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OPTIMIZATION OF HYDROLOGICAL PARAMETERS TRACKING AND DEVELOPMENT OF DATA COLLECTION SYSTEMS FOR IMPROVING FORECASTS AND WATER RESOURCE MANAGEMENT

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The problem statement. In the modern world, where the conservation of water resources becomes an extremely important task, the study of hydrological parameters of rivers and their optimization becomes critically important. In order to improve the quality of forecasts and efficiently manage water resources, the development and implementation of data collection systems are a necessity.

Research Findings. Definition of Hydrological Parameters: The considered parameters include water level, flow velocity, water discharge, water temperature, and others that are crucial for understanding river behavior.

Importance of Measurements: Analyzing the impact of hydrological parameters on water resources, considering their seasonal variation, and their correlation with climatic factors.

Traditional Methods: Utilizing hydrological stations, measuring devices, and manual observations.

Modern Technologies: Employing sensors, satellite sensing, and the Internet of Things for automation and high-precision measurements.

Integration of Technologies: Combining traditional and modern methods to ensure data accuracy and availability.

Employing advanced sensor technologies is crucial for real-time monitoring of hydrological parameters. These sensors can be deployed in various water bodies, collecting data on water levels, temperature, flow rates, and water quality. The data collected by sensors provide accurate and timely information, enabling quick response to changes and potential issues.

Satellite technology plays a vital role in monitoring large-scale changes in water bodies. Remote sensing satellites can capture imagery and data related to water levels, land use, and vegetation cover. This information is valuable for assessing the overall health of water ecosystems and identifying trends or anomalies over time.

The Internet of Things involves the interconnection of devices and systems, allowing for seamless data exchange. In water resource management, IoT devices can be deployed in water infrastructure, such as dams and reservoirs, to enable remote monitoring and control. These devices enhance automation, improve efficiency, and contribute to more sustainable water usage practices.

Automation in water management involves the use of computer-based control systems to regulate water-related processes. High-precision measurements, facilitated by technologies like GPS and advanced telemetry, ensure accuracy in data collection and enable precise control of water distribution systems.

Integrating data from various sources is crucial for obtaining a comprehensive understanding of water ecosystems. Traditional methods, such as manual measurements and historical records, can be combined with modern technologies like satellite data and sensor readings. This integration enhances the reliability and completeness of the information available for decision-making.

The use of advanced analytics and modeling techniques aids in predicting future changes in water bodies based on historical data. Machine learning algorithms can analyze complex datasets, identify patterns, and provide insights into potential hydrological shifts. This proactive approach is essential for mitigating risks and planning for sustainable water resource management.

Blockchain technology ensures transparency and security in water resource management. It can be used for maintaining accurate records of water transactions, tracking water usage, and creating a decentralized and tamper-proof database. This enhances accountability and trust among stakeholders involved in water governance.

Effective communication is vital during emergencies or sudden changes in water conditions. Modern technologies enable the development of automated alert systems that can quickly notify authorities and the public about rising water levels, potential floods, or other critical situations. This aids in timely response and evacuation efforts [1].

Application of Artificial Intelligence: Utilizing machine learning algorithms for automated data processing and improving forecast accuracy. Forecast Model Development: Using obtained data to create predictive models of river regimes. Implementation in Water Resources: Utilizing obtained data for effective water resource management, anticipating emergencies, and minimizing the impact of adverse events. Use of Data for Optimization: Applying obtained data to optimize the distribution of water resources, especially for drinking water, agricultural needs, technical water use, and environmental measures.

Application of automated systems for continuous monitoring of hydrological indicators and regulation of water consumption modes depends on changes in water bodies. Use of analytics and forecast models to detect changes in hydrological parameters that may lead to emergencies.

Implementation of automatic notification and evacuation systems for the population in case of rising water levels, natural disasters, or other threats. Development of adaptation strategies, taking into account climate changes and their impact on the availability of water resources.[1]

Adoption of modern technologies, such as blockchain, for efficient water resource accounting and ensuring transparency in management. Artificial intelligence systems are applied to predict changes in water bodies and increase the accuracy of management decisions. Use of data to implement environmentally balanced strategies aimed at preserving aquatic ecosystems and regulating human activities.

Conclusion. Optimization of tools for tracking river hydrological parameters and the development of data collection systems are crucial steps in ensuring sustainable water resource management. The integration of technologies, big data analysis, and the application of artificial intelligence help improve forecast accuracy and ensure the efficient use of water resources for the needs of modern society.

References

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integrate human dimensions into riverscape ecology and management. Wiley Interdiscip. Rev. *Water*. 2018, no. 5, e1291.

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IMPACT OF OPEN WATER SUPPLY SOURCES SPEED ON SOIL EROSION

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Elements and objects of systems operate in complex conditions, but the greatest loads are borne by water intake structures from open sources, which constantly experience and endure negative natural impact.

Open water supply sources, due to the velocities of water movement, the presence of suspended matter, nutrition, ice conditions, and channel characteristics, create special conditions for the design, placement, and operation of water intakes.

In addition, changes in flow regimes and directions of water currents, which occur when installing the intake directly into the source channel, create additional challenges for the operation of structures. In this case, an increase in water velocity is observed when bypassing the structures and a decrease in the source channel.

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A characteristic result of the negative impact of water supply sources on intakes is soil erosion, sedimentation, shifts, and overturning of structures. In most cases, these processes reduce or stop water intake, and addressing their consequences requires time and resources.

Preventing the negative impact of water supply sources on water intake structures and reducing costs for addressing its consequences requires consideration of all influencing factors during the design stage.

The analysis of the literature indicates a complex set of factors influencing soil erosion processes in the areas of water intakes. The main factor among them is the velocity of water flow, which creates conditions for the transport and removal of soil particles from the locations necessary for the placement of water intakes.

Reducing velocities is possible by increasing the cross-section of the source channel in the water intake area and selecting geometric shapes for structures that create minimal resistance to the flow of water around the structure. Conditions that protect the water intake area from damage due to soil erosion include securing the bottom and shorelines with stone (artificial or natural) embankments, with particle fractions that are not influenced by the water flow.

Erosion of the banks and bottom of open water sources is a significant issue accompanying the operation of water intake structures. It requires an analysis of factors influencing the intensity of erosion, reducing its intensity, or stopping it altogether.

This involves considering the flow regimes of river currents − their turbulence, composition, and particle size distribution of the rocks comprising the banks and bottom of the sources.