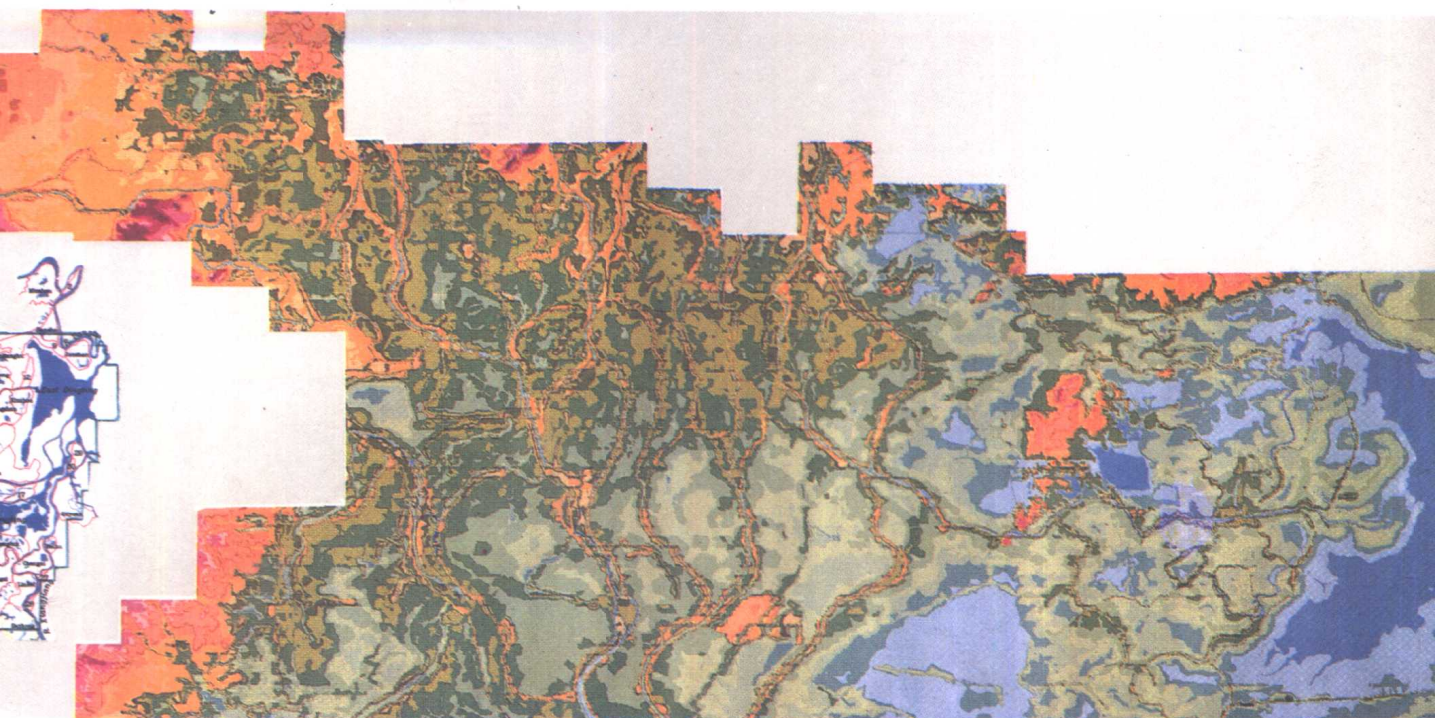


INDEX ATLAS OF GIS OF CHINA

Volume 2

**RESOURCES
AND ENVIRONMENT
INFORMATION
SYSTEM
IN DONGTING LAKE REGION**



SCIENCE PRESS

INDEX ATLAS OF GEOGRAPHIC INFORMATION SYSTEM OF CHINA

Vol. 2

**Resources and Environment Information
System in Dongting Lake Region**

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Foreword

It has been decided by the Laboratory of Resources and Environment Information System (LREIS) of the Chinese Academy of Sciences to publish a series of GIS index atlases. This move serves a double purpose—on the one hand, these atlases will show the research achievements of LREIS; on the other, they will promote the application of GIS by providing the users with concrete examples of application model and software for data capture, storage, updating and analysis. The reason why the functions of GIS such as indexing and graphic display are shown in the form of a hard copy like the map is primarily that about 70% of environmental information is collected by the human eyes, and compared with the screen of a computer monitor, the map is something that people in China are accustomed to, and is widely accepted for its easy use which calls for no special equipment. In view of the fact that GIS is now still a high technology a little ahead of the time in our country, the map may well be regarded as an effective means at the transition stage to spread and deepen the knowledge of the storage and applications of GIS so as to encourage users of the system to conduct overall analyses, simulation experiments and forecasting in relation to environmental protection and resources exploitation.

The publication of the index atlases also represents a breakthrough in the technology of atlas editing and printing—a triumph which will match the achievement of laser photo type-setting technology. This is because the graphs and images produced as a result of the processing by GIS of all the data and images collected from socio-economic statistics, ground observation networks and aeronautical and space observation systems possess an entirely new conception and contents; in other words, they provide multi-dimensional information based on high generalization, summarization, induction and deduction. Undoubtedly, this new technology will go a long way towards enhancing automation and intellectualization in atlas design and compilation. As confirmed by experiments, amono-chromatic scanning and four-colour process printing can take the place of electronic colour scanning, and reduce to the minimum the large amounts of labour usually needed in atlas editing and printing.

What is gratifying is that the index atlases will offer the possibility for the users to obtain a key to the treasure trove and to share the database and software system created by LREIS. In fact, LREIS as a national laboratory has all along made it its duty and task to join efforts with the users to make use of its information resources for the development of regional economy and the construction of engineering projects, and to promote information exchanges and database building.

LREIS plans to publish this kind of atlases regularly, as a part of its systematic effort to open to society. The index atlases will focus respectively on the urban system, coastal ecology, lake dynamics, water and soil conservation, forestry economic benefit, environmental evaluation, etc. It is hoped that by so doing, LREIS will have an opportunity to seek advice and opinions from experts both at home and abroad and to report the results of research work it has done to project sponsors and academic committee members inside and out-side China, and also that this course of action will epitomize the state's open to outside world and reform policies, facilitate social supervision, improve LREIS work and bring LREIS systems to greater perfection.

LREIS is looking forward to responses from units and departments possessing information resources to the call for ensuring a free flow of information in China, so as to accelerate material and energy flows among the country's different regions and enable its economic construction to keep pace with the age of information. An age when man-imposed blockade and technological monopoly will eventually be eliminated. With its progress made in the use of survey satellites, communication network and computer technique, China has managed to stand in the front ranks of the world, and is playing an active part in international cooperation programs, and in the building of world database network. Now that the time characterized by big-power domination is gone, China should and can stand on its own feet among the nations, and make its contribution to mankind.

Chen Shupeng

1969. 11

序

中国科学院资源与环境信息系统国家重点实验室计划陆续出版一系列地理信息系统检索地图集，旨在方便用户，反映该室研究成果，提供有关数据采集、存储与更新以及分析应用模型和软件的实例。地理信息系统原有的检索和图形显示功能之所以采用这种硬拷贝形式，主要是考虑人类采集的环境信息量的70%是靠视觉采集。同计算机屏幕相比，地图早已为人们喜闻乐见，无需专门设备，流行广泛。目前在我国地理信息系统尚属于超前阶段的“高技术”，借助地图来宣传与推广，说明其科学储备和应用功能，加深用户的理解，也许不失为有效的过渡方式，以期引导更多的用户来应用地理信息系统，举一反三，对资源开发、环境保护过程中进行多方面的综合分析，模拟实验与预测预报。

这种检索图集的出版，对于地图集的编辑、印刷工艺过程的改革，也发出了闪光的信号，与文字编辑的激光照排相映成辉。来自社会经济统计、地面观测台站网络以及航空、航天对地观测系统的各种数据和图像，通过地理信息系统的深加工以及智能化信息处理之后，所输出的图像和图形已经具有崭新的概念和内容，即经高度概括、归纳、分析、演绎所产生的多维信息。这种流程对于提高地图集编制自动化和智能化，无疑是有益的探索和尝试。试验表明，利用单色扫描输出，四色套印合成，可以取代电子分色，简化地图集制印工艺，使清绘、分版、注记、校对、修版等大量手工劳动减少到最低限度。

令人欣慰的是，用户通过检索地图集这个窗口，可以得到打开知识宝库的钥匙，分享资源与环境信息系统国家重点实验室已建成的一些数据库及软件系统，共同开发利用这些信息资源为地区经济开发和工程建设服务，并为促进信息交流和更新这些数据库而努力不懈。这是作为国家重点实验室的光荣使命和应尽职责。我们是乐于提供这方面服务的。

我们希望把出版这种检索地图集作为开放实验室的一项制度坚持下去。分别将城镇体系、海岸生态、湖泊动态、水土保持、森林效益、环境评价等方面的实验系统，公诸国内外同行专家，征求意见，欢迎批评指教；同时作为向国内外学术委员及资助单位的汇报材料，体现国家开放实验室的改革、开放方针，接受社会的监督，以利改进工作，提高水平，使系统更臻完善。

我们更希望得到更多的拥有信息资源的单位和部门的响应，使我国的信息流日益畅通，保障地区之间的物质流与能量流的加速运行，使整个国家的经济建设适应信息时代的步伐。人为的封锁和技术垄断将为历史所淘汰。我国应用卫星、通讯业务网络、计算机技术的进步已跻身国际先进行列，开展更广泛的国际合作，参与许多全球性数据库与信息网络建设工作。列强越俎代庖的时代已成过去，中国人民应该自立于世界民族之林，为人类作出应有的贡献。

A handwritten signature in black ink, appearing to read '陈逸之' (Chen Yizhi). The signature is written in a cursive, flowing style with a long vertical stroke extending downwards from the right side.

1989年11月于杭州

Preface

The relief of the Dongting Lake Region, like the center of a palm, gathers water and sand from all sides, in which river system crisscrosses at a network, lakes spread all over, protective embankments in the lakeside area strewn at random. For thousands of years, Dongting Lake has experienced a historical process from small to big and from big to small, controlled by the Jingjiang River evolution and effected by mankind's activities. The formation of the Four Tributaries of the Changjiang River (the Yangtze River) brought Dongting Lake to its most flourishing period, but in the past 200 years large quantity silt and sand flowed into and deposited in the lake area, which has made the lake shrivel rapidly and resulted in the decrease of the flood adjusting and storing capability for the Middle Changjiang River. Four problems, i.e. flood, waterlogging, siltation and disease are threatening the safety of people's life and property and socio-economic development in the region. As one of the important base of grain and fish production of commodities of China, the regional integrated development and renovation with flood control as the main target in the Dongting Lake Region have become an important research project at present. To make an experiment with the Resources and Environment Information System of the Dongting Lake Region, based on remote sensing and geographic information system (GIS), aims to provide multi-source, multi-level and renewable data and to provide modern technological and scientific facts for auxiliary decision-making in dynamic monitoring of the regional resources and environment, flood control and disaster relief and regional development. At the same time, we can explore the application potentiality of GIS, evaluate its efficiency and promote GIS development.

The system design was based on the criteria of on-going system to meet user's multi-level needs. The system consists of a database system, a database updating system and a modelbase system. The database stores many kinds of thematic data in graphy, image or digit, which describes the historical evolution, flood controlling and guiding works and topography of the dyke surrounded area (DSA), environmental background and socio-economic conditions in the region.

The database updating system is a method base for the registration of remote sensing imagery, the extraction of remote sensing information and the data updating by using remote sensing information. The applied professional models are suitable for one to know the environment changes, forecast development tendency, analyze flood situation and decision-make for the flood control in the region, but also for him to use them elsewhere. The models were organized into a modelbase with a flexible structure. The system has a friendly interface with the user. It is very convenient and easy to use.

This atlas shows the composition, structure and function of the system. The design, compilation and graphic output are automatically done in computer aided cartography (CAC), which greatly increases the automation of CAC used at present.

It is our purposes to put this atlas to you as a brick attracting jade to get your precious advices and suggestions. And let us work together to widen GIS's application in China, enhance the system's capability of solving the problems in resources and environment, raise the system intellectualization, and take GIS to decision-making process.

前 言

洞庭湖区地势宛如掌心，汇集四面七方的来水来沙，水系纵横交错，湖泊星罗棋布，垸坑错落相间。几千年来，受荆江变迁控制及人为活动的影响，洞庭湖经历了一个由小变大、又由大变小的历史过程；长江四口的形成使其发展至鼎盛期。近200年来，长江泥沙的输入与淤积，使湖体萎缩，对长江中游洪水的调蓄能力明显减弱，所带来的洪、涝、渍、病等问题已严重威胁着人民生命财产安全和经济的发展。作为我国重要的商品粮、鱼基地之一，洞庭湖区以防洪为主体的区域规划问题已成为当前急待解决的重大课题。发挥遥感覆盖面广、信息获取周期短及地理信息系统区域性与综合性的特点，开展洞庭湖区资源与环境信息系统研究，旨在为区域资源与环境的动态监测，防洪减灾、区域的整治开发提供多源、多层次、可更新的基础数据和辅助决策的现代化技术手段，同时探索地理信息系统的应用潜力，评价其应用效果，促进地理信息系统自身的发展。

系统的设计以运行系统的要求为基础，以满足多层次用户需求为目标。系统由数据库系统、数据库更新系统和模型库系统组成。数据库以图形、图像以及数字方式存储了洞庭湖近200年历史变迁专题信息：区域地貌、土壤、植被、土地类型及钉螺分布等专题数据；堤垸区防洪工程有关数据和数字高程模型；以县、乡、国营农场、自然村和以堤垸为单位的统计数据。数据库更新系统是针对遥感图像配准，遥感信息快速提取，遥感遥测信息对数据更新而设计的方法库。应用分析模型的研制以洞庭湖环境演变与未来发展趋势预测、水情分析与防洪决策、低洼地合理利用等为背景，同时考虑其应用的广泛性。模型库采用开放结构，易于修改、扩充和重新构造。系统具有友好的用户界面、方便、易用等特色。该系统在1989年长江中游防汛遥感试验中发挥了良好的作用，受到国家科委及水利部门的肯定和嘉奖。

本图集反映了洞庭湖区地理信息系统的组成、结构与功能。图集采用计算机辅助制图的制作方法和输出方式，不仅制作周期短，节省大量费用，而且实现了计算机自动分版，获取常规方法难以制作的图件。但本图集的编制仍属试验研究工作，尚期得到批评指正。为进一步拓宽地理信息系统的应用领域，提高其解决问题的能力及智能化水平，推动其发展，还需作坚持不懈的努力。

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Introduction to the Dongting Lake Region

Dongting Lake, the second largest fresh water lake in China, located at the south bank of the Jingjiang River (a section of the Changjiang River), is a flood channel type one conjuncted with the Changjiang River and the Xiang, Zi, Yuan, Li Rivers in the northern Hunan Province.

The Dongting Lake Region extends Hunan, Hubei Provinces with the centre of Dongting Lake. It consists of a vast flood and alluvial plain and its surrounding hills and rolling hills. This atlas mainly involves the part of the Dongting Lake region in Hunan Province, covering four cities, fifteen counties and fifteen state farms with an area of 32,064 square km of which the Dyke Surrounded Area (DSA) is 15,200 square km and the natural lakes is 2,691 square km, flood channel is 1,013 square km.

The region, with smooth terrain, plentiful resources, long developing history and relatively developed socio-economic conditions, is one of the most important bases for the grain and fish production of commodities, and plays a decisive role in socio-economic development of Hunan Province. The main advantages include the following aspects:

1. With water channels linking its east and west and railways acrossing it from the south to the north, the region is superior with its geographic location which has the good conditions for storage and reception.

2. The land area in the region is 47,500,000 mu of which 37,500,000 mu is still not made into use, including 2,300,000 mu of desolate land, 1,200,000 mu of islet and 3,000,000 mu of water surface. If the parts of land came into use, the output in agriculture only would increase 20%.

3. The region is a river network one. The immense water surface and variety of large discharge make it an excellent region to develop fishery and navigation. They can also meet the needs of various water supply for industrial development.

4. There are plentiful products of agriculture and sideline. In recent years, the grain production in the region was about 25% of the whole Hunan Province, and the outputs of hemp, cotton and silk were 90%, 80%, and 50% of Hunan Province respectively.

In a long period, Dongting Lake has experienced in a sharp evolution from prosperity to decline and from large to small because of rapid silting up and delta growing. A series of ecological and environmental problems have come into being.

1. With the flood level rising continuously, flood threatens the security of the region more and more seriously. According to actual surveying results, the flood level of the equivalent flood peak flow has gone up 1 to 2 meters in recent 30 years. The order of severity of high flood level even in a common year is increasing sharply. The lake bottom has been higher than low-lying paddy fields surrounded with dykes at many places.

2. Waterlogging is frequent because of old dykes and low-lying fields. With development of delta, man reclaimed wasteland and enclosed tideland for cultivation. Once a field