THE JULY 2005 FLOOD IN VEDEA RIVER HYDROGRPAHIC BASIN IN

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ABSTRACT. – The flood in Vedea River hydrogrpahic basin in july 2005. The present paper is focused on some aspects of the flood that occured in the hydrographic basin of Vedea river, located in central part of the Teleorman Plain. Daily data of discharge flow recorded in 7 hydrologic stations (Buzeşti, Văleni, Alexandria, Tătărăştii de Sus, Teleormanu, Ciobani, Vârtoapele) were used for this study for the period 3-10 july 2005. The conditions of the flood occurence were analyzed, as well as its type. To draw the flood hydrograph and to calculate the flood parameters the Cavis software, developed by researchers in INHGA Bucharest, was used. The main results are: the 2005 flood was generated by the high amounts of precipitation fallen at the beginning of July in the area; they were followed by the increase of the discharge flows and by dams collapse; an extreme negative impact was identified at economic, social and ecologic levels.

Keywords: flood, Vedea hydrographic basin, , flood parameters, negative impact

1. INTRODUCTION

The flood occured in July of 2005, in Vedea basin was the most spectacular one in terms of affected area, large flow of rivers and damage.

The present study addresses aspects of this particular flood: the cause (the large amount of rainfall in early July 2005), the elements of the flood wave and its negative effects.

The most part of Vedea basin overlaps the Teleorman Plain, the center part of the Romanian Plain, between Olt and Arges rivers (Posea , 2005).

Vedea basin runs North to South from Olt basin (in the west and north) to the Calmatui (in the west) and Arges (north and east) It has an area of 5430 km^2 being ranked as medium in terms of size. The river is directly tributary to the Danube. The shape of the basin is elongated in the direction NW-SE, and the length of the basin is 224 km. The average altitude of the basin as one of the most important morphometric parameters is 166 m, while the maximum altitude is 504 m, and the minimum is about 70 m in area flowing into the Danube. Sinuosity coefficient is 1.39 (Fig. 1).

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important morphometric parameters, is 166 m, while the maximum altitude is 504 m, and the minimum is about 70 m in area flowing into the Danube. Sinuosity coefficient is 1.39.

Analysis of the region under study has been made on both morphological characteristics (Posea, 2005), and of the hydrological ones (Mociorniţa, Popovici, 1979, Zaharia, 1993, 2004).

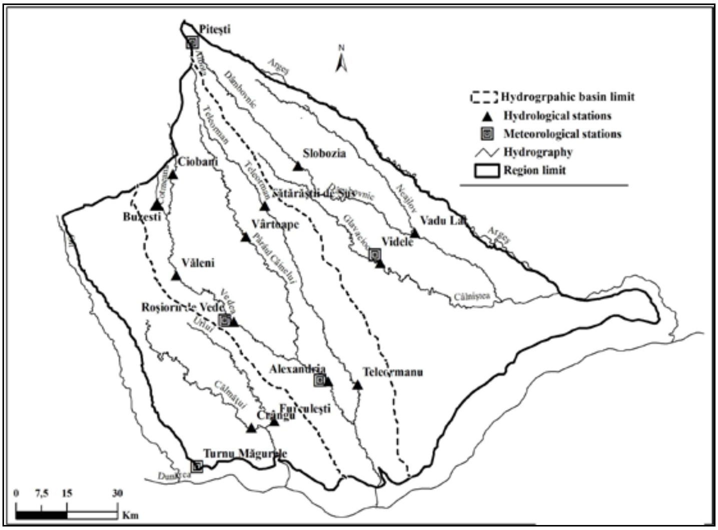

Fig.1. The limits of the area and the hydrological and weather stations network

Previously, the floods occured in the Romanian Plain were analyzed by Haraga and Niţulescu (1973) while other authors focused on the exceptional ones (Ujvari, 1972, Trufaş and Vrabie, 1973, Diaconu, Lăzărescu, Mociorniţa, 1972, Zăvoianu and Podani, 1977).

Aspects of floods produced in the Romanian Plain between Olt and Argeş were recently analyzed by Toma and Barbu (2011).

2.DATA AND METHODS

2.1.Data

For this study we used daily discharge flow data over the period 3 - 10 July 2005 recorded in the major hydrometrical stations located in the Vedea hydrological basin: Buzeşti, Văleni, Alexandria, Tătărăştii de Sus, Teleorman, Ciobani, Vârtoapele. To analyze the amount of rainfall in the period under review we used the daily amounts registered at Pitesti, Rosiorii the Vede and Alexandria weather stations.

Data were provided by the Vedea and Arges Water Branch and ANM (National Meteorological Administration).

For this study we used daily discharge flow data over the period 3 - 10 July 2005 recorded in the major hydrometrical stations located in the Vedea's catchment: Buzeşti, Văleni, Alexandria, Tătărăştii de Sus, Teleorman, Ciobani, Vârtoapele. To analyze the amount of rainfall in the period under review we used the daily amounts registered at Pitesti, Rosiorii the Vede and Alexandria weather stations (Fig. 1). Data were provided by the Vedea and Arges Water Branch and ANM (National Meteorological Administration

2.2. Methods

In order to draw the flood hidrograph and to calculate the parameters of the singular floods the CAVIS softwere developed by researchers in the National Hydrology and Water Management Institute in Bucharest was employed. CAVIS softwere is an application developped under Windows, with two main modules: *input data management module* and *calculation of singular flood wave specific elements module*. The separation of singular floods from composite floods was made using the same application.

3. RESULTS

The year 2005 is characterized as being one extraordinary in terms of recorded rainfall and rivers water flow.

Alexandria weather station, located in the lower basin of the Vedea river, recorded 1061 mm, a value almost twice higher than the annual average amount of precipitation (536.8 mm). April, October, November and December recorded below average values, but all the other months had values above average: May, June, July, August and September recorded values of 100-150 mm above average (Fig. 2).

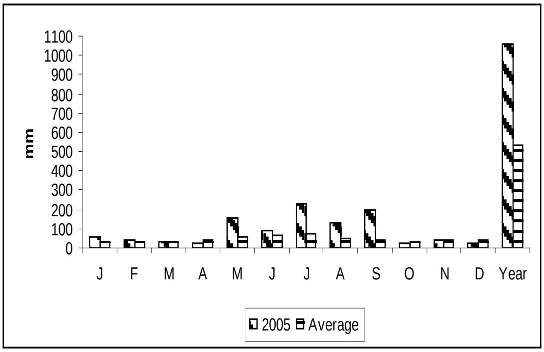

Fig. 2 ***The mean multiannual monthly amount of precipitation (1965-2007) and monthly amounts of precipitation recorded in 2005***

These precipitations resulted in significant increase both in the level and in the discharge flow in the basin, leading to the occurence of the flood.

Synoptic situation that generated heavy rainfall during 2 to 7 July, 2005 was characterized initially in altitude, on the surface level of 500 hPa, by a western movement. From 2 to 4 July, the maximum high geopotential located over Western and Central Europe. At that time, over Romania a Mediterranean cyclon was still acting, especially over southern part of the country. Its development was favored by also individualizing in altitude of a secondary nucleus, colder, detached from cold core centered over the Russian Plain, while the south-west of the continent was under the high geopotential of North African origin (Fig. 3) .

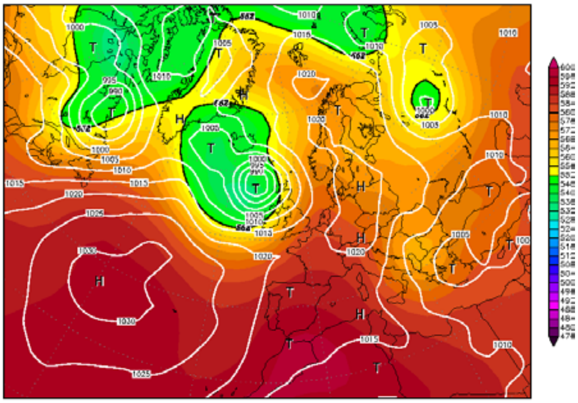

Fig. 3. ***Geopotential field at 500 hPa isobaric surface (5500 m) and sea level pressure on 03. 07. 2005, at 00.00 UTC (after www.wetterzentrale.de)***

From July 5, circulation in altitude became again western; the contact between the cooler air of northern origin and the warmer one of tropical origin, developed exactly over Romania's latitude. At sea level, most of Europe remains under the influence of barometric low pressure centers located in northwestern Romania, north of the Black Sea and over the British Isles and the Baltic Sea.

Between 2 to 4 July 2005, under these synoptic conditions, the rainfall rate increase to huge values for the considered area. Thus, the values recorded varied between 143.4 mm (at Alexandria) and 218 mm (at Văleni) (Table 1).

Table 1. Daily rainfall amounts from 2 to 4 July 2005 in Vedea Hydrographic Basin and annual average amount of July

Weather station	**Precipitations (mm)**				**July average**
	2.07.2005	**3.07.2005**	**4.07.2005**	**Total**	
Piteşti	45.4	24.2	30.2	99.8	90.9
Roşiorii de Vede	8.8	48.0	8.6	65.4	59.6
Alexandria	0.0	99.6	43.8	143.4	70.64

Source: ANM

Liquid precipitation fallen in July had already found a waterlogged soil, and thus the drainage coefficient was high due to very low infiltration.

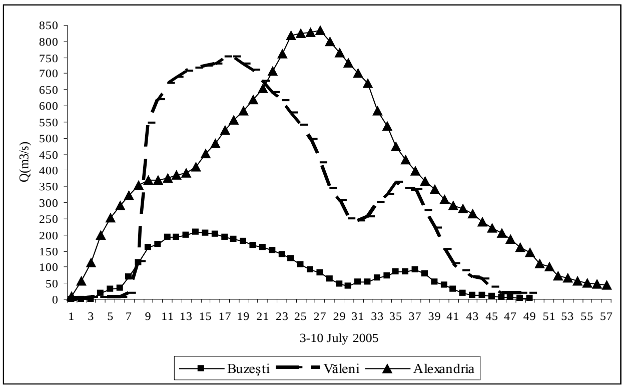

Fig. 4 ***The flood hydrograph produced on the Vedea river in July 2005***

Flood hydrographs from three hydrometric stations that monitor Vedea river show a single peak at Alexandria and two peaks at Buzeşti and Văleni. The first peak, which was also the highest, was determined by rainfall between July 2 to 3, and the second one was due to the day of July 4 when the precipitations were less consistent. Overall, precipitations affected especially the northern half of the hydrographic basin where the flood occured.

Based on hydrographs, flood wave elements for each hy-drometric station where flood occurred in July 2005 in the study area were calculated. At Buzesti station the flood peak reached 208 m^3/s (Fig. 4). It was more than twice higher compared to the danger limit calculated for the station (92 m^3/s). The total time of the flood weave was 51 hours, and the water volume of the flood was of 17.78 mil.m^3. At Văleni station the flood peak was 751 m^3/s (Fig. 3), almost two times higher than the inundation limit calculated for that station (393 m^3/s). The highest values of the discharge during the flood (834 m^3/s) occured at Alexandria in July 2005 was 180.51% higher than the danger limit (Fig. 4).

The maximum increasing flood time ranged from 49 hours recorded at Vârtoapele station, to 7 hours ((at Tătărăştii de Sus) (Table 2).

Table 2. ***Elements of direct flow and of flood w aves at stations affected in July 2005***

Parameteres		Vedea River			Teleorman River		Cânelui River
		Buzeşti	Văleni	Alexandria	Tătărăştii de Sus	Teleormanu	Vârtoapele
Direct flow parameteres	QmaxV	192.51	730.54	802.06	66.88	179.86	10.42
	WcV	4.49	22.09	41.91	0.59	5.97	1.24
	WdV	8.34	52.83	43.94	7.82	16.46	0.97
	WtV	12.83	74.92	85.85	8.41	22.43	2.21
	HsV	25.92	43.46	26.45	20.26	16.73	9.24
	GammaV	0.36	0.41	0.36	0.48	0.36	0.51
Flood parameteres	Qmax	208.00	751.00	834.00	75.30	196.00	12.00
	Wc	4.92	22.92	44.14	0.79	6.95	1.43
	Wd	12.86	60.57	53.57	10.59	24.50	1.50
	Wt	17.78	83.48	97.72	11.34	31.45	2.93
	Hs	35.92	48.43	30.10	27.33	23.45	12.27
	Gamma	0.47	0.45	0.40	0.58	0.46	0.59
	Tc	14	18	30	7	27	49
	Td	37	51	52	65	70	66
	Tt	51	69	82	72	97	115

Legend: QmaxV (m^3/s)-maximum discharge flow of direct flow; Qmax (m^3/s) - flood peak; Tc (hours) – rising time; Td (hours) – recession time; Tt (hours) - total time of the flood; WcV (mil. m^3) - the growth volume of direct flow; Wc (mil. m^3) - the growth volume of the flood; WdV (mil. m^3) - the decrease volume of the direct flow; Wd (mil. m^3) - the decreasing volume of the flood; WtV (mil. m^3)- total volume of the direct flow; Wt (mil. m^3) total volume of flood; Gamma- shape coefficient of the direct flow hydrograph; Gamma-shape coefficient of the flood; *HsV*(mm)-elapsed layer of direct flow; *Hs* (mm)-layer drained since the flood beginning.

The total volume of flood had maximum values (97.72 mil.m^3) at Alexandria hydrometric station and minimum (2.93 mil.m^3) at Vârtoapele station (Fig. 5, and table 2).

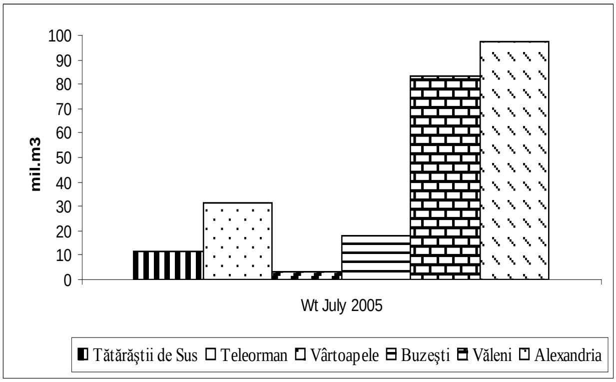

Fig. 5 ***The total volume of wave flood in July 2005 on the main rivers in Vedea's catchment***

The highest values of the decreasing time was 70 hours recorded at Teleorman station and the lowest values in Buzeşti (37 hours). The total time of the flood was 115 hours at Vârtoapele and the lowest values were recorded in Văleni - 69 hours and Buzeşti - 51 hours.

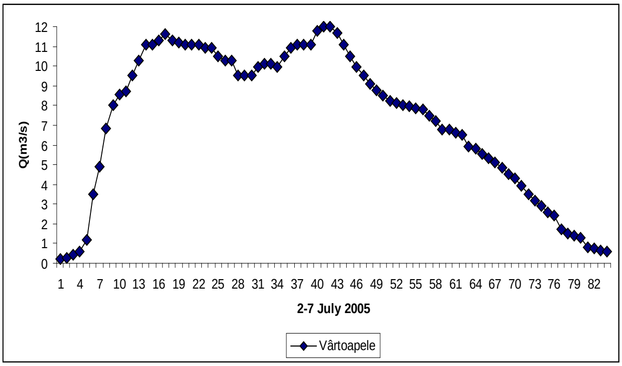

Fig.6. ***The hydrograpf of the flood in July 2005 at Vârtoapele hydrometric station on the Valea Câinelui River***

The flood recorded on Câinelui River had two peaks, the first on July 3, 2005, at 4.00 pm when the flow was of 11.60 m^3/s, and the second peak caused by large amounts of rainfall fallen on 4th of July 2005 had a rate of 12.00 m^3/s (between 7 and 8 pm), which represents the maximum value recorded during this flood (Fig.6)

The July 2005 flood was recorded at the two hydrometric stations on the Teleorman River, respectively at Tătărăştii de Sus, located in the upper basin, where the flood had two peaks, and at Teleormanu station in the lower basin, not far from the confluence with the Vedea River. On Teleorman River the flood had a single peak, but the magnitude and intensity were higher in the lower sector. At Tătărăştii de Sus station, the flood peak was 75.3 m^3/s recorded on July 3, 2005, between 9 a.m. and 10 a.m. and the second peak of the flow was of 59.20 m^3/s on 5 July at 4 a.m. (Fig. 7).

In the case of the flood on the Teleormanu station, all the water drained was quantified and maximum flow was 196 m^3/s, achieved on 4 July 2005 at 7 p.m. This value represents an overtaking of the flow risk by 132.43%.

Impact and damages caused by the flood. The extent of the damage depends on the following factors: population density in the areas under flood, flood wave characteristics and immediately intervention of the public institutions.

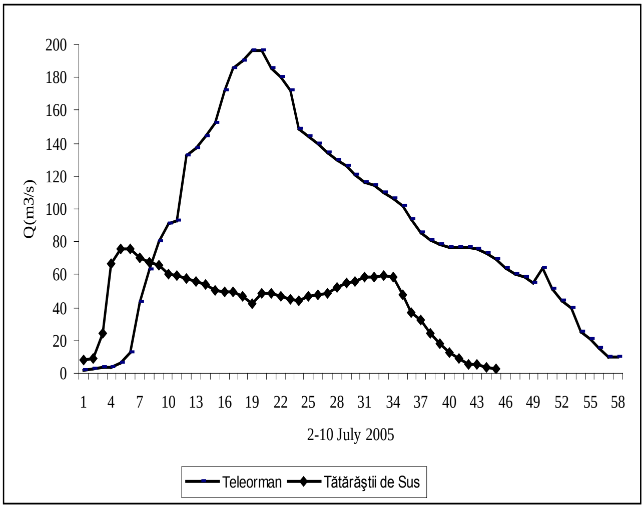

Fig. 7. The Hydrograph of the flood in July 2005 occured on the Teleorman River

Negative impacts associated with floods occur at economic, social and environmental levels.

Social effects are seen in terms of casualties, which may be caused by direct action of water by drowning or fatal injuries, but also indirectly through the emergence of deseases. The data provided by the Administration and Home Affaires Ministry, after the flood of July 2005, account for 3 deaths, contamination of drinking water increased incidence of gastrointestinal diseases, degradation or destruction of socio-cultural, religious, health, political and administrative institutions buildings.

Thus, in the studied region of Dobreni (in Teleorman County) was covered in water 90% in July 2005, and rural residents of the 11 villages affected by the flood were evacuated and accommodated in schools, community centers, hospitals. Two schools, one communal library, two dispensaries and one church were flooded.

Also the flood impacted in eight hydraulic works in rural area, 80 bridges were distroyed out of which 66 were broken in Teleorman county.

The floods in July 2005, due to its huge discharge flow of waters affected 17 fish ponds. The floods generated the increase in the ground water levels, imposing measures to protect population from 6 settlements. Agricultureal areas planted with wheat, corn and vegetables in some villages were also damaged**.**

4. CONCLUSIONS

Analysis of the flood occurred in July 2005 revealed that it was the most important flood prodused in Vedea river basin over the period 1965-2007. The main factor was the huge amount of precipitation in the mentioned, which exceeded by far the multiannual mean value of July.

The flood had a high rate and affected the majority of rivers in the studied basin at all analysed stations recorded flood peaks over the risk flow. The highest discharge was recorded at the hydrometric station of Alexandria, on Vedea River (834 m^3/s).

The analysis of the flood hydrographs revealed the presence of simple floods (with one peak), at Teleormanu and Alexandria stations, and composed floods at Buzeşti, Văleni, Tătărăştii de Sus and Vârtoapele stations.

The strongest intensity of the flood was recorded in the lower basin, the area with the highest damage.

Significant damage was recorded in Teleorman county where certain settlements were affected in 90%, bridges were broken, important crops were compromised but also the buildings of the public institutions.

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