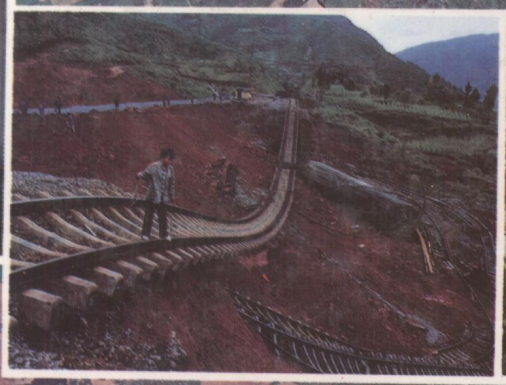
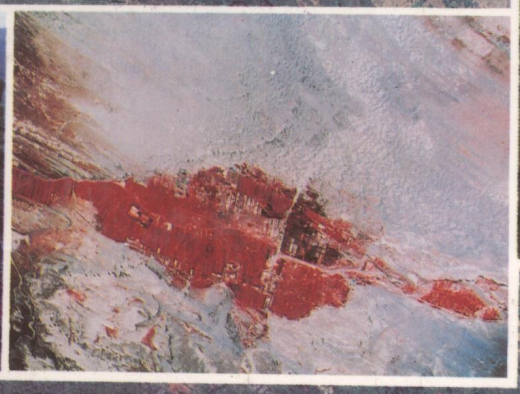
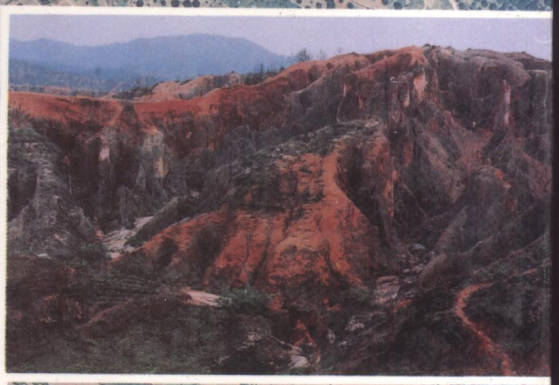
中国地质灾害与防治

GEOLOGICAL HAZARDS IN CHINA AND THEIR PREVENTION AND CONTROL

中华人民共和国地质矿产部
中华人民共和国国家科学技术委员会
中华人民共和国国家计划委员会







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MINISTRY OF GEOLOGY & MINERAL RESOURCES, P.R.C.
STATE SCIENCE & TECHNOLOGY COMMISSION, P.R.C.
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GEOLOGICAL HAZARDS IN CHINA AND THEIR PREVENTION AND CONTROL

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国际减轻自然

灾害十年活动

To International Decade

for Natural Disaster Reduction

天地有灾害
危及亿万民
尤须防治术
科技宜先行

李绪鄂

序

中国地域辽阔，地质条件复杂，地壳运动频繁、强烈，中国又是人口众多的发展中的社会主义国家，因此，地质灾害的监测和防治越来越引起人们的关注。

地质灾害的种类很多，诸如：地震，火山，地裂缝，地下热害，煤田自燃，瓦斯突出，岩爆，崩塌，滑坡，泥石流，地面沉降，地面塌陷，渗透变形，突水突泥，砂土液化，特殊岩土地质灾害，冰川运动，土地冷浸，盐渍化，沼泽化，沙漠化，水土流失，河湖变迁，海洋地质灾害，地下水污染和地方病等。凡直接或间接、已发生或潜在的恶化环境、降低环境质量、危害人类安全及整个生物圈生态发展的地质事件，都属于地质灾害。

地质灾害，有的突然爆发，有的长期缓慢发展，在我国山区、平原和海洋时有发生，且有增多的趋势，都直接或间接影响经济建设，危害人民生命安全和生态平衡。

地质灾害由自然地质作用和人为地质作用形成。人类大规模的经济-工程活动对环境的影响，已具有与自然地质作用相提并论的程度，且发展速度快，影响范围广。由人为作用形成或诱发的地质灾害越来越多。

据统计，我国每年由各种自然灾害造成的直接经济损失约 300～500 亿元。地质灾害（地震除外）造成的直接经济损失至少占上述总损失的四分之一。其中崩塌、滑坡、泥石流、地面塌陷等突发性地质灾害每年造成的损失多达数十亿元，并造成人员伤亡。因此，在我国社会主义现代化建设过程中，保护地质环境、防治地质灾害已成为刻不容缓的紧迫任务。

地质灾害是可以监测、预报的，许多地质灾害也是可以预防和治理的，而且随着科学技术的发展和人类认识能力的提高，对地质灾害的防治能力也必将进一步增强。对地质灾害的监测和防治，既是经济问题又是社会问题，关系到经济发展和社会稳定，因此，我国政府对地质灾害的监测、防治和地质环境保护非常重视，并把环境保护作为一项基本国策。在地质勘查和工程勘查中，都把地质灾害研究作为重要内容，近几年还开展了专门性的地质灾害普查和勘查工作，获得了一批可喜的成果，为地质灾害的监测和防治提供了宝贵的资料。同时，监测和防治的手段、水平也有了新的发展与提高。一九八八年，国务院赋予地质矿产部对全国地质环境进行监测、评价和监督管理的职能。一九八九年一月，由国家科学技术委员会、地质矿产部发起和组织，在十多个部、委、局的大力支持下，召开了首次全国地质灾害防治工作会议，并成立了“中国地质灾害研究会”。一九八九年四月，国家又成立了“中国国家减轻自然灾害十年”委员会。这些工作大大促进了我国对地质灾害的研究和防治。

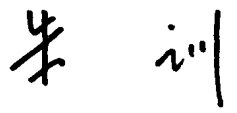
为了进一步推动地质灾害防治的研究，为了让人们了解地质灾害的种类、特征、发生发展规律、严重性和危害性，提高全民族爱护地质环境、保护地质环境的意识，合理地利用地质环境，促进经济发展，造福于子孙后代，特编辑出版《中国地质灾害与防治》图集。

《中国地质灾害与防治》图集，由地质矿产部、国家科学技术委员会和国家计划委员会共同组织编辑。编目以地质灾害种类为主，图（地质图）、片（地面实景、实地像片，航天和航空像片）并重，配以简要文字说明，分十一篇介绍了我国三十一种地质灾害的地质背景、成因、特征、危害程度和防治措施。它是我国第一部全面、系统反映地质灾害的综合性图集，也是我国地质灾害研究的最新成果。图集的出版，不仅可以帮助我们了解我国地质灾害的分布特征和发育规律，而且对于有关方面的教学和科研也具有重要的参考价值，对于指导国土开发、经济建设和环境保护也有十分重要的意义。

谨为之序。

地质矿产部部长

中国地质灾害研究会理事长



PREFACE

China is a country of vast territory with complex geological conditions and frequent, intense crustal movements. China is also a developing socialist country with a large population. It is no wonder in such a country that more and more attention has been given to the monitoring, prevention and control of geological hazards.

There are a great variety of geological hazards, such as earthquake, volcanism, ground cracking, geothermal hazard, coalfield self-combustion, gas burst, rock burst, rockfall, landslide, mud flow, ground subsidence, surface collapse, seepage-induced deformation, water-mud bursting, sand-soil liquefaction, special rock-soil geological hazard, glaciation, cold-soaking of land, salinization, swamping, desertization, soil erosion, river and lake change, marine geological hazard, groundwater contamination and endemics. That is to say, any geological event that has already or is likely to deteriorate, directly or indirectly, the environment, worsen the quality of environment or threaten human safety and the ecological development of the biosphere as a whole should be in the category of geological hazards.

Geological hazards, whether breaking out abruptly or developing progressively in a long run, occur frequently in the mountainous areas or on the plains and seas of our country, increasingly affecting economic construction, endangering people' s lives and destroying ecological balance.

Geological hazards are caused by geological processes, both natural and man-made. The man-made large-scale economic-engineering activities exert an influence almost as much as the natural geological processes do and what is more, they seem to develop at a fast rate and have a wide impact. The geological hazards formed or induced by man's activities are growing in number.

It is estimated that the total annual economic loss made directly by natural disasters in China amounts up to 30—50 billion RMB yuan, out of which at least one fourth comes from geological hazards other than earthguake. Among them, geological hazards of sudden occurrence like rockfall, landslide, mud flow and surface collapse produce a direct economic loss as much as several billion yuan per year, not to mention the casulties involved. This indicates how imperative a task it is to protect the geological environment and to prevent and control the geological hazards during our socialist modernization construction.

Geological hazards can be monitored and forecast, and many of them can even be prevented and controlled. And it is definite that the ability to prevent and control them will be further improved with the advancement of science and technology and the accumulating knowledge of mankind. Monitoring, prevention and control of geological hazards are not only an economic problem but a social problem as well, for they are in association with economic development and social stability. It is for this reason that the Chinese Government has attached great importance to this problem as well as to the geological environment protection, and has taken environment protection as one of its basic national policies. The study of geological hazards has already been accepted as an important part of any geological and engineering explorations, and specialized geological hazard survey and exploration have been conducted separately in the last few years. All these efforts have led to encouraging achievements and valuable information useful to the geological hazard monitoring and control work. In the meantime, new developments and advancements have been attained in monitoring and control techniques.

In 1988, the Ministry of Geology and Mineral Resources was conferred by the State Council the authority to monitor, assess and supervise the geological environment across the country. Then in January, 1989, under the sponsorship and organization of the State Science and Technology Commission and the Ministry of Geology and Mineral Resources and in close collaboration and under energetic support of more than 10 ministries, committees and bureaus, the First National Conference of Geological Hazard Prevention and Control opened, at which the founding of the China Research Society of Geological Hazards was proclaimed. Finally in April, 1989 the Chinese Committee of National Decade of Disaster Reduction was established. All these events have substantially promoted the geological hazard study and control work in China.

This pictorial book — "Geological Hazards of China and Their Prevention and Control" is published in the hope of further promoting the study of geological hazards and helping the readers understand their types, characteristics, occurrence and development, seriousness and harmfulness, so as to raise the whole nation's awareness of treasuring, protecting, reasonably utilizing and scientifically reforming the geological environment in favor of economic development and benefits of future generations.

This book is compiled under the organization of the Ministry of Geology and Mineral Resources, the State Science and Technology Commission and the State Planning Commission. It is concentrated on the variety of geological hazards illustrated by maps (geological maps) and photograghs (terrestrial, aerial and aerospace images) alike and accompanied by brief explanations to expound, in 11 chapters, the geological background, origin, characteristics, hazardousness and remedy measures to be taken for 31 geological hazards. It is an inclusive pictorial book, the first one ever published in China that is devoted to a comprehensive and systematic discussion of geological hazards. Also, it is a collection of latest achievements obtained thus far in China in this field. This publication not only gives the readers an insight into the distribution and development of geological hazards, but can as well be regarded as a worthy reference book for professional faculties and researchers and particularly, it is of considerable significance in guiding land planning, economic construction and environment protection.

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Minister of Geology and Mineral Resources
Chairman of China Research Society of Geological Hazards

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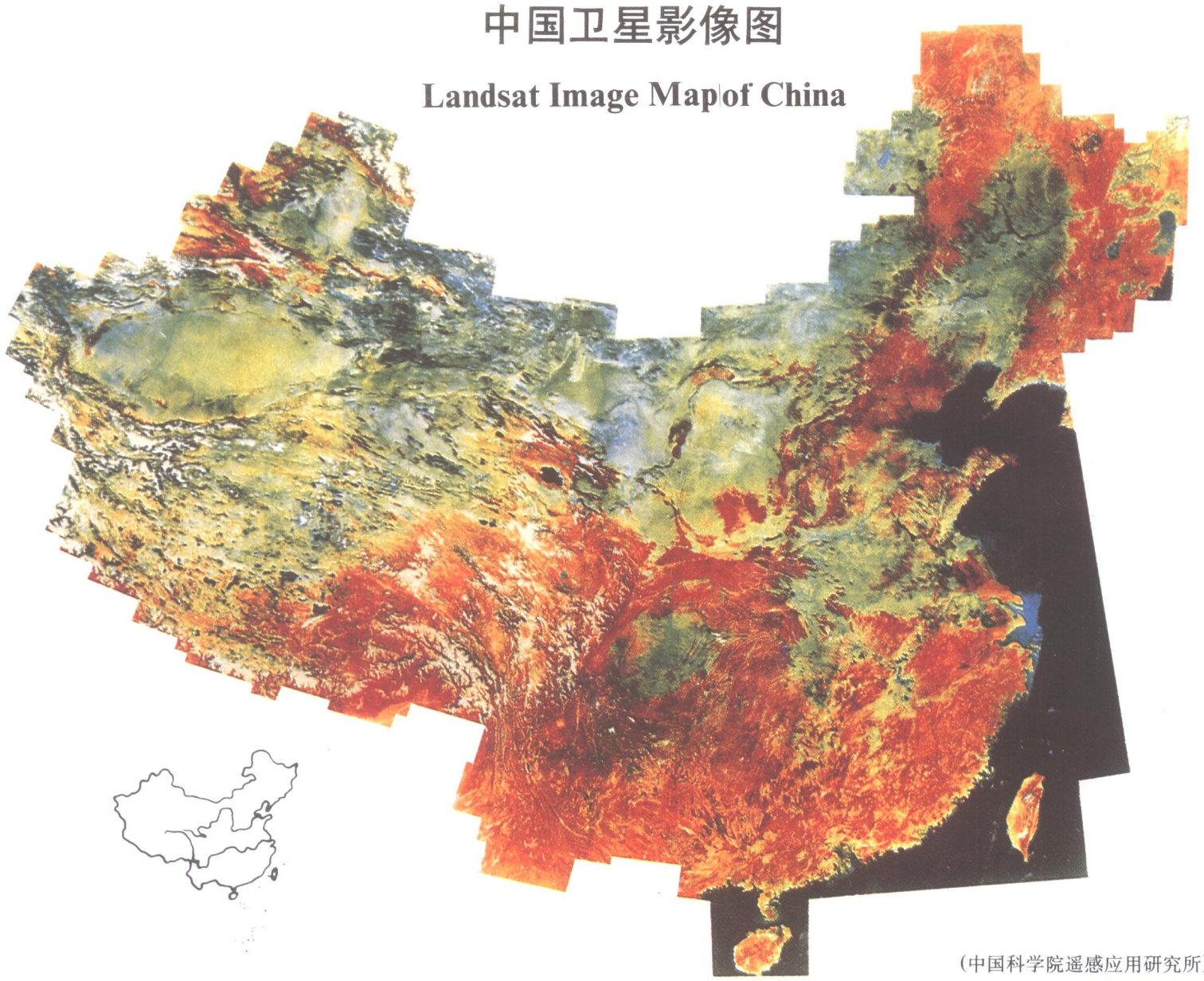
中国卫星影像图

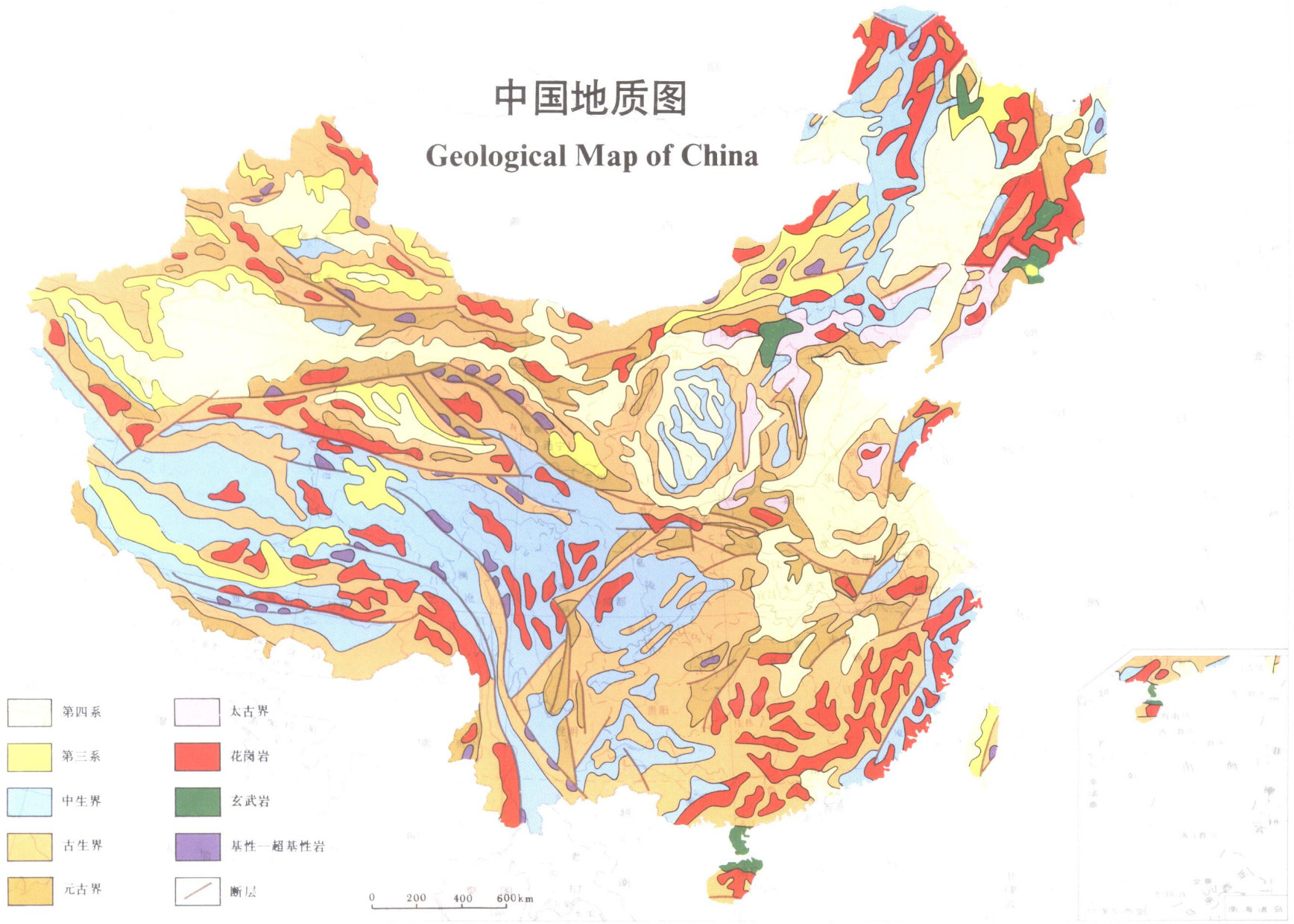
Landsat Image Map of China



（中国科学院遥感应用研究所）

中国地质图

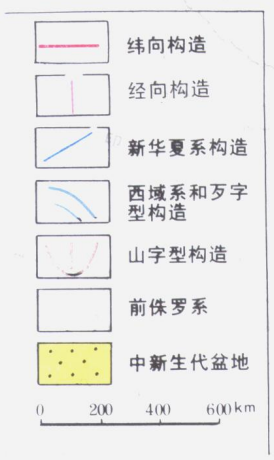
Geological Map of China



（据中国地质学会耿树方、范文贤，地质出版社）

中国现今活动的主要构造体系图

Map of Major Active Tectonic Systems of China



（中国地质科学院城市与工程场地稳定性研究中心，1989 年）

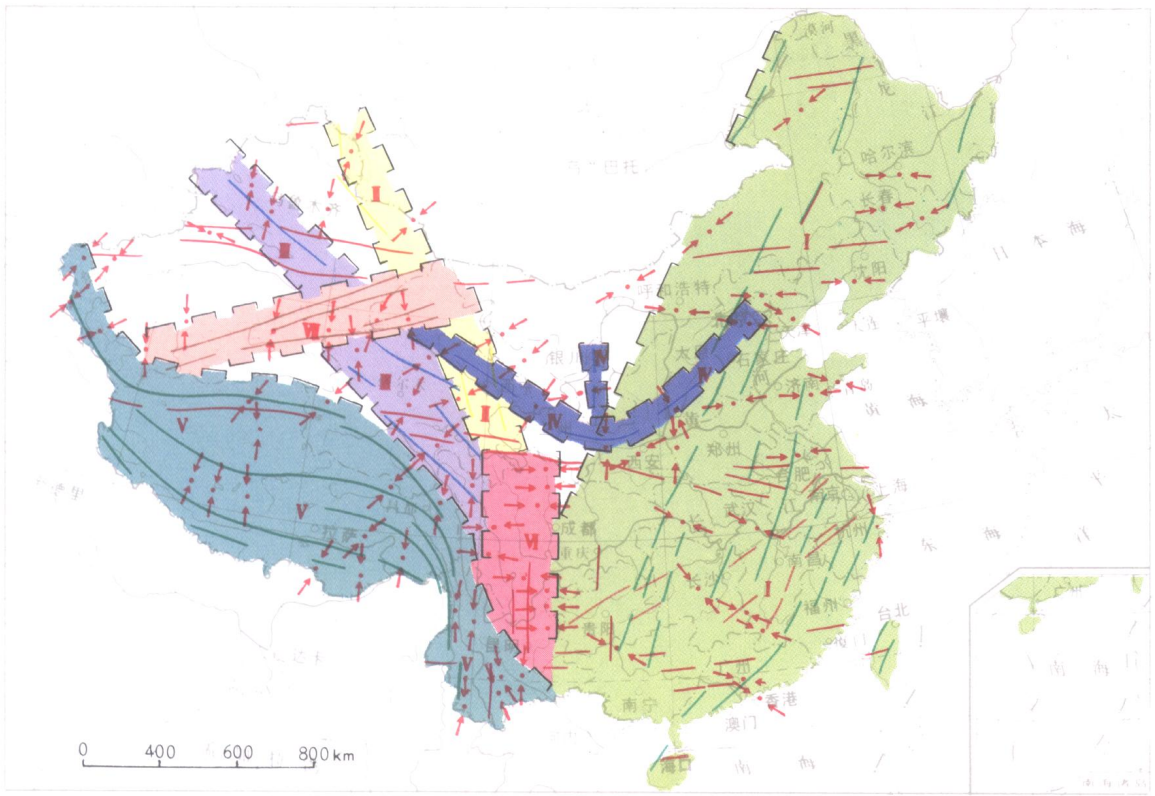
中国现今地形变速率图

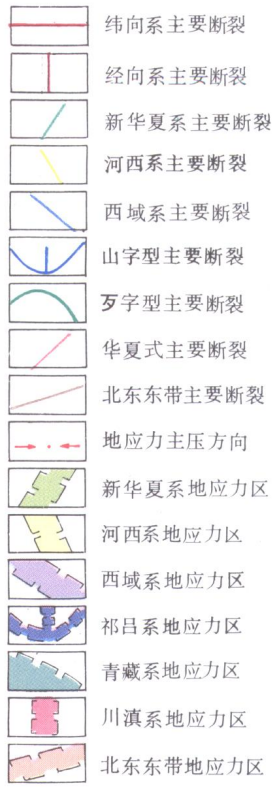
Map of Present Ground Deformation Rate in China

（中国地质科学院城市与工程场地稳定性研究中心，1989 年）

中国地应力分区略图

Regionalization of Crustal Stress in China

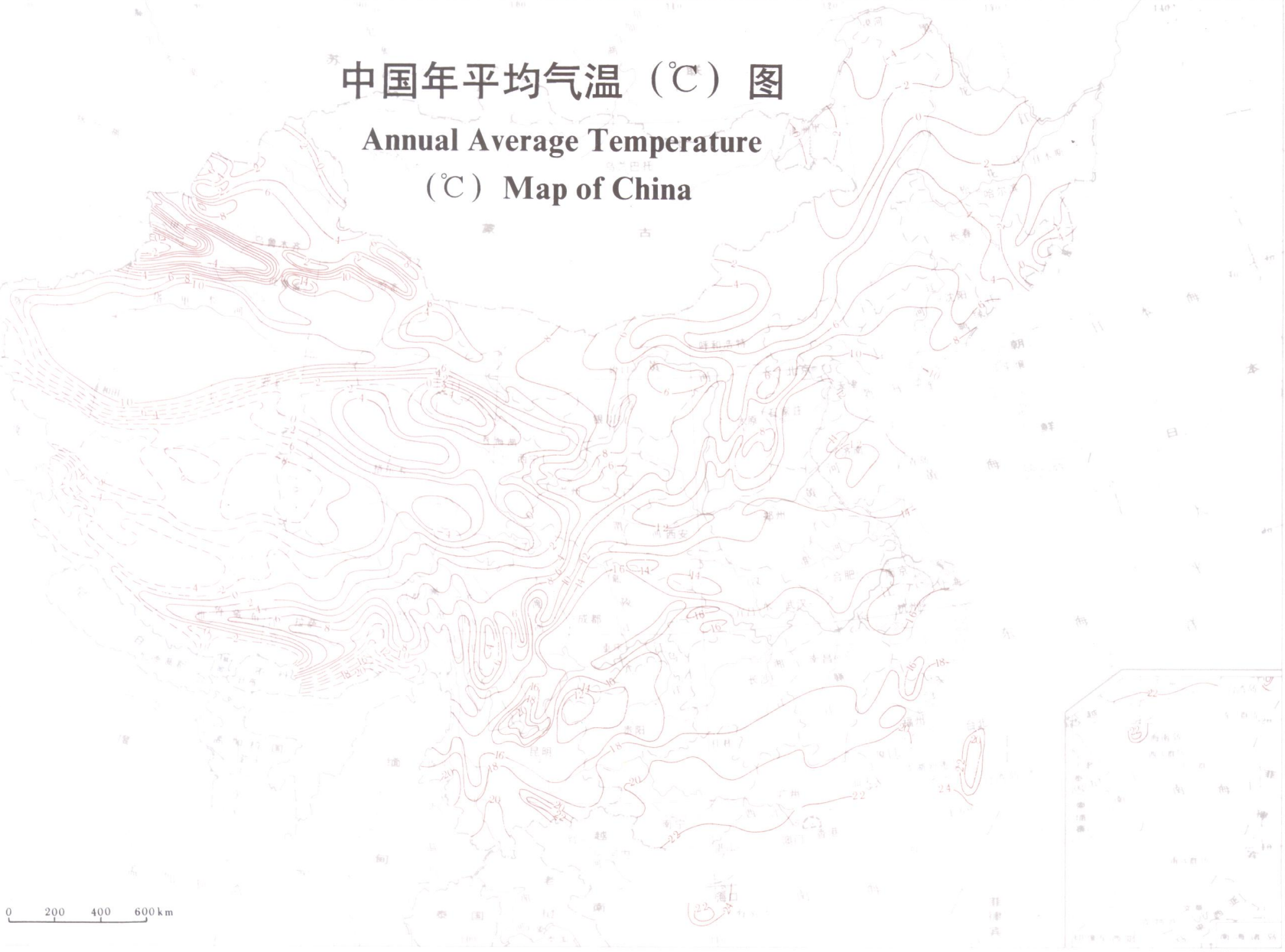




（中国地质科学院城市与工程场地稳定性研究中心，1989 年）

中国年平均气温（℃）图

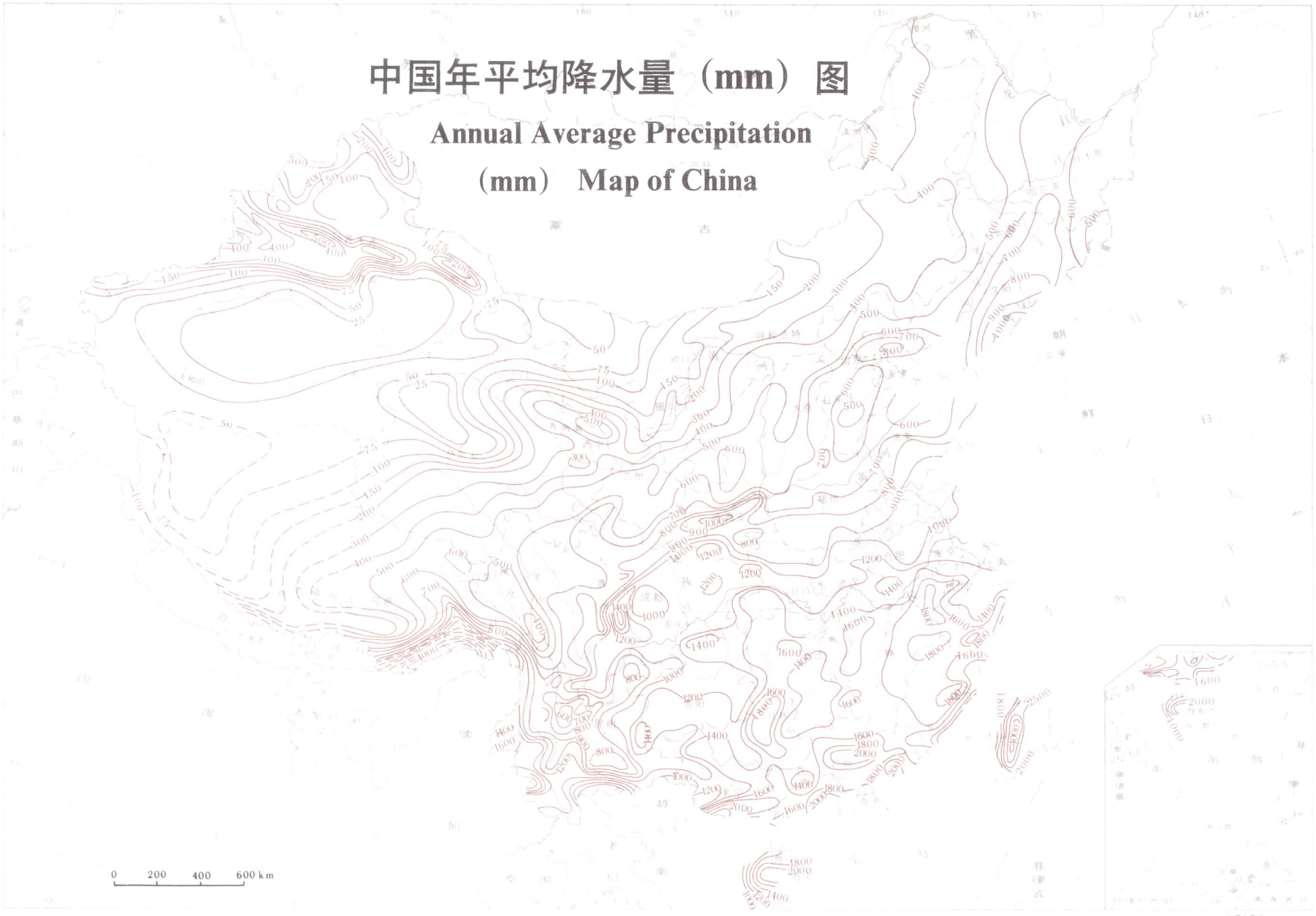
Annual Average Temperature （℃） Map of China



（据《中国自然地理＊气候》，科学出版社，1984 年）

中国年平均降水量（mm）图

Annual Average Precipitation (mm) Map of China



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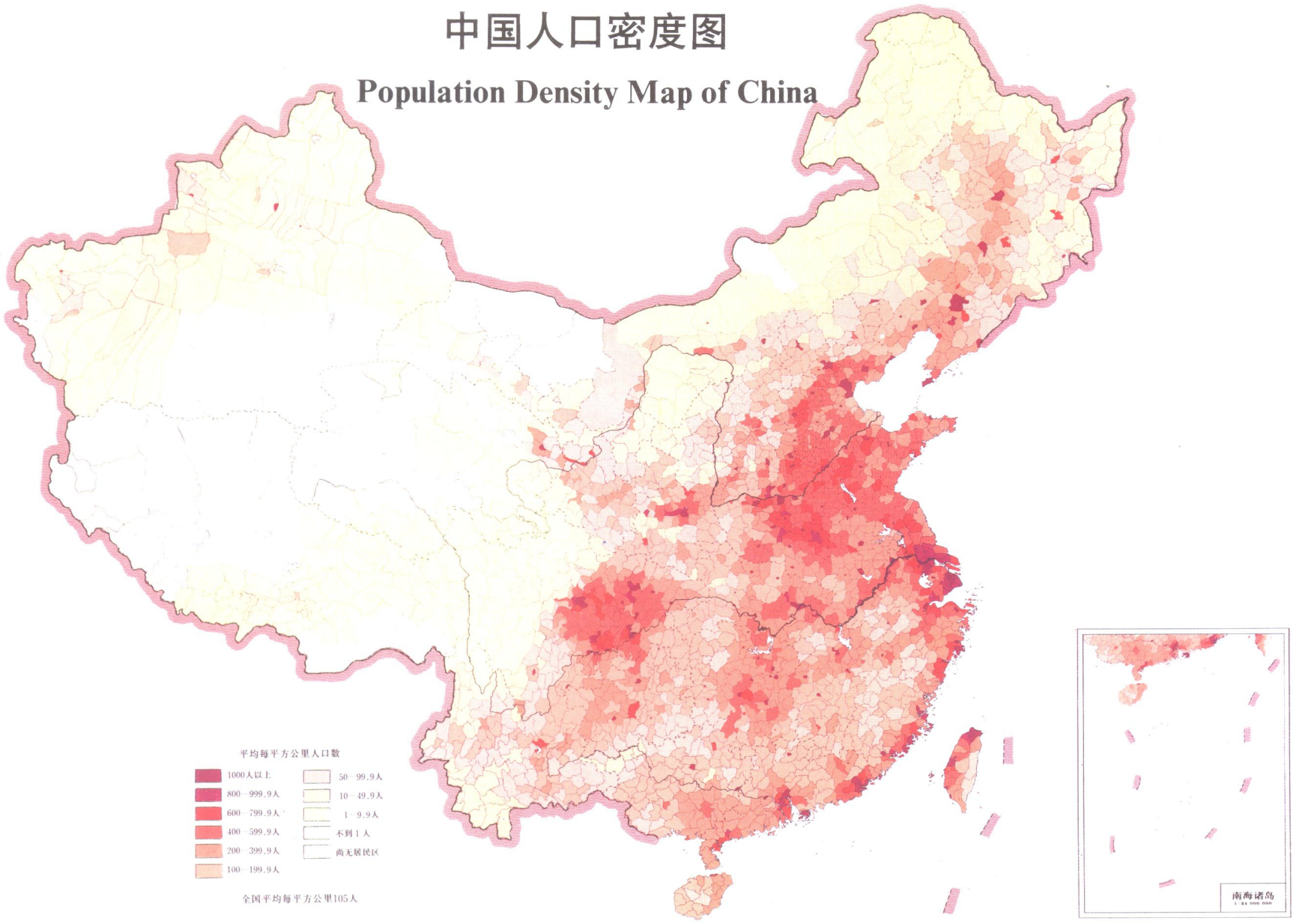
中国人口密度图

Population Density Map of China



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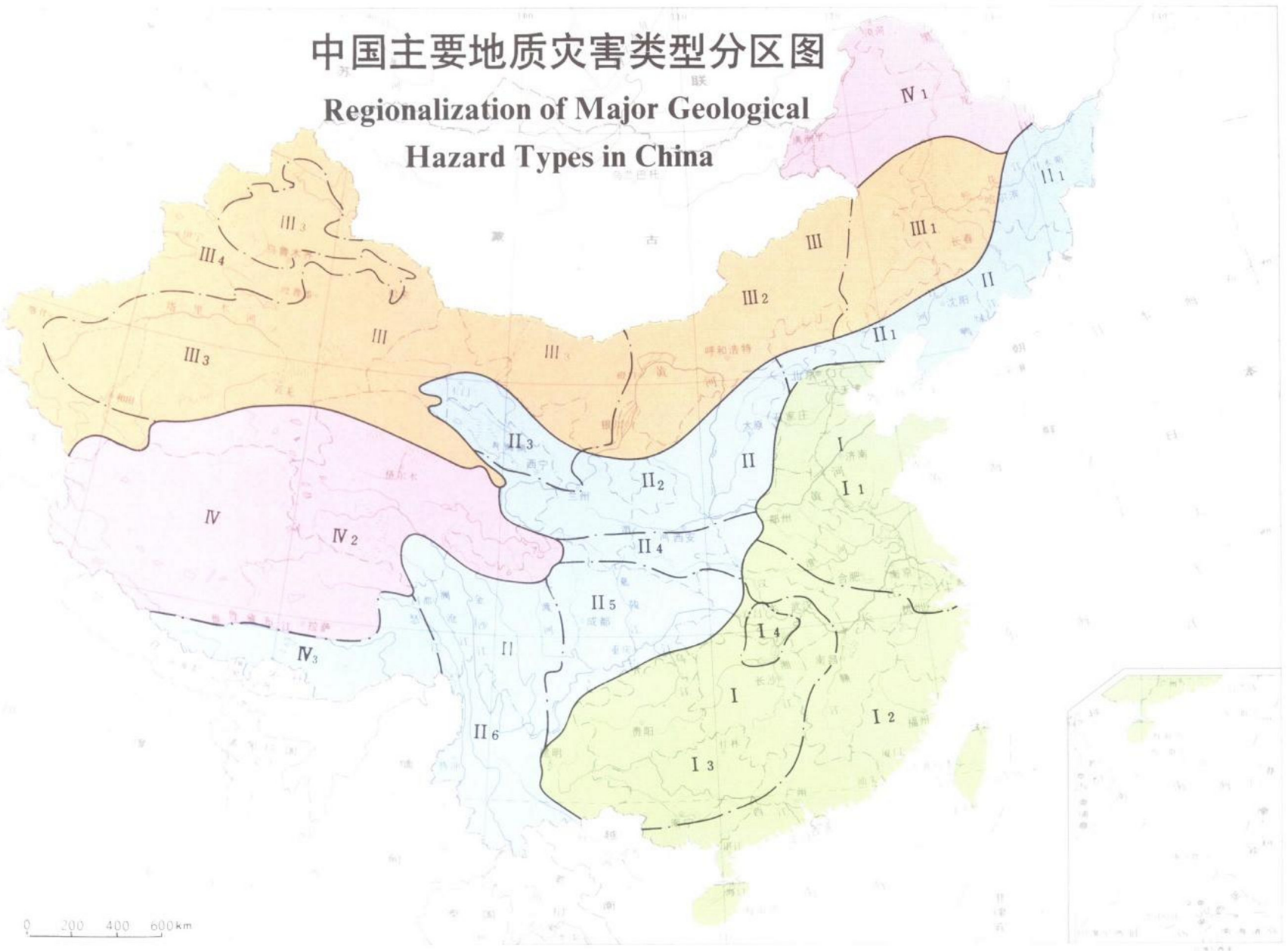
（据《中国人口地图集》，中国统计出版社，1987年）

中国主要地质灾害类型分区图

Regionalization of Major Geological Hazard Types in China



Ⅰ中国东部丘陵、平原地面变形为主大区

Region Ⅰ Hills and plains in Eastern China, with surficial deformation

Ⅰ$_1$ 华北平原、长江下游平原地面沉降、盐渍化、河湖淤积为主区

Ⅰ$_2$ 大别山地、东南沿海丘陵滑坡、水土流失、河湖淤积、土地冷浸为主区

Ⅰ$_3$ 云贵高原岩溶塌陷滑坡、水土流失为主区

Ⅰ$_4$ 江汉平原河湖变迁、土地冷浸为主区

Ⅱ 中国中部高原、山地斜坡变形为主大区

Region Ⅱ Plateaus and mountains in central China, with slope deformation

Ⅱ$_1$ 长白山地、燕山山地泥石流、矿区塌陷为主区

Ⅱ$_2$ 黄土高原滑坡、湿陷、水土流失、地裂缝为主区

Ⅱ$_3$ 祁连山地滑坡、泥石流为主区

Ⅱ$_4$ 秦岭山地滑坡、泥石流为主区

Ⅱ$_5$ 川鄂山地滑坡、水土流失为主区

Ⅱ$_6$ 横断山地滑坡、泥石流为主区

Ⅲ 中国北部内陆高原、盆地沙漠化、盐渍化为主大区

Region Ⅲ Interior plateaus and basins in northern China, with desertization and salinization

Ⅲ$_1$ 松辽平原沙漠化、盐渍化、矿区塌陷为主区

Ⅲ$_2$ 内蒙古高原沙漠化、盐渍化为主区

Ⅲ$_3$ 准噶尔盆地、塔里木盆地、阿拉善高原沙漠化、盐渍化为主区

Ⅲ$_4$ 天山东段、昆仑山西段山地滑坡、冰川雪崩为主区

Ⅳ 中国北部大兴安岭北段山地和西部青藏高原山地岩土冻融为主大区

Region Ⅳ Northern section of Dahinggan Mountains in northern China and Qinghai-Xizang Plateau in western China, with freeze-thaw actions of mountainous rocks and soils

Ⅳ$_1$ 大兴安岭北段山地岩土冻融为主区

Ⅳ$_2$ 青藏高原山地岩土冻融、冰川雪崩为主区

Ⅳ$_3$ 藏南山地泥石流、冰川雪崩为主区

（据地质矿产部成都水文地质工程地质中心地质灾害研究室同名图稍加修改）

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