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STUDY OF THE STATE OF G'IJDAVON DISTRICT THROUGH GEODESIC SCIENTIFIC ANALYSIS

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Abstract

This scientific article contains an extended analysis of the territory of Gijduvan district based on modern methods of geodetic surveys, geographical structure, relief, natural resources, economic infrastructure and cadastral systems. The article highlights the importance of GNSS, RTK, remote sensing, drone cartography, Digital Elevation Model (DEM) technologies, geoid modeling, coordinate system transformation and geodetic monitoring.

Keywords: Geodesy, G'ijduvan, GNSS, RTK, WGS-84, SK-42, geoid, cartography, drone, DEM, cadastre, GIS.

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Introduction

The science of geodesy is engaged in the precise study of the shape, dimensions and spatial coordinates of the earth's surface. The natural conditions, relief, economic potential and infrastructure of the Gijduvan district create favorable conditions for geodetic analysis. In an era of rapid development of digital technologies, geodetic surveys in the district are gaining even greater importance. Gijduvan district is located in the north-east of the Bukhara region and was founded in 1926. The coordinates of the territory are determined by 40.10° N and 64.67° E. The area is 3,700–3,840 km². The population as of 2025 is 327,500 people. The climate is sharply continental: summers are hot and dry, and winters are cold. The annual precipitation is 130–150 mm. The vegetation period is 200–210 days. The territory consists of plains descending to the west, which creates very favorable conditions for geodetic work. The highest points reach 505 meters. Mount Kokcha, Oyakogitma swamp, and the Shurkul plateau are the main elements of the relief of the region. Agriculture is the leading sector in the Gijduvan district. Cotton, grain, vegetables, potatoes, and livestock are the main industries. There are 22 thousand hectares of irrigated land.

In the territory of Gijduvan district, industrial and production infrastructure has been developing significantly in recent years. Major industrial facilities operating in the district include the Gijduvan cotton ginning plant, the Yakhna beverage factory, the Cannery, the Gijduvan free economic zone, and the “Bukhorotex” textile enterprise. These production complexes, along with increasing the economic potential of the region, sharply increase the need for high-precision geodetic data for the rational use of land resources, planning of industrial areas, and the placement of infrastructure facilities.

At the same time, the district also has developed traditional areas of handicrafts - pottery, blacksmithing, jewelry, and cradle-making, and there is a need to use modern geodetic and cartographic technologies to inventory historical and cultural objects, determine their location, and form a tourist infrastructure.

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Various coordinate systems and modern measurement technologies are used in geodetic surveys in the Gijduvan district. The WGS-84, SK-42, and UTM Zone 41N coordinate systems are mainly used in the region. WGS-84 serves as the main geodetic base for global navigation satellite systems (GNSS). SK-42, as a historical system based on the former geodetic base, is still found in some cadastral documents. The UTM Zone 41N projection is widely used in drone cartography and digital mapping processes. However, spatial displacement errors ranging from 10 to 100 meters are observed during the transformation from the SK-42 system to the WGS-84 system. This discrepancy creates accuracy problems in land cadastre, industrial facility placement, and territorial planning.

Modern GNSS and RTK (Real Time Kinematic) technologies allow for high-precision (up to 1–2 cm) geodetic measurements in the district. These technologies are especially important for delimiting land plots, forming cadastral documents, and constructing industrial facilities. Currently, work is being carried out in stages to update geodetic points and establish modern base stations in the district.

Aerial photography based on UAVs (unmanned aerial vehicles) allows for high-resolution digital modeling of the territory. This serves as an important methodological basis for monitoring agricultural land, assessing construction sites, and planning infrastructure facilities.

Remote sensing technologies are expanding the ability to monitor ecological and landscape changes in the region. In particular, images from NASA's Landsat and the European Space Agency's Sentinel satellites are used to identify irrigated land degradation, salinity levels, and desertification processes. This information serves as an important scientific basis for ensuring agro-ecological sustainability.

Global digital elevation models such as SRTM, ALOS AW3D30, and ASTER GDEM are widely used in the analysis of the terrain of the region. DEM data are used to create elevation maps, develop slope models, and determine the natural directions of water flows. This is important in assessing the state of land

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reclamation, designing water management structures, and predicting erosion risks.

The issue of vertical accuracy in the region remains relevant. Due to the incomplete formation of a single high-precision national geoid model in Uzbekistan, there is a difference of 0.5–1.2 meters between ellipsoidal heights obtained via GNSS and orthometric heights based on classical leveling. In the conditions of the Gijduvan district, this difference can cause significant problems in the design of irrigation systems and construction facilities. Therefore, the development of a refined local geoid model for the region is a pressing scientific and practical task.

Conclusion

Gijduvan district has wide opportunities for geodesy, and modern GNSS, drone cartography and remote sensing technologies play an important role in the development of the region. The topography, economic potential and natural conditions of the region create great convenience for geodetic research. If the problems are eliminated, the district cadastre and infrastructure will rise to a qualitatively new level. Some elements of the geodetic infrastructure in the region are outdated, and some of the points in the former SK-42 system are damaged or have lost their coordinates. Insufficiently defined transformation parameters, the absence of a modern geoid model, and the lack of high-precision equipment negatively affect the quality of geodetic work.

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