters under Ministry of Science and Technology, State Development and Planning Commission, State Economic and Trade Commission of PRC (in 1999), under the leadership of former State Science and Technology Commission, State Planning Commission and State Economic and Trade Commission and under the joint support by former State Seismological Bureau, State Oceanic Administration, China Meteorological Administration, Ministry of Water Resources of PRC, Ministry of Geology and Mineral Resources of PRC, Ministry of Agriculture of PRC, and Ministry of Forestry of PRC, during the 8th Five-Year Plan the Integrated Research Group has carried out a systematic study of the effects, characteristics and regularities of various types of major natural disasters in China and suggested a social disaster reduction strategy. During the 9th Five-Year Plan, under the leadership and support again by the mentioned-above departments and the Administrative Center for China's Agenda 21, the Integrated Research Group has carried out studies on "Integrated Disaster Reduction Ability of China", "Pushing the Disaster Reduction Work in Urban and Rural Demonstration Zones Forward", and "Gradation of Disasters, and Statistic Standardization for Counting Disaster Effects and Analysis of Disaster Situation and Tendency". Under the support by People's Insurance Company of China, the Integrated Research Group has developed study and mapping of natural disasters regionalization of China and disaster insurance regionalization of China. More than 20 scientific works on natural disasters and society responding to them, such as *Major Natural Disasters and Disaster Reduction Strategies in China: Introduction, Special Topic Parts and Chronological Table, Serial Books of Research on Disasters in China, Probing into and Promoting Socialization of Disaster Reduction in China*, etc. were successively compiled and co-written and 7 types of natural disasters were mapped to be the *Map of Distribution of Disasters in China* on scale 1 : 6 million and *A Series of Maps of Risk Insurance Against Natural Disasters in China*. Later, the disaster research projects supported by the Ministry of Science and Technology and the Administrative Center for China's Agenda 21, were adopted as the special topics "Integrated Disaster Reduction and its Demonstrations" and "Study on the Distribution Regularities of Natural Disasters and Their Impact on Society and Economy in China" under the National Key S&T Research Projects "Establishing the Capacity for Implementation of the 21st Century Agenda in China" and as a National Key S&T Research Project "Demonstration of Sustainable Development Information Share in China" during the 9th Five-Year Plan. Under the direction of academician Ma Zongjin, a group of experts organized by Gao Qinghua fully assembled available data from the Integrated Research Group on Natural Disasters under Three Commissions, relevant ministries and bureaus and a large amount of statistic data from State Statistical Bureau and Ministry of Civil Affairs. After a systematic analysis, evaluation and integrated study, a monograph

Disasters, Society, Disaster Reduction, and Development: Analysis of the Situation and Tendency of Natural Disasters in China for a Century and Disaster Reduction Strategy in the 21st Century was compiled and published. Meanwhile, study and compilation of the *Atlas of Major Natural Disasters and Society Responding to Them in China* were performed. Firstly, assemblage and comparative digital processing of the disaster effect data of all types of natural disasters in China were performed and then the regional risks and hazardousness of various disasters were estimated. A disaster reduction systematic engineering strategy was suggested on the basis of full understanding of the regional activities of all types of natural disasters, their temporal-spatial distributions and their damages to society and economy. Based on these works, for the convenience of reading, to the benefit of spreading to the society and disseminating to public compulsory education, with the funding by the Excellent Science-Technology Works Publication Foundation of Guangdong Province, under energetic support by Guangdong Science and Technology Press and meticulous assistance of Guangzhou Institute of Geography, an expression style of the *Atlas of Major Natural Disasters and Society Responding to Them in China* with excellent maps, graphics and text was formulated. This expression style is a reform of traditional style of scientific works and is an innovation of expression of special-topic maps.

2. Creation of Draft of the Maps

Creation of draft of the maps was performed in three steps.

(1) According to the purpose and requirements of the *Atlas* and after repeated talks and discussions by experts from many departments, academician Ma Zongjin drafted a program of the *Atlas* compilation in June 1998. Based on the program, Gao Qinghua worked out a plan of the *Atlas* compilation and drew up the concrete contents and patterns of 120 sets of maps and graphics for 8 parts and requirements for the compilation. Each set of maps and graphics should reflect and demonstrate its topic contents of one related disaster and consists generally of one main map and some supplementary maps and graphics and explanatory text with data lists. The experts from relevant departments were organized in assistance of Liu Huimin and Su Guiwu and started to create the drafts of the maps (or original maps) from March 1999. The compilation work was divided up and performed as follows:

Group for Compilation of Flood Disaster Maps: Lu Jian, Guo Shu and Zhou Kuiyi compiled 6 sets of maps of flood-waterlogging disasters and disaster reduction.

Group for Compilation of Meteorological Disaster Maps: Zhang Baoyuan and Li Cuijin compiled 6 sets of maps of meteorological disasters and disaster reduction, which provide the data for mapping of environment for disaster preparation.

Group for Compilation of Earthquake Hazard Maps: Li

Zhiqiang, Nie Gaozhong, Liu Huimin, Qu Guosheng, Li Yigang, Gao Jianguo, and Chen Jianying compiled 8 sets of maps of earthquake disasters and disaster reduction.

Group for Compilation of Geologic Hazards Maps: Zhang Yecheng, Zhang Chunshan, Gao Qingzhao, Hu Jingjiang, Zhang Liang, Wang Jingming, Ge Zhongyuan et al. compiled 8 sets of maps of geologic hazards and their reduction.

Group for Compilation of Sea Hazards Maps: Yang Huating and Hu Jingjiang compiled 3 sets of maps of sea hazards.

Group for Compilation of Agrobiohazards Maps: Zhang Kecheng, Ye Zhihua, Chen Yanning, Feng Yuxian, and Chen Dengfa compiled 4 sets of maps of agrobiohazards and their reduction.

Group for Compilation of Maps of Hazards to Forests: Liu Kailing, Zhao Wenxia, and Zhang Xijin compiled 5 sets of maps of hazards to forests and their reduction, which provide the data for mapping environment for the hazard preparation.

Group for Compilation of Maps of Natural Disasters in China in Historical Times: Bi Ziwei, Gao Qinghua, Zhang Yecheng, Hu Jingjiang, and Su Guiwu compiled 8 sets of maps of distributions of natural disasters before the Sui-Tang dynasties (before 581 AD), during the Sui-Tang Dynasties (581-907 AD), during the Song Dynasty (960-1279), during the Yuan Dynasty (1279-1368), during the Ming dynasty (1368-1644), during the Qing Dynasty (1644-1911), and in the period of Republic of China (1911-1949), and map of the characteristics of historic evolution of natural disasters in China.

Integrated Group for Compilation of Maps: Gao Qinghua and Zhang Yecheng in charge. The work for this group was divided up as follows: Zhang Yecheng, Gao Qinghua, Zhang Chunshan, Hu Jingjiang, Li Xianggen, Gao Qingzhao, Zhang Liang, and others compiled 10 sets of maps of environments for disaster preparation, 7 sets of maps of losses and damages from natural disasters, 15 sets of maps of outline of natural disasters and their impacts on society in China, 3 sets of maps of predicted disaster risks, 4 sets of maps of analyzed disaster reduction capabilities, and 10 sets of maps of socialization and management of disaster reduction. Gao Jianguo was responsible for compilation of maps of distribution of heavy disasters in China, impacts of natural disasters on society and economy, standard for grading disaster fighting and disaster relief, and demonstration of disaster reduction in Guangyuan City, Sichuan, which provide the data for compiling maps of historic disasters and disaster fighting and disaster relief. Chen Jianying compiled 4 sets of maps of distribution of disasters in the world and the current status of disaster reduction in China. Nie Gaozhong compiled 4 sets of maps of disaster information system and map of current status of disaster reduction legislation in China.

The compilers are specially grateful to Zhou Chenghu, Cui Chengyu, Wang Chao, and Zhu Boqin of Chinese Academy of Sciences, Li Guangwei of Ministry of Land and Resources of PRC,

Xie Guanglin of Hubei Provincial Seismological Bureau, Fu Chongguang of the People's Insurance Company of China, and the related comrades of the Disaster Relief Office of Guangyuan City, Sichuan Province, for their valuable data for map compilation, and also to those authors, who's photos in journals, atlases, and picture albums are cited for increasing the popularity, vivid description, and readability of the *Atlas*.

(1) The drafts of the maps were completed and handed over by all groups on schedules on September 25, 1999.

(2) From September 26, 1999, a plan of general structure and the sequence of the maps in the *Atlas* were worked up by Gao Qinghua and others. Later, the drafts were selected, reorganized, examined, revised, and supplemented. In order to explain the environment for generation of natural disasters in China, the effects and historical situations of various types of natural disasters and their impacts on society and economy, the future disaster risk in China, the great achievements in disaster reduction, the disaster reduction capability, and the disaster reduction strategies in China, the compiled drafts of the maps were divided into 100 sets of eight parts of the *Atlas*. Thus, the first drafts of the maps in the *Atlas* were formed.

(3) After coordination and examination of the first drafts of the maps by compilers, assistant compilers and publishers and refinement of the compilation standards and the map patterns in middle October, 1999, the actual data in the first drafts were again examined, revised, and carefully chosen by Zhang Yecheng, Liu Huimin, Su Guiwu, Chen Jianying and others under the direction of Gao Qinghua. In accordance with the requirements of publication, all the maps were recombined into 72 sets of 8 parts and the explanations to all sets of the maps were written by Gao Qinghua and others and translated into English by Shen Defu. Thus, the second drafts of the maps were formed.

The second drafts of the maps were again revised and rearranged by Wang Boyan from the Guangdong Science and Technology Press and Liu Huiping, Ye Shuning, Xu Jianqing and others from Guangdong Institute of Geography in September 2000. After the rearrangement and layout of the second drafts of the maps, the *Atlas* consists of an introduction and 6 parts of special topic maps, and was finalized by Ma Zongjin and Gao Qinghua, the compilers in chief. Thus, the third drafts of the maps were formed.

3. Drawing of Base Maps for Publication

The *Atlas* represents an integrated atlas of popular and academic characters with special topic maps. It contains a wealth of information, covering extensive fields and derived from numerous sources. The process of the *Atlas* compilation was considerably complex. For visually and systematically integrated reflection of the characteristics, distribution regularities and regional difference of various natural disasters in China, a new and original, interesting

and absorbing style is adopted for providing necessary and useful information for the reading public. In order to meet the demands of general layout of the *Atlas* and according to the scientific, practical, and artistic principles, the accuracy and reality of the data, choice of base maps and their scale system, layout of printed sheets, representation methods, etc. were repeatedly verified and tested.

(1) Examination and finalization

The *Atlas* has its substantial contents, covering a lot of ground, and was compiled by the experts in many professional fields and based on different details and omissions of original data. Accordingly, the following problems were examined during layout of the pictures and text: the reliability and reality of the data; the correctness and suitability of the contents and indexes in the maps, photos, graphics and text; whether the weight and measure units and their representations are standardized and are in the line with international metric system; correct and clear expression of topic text and its relation to geographic elements; whether the cartographic units and legends are rational; the logicity and artistry of the representation. After the examination and finalization, the original drafts were chosen and added and the graphics and statistic data were added with the data up to 2000.

(2) General layout of maps and text

The *Atlas* is characterized by the coexistence of maps, graphics, photos and their explanations, substantial and diversified contents, and complex and multiple hierarchies. The whole *Atlas* embodies three levels of its contents, i.e. parts, sets of maps and sheets. Of them each part and each set of maps have their own names expressing their topics. According to the principles of systematization, reliability and unified harmony, the order of layout of parts, sets of maps, and map sheets were adjusted many times. In layout of the sheets, we paid attention to keeping the interrelation between photos, graphics and explanations to the maps, in order to determine the spatial ratio between contents and plane location with optimal general effectiveness, so as to form an organic whole and to keep the space of a whole page clean and tidy, pleasing to the eye and the mind, not limited to any one form, flexible and diversified, vivid and vigorous.

(3) Representation method

For ensuring the systematization and unified harmony of the *Atlas*, the scale system and geographic elements of base maps in the *Atlas*, typeface and its size of the third-level headline, colors and maps, graphics, photos, and titles of text were chosen and tested many times and then were put in a unified regulation.

1) System of base maps. The geographic base maps in the *Atlas* are of a double-standard latitude equiangular-conic projection. The national boundaries are based on the Geographic Map of People's Republic of China on scale of 1:4 million (second edition) published in April 1996, in which the boundaries of Hong Kong and Macao special administrative regions and Chongqing Municipality directly under the Central Government were drawn from the latest

data. For more appropriate and reliable demonstration of the special topic contents in the *Atlas*, the following scale system is used in layout of the *Atlas*: the subject maps (unfolded page) is on scale 1: 15 million; set of maps of historical data is on scale 1: 24 million; map sheets less than single page are on 1:30 million and those less than 1/4 page are on 1: 65 million and on 1: 50 million.

2) Choice of geographic elements for base maps. The geographic elements, such as water system etc., are the frame of the base maps, play a deciding role in the base maps and contents of special topics, and provide a basis for demonstrating the distribution regularities of various natural disasters. In the sheets on different scales, the geographic elements for water systems and geographic names were chosen with different details and omissions. The elements in set of maps of historic data, especially for water systems and geographic names, their current and ancient names are together shown for convenient reference. For the sheets reflecting regional or local natural disasters, the special-purpose base maps were drawn. The Chinese islands region in the South China Sea is usually shown as an insert located at the right-lower corner of the geographic map of China, but for achieving good effectiveness in reading, the region is shown in its original place as far as possible, indicating the integrity of China territory.

3) Representation of the contents of the special topics. With raising the level of computerized cartographic technology, various new distinctive representation methods were suggested and gradually replaced the traditional representations of contents of special topic maps in the *Atlas*. The contents of special topic maps in the *Atlas* are of many types and in various fields, and are complex in statistic indexes. Accordingly, in design of their representations, we keep some excellent traditional representation methods and tentatively use several new-created legends and symbols for visually and vividly expressing columnar, circular, sector and cake-shaped structural patterns in order to enhance their appeal. Using the deformed, reorganized and stressed marks and linear labels to enrich the combination of colors and changing patterns, so as to increase the coloring stereoscopic and moving effectiveness. For statistically graded zones, in addition to keep some traditional coloring, a gradual transitional representation skill, i.e. coloring from dark shade at edge to light shade at the center of a color block and a step-by-step rising shading, is used for replacing the flat-style, pedestrian traditional coloring skill and increasing the three-dimensional spatial artistry.

III. Main Contents and Intentions of the *Atlas*

The essentials of the contents in the *Atlas* are the keynote that the natural disasters have dual attributes, the natural and societal attributes. In the *Atlas*, the effects, characteristics and regularities of natural disasters are described, the damages from and impacts of natural disasters on society, economy and their sustainable deve-

lopment are analyzed, the achievements in disaster reduction and the capability for disaster reduction are summarized, the tendency of development of natural disasters and risk of heavy disasters in China in the early 21st century are predicted, and a disaster reduction strategy is systematically suggested.

The *Atlas* represents a scientific research result and its basic viewpoints are as follows:

1) China is one of the countries affected by natural disasters most seriously in the world.

2) Natural disasters in China are of many types, high intensity, and high frequency, cause great losses, and are unevenly distributed in time and space.

3) From ancient times, China was being badly affected by natural disasters in the feudal dynasties of past ages.

4) The impact of natural disasters on the society was extensive and the damages were increasingly serious. They are the important factors constraining the social progress and economic growth and sustainable development.

5) The environment for generation of natural disasters in China has both natural and social factors. A preliminary analysis indicates that China will face a serious risk of natural disasters in the early 21st century.

6) From the founding of People's Republic, great achievements in disaster reduction were scored in China, but in the face of serious disaster situation, the integrated disaster reduction capability remains to be improved.

7) Disaster reduction is a social development undertaking in which the whole people participates. In order to more effectively mitigate natural disasters, it is necessary to construct a disaster reduction systematic engineering project and to promote the socialization and industrialization of disaster reduction, including setup of monitoring, prediction and warning systems, construction of disaster prevention and control engineering projects and remedying eco-environment, setup of disaster fighting and prevention systems, application of high and new scientific methods and techniques and setup of disaster reduction science-technology systems, insurance and disaster and damage prevention, and disaster reduction information systems, legislation and planning of disaster reduction, setup of integrated disaster management system, and international exchange and cooperation, etc.

The ultimate purpose of the *Atlas* compilation is to make all circles of the society, in particular, disaster managers and leaders of all levels, fully understand the disaster effects in China and perceive the damage from natural disasters to society and economy and the necessity of disaster reduction from viewpoint of national safety and sustainable development, so as to implement a scientific disaster reduction strategy and to realize the synchronous development of economic construction and disaster reduction undertakings at the precondition of raising the awareness of the whole society and improving disaster reduction capability. Following an eco-

nomical rule "minus negative is equal to plus positive", the disaster reduction undertakings may be considered as a new approach to economic growth, ensuring the safety of people's life and property and the social stability, and hence to realize the grand program of sustainable development in China.

The *Atlas* is not a popular reader of general disaster reduction knowledge, although it contains maps, graphics and tables compiled in the form of popular and common imagery expressions. In its creation and compilation, an attention has been paid to a combination of specialty with popularity. It is a result of fairly comprehensive and in-depth study of almost all problems of natural disasters and disaster reduction. After deep scientific research of natural disasters, from the stage of disaster effect investigation and data statistics to the stage of analysis and evaluation of disaster perils, disaster damages, and disaster risks, a series of new concepts and ideas, such as dual attributes of natural disasters, natural disaster systems, catastrophes, hazardousness, disaster risks, disaster regionalization, integrated disaster reduction systematic engineering, evaluation of integrated disaster reduction capability, and socialization and industrialization of disaster reduction, are put forward. It will inspire the persons engaged in scientific research of natural disasters and in management of disaster reduction.

The *Atlas* represents not only a collection and integration of investigation and study results by the Integrated Research Group on Natural Disasters under Three Commissions, but also concentrates the latest data and the research results by many specialists in multiple disciplines from many departments. It basically reflects a general situation of natural disasters in China, current status of disaster reduction in China, and disaster reduction strategy in China in the early 21st century, demonstrates a current scientific research level of disasters, and gives a perspective probe to disaster science. The *Atlas* is intended to serve as a reference for the persons in various fields who are engaged in disaster reduction at home and abroad and is beneficial to further strengthening internal and international exchanges and cooperation and to jointly promoting the development of disaster reduction activities in China and in the whole world, and hence to making the world more safe and more glorious in the 21st century.

IV. Problems and Prospects

The contents of the *Atlas* involve two large scientific systems, natural and social sciences, including geology, seismology, geography, climatology-meteorology, oceanography, hydrology, agronomy, forestry, environmental science, astronomy, and economy, statistics, security science, sociology, management science and others. China is vast in territory and has a long history. Thus, the data concerning disasters and society to be collected are fairly enormous. Although many specialists from seven disaster management departments together investigated and studied for