EXTREME TEMPERATURES IN THE CITY OF ORADEA

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Abstract

This paper presents an analysis of the extreme air temperatures, showing the real limits temperature values vary within, in the area of Oradea. Extreme temperatures are expressed by the averages of monthly and annual maximum and mininmum values, and by the absolute minimum and maximum temperatures. In order to study the extreme air temperature values the data recorded at the Oradea weather station between 1970-2014 were used.

The average of daily maximum temperatures is 16.2ºC, with positive average values over the whole year. The average of the multiannual minimum temperatures is 5.7ºC, with negative values between December and February.

The absolute maximum temperature was recorded on 20th July 2007, the value of 40.4ºC, and the absolute minimum was recorded on 13th January 1987, the value of -22.5ºC.

Key words: absolute maximum temperature, absolute minimum temperature.

INTRODUCTION

The highest air temperature values are determined by accidental invasions of continental tropical hot, dry air brought here as a result of the expansion in this area of anticylcones formed over North Africa or over the Arabian Peninsula. The lowest temperatures occur due to the invasion of cold, arctic air carries by anticyclonic formations: the Eastern European anticyclone or the Scandinavian one, as well as synoptic situations with clear sky, which helps nocturnal radiation processes, significantly intensified by snow (Dumiter Aurelia Florina, 2007; Gaceu O., 2002, 2005; Moza Ana Cornelia, 2009; Pereş Ana Cornelia, Köteles N., 2010, 2011, 2012, 2013).

MATERIAL AND METHODS

In order to study extreme temperatures in the area of Oradea, data recorded at Oradea weather station over a period of 45 years were used, that is, the 1970-2014 period. The averages of monthly and annual maximum and minimum temperatures were calculated, and the absolute maximum and minimum values were picked out.

RESULTS AND DISCUSSION

1. Average of monthly and annual maximum temperatures

The average of daily maximum values in Oradea calculated for a period of 45 years, the 1970-2014 period, is 16.2ºC.

The monthly averages of daily maximum temperatures are positive over the whole year, and beginning with March the averages of the maximum temperatures increase gradually, due to increased solar radiation. The averages reach the highest values in July and August and after that they gradually decrease until December. In the period included in the study there were also cases when the average of the maximum values were negative, but that happened quite randomly. Thus, the lowest average of daily maximum values was -3.2ºC, recorded in February 1985. Although in winter months the majority of monthly averages of maximum values are positive, there were some cases with negative values. The frequency of negative values in the period of the study was between 15.6% in January and 6.7% in February, with 7 and 3 cases respectively when the averages of the maximum values were negative in these months. These negative values for the averages of maximum temperatures, recorded in the winter months, were due to cold, polar air advections that reached the western part of the country from the north, north-east and north-west of Europe.

The highest average of maximum values for the winter months was recorded in February 1998, that is, 11.0ºC. January reached the monthly maximum value of the average of maximum temperatures in 2007, with a value of 7.7ºC. The average of maximum temperatures for December reached the highest value, 8.0ºC, in 2000 (see Figure 1).

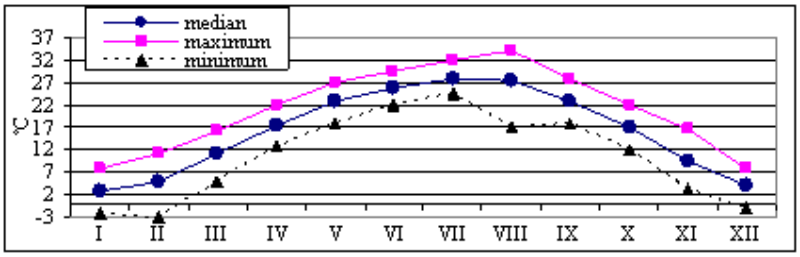

Fig. 1. Monthly evolution of maximum temperature averages (median, maximum and minimum values) in Oradea in the 1970-2014 period

Regarding the spring months, the highest average of maximum temperatures is recorded in May, with a value that reached as much as 27.2ºC in 2003. The minimum value of the average of maximum temperatures in March, 5.0ºC, was recorded in 1987. The average of maximum temperatures reach the lowest values in March.

In summer, the highest value of the average of maximum temperatures was recorded in August 1992, when it reached 34.0ºC. For July, the highest value was recorded in 2012, the value being 32.0ºC, and regarding June, over the period of the study, the maximum average was reached in 2000 and 2003, with 29.3ºC.

In autumn, the highest values are those of September, when the maximum value of this parameter rose to 27.7ºC in 2012. The multiannual monthly average for September is 23.0ºC, for October 17.0ºC, and for November these values drop to 9.6ºC (see Figure 1).

The annual values of the average of maximum temperatures varied from one year to another, the lowest value being recorded in 1978, 14.0ºC, and the highest in 2000, 18.7ºC, thus the multiannual amplitude was 4.7ºC.

2. Average of monthly and annual minimum temperatures

In the area of Oradea, the average of multiannual minimum temperatures is 5.7ºC. The average of multiannual monthly minimum temperatures is negative in the December-February period.

The lowest average of minimum temperatures in winter months was recorded in February 1985, its value being -11.8ºC. The highest average of minimum temperatures in the cold season was 2.6ºC, recorded in February 1977.

In spring, the averages of minimum values is always positive. In March, the daily minimum averages have positive values, but there might also be situations with negative values. Thus, in the period of the study, the frequency of negative values for the average of minimum temperatures in March was 24.4%, which means there were 11 such months. The lowest monthly average of minimum temperatures in spring was recorded in March 1987, that is, -4.0ºC, and the highest in May 2003, 13.4ºC.

In the summer months, the lowest multiannual average of the monthly minimum temperature averages was recorded in June, 13.3ºC, and the highest in July, 14.9ºC. The lowest value of the monthly average was recorded in June 1976, 10.8ºC. The highest value was reached in August 1992, 18.1ºC.

Regarding the autumn months, both positive and negative values were recorded for the averages of minimum temperatures, thus in the months of September and October the values are always positive, and in November the frequency of negative values was 20.0%, which means 9 years with such values, and 80% positive values, which means 36 years when the values were positive. The highest values of minimum average can be found in September, the multiannual monthly average value for this month being 10.8ºC, and the lowest values are those of November, with a multiannual average of 1.8ºC (see Figure 2). The lowest monthly value of the average of

minimum temperatures in autumn months was recorded in November 1988, being -4.0ºC, and the highest value belongs to September 1994, 14.3ºC.

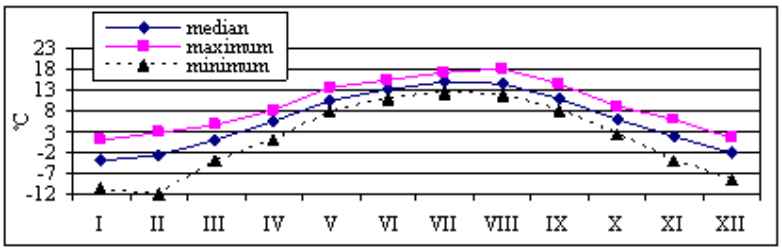

Fig. 2. Monthly evolution of minimum temperature averages
(median, maximum and minimum values) in Oradea in the 1970-2014 period

The annual values of the averages of minimum temperatures varied from one year to another, the lowest value being recorded in 1979, 0.5ºC, and the highest in 2014, 8.1ºC, which gives a multiannual amplitude of 7.6ºC.

3. Extreme air temperatures

Absolute maximum temperature

At the Oradea weather station, the absolute maximum temperature was recorded on 20th July 2007, the value reached on that day was 40.4ºC (see Table 1).

Table 1

Variation of monthly and annual absolute maximum temperatures in Oradea (1970-2014)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
TºC	17.4	19.0	26.4	31.0	32.9	37.8	40.4	40.0	36.6	30.5	26.0	17.9	40.4
Date	07.01	25.77	22.74	30.12	28.00	23.00	20.07	21.00	07.08	01.12	08.97	09.06	20.07.2007

Source: the A.N.M. Archives

At the same weather station the annual absolute maximum temperature is recorded mostly in July, with a frequency of over 50% of the cases (51.1%), which means 23 years of those 45 included in the study. A high frequency was reached by August as well, 40.0% (18 cases), June has a frequency of 6.7%, while September 2.2%.

Regarding the winter months, the absolute maximum temperatures have positive values for all years. Thus, the absolute maximum value for the cold season was recorded in February, when the air temperature in Oradea rose to 19.0ºC, on 25th February 1977. The cold season month with the highest number of years (21) in which the temperature rises to the highest values is February, that is, a frequency of 46.7%, followed by December, with a frequency of 42.2%.

In the spring season, the absolute maximum values are recorded mostly in May, with 42 years of the total of years included in the study, which means a frequency of 93.3%. The highest air temperature value

recorded in a spring month was 32.9ºC, on 28th May 2000. In April, the absolute maximum values occur in 2 years, which means a frequency of 4.4%, and in March their frequency is 2.2%.

The highest values of temperature in autumn are reached in September, when they have a frequency of 93.3% (42 years) of the cases. There was one year when the annual absolute maximum temperature, 36.6ºC, was recorded in September, that is, 7th September 2008. Maximum temperature values are reached in October as well, but with a much lower frequency, only 6.7% (3 years) of the cases.

A comparative analysis of the monthly absolute maximum values and of the monthly average temperatures shows significant differences between them, which means that the absolute maximum values occur randomly.

Absolute minimum temperature

At the Oradea weather station the absolute minimum air temperature was recorded on 13th January 1987, the values reached on that day was -22.5ºC (see Table 2).

Table 2

Variation of monthly and annual absolute minimum temperatures in Oradea (1970-2014)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
TºC	-22.5	-21.6	-16.0	-6.2	-0.6	1.9	6.1	4.4	-1.9	-12.1	-18.9	-21.2	-22.5
Date	13.87	23.83	05.96	09.97	01.76	04.77	20.96	26.80	29.70	13.71	29.95	25.01	13.01.1987

Source: the A.N.M. Archives

The absolute minimum temperatures have negative values in the cold season and in the transition one, while in the summer these values are positive. The values are between -22.5ºC, value recorded on 13th January 1987 and 6.1ºC, value recorded on 20 iulie 1996.

For the summer season, the absolute minimum value over the 45 years was recorded in a June month, that is, 4th June 1977, with a value of 1.9ºC. The highest value of absolute minimum temperature for the summer season occurred on 20th July 1996, with a value of 6.1ºC.

In wintertime, the absolute minimum temperature occurred on 13th January 1987, with a value of -22.5ºC, the same parameter for February was -21.6ºC, and for December -21.2ºC (see Table 2).

At the Oradea weather station the annual absolute minimum temperature was recorded in most of the years included in the study in January, with a frequency of 46.7%. Thus, over the 45 years, the annual absolute minimum temperature occurred in January in 21 years. In February, the frequency is 22.2%, which means 10 years. There are also 10 Decembers with such absolute minimum values, that is again a frequency of 22.2%, and for November the frequency of these values is 8.9%.

CONCLUSIONS

In the period included in the study the absolute maximum temperature rose to 40.4ºC, on 20th July 2007, and the absolute minimum temperature dropped as low as -22.5ºC, on 13th January 1987.

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