EXTREME PHASES OF THE DISCHARGE OF WATER ON SMALL RIVERS FROM ROMANIA SITUATED IN DIFFERENT CLIMATIC AREAS

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Introduction

The study of extreme events within the evolution of water runoff became a much debated problem lately, including the case of small rivers. The reason is well known. In the last years there were recorded very destructive floods, with serious consequences, even in the case of the rivers with surfaces that are smaller than 30-40 km^2.

Also in the last 9-10 years in Romania there were recorded high intensity droughts. Usually those phenomena came also in the attention of hydrological practice, and in the main domains of the national economy.

During the elaboration conditions of the paper, we considered obvious that the analysis of those extreme events must be accomplished simultaneously with the causes that generated them. For this kind of study there were chosen hydrometric stations within certain representative basins, with surfaces of 30-40 km^2, but also stations from the larger rivers of the country

It was taken into consideration that those basins were situated in all hydrological areas of Romania, in a diversity of climatic conditions, which have the determinant role on the discharge of water variation.

Besides the differentiation from the climatic point of view, the river basins are also differentiated from the point of view of the basin slopes and of the vegetation covering degree.

The selection of some basins differentiated by the characteristics from above had as main purpose the emphasis of the influence that all those factors have on surface runoff variation.

In the Figure 1 it is presented the map of Romania with the representative basins for which there were analyzed the extreme phases of the discharge of water runoff variation. For two of them, Iedut and Tinoasa Ciurea are also represented the water runoff mean monthly values, corresponding to a characteristic real year.

The real characteristic year represents the real year that is the closest from the point of view of mean and monthly values and time distribution, compared to the multi – annual mean values. In the case of the two basins, there will be briefly presented the manner in which the extreme phases of runoff will be analyzed and the fact that between the two basins there is the largest differentiation from the point of view of the factors exposed above.

A first explanation before the presentation of the runoff extreme phases would be that the largest maximum discharges in the case of the two basins did not occur in the months in which the maximum runoff values are recorded: V-VI in the case of Iedut basin and III –V in the case of Tinoasa Ciurea basin, but in the summer months VII-VIII.

The cause is represented by the fact that in spring the larger volume of water is due to the snow melting and also to the small intensity rains which don't produce important peak discharge.

The maximum discharges from the summer months are much more important in the case of both basins, being caused by short rains of high intensity.

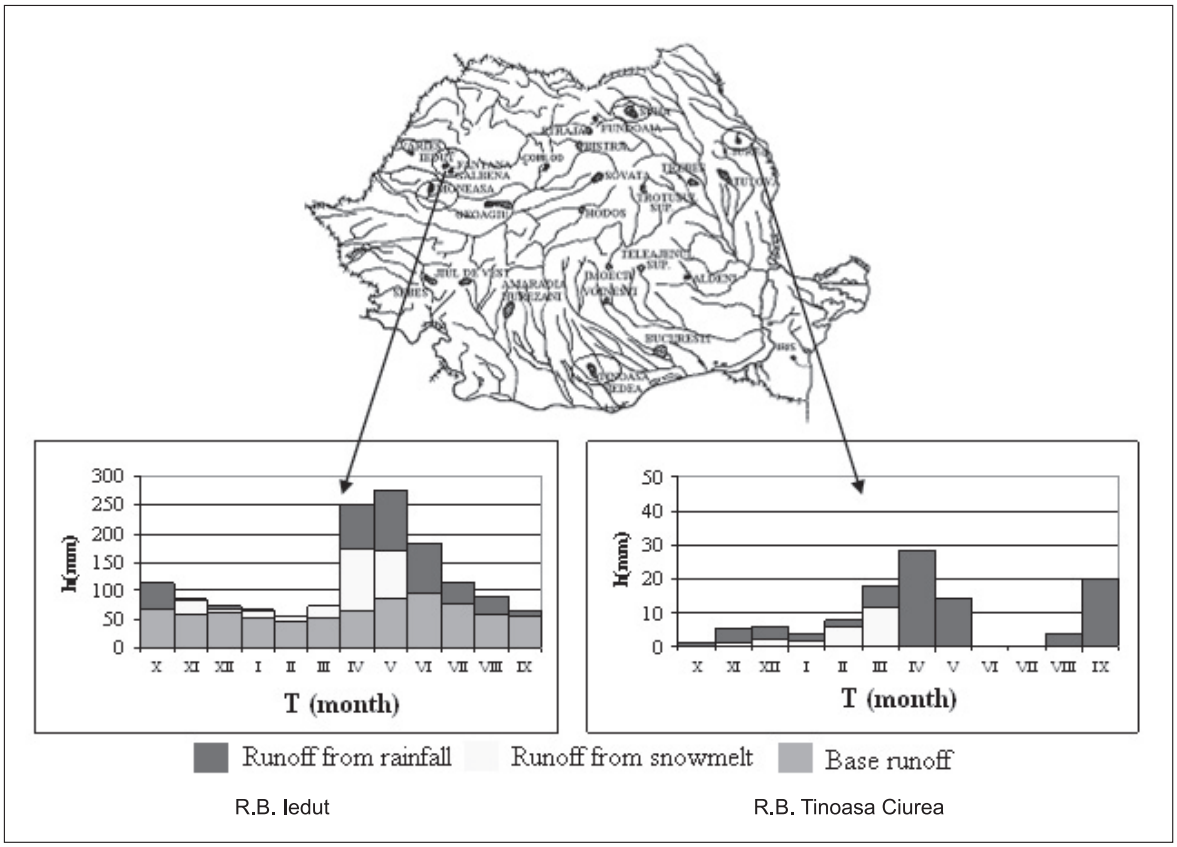


Figure 1. The water runoff mean monthly values from the characteristic years: 1975 in the R.B.Iedut case and 1981 in the R.B. Tinoasa Ciurea case

Short presentation of the runoff extreme phases and the causes that produce them

The results are presented in the case of the Iedut river (s.h. upstream of Caprita), and Tinoasa Ciurea (s.h. Ciurea) simultaneously with the analysis manner of the problems.

The case of the maximum runoff

A. From the analysis of the maximum annual discharges recorded in the measurements period 1970-2007 resulted the highest values of the recorded maximum discharges. Those values are represented for the Iedut river in the Table 1 simultaneously with the rains characteristics which produced them.

Table 1. The characteristics of flood and precipitations which generated them

No	Date of flood occurrence	Maximum Discharge Qmax (mc/s)	Characteristics of Precipitation					Estimated Exceeding probability (%)	Maximum specific discharge ($dm^3 \cdot s^{-1} km^{-2}$)	10 day index of previous precipitation (mm)
			Total Duration of Rainfall (min)	Total quantity of precipitation (mm)	Duration of Rain core (mm)	Precipitation quantity corresponding to the rain core	Rain Core Intensity ($mm \cdot min^{-1}$)			
1	14.07.1991	24.8	140	70.5	40	54.8	1.37	2.5-3	10290	7
2	25.07.1970	22.7	130	76.2	42	51.2	1.22	3-3.5	9420	11
3	24.07.1995	14.4	110	39.4	45	37.5	0.83	10-15	5975	5.5

In the study period there were numerous rains characterized through precipitations quantities close to the ones that generated important floods. But, due to some cores of smaller intensity they didn't determine special flood peaks in the respective years.

This emphasizes the determinant role of the rains cores in the maximum discharges accomplishing, especially in the case of small rivers.

B. The estimation of the exceeding probabilities of the recorded maximum discharges is also represented in Table 1. This probability resulted from the probability curve drew up for the annual maximum discharges.

C. The values of the maximum discharges exceeding probabilities were verified with the help of the probability curve of the rain core intensity (Figure 2)

D. It is ascertain that there is a good concordance of the rain core probabilities with the maximum discharges probability value, emphasizing once again their determinant dependence towards the rain core.

E. Other characteristic values within the maximum discharge of water analyzed within the maximum discharges variation.

This analysis was made because there are considered to be useful to the hydrological practice. Those characteristics are:

- The highest values of the maximum discharges recorded at a hydrometric station.
- The lowest values of the recorded maximum discharges.
- The medium multi – annual value of the recorded maximum discharges.
- The maximum values which can be recorded (Ex. Probability maximum discharges of exceeding 1%)

Those values can be also called characteristic thresholds of the maximum discharges. A suggestive way to present them is right in the section of the hydrometric station (the cross section) – Figure 3.

In the case of Iedut river, for all these maximum discharge thresholds there were also estimated the characteristics of the rains that could generate them. The same as in table 1. A lot of these results obtained on the basis of the data from the small basins, can be useful in the case of large basins in which constitution they enter.

For this purpose our staff elaborated a model which takes into consideration the values of the flood wave elements (maximum discharge, increase time, total time) recorded in small basins in different conditions, regarding the precipitation and which is fitting in the big basins.

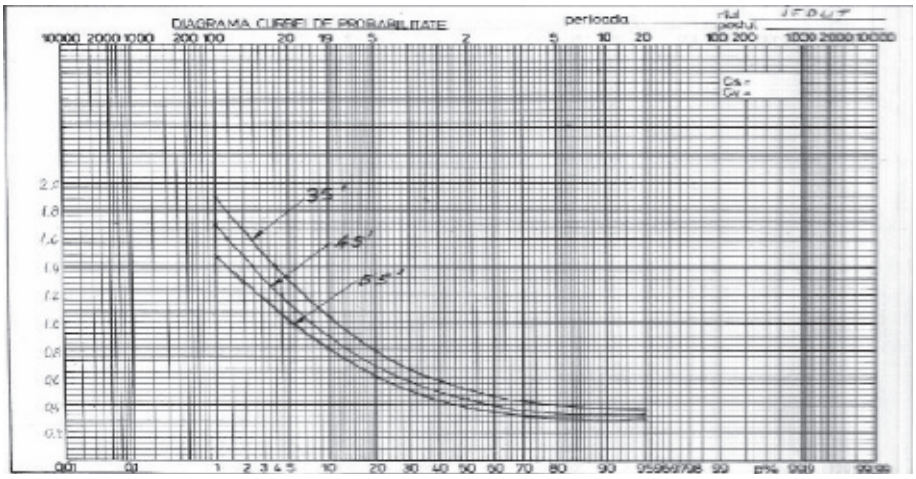
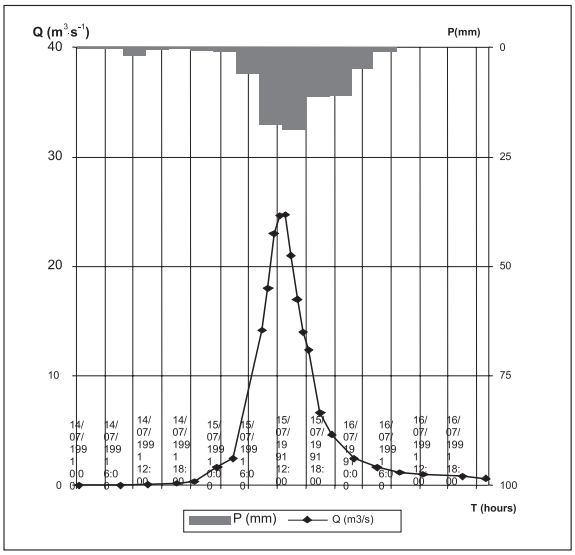


Figure 2. The probability curves of the precipitations which correspond to the different time intervals for the Iedut basin



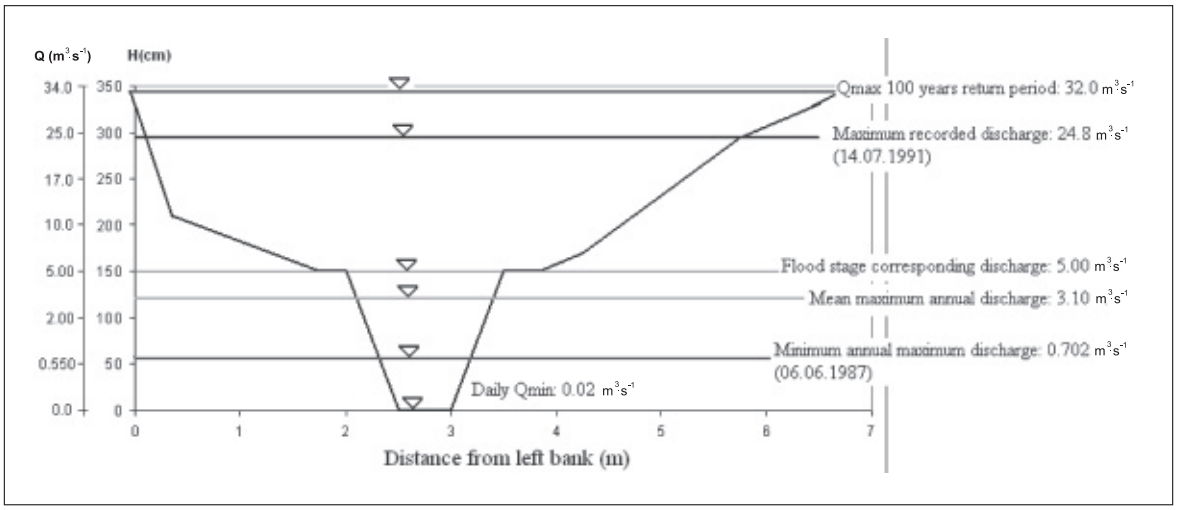


Figure 3. The largest flood recorded (14.07.1991) and characteristic thresholds of the maximum discharges in the section of the hydrometric station – Iedut river

The case of minimum discharge of water

The analysis was made in two different situations:

A. In the conditions of some rivers characterized through permanent runoff (the Iedut basin case)

- There were emphasized the smallest values of the daily discharges recorded in the analyzed period (1970-2007) and the cause of their occurrence: small quantities of precipitations previous fallen or their lack on big time intervals.
- Their values were established from the daily minimum probability curves, in the case of the producing probability of 80%, 90% and 95% simultaneous with the climatic conditions which lead to those kinds of values.

B. In the conditions of the rivers which present the drought phenomenon (the Tinoasa Ciurea basin case)

- From the analyzed period there were mentioned:
  - The largest number of days with presence of drought;
  - The medium number of days with a drought phenomenon determined from the analyzed period.

– By means of the probability curves there was established the value of the maximum number of days with drought phenomenon which can be recorded in the case of some rare probabilities (1%, 2%).

In all situations there were established relations between the number of days with the presence of drought and the former regime of precipitations which determined the presence of this phenomenon.

References

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