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THE STUDY OF THE GREATEST FLASH-FLOOD ON THE BELCINA RIVER IN A PERIOD OF 25 YEARS

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ABSTRACT. The study of the greatest flash-flood on the Belcina river in a period of 25 years. The article aims to analyze the greatest flash-flood recorded within a period of 25 years namely the period of 1986-2010, on the Belcina river, an affluent of the Mureș river in the Gheorgheni Depression. The article begins by analyzing the particularities of the Belcina river basin, and it continues by emphasizing the methodology applied in this case. After that the study focuses on the conditional factors of the flash-flood phenomena on the Belcina river on a general basis followed by a study of the flash-flood event frequency on the Belcina river, and finally a study of the greatest flash-flood parameters. In studying the particularities of the greatest flash flood in 25 years (1986-2010) on the Belcina river, one has applied the following methodology: a study of the particularities of the conditional factors that influence the genesis and propagation of flash-floods on the Belcina river on a normal basis, a study of flash-flood frequency on the Belcina river, a comparative analysis of the first two greatest flash-floods occurring on the Belcina river each year within the period taken into consideration and finally the case study of the event itself.

Keywords: flash-floods, Belcina river

1. INTRODUCTION

The Belcina River springs from the Giurgeu mountains and merges with the Mureș River within the Gheorgheni Depression near Joseni. It is one of the main affluents of the Mureș river in its upper river sector.

The Belcina river creates its basin based on the main collector, namely the Belcina River with the help of its effluents: on the left: Gherpălocul Mare, Gherpălocul Mic, Veleșchia, Bodoroș Biuc, Mogoș Biuc and on the right: Prișca, Ceahod, Pârâul Cetății.

The data used for the present article was collected from the Gheorgheni hydrological station, which is responsible for an area of 94 km^2 and the Joseni meteorological station.

The Gheorgheni hydrological station is located on the Belcina river, at an altitude of 1115 m, in the Giurgeu Mountains. The river length, up until the Gheorgheni hydrological station is 31 km.

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The studied flash-flood represents a hydrological risk phenomenon which implies a rapid increase in flow and volume transported by the river as dictated by extreme meteorological conditions.

2. METHODOLOGY

The methodology used for the present article includes the study of a series of 44 flash-floods occuring during the period of 1986-2010 on the Belcina river. The delimitation of said flash-floods from periods of high flow was determined with the aid of the Cavis programme (Fig. 1).

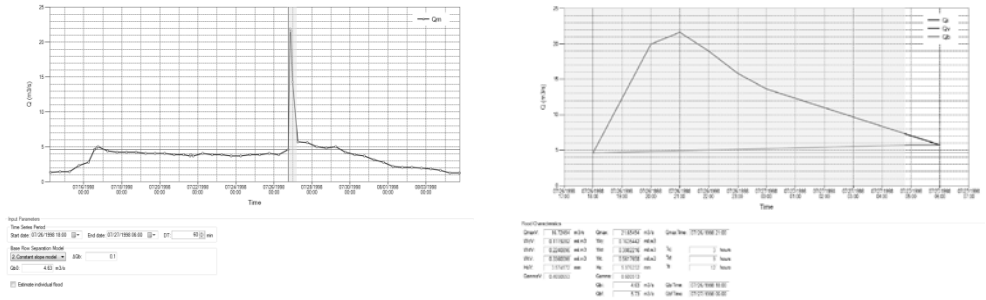

Fig. 1. The two modules of the Cavis programme displaying a flash flood hydrograph (the 1998 main flash-flood on the Belcina river)

The study is completed by a short analysis of the flash-flood frecquency on the Belcina river in terms of monthly and seasonal frequency as well as flash-flood typology based on the hydrograph form. This short analysis helps characterize the flash-flood studied here.

Also we have considered a short study of the conditional factors and the genetic ones, thus including a study of a string of data referring to precipitation measured at the Gheorgheni hydrometrical station and snow cover measured at the Joseni meteorological station within the period of 25 years.

3. A DESCRIPTION OF THE FACTORS THAT INFLUENCE THE FLASH-FLOOD PHENOMENA ON THE BELCINA RIVER

The Belcina river basin is located partly on the slopes of the Giurgeu Mountains and partly within the Gheorgheni Depression. Thus, having the geographic unit dictate the slope distribution within the basin also influences the way the flash-floods propagate.

Steeper slopes such as 20-30° or higher characterize the upper river basin, untill the hydrographical station of Gheorgheni. Therefore, until the Gheorgheni hydrographical station the speed of the flash-flood phenomena is greater due to a prevalence of steeper slopes, as compared to the downstream river basin, situated

in the Gheorgheni Depression and mostly characterized by slopes categories of 0-10°. (Fig. 2)

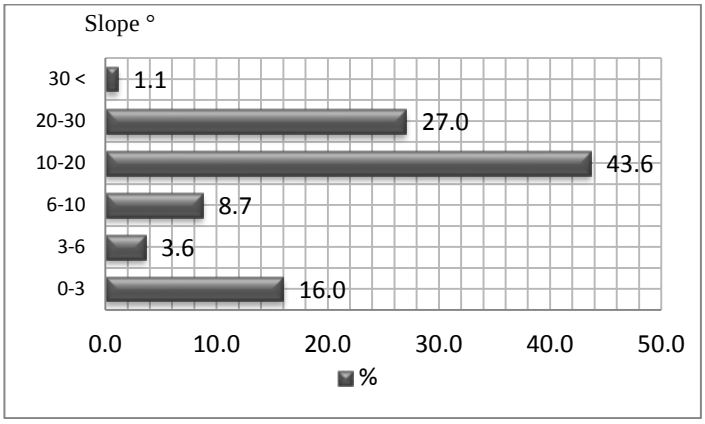

Fig. 2. The slope distribution within the Belcina river basin

The Belcina river measured average flow within a period of 25 years is 1.05 m^3/s and during the flash-flood period it reaches an average of 5.73 m^3/s which is not very high, especially when compared to other important affluents of the Mureș river in its upper sector, such as Toplița, Răstolița or Bistra. The reason for this is the location of the Belcina river basin within an area that is fended and depleted of precipitation. The humid western air mases barely reach this area after pouring most of the precipitation they carry upon the western end of the Toplița-Deda gorge area. While most of the precipitation in the upper river basin of Mureș falls within this sector (887 mm/m^2/year at Gălăoaia, 780 mm/m^2/year at Răstolița) the precipitation that reaches the Gheorgheni depression is significantly reduced: 586 mm/m^2/year measured at the Gheorgheni hydrographical station.

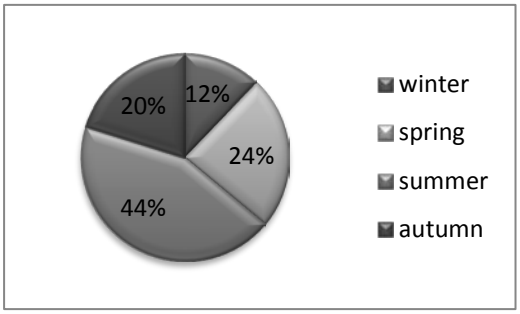

Fig. 3. The seasonal distribution of precipitation at the Gheorgheni hydrometrical station

The annual amount of precipitation measured at the Gheorgheni hydrometrical station si distributed mostly in the summer (44%) followed by spring (24%) and autumn (20%) a distribution that has a clear influence upon the flash-flood seasonal frequency. (Fig. 3)

Snow covers the ground for 6 months on average within the Gheorgheni Depression as the Joseni meteorological station suggests (Fig. 4). The melting process occurring in spring but also ocasionally in winter under the influence of a

warm air mass accounts for the mixed flash-floods that usually take place in april as well as december.

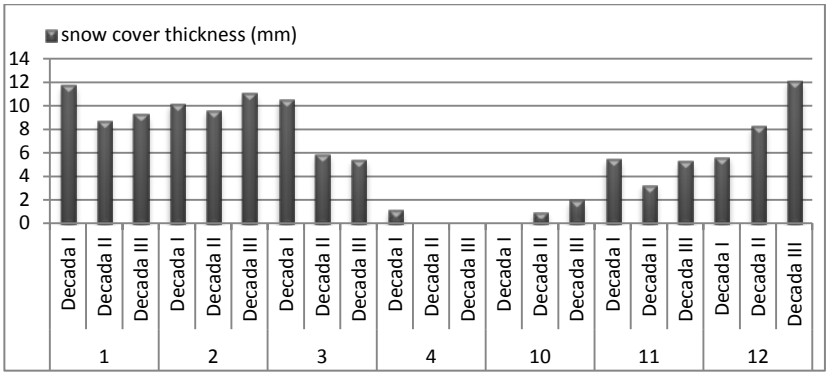

Fig. 4. Snow cover thickness at the Joseni meteorological station, on average within the period of 1986-2010

4. A SHORT ANALYSIS OF THE FLASH FLOOD PHENOMENA FREQUENCY ON THE BELCINA RIVER WITHIN THE GIVEN PERIOD

This chapter focuses on the study of the flash flood frequency on a monthly and seasonal basis as well as analyzing the type of flash floods most common on the Belcina River in the given period based on the shape of their hydrograph. The graph below represents a string of the main flash-floods occurring within the period 1986-2010. On average, the peak flow of the Belcina River during a flash-flood is 5.73 m^3/s.

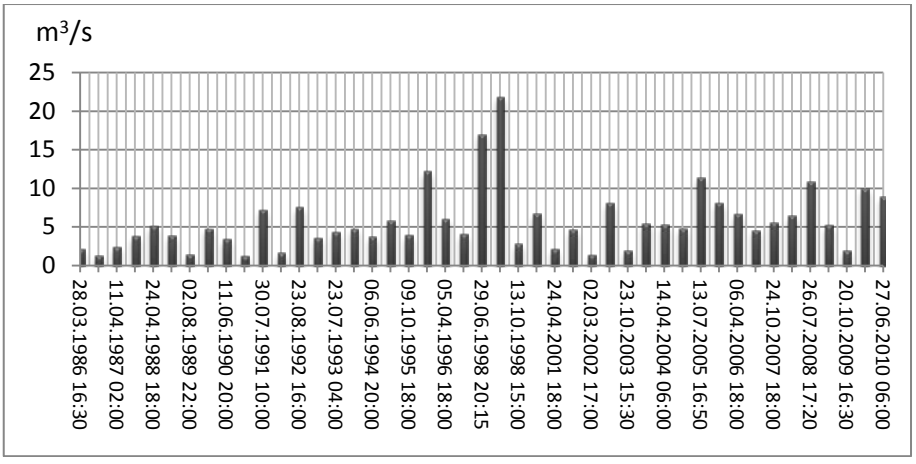

Fig. 5. The main flash-floods of the period 1986-2010 on the Belcina river basin

As compared to that, the peak flow of the greatest flash-flood that occurred during the studied period is 21.65 m^3/s, and it can be easily identified from the graph below, as being the second flash-flood - in chronological order - to take place during the year 1998 (Fig. 5).

Flash-floods mainly occur during the summer season (42%), (Fig. 6) due to the fact that 44% of the amount of precipitation falls during this season on the Belcina river (Fig. 3). Due to snow melt combined with an important amount of precipitation flash-floods of mixed genesis also occurr during spring (31%) (Fig. 6).

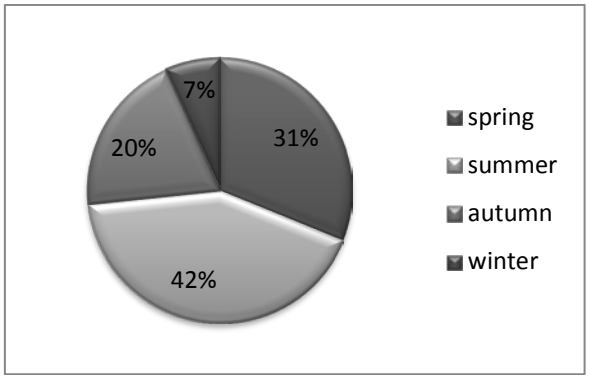

Fig. 6. The flash-flood frequency on a seasonal basis within the given period

On a monthly basis, flash-floods most frequently occur during the month of April (Fig. 7). The summer peak can be explained by a high frequency of flash-floods during the months of June and July.

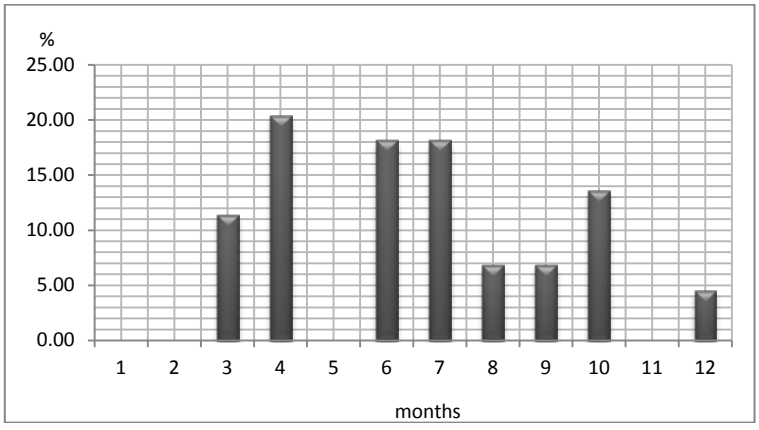

Fig. 7. The flash-flood frequency on a monthly basis within the given period

Considering the hydrograph shape, most of the flash-floods taking place on the Belcina river are singular (63%), only 37% being compound flash-floods.

5. THE PARTICULIARITIES OF THE GREATEST FLASH-FLOOD ON THE BELCINA RIVER WITHIN THE PERIOD 1986-2010

The greatest flash-flood on the Belcina river within a period of 25 years is the second flash-flood to be registered at the Gheorgheni hydrometrical station during the year 1998.

The genesis of this summer flash-flood is mainly pluvial as it starts after the river basin receives an imput of 25.8 mm/m^2 in the form of torrential rain on the 26th of July 1998.

The flash flood starts on the 26th of July 1998 at 18.00 hours when the Belcina river flow abruptly increases from 4.63 m^3/s to 21.9m^3/s in just two hours, having reached this peak flow by 20.15 hours that same day.

The total duration of the flash-flood is 12 hours, with a total of 3 hours increase duration (Tc) and 9 hours decrease duration (Td) which accounts for a raport (Tcr/Tt) of 1/4 which is common for flash-floods occurring in greater river basins of Romania. However, it is not the case of a great river basin, but of a great flash-flood that made the Belcina river reach a flow peak 20 times greater than its measured average flow.

The total volume of water transported by the Belcina River during this flash-flood was 0.56 mil. m^3, distributed as follows: 0.16 mil. m^3 increase volume (V cr) and 0.39 mil. m^3 decrease volume (V sc). This accounts for a Volume Raport (V cr/ Vsc) of 0.41 indicating a rapid concentration of the flash flood within a contact area, in this case, the contact betweeen the Giurgeu Mountains and the Gheorgheni Depression.

The hydrograph shape coefficient describing the flash-flood is 0.60 indicating a slightly ample yet singular flash-flood (Fig. 1). The drained layer of the flood was 5.97 mm. The flash-flood ended on the 27th of July 1998 when Belcina's flow measured 5.73 m^3/s.

6. CONCLUSIONS

The greatest flash flood during the period of 25 years, namely, 1986-2010 on the Belcina river was a summer flash-flood that occurred towards the end of July 1998 and it was due to an exceptional amount of precipitation that fell upon the area that same day.

Considering the short flash-flood frequency analysis that has been presented within the article, the studied flash-flood could be classified as a summer singular flash-flood which is indeed the most common category of flash-floods to occur on the Belcina River. One element that makes this flash-flood uncommon is its peak flow - four times bigger than the average peak flow of the studied flash-floods on the Belcina River.

The rapid response of the Belcina River to the climatic factor is typical for a small river basin; however the particularities of the flash-flood make it intriguing.

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