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The Development Of Rational Qualimetric Characteristic Of Progressive Method The Estimation Of Reproduction Quality Of Topographic And Map Production.

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Abstract

This article is about the development of qualimetric characteristics and effective methodology for assessing the completeness of the reproduction of topographic and cartographic products. The paper explains the possibility of rational choice and modification of the characteristic exponents of the completeness of topographic mapping of terrain surface. Put forward the conceptual provisions qualimetrization reproduction completeness display topographic surface.

Keywords: Information, content, completeness, accuracy, reliability, geodesy, topography, topographic and cartographic products, mine surveying, morphometry;

Introduction

The increasing pace of development and industrialization of various industries of RK demanding higher quality and the formation of topographic map products for different purposes, hence the need for the simultaneous use of sufficiently geodetic, geomorphic and economic information. The end product of such use - map or a plan, in the end it has to meet the necessary or required (at the request of the "Customer") parameters.

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By now there are almost no scientifically based qualitative characteristics and evaluation effective approaches of topographic surface of the land. Methods of management information display performance parameters forming cartographic production, due to the lack of a unified science-based conceptual and progressive methodology. Multifactorial and variably-forming significance of cartographic products makes it consisting of: - surveying, geo-morphological, morphometric, economic, social, environmental solutions, which still barely started.

In this connection, to improve the use of topographic and cartographic products is necessary to improve the efficiency and effectiveness of scientific studies and analyses aimed at assessing, forecasting and formation of informative indicators, parameters for the formation of plans and maps as the basis of the processes the ground - and the subsoil. Relevant is the development of a rational qualimetric characteristics and progressive method of assessing the completeness of the reproduction of topographic and cartographic products. Relevance of the work is to develop and implement a rational qualimetric characteristics and effective methodology for assessing the information content of the object studied the formation of topographic and cartographic products, obtaining exhaustive results of natural-experimental evaluation of the effectiveness of the new method in terms of various types of relief formation and surface plots.

The purpose of this paper is to assess the completeness and that detail in the reproduction of topographic and cartographic production in complex terrain.

2. Methodology

The development of theoretical models of qualimetric characteristics and effective new method of assessing the completeness of the reproduction of topographic and cartographic products that provides commercial quality and usefulness, and compliance with modern production and market requirements.

The theoretical part of the traditional scientific field of geometrisation depths is based on a geometric analysis of topographic surface, the theoretical value of which is a direct consequence of the general analysis of geochemical field. The concept of the height field is the earth's surface has been introduced for the first time, P.K. Sobolev (1932), called topographic surface. Later, other scientists, using presentation of P.K. Sobolev, consider land surface as a scalar field heights. In this direction began its development a new science - geomorphology, in recent years, which is in development called morphometric method [1].

There are two fundamentally different directions of quantitative estimation of land surface topography:

• Statistical area based on the use of the theory of random functions, and linked to the development of numerical methods for obtaining relief characteristics and the identification of their distribution laws, the results of which are used in geomorphic zoning area and the construction of topographic, morphometric, morphographic plans.

• Analytical direction is based on the notion of relief as the scalar field heights, every point with “x” coordinates, “y” corresponds to the value of the field [2].

The main feature of the structure-defining the shape and geometry of the topographic surface topography of the land surface is a height field of characteristic points of the relief, i.e. relief height, whose variance depends on the volatility of relief microforms and measurement errors. The distribution of this trait is closely related to the complexity, variety of forms and the type of relief. In this morphometric elements include topographic surface - quantitative indicators of the forms of relief: the absolute height of the top or bottom, or talweg ridge line, the relative height of the positive or negative of the depth, the size of the diameter, length and width of the elongated forms azimuth of the long axis azimuth lines drop steep and shallow slopes of asymmetrical shapes, the radius of curvature, etc. [2,3].

The theoretical model of qualimetric characteristics of completeness and detail of the display topographical surface area is structured based on the selected base-forming inform baseline values by modifying them according to properties of factor shaping information. At that directly provides direct consideration of the effect of modal propagation characteristics and the degree of amplitude fluctuations in topographic surface to display the fullness of basic topographic maps and cartographic maps.

The theoretical model kvalimetriceskoj characteristics generally obtained in the form of

\[ \omega(J_x) = F(\Gamma_{mo}, \sigma_d) \]  

where \( \Gamma_{mo} \) – parameter expressing the relative share of influence modal frequency distribution of the
studied trait, $\sigma_d$ – RMS amplitude sweep diversity characteristic distribution along the contour of land area.

The structural model parameterization expressions kvalimetricchesskoj performance held at the basis of the modification of the baseline chosen qualimetric parameters ($X_{ave}$, $f_{max}$, $\sigma_d$, $X_{min}$) and expressly obtained in the form

$$\omega_i = \Gamma_{mo} \log \sigma_\Delta$$

(2)

Quantity $\Gamma_{mo}$ as a structural factor of qualimetric characteristics presented as an index reflecting the impact of the modal value spread of the sign on the completeness and detail of the display topographical surface area.

To enhance the evaluation of the influence of the private sharing feature, the analytical expression for the coefficient $\Gamma$ is represented as a numerical value for the modal and mean minimum frequency of the studied trait. Here, the average minimum value of the frequency characteristic is the average number of occurrences of the minimum and maximum sizes of topographic feature on the surface $0.5(f_{max} + f_{min})$.

The frequency of occurrence of maximum $f_{max}$ and minimum $f_{min}$ size used as reference values of level values are in a topographical surfaces are very different depending on the distribution of the studied trait [3,4].

The main base structure-reference value in the theoretical model is probabilistic and statistical measure - the dispersion of the first sequential differences of the measured values of the studied trait. The dispersion estimate quantitatively reflects the diversity of the possible values of the trait and is calculated in the form of standard deviation values of the trait through their first successive differences ($\Delta$)

$$D = \sigma_\Delta^2 = \frac{\sum_{i=1}^{n} (|\Delta_i|)^2}{2k},$$

(3)

where $k$ – the number of first differences; $i$ – the spacing between adjacent indices studied trait.

The average value of the first differences of the measured values of topographical feature is determined by the known formula statistics

$$\bar{\Delta} = \frac{\sum_{i=1}^{k} (x_i - x_{i-1})}{2k},$$

(4)

In the field of statistical research and theory to evaluate the value of finite differences (the first or the $k$-th) is an important scientific role from a theoretical and methodological point of view. As above mentioned, active this statistical dispersion used in the assessment of a variety of engineering problems of geodesy.

The theoretical model qualimetric characteristics completeness of detail display topographic surface on the i-th feature of the relief in the further transformation of the modified model of (1) is obtained in the form of

$$\omega_i = \frac{f_{0}}{f_{c,m}} \cdot \log \left( \sqrt{\frac{\sum_{i=1}^{k} (X_i - X_{i+1})^2}{2k}} \right),$$

(5)

If when you need to evaluate the completeness and topographic mapping of the surface area for several ($n = 2$) characteristics of the relief is recommended to use the model expression qualimetric integral characteristic as
Here qualimetric integral characteristic of completeness and detail of the display by several attributes of the terrain is represented as the sum of the characteristics of counted these signs of relief. There should also be taken into account factors the accuracy of interpretation and prediction of information across the entire range of the parameter $X$ of the studied land plot [3,4].

3. Results

Analytical estimation of the theoretical model qualimetric characteristics of completeness and display topographic surface shows that the modal value and the RMS value of the first differences of the studied trait as the main generators of generalized inform the source of its functional components directly affect the quality of the reproduction of topographic bases qualimetric land surface.

Evaluation of trends in performance kvalimetricheskoy completeness display topographic surface as changes in the value of initial values held by three natural-terrain experimental plots. According to the calculated values $w_i, \Gamma_m, \ln \sigma_\Delta$, the graphs that reflect the geometry change of the $w_i$ on this land sections of varying complexity.

The nature of the changes qualimetric features complete topographic mapping features of the surface area depending on the values of the values of the modal frequency distribution $\left( \Gamma_m \right)$ morphometric sign-altitude elementary surfaces (roughness) of the relief on the plain (a) and hilly (b) and alpine (c) relief-type is shown in Figure 1 a, b, c, and similarly, depending on the degree of diversity of the amplitude of the scattering feature $\left( \sigma_\Delta \right)$ on these types of relief formation in Figure 2 a, b, c.

![Figure 1 - The nature of trends of qualimetric characteristics depending on the modal frequency distribution of heights elementary surfaces on the plain (a) and hilly (b), alpine (c) relief-type areas.](image-url)
Figure 2 - The nature of trends of qualimetric characteristics depending on the degree of diversity Heights elementary surface topography on the plain (a) and hilly (b), alpine (c) the types of relief formation.

The calculation of the characteristics of qualimetry $\{W_j\}$ and source-inform its constituent units $\Gamma_0, \ln \sigma_\Delta$ performed on actual measured values of the heights of the elementary surfaces of the relief given by the three natural-experimental sites differing in complexity esses.

The results of graphical-analytical evaluation of the nature of the changes of qualimetric characteristics to complete topographic and cartographic display surface as a function of its constituent inform the underlying source-forming units $\{\Gamma_{mo}, \sigma_\Delta\}$ in three natural-experimental plots, respectively, three types of relief formation of varying complexity have shown that the changes inherent in their stable trend.

To land high complexity inherent in large values of relief-modal frequency distribution of heights elementary surface topography, and, accordingly, for this type of terrain relief-character is the increased value of qualimetric display characteristics of topographic surface. This is similar to a steady inherent to the nature of changes in the values of qualimetric characteristics and the degree of diversity Heights elementary surfaces of relief as the complexity of relief formation of land.

4. Discussion and Conclusion

The theoretical model of qualimetric characteristics of completeness and detail of the display topographical surface area is structured based on the selected base inform-based initial values. An analytical model of qualimetric features informative topographic surface on which directly takes into account the impact of modal propagation characteristics and the degree of amplitude variations of the parameters of the surface on the information content of the surface of the display area of the land surface. Also found that qualimetric characteristics of informativeness vary depending on the diversity of the elementary surfaces is directly proportional to the extent of elevation change regardless of the type of terrain.

Thus, the recommended theoretical model of qualimetric characteristics allows detecting and evaluating the degree of the topographic surface of the land with sufficient reliability.

REFERENCES