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CALCULATION OF BOTTOM SEDIMENTS IN MOUNTAIN RIVERS BASED OF FIELD DATA

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Abstract

In this article there were given the results of the deformation processes where happens in the mountainous riverbeds and result of analyse of influence factor of riverbed creation. Based on the field experiment data analysed methods for calculation discharge ofbottom sediments.

Keywords: diameter, bottom sediments, riverbed, deformation, discharge, velocity, flow.

Introduction

Modification of calculation technics and technologies of changes in riverbeds and prediction of deformation in itis one of the most important issues of hydro technical constructions. In this regard, in the riverbed evaluation procedure it is important to determine the effects of sedimentation and soil washing of the river bed, in exploitation condition of hydro technical constructions, drainage channels from rivers.

The problem of calculating sediment discharge in the river is one of the most complex and unsolved problems in the theory of processes in bed. Nowadays, for solving those problem created different methods and formulas by several authors [1, 2, 3, 4,5, 6].

In this article were given discussion of different methods for calculation bottom sediments discharge based of field experiments which provided in Sokhsoy mountainous river of Ferghana valley (Fig. 1).

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The characteristically feature of the Sokhsoy which chosen as research area is that the water flows only at certain times. This object can be considered as a natural experiment field.

In order to determine the amount of sediment and fractional composition of the sediments in theSokhsoy river, several pickets were selected on the riverbed, and provided analysis about river bed and flow parameters (Fig. 1).

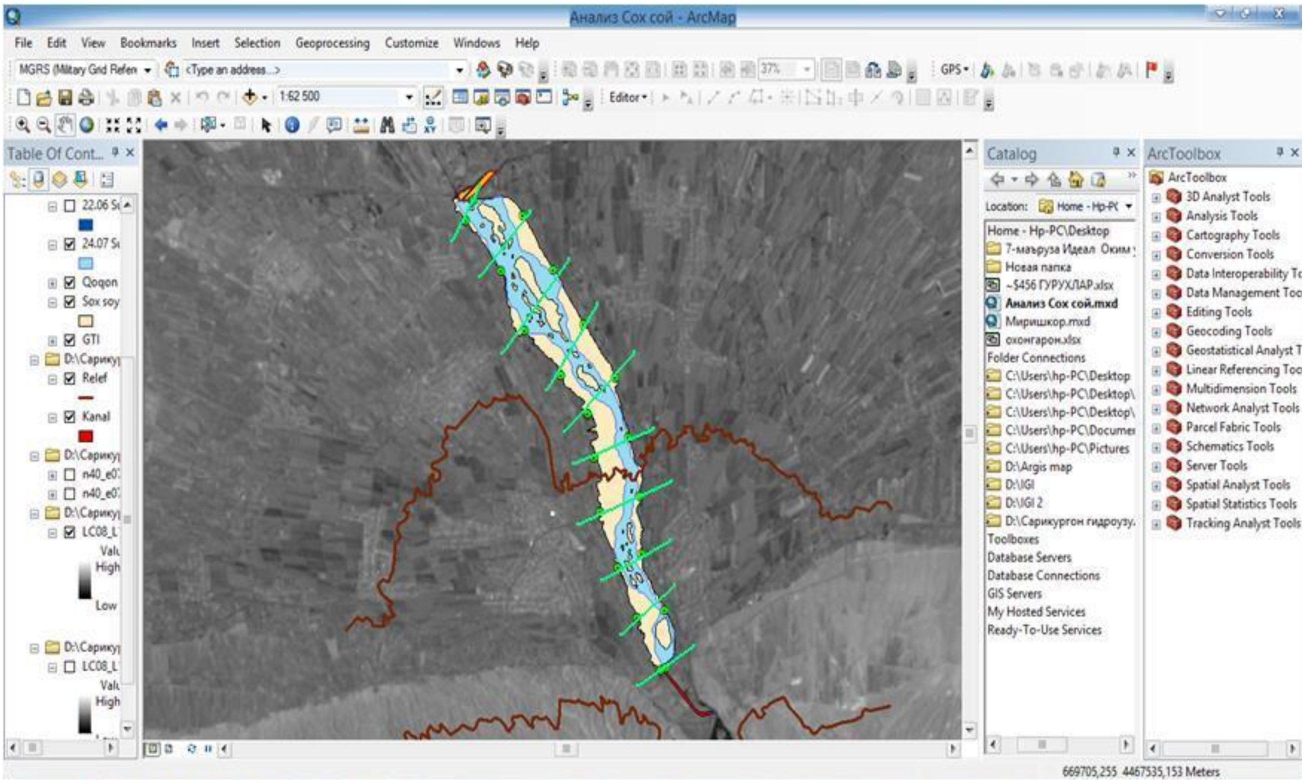

Figure 1. Map of Sokhsoy

GIS is the main tool for analyzing Satellite images. It hap opportunity to collect information fast and in high masshtapand to analyze it with high accuracy. The Sokhsoyarea consist of two trapezium of SRTM data. These areas are trapezium in latitude 40 degrees north and 70-71 western longitude trapezes. These images were loaded into GIS and extracted using the Extract by Mask operator and analyzed. These images have a pixel resolution of up to 30 m / pixels. At the end of analysis created general map of Sokhsoy.

Riverbed of the Sokhsoy separated into 10 parts and provided monitor of accumulation and deformation procces throughout the year.

In the experiments, were analyzed the change in sediment content, fractional composition and their length. During the year, were collected flow discharge and sediment concentrations information and the results were shown in Figure 2 (on one picket PK-12).

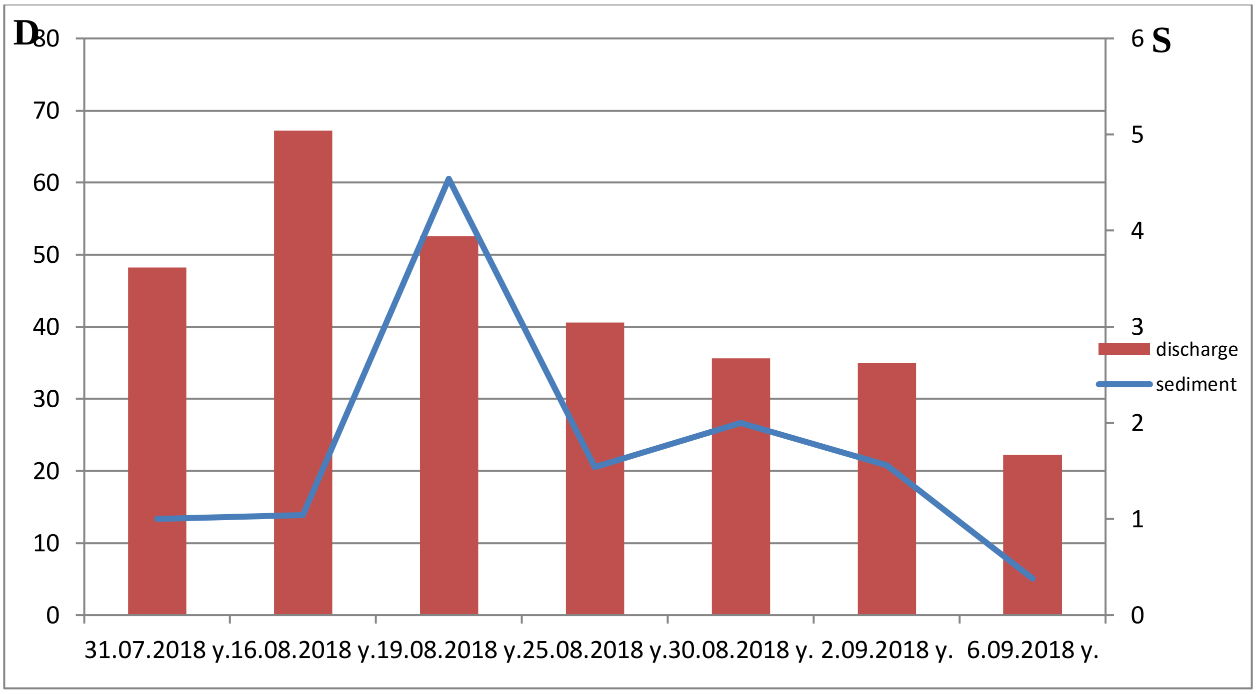

Figure 2 .Schedule of dependence of sediment flow with water discharge

In fig. 3 were given changement of the sedimentation of the flow along the flow leigh in theSokhsoy.

On the basis of the data which collected in natural field experiments in the Sokhsayriverbed, analyzed sediment discharge with several calculation methods.

Analyzed natural field experiment data, the average values are given in the table (Table 1).

Table 1. Data obtained in natural field conditions

H, m	i	d,m	Q,m³/s
1,1	0.01	0.0055	60

There: H – water level of the flow, i – slope of the bottom, d – average diameter of the sediments, Q – water discharge.

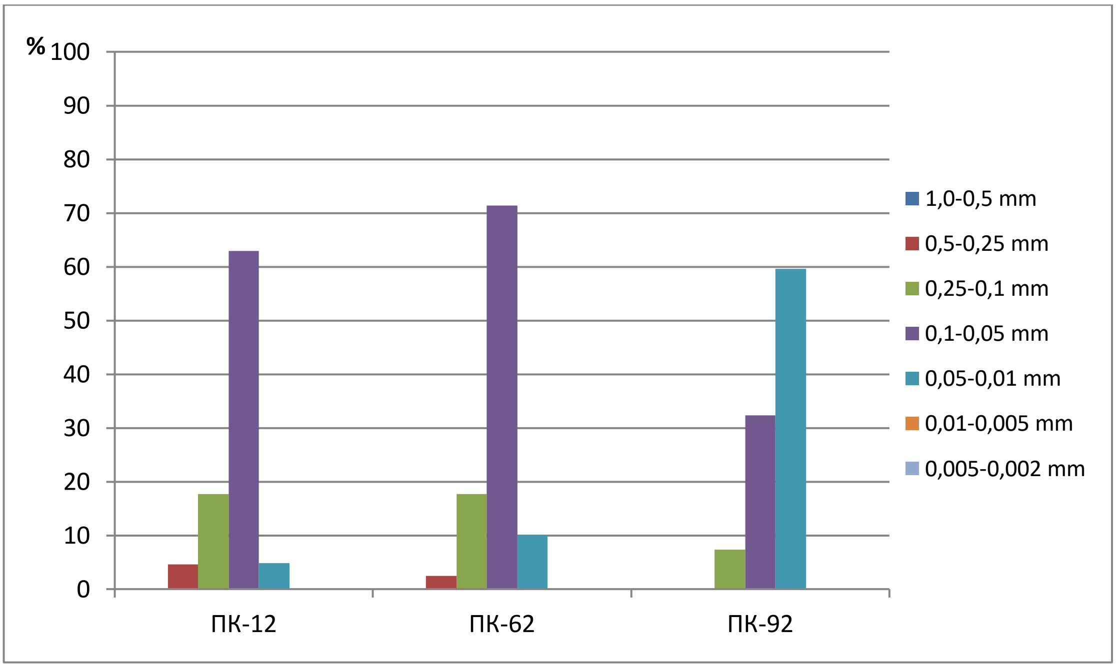

Figure 3. The fractional structure of the sediments in the Sokhsoybed by the PCs

The following methods have been selected for mountain rivers [7, 8, 9, 10] for analyze of calculation bottom sediments:

According to G.I.Shamov [11] method, sediment discharge and initial velocity are determined as follows.

$$q = k\left(\frac{\vartheta}{\vartheta_0}\right)^3 (\vartheta - \vartheta_0)\left(\frac{d}{H}\right)^{0.25} \quad (1)$$

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k - coefficient which relates to the sediment composition.

There: ϑ_o – initial speed of the sediment movement in stationary flow;

The initial speed in the steady movement calculates as follows:

$$\vartheta_0 = 4{,}4 d^{1/3} H^{1/6} \qquad (2)$$

According to the I.I.Levi [12] method consumption of the bottom sediment and initial velocity calculates as follow.

$$q = 0{,}002 \left(\frac{\vartheta}{\sqrt{gd}} \right)^3 (\vartheta - \vartheta_0) \left(\frac{d}{H} \right)^{0.25} \qquad (3)$$

In this calculation method, the initial speed is determined as follows:

$$\vartheta_0 = 3{,}2 \sqrt{gd} \lg \frac{H}{7d} \qquad (4)$$

According to the L.G.Gvelesianimethod, bottom sediment discharge and initial velocity are determined as follows.

$$q_T = 12{,}95 \frac{d \vartheta_0}{\left(\lg \frac{12 d_{\max} + d}{d} \right)^2} \left(\frac{\vartheta^3}{\vartheta_0} - 1 \right) \left(\frac{\vartheta}{\vartheta_0} - 1 \right) \qquad (5)$$

In this calculation method, the initial speed is determined as follows:

$$\vartheta_0 = 3{,}4 \frac{\lg \left(\frac{8{,}8H}{d} \right)}{\lg \left(\frac{12 d_{\max} + d}{d} \right) \sqrt{d}} \qquad (6)$$

Depending on the formula (1), (3), (5) discharge of the sediments were calculated according to the field experiments (Table 1), and the results are given in the Table (Table 2).

Table 2. Calculation of bottom sediment discharge

№	Author's	Calculation formula	Result m^2/s
1	G.I.Shamov	$q = k\left(\frac{\vartheta}{\vartheta_0}\right)^3(\vartheta-\vartheta_0)\left(\frac{d}{H}\right)^{0,25}$	0,01
2	I.I.Levi	$q = 0{,}002\left(\frac{\vartheta}{\sqrt{gd}}\right)^3(\vartheta-\vartheta_0)\left(\frac{d}{H}\right)^{0,25}$	0,016
3	L.G.Gvelesiani	$q_T = 12{,}95\frac{d\vartheta_0}{\left(\lg\frac{12d_{max}+d}{d}\right)^2}\left(\frac{\vartheta^3}{\vartheta_0}-1\right)\left(\frac{\vartheta}{\vartheta_0}-1\right)$	0,3

Conclusion. The results of the analysis shows that the difference of the results varies from 38% to 97%. When using the different methods and formulas for sediment discharge, it is necessary to improve the work with taking into account hydrological and hydraulic conditions of each region.

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