USING DIGITAL TECHNOLOGIES IN DESIGNING AND CREATING MAPS

Gulmurzaeva R.E.
TIACE, acting Associate Professor, “Engineering Geomatics” Department,
https://doi.org/10.5281/zenodo.11382683

Abstract. *In the given article the essence of using digital technologies and creating a product that meets its purpose in terms of the content of the map being created are described by introducing the tools of a digital cartographic product and the basic principles based on it.*
Keywords*: interpretation, proofreading, aerial photography, relief, comfort, digital map.*

These days digital cartographic products are created based on the results of space satellite imagery; aerial photography; information obtained during topographic work in the field; based on original, not yet digitized materials. Cartography includes the creation of approximate and accurate plans, atlases, preliminary processes for collecting and sorting data, technologies for processing and modeling digital arrays.

One of the important aspects of a space and aerial photography system is the provision of a stereo image of a pair of images (superimposed on each other) obtained from both systems. These combined images, in turn, make it possible to create a simple three-dimensional or digital model. Based on these models, three-dimensional coordinates, contours and digital terrain models are created. In addition, it allows monitoring the status of annual vegetation by comparing and analyzing periodic satellite images. Aerial photography plays an important role in the detailed examination and mapping of urban and archaeological sites and the creation of a three-dimensional image of the object based on them.

The features of the map are best understood by comparison with aerial photographs and satellite images. The photographs provide a detailed portrait, an exact replica of the area, but without traditional identifying marks. The photographs show the area as it is.

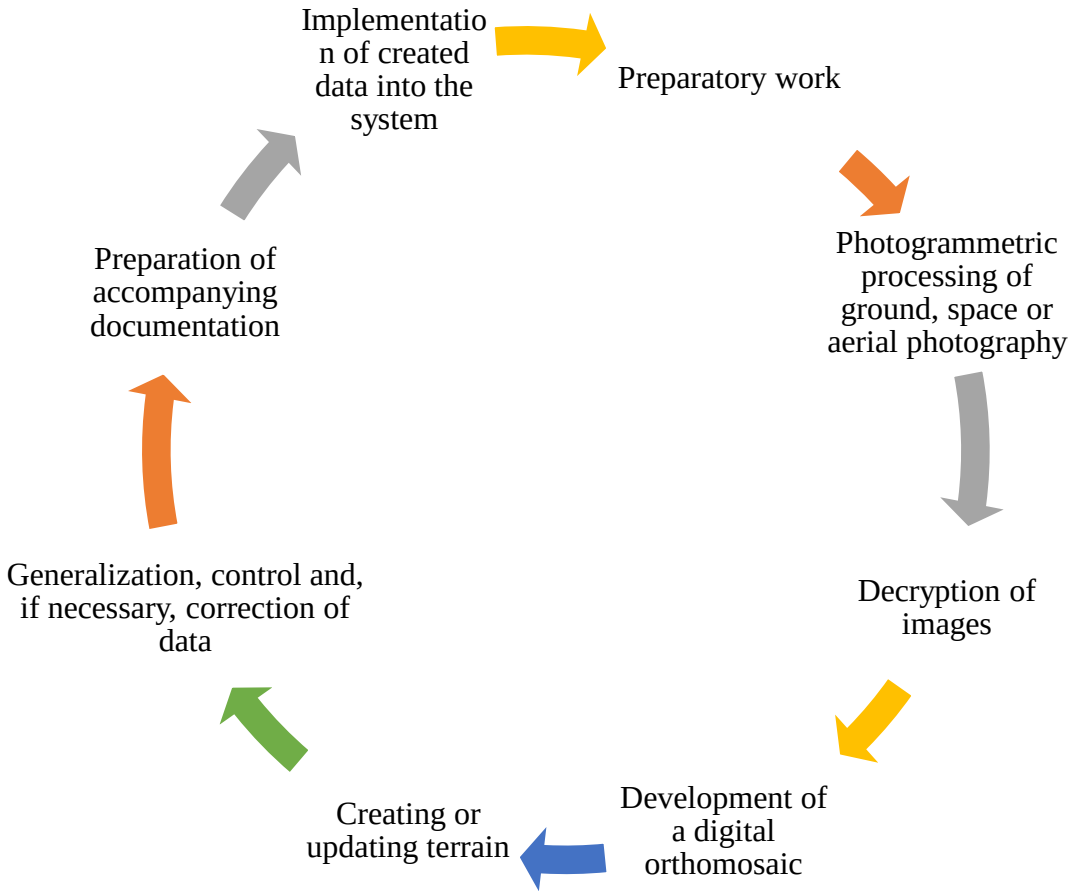
Cartographic symbols greatly enrich the image. They make it possible to convey the quantitative and qualitative characteristics of objects (for example, the age of geological rocks, soil types, permeability of swamps), reflect objects inaccessible to the human eye (the topography of the ocean floor, the structure of the earth’s crust at great depths, etc.), and even clearly show that is not perceived by the senses (magnetic declination, gravity anomalies, etc.), convey the dynamics of processes, their course in time and movement in space (movement of the land-sea boundary as a result of coastal abrasion, migration of magnetic poles, etc.).

All cartographic work is carried out in strict accordance with the requirements of the standards. The general scheme for creating and updating maps in computer cartography can be presented as follows:

Finally, with the help of symbols on the map, you can present calculated indicators and scientific abstractions, for example, the gradient of the temperature field or the comfort of human habitation in a given territory.

The cartographer himself chooses the signs and methods of representation, decides what and how will be shown on the map. At the same time, he selects and generalizes objects, i.e. determines what is important for a given map and must be shown on it, and what is not very important and can be partially or completely excluded. In this case, the map maker is guided not

only by certain scientific principles, rules and instructions, but also uses his knowledge, his own understanding of the essence of the displayed phenomenon, its genesis and significance in the geosystem being mapped.



Many decisions that a cartographer makes are individual in each specific situation and therefore difficult to formalize! A map, unlike a photograph, is not a copy of the area; it is an image of reality, passed through the consciousness of the cartographer. Figuratively speaking, the picture shows only facts, but the map also shows scientific concepts, generalizations, and logical abstractions [1].

Nowadays, almost all cartographic products are produced in the form of digital maps. Digital cartography is carried out according to the concepts of “digital map” and “digital model” and is defined as follows:

1) Digital card; CC: digital cartographic model, the content of which corresponds to the content of a map of a certain type and scale.

2) Digital (cartographic) model: logical and mathematical representation in digital form of mapping objects and the relationships between them.

Digital maps are well presented in visual form and show topology well. They are a simplified spatial model, convenient for human analysis. Digital maps and digital models are information structures that allow you to build a set of scenes or information situations using computer graphics or electronic printing.

Digital models are, in general, three-dimensional spatial analogues of real objects.

The first definition does not reveal the essence of the concept of a digital map, and the second can only be understood by a narrow circle of specialists working directly in the field of digital cartography [2].

To create and effectively work with maps, Geographic Information Systems (GIS) are now used. GIS are computer systems for collecting, storing, managing, analyzing and presenting spatially defined information. In other words, they are tools that allow users to search, analyze and edit digital maps.

The main objectives of a geographic information system are to create an automated digital database by collecting and processing spatial data, storing it for further analysis and printing.

GIS technology combines traditional database operations, such as querying and statistical analysis, with the visualization and spatial analysis benefits of a map. GIS includes the capabilities of raster and vector graphics editors and analytical tools and is used in cartography, environmental management, geology, meteorology, land management, ecology, municipal administration, transport, economics, defense, etc.

The emergence and rapid development of GIS was predetermined by the rich experience of topographic and thematic mapping, successful attempts to automate the mapping process, as well as revolutionary achievements in the field of computer technology, information science and computer graphics at the end of the XX century.

As other information technologies, GIS supports the well-known thesis: better information helps you make better decisions. You can quickly view and analyze multiple query processing options and justify the most effective solution.

However, GIS is not a tool for making decisions, but a tool that helps speed up and increase the efficiency of the decision-making procedure. The first (problem setting) and the last word (decision making) always remains with the person!

We have already said that many decisions that a cartographer makes are individual in each specific situation and therefore difficult to formalize. And any computer technology, on the contrary, requires formalization!

Is it possible to build, on the basis of formal conditions “understandable” to a computer, an abstraction that would distinguish, for example, images? Of course yes! But for this you need to clearly understand the capabilities and limitations of this or that computer technology [1].

The first thing a cartographer should learn when becoming familiar with a particular GIS is the data formats supported by the software and the characteristics of the map models created using that format.

One last important note before moving on to learning about GIS. Awareness of the technological advantages of GIS has led to the fact that now in all developed countries, including the Republic of Uzbekistan, state funds of geological, geographic, environmental and other geoinformatics have been transferred or are being converted into electronic form [1].

The instructions stipulate that reports on all types of regional geological studies in our country are presented in GIS format - and this imposes certain requirements for the training of specialists. And the point here is not only that today's students will need to create a GIS in due time - perhaps the majority will not have to do this directly. The important thing is that it will still be done by someone. To save your colleagues from problems, the source data themselves should be presented with an understanding of how and in what form they will be integrated into the GIS. And for this you need to at least minimally imagine the entire path of creating a GIS. Selecting a GIS. ArcGIS. Certain GIS (ArcGIS, MapInfo, AutoCAD map, etc.) have both advantages and disadvantages. For example, licensed ArcGIS software costs the first tens of thousands of dollars. However, the fact remains: all domestic organizations involved in the production and storage of digital cartographic products have chosen ESRI software products.

Nowadays, GIS technology on the ESRI platform is developing in the following main directions, which are gradually being implemented in new versions of software products of the ArcGIS family:

Cartography and GIS – this area is of interest to all specialists without exception who use GIS in their work. After all, not a single GIS project can do without maps, as one of the most important results of work.

GIS and Science – GIS makes it easier to understand and analyze complex systems that contain important spatial components.

Enterprise GIS – provides a common infrastructure for creating and deploying GIS solutions, allowing you to easily integrate data from different parts of the organization.

Server GIS – a developed environment is being introduced to provide modern network geographic information services through a wide range of client applications and client platforms.

GIS technology is also important in teaching students by helping them design and create maps. Digital technologies are widely used in higher education institutions and other disciplines; they are also used in data collection, cadastral direction, geodesy using GIS technologies, and are effective in conducting the educational process [3].

The value of good cards remains relevant. Geographic information systems have brought certain changes to the field of cartography. Web GIS allows you to create and publish maps for public access. Creating them is considered the only way to share your work with others. Electronic cartography has significantly expanded the capabilities of users; such maps can be downloaded to a smartphone or tablet.

REFERENCES

1. Digital model of geoecological map in GIS ArcGIS: Textbook for university students / Lebedev S.V., Nesterov E.M. - St. Petersburg: Publishing house of the Russian State Pedagogical University named after. A. I. Herzen, 2012, P. 380.
2. Tsvetkov V.Ya. Digital maps and digital models // International Journal of Applied and Fundamental Research. – 2016. – N. 4-2, P. 348-351;
3. Zalessky M.L., Vinnik V.K. “The effectiveness of using digital technologies in the educational process of a university // Modern problems of science and education. – 2023. – N. 3.;