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A STUDY REGARDING THE HYDROLOGICAL FEATURES OF THE TUR VALLEY

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Abstract: Water is a natural resource, vital for life on earth, and for a long time, it hasn’t been considered an unlimited resource. The economical development and demographic rise of the late 20th century have made mankind’s water demands rise substantially and endlessly. The need to reply to these needs has turned into the responsibility of a rational water usage, for the sake of the solving the ‘resource-demand’ issue. The existence of water is a condition for maintaining certain integrity of the natural environment, and fuel for developing social and economical systems.
Keywords: water, demand, preoccupation, usage

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The Tur hydrographic basin is situated in the north-west area of our country, in Satu Mare county. It’s the river Tisa’s first rank affluent, coming from the S-E through the West Plain of Romania. The river’s basin is, on a SE-NV direction, between the 47° 46’- 48° 05’ northern latitude and the meridians 22° 52’ – 23° 37’ east longitude, in between the hydrographic basins of the rivers Săpânţa, Someş and Batar.

Physico-geographically speaking, the region is situated in the Central European Province and climatically speaking, in the area if influence of the Baltic air masses, with a relatively high humidity.

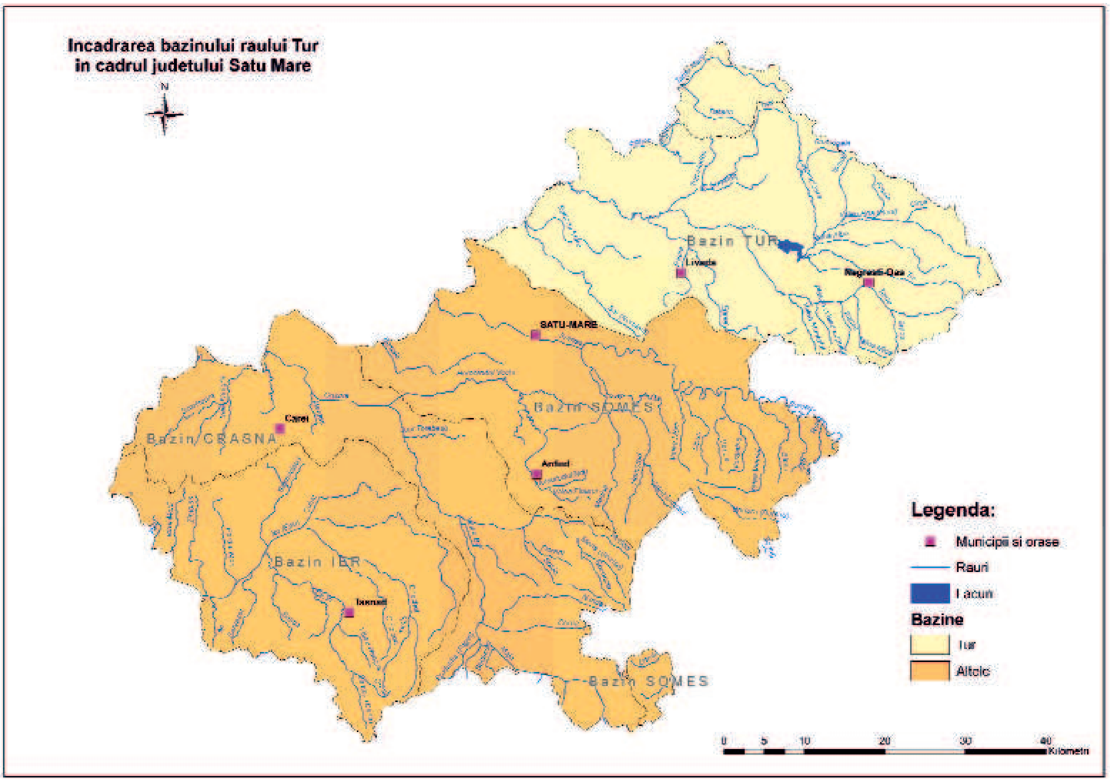

Figure no. 1: The framing of the Tur River Valley in the Satu Mare County

The Tur hydrographic basin is confined between the river Săpânţa’s basin in the E, on the south and west directions by the river Someş’s basin and on the North side, by the border with Ukraine. (Fig. No 1)

The Tur springs from the west cliff of the Gutâi Mountains, from under the Buiana peak (at 950 m altitude) and flows in the east-west direction. The added length of its course is of 100 kilometers, 70 linear kilometers of which are located in Satu Mare county.

The Tur flows in the Tisa river, on the territory of Hungary, through an artificial channel of 11.5 kilometers. Between these limits, the Tur basin adds up to a 1210 square kilometers on our country's territory. The length of the water sweep is of 151 kilometers, surrounding a symmetrical pear-shaped territory.

Between the hydrographic basins of the rivers Săpânța and Someş, the Tur river's basin unfolds in a SE-NV direction, with a maximum length of 54 kilometers and a maximum width of 31 kilometers. In regards to the altitude, the mountain area ranges between 900-1200 m. altitude, and the flowing point in Tisa is 115 meters. The medium altitude, up to Turulung village, is 370 meters.

Main quantity parameters regimen

Medium multi-annual rain

The Tur is alimented by subterranean waters up to approx. 27%; the remaining 73% consists of water from superficial sources (80.4% of which is rain, and 19.6 % of which is snow melting).

The liquid flow is directly influenced on the quantity and quality of the main water precipitations on the hydrographic basin's surface. In turn, these are an effect of the types of atmospheric air flow above the studied unit, per year.

Due to the unit's position on national and European territory, we can define four types of atmospheric circulation.

The west circulation is the most stable and frequent. In this case, the sea/polar air masses move on a west-east direction, also forming Atlantic cyclones. As a result of the advection of these air masses above the region, the weather is relatively humid in the winter, respectively cool and unstable in the summer.

The polar circulation is characteristically less frequent and stable. Still, it plays a major role in Romania's weather condition.

We can define three categories in this range of air movement: the direct, reversed or ultrapolar polar circulation. The first one moves the sea/polar air masses from the north-west of the continent to its south-west side, generating a cool and humid climate in the summer, very unstable, respectively humid in the winter. The air masses involved in this circulation subtype are characterised by a high humidity and lower temperatures. Upon reaching the warm (during the warm season) continental surface, extreme weather conditions emerge with precipitations such as pouring rain and electrical discharges sometimes violent rain in big quantities in short intervals of time. These type of weather manifestation can cause floods and rapids, especially in the small hydrographic basins.

The reversed polar circulation involves cooler and less humid sea/polar air masses, an effect of which can be seen in the reduction of the amount of precipitations.

The ultra-polar circulation causes the spring and fall drops in temperature, and the colder temperatures in winter.

The tropical circulation, with its two types -sea and continental tropical- is less frequent, with a peak at the beginning of the summer and one at the beginning of winter. The tropical sea air masses which travel with the Mediterranean cyclones determine generalized precipitations, in significant amounts especially in places with hill and mountains as a result of the orographic ascent. The invasion of the continental tropical air masses to the north of the continent are generally associated with a barometric pressure maximum extended from the north of Africa to the central part of the European continent, on the ground level as well as on higher altitudes, determining a lack of precipitations in the affected region and extremely high temperatures, with frequent spells of drought.

A special type of atmospheric circulation is constituted by the blocking situation, in which, when above the central-eastern side of the continent, an anticyclone dorsal of altitude is extended from the south or the east of the continent. This situation prevents the advection of the oceanic air masses from the south, west or north-west of the continent, generating warm climate conditions, and drought.

Besides these types of atmospheric circulation, we can also define other situations that influence weather conditions on the north-west side of Romania, implicitly the area we are studying:

when the sea-tropical air masses(warm and humid) meet the continental-polar ones. This situation determines a significant fall of precipitations. The month May of 1970 is particularly remarkable in this aspect. Thus, at the Negresti-Oas hydrometric post the monthly sum of the precipitation amount was 184.9 l/square metres, 171.4% more substantial than the multi-annual monthly average, and at Turulung a 166.8 l/ square metres was recorded, exceeding the monthly multianual average by 213.3%;

the types of atmospheric fronts. The cold fronts, frequent in the April-June interval, generate far larger quantities of precipitation than the warm or occluded ones.

the daytime convection of the warm season. The powerful convective moves, determined by the heating of the sub adjacent continental surface accompanied by powerful adiabatic cooling, determine the formation of thermical convection clouds, which, most of the times, cause important quantities of pre-

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cipitations in short intervals of time;

in some situations when these fall on the surface of small hydrographic basins or sub-basins, they determine a rise in levels and substantial transportation of suspension or drawn materials with repercussions on the valley morphology. Atmospheric precipitations constitute the most important climatic element on which dwell the reserves of soil moisture and river alimentation. On the character and regimen of precipitations depends the variation of river levels which in its turn influences the liquid flow, the solid flow, the valley morphology and water chemistry.

The ration between the monthly precipitation quantity and the altitude underlines the existence of a pluviometric gradient oriented from west to the east of the Tur Valley, respectively from the plains to the hill and mountainous zone, the difference being of more than 250 l/square meters.

Thus the smallest amount of precipitations fall on the inferior course of the Tur River, in the plains, these amounting to 666.8 l/square meters, and the greatest amount in the superior basin (901.2 l/square meters at Negreşti-Oaş). Taking into consideration that the reception basin of the Tur resembles, on its superior course to a fan, with a large opening towards west and south –west, and heights of more than 1,200 metres on its limit, the air masses which move from east to north-east enter this zone like into a „funnel" , generating important precipitation amounts on the superior course.

Table no. 1 The pluviometric network of the Tur's hydrographic basin

No. crt.	Pluviometric posts	Year est.	Altitude (m)	Latitude	Longitude
1.	Huta Certeze	1976	285	47°56´	23°29´
2.	Negreşti Oaş	1961	238	47°87´	23°43´
3.	Boineşti	1979	165	47°55´	23°21´
4.	Cămârzana	1997	225	48°00´	23°32´
5.	Vama	1971	192	47°83´	23°40´
6.	Oraşul Nou	1997	150	47°83´	23°28´
7.	Pasunea Mare	1979	137	47°53´	23°14´
8.	Calineşti Oaş	1978	140	47°54´	23°17´
9.	Gherța Mare	1974	149	47°85´	23°35´
10.	Turulung	1958	130	47°93´	23°08´
11.	Micula	1997	124	47°54´	22°57´

On the medium course and especially on the inferior one, the precipitations are both of a frontal and of a convective nature. (during the warm season).

The most significant annual precipitation quantities were registered during the years characterized by a predominance of cyclonic and frontal activity.

Figure number 2: The Chart of multi-annual monthly average rainfall (l/square meters)

AS it has already been mentioned, one can notice a raise in the rainfall quantity in the Tur basin from west to east, respectively from the plain to the mountainous zones of the water collecting surface. (figure 2)

The distribution of the average monthly precipitation quantity underlines a pluviometric maximum during the months of June, July, and the minimum during February for the entire unit. One can remark that for this situation, values over the monthly average are registered for the may-August period, and values under the average, during the September-April period. The pluviometric maximum for July is 1.7 times greater than the average, both on the lower part of the unit and on its higher one. The pluviometric minimum in February represents between 54.8% (Negreşti- Oaş) and 39.4 % (Turulung) of the annual average. In other words, if during the warm season the convective precipitations from the plain side of the hydrographic basin compensate for the lack of orographic precipitations, resulting in an equal percentage value of the average, and during the cold season the lack of thermal convection determines lower percentage values in the lower zone (39.4 %) than in the higher one (54.8 % of the average) (Figure no. 3)

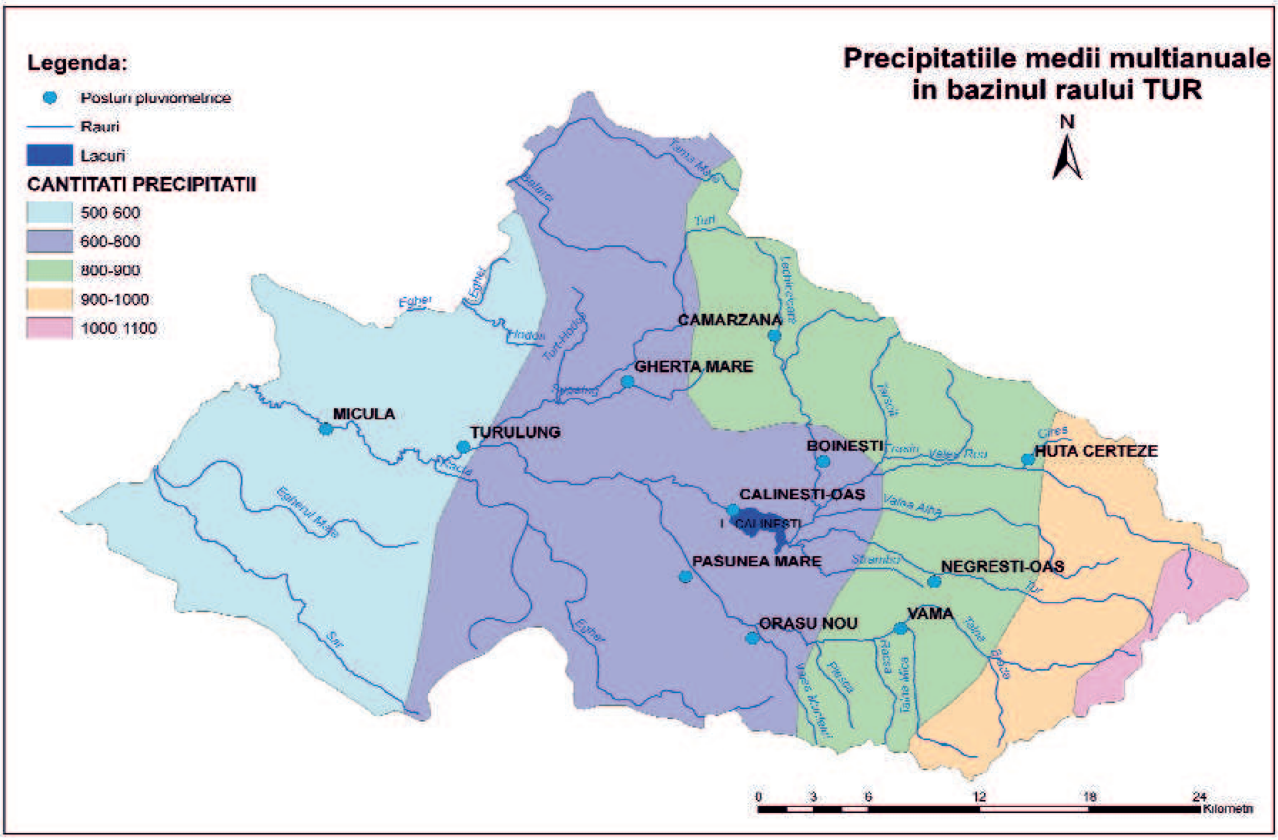

Figure number 3. Precipitation Map in the Tur River Valley

Liquid flow

The river flow is a complex natural phenomenon, conditioned by physical-geographic factors, that can be classified as climacteric and non-climacteric factors.

The general connection system includes the anthropic factor which, through its many social and economical activities brings substantial changes to the way the flowing process is formed and evolves. The main role is played by the climacteric factors, which determine the amount of water available in a certain basin and how it evolves in time. The non-climacteric factors play a secondary role, representing the general fundament from which the river flow evolves. The influence of non-climacteric factors is the more obvious, the smaller the basin in question is.

In the Tur basin, the liquid flow is determined by its climacteric and geographical conditions. It presents a temporary variation, related to the type of precipitation and the topography of the hydrographic basin, the underlayer's permeability, the structure and the texture of the soil, the geological structure, the slope, how much of it is covered in vegetation, the anthropic activity, etc. The interaction of these parameters may determine a stop in the flow. If the soil's infiltration capacity is greater than the amount of water fallen form precipitations, the flow stops. But when the amount and time span of the precipita-

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tions is greater than the infiltration capacity, the flow amplifies.

Average monthly flows

The average annual flow is directly influenced by the regimen and features of the yearly precipitations, and indirectly influenced by the characteristic topography of the hydrographic basin. Also, differences are induced by any hydrotechnical works in process in the riverbed (building dams, artificial lakes etc).

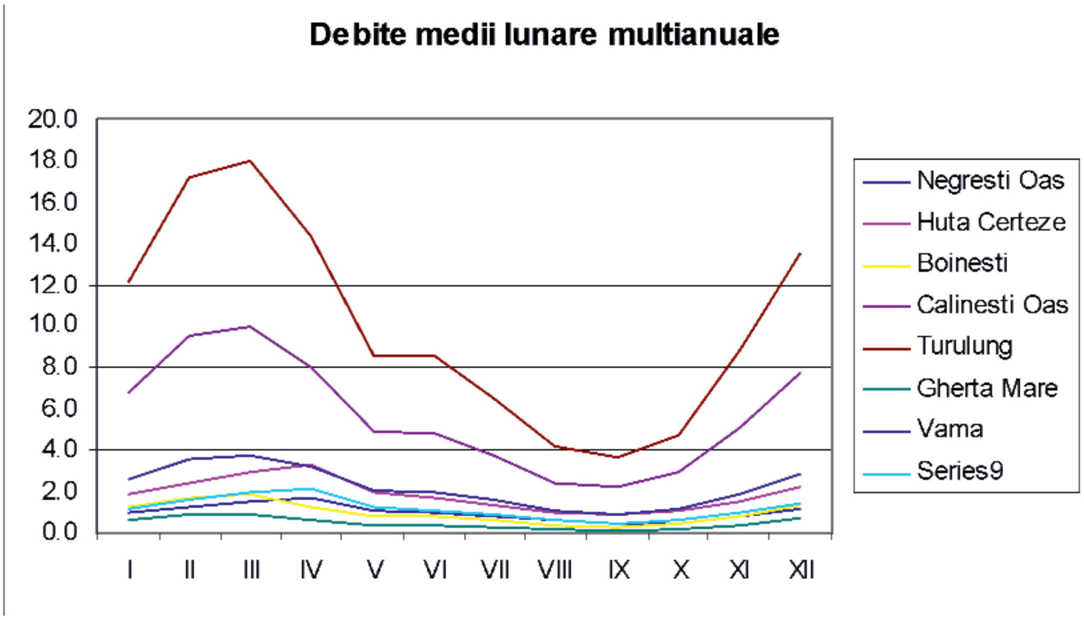

Figure no. 4. : Multi-annual monthly average flows (m³/s)

The average monthly flow, measured multi-annually in the Tur basin presents significant variations mainly due to varying the measuring point (upstream or downstream) and the amount of water the tributaries bring. On the upper branch, where there are few tributaries, the monthly average is small: 970 m³/ s- Negreşti-Oaş, while at Turulung, downstream from the Calinesti accumulation lake and its main flow of tributaries, its flow is over 10 times bigger:10.0 m³/ s. (Figure no. 4)

Maximum monthly flows

The maximum monthly flow is determined by the amount of monthly precipitations, of their type (liquid or solid) and their distribution in time. In some cases, when one or two of the above mentioned elements override each other, the flow can reach very high values.

The largest figures recorded occur in the summer (35.9 % in the upper basin and 38.4 % in the inferior one) followed by those in spring and autumn (over 20 % of the total), and the lowest in winter (20 % of the total).

If the precipitations registered in winter are maintained up to the end of spring (as a layer of snow) and when, due to abrupt heating, liquid precipitations occur, the flow will be amplified, being a result of both the liquid precipitations and the existing snow.

In the warm season, when the main precipitations occur as rain, we can measure significant amounts of water in short periods of time, generating significant flow on slopes and river beds.

In the superior basin, where the flow in the river bed is “controlled” only by natural factors, multi-annual maximum monthly flows are registered in April, due to frontal precipitations characteristic of the season and to the melting of the snow layer.

The maximum monthly flow on the inferior course is characterized by two maximal figures – one at the beginning of spring, the other at the end of it. The former is strongly related by the unit’s climactic conditions And the latter is determined by the exploitation conditions of the Călineşti accumulation, which, according to weather forecasts undergoes diverse measures against flooding (in the periods with a pluviometric surplus)

Minimal monthly flows

The multi-annual minimal monthly flow both in the mountainous region and in on the plain is registered in August-September and is closely linked to the reduction in precipitations fallen on the surface of the basin. Although during this period the quantity of precipitations has higher values than during the cold period, the reduction in the soil humidity due to the high temperatures in summer (thus affecting the groundwater) leads to a diminishing of the liquid flow.

Solid flow

River water acquires and contains a larger, equal or smaller quantity of alluviums, which influence the energetics of the flow in an observable way. Specialised literature uses two notions: river competence, the maximal value of the alluviums diameter that can be transported and river capacity, the total amount of transported material. The two proprieties vary in time and space and represent average values for any given river course. They are dependent upon the speed and debit of the river.

The processes are influenced by the system of forces, by the contact surfaces and by the duration of the given process.

Water puts pressure on the bed for a surface that depends upon the dimension of the transversal section, and the duration for which the pressure is constant or variable depends upon the uniformity or variation of the water quantity.

The pressure upon the river bed has two components: the static pressure – vertical and proportional to the height of the water column, a resultant of the difference in pressure vertically; and the dynamic pressure – horizontal and due to the potential energy contained in the movement of water, a resultant of the difference between upstream and downstream pressure.

The system of forces at work has also a negative component, opposed to the hydro-dynamic involvement. It registers the dynamic forces constituted of: the own mass of the particles, the contact forces between neighbouring particles in the bed and the cohesion forces.

The spatio-temporal ratio between the components of this system determines the status of the solid phase reported to the liquid phase for the length of the river bed. This ratio determines 5 principal states: the immobility state, the critical assimilation state, the movement at the bottom of the river state, the suspension movement state and the sedimentation state.

The water flow has diverse influences upon the bed. It can determine through erosion and sedimentation not only a growth in roughness but also the forming of a protection shield. The former causes a growth in turbulence, the latter a diminishing of it.

Solid particles act more efficiently than water because of their higher density and superior roughness of the metals in their composition.

The modelling action manifests itself in two directions: on the particles themselves and on the contact surface between the fluid and the underlayer. In the first case the result is the dimensional diminishing and the progressive rounding of alluviums. The second case represents a part of the modelling action on the terrain surface, through the splitting of particles from the adjacent surface.

During flooding the turbidity of the water is substantially modified, which brings along a corresponding growth in the mobilizing force and the quantity of energy represented by the suspension alluviums.

In the Tur river basin there is a correlation between the liquid flow annual averages and the solid flow annual averages. The solid flow presents higher values once the liquid flow increases.

The value of the multi-annual solid flow is of 0.950 m³/s. compared to this multi-annual value, the solid flow annual averages present certain fluctuations. The maximum of the solid flows average was realized in 1974 when it surpassed by 3.7 times the multi-annual average (3.54 m³/s), and the minimum was registered in 1983 (0.410 m³/s). The differences to be noticed are brought about by the variation in the liquid flow connected to the industrial use of the Călineşti lake, respectively by the transportation capacity of the water.

The solid flow monthly average presents the higher values in June, and the smallest in August. This situation is due to the higher precipitation figures during the hot season which lead to higher values of the liquid flow and the small precipitation figures in August, which reduce the liquid flow.

Human interventions on river beds through the construction of hydro-technical buildings (thresholds, dams, hydro-improvements) lead to substantial modifications of the water flow regimen, of the river bed mobility, of underground water regimen, of micro-climates and topo-climates, of water quality and aquatic fauna.

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