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IMPROVING METHODS FOR MAPPING IRRIGATION NETWORKS USING GIS TECHNOLOGIES.

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Annotation.

In this paper, the evolution of geographic information systems (GIS) has facilitated the use of irrigation network data based on topography. The use of spatial data for irrigation has emerged from the great capacity of GIS tools to store and manage information on the hydromorphology of the basin. These models use spatially variable topography data to convert precipitation to surface water flow. Manual manipulation of maps has always been a challenge in the analysis and design of large-scale water resources projects. Water runs off the hillside - this clears up the importance of terrain modeling in watershed management. Thus, the integration of the hydrological model into the GIS environment has aroused the great interest of scientists and engineers. The paper describes attempts by researchers to integrate GIS and hydraulic modeling for watershed analysis.

Key words.

Irrigation, GIS, geographic, hydrological, land, modeling, hydromorphology, water bodies, attributes.

Introduction.

In order to ensure the consistent implementation of the tasks defined in the concept of water management development of the Republic of Uzbekistan for 2020-2030, as well as the achievement of the main target indicators:

In accordance with the Decree of the President of the Republic of Uzbekistan dated July 10, 2020 "On approval of the concept of the development of the water industry of the Republic of Uzbekistan for 2020-2030" No. PF-6024, the water industry of the Republic of Uzbekistan determining the concept of development for 2020-2030, based on its priority directions and target parameters and indicators for the relevant period, to be implemented step by step through the water management development strategies of the Republic of Uzbekistan, which are approved every three years is accepted for information [1-6].

The strategy for water resources management and development of the irrigation sector in the Republic of Uzbekistan for 2021-2023 (hereinafter referred to as the Strategy) developed by the Ministry of Water Management with the participation of interested ministries and agencies and international experts was approved [7-9].

The strategy includes a number of infrastructural, political, institutional and capacity development measures covering the sustainable management of the country's water resources and improvement of the irrigation sector, including:

- the concrete-covered part of the irrigation system channels will increase from 35 to 38 percent, the efficiency of the irrigation system and irrigation networks will increase from 0.63 to 0.66;
- reduction of irrigated areas with low water supply from 526 thousand hectares to 424 thousand hectares;
- Replacement of 518 pump units and 807 electric motors in pumping stations in the system of the Ministry of Water Economy with modern energy savers, reducing their annual electricity consumption from 7.6 billion kWh to 7.15 billion kWh;
- introduction of water-saving irrigation technologies from 308 thousand hectares to 1.1 million hectares, including drip irrigation technology from 121 thousand hectares to 822 thousand hectares;
- reduction of saline areas from 1,926,000 hectares to 1,888,000 hectares, including moderately and strongly saline areas from 581,000 hectares to 532,000 hectares;
- reduction of irrigated land areas with problematic groundwater level (0-2 meters) from 988,000 hectares to 900,000 hectares [10-15];
- putting a total of 232,000 hectares of irrigated land out of use in agriculture into use again;
- construction and restoration of 6 hydrological posts on rivers and streams, equipping 6 hydrological posts with automated equipment based on digital technologies;

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- The number of water management facilities with water accounting based on "Smart Water" digital technology will be increased to 18,576;
- Transfer of 60 large water management facilities to automated management based on digital technologies;
- Monitoring of electricity consumption and water consumption calculation of 5,231 pumping units in 1,688 pumping stations in the system of the Ministry of Water Management in "online" mode;
- monitoring through digital technologies in 2,100 existing reclamation monitoring wells;
- a total of 124 projects will be implemented in water management based on the principles of public-private partnership, and 9% of the cost of water supply for irrigation will be covered by water consumers [16-18].

Result and discussion.

Hydrological models provide important support in water resources analysis and hence its integration with GIS is highly appreciated. Hydrological processes change both in space and time. Metrological and land use data are inputs for such processes. These processes also vary as a function of topology and soil types. The development of a hydraulic model with the possibility of effective use of GIS data is widely studied. In context, the first task of GIS is to average slope, soil type and land use. Then determine physical and empirical coefficients by comparing map attributes. Overlaying multiple map layers leads to parcels. A grid network for evapotranspiration and groundwater models is used to describe the desiccation model. For watershed models, a catchment area or watershed is a spatial descriptive unit. The problem of water resources [19-20].

The GIS-based solution is obtained in five different steps

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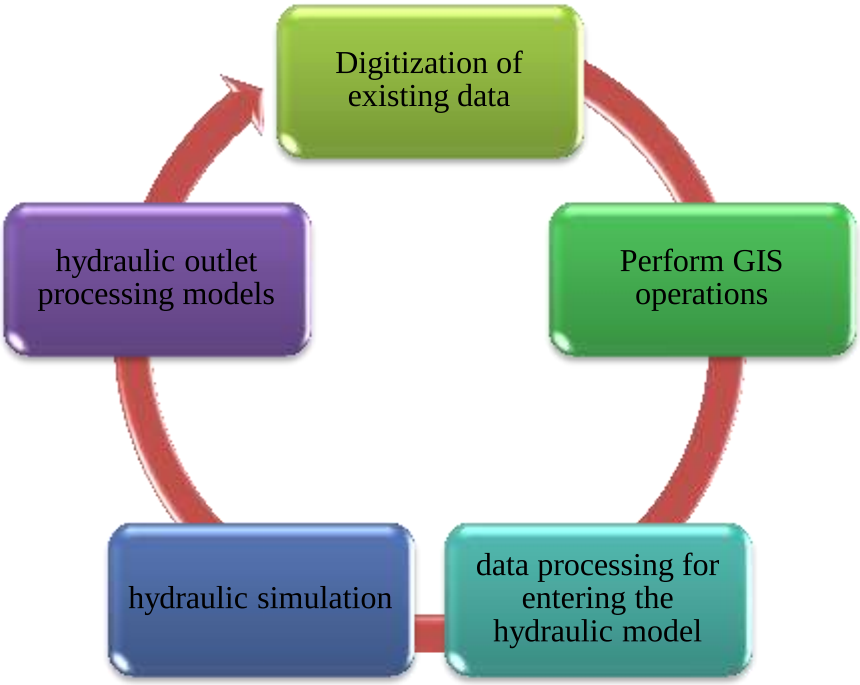

The GIS environment was not designed specifically for water resources problems. GIS analysis of a hydrologic model requires considerable effort in data processing, calibration, and presentation of data as ready-to-use maps. An integrated GIS environment should act to perform spatial analysis of input data for hydraulic models, to provide a mechanism for linking models with different spatial representations. It should also display geographic information and graphical output of subsequent simulations and evaluate the results of hydrological simulations [21-22].

GIS programs are equipped with tools to collect, store and manage data such as vector data (Points, lines) and polygons) or Raster data (permanent areas). Tablet digitization is a key function of GIS and is popular due to its low capital cost. Scanning technologies allow obtaining and processing map stocks using image processing. GIS software makes it easy to convert data from other data sources to GIS. The COGO (coordinate geometry) feature is used to maintain distance, calculate beds and curves from field surveys. Field data collection is facilitated by the Global Positioning System (GPS). GPS data can be imported into GIS to provide local information. Using photogrammetry, high-resolution spatial databases for cities can be developed. Satellite photogrammetry facilitates the mapping of selected areas with dimensions less than one meter. GIS software can transform data from one reference system to another. The feature input feature allows you to collect and manipulate non-spatial data. The relational database feature of commercial GIS software is useful for data integrity and data consistency [19-24]. A structured query language is used to change parameters. Rapid updating of model parameters is an added advantage for models that depend on in situ parameters. In addition to parameter data, quantitative data can be combined using spatial relationships instead of relationships between both qualitative and non-existent attributes. Also, GIS software facilitates the creation and import of Digital Elevation Models (DEM) and Triangular Irregular Networks (TIN). Features that can be extracted from DEMs and TINs using slope and edge properties. Such data are the basis for surface runoff and slope stability models [23-28].

Previously, space operations were performed manually. Map-based engineering analysis such as flood forecasting can greatly benefit from GIS. Functions such as area calculation, stream length measurement, and critical path identification are facilitated by map-based modeling using GIS software.

The drainage structure can be determined using free software compatible with GIS. The raster type DEM must be accurately sized to reflect the actual topography and accuracy of the watershed area, its tributaries, and watersheds. Filtering the initial data allows you to determine the bias and side of each cell. Then the exiting cell is determined, then the neighboring cells adjacent to this cell are determined, all cells form a water basin. The next step is to identify the river network and watersheds that correspond to the river network.

Land use information is derived from high-resolution remote sensing data. Land use classes are combined into new classes depending on their hydrological impact. The average soil type is determined from soil maps for each cell that makes up the watershed.

Spatial querying of a GIS database is an important task for error checking and review. The label operation returns information about certain features and depends on the topological integrity of the spatial database. "Show attributes", "Show records", "find", "Browse", "generate reports" and various other search commands [29-32].

Database keys link files with different attributes. A relational join joins two or more tables together, useful for data analysis and reporting. The user can perform classification and summarization using the set of commands mentioned above. The reclass command resolves spatial data into patterns we can understand. Combining a number of classes into a detailed class is called generalization. Relationships between map themes, scopes, or layers are derived from Principal Component Analysis. The conditions in the area surrounding the designated place are analyzed with the activities of the neighborhood. Proximity defines areas of proximity to features. Buffer operations are performed to find features at certain distances from other features. Elevation data filters are used to find slope, slope, and other terrain features. GIS has a great ability to present the results of analysis in the form of a map. The validity of the predictions can be achieved by visualizing the results of the model. It is possible to identify an important area that requires in-depth analysis. Visualizations supplemented with spatial queries of model results help to identify the relationship between input parameters and model results [33-34].

In the last decade, the computing power of the desktop computer has increased dramatically. The availability of spatial data has greatly facilitated the distributed representation and visualization of watershed characteristics and the validation of hydrological data in a distributed approach. Augmentation of radar and satellite data is an excellent source of datasets of watershed characteristics.

Conclusion.

GIS provides regridding capabilities to assess feature reliability and model sensitivity analysis. Particularly useful for integrating GIS and groundwater modeling.

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