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Software instruments for investigation of landscape metric features

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Monitoring the state and dynamics of natural phenomena using geographic information systems (GIS) supposes conducting a variety of measurements and drafting on maps, remote sensing images and other imagery. However, the initial data can be represented in different coordinate systems and map projections with different metric properties, and thus measurement task is complicated. Conversion to a common coordinate system and projection allows to perform measurements uniformly and to visualize data jointly at once. But often the problem of projection selection solves ambiguously, especially over large areas in which the projection usage and data reprojecting lead to metrical distortions.

Instead of using the map projections the most convenient way of storing data is their representation in geographic coordinate system. However, in most cases GIS have no instruments to carry out measurements basing on such data. Going out from this point of view, the author proposes to elaborate usage of geographic coordinate system not only for data storing but also to determine the dimensions of landscape features and their morphometric parameters. Such approach provides the Earth's ellipsoid surface for measurements without translating data to plane of the map projection.

The approach was implemented in form of the library of instruments for the cartometric and morphometric surveys. The library allows: 1) to store and process initial data directly in the geographic coordinate system; 2) to dispose of map projection distortions in measurements; 3) to take into account the curvature of the Earth's surface for the large distances and territories. The library was developed in the C# programming language as an ArcGIS extension and named as "Cartometry". Current library version accepts the following basic procedures: 1) measurement of curves (geodetic line, rhumb line, relief profile); 2) drafting and saving geometrically correct geodetic lines and rhumb lines; 3) object area measurement on the ellipsoid surface; 4) constructing of visibility field based on digital elevation model, considering the Earth's curvature. Proposed approach and software instruments were tested in number of geographic investigations mainly by studying the dynamics of water-ice landscapes in the Arctic basin and creating the landscape-climatologic GIS for this area.