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**POSSIBILITIES OF USING GEOGRAPHIC INFORMATION SYSTEMS
IN THE STUDY OF MOUNTAIN GLACIERS**

Abstract: The article provides analytical opinions on such issues as the possibilities and convenience of using modern Geographic Information Systems in the study of mountain glaciers, the use of remote data in the scientific study of changes in Mountain glaciers.

Keywords: Geographic Information Systems (GIS), remote sensing, cartography, thematic mapping, mountain glaciers, space shots, glacier retreat, glacier thickness, mountain glacier significance, mountain glacier monitoring.

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**ВОЗМОЖНОСТИ ИСПОЛЬЗОВАНИЯ ГЕОИНФОРМАЦИОННЫХ
СИСТЕМ ПРИ ИЗУЧЕНИИ ГОРНЫХ ЛЕДНИКОВ**

Аннотация: В статье представлены аналитические мнения по таким вопросам, как возможности и удобство использования современных геоинформационных систем при изучении горных ледников, использование данных дистанционного зондирования в научных исследованиях изменений горных ледников.

Ключевые слова: географические информационные системы (ГИС), дистанционное зондирование, картография, тематические карты, горные

ледники, космические снимки, отступление ледников, толщина ледников, значение горных ледников, мониторинг горных ледников.

Introduction: In recent decades, one of the most controversial scientific problems has been the problem of global warming. It has now been proven that we are in the warm phase of the glacial epoch within the Quaternary period¹, the beginning of which is dated to the second half of the XIX century (the end of the so-called Little Ice Age). Despite scientific and technological progress, the life of modern humanity still largely depends on the natural environment, therefore, the study of natural systems in the context of climate change is undoubtedly relevant.

In this regard, observations of fluctuations in glaciers, i.e., the dynamics of their size and shape caused by changes in the internal regime and climate, are of great importance. This is due, first of all, to the fact that they are sensitive indicators of both local and global climate change. Secondly, glaciers are sources of clean fresh water. During favorable periods (cooling or humidification), glaciers accumulate matter (snow and ice), and during unfavorable periods (warming or drying) they release it in the form of melt runoff, changing their size and shape.

Studying mountain glaciers using Geographic Information Systems (GIS) has important implications for our understanding of climate change and hydrological processes. Here are some reasons why this is important: change monitoring, water resource forecasting, risk assessment and scientific research.

Methods: Today, a lot of information about mountain glaciers has been collected to transform it into various forms, and the relevance of glaciological research is constantly increasing. Researchers from different countries are proposing new ways to collect and store information about glaciers. The introduction of GIS technologies in the study of glaciers served to develop new

¹ Hagedon, H. Eiszeit, Klimaänderung und Menschheit / H. Hagedon // Akademie aktuell. – Dezember. – 2004. p. 8 – 13,

high-quality methods of data collection and storage. In the article, the use of GIS technologies, that is, the modern cartographic method, is used in the study of mountain glaciers.

Results: The use of Geographic Information Systems (GIS) in the study of mountain glaciers opens up wide possibilities for research, monitoring, and management of these unique ecosystems. Geographic Information Systems are software that allows for the collection, storage, analysis, and visualization of spatial data. In the context of studying mountain glaciers, GIS enables scientists and ecologists to obtain valuable information necessary for understanding changes in glacier systems and their impact on the environment.

One of the key advantages of using GIS in the study of mountain glaciers is the ability to integrate various types of data, such as elevation data, temperature, precipitation, ice melt rates, and other parameters. By analyzing and visualizing these data, researchers can identify trends in glacier area changes, temperature regimes, dynamics of glacier boundaries shifts, and other parameters. This allows for better understanding of the processes occurring within mountain glaciers and the factors influencing their behavior.

GIS also enables scientists to create detailed maps of glacier areas, showing features such as crevasses, moraines, ice flow patterns, and glacier retreat areas. These maps are valuable tools for monitoring changes in glacier morphology over time and for predicting future glacier behavior based on different scenarios of climate change.

Furthermore, GIS can be used to model the impacts of climate change on mountain glaciers, such as changes in temperature and precipitation patterns, and their effects on glacier mass balance and melt rates. These models can help in assessing the vulnerability of mountain glaciers to climate change and in formulating adaptation and mitigation strategies to reduce the negative impacts of glacier retreat on local ecosystems and communities.

In addition, GIS facilitates the sharing of data and information among the scientific community, policymakers, and the public, promoting collaboration and informed decision-making in glacier conservation and management efforts. By visualizing complex spatial data in an accessible and interactive way, GIS helps to communicate the scientific findings and raise awareness about the importance of protecting mountain glaciers as sensitive indicators of environmental change.

In addition to the above, the following actions can be performed with the help of GIS in the study of mountain glaciers:

1. Mapping and Visualization:

Digital Glacier Maps: Creating accurate and high-resolution maps of glaciers using satellite imagery and georeferenced data.

3D Visualization: Developing three-dimensional visualizations of glacier surfaces and terrain for better understanding and communication.

2. Glacier Dynamics Analysis:

GPS Data Integration: Incorporating GPS data for monitoring and analyzing glacier movement and changes in surface elevation.

Temporal Analysis: Using GIS tools to analyze temporal changes in glacier features over time.

3. Ice Thickness and Volume Estimation:

Radar Data Integration: Utilizing radar data to estimate ice thickness and volume on different parts of the glacier.

Modeling Glacier Volume Changes: Developing GIS-based models to simulate glacier volume changes in response to climate variations.

4. Surface Temperature Monitoring:

Thermal Mapping: Analyzing the thermal regime of glaciers using thermal mapping to identify variations in temperature across the glacier surface.

5. Glacier Retreat and Advance Analysis:

Change Detection: Implementing change detection techniques in GIS to identify areas of glacier retreat or advance over time.

6. Glacier Lake Monitoring:

Lake Dynamics Mapping: Monitoring and mapping changes in glacier lakes using GIS, helping to assess the risk of glacial lake outburst floods (GLOFs).

Hydrological Modeling: Integrating GIS with hydrological models to simulate and predict glacier lake behavior.

7. Morphological Studies:

Digital Elevation Model (DEM) Analysis: Analyzing glacier morphology and landforms using high-resolution DEMs.

Landform Classification: Employing GIS for landform classification to understand glacier-related geomorphology.

8. Integration with Climatic Data:

Climate Data Overlay: Integrating GIS with climate data to study correlations between climatic variables and glacier changes.

Climate Change Impact Assessment: Assessing the impact of climate change on glaciers by combining GIS with climate modeling.

9. Web-based Mapping and Data Sharing:

Online Mapping Platforms: Developing web-based GIS applications for interactive mapping, data sharing, and public outreach.

These GIS applications allow researchers to analyze, model, and visualize complex spatial relationships, enhancing our understanding of mountain glacier dynamics in response to changing environmental conditions.

Discussion: In conclusion, the possibilities of using Geographic Information Systems in the study of mountain glaciers are vast and offer great potential for advancing our knowledge of these dynamic ecosystems. By harnessing the power of GIS tools and techniques, researchers can gain valuable

insights into the processes shaping glacier landscapes and contribute to the preservation of these natural wonders for future generations.

References (Использованные источники):

1. Hagedon, H. Eiszeit, Klimaänderung und Menschheit / H. Hagedon // Akademie aktuell. – Dezember. – 2004.

2. Самойлова, С. Ю. (2012). Мониторинг горных ледников: задачи, новые методы, перспективы. СибСкрипт, 4 (2), 131-135.

3. https://unesdoc.unesco.org/ark:/48223/pf0000379646_rus.locale=ru

4. Книжников Ю.Ф., Золотарев Е.А., Кравцова В.И., Харьковец Е.А. Дистанционный мониторинг горных ледников: Изменения технологии за последние 50 лет (На примере Эльбруса) / Ю.Ф. Книжников // Материалы гляциологических исследований. – 2000. – № 89. – С. 58–64.

5. Акабоев И.З., Гляциологик тадқиқотларда географик ахборот тизимларидан фойдаланиш // «Geografiya fani va raqamli iqtisodiyot: muammo va istiqbollar» xalqaro ilmiy-amaliy konferensiya materiallari. Namangan – 2023. – b. 74-78.

6. Akaboyev, I. Z., & Qarorov, Z. R. Iqlim o'zgarishi natijasida yuzaga kelgan ayrim geoeologik muammolar. "Янги Узбекистонда география фани ва таълимидаги муаммолар" мавзусидаги республика илмий-амалий конференцияси материаллари, Жиззах-2022, 431-433.

7. Акабоев И.З., Хакимов М.М., & Турдалиев И.Э. (2023). ЗНАЧЕНИЕ ЭКОЛОГИЧЕСКИХ КАРТ В ОХРАНЕ ПРИРОДЫ И ОКРУЖАЮЩЕЙ СРЕДЫ. Экономика и социум, (6-1 (109)), 593-598.

8. Akaboyev, I. Z., & Mirabdullayev, B. B. (2020). THE IMPORTANCE OF ELECTRONIC MAPS IN THE DISTRIBUTION OF AGRICULTURAL. Theoretical & Applied Science, (4), 123-126.

9. Mirzaakhmedov, H., & Akaboyev, I. (2015). Advantages of using geoinformation systems when developing thematic maps. In Proceedings of the scientific-practical seminar of the Fergana Valley Geographers Association (pp. 165-167).

10. Akaboyev, I. Z. (2020). ANALYSIS OF DRAINAGE AND RAIN INTENSITY TO SOLVE THE FLOOD PROBLEM IN TASHKENT. Экономика и социум, (6 (73)), 126-129.

11. Akaboyev, I., & Tokhtanazarov, A. (2022). Geoeological problems caused by anthropogenic activity at the varzik reservoir. Theoretical & Applied Science, 116, 764-768.

12. Akaboev I.Z., & Mirabdullaev B.B. (2020). SOME ASPECTS OF THE PROCESS OF CREATING AN INDUSTRIAL MAP USING ARCGIS. Экономика и социум, (11 (78)), 50-56.

13. Akaboyev, I. Z., & Mirabdullayev, B. B. (2020). The importance of electronic maps in the distribution of agricultural Theoretical & Applied Science 4 (84) 123-126. DOI, 10, 15863.