

## **CLIMATIC INTERPRETATION OF METEOROLOGICAL ASPECTS IN THE SATU MARE AREA OVER A PERIOD OF THREE YEARS**

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### **Abstract**

The study of weather-climatic phenomena, especially the extremes that have become more and more frequent, has acquired increased significance, given the increasing awareness of the importance of preventing material damage, but especially of the human victims they cause. The monitoring and analysis of atmospheric risk phenomena thus comes to the aid of local and national authorities whose duty is to protect the population and goods of any kind, and early warning of the occurrence of such a phenomenon is useful to each individual [6,7].

The west and north-west of Romania, like the whole country, due to its geographical position - in the temperate zone, is exposed to a wide range of weather-climatic risk phenomena with the potential to occur throughout the year.

### **Introduction**

The city of Satu Mare benefits from a moderate temperate continental climate. The winter periods, due to the northern location, are longer and colder in Satu Mare, the average thermal value of the cold season being lower, -17°C, than the values recorded in the other cities in the west, for example -15°C in Oradea and -12°C in Timisoara [11]. The annual average temperature is 9.6°, and the atmospheric humidity is quite high [8]. The wind regime is characterized by the predominance of currents from the north-western sector, which bring precipitation in spring and summer [1,2]. The hydrographic network in the area of the city of Satu Mare is represented by the Someș river, in the north by the Sar stream, and in the south by the Homorod stream [5,9]. The constitution and evolution of the municipality of Satu Mare was closely linked to the Someș river, which, apart from the favorable conditions for the settlement of a human community around it, offered, starting from the early Middle Ages, the possibility of intense commercial links with the riparian regions of this water, favored the practice of milling, fishing, etc. [3,10].



Figure 1 Northern Transylvania Regional Meteorological Center

## Experimental

The purpose of this work is to identify some indicators that most accurately express the extreme nature of the manifestations of some meteorological parameters, and through the Banat Crisana and Transilvania Nord Meteorological Centers, we highlighted the period 2019-2021, but also the summary evolution of certain parameters over a period of forty years, between 1961 and 2000 [4,12,14]. Ocna Șugatag and Cluj-Napoca weather stations are included in the international Regional Basic Synoptic Network, while Bistrița and Cluj-Napoca weather stations are included in the international [13].

## Results and discussions

The table below shows the differences between the monthly averages of the daily minimums, over a period of forty years, from the stations located in the west and east of the country, it can be seen that, in general, in winter and at the beginning of spring, these differences are positive, and summer and early autumn are negative. As in the case of the average of the maximum and the average of the minimum, it is generally higher at the stations in the west of the country, by several tenths of a degree, compared to the stations in the east of the country, the causes being the same.

Table 1.

Difference between monthly and annual averages of minimum daily temperatures from meteorological stations located in the west of the country (°C)

Stațiile	lunile											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Satu Mare	0,3	0,6	1,0	-0,1	-0,6	-0,9	-1,1	-0,8	-0,5	-0,5	0,7	0,4
Oradea	1,6	1,6	1,4	0,1	-0,4	-0,9	-0,9	-0,4	0,2	0,3	1,0	1,1
Sannicolau-Mare	1,4	1,5	1,2	0,4	-0,1	-0,4	-0,4	0,0	0,7	0,7	0,9	1,2
Banloc	1,2	1,3	1,0	0,4	-0,1	-0,8	-1,3	-0,9	-0,1	-0,1	1,1	1,0

The dates of production of absolute maximum temperatures on the territory of our country depend a lot on the landforms. The maximum temperature in Romania during the period under consideration, between 1961 and 2000, was 43.5°C recorded in Giurgiu, on July 5, 2000. As is known, the highest absolute maximum temperature in our country recorded since the beginning meteorological observations and until now it is 44.5°C reported on August 10, 1951, in the town of Ion Sion. In these conditions, the circulation of air from the lower layers of the troposphere, having a northeast to southwest direction, determines the penetration of cold arctic continental air masses of Siberian origin into our country, in the form of the Crivățului. These air masses cause cold and dry weather in the south and east of the country and something warmer, quiet

and with more frequent snow in the Transylvanian Plateau and in the mountain area. The high mountain area is characterized by less cloudiness and a greater number of clear days. Next, we present the maximum temperature values from meteorological stations representative of the studied area.

Table 2

Maximum monthly temperature recorded during the period 1961-2000

Stațiile	Lunile												
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Timișoara	°C	17,4	20,5	28,0	30,6	34,3	37,5	39,5	39,5	33,8	30,5	24,8	17,9
	zi	29	28	24	27	12	14	6	22	19	2	14,8	16
	an	1979	1994	1977	1992	1968	2000	1988	2000	1961	1965	1997	1989
Satu Mare	°C	14,7	17,9	26,0	28,8	31,4	36,3	37,2	38,8	33,8	27,9	24,2	18,0
	zi	31	26	21	30	18	23	24	21	14	2	4	17
	an	1990	1989	1974	1969	1994	2000	1987	2000	1994	1965	1968	1989
Târgu Mureș	°C	13,8	19,0	27,0	28,2	33,1	35,3	37,7	36,8	34,0	28,2	23,3	17,2
	zi	24	28	31	26	16	30	25	22	15	14	6,1	11
	an	1971	1994	1975	1968	1969	1963	1987	2000	1994	1993	63,90	1982

In the Transylvanian Plateau and Maramureș, in terms of cloudiness, apart from the maximum in December and the minimum in August, there is a secondary maximum in April and a secondary minimum in March. For the Getic Subcarpathians (with southern exposure), the secondary maximum is recorded in February-March, and the secondary minimum in January. If during the main maximum (December) the average values of total cloudiness, in the hill and plateau regions, oscillate between 7.0-7.9 tenths, during the secondary maximum they are only 6.1-6.5 tenths.

Table 3.

Monthly and annual averages of total cloudiness

Stațiile	Lunile	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Timișoara		7,2	6,8	6,4	6,4	6,0	5,6	4,6	4,3	4,9	5,0	6,9	7,6
Satu Mare		2,3	6,9	6,4	6,3	5,9	5,6	5,1	4,7	5,2	5,5	7,3	7,7
Tg. Mureș		7,4	6,8	6,2	6,4	6,0	5,7	5,1	4,6	5,1	5,1	6,8	7,9

During the analyzed interval, the amounts of both monthly and annual precipitation showed important variations in all areas of the country, as can be seen from the table below in the period 1961-2000, the highest annual amount of precipitation was recorded in Stana of 370 mm, in 1980, and the lowest, 137.6 mm, in Sulina in 2000. On large geographical areas, the maximum annual precipitation amounts reached 950-1,100 mm in the Romanian Plain, 850-1,000 mm in Moldova, 1,000-1,300 mm in Transylvania and the Western Plain, while in Dobrogea the highest annual amounts did not exceed 700 mm. In the mountainous areas, they exceeded 2,000 mm.

Regarding the rainfall regime recorded in Satu Mare, in recent years, respectively in 2019 and 2020, differences of approximately 200 mm have appeared between the two years studied, concretely, in 2019 515.7 mm were recorded, and in 2020 record amount for Satu Mare, i.e. 706.1 mm. There were enormous differences in the summer months, from June, July, August and until September, it rained approximately 350 mm in the 4 months, in 2020, compared to only 150 mm recorded in 2019. Regarding the thermal regime for the period 2019-2021 we can say that the values showed small deviations, in the winter of 2020, the difference being from 0.8 degrees C to 1.2 degrees C, values recorded in the months of January, March and April. In the conditions of our country, the regime of atmospheric precipitation is characterized by a

more pronounced variability, as is natural during the warm period of the year. The high variability of the annual quantities was realized both in the phenomenon of drought and in excess rainfall. Thus, the years 1961, 1983, 1986, 1990, 1992, 1993, 1994 and 2000 stand out as dry years in a large part of the country, and the period 1983-1992 as dry decades. They are known as years with excess rainfall 1969, 1970, 1975, 1991-1992, 1997, and as rainy decades 1966-1975.

The period 1961-2000 is characterized by lower annual amounts, this deficit is the result of the very small amounts that fell in the period 1980-2000, in the intervals January-April in the west of the country and June-December, in the south and east of the country. In the Transylvanian Plateau, with the exception of December, there is a moderate decrease in precipitation throughout the year. The end of spring was marked by a pluviometric surplus throughout the country. The rainfall deficit, generalized in the reference period, overlaps the intervals warmer than the multiannual average, which include the second half of the winter and the spring season.

### **Conclusions**

Regarding the rainfall regime recorded in Satu Mare, during the years 2019-2021, respectively in 2019 and 2020, there were differences of approximately 200 mm between the two years studied, concretely, in 2019 515.7 mm were recorded, and the following year the record amount for Satu Mare, i.e. 706.1 mm, while 2021 brought approximately 640 l/m<sup>2</sup>. There were enormous differences in the summer months, from June, July, August and until September, it rained approximately 350 mm in the 4 months, in 2020, compared to only 150 mm recorded in 2019.

Also, the maximum daily amount of precipitation in 2019 was 22.6 mm, on 27.07, compared to 45.4 mm, in 2021, and also in July, more precisely, on 03.07.

We can say that it was a beneficial year for most of the agricultural crops in our area, we can say that the thermal values were not strongly felt, although there were warm periods, the thermal maxima of the two years being, on 29.06.2020, 32 degrees was recorded, and the same maximum value of 32.2 degrees, all the month of July, more precisely on 02.07.2021, at an interval of 70 h. The rainfall deficit, generalized in the reference period, overlaps the intervals warmer than the multiannual average, which include the second half of the winter and the spring season. Based on the analysis of the daily maximum precipitation regime and over longer intervals, we took into account the rainfall data from both the meteorological stations and those from the rainfall stations for a significant period of operation. The accumulation of exceptional amounts of precipitation over the intervals of 24, 48 and 72 hours is random, both in time and in space, and falls under the category of climatic hazards, with major negative effects on the most important economic and social fields.

From the values shown in certain tables in the paper, it can be seen that, in the territorial distribution of the respective parameters, the distance from the sea, the altitude and the Fohn effect will be taken into account, causes that play the main role. The air descent specific to both the proximity to the sea and the Fohn phenomenon also cause small differences in the average of the maximum amounts over different time intervals.

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