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ANALYSIS OF SPATIAL DATA FOR GIS

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Spatial analysis tools include various procedures for manipulating spatial and attribute data performed during the processing of user requests. (For example, overlaying graphical objects, tools for analyzing network structures, or selecting objects based on specified characteristics).

Each GIS package is characterized by its own set of spatial analysis tools that provide solutions to specific user tasks, while at the same time it is possible to identify a number of basic functions inherent in almost every GIS package. This is, above all, the organization of the selection and combination of objects in accordance with the given conditions, the implementation of computational geometry operations, analysis of overlaps, construction of buffer zones, network analysis.

Selecting objects on request: the simplest form of a query is to obtain the characteristics of the object indicated by the cursor on the screen and the inverse operation when objects with specified attributes are displayed. More complex queries allow you to select objects based on several features, for example, based on the distance of some objects from others, matching objects, but located in different layers, etc.

SQL queries are used to select data according to certain conditions. In order to fulfill queries of different complexity, the possibilities of using mathematical and statistical functions as well as geographic operators are used in drawing up queries that allow you to select objects based on their relative position in space (for example, whether the object being analyzed is inside another object or intersects it).

Generalization of data can be carried out on the equality of the values of a particular attribute, in particular for zoning. Another way of grouping is to merge objects of one thematic layer in accordance with their placement inside polygonal objects of other thematic layers.

Geometric functions: these include calculations of the geometric characteristics of objects or their mutual position in space, using the formulas of analytical geometry on the plane and in space. So for area objects, the areas occupied by them or the perimeters of the borders are calculated, for linear objects, the lengths, and also the distances between objects, etc.

Overlay operations (topological overlay layers) are among the most common and effective tools. As a result of the superposition of two thematic layers, another additional layer is formed in the form of a graphic composition of the original layers. Considering that the objects being analyzed can be of different types (point, line, polygon), different forms of analysis are possible: point to point, point to polygon, etc. The combination of polygons is most often analyzed.

Build buffer zones. One of the means of analyzing the proximity of objects is the construction of buffer zones. Buffer zones are areas (polygons) whose border is located at a specified distance from the boundary of the original object. The boundaries of such zones are calculated on the basis of an analysis of the corresponding attribute characteristics. In this case, the width of the buffer zone can be both constant and variable. For example, the buffer zone around the source of electromagnetic radiation will have the shape of a circle, and the zone of pollution from the chimney of the plant, taking into account the wind rose, will have a shape close to an ellipse.

Network analysis allows the user to analyze spatial networks of connected linear objects (roads, power lines, etc.). Typically, network analysis is used to determine the nearest, most advantageous path, determine the level of network load, determine the address of an object or route at a given address, and other tasks.

Analysis of the spatial distribution of objects. In fact, in many cases, it is necessary to know not only the amount of space occupied by objects, but also the location of objects in space, which can be characterized by the number of objects in a particular area, for example, the

distribution of population. The most common methods for analyzing the distribution of point objects. The measure of the point distribution is the density. It is defined as the result of dividing the number of points by the value of the area of the territory in which they are located. In addition to the distribution density, you can estimate the shape of the distribution. Point distributions are found in one of four possible options: uniform (if the number of points in each small subdomain is the same as in any other subdomain), regular (if the points separated by equal intervals throughout the region are located at the nodes of the grid), random clustered (if the points are collected in tight groups).

Point distributions can be described not only by the number of points within the subdomains. Local relationships within pairs of points are often analyzed. The calculation of this statistic includes the determination of the average distance to the nearest neighboring point among all possible pairs of nearest points.