THE LIQUID PRECIPITATION ABUNDANCE OF THE PRUT BASIN IN JULY 2008

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ABSTRACT. – The liquid precipitation abundance of the Prut Basin in July 2008. In the last years, the severe meteorological phenomen, Moldavia included, have increased significantly in intensity, reaching here and there certain thresholds difficult to accept a couple of years ago. This study proposes to marked the role of abundant rainfall that had caused the floods in July 2008 on the Prut river and to identify and to characterize the synoptic situation that favored large amounts of precipitation fall in the period mentioned above. The consequences of exces precipitation periods from July 2008 have led to the increased of the debit river that had produced important floods in North and North-Eastern of Romania on Prut, Siret and Tisa drowned large area of flamand and grassland destroying road infrastructure and even leading to lives lost.

Keywords: rainfall, floods, synoptic conditions, Prut.

1. INTRODUCTION

The rainfall are characteristic especially of the warm season .The most important result of this situations is the appearance of floods. „The flood is sudenlly increase of short-term level, and implicitly of the debit water of a river, over the ordinary value. In this case the nearby territory is covered temporaly or permanent (reduced time-scale) with water”(Romanescu, 2003).

The Prut river has its source in the Carpathians Forests in Ukraine to the North-Eastern slope of the Cerna-Hora (or Cerna Gora) ridge, under Hoverla top at an altitude of 2068 m. Trought Izvorul Căţelei, affluent of Ceremuşului Alb, the Prut has is source also in Romania, in the country north, between Tisa and Siret.

The common characteristic of the basin river Prut relief it is a series of hills whose altitude decreases from North-West to South-East. In the northern half, the large surface wave is located at altitudes of 200-300 m, shorter by up to 200m, to the sorrounding frame that separates west and the south Prut basin of the Siret basin (Bucureşteanu, 2008).

In thermal point of views the Prut basin is situated in a temperate-continental climate of transition with excesive influence , influence that are emphazise not by the environments of this element, but by the values of concrete, real, which shapes the extreme limits of this development. Multi-year variation of the air temperature, but especially the soil temperature at the surface and in depth and their spatial distribution has particular importance from the hydrological point

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of view. Rainfall is the most important climatic element in supply the Prut Basin water reserves, of the quantity, mode of manifestation and their gender depending on the basic characteristics of the territory studied. If in the norhern half of the Prut Basin fall an annual average about 550 mm of precipitation, in the south it reduced to approximately 450 mm.

In years whith hight rainfall the pluviometric excess, usually registered only during several rain has the effect of flooding, flood, moisture excess, raising the ground water, and if the years with low rainfall the deficit is seen in the events of drought and dryness.

This study proposes to marked the role of abundant rainfall that had caused the floods in July 2008 on the Prut river

2. DATA SOURCES AND USED METHODS

2.1. Sources and data types

For this paper were chosen three weather stations representative of the Prut Basin: Botoşani, Iaşi and Galaţi, and values used cover a period of 30 years (1980-2009).

It will analyze the impact of rainfall in this period, and in particular those of July 2008, based on the identification and characterization of synoptic situation that favored the fall of these significant amounts of precipitation.

Table1. ***Location of weather stations Prut Basin***

Serial Number	Weather station	The average altitude (m)	Latitude	Longitude
1	Botoşani	163	47°44´	26°38´
2	Iaşi	84	47°10´	27°37’
3	Galaţi	2	45°28’	22°56’

Besides the data from these three meteorological stations will use the data from the database European weather and hemisferic (electronic archive Meteorlogical Center in Karlsruhe, Germany and the electronic archive of northern hemisferic server in Moscow). These databases contain synoptic maps and weather data for two main climate weather elements, temperature and rainfall. We will identify periods with excessive rainfall in 2008 and synoptic conditions in july.

2.2. Research methods

In order to achieve the proposed study it will be used statistical and mathematical methods as and particular methods for studying the main climatic elements. For the analysis of precipitation amount it will be used: the standardized anomaly precipitation (SAP) and Wheighted anomaly of standardized precipitation(WASP).

For a better highlighting of results was used graphical method and, this way to graphically represented the amount of precipitation fallen in the interval studied but also results obtained there from calculating SAP and WASP.

3. RESULTS AND DISCUSSION

3.1. Analyzing the phenomenon

Floods are one of the most devasting extreme natural phenomenon, triggered as a result of the direct causal relation ship between weather factors (rainfall) and the retention factors, to these area added in many situations and the geomorphic and anthropogenetic factors (Bălteanu and Rădița Alexe, 2001; Sorocovschi, 2002).

In the figure 1 are graphically represented the amount of precipitation recorded in 2008 at the meteorological stations in the Prut Basin, Botoșani, Iași and Galați, highlighting the April and July for the Botoșani and Iași stations, and September to Galați and in particularly those in July recorded in a short time.

The largest amounts had fallen in the period 24-27.07.2008 when the intensity of the cyclone activity that generated them was highest. These amounts accumulated in 72 hours have passed the multiannual average of July in Iași and Botoșani (Fig. 2).

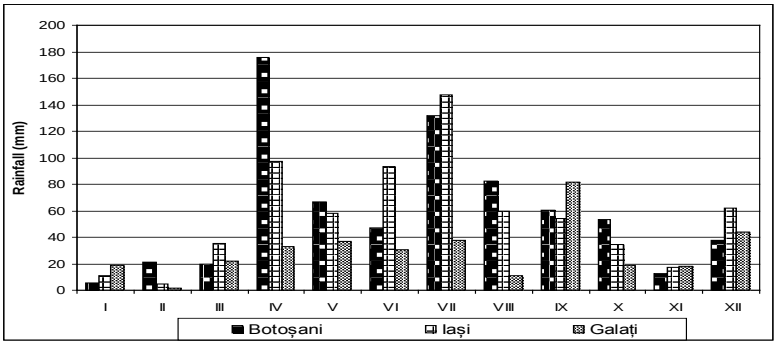


Fig.1. ***Amount of precipitation recorded at weather stations Botoşani, Iaşi and Galaţi in 2008***

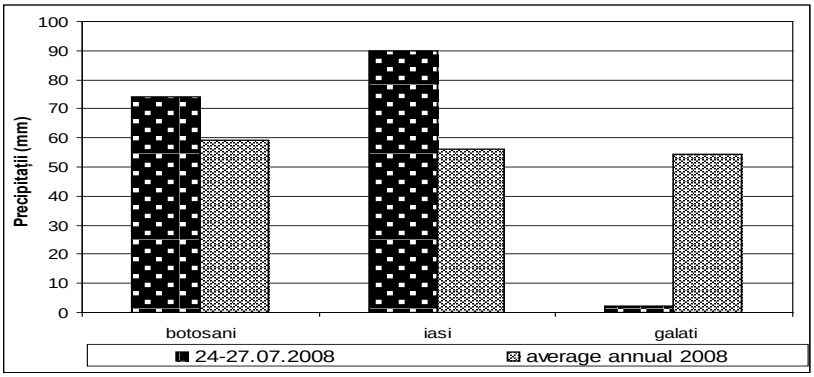


Fig. 2. ***Precipitation fallen in the period 24-27.07.2008 compared with multiannual average July***

3.2.The standardized precipitation anomaly

The standardized anomaly of precipitation (SAP), recommended by the World Meteorological Organization for analysis precipitation amount is widely used in specialty practice defining the pluviometric character of one year, season or month (Vasenciuc, 2001, quoted by Croitoru, 2006).

Following the interpretation of the results obtained from the three weather stations it can be noticed that in the period 64,4% were analysed in terms of normal pluviometric (SPA between-1.0 and 1.0). 2008 year rainy characteristics (wet) in Botoşani and Iaşi stations (i.e. SPA 1.23 1.00), and dry year station Galaţi (SPA-1.29) (fig. 3).

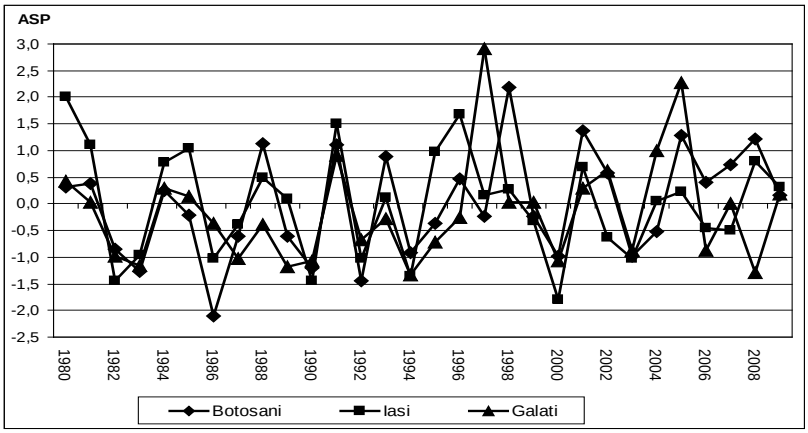


Fig.3. ***Hierarchy during the years 1980-2009 as SPA values***

3.3. Weighted standardized precipitation anomaly

Weighted standardized precipitation anomaly is one of the methods commonly used in literature, being recommended for in the study of excess or weak pluviometric periods. WSPA's value at all three stations varies from North to South, thus of Botoşani is registered the highest values following to decrease gradually to the south basin, in Galați (fig. 4).

The frequency on precipitation amount pluviometric areas totaled in 2008 puts in evidence the predominance of normal domain, both in the basin (51%) and at each meteorological station in part (fig. 5).

Although the pluviometric normal class has a higher frequency than the rainy, „the intensity of rainfall situations and their classification in the category of severe weather situations (or situations with pluviometric risk) is that they are in charge of significant damage, which places the excess quantities of precipitation on one of the leading places among natural hazards"(Croitoru, 2006).

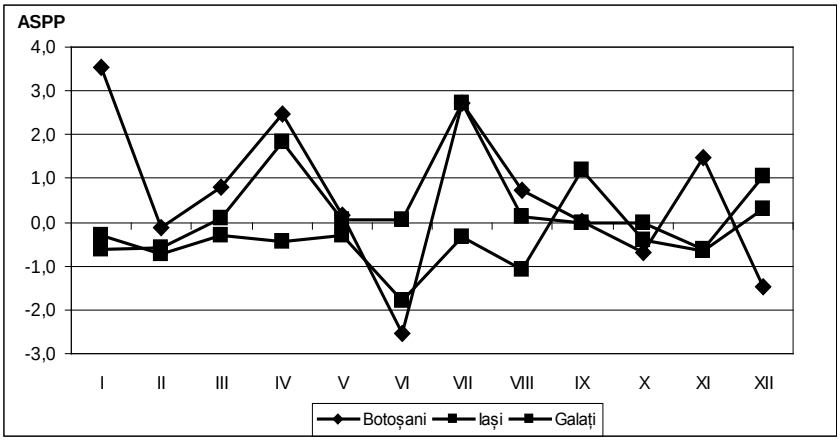
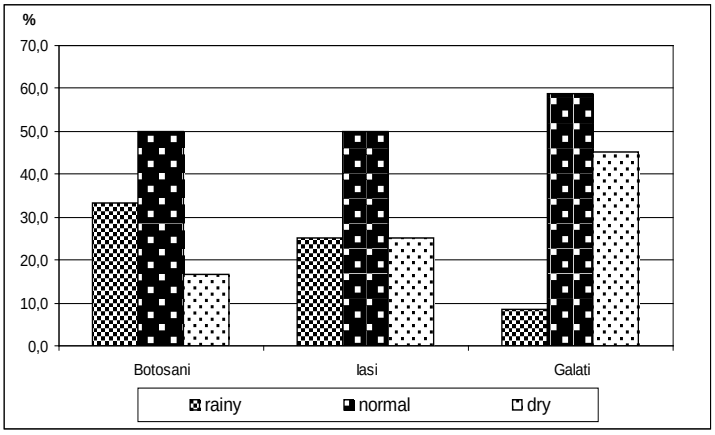
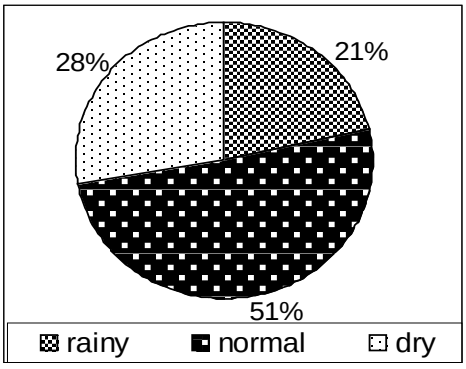


Fig.4. ***WSPA's value at the three stations in 2008***



a.



b.

Fig.5. ***The average frecuency of 2008 the analisys weather stations rainfall areas (a), and the Prut River Basin (b)***

3.4. Synoptic conditions generating phenomenon

The synoptic conditions that have caused large amounts of precipitation in the period 24-27.07.2008 have been genereted by the increased of cyclonic activity. Thus from 21 and 22 July in Romania under the influence of tropical air masses were reached maximum temperatures that frequently exceeded 30°C, and from Scandinavia to Central Europe gets a kernel altitude cold. During the days 23 and 24 July traffic ground to has rotated from the north, west and south of Romania and warm tropical air mass comes in contact with much colder air mass from Scandinavia, the temperature dropped significantly in average up to 6-10°C. At that point in the western Black Sea near the Romanian coast, dominated an cyclonic activity with a core of 1005hPa.

The precipitations with rain character have begun on the night of 23/24 July and have reached in a few hours large quanties, which have increased significantly over the 24 day, especially in northern Moldova, on the border with Ukraine, with repercurssions in the hydrological regime. Thus the day of 24 July „the debit has suddenly increased to the value of 387 m³/s, and the maximum rates of flow of the Prut river were recorded upstream of the Lake Stânca-Costeşti in section Rădăuţi Prut, being 7140 m³/s(Romanescu, 2010), causing significant flooding, especially in Botoşani County, located upstream of the Lake Stânca-Costeşti. The situations has been improved in Iaşi County, located downstream of Lake Stânca-Costeşti, because the presence of the lake allowed the controlled release of waters.

"The precipitations fallen in the period 21-27 July 2008 in Botoşani could not have cause catastrophic flooding in Rădăuţi Prut section. They are charged to the precipitation fallen in the Wooded Carpathians of Ukraine, but also as a result of the unauthorized accumulation discharges located the upper course of Prut (unfortunately this information is not officially confirmed)."(Romanescu, 2010).

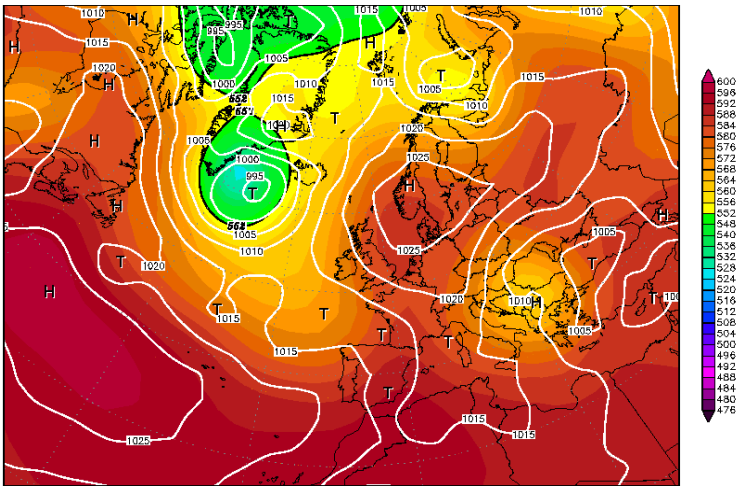


Fig.6. ***Field soil and atmospheric pressure at 550hPa geopotential field (550m), 24/07/2008), by electronic archive Meteorological Centre in Karlsruhe, Germany.***

CONCLUSIONS

Liquid precipitation fall in the interval 24-27 July 2008, which produced floods were caused by an intensive cyclonic activity, the cyclonic centers were located over our country and in the regions immediately nearby. The cyclonic formations that caused precipitation generating flood had high speed travel. Given that synoptic situation favored the appearance of a depression at ground nucleus that had the altitude correspondent up to 500hPa, and existence of an unstableair masses favored the development of type Cumulonimbus clouds that can reach heights of 28 km, being the source of a large amounts of precipitation, hail, frequency lightning and storms sometimes.

The consequences of excess precipitation of periods July 2008 ledded to river flows increase producing real important floods in nortern and north-eastern Romania on the Prut, Sire and Tisa rivers. Acording to the report delivered by Ministerial Committee for Emergency Situations, on July 30, were 150 villages affected by flooding in six districs: Bacău, Botoşani, Iaşi, Maramureş, Neamţ and Suceava. 6,826 households were flooded and 35,000 hectars of agricultural land, rains affecting 7.2 km of a highway. There were registred five deaths because the flooding and 15,183 people were evacuated.

The main cause which led to the production of floods in July-August 2008 on the Prut River is one natural, which are caused by extremely large amounts of precipitation that fell in the third decade of July(24-27 July), especially in its apper basin (Ukraine), and middle (Romania).

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