

Brief information about the project

Name of the project	AP27511595 "Development of a regional geographic information system for monitoring and assessing the outburst hazard of moraine-glacial lakes in the eastern part of Ile Alatau"
Relevance	The moraine-glacial complex of the Ile Alatau is located in a highly dynamic zone. Physical and chemical processes actively occur here, resulting in the formation of morphological depressions, which are then filled with water due to the intensification of glacial runoff and meltwater. Consequently, assessing the outburst hazard of moraine-glacial lakes formed as a result of their development and overfilling, as well as conducting an inventory of these lakes based on ground-based, aerovisual, and reconnaissance surveys - including satellite imagery and the application of advanced computer technologies - is an urgent task. The project aims to develop a regional geographic information system (GIS) for monitoring and assessing the outburst hazard of moraine-glacial lakes in the eastern part of the Ile Alatau. The system is based on a comprehensive approach that includes lake inventory using satellite imagery, field surveys, and modern computer technologies. The regional GIS will enable a detailed study of the topographic, climatic, and hydrological characteristics of the region, the assessment of potential risks, and the development of mitigation measures for possible outbursts.
Purpose	The objective of this project is to develop a regional geographic information system (GIS) for monitoring and assessing the outburst hazard of moraine-glacial lakes in the eastern part of the Ile Alatau, utilizing remote sensing (RS) data, unmanned aerial vehicles (UAVs), and GIS technologies.
Objectives	1.Collection of archival, departmental, historical, and monitoring data on moraine-glacial lakes in the eastern part of the Ile Alatau. 2.Systematization and analysis of satellite imagery and UAV aerial photographs to assess the current state of moraine-glacial lakes in the eastern part of the Ile Alatau. 3.UAV deployment and capture of high-resolution overlapping images to enable the creation of 3D models of vulnerable mudflow hazard areas in the eastern part of the Ile Alatau. 4.Determination of the morphometric characteristics of moraine lakes in the eastern part of the Ile Alatau based on remote sensing (RS) and UAV data. 5.Analysis of changes in meteorological, glaciological, and geomorphological factors influencing the state and dynamics of moraine-glacial lakes. 6.Determination of outburst hazard criteria for moraine-glacial lakes based on the identification of mudflow-

	forming conditions using GIS technologies, RS, and UAV data. 7. Modeling the outburst of moraine-glacial lakes in the eastern part of the Ile Alatau. 8. Creation of interactive maps (inventory, assessment, and predictive-recommendatory types) of moraine-glacial lakes in the eastern part of the Ile Alatau. 9. Development of a regional geographic information system (GIS) for monitoring and assessing the outburst hazard of moraine-glacial lakes in the eastern part of the Ile Alatau.
Expected and achieved results	1. Creation of a scientific-methodological database containing archival, departmental, historical, and monitoring data on moraine-glacial lakes to assess their outburst hazard. 2. Spatial analysis of the moraine-glacial complex in the eastern part of the Ile Alatau, including quantitative and qualitative characteristics. 3. Detailed processing of UAV data to obtain precise information on the characteristics of moraine-glacial lakes. 4. Classification of moraine-glacial lakes based on the processing and analysis of morphometric data. 5. Calculated and processed data on meteorological, glaciological, and geomorphological characteristics to assess the outburst hazard of moraine-glacial lakes and determine their criteria. 6. Methodology for determining hazard assessment criteria for moraine-glacial lakes in the eastern part of the Ile Alatau. 7. Refined large-scale maps of outburst-prone areas of the moraine-glacial complex based on remote sensing (RS) and UAV data. 8. Interactive map (inventory, assessment, and predictive-recommendatory type) of moraine-glacial lakes in the Ile Alatau based on the integrated use of GIS technologies, RS, and UAV data. 9. Regional geographic information system (GIS) for monitoring and assessing the outburst hazard of moraine-glacial lakes in the eastern part of the Ile Alatau. In 2025, as part of the research, a comprehensive scientific-methodological database on moraine-glacial lakes in the eastern part of the Ile Alatau (Talgat and Esik river basins) was created. This database consolidated archival, historical, and monitoring data regarding their condition and historical cases of mudflows. To supplement this database, a detailed analysis of recent satellite and aerial imagery was performed, allowing for the assessment of the spatiotemporal dynamics of the lakes over the last decade. Additionally, UAV aerial photography was conducted over the Talgat riverbed. Based on the data obtained from the drone, a high-precision 3D digital elevation model (DEM) was constructed, which is essential for a detailed morphometric analysis of the riverbed and the

	identification of potentially vulnerable mudflow hazard areas. The results of the spatiotemporal analysis were successfully validated and published in an article recommended by CQASHE (KOKHBO), titled "Іле Алатауының солтүстік беткейінің орталық және шығыс бөлігіндегі мұздықтық-мореналық көлдердің кеңістіктік-уақыттық үлестірілуін талдау" [Analysis of the spatiotemporal distribution of glacial-moraine lakes in the central and eastern parts of the northern slope of the Ile Alatau].
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Usage	
Priority compared to real-world alternatives	
List of publications with links to them	A.K.Мусина, Ә.С.Абдуллаева, М.Н.Тұрсынғали, Қ.М.Наконова, С.Е. Қайрат. Іле Алатауының солтүстік беткейінің орталық және шығыс бөлігіндегі мұздықтық-мореналық көлдердің кеңістіктік-уақыттық үлестірілуінс талдау // География және су ресурстары – 2025 - № 4. – С. 57-74. DOI: 10.55764/2957-9856/2025-4-57-74.46
Patents	