Journal of Regional and City Planning
Special Issue, pp. 146-152, October 2021

Map Idealization of the relief and its role in studying the structure of system-forming flows of delts Geosystems

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[Received: 22 April 2021; accepted in final version: 18 October 2021]

Abstract*. The article deals with the issues of cartographic idealization of the relief in the study of the system-forming flows of the modern delta of the Amu Darya. The system-forming flows of small deltas form a "topological tree". Examples of the idealization of the relief of hills and sands are also given. In structure, they differ from the system-forming flows of the alluvial plains. Instead, the significance of system-forming flows is shown in the study of the systemic organization of natural-reclamation conditions of deltaic geosystems. The process of idealization of the relief is a new direction in geomorphology and ameliorative landscape science.*

Keywords. *System-forming flows, small deltas, relief plastics, rises and falls, landscape, cartographic idealization, abstraction, hills and sands.*

Introduction

Any targeted analysis of system-forming flows is associated with the study of the relief. In the modern Amu Darya delta, the relief is a product of system-forming flows. To study their spatial properties, a plastic map of the relief of the Amu Darya delta (Fig. 1, A), compiled by the author (10), was used. In fig. 1, B, C, for comparison, fragments of maps for the same territory, but made by other methods are shown. Our task is to show that the cartographic idealization of landscape patterns is possible only on the basis of plastic maps (see Fig. 1, A). Other maps (see Fig. 1, B, C) do not allow this, since their outlines are too generalized. The map in Fig. 1, A shows all the rise and fall of the relief, creating geometrically right threats, which become clear after abstraction.

The transition from accurate real landscapes to abstract ones requires a special cartographic procedure - idealization. "The process of idealization in logic (in philosophy) is called the mental creation of such an object that does not exist in objective reality, but there are its approximate prototypes" [4], and in cartography, idealization is understood as the creation of new graphic images that are endowed not only with existing real properties, but also imaginary ones [1, 2, 8, 9]. Through the process of idealization, we can talk about idealized objects (objects and their properties) as existing in reality, although in reality there are only prototypes of such idealized objects in the form of rows of really existing objects ordered in a certain way.

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Creating idealized images, revealing their general and essential properties, we obtain simplified (formalized) concepts about real objects, in particular, about the patterns of the system-forming flows of the Amu Darya delta. The following stages of cartographic idealization of the delta relief can be distinguished (Urazbayev, 10, 11, 12):

1) the initial topographic map, on which the idealized relief of the delta is depicted with isogypsum in the form of a continuous constancy, reflecting the statics of the earth's surface [7, 9];

2) a map of the plasticity of the topography, compiled from a topographic map using satellite images; it highlighted decreases and increases in the topography of the delta in a discontinuous, discrete and dynamic form by converting isogypsum into morphoisographs; instead of isohypsum obtaining relief structures, displayed in plan in the form of delta blades;

3) graphic display of blades of large and small deltas in the form of curvilinear geometrically regular figures (Fig. 2); they line up along the lines of ancient and modern watercourses, i.e. the figures are arranged in an orderly manner along the lines of the flow;

4) geometric images shown in Fig. 2, are simplified with further idealization to line cuts, which show champaigns (axes) of symmetry of the indicated figures (Fig. 3).

Idealization makes it easier for a soil scientist, geographer and geologist to study the framework of the structure of a system-forming stream - a geosystem, simplifying it to a geometric model. During idealization, all secondary parameters are discarded, only essential ones that are necessary for geometric analysis remain: points, lines, planes, on the basis of which the axioms are constructed according to the proposal of I.N Stepanoa [9]. The latter form geometrical figures (see Fig. 2, 3), reflecting the natural forms of structures of system-forming flows of small deltas in the first abstract approximations. Abstraction of the topography in the form of straight-line segments (see Fig. 3) creates a branching system: a "topological tree", and from "trees", "topological forest" is built.

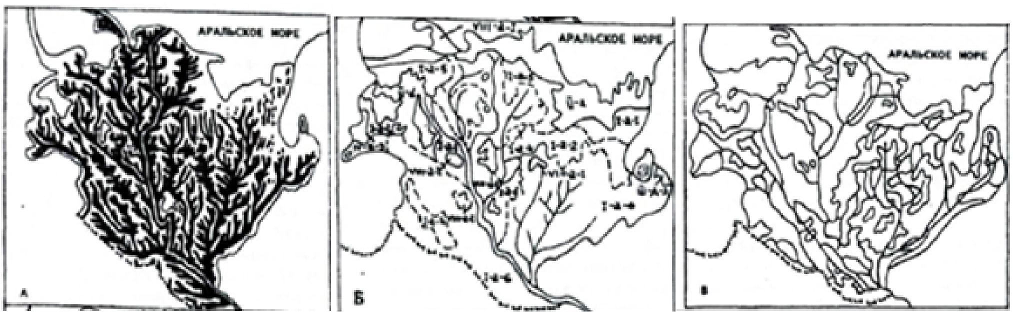

Fig. 1. Comparative assessment of the contour on the maps of the modern delta of the Amu Darya, compiled by different authors:
A - methods of relief plastics (OG AN RUz, 1983);
B - landscape using aerial photographs (Uzgidroingeo, 1982);
C- traditional methods soil map (Uzgiprozem, 1970)

The study of the structure of the earth's surface of the region shows that the delta consists of several small "topological trees" that form an integral system. Elementary landscapes (systemforming flows), combining with each other, create interconnected geosystems of small deltas (Kazakhdarya, Erkindarya, etc.), which, in turn, can be considered as elements of even larger and more complex geosystems ("topological trees" of the delta Amu Darya). If the tops of the trees are connected, then a system consisting of polygons is formed (see Fig. 2). Such polygons reflect the state of the spatial boundaries of soil-geological bodies and system-forming flows of landscapes and include two parts - left and right, i.e. have a specular reflection: each half is specularly asymmetrical. This asymmetry is widespread in delta geosystems. As seen in Fig. 2, the set of geometric shapes is in the form of blades. Here, branches flows depart from the upper part of the delta (branch point) at a certain angle. Each such form is a topological tree, and their collection is a topological forest.

Branching landscape systems of the delta originate in the upper part of the channel, where, the initial material “flows down” to the end of the fan in the form of system-forming ribbonsstreams, under the action of gravity. The more powerful forces of the flow means the larger area for them. At the beginning of a stream or at a branch point, ideal soil-geological bodies have a large width, which gradually decreases downward. Such a gradual increase in the delta area along the bifurcation points indicates that the increment in areas in the delta system obeys the law of topological branching

The direction of one-way system-forming flows can be simplified to straight line segments. The lines show the main directions of flows on an ideal soil-geological body. As can be seen from Fig. 3, at the points of division they are characterized by different directions. For example, at the initial point A, the streams form two diverging lines at an angle of 35 °, which can be explained by the specifics of their natural forces. Stream C2 is more powerful than stream C1. These two streams form systems of streams that differ from each other in the degree and nature of branching. The flows of the C2 geosystem are directed mainly to the north, and the C1 geosystems are directed to the northwest. Apparently, the directions of the system-forming flows can be identified on the maps of the relief plastics, i.e. flow system of Fig. 3 can only be obtained from fig. 1, A or fig. 2, but not from traditional maps (see Fig. 1, B, C). Although the systemic streams are clearly visible on space images, they are not drawn by cartographers.

Fig. 2. Graphic display of the blades of shallow deltas of the modern Amu Darya delta (the first stage of idealization according to Fig. 1.A)

Fig. 3. Abstraction of the relief of the modern Amu Darya delta in the form of segments of straight lines (the second stage of idealization according to Fig. 1.A)

As it is well known, large-scale maps of the plastics of the relief of the accumulative plain make it possible to reveal all actually existing relief elements. This, in turn, allows all elevated relief elements to be shown in the form of lines (Fig. 4). In a similar way, elevated relief elements of elevated objects can be shown (Fig. 5). As it is visible, the display of positive landforms in the form of lines facilitates the study of the internal structure of these territories. The line structures fully show the direction of one-way system-forming flows. At the same time, it should be emphasized that the cartographic idealization of sandy territories is of great importance. The display of elevated sand relief elements in the form of lines reflects the structure of the earth's surface (Fig. 6). These maps make it possible to study the geometric patterns of the system-forming flows of the territories under consideration.
V.R. Volobuev [3] to study the surface structure of the Milskaya steppe identified relief forms as increment and decrement. In our opinion, the increments highlighted on the relief plastics maps can be called a topological forest. More widely, the method of relief plastics made it possible to use the idea of showing the topography in the form of a topological forest on the maps of I.N Stepanov [9] for Central Asia. The fig. Figure 7 shows fragments from this map related to the lower reaches of the Amu Darya.
The consistency of using the relief plastics method in compiling various soil reclamation maps is confirmed by other examples. For example, M. Sh. Ishankulov [5] shows the branching systems of alluvial fans in Kazakhstan in the form of streamlines of former water-soil flows. The specificity of cartographic idealization lies in the fact that on idealized objects it is possible to study the systemic organization of natural-reclamation conditions of deltaic geosystems. The structure of soil-geological bodies and the direction of system-forming flows play an important role in the formation of the material composition of landscapes and sediments, as well as in the organization of the hydrochemical regime of groundwater. Therefore, first, it is required to identify the geometric structure of the landscape space, and then to establish a connection between this structure and the material composition of natural territorial complexes. Apparently, the idealization procedure can be viewed not as a kind of abstraction, but as a special independent mental process (Fig. 8).
Geologists are already using the concept of a parallelepiped (or parallelogram for a plane) when describing the structures of the earth's crust. Soil scientists also compile soil maps based on identifying the ordering of soil areas along a flat parallelogram grid.

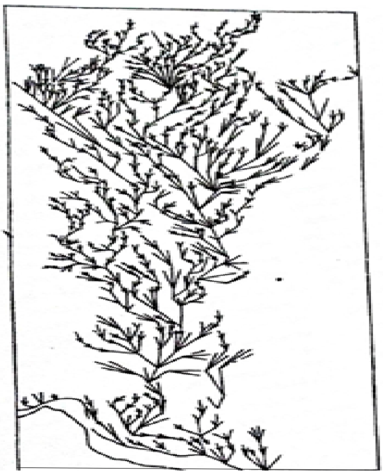

Fig. 4. Idealization of the relief of the Churtambay delta in the form of lines "Topological tree"

Fig. 5. Idealization of the relief of the western part of the Kuskanatau Upland in the form of lines

Fig. 6. Idealization of the relief of sandy areas in the form of lines

This created the idea that the structure of the soil cover is predominantly cellular (mesh),which obeys the law of a parallelogrammatic flat grid, although other types of symmetry are not excluded [8, 9]. The study of the structure of the earth's surface of small deltas and their geometrization (idealization) show that in deltas there are mainly rectangular, rhombic, oblique-angled "blades". At the same time, a regular hexagon and deformed rectangles are sometimes widespread.

We, through forming the geometric shapes of landscapes, get the opportunity to solve such problems that cannot be solved and disclosed on the basis of direct contemplation of the objects under study. The study of the direction of system-forming flows in idealized objects always requires, in one form or another, taking the movement or development associated with a change in the content of the concepts into account, with which we operate.

The process of cartographic idealization of the relief plays a huge role in the geosciences:

1. Using the idealization of the relief makes it possible to display the objects under study in the following categories: regular, necessary, essential:

a) the image of small deltas in the form of a "topological tree" shows that the idealized forms of hills and sands do not form these patterns;

b) displaying objects (accumulative plains, hills, sands) in the form of lines makes it possible to study the direction of system-forming flows, that need to be explained to form the forms of the earth's surface;

c) shallow deltas, hills and sandy areas differ in structure from each other and these differences are clearly depicted on idealized maps.

2. Under the conditions of idealized simplified situations, we get the opportunity to effectively describe the relations of interest to us on the basis of the minimum number of parameters, meaningly the representation of objects in the form of lines is of great importance in studying the direction of natural flows of groundwater, etc.

3. Operating in physical geography, geomorphology and soil science with such idealized objects as "topological tree", "topological forest" and an equilateral triangle, etc., we get the opportunity to describe changes in natural-ameliorative conditions within the object.

Fig. 7. Relief map of Central Asia (M1: 1,000,000). Elevated elements are shown in the form of a topological forest with dividing points along the "tillering" nodes. Lower reaches of the Amu Darya and adjacent territories. Compiled by I.N.Stepanov

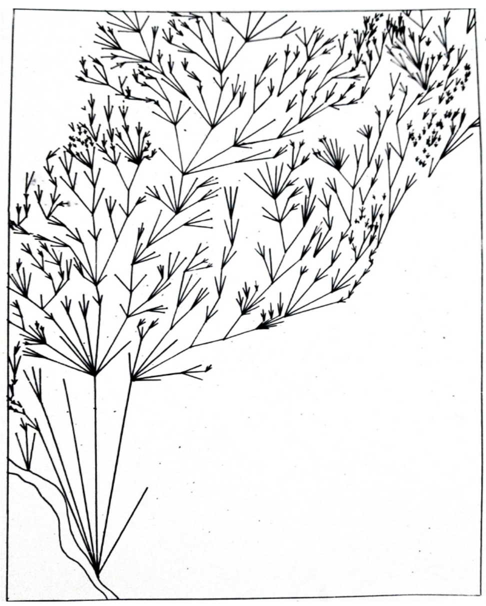

Fig. 8. Idealization of the relief of the upper part of the Kyzketgen-Chimbay delta

4. Application of the process of cartographic idealization of the relief is of great heuristic significance. Displaying the relief in the form of lines makes it possible to make a discovery in the earth sciences.

Conclusion

It is possible to cite a huge number of examples from the history of science, where its greatest discoveries were carried out on the basis of the application of the idealization process to the objects under study. For example, S. V. Kalesnik [6] wrote: "Through, the identification of soil zones on maps became possible with the help of cartographic idealization of space and generalization of the content of different types of soils, it has been made possible for V. V. Dokuchaev (on the eve of the XX century) to discover the well-known law of geographic zoning".

The empirical material of cartography fully confirms that the idealization process allows you to create a theory that is general in nature and displays systems of objects and their spatial relationships. The identification of branching forms (topological trees) in the modern Amu Darya delta makes it possible, by analogy, to detect similar geometric shapes in other delta areas through cartographic idealization.

The main aspects of the cartographic idealization of the relief are the spatial structure, spatial laws, spatial structures of system-forming flows, geographical assessments, etc., which are unrealizable without metric information taken from the corresponding maps. Thus, the idealization of the spatial structures of the system-forming flows shows that a number of phenomena (the direction of the system-forming flows, the dynamics of the material composition of the soil, etc.) and the geometric forms of nature have a systemic organization.

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