

THE MAP IN THE TWENTY FIRST CENTURY

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Abstract

Rapid development of information technology, aviation and aeronautics technology and surveying and mapping technology has made new requirements for map. The traditional map can not meet the needs of modern society any more. The concept of map in the 21st century is stated at first in this paper, and then the characteristics of new century map are discussed, including the variety of expression form of map, the infinite expansion of space describing and the extension of map function. At last, the main features of the 21st century map are stated----such as digital and information from the aspects of digital map, GIS and digital earth.

Keywords

Map concept Digital map GIS Digital earth

1. Introduction

The map, a main surveying and mapping production in connection with science and art, has been playing the part of more and more important roles in national economic construction, the building up of national defense and scientific research. Especially in the present informational times, the map, as an information carrier describing and researching human living environment, provides direct, visual and reliable scientific evidence for leading groups to make correct decisions, in which to show its special function as possible. The various mapping productions have come into all trades and professions and families, which have become the necessary tools for production, scientific research, education, daily life and journey. Now, it is in the 21st century that the map must have new contents and new development. Therefore, it is necessary to redefine and understand the map.

2. The conception of map in the 21st century

It is the development of spatial technology that drives the exact measure of spheroid and the headway of remote sensing and celestial body cartography and makes the traditional conception of map changing in the new century.

The describing object of map is only limited the surface of the earth in the traditional conception

of map, and its expression form is the figures and notes on the plane according to a determinate mathematical principle such as cylindrical projection, conical projection, azimuthal projection and Gauss projection. But now the describing object and representing style of map have changed. Some foreign scholars believed that the map is the graph expression of ambience, others regarded the map as the channels of transmitting information, or visual symbol model reflecting nature and society phenomena. Chinese scholars gave such a definition for the map after they had discussed map's modern theory and productive technology -- the map is the representation on the plane surface (paper, card, plastic, cloth, disk, tape, screen or some other material) of the features of part of the surface of the earth or other celestial body, including information of nature and social economic phenomena, drawn to some specific scale, basing on a determinate mathematical principle, according to certain degrees of cartographic generalization and selection, using symbolism, to transfer developing and distributing in time and space of their quantity and quality. We think that above concept of map didn't reflect cartographic characteristics of modern times accurately and completely.

To sum up, the concept of the map in the 21st century may be stated like this-- the map is the representation and abstract of the realistic world, and a kind of tools to represent geographic information by visual, digital and tactual methods. The concept not only includes three traditional characteristics such as mathematical principle, cartographic integration and map symbolism, but also reflects that the content showing in figures and notations is geographic environment information after cartographic integration, in which the figure is not merely the objective depiction of a feature, but is also a reflection of cognition and principle. It accord with the epistemology and methodology, showing the developing statement of geography, and reflecting the objective fact that the map is to describe geographic information.

3. The traits of the map in the 21st century

The map in the 21st century is born out off the map in the 20th century, however, it appears qualitative changes as the following.

3.1 The diversification of the representation of map

The map represents objects from using symbol system formerly to using image and digital and other forms today. With the development of printing and electronic computer technology, the map can be represented by not only line symbols, but also image and digital. The reader requires the map with intuitional third-dimensional sense to provide entire shape to manifest spatial phenomena from the visual feeling as reading. Then the map has achieved the goal from stenograph symbol, contour, vignette, hachure, layer tinting, hill shade and image map on the plane carrier, and three-dimensional tellurion and solid map model has been made, and then it extends from 3D to 4D on the plane carrier

including time-dimension. In other words, the new style map is not just graphic form, it may be image or digital or other forms to be easy to identify and record for computer. We can get detailed and exact character data of object and phenomena after deal with the map recorded in the tape by computer system. If necessary, we can convert the digital map to the line graph map automatically in order to meet the needs of map users. For instance, the digital map used in data matching of the cruise missile is recorded and stored in the tape, it is unnecessary to display graph when missile flying. After these great changes, although the map's basic characteristic doesn't disappear, but it is different from the traditional map.

3.2 The immense expansion of space of map depicting

The map depicts cartographic features from the earth's surface simply into the underground or spatial area, furthermore to other celestial bodies. With the development of technology and population increasing, human lives to spread all over the earth. In order to empolder and utilize earth resource reasonably and keep society to be continual developed, we should make a macroscopical program for the whole globe. The traditional surveying technology such as aerial survey and ground survey can't provide the map which we needed scale for user quickly, and can't meet the needs of fast updating of map production. Now the updating speed of the map is too slow to adapt the step of fast development of the modern society. It is reported that the average age of the map which the scale of 1 : 50 000 is 50 years old, and 1 : 2 5000 is 20 years old in the world in 1993 by the United Nations Survey Office. Therefore, people adopt extra-terrestrial surveying technology that the main way to observe the earth to solve the problem. With the development of remote sensing technology and modern survey and mapping technology, it is to be true that the measuring spatial scope has extended from the earth's surface to underground or extra-terrestrial area. Meanwhile, the objects of map depicting have extended to other celestial bodies, such as moon relief map, moon geologic map, Mars general map, etc. Lots of celestial body's maps will be appeared before long.

3.3 The map's function to be further developed

The map contents change from static and up-to-date representation to dynamic, forecasting and predictive depiction. The traditional map is static and graphic mathematical model, in which the information to be describe is assured entirely. The descriptive information is objective depiction of all kinds of features on the earth surface, more intuitionistic, not to show relationship and developing rule of them fully. In the 21st century, environment is getting more and more worse, human is faced with environment problem to settle urgently such as the global warming up, forest disappeared, ozone hole appeared, El Nino phenomena occurred, etc. All these problems require that the map as the information carrier must have a certain degree of analyzing, forecasting and predicting function. People can get information changing in time-dimension by the information system built in computer system such as the spatial distributing, combination and relation of map contents. Using scientific

abstract of selection and generalization can always induce and deduce the interactional, developmental and scientific rule from a great deal of phenomena and relationship among features. So it can create new information, and make the map to reflect the dynamic changes and developing trend of cartographic objects, in which the map possesses dynamic and forecast characters.

4. The main characteristics and types of map in 21st century

In the 21st century, we come into the information times from industry age, the course of social information speeds rapidly. The traditional paper map has been given play to important function in economic construction and the building up of national defense. Its main applications are the evidence of cadastre and territory, general view, the looking up and studying of placename, etc. But this kind of map hasn't spatial analyzing function --- such as searching relation, restriction and distribution rules of objects, and has no the function of dynamic monitoring, program designing, forecast and prediction, joining military activities directly. The 21st century's map will not only accomplish that applications, but also content with all requirements of the information society. Its main characteristics are digital and information stated as following ---digital map, GIS and digital earth.

4.1 The digital map

Because the period of both production and updating of traditional maps is more longer, the way of transmittal is monotony, and the preservation and transfer are inconvenient, it is difficult to show the abundant content in the space and development in the time-dimension of geographic information completely. It is necessary to search a more excellent geographic information carrier which is called the digital map. Here we give its definiens--- digital maps, which are also called virtual maps, are the map stored in a computer system. Their basic character is to represent the information of maps in digital styles.

Compared with the traditional map, the digital map has many strongpoints. ①query and retrieval are convenient, the renewal speed is fast. It has two-way query and retrieval functions from attribute to graph or from graph to attribute. All kinds of states, development and diversification rule of objects are show exactly and quickly by the way of renewal constantly to change the static map into the tool of spatial analyzing and decision-making. ②It has the transmittal way of multimedia which expresses geographic information to graph, image, letter, sound, kinescope and movie picture. ③Conservation and transfer are very convenient. It stores much map information by the medium of tape, disk and Compact Disc, and easy to be carried and to be saved. ④It is possible to transfer and use digital map of long-distance for user with network connections.

4.2 GIS

We know that the map contents have changed from static and up-to-date describing to dynamic, forecast and prediction representation, so it requires the map to satisfy with much huge information container, to transfer information in time and quickly, and to display 3D or multidimensional dynamic information, and it is necessary to break through the stimulant information of traditional plane carrier. GIS can meet these requirements.

GIS is born out of cartology. Like map, it is also a carrier and a tool of geographic information. It has the functions of input, management, output and spatial analysis of spatial data. Hence we can regard GIS as a kind of map in general. Under the different background, GIS can also be named land information system or space information system. Compared with the traditional map, GIS has the following characteristics--- expressing information with electronic show, static state combining with dynamic state, abstract combining with visualization, multi-scales (not restricted by scale) and converting in different scale fast, overlapping analysis with spatial matching to get the spatial relation and variational characters of objects, carrying through manifold spatial operations to spatial orientation data with the fast speed, high precision, and abundant information deriving.

4.3 The digital earth

Veep, Al Gore expatiated the concept of digital earth at first in a lecture in January, 1998. He pointed out that social economic researching needs globalization, so resource and environment researching are. Therefore, going on the global study is an important task in the 21st century. The tendency of global information is being formed at the present time, marked with the basic establishment of global information and the global spatial, it is very important to build the digital globe for human.

The digital earth is the globe digitalized which accord with the concept of nation information. In detail, the digital earth is a kind of technology system that takes the globe as it's describing object, bases on geographic coordinate, possesses multiple resolution, magnanimous data and manifold data, displays multidimensional and dynamic objects by multimedia and virtual way, with spatial, digital, network, intelligentized and visual traits. In reality, it is the system managed by computer network after the globe digitized. The digital earth includes the information of high multiple resolving power images of satellites, digital maps, economy and society phenomena, which is available to implement of continuous developing strategy, and to bring more wide benefits of society, economy and military. In recent years, some developed countries have been surveyed and mapped the most areas of the globe by the surveying and mapping satellites, to establish the base for building the digital earth. To build the digital earth is unable to separate from 3S (GPS、RS、GIS) and data communication technology to support. The digital earth, cartology and GIS are correlated closely, so it is necessary to study the digital earth as we study the map in 21st century.

5. Conclusion

The expansive developing space and more opportunity for the map is provided with the development of science and technology in the new century. The applied field of map becomes more and more wide, the functions of map turn more and more strong and the requirements for types and amount of map for map user are more and more large. GIS will show its strong analysis function. 3D GIS, Web GIS and open GIS will be so perfect and mature to be in use. User can get all kinds of spatial data that they need and make geographic spatial analysis via Internet. In a word, cartology of the 21st century will have hugely developing foreground.

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