Fenomene şi procese climatice de risc

THE ABUNDANT PRECIPITATIONS IN THE PERIOD 22ND – 27TH OF JULY, 2008, FROM SUCEAVA COUNTY AND THE SURROUNDING AREAS. CAUSES AND CONSEQUENCES

Diana BOSTAN, D. MIHĂILĂ, I. TĂNASĂ

ABSTRACT. - **The abundant precipitations in the period 22nd – 27th of july, 2008, from Suceava county and the surrounding areas. Causes and consequences.** Between 23-27.07.2008, on the territory of Suceava county and the neighbouring areas were registered prominent quantities of precipitations which produced exceptional flash floods in the interval 24.07 – 5.08.2008. The synoptic context which determined the abundant precipitations consisted in the presence of a coupling between a nucleus come from the Arabic Depression and a cold nucleus of altitude which persisted for a few days and had a retrograde evolution, from the north of the Black Sea to the north of Moldavia and Bucovina.The synoptic and orographic conditions from the specified areas led to large quantities of precipitations which fell in a short time in different stages. In a first stage, in the western side of Suceava county (in the hydrographic basin of the river Moldavia) fell abundant precipitations. After about 24 hours, this time in the east of the county, another wave of precipitations, even more abundant quantitatively, affected especially the hydrographic basins of Suceava and the superior Siret. The very large quantities of precipitations from the interval analysed (which culminated the value of 431,9l/m^2 in Vicovu de Jos), broke out the apparition in the field of at least two exceptional flash floods, with a historical character. The evolution of the hydrometeorological events from these habitats, the production, in only 2-3 days, of two successive, extremely violent flash floods determined uncommon material losses.

Key words: torrential precipitations, flash floods, material losses.

1. General considerations

Suceava county is set in the north-east side of Romania and extends itself on a surface of 8553,5km2 (3,6% from the country surface). This overlaps itself to the East Carpathians (55%) and the Plateau of Suceava (47%), being characterized by a large variety of the physical-geographical (dense hydrographic system) and socio-economic cadre.

2. The pluviometry, specific features and influences

The spatial-temporal variability of the dynamic nature factors, the altitude and the big fragmentation of the relief etc., often determine (V. Dornei-1912, Cârlibaba-1938, Suceava-2005, Arbore-2006 etc.), in Suceava county, extreme pluviometric manifestations (large quantities of precipitations – over 200mm/24h).

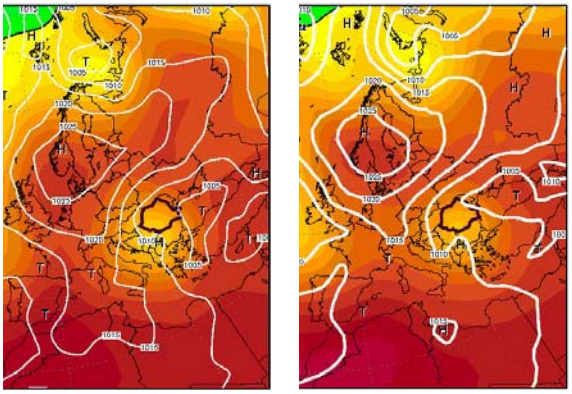

Fig. 2 a. The synoptic situation from 24-25.07. 08

3. The synoptic situation in the interval 22nd – 27th of July 2008

Starting from the day of July 22, 2008, at the ground, on a thalweg of the Arabic Depression shows up a depressionary nucleus of 1005hPa in the basin of the Aegean Sea. During the following days (fig. 2 a), the pressure continued to decrease, the nucleus of 1005hPa extended itself all over the basin of the Black Sea, then, from July 27, 2008, this moved slowly over the Sea of Azov to Russia, our country territory getting out from under its influence (fig. 2 b).

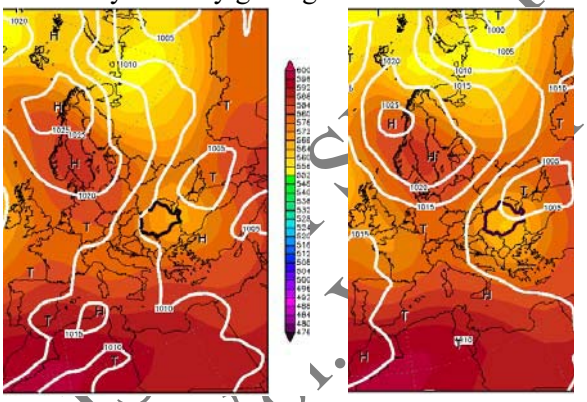

Fig. 2 b. The allotment of the air pressure at the ground and at the level of the 500hPa isobaric surface above the east of Europe on the days of 26-27.VII.08 – after www.wetterzentrale.de

In altitude, at 500hPa, showed up, from July 23, a closed nucleus with a centre on the south of Hungary, which evolved gradually over Serbia, the south of Romania, finally reaching the west of the Black Sea.

The nucleus formed in the thalweg of the Arabic Depression - with the afflux of moisture and warmth – correlated with the cold nucleus of altitude which manifested their presence during the 5 days from the last decade of the month of July, determined the abundant precipitations that led to the record debits registered on the rivers Moldavia, Suceava, Siret and Prut.

From the aerologic soundings made at Bucharest-Baneasa (which may be expanded, due to the lack of data, also to the north-east of Romania) can be observed (fig.3) the big values of the absolute moisture, not only for the low altitudes, but also for the medium and high ones, until over 9000m, premise of the genesis of some abundant precipitations.

4. The abundant precipitations generating of floods

The flash floods and floods from the months of July and August 2008 from the hydrographic arteries of Suceava county were determined by the regional meteo-synoptic peculiarities and the local geographic conditions.

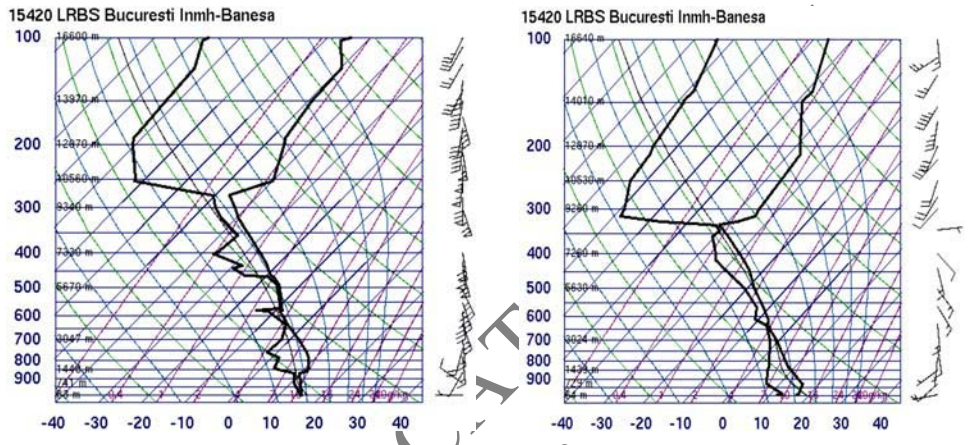

Fig. 3. Atmospheric soundings on the entire tropospheric column made at Bucharest

The flash floods affected almost all the water courses from the county (excepting the basin of Bistrita), but having very different durations, maximum debits and volumes, depending on the volume of the flows from the slopes, on the alimentation conditions and the morphometric parameters of each of the basins (surface, me-dium altitude, inclinations, the relief fragmen-tation, the af-forestation le- vel, the propor-tions of the antrophic im-pact etc.).

At national scale, the precipita-tions situation from the inter-val 24-25 July 2008 is illustra-ted in fig. 4. There can be seen very clearly that the nucleus with the biggest precipitations is set in the north-east of the country, in the space of Suceava county.

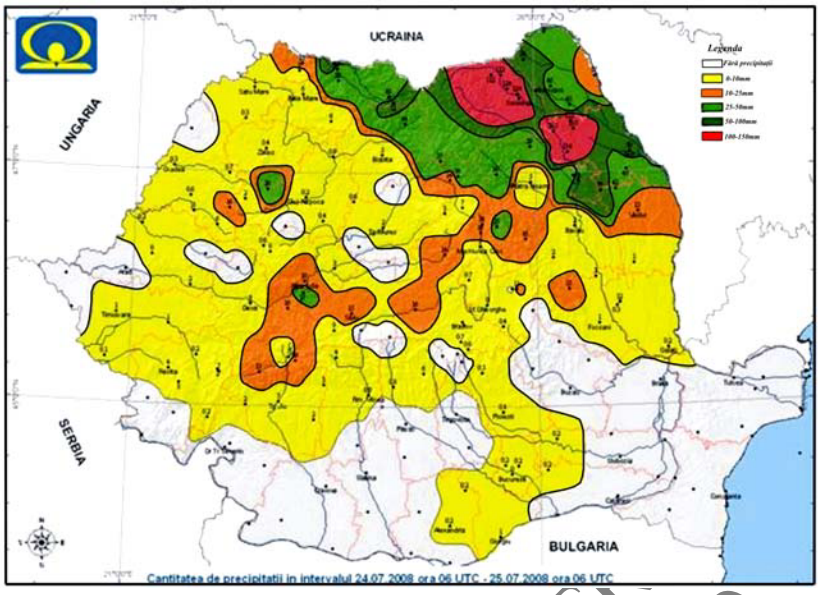

Fig. 4. The precipitations registered in the interval 24 - 25.07.08 in Romania

5. The precipitations and the flash floods from 22-27 July 2008 in the west of Suceava county

The synoptic conditions previously illustrated, cumulated with the local physico-geographic peculiarities determined torrential precipitations in successive cycles, at first spread out in the west and then in the centre and the east of the county. The hydrometeorologic evolution from this habitat characterized itself through the production and propagation, in only 2-3 days, of two successive, extremely violent flash floods (especially in the hydrographic basin of the river Suceava), being registered historical maximum debits.

Rich precipitations in the hydrographic basin of the river Moldavia, from the analysed interval, reached the maximum at the large majority of the surveillance points on the day of July 24, 2008 – tab. 1. In general, at the pluviometric posts situated in the hydrographic basin Moldavia-Moldovita, between 22-27 July 2008, fell quantities of precipitations which totalized:

- 161,5mm at Moldova Sulița, 103,4mm at Fundu Moldovei, 149,4mm at Câmpulung Moldovenesc, 130,8mm at Prisaca Dornei and 141,2mm at Gura Humorului on the river Moldavia;
- 129,5mm at Pojorâta on Putna, affluent of Moldavia on the right;

- 169,4mm at Lunguleț and 123,9mm at Dragoşa on the river Moldovița;
- 113,8mm at Stulpicani on the river Suha Mare.

Table 1. Diurnal precipitations registered at the hydrometric stations from the hydrographic basin of the river Moldavia

Crt. No.	Measurement point	22 VII	23 VII	24 VII	25 VII	26 VII	27 VII	Total 22-27iul	Hydrographic basin
1	Moldova Sulița	4,2	11,2	63,3	18,7	46,2	17,9	161,5	Moldavia
2	Fundu Moldovei	0,7	8,6	64,8	6,4	6,7	16,2	103,4	
3	Pojorâta	2,5	7,2	78,1	2,9	5,0	33,9	129,6	
4	Câmpulung Moldovenesc	0,5	9,7	98,2	7,9	6,8	26,3	149,4	
5	Prisaca Dornei	1,1	7,4	56,3	14,2	4,0	47,8	130,8	
6	Frasin	7,3	23,0	30,5	60,0	32,5	35,0	188,3	
7	Stulpicani	3,5	7,4	74,9		8,1	19,9	113,8	
8	Gura Humorului		5,9	62,4	33,5	1,6	37,8	141,2	
9	Bogdănești		10,0	42,0	36,0	9,8	2,5	100,3	
10	Lunguleț	0,4	9,1	57,3	30,0	16,2	56,4	169,4	Moldovița
11	Dragoşa	0,2	9,4	73,6	36,5	4,2		123,9	

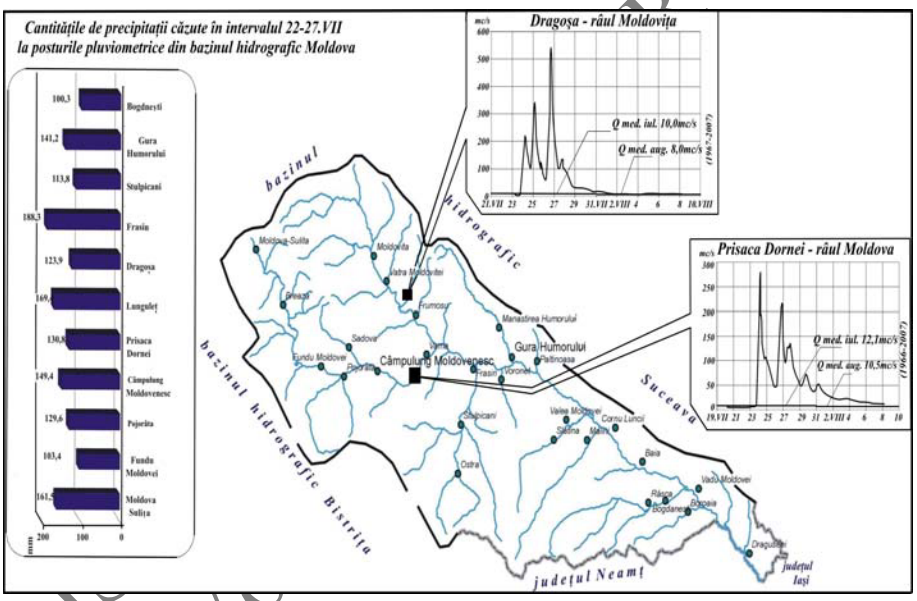

Fig. 5. The quantities of precipitations fallen and the flash floods generated in the interval 22-27.07.08 in the hydrographic basin Moldavia

There can be ascertained, without too many exceptions – fig. 5, that rich precipitations fell in the entire basin of the river Moldavia, where the surface flow could not take over the water surplus any longer, thus being generated floods with important material damages.

Also, in the superior hydrographic basin of the river Bistrita were registered significant local precipitations which exceeded the attention marks, but without uncommon effects.

6. The evolution of the precipitations registered in the eastern side of Suceava county in the period 22-27 July 2008

The wave with the biggest precipitations which affected the eastern side of the county (the hydrographic basins Suceava, Şomuz and Siret) in the analysed interval generated itself with a temporal postponement of 12-24 hours in comparison with the western and central sides of the administrative unit under investigation.

Table 2. Precipitations registered in the period 22-27 July 2008 at the pluviometric posts from the hydrographic basins of the rivers Suceava, Şomuz and Siret

Crt. No.	Measurement point	22	23	24	25	26	27	Total 22-27	Hydrographic basin
1	**Brodina**	3,2	23,8	52,7	**102,3**	**107,7**	10,2	299,9	Suceava
2	**Vicovu de Jos**	6,0	32,7	56,2	**145,5**	99,5	92,0	431,9	
3	**Țibeni**		8,9	**58,1**	**55,6**	23,2	27,6	173,4	
4	**Iţcani**	0,1	8,6	51,1	**74,4**	19,8		154,0	
5	**Suceava**	7,1	1,6	58,1	**77,8**	5,2	19,2	169,0	
6	**Horodnic**		8,3	73,4	**85,0**	24,1	1,2	192,0	Pozen
7	**Rădăuți**	5,2	7,4	65,0	**75,4**	45,4	3,8	202,2	Sucevița
8	**Cacica**	3,5	15,8	50,8	**80,0**	7,5	13,0	170,6	Soloneț
9	**Pârhăuți**		10,8	51,3	**85,5**	13,0	16,8	177,4	
10	**Fălticeni**	5,8	14,1	47,6	**50,0**	17,4	28,6	163,5	Şomuzul Mare
11	**Dolhesti**	0,2	10,5	28,2	**73,6**	27,5	3,8	143,8	
12	**Dolhasca**	5,0	9,0	44,2	**64,6**	13,0	26,3	162,1	
13	**Siret**		13,5	36,6	**37,9**	16,3	71,6	175,9	Siret
14	**Zvorişte a**	3,4	7,8	33,0	**34,3**	18,6	9,2	106,3	
15	**Huțani**		11,9	**42,3**	15,6	22,7	3,5	96,0	
16	**Adâncata**	3,0	8,0	50,0	**70,0**	34,7	27,5	193,2	
17	**Fântânele**	6,0		49,0	**78,0**	18,2	28,7	179,9	

The pluviometric maximums generated themselves in the large majority of the pluviometric posts, from where we benefited of information on the date of 25th of July 2008. Cumulatively, in the 6 days rich in precipitations fell large quantities of water in all the observations points – tab. 2. From the pluviometric casuistry we are pointing out: - the 299,9 mm fallen at Brodina – on Suceava; - 431,9 mm at Vicovu de Jos – on Suceava; - 202,2 mm at Rădăuți – on Sucevița; - 163,5 mm at Fălticeni on Şomuzul Mare; 193,2 mm at Adâncata – in the basin of the Siret (table 2 and fig. 6).

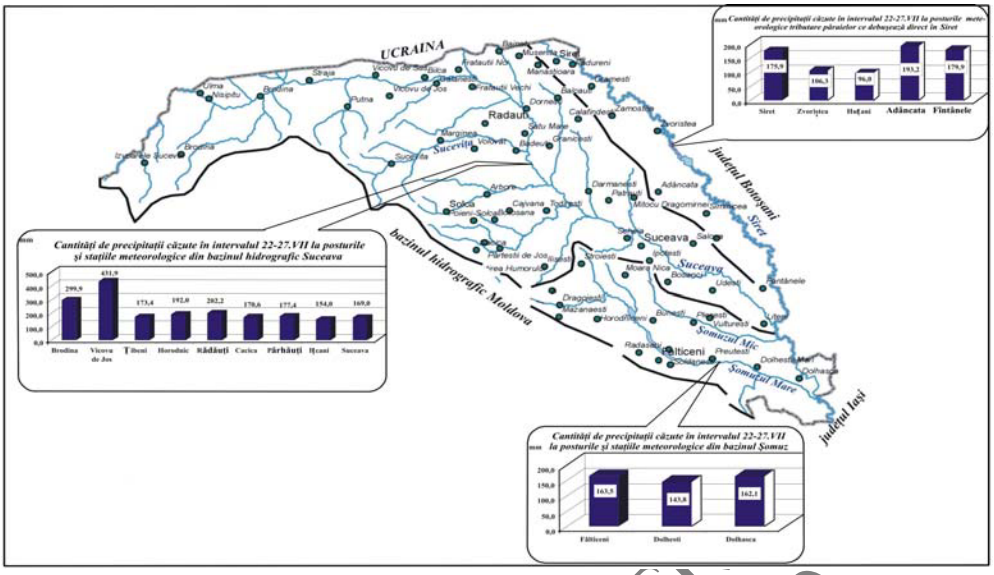

Fig. 6. The quantities of precipitations fallen in the interval 22-27.07.08 in the hydrographic basins of the rivers Suceava, Somuz and Siret

Among the quantities of precipitations from the period 22-27 July the ones from the following locations acquired a character of absolute maximums: Vicovu de Jos (431,9mm), Brodina (299,9mm), Rădăuți (202,2mm), Adâncata (193,2mm), Fântânele (179,9mm), Siret (175,9mm), Tibeni (173,4mm).

There is obvious the fact that on the inferior sector of the river Suceava and on the middling one of the river Siret the flash floods generated themselves due to the precipitations fallen in the superior sectors of the basins and because of the propagation of the flash flood ripples from upstream to downstream.

7. The catastrophic flash floods from the east of Suceava county from the period 24 – 27 July 2008

These repeated sequences of abundant precipitations fallen with a big intensity and at relatively short intervals have determined the production of some exceptional flash floods.

At the majority of the hydrometric stations from the area there were actually determined two flash floods – fig. 7 in a relatively short time (24-36 hours). Therefore, it is hard to ascertain which precipitations have generated each of the two flash floods, but it seems that the first was caused by the ones registered in the interval 23-24 July and the second by the ones that came after 24-25 July.

Table 3. The maximum debits registered at the hydrometric stations from the superior hydrographic basin of the river Moldavia

The river	The hydrometric station	Q. max. untill 2008		Q. max. 2008	
		m^3/s	day/month/year	m^3/s	Day/hour
Moldavia	Prisaca Dornei	304	VI 1972	274	24.07 / 5.00
	Gura Humorului	694	17.08.2002	664	26.VII / 20
Moldovița	Lunguleț	186	VII-1969	254	26.VII / 13.30
	Dragoșa	**463**	**VIII.2002**	**539**	**26.VII / 15-16**

The precipitations fallen after the date of 27.07 2008 no longer have important hydrologic consequences. In the hydrographic basin Moldavia, on its affluent Moldovița, at the hydrometric stations Lunguleț and Dragoşa were exceeded the maximum debits registered previously to the year 2008 – table 3.

Table 4. The maximum debits registered at the hydrometric stations from the hydrographic basins Suceava and Siret

The river	The hydrometric station	Q max. untill 2008 (cm/s)	month/year	Q max. 2008 (cm/s)	day/hour
Suceava	Brodina	325	VI 1969	465	26.07 / 16
	Țibeni	520	VI.1995	858 966	25.07 / 10^{00} 26.07 / 21- 27.07 / 1
	Ițcani	1354	VI.1969	1640 1946	25.07 / 16 27.07 / 4
Pozen	Horodnic	108	VI.1975	104	26.07 / 16
Soloneț	Părhăuți	309	VII 2006	360	25. 07 / 6^{00}
Siret	Siret	1193	VII.1969	920	26.07 / 1-2
	Huțani	866	VII.1969	672	27.07 / 8-10

The historical debits registered during a long observation (over 30 years) at some hydrometric stations from the hydrographic basin Suceava, as on the Siret too (middling and superior sectors), are illustrated in table 4.

From table 4 we can observe that the maximum debits registered at the flash flood from 22-27 July 2008 (flash flood which continued in an attenuated form for a few days) exceeded, on Suceava and Soloneț, the maximum historical values registered in the previous interval.

The hydrogtaphs from the few hydrometric posts illustrated in fig. 7 (Brodina, Tibeni, Itcani – on Suceava; Siret and Lespezi – Iaşi county – on Siret) are suggestive in reflecting the amplitude of the flash floods on these hydrographic arteries.

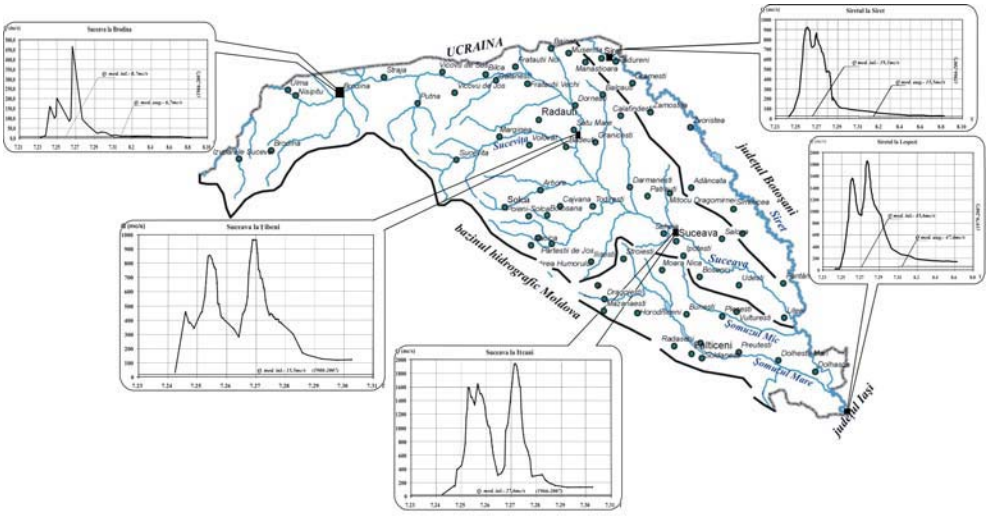

Fig. 7. The flash floods generated in the interval 24-27.07.08 on the rivers Suceava and Siret

8. The consequences of the floods

Important damages in establishments, annexes, fencings and the clogging of the fountains; modifications of the river beds, destructions of dikes, landfalls, land slides and subsidences of terrain; damages at the road substructure and C.F.;injuries at the main and local gas pipe-lines; injuries and destructions at the communal administration networks (water, canal, heating); injuries at the main and local networks of transport and distribution of the electric power; injuries of the fixed telephony systems and GSM; damages in agriculture (in cultivations and losses of animals) and at the forest fund; losses of human lives (one victim) and an advanced level of social and economic disorganization.

9. Conclusions

The floods generating storms from the warm season are the most frequent and severe phenomena of hydrometeorologic risk from all over the teritorry of Suceava county.

The geographic setting, the relief, the climate, the disposition and structure of the hydrographic network, the determinations of antrophic order (the massive clearrings, the river beds pollution with scraps, the feeble maintenance of the banks and the protection dikes, inadequate investments, underdimensioned bridges, the locating of some buildings into the major river bed etc.) favour the production of these phenomena of risk on the entire surface of the county.

In the mountain sector fast floods are generated by the massive flows from the slopes and the reduced capacity of collecting the affluents.

The statistics of the last 15 years discloses the fact that, practically, each locality has been frequently affected by these phenomena which generate important damages, both to the citizens and to the economic operators from the forest sector and the sector of the wood primary processing, favouring, with the wind intensification, a large volume of fellings and the destruction of many forest roads.

There are also generated obstructions in the zone of the bridges and little bridges, cloggings and deviations of the river beds. Practically, there have been affected all the economic and social domains of the investigated territory. The measures regarding the control of these phenomena must be taken at once, without expecting the production of another similar phenomena, which, according to the statistics, will be more and more frequent.

REFERENCES

1. Mihăilă D., Tănasă I., Bostan Diana (2007), *Precipitațiile din seara de 30 iunie 2006 de la Arbore; cauze şi consecințe*, Lucrările Seminarului Geografic Dimitrie Cantemir, Univ. „Al. I. Cuza", Iasi,
2. Romanescu, Gh. (2003), *Inundațiile-între natural şi accidental*, în volumul „Riscuri şi Catastrofe", Editor V. Sorocovschi, Edit. Casa Cărții de Ştiință, Cluj-Napoca.

* * * Date meteorologice şi hidrologice preluate din fondul de date al S.G.A Suceava şi D.A. Siret din Bacău,

* * *www.wetterzendrale.de