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THE DEBITS STUDY OF TĂRCĂIȚA VALLEY IN ORDER OF HYDROENERGETICAL VALORIFICATION

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Abstract: *Measuring debits of a water course is the first step in a broader study of their profitable purposes in various ways, in this case is an energy valorification. This study is based on measurements made in 2008 and 2009, the results give a clear picture of the debits variation of Tărcăița Valley in the summer, when they are severely affected by drought, but if this valley is not about a significant variation. The study was realised on the watercourse Tărcăița Valley located on the north-eastern side Codru-Moma Mountains on the hydrological basin's Crişul Negru river and is based on measuring debits in three sections of the surface float method used in determining current and water and measuring method using hydrometric ratchet. Water is being held in a mountain area, hydroenergetical valorification can bring many benefits, in the sense that the production of a certain quantity of electricity can perform various productive activities (animal breeding, trout, woodworking, etc.) or unproductive (agritourism or supply isolated villages). Energy that can be produced this way is a renewable and clean, so should be viewed with the current focus on reducing fossil fuels and the increasingly intense attempts to reduce pollution from their use. Considering measurement errors that can occur for debits determined on each section of the watercourse have been identified as the minimum to avoid other errors in the calculation of powers available and because of this in certain areas of karst structures that can cause large variations of this debits (through underground infiltrations). General trend of variation of debits is a slight decrease. The work was carried out with the wish to present one of many alternative energy generation using natural resources (water) in mountain areas through a method that is without environmental damage.*

Key words**:** *flow, section, water course, float, hydrometric ratchet, hydroenergetical valorification*

INTRODUCTION

The water courses – rivers and streams - are considered in hydrology as running waters and they are the main aquatic units from the mountain area. They form through a lot of complex processes, starting with rain falls, then they drip on the mountain slopes and connect with the phreatic waters. In order to establish the natural conditions and the hydroenergetic potential given by the studied water course, certain measurements had been made which shall constitute the basis of this work. The macroeconomic situation emphasizes the idea that the small producers of hydro-electric power represent a necessity for the social and economical development of the remote, isolated areas (VOIA I.,1996).

MATERIAL AND METHODS

The Tărcăița Valley is situated on the north-east part of the Codru-Moma Mountains, which are characterizd through the presence of the grabens, rifts that guide the primary hydrographic net. (POSEA G.,2002). It has a length of 11 km and it is a left tributary of the Crişul Negru river**(***** 1).

The liquid flow of a river (Q) represents the volume of water which is drained through a transversal section in a certain period of time; it is expressed in [m^3/s] sau [l/s].

The specific draining avergage flow on the surface of a hydrographic basin (the flow on the surface unit) (q) is the report between the flow (Q) and the surface of the hydrographic basin (F):

$$q = \frac{Q}{F} \quad [m^3/s/km^2] \text{ sau } [l/s/km^2]$$

In order to establish the hydroenergetic value of a flow, firstly one has to determine its flow, the (Q), which constitutes the energy sourse. The most important values of a water flow are:

- *the maximum maximorum flow* ($Q_{max.max.}$) represents the biggest value of the flow registered so far, but it can also have a *catastrophic* value (Q_{cat}).
- *the extraordinary flow* ($Q_{max.ex.}$) represents the biggest value of the flow registered in 30 consecutive years.
- *the maximum yearly flow* ($Q_{max.an.}$) represents the biggest value of the flow registered in one year and it lasts only one day in that specific year.
- *the normal flow* or *the modulus flow* (Q_{mm}) represents the mathematical average of the yearly flows over a long period of years (5-10 years).
- *the average flow* (Q_{med}) represents the avergae value of the flow for a certain period of time (year, month, decade, season).

The work method consists in measuring the morphometrical elements of the sections studied: the upper section (the entrance of the floats), the hydroleaf (the main section), the inferior section (the outgoing of the floats); determining the speeds with the help of the floats and of the handmill. The water flows had been determined in transversal sections through analytical calculus. The method respected all the conditions: the lack of wind which can influence the speed of the floats, the lack of vegetation on the river banks and the straight form of the water course in the studied area.

The surface of the active section (ω) had been determined with the help of the relation:

$$\omega = \frac{h_1}{2} b_1 + \frac{h_1 + h_2}{2} b_2 + \ldots\ldots + \frac{h_{n-1} + h_n}{2} b_{n-1} + \frac{h_n}{2} b_n$$

where:

$b_1 \ldots b_n$ are the distances between the verticals;

$h_1 \ldots h_n$ are the depths of the survey verticals.

In th measured sections the flow had been obtained as follows: firstly a fictitious flow Q_Φ, and then the real flow Q, on the basis of the following relations:

$Q_\Phi = \omega\, V_m \quad [m^3/s]$;

$Q = K\, Q_\Phi \quad [m^3/s]$

where:

V_m is the average speed;

K- transition or reduction coefficient which is obtained as a report betwen the handmill measured flow and the flow calculated on the basis of the surface speeds, K's value being approximately between 0.86 and 0.89 (MORARIU T. et. co, 1970).

The hydrometrical handmill used on a large scale to measure the speed of water in different points of the stream is of the OTT type, and the working method consists in mesuring the number of rotations (n) of the handmill bats in a period of time.

RESULTS AND DISCUSSIONS

The flows followed in the study sections are to be found in Table 1, they had been measured with the help of the surface floats and in Table 2 they had been measured wityh the help of the handmill, the location section representing the inferior section, upstream 1 the main one (the hydroleaf), the superior section upstream 2, respectively. The inferior section is considered the location that fulfills the conditions for building a micro hydrocentral in order to value, energetically, the water flow. The handmill measures had been processed with the help of the Camdar 05 programme.

Table 1

The morphometrical characteristics and the flows measured with the floats

Month	Section	Hydrometric data					Q (m^3/s)
		ω (m^2)	Average speed (m/s)	Breadth (m)	Depth (cm)		
					H_m	H_{max}	
Aug.08	Location	0,320	0,518	4,50	13,00	18	0,276
	Upstream 1	0,345	0,587	5,00	11,00	16	0,293
	Upstream 2	0,300	0,439	4,00	9,00	14	0,262
Sept.08	Location	0,440	0,635	4,00	16,20	23	0,300
	Upstream 1	0,490	0,590	5,00	15,00	20	0,313
	Upstream 2	0,420	0,650	4,50	14,00	18	0,289
July09	Location	0,350	0,643	3,80	12,00	16	0,198
	Upstream 1	0,260	0,650	4,00	8,66	12	0,149
	Upstream 2	0,360	0,550	3,00	16,00	22	0,174
Aug.09	Location	0,410	0,350	4,00	13,66	18	0,271
	Upstream 1	0,520	0,625	5,00	13,00	18	0,286
	Upstream 2	0,500	0,586	5,00	12,50	19	0,258
Sept.09	Location	0,506	0,737	4,40	15,33	20	0,328
	Upstream 1	0,460	0,740	5,00	11,50	16	0,299
	Upstream 2	0,550	0,642	5,00	13,75	16	0,311

Table 2

The morphometrical characteristics and the flows measured with the hydrometric handmill.

Month	Hydrometric data in th profile of the rod								Q (m^3/s)	$Q_Φ$ debit fictiv (m^3/s)	μ= $Q/Q_Φ$
	Hydrometric data in the profile of the measurements										
	Ω (m^2)	Speed (m/s)		Breadth (m)	Depth (m)		Perimeter P(m)	Radius R(m)			
		V_m	V_{max}	B	H_m	H_{max}					
Aug.08	0,541	0,416	0,561	4,8	0,11	0,18	4,8	0,11	0,225	0,225	1,00
Sept.08	0,497	0,399	0,519	4,8	0,10	0,17	4,8	0,10	0,198	0,198	1,00
Iul.09	0,576	0,283	0,460	4,8	0,12	0,19	4,8	0,12	0,163	0,173	0,94
Aug.09	0,750	0,320	0,470	4,5	0,17	0,24	4,6	0,16	0,239	0,266	0,90
Sept.09	0,842	0,323	0,460	4,5	0,19	0,26	4,6	0,18	0,271	0,310	0,88

Figure 1:Location of the study sections on the Tărcăița Valley

After calculating the flows on the Tărcăița Valley, an interdependence comes out between the flows and the surface of the active section, between the surface and the depth speeds of the water course, respectively. For the comparative analysis of the flow variations the 1st and the 2nd drawings had been done. In these drawings the following had been followed:

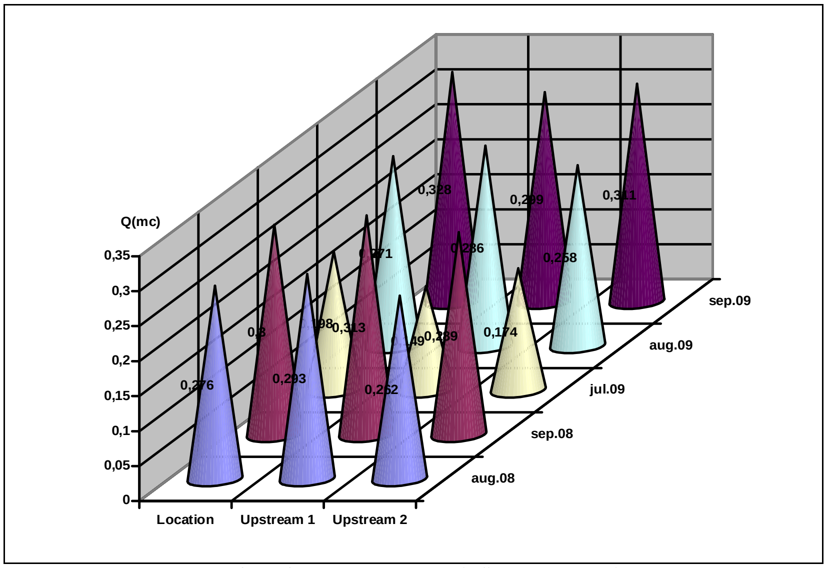

Figure 2: Variation of the flows measured with floats on Tărcăița Valley between August 2008-Sepember 2009

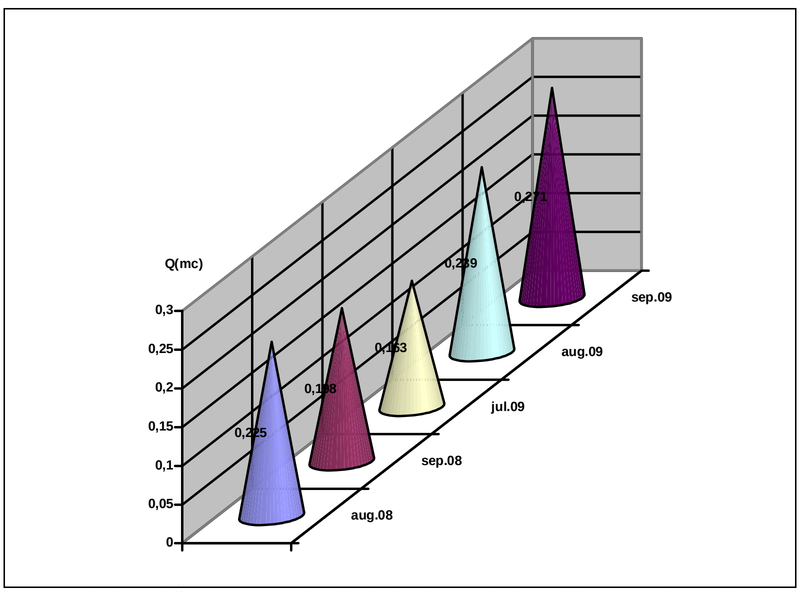

Figure 3: Variation of flows measured with the hydrometric hanmill on Tărcăița Valley between August 2008-September 2009

CONCLUSIONS

Running waters, especially mountain streams offer a hydro potential that can be easily valued in order to obtain cheap and non polluting electric power. From an analysis of the flows in the Tărcăița Valley a certain constancy of the latter can be observed, fact which can constitute the basis of a certified preoccupation, having in view the current economical conditions all over the world, for finding and implementing technical solutions able to ensure a low scale energetical independence. The flows of water flows like the Tărcăița Valley must be valued from an energetic point of view to serve to agricultural, zootechnical, forestry or industrial activities and why not for supplying remote localities from mountain areas.

BIBLIOGRAPHY

1. MORARIU T.,PIȘOTA I.,BUTA I., 1970- Hidrologie generală, Editura Didactică şi Pedagogi- că, Bucureşti
2. POSEA G.,2002- Geomorfologia României, Editura Fundației *România de mâine*, Bucureşti
3. VOIA I.,1996 – Micii producători de hidroelectricitate în România. Necesitate şi şansă. Revista Energetica nr.2
*** 1 Atlas Cadastral, Apele Române, Direcția Apelor Crişuri