THE EVOLUTION OF PRECIPITATION IN MARAMURES COUNTY BETWEEN 2006–2009

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ABSTRACT. – The National Administration "Romanian Waters" is consist from 11 rivers basin, that it manages through the Waters Management Systems at every level of county. Waters Management System Maramures is invested with the uniform application of national strategy in the management of water resources from Somes basins (partialy) and Tisa in Maramures county. The system is invested with duty of related to monitoring hydrological and quality of waters, but also with weather warnings and implementation of prevent measures, combat and eliminate the effects of floods and accidental pollutions. This weather warnings are continuously and properly interpreted by specialists, to take specific measures in the event of adverse natural phenomena (floods and/or accidental pollution). Global warming and anthropogenic influences on the environment from recent years have visible effects in the quantaty of rainfalls registrated on every year. This study aims to emphasize the evolution of precipitation amounts monitored in this organization betwen 2006–2009.

Keywords: precipitation, weather station, pluviometric post, the rate of flood.

1. INTRODUCTION

Maramureş county is located in the northern in Romania, between parallels 47º 20′ 00″ and 48º 00′ 15″ north' latitude and meridians 22º 52′ 30″ and 25º 07′ 30″ east longitude [Posea, 1980, Retegan, 1980].

Wider opening toward western, is one of the causes from the unstable weather with important rainfalls in the spring and summer, and drizzle and/or continuous rain mainly fall and early winter. Precipitation are generally quite high, from 700 mm (in the depression area) to over 1400 mm (in mountain regions). About 70% of the county receives over 1000 mm/year. The anual number of days with precipitation varies between 150 and 170. Maximum levels in 24 hours often exceeded 50 mm, and isolated and in some cases even over 100 mm/day, in lately, we observing even an increase in frequency of torrential rains [***, 2010, Nacu, 2009].

Waters Management System from Maramures county continuously monitor the weather with stations equipped with advanced technologies, the evolution of meteorological parameters; this monitoring is important for

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hydrological data, but also to avoid events that would require the establishment the situations of emergency.

2. FEATURES AND MAJOR EVENTS CAUSED BY RAINFALL RECORDED IN THE PERIOD 2006–2009, IN MARAMURES COUNTY

Year 2006

Year 2006 was characterized by periods of atmospferic calm but also through periods of atmospheric instability, which led the period from March to August to the development to formations cloudy accompanied by convective storms, intensification of wind, hail and lightning accompanied by thunder.

In March 2006 there have been increases in the levels of rivers in the lower sectors of their quotas have been exceeded and river flooding on the river Iza Lapus.

In May 2006 the largest cumulative amount of rainfall were recorded at: Cavnic – 126.8 mm, Poiana Borsa – 95.6 mm, Moisei – 89.0 mm and Strâmtura – 85.7 mm.

The second decade of June 2006 was characterized by special meteorological phenomenon (precipitation who have exceeded critical thresholds – code red); in 17/06/2006 at hydrometric station Botiza, between 16^{30}–20^{20} it was registred 107 mm of rainfall.

Following these events on the Botiza river, at hydrometric station Şieu it was registered highest level 350 cm (hazard level +110 cm) – historical level [Raport Sinteză, 2006].

Year 2007

In period 17–18/05/2007 the largest rainfall cumulative were recorded as follows: Poieni Luhei – 44.8 mm, Moisei – 42.5 mm, Şieu – 32.2 mm, Săcel – 30.7 mm and Bistra – 30.0 mm.

In the afternoon of 01/06/2007 have fell down precipitation in all the county area, the largest rainfall were recorded in the following posts pluviometric: Strâmtura – 31.4 mm, Şieu – 25.2 mm, Vadu Izei – 20.0 mm, Mara – 18,4 mm and Sighetu Marmatiei – 17.1 mm [Annual summary report 2007].

In the first and second decade of July, the rainfall cumulative amount in the following posts pluviometric were to: Poieni Luhei – 189.5 mm, Moisei – 159.7 mm, Cavnic – 144.2 mm, Strâmtura – 141.1 mm, Firiza – 133.7 mm; Sighetu Marmatiei – 130.7 mm and Suciu de Jos – 123..8 mm.

Following the rainfalls, the Iza river, to hydrometric station from Strâmtura recorded a high of 253 cm (attention quota+53 cm) on 12/07/2007 at 16^{00}.

Amount of maximum rainfalls cumulative in the second and third decade of August 2007 at the following posts pluviometric were to: Sieu – 102.5 mm, Poieni Luhei – 95.1 mm, Suciu de Jos – 87.1 mm, Sighetu Marmatiei – 59.1 mm, Ulmeni – 57.0 mm [Annual summary report, 2007].

Year 2008

March month began with significant quantity of rainfall, phenomenon who have lead to melting snow, spills down a hillside, with consequent significant increases in the levels of rivers from the county, with overcome the odds and the flood of attention within 1–3 March 2008.

In this period it was recorded the rainfall, in 24 hours, at stations pluviometric as following: Cavnic – 81.0 mm, Mara – 64.7 mm, Cabana Plesca – 57.2 mm, Firiza – 55.6 mm; Poieni Luhei – 40.0 mm.

The quotas by the flood and attention were exceeded on the following rivers: Iza, Mara, the Tisa, Botiza, Cosău, Lapus and Firiza [Annual summary report, 2007].

July month started with quantitatively insignificant rainfall, without reaching the quota of attention of the rivers. During 24–27 July 2008 it have fell the quantitatively important rainfall, especially in the Tisa river basin [Nacu, 2009, Annual summary report, 2008].

Quotas of attention, flood and hazard have been exceeded on the following rivers: Tisa Cisla, Viseu, Vaser, Ruscova, Iza, Lapus River and Botiza. Viseu River at hydrometric station from Bistra it had maximum level quota to 570 cm (danger quota +200 cm) on 27/07/2008 at 01^{00}, code red – historycal level.

For the period 22–27 July, the quantaty of precipitation from Viseu river basin it was 119 mm at hydrometric station from Bistra and 144.6 mm at weather station from Iezer, in conditions, in the annual average monthly is around 80 mm [Nacu, 2009].

Year 2009

On the morning of 11/06/2009 have been the most rainfall, in 24 hours at hidrometric stations from: Ulmeni – 32.7 mm, Bârgău – 21.2 mm, Şieu – 16.1 mm and Firiza – 15.3 mm[Annual summary report, 2009].

On the evening of 20/06/2009 on the county area, precipitations fell down as rain accompanied by the phenomenon of lightning accompanied by thunder. The largest amounts of rainfall, in 24 hours, was registred at pluviometric stations and weather stations as following: Ocna Şugatag – 27.2 mm, Lăpuşel – 36.0 mm, Salsig – 32.3 l/m2, Ruscova – 31.0 mm, Copalnic – 28.2 mm, Bargau – 27.3 mm and Răzoare – 23.4 mm.

Between 22/06/2009 (at 12^{00})–23/06/2009 (at 21^{00}) in Maramureş county was under alert: yelow code for precipitation. During the day of 22 June have been exceeded the thresholds of the rainfall at: weather station Baia Mare (in range 21^{02}–21^{32}) 21.0 mm; hidrometric station from Răzoare (range 20^{50}–21^{50}) 21.4 l /sqm and hidrometric station from Copalnic (range 20^{42}–22^{00}) 43.5 mm [Annual summary report, 2009].

The highest quantaty of rainfalls, in 24 hours, were recorded at following hydrometric stations: Copalnic – 53.3 mm (on 23/06/2009, at 06^{00}), Răzoare – 39.6 mm (24/06/2009 at 06^{00}) , Şieu – 30, 1 mm (on 23.06.2009 at 06^{00}), Sighet – 37.2 mm (on 24.06.2009 at 06^{00}), Strâmtura – 27.1 mm (on 24.06.2009 at 06^{00}), Firiza – 27.7 mm (on 24/06/2009 0 at 06^{00}) [Annual summary report, 2009].

During the day of 23/06/2009 the quotas of precipitation were exceeded; at stations from: Strâmtura between 14^{10}–14^{30} have fell down 22.3 mm, at Sighet, between 13^{40}–15^{00} have fell down 25.0 mm, at Lăpuşel between15^{30}–15^{50} have fell down 17.6 mm, at Baia Sprie between19^{00}–21^{15} have fell down 33.4 mm, and Răzoare, between 20^{30}–23^{00} have fell down 22.1 mm.

The end of June 2009 bring significant amounts of precipitation. During the day of 26/06/2009 the quotas of precipitation were exceeded at stations hydrometric as following, at: Ruscova (in range 18^{30}–20^{00}) have fell down 16.0 mm, Sighet (in range 19^{30}–20^{00}) have fell down 40.8 mm; Firiza (in range 19^{30}–20^{10}) have fell down 20.0 mm, Bistra (in range 19^{00}–20^{15}) have fell down 37.1 mm.

The highest rainfalls, in 24 hours, were recorded on 27/06/2009, the following hydrometric stations: Sighet – 55.4 mm, Bistra – 42.0 mm and Firiza – 21.8 mm [Annual summary report, 2009].

July 2009 started with significant in quantaty rainfalls. During the day 03/07/2009 at 15^{40} was received an warning of hazardous weather phenomena, code yellow, which cover the entire Maramures county. Most precipitation in the 12 hours, was registred the morning of 04/07/2009 at hydrometric station from Buciumi of 36.2 mm and from Ulmeni of 25.5 mm.

During the period of 23–31/12/2009 significant amounts of precipitation have fell down across the county, phenomenon which was overlapped with the melting of snow and caused increases in levels and flows on the rivers in the county.

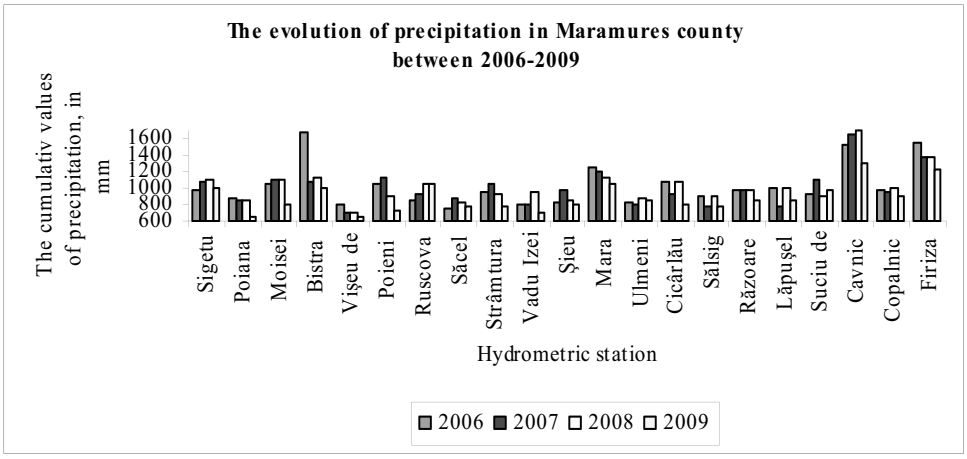

Fig. 1. ***The evolution of precipitation quantities in Maramureş County, between 2006–2009***

The highest quantaty of rainfalls, in 24 hours, were recorded on the morning of 26/12/2009 at following hydrometric stations: Cavnic – 64.0 mm, Firiza – 50.1 mm, Mara – 39.2 mm, Lăpuşel – 32.4 mm and Poiana Luhei 31.4 mm.

On days of 30 and 31 December predominantly continued to fall down rainfall as rain; the cumulative values of precipitation in this two days were as follows, on hydrometric stations: Cavnic of 61.7 mm, Firiza of 42.7 mm, Mara of 29.2 mm, Lăpuş of 35.3 mm, Răzoare of 29.2 mm, Ulmeni of 33.6 mm, Salsig of 33.2 mm [Annual summary report 01–31 decembrie 2009].

On the 31/12/2009 quotas were exceeded flood on the river Lapus to hydrometric station from Lăpuşel (H_{max}=444 cm, flood quota+34 cm) recorded in 31/12/2009 at 24^{00} and, on the river Bârsău at hydrometric station from Buciumi (H_{max}=132 cm, flood quota +2 cm) registered on 31.12.2009, at 09^{00}.

Quantaty of cumulative annual rainfall in Maramures county, for the period 2006–2009 are presented in the following table:

Table 1. ***Annual precipitation cumulated in the period assessed***

No.	Station name	River	Total rainfall, 2006,(mm)	Total rainfall 2007,(mm)	Total rainfall, 2008, (mm)	Total rainfall, 2009, (mm)
1	Sighetu Marmaţiei	Tisa	964,6	1073.5	1090.7	1003.1
2	Poiana Borsa	Vişeu	872	857.5	853.2	660.5
3	Moisei	Vişeu	1049.6	11115	1100.3	799.9
4	Bistra	Vişeu	1670.2	1075.9	1113	988.4
5	Vişeu de Sus	Vaser	805.5	699.2	697.9	656.3
6	Poieni Luhei	Ruscova	1048.3	1126.3	903.6	732.8
7	Ruscova	Ruscova	859	931	1056.4	1051.6
8	Sacel	Iza	752.4	883.7	814.4	773.8
9	Strâmtura	Iza	941.7	1037.7	918.2	765.8
10	Vadu Izei	Iza	797.1	789.1	939.2	705.5
11	Sieu	Botiza	825.9	966.4	845.5	796.8
12	Mara	Mara	1243.4	1197.9	1130.5	1055.3
13	Ulmeni	Someş	827.7	793	883.9	850.7
14	Cicârlău	Someş	1074	933.8	1087.4	809.2
15	Salsig	Salaj	911.1	776.5	894.7	782.3
16	Răzoare	Lăpuş	976	966.9	965.4	839.1
17	Lăpuşel	Lăpuş	996.8	767.5	1009.2	851.3
18	Suciu de Jos	Suciu	926.4	1089.5	888.2	962.9
19	Cavnic	Cavnic	1526.4	1662.2	1688.5	1309
20	Copalnic	Cavnic	971.3	941.5	989.4	891.2
21	Firiza	Firiza	1548.2	1381.9	1367.6	1226.2

3. CONCLUSION

In terms of quantities of precipitation monthly and multi-annual, we can remark a uneven distribution level of them, in Maramures area, in function by altitude and also, in function on the general atmospheric circulation.

We can conclude that:

– in 2006 the largest quantaty of cumulative rainfall was recorded at hydrometric stations : Bistra – 1670.2 mm, Firiza – 1548.2 mm, Cavnic –

1526.4 mm, and the highest rainfall in a short time has been recorded on 17/06/2006 at hydrometric station from Botiza – 107 mm, between the 16^{30}–20^{20};

– in 2007 the largest quantaty of cumulative rainfall was recorded at hydrometric stations : Cavnic – 1662.2 mm, Firiza – 1381.9 mm, Poieni Luhei – 1126.3 mm, Moisei – 1111.5 mm;

– in 2008 the largest quantaty of cumulative rainfall was recorded at hydrometric stationst: Cavnic – 1688.2 mm, Firiza – 1367,6 mm, Mara – 1130 mm, Bistra – 1113 mm and the largest amount of precipitation was recorded at hydrometric station from Cavnic – 1688 mm.

– in 2009 was recorded the lowest total quantaty of rainfall from the period under review. The highest quantaty of cumulative rainfalls was recorded at: Cavnic – 1309 mm, Firiza – 1226.2 mm and Mara – 1055.3 mm;

– in period 2006–2009, year 2006 was the year in which fell the largest quantaty of precipitations, and 2009 the poorest year in rainfall.

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