PECULIARITIES OF THE AVERAGE AMOUNT OF PRECIPITATIONS REGISTERED AT THE METEOROLOGICAL STATION TÂRGU MUREŞ, DURING 1961-2007

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Abstract. Peculiarities of the average amount of precipitations registered at the meteorological station Târgu Mureş, during 1961-2007. From the analysis of the yearly and monthly average precipitations registered at Târgu Mureş, meteorological station it is noticeable that the most abundant amounts fall in the warm period of the year, determined by the atmospheric circulation, the local conditions and also by the more and more active role of the thermal convection that develops in the instable air masses.

Keywords: thermal convection, atmospheric circulation, cyclone, anticyclone

1. INTRODUCTION

Due to the extremely varied relief, the water amount, resulted from various types of atmospheric precipitations, has an uneven distribution in time and space. During the year, from one season to another, the territorial distribution of the water amount fallen as a result of precipitations changes because of the variable regime of the general circulation of the atmosphere and the thermodynamic convection, closely related to the peculiarities of the subjacent surface, specific to the considered area.

The variations in time and space of precipitations are also due to the frequency of the temperature inversions that occur in the cold season of the year, when the atmospheric stability is higher. Some low precipitations fall due to the frontal clouds. Starting with March, the amounts of precipitations that fall in the interior of the Carpathians Arch, including at Târgu Mureş Meteorological Station, begin to rise, due to the increase in the activity of Atlantic cyclones passing through east the Central Europe.

During the warm season, precipitations become more and more abundant due to the increased general circulation of the atmosphere and to the more active role of the thermal convection that develops into the instable air masses, which is reflected in the amount of precipitations. In the summer months the most abundant precipitations fall in most cases due to the thermal convection.

The dependence upon the frequency and the degree of development of the baric systems that crosses Transylvania from one direction or another, as well as the local thermo-convective processes present an annual evolution characterized by

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the increase in water amount from March till June and their decrease from June till March.

2. GENETIC CONDITIONS

The atmospheric precipitations, which by their genesis are meteorological phenomena (hydrometeors), occur in different amounts, presenting discontinuities in time and space. The rainy intervals are generally determined by the cyclonic baric formations, or in some cases by the contact area (quasi-stationary fronts) between the masses of cold air, belonging to an anticyclonic field, and the masses of warm air, associated to cyclonic formations (Topor, 1963).

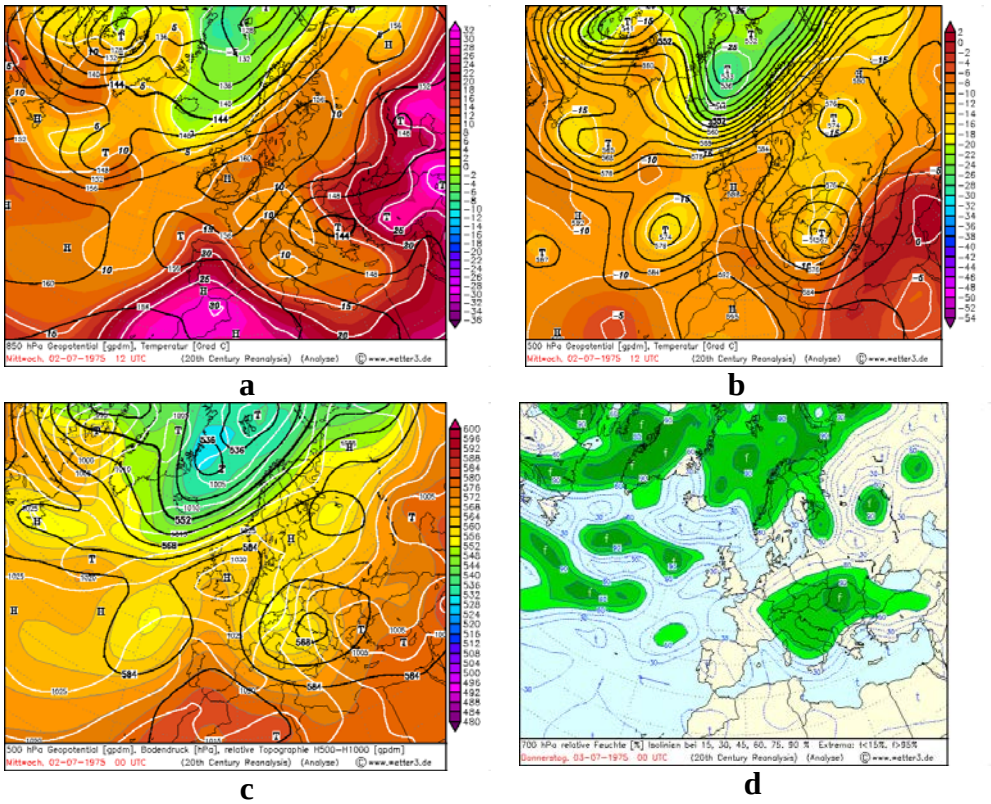

Fig. 1. ***a) Map of the geopotential field and the temperatures at 850hPa; b) Map of the geopotential field and the temperatures at 500 hPa ; c) Map of the pressure field at the ground level, the geopotential field at 500 hPa and the relative topography 500/1000 hPa; d) Map of relative humidity field at 700 hPa on 2 July 1975 at 12 UTC (after Archiv, wetter3.de)***

The baric cyclonic structures from Romania are ensured by a certain position of the main baric systems on the continent. The thermo-baric structure at the ground level is driven by the general circulation of the atmosphere from the middle troposphere. Therefore, during the rainy intervals there are more cyclonic

areas over Europe and an anticyclone extended towards the poles or in the North Atlantic. In the middle troposphere, at the surface level of 500 hPa (at the altitude of 5500 m), the geopotential has low values, and the isohypses have a clear cyclonic curve, outlining the presence of a talweg or a cyclonic nucleus in the close proximity to Romania (Bordei-Ioan, Ecaterina, Bordei-Ioan, N., 1970).

One of the synoptic situations in which there were reported significant amounts of precipitations is that presented in figure 1. a, b and c (on the 2nd of July 1975). Even since the 30th of June 1975, through the anterior part of the barometric maxim above the North Atlantic, it has been produced an infiltration of cold air that descended up to the south-western Europe. This cold air penetrated the entire tropospheric column, being emphasized in the middle troposphere (500 hPa) by a talweg associated to the Icelandic Cyclone, and also by cut-off nuclei in the Scandinavian Peninsula and the basin of the Mediterranean Sea. This cyclone continued to deepen because of the cold air penetration on its posterior side, after which it engaged on a Transbalkanic trajectory. On the 2nd of July 1975 due to the slow movement, we find it positioned in the south-west of Romania. The southern component is more powerful, which makes it to be deviated northwards and our country is crossed by the systems of the warm and humid fronts (fig. 1 d), associated to this atmospheric depression. This situation has led to significant falls of precipitations in the country and implicitly at Târgu Mureş, where there were registered 67.8 l/m² in 24 hours.

3. ANNUAL VARIATION OF PRECIPITATIONS

Analyzing the average amount of precipitations during the year, we can observe a variation of this from one month to another. From the analysis of the multianuual monthly values (1961-2007) of the amount of precipitations at Târgu Mureş station, it is highlighted that from March till July-August and sometimes even September, the monthly course of the average amount of precipitations show increasingly higher values, whereupon towards the end of the year and in January they gradually decrease (Rusan, N, Alina Negoescu, 2008).

The average monthly amounts during a period of 47 years (1961-2007), as well as other climatic parameters, have a complex distribution, as a consequence of the more important weight of the atmospheric circulation in their genesis. From the analysis of the distribution of the amounts of precipitations per each month, there are emphasized the highest amounts of precipitations registered at Târgu Mureş station.

Analyzing the monthly average data string, as well as the graphic of the annual variation of monthly average amount of precipitations the months with the highest amount of precipitations stand out. During the interval May-September, the highest amount of water (71.5 mm) is registered. Afterwards it increases in June (83.0 mm) and July (83.2 mm) and begin to decrease in August (68.8 mm) and September (49.9 mm) (table 1 and fig. 2). The important increase of the amount of precipitations during the warm period of the year is due to the frequent penetration

on the territory of our country of the humid air masses of oceanic origin but also to the development of the thermal convection.

During the autumn months, the intensification of the anticyclonic regime and the low temperatures reduces the role of thermal convection in producing precipitations. As a consequence, the amount of precipitations decreases quite a lot. Thus, if in the first month of autumn (September) there were registered 49.9 mm, the amount of precipitations decreases till 33.4 mm in November.

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Average	**32.1**	**23.6**	**27.8**	**47.8**	**71.5**	**83**	**83.2**	**68.8**	**49.9**	**37.6**	**33.4**	**34.9**

Table 1. ***Annual variation of the monthly average amounts of precipitations (mm) (1961 – 2007)***

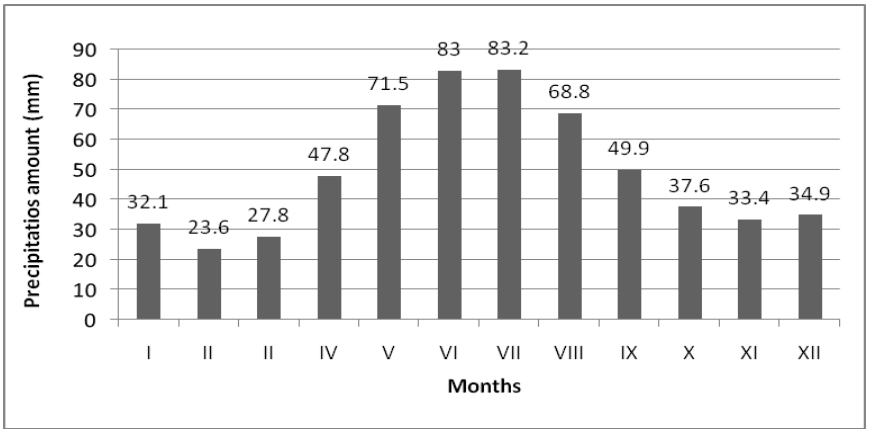

Fig. 2. ***Annual variation of the monthly average amounts of precipitations (mm) (1961 – 2007) at Târgu Mureş meteorological station***

Following the variation of the monthly averages of precipitations, it appears that the summer rains have a significant contribution to the annual values of precipitations. As it shows in table 1 and figure 2, even since May the atmospheric precipitations summarizes important amounts, as a result of the frequency with which the air masses of oceanic type (humid air), at the periphery of the Azores Anticyclone, enters over Romania and of the development of the thermal convection.

4. VARIATION OF THE ANNUAL AVERAGE PRECIPITATIONS AMOUNT

The high variability of the annual precipitations amount has resulted in many years in which both the drought phenomenon and the pluviometric excess

manifested. Among the years with pluviometric excess we enumerate: 1966, 1970, 1974, 1998, 2001, 2005 and 2007, years in which the pluviometric regime exceeded the average of 700 mm (table 2 and 3) (Dragotă**,** 2006).

Table 2. ***Variation of annual average precipitations amount (mm) registered at Târgu Mureş, during the period 1961 – 2007***

Years	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Total amount	444.0	579.7	499.7	511.5	518.0	743.4	582.7	696.6	673.3	732.2

Years	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total amount	502.8	609.7	583.1	745.6	625.5	543.4	554.5	664.3	533.1	732.6

Years	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total amount	692.8	444.3	443.4	654.2	691.2	407.8	384.0	513.4	471.7	446.8

Years	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total amount	543.2	491.2	564.3	508.6	555.9	524.3	685.5	762.8	661.8	408.7

Years	2001	2002	2003	2004	2005	2006	2007
Total amount	739.9	595.2	481.2	637.6	852.6	652.8	746.1

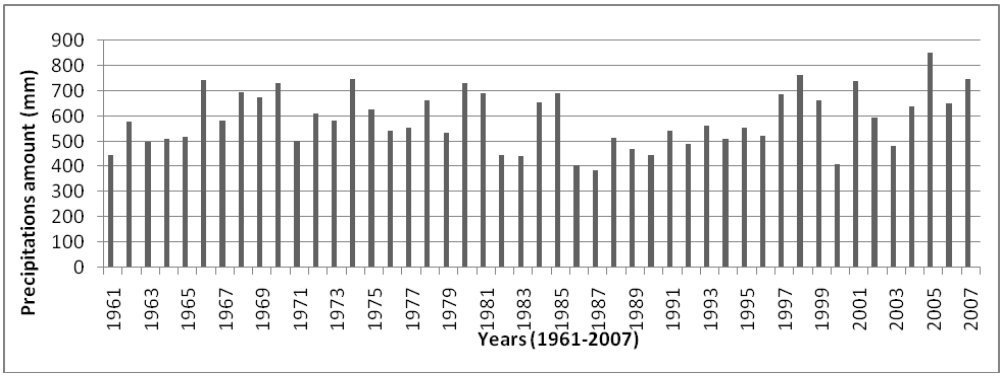

Fig. 3. ***Non-periodic variability of precipitations registered during the period 1961-2007***

Of the sequence of 47 years under study, the most droughty years were those in which the total amount of precipitations was <500 mm and even of 384.0 mm: 1987 (384.0 mm), 1986 (407.8 mm) and 2000 (408.7 mm).

5. VARIATION OF TOTAL MONTHLY AMOUNT OF PRECIPITATIONS

In terms of total monthly amount of multiannual precipitations fell at Târgu Mureş station, during the analyzed period, they exceed in all the months of the year the value of 1000 mm, and over 3000 mm in May June, July and August (table 3 and fig. 4) (Rusan 2009).

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Total amount	1506.4	1111.3	1307.8	2247.1	3361.4	3901.0	3908.2	3232.9	2309.7	1768.9	1568.0	1641.7

Table 3. ***Total precipitations/ month (mm) registered at Târgu Mureş, during the period 1961 – 2007***

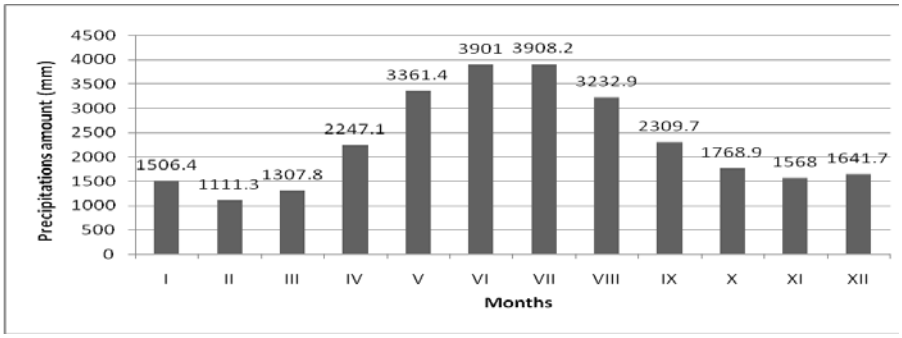

Fig. 4. ***Total monthly precipitations (mm), recorded over the period of the years 1961-2007***

6. THE AVERAGE NUMBER OF DAYS WITH PRECIPITAIONS ≥1.0 MM

During the year, the average number of days with precipitations has a similar distribution with the precipitations amount. From the analysis of the number of days with precipitations it results that, during the year, we have a maximum of days with precipitation of ≥1.0 mm, in May, June and July, when it exceeds 9 days (10.8 in June). Also, during these months the main pluviometric maxim is achieved. From the distribution of the average number of days with precipitations we can notice a fairly high accordance with that of their corresponding precipitations amount (table 4 and figure 5).

Table 4. ***The average number of days with precipitations ≥1.0 mm***

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Anual
Târgu Mureş	6.9	6.1	6.2	8.7	10.3	10.8	9.2	7.5	5.7	5.5	7.1	8.4	92.3

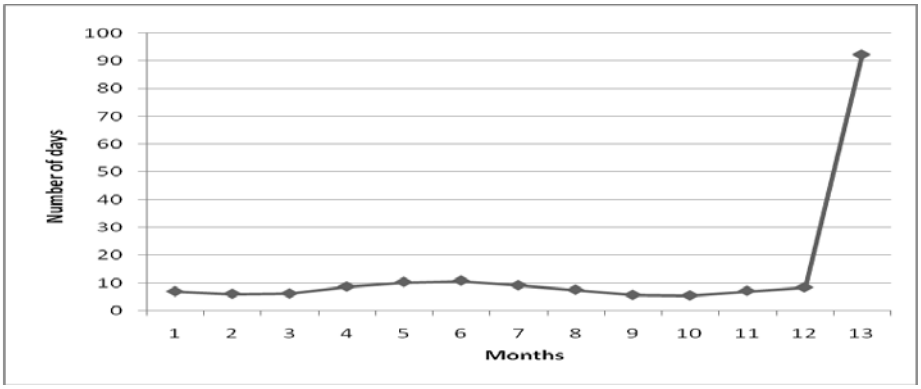

Fig. 5. ***The average number of days with precipitations ≥1.0 mm***

In conclusion, the number of days with precipitations, but also the largest amounts, have an ascended curve beginning with March till June- July, afterwards the curve decreases till February. The advections from west and north-west of the air masses favor from the pluviometric point of view the Western Plain and Hills, as well as the western slopes of the Apuseni Mountains and the interior of the Carpathians Arch.

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