



GIS TECHNOLOGY IN THE ASSESSMENT OF EROSION AND ACCUMULATION PROCESSES IN THE RIVER BED

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Article DOI: <https://doi.org/10.36713/epra11226>

DOI No: 10.36713/epra11226

ABSTRACT

Article deals with the use of modern GIS (geographic information system) in the study of the deformation processes in the river. The most difficult problem in obtaining information on erosion and accumulative process is rapid assessment of the process. In the researches analyzed the possibility of using GIS technologies in the assessment of deformation processes in the foothills of the river, which have a highly variable nature. This information helps to draw conclusions about changes and events in nature. Study included collection, analysis and delivery of data to users with using GIS. The deformation processes in the river bed were evaluated and analyzed using Landsat satellite data. The researches described how to achieve a quick assessment of their processes.

INTRODUCTION

Deformation changes are occurring the management of water resources, rivers and streams. It is important to identify these changes in a timely manner so that they can be prevented [1,2,3]. Because the size and extent of changes are unstable, they require speed and accuracy, scientifically sound conclusions, and the development of useful measures. Targeted research is important around the world, with the aim of developing a variety of risk-based measures to remotely control land, creating a systematic, electronic, rapid and accurate network of ground water information [4,5,6,7]. Establishment of a global system of land and water management through GIS systems, organizing global surveillance and analysis based on Earth satellites, thus reducing redundant resources, improving results accuracy, creating different models, databases, rural and water resources. Introduction to agriculture is important [8,9]. One of the important issues is the improvement of computational methods and technologies for river flow assessment and river deformation prediction. Today, these issues are being studied, such as accurate and reliable assessment of the situation, and economic efficiency. This requires the use of modern technologies as the development of these works [10,11]. Today, GIS has the ability to analyze data from a remote location without problems, and has increased its use in various fields. Remote sensing technologies are a set of devices, techniques, and programs that help gather information about nature and the Earth. These data are collected on Earth by recording on active and passive sensors mounted on the Earth's satellite or pilot [12,13,14]. Active sensors emit light from them and capture them by means of absorption and return to the earth and various objects. Examples are radar sensors. Passive sensors are based on the absorption and return of sunlight to various objects and surface. Variation in the absorption capability of the objects allows for more detailed study of plant, water and other objects in the remote sensing by spectra. Satellite imagery can also explore areas that are difficult to navigate and explore. Since irrigation systems are relatively small, so far only linear maps have been generated using GPS (Global Position System) devices. Losses and their operational status have been studied locally. The launch of satellites with high-resolution sensors over the last 10 years has also enabled remote sensing in the water industry using their images [15,16]. This article presents the results of studies on river flow assessment using GIS technologies, determination of flow and river hydraulic and hydrological parameters.

METHODS AND MATERIALS

The Landsat archive-high-resolution satellite systems were used to assess the deformation processes in the river. The ability to easily analyze the remote sensing data in GIS has increased its use in various fields. These images also explore areas that are difficult to navigate and explore. However, initially they were of low resolution and were not available in the water sector. Therefore, to date, there has been little research on the use of water in the water. Mostly, many studies have focused on land use and land classification by analyzing mid- and high-resolution images. ArcGIS plays an important role in this system. Specific information includes properties of an object (statistics, maps, geometry, etc.). The prospect of using this program in science is rapidly evolving as it has the advantage of incorporating it into all data [17,18].



One of the key factors in the evaluation of river processes is the change in river parameters over time. These studies used the ArcGIS application ArcMap. Originally, Landsat 8 satellite images were downloaded free of charge from GloVis US official website. The maps are made by date for each downloaded image. GPS and GPS data were used to verify the accuracy of the mapped maps. Initially, the geodetic survey was conducted to study the existing parameters of the Sox River. Nine invariants were selected for each kilometer along the length of the stream. At that point, 7 immutable points were selected in each station, and at these points measurements were performed using GPS [19]. For each student, the leveling works were completed and mapped (Table 1).

Table 1. Geodesic measurements

No	Right	Centre	Left
PC 12	659	657	656,8
PC 22	648,75	647	645,63
PC 32	638,23	637,09	636,11
PC 42	623,8	622,8	622,72
PC 52	613,97	612,02	612,47
PC 62	602,15	600,65	600,8
PC 72	590,9	588,45	588,6
PC 82	579	575,3	575,8
PC 92	567	564.3	564.85

Subsequently, measurements were made with each GPS device and mapped to the table (Table 2). There was a difference between level and GPS-based results. The maximum value of these differences was 2 meters.

Table 2. GPS data

No	Right	Centre	Left
PC 12	659	658	656
PC 22	645	643	641
PC 32	634	633	635
PC 42	624	620	621
PC 52	611	610	611
PC 62	600	600	600
PC 72	593	591	588
PC 82	580	577	577
PC 92	569	565	565

RESULTS AND DISCUSSION

On the basis of the values measured in our analysis phase, the cross-sectional surface for each stave was drawn (Figure 1). The difference between level and GPS is 1.5-2 meters.

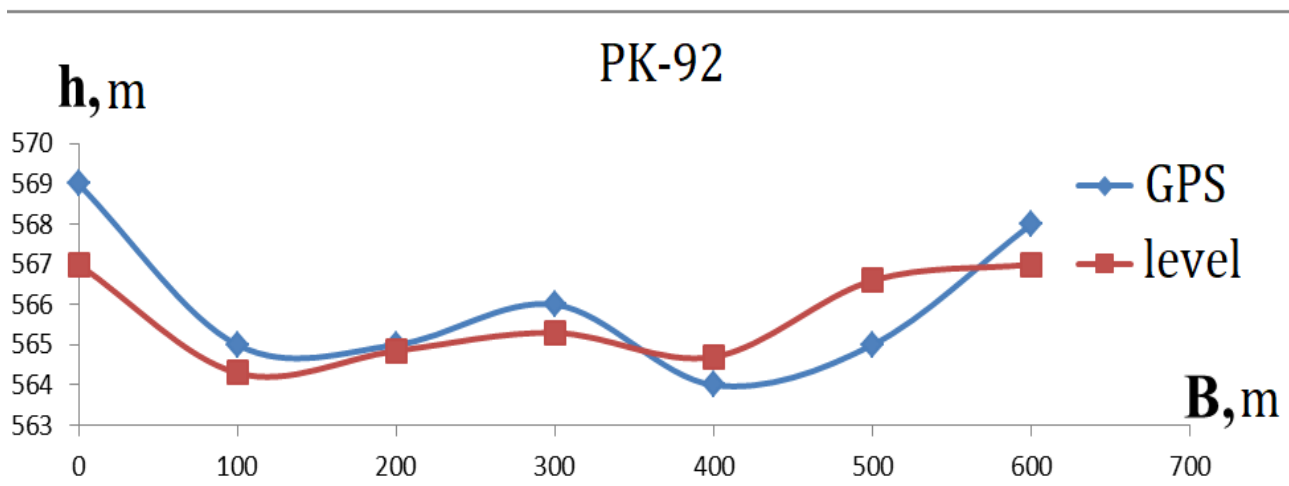


Fig. 1. Cross-section of the Sox River PK-92



The map based on this data has been verified. At the same time, the width and width of the stream were measured and compared using the ArcMap application of ArcGIS (Figure 2). The results of the field experiments and satellite imagery were the same.

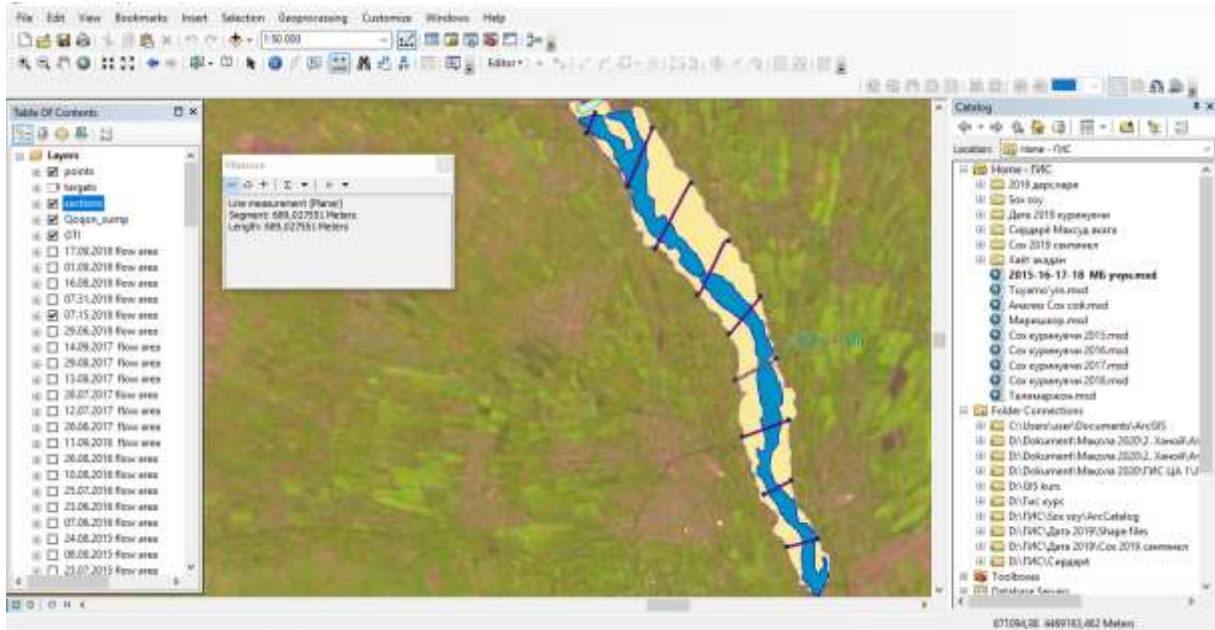


Fig. 2. Measurement of leith and with of Sox in ArcMap

The last 4 years of Landsat 8 satellite image data have been downloaded for free from the GloVis USGS official website. Based on these data, water flow maps for the past 4 years have been made. Based on the maps, the flow area and the width of the pickets were determined (Table 3). Based on the average width of the Sox stream in the identified pickets, the average depth of each picket was determined from the linkage equation of river width and average depth. Determination of the morphometric connections of the river was analyzed based on the most commonly used computational methods to evaluate the processes in the river [20,21]:

$$H=0.05B^{0.74} \tag{1}$$

Table 3. River morphometric connections

Picket	Discharge m ³ /s	Water surface area ha	Average width m	Actual width m	Slope	Average depth m	Cross-section surface m ²	Average speed m/s
12	95	127.1	149.5	93	0.011	1.43	133.09	0.71
22	95	127.1	149.5	138	0.011	1.92	264.46	0.36
32	95	127.1	149.5	75	0.011	1.22	91.53	1.04
42	95	127.1	149.5	127	0.011	1.80	228.87	0.42
52	95	127.1	149.5	106	0.011	1.58	167.11	0.57
62	95	127.1	149.5	182	0.011	2.35	428.05	0.22
72	95	127.1	149.5	120	0.011	1.73	207.37	0.46
82	95	127.1	149.5	115	0.011	1.67	192.57	0.49
92	95	127.1	149.5	115	0.011	1.67	192.57	0.49

CONCLUSION

Based on the data in the table we can see that the flow rates in the sampled sediments vary with cross-sectional surface, average depth and average velocities. In relatively large areas with average depth, average velocity is small. This indicates that the average flow rate is greater and more likely to be washed off at high velocities, whereas fuzzy particle sinking is observed due to the smaller velocity in the medium with a high flow rate. Based on the above processes, it is possible to evaluate the deformation processes in the river. The studies analyzed the last four years of river flow data.

In our research, we extracted and evaluated river formation based on a five-year observation of sedimentation processes using Landsat images. According to the analysis, the use of GIS in the remote sensing of the deformation processes in the basin



allows the rapid detection of emerging processes. This allowed saving time and resources, creating a reliable and quality database. It shows the ability to map maps using Landsat images for many years and create a database based on these maps and predict the future based on hydraulic laws.

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