

IMPACT OF THE ABUNDANT PRECIPITATIONS OF 22-27 JULY 2008 IN THE NORTH AND NORTH-EAST MOLDOVA

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Key words: abundant precipitations, floods, damages

Abstract: In the last decade of the month of July 2008, the appearance and the persistence of a retrograde cyclone for a few days in the northern and northeastern area of Moldova determined the production of precipitations that had especially high intensity and that were taken over by the Prut and Siret Rivers and their tributaries. The high flow of the Siret River's tributaries was mainly caused by the large quantities of precipitations fallen in the area in contact with the higher flanks of the Carpathians. The flash flood flow registered a few days later by the Prut River at the entrance to Romania was mainly caused by the rains fallen in the southwestern area of Ukraine. This paper presents the evolution of the process, quantities registered by the meteorological stations and the rain-gauge stations, the hydrological consequences and the impact of these pluviometric events on the environment of the northern and northeastern Moldova.

Floods of the end of July and beginning of August 2009, in the northeastern part of Romania follow closely those of the end of 2005. The last decade witnessed in this area a succession without precedent of very hot and dry periods and rainy periods, some of them constituting records of the entire observation period.

The cause was, as for the majority of Moldova catastrophic floods, a retrograde cyclone. Since 19 of July, a cyclonic nucleus originated of the Arabian Depression, very low and extended to north-west, up to Turkey, had been evolving to north-west, in a retrograde manner. When it crossed the Black Sea, the retrograde cyclone extended its surface. On the Romanian territory, the cyclone had a slow evolution. Beginning from 21 of July, Romania had been under a slow movement front, going from south-west to north-east. Quantities of rainfall exceeded 88 mm in the Southern Carpathians and Transylvania. On 22 of July,

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Fig. 1 – Floods in the upper basin of Nistru river - 25 VII. 2008 (foto: L.Apostol)



Fig. 2 – Prut waterfall - 25 VII. 2008 (foto: L.Apostol)

rains were abundant in Maramures, Ukraine's Transcarpathia and Ukraine's Carpathians. On 23 of July, abundant rains fell on the external flank of the Ukraine's Carpathians and on the upper basins of the Nistru and Prut Rivers until the 26 of July. The absolute maximums in a 24 hours period were surpassed in numerous stations of the upper basins of the Nistru and Prut, with values that exceeded 200 mm at many rain-gauge stations. On 27 of July, the cyclone moved to the north of the Black Sea and precipitations stopped in these areas. Floods affected the upper basin of the Tisa River, the upper basin of Siret and the upper basin of Prut and its valley, till the Stanca-Costesti storage basin, but also other sectors of its entire valley, as well as the upper Nistru and its tributaries with springs in the mountain area. In the upper basin of Siret River, record flow rates were registered, as well as on the Siret, Suceava and Moldova Rivers. In Romania, the maximum values of precipitations were registered in Suceava and Iasi Counties, on the 23/24 and 24/25 of July, when many absolute values of the maximum precipitations in a 24 hours period had been surpassed.

1. Daily evolution of precipitations in between 22 and 27 July 2008 in the northern and northeastern area of Moldova

At the beginning of this period (22/23.07.2008), precipitations registered at the observation points were of maximum 15,8 l/m² (Stanca Stefanesti Meteorological station) – table 1.a and b.

Since 23/24.07.2008, starting from the mountains and then from the plateaus, precipitations summed up increasingly larger quantities, exceeding 50 l/m² in a 24 hours period – see tables 1.a and b.

Tab. 1.a. Quantities of precipitations (l/m²) registered in the periods 22/23 and 23/24.07.2008 at the meteorological stations and rain-gauges stations of the Suceava and Botosani counties

<i>Hydrographic basin</i>	<i>Meteorological station / Rain-gauge station</i>	<i>Quantity of precipitations (l/m²)</i>	
		<i>22/23.07.2008</i>	<i>23/24/07.2008</i>
<i>Siret</i>	Siret	13.5	6.3
	Zvoriştea	11.2	2.9
	Huţani	11.9	1.3
	Fântânele	6.0	22.5
<i>Suceava</i>	Tibeni	8.9	1.9
	Iţcani	8.6	24.5
	Vicovu de jos	8.5	33.4

Source: C.M.R. Moldova; S.G.A. Suceava; S.G.A. Botoşani



Fig. 3 - Floods in the subcarpathian area of Prut river basin - 24.VII. 2008 (foto L.Apostol)



Fig. 4 - Prut river at Colomeea - 24 VII 2008 (foto L.Apostol)

Tab. 1.b. Quantities of precipitations (l/m^2) registered in the 22/23 and 23/24.07.2008 period at the meteorological stations and rain-gauges stations of the Suceava and Botoşani counties

<i>Hydrographic basin</i>	<i>Meteorological station / Rain-gauge station</i>	<i>Quantity of precipitations (l/m^2)</i>	
		<i>22/23.07.2008</i>	<i>23/24/07.2008</i>
<i>Suceava</i>	Adâncata	9.0	2.0
	Suceava	1.6	58.1
	Cacica	3.5	25.8
<i>Moldova</i>	Fundu Moldovei	7.2	54.4
	Câmpulung Moldovenesc	8.6	46.5
	Prisaca Dornei	9.7	82.4
	Moldova Sulița	7.4	36.6
	Frasin	4.6	62.3
	Gura Humorului	7.0	33.0
<i>Șomuz</i>	Fălticeni	5.9	31.3
	Dolhasca	9.1	37.2
<i>Izv.Giumalău (Colbul)</i>	Pojorâta	9.8	10.1
<i>Moldovița</i>	Lunguleț	13.0	1.0
<i>Sucevița</i>	Rădăuți	7.4	65.0
<i>Soloneț</i>	Părhăuți	10.8	12.5
<i>Șomuzul Mare – Granita–</i>	Dolhești	10.5	1.6
<i>Suha</i>	Stulpicani	0.4	50.9
<i>Humor</i>	Gura Humorului	0.5	31.3
<i>Râsca</i>	Bogdănești	1.5	23.5
<i>Dorna</i>	Poiana Stampei	9.2	57.8
<i>Prut</i>	Orofteana	6.9	5.7
	Rădăuți Prut	2.0	11.8
	Santa Mare	4.9	21.7
	Stâncă Ștefănești	15.8	9.0
<i>Jijia</i>	Ungureni	0.6	25.3
<i>Bașeu</i>	Suharău	5.3	31.2
<i>Volovăț</i>	Avrămeni	7.0	7.0
<i>Stâna</i>	Roma	-	39.6
<i>Ibăneasa</i>	Vorniceni	1.0	25.2
<i>Dresleuca</i>	Botoșani	0.6	34.9
<i>Podriga</i>	Darabani	5.5	32.2

Source: C.M.R. Moldova; S.G.A. Suceava; S.G.A. Botoșani

Between 24/25.07.2008 and 25/26.07.2008, rainfalls, which frequently had a torrential character in certain areas, caused the accumulation of significant water

quantities, exceeding 100 l/m²/24 hours at some rain gauge stations, situated especially in the mountain area – see table 2.

Tab. 2. Quantities of precipitations (l/m²) registered in the 24/25 and 25/26.07.2008 period at the meteorological stations and rain-gauge stations of the Suceava and Botosani counties

<i>Hydrographic basin</i>	<i>Meteorological station / Rain-gauge station</i>	<i>Quantity of precipitations (l/m²)</i>	
		<i>24/25.07.2008</i>	<i>25/26/07.2008</i>
<i>Siret</i>	Siret	68.2	16.3
	Zvoriștea	51.6	12.8
	Huțani	56.4	22.7
	Fântânele	127.0	18.2
<i>Suceava</i>	Tibeni	111.8	23.2
	Ițcani	124.1	19.8
	Vicovu de jos	113.0	135.0
	Adâncata	120.0	34.7
	Suceava	77.8	5.2
	Cacica	115.8	9.5
<i>Moldova</i>	Fundu Moldovei	26.6	5.0
	Câmpulung Moldovenesc	24.7	6.7
	Prisaca Dornei	23.7	6.8
	Moldova Sulița	33.9	4.0
	Frasin	24.0	15.5
	Gura Humorului	60.5	27.5
<i>Șomuz</i>	Fălticeni	66.6	1.6
	Dolhasca	50.1	-
<i>Izv.Giumalău (Colbul)</i>	Pojorâta	97.6	17.4
<i>Moldovița</i>	Lunguleț	108.8	13.0
<i>Sucevița</i>	Rădăuți	75.4	45.8
<i>Soloneț</i>	Părhăuți	124.2	13.0
<i>Șomuzul Mare – Granita–</i>	Dolhești	100.2	27.5
<i>Suha</i>	Stulpicani	24.0	0.4
<i>Humor</i>	Gura Humorului	66.6	0.5
<i>Râsca</i>	Bogdănești	64.5	1.5
<i>Dorna</i>	Poiana Stampei	0.2	11.2
<i>Prut</i>	Orofteana	28.1	23.3
	Rădăuți Prut	15.3	29.2
	Santa Mare	21.8	-
	Stâncă Ștefănești	15.5	10.2
<i>Jijia</i>	Ungureni	20.5	5.6
<i>Bașeu</i>	Suharău	4.8	47.2
<i>Volovăț</i>	Avrămeni	17.4	8.1
<i>Stâna</i>	Roma	20.0	1.9
<i>Ibăneasa</i>	Vorniceni	12.2	29.3
<i>Dresleuca</i>	Botoșani	34.8	-
<i>Podriga</i>	Darabani	7.1	49.1

Source: C.M.R. Moldova; S.G.A. Suceava; S.G.A. Botoșani



Fig. 5 - Prut river at Cernăuți - 27.VII.2008 (foto L.Apostol)

If on 26/27.06.2008, precipitations were still important, especially in the mountain area, since 27.07.2008, rains decreased and water quantities did not reach significant values anymore – see table 3 a and b.

We have to notice that in the 22-27.07.2008 period, the largest precipitation quantities were produced in the northern mountain area of Moldova, where more than 200 l/m² fell (246,0 l/m² at Vicovu de Jos, Suceva County - table 2.) over a period of less than 48 hours. In the northeastern Moldova, instead, in the 22 - 27.07.2008 period, insignificant quantities of precipitations were registered in most of the rain observation points, with daytime maximums ranging from 15 to 50 l/m².

Unlike the hydro-meteorological evolution of the mountain and plateau area of the northern Moldova, where the cause of the flash floods was the abundance of precipitations registered in the tributaries basins of the Siret River, in the northeastern area of Moldova, precisely on the upper stream of the Prut River, the huge water volume came from precipitations registered in the southwest of Ukraine.

In Romania, the institutions of the Ministry of Environment and Durable Development issued 6 meteorological warnings and 13 hydrological warnings. 309 localities of the Alba, Sălaj, Satu Mare, Maramureș, Suceava, Neamț, Botoșani and Iași Counties had been affected. Through the controlled discharges from the Stanca-Costesti dam, special situations persisted in the Prut valley, in Botoșani,

Iași, Vaslui and Galați Counties until the 15 of August. On the big rivers of the northeast Moldova, there were two peaks of the levels. The Prut River flow reached 4635 cm.s on 28 of July, at the Radauti-Prut hydrometric station. The controlled discharge from the Stanca-Costesti lake, of flows over 1000 cm/s, was necessary. On the Siret River, the maximum flow was of 2676 cm/s. On 23-34 of July, localities of Satu Mare, Suceava and Botosani Counties were flooded; on 24-25 of July, of Satu Mare and Salaj; and beginning with 28 of July, localities of Suceava, Neamt, Botosani and Iasi Counties. In the Neamt County, more than 9000 persons were evacuated. In Suceava, Botosani and Iasi Counties more than 15.000 were evacuated of the 28.000 persons evacuated from all the areas of the country. 3000 persons had been temporarily isolated, 1500 were saved and seven human lives were lost. More than 8000 households were damaged, of which more than 1000 were completely destroyed. Over 1600 km of roads were damaged, over 17 km of railways, 363 bridges and more than 20 km of the electrical network. More than 80 km of dams and more than 100 km of river bank defenses. In agriculture, damages included the flooding of more than 49.000 hectares, of which more than 41.000 hectares of arable land. Damages in agriculture exceeded 188.000.000 RON. The most affected county was Suceava. Humanitarian assistance was requested from abroad and eleven countries responded positively. In general, local and central administration and competent institutions acted adequately.



Fig. 6 - Siret river by the romanian-ukrainean border - 27.VII.2008

Tab. 3.a. Quantities of precipitations (l/m²) registered in the 26/27 and 27/28.07.2008 period at the meteorological stations and rain-gauge stations of the Suceava and Botosani counties

<i>Hydrographic basin</i>	<i>Meteorological station / Rain-gauge station</i>	<i>Quantity of precipitations (l/m²)</i>	
		<i>26/27.07.2008</i>	<i>27/28.07.2008</i>
<i>Siret</i>	Siret	71.6	-
	Zvoriștea	18.7	-
	Huțani	28.5	-
	Fântânele	18.5	10.2
<i>Suceava</i>	Tibeni	27.6	-
	Ițcani	1.6	-
	Vicovu de jos	88.0	54.0
	Adâncata	16.0	11.5
	Suceava	19.2	0
	Cacica	6.0	10.0
	<i>Moldova</i>	Fundu Moldovei	33.9
Câmpulung Moldovenesc		19.2	-
Prisaca Dornei		29.3	-
Moldova Sulița		47.5	-
Frasin		42.4	12.8
Gura Humorului		49.0	11.0
<i>Șomuz</i>	Fălticeni	37.8	-
	Dolhasca	56.4	-
<i>Izv. Giurnalău (Colbul)</i>	Pojorâta	4.2	24.4
<i>Moldovița</i>	Lunguleț	9.3	17.0
<i>Sucevița</i>	Rădăuți	3.8	0
<i>Soloneț</i>	Părhăuți	16.8	-
<i>Șomuzul Mare – Granita–</i>	Dolhești	3.8	-
<i>Suha</i>	Stulpicani	19.9	-
<i>Humor</i>	Gura Humorului	37.8	-
<i>Râsca</i>	Bogdănești	2.5	-
<i>Dorna</i>	Poiana Stampei	10.4	1.2
<i>Prut</i>	Orofteana	38.3	2.1
	Rădăuți Prut	15.4	5.2
	Santa Mare	-	6.5
	Stânca Ștefănești	10.0	0.1
<i>Jijia</i>	Ungureni	10.1	-
<i>Bașeu</i>	Suharău	7.0	-

Source: C.M.R. Moldova; S.G.A. Suceava; S.G.A. Botoșani



Fig. 7 - Dam of Rogojeni, Galati County, on the lower Prut - 15 VIII. 2008 (ISU Galați)

Tab. 3.b. Quantities of precipitations (l/m^2) registered in the 26/27 and 27/28.07.2008 period at the meteorological stations and rain-gauge stations of the Suceava and Botoșani counties.

<i>Hydrographic basin</i>	<i>Meteorological station / Rain-gauge station</i>	<i>Quantity of precipitations (l/m^2)</i>	
		<i>26/27.07.2008</i>	<i>27/28/07.2008</i>
<i>Volovăț</i>	Avrămeni	23.3	1.0
<i>Stâna</i>	Roma	45.3	4.1
<i>Ibăneasa</i>	Vorniceni	26.8	-
<i>Dresleuca</i>	Botoșani	19.2	-
<i>Podriga</i>	Darabani	6.4	0.5

Source: C.M.R. Moldova; S.G.A. Suceava; S.G.A. Botoșani

Taking into consideration the increase of the frequency and intensity of this kind of phenomena in our country, the UN included Romania in 2008, along with the Republic of Moldova, among the countries with high potential of natural risks. Under the new conditions, we have to revise the calculations of the hydro-technical works.

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